CN-09-03

Project Title: **SWFWMD Hydrogeologic Investigation of the Lower Floridan Aquifer in Polk County - Lake Wales Site**

Document Title: **Lake Wales Construction Documents**

May 2018

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SECTION 01 10 00 - SUMMARY OF WORK

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The WORK to be performed under this Contract shall consist of furnishing tools, equipment, materials, supplies, and manufactured articles, and furnishing all labor, transportation, and services, including fuel, power, water, and essential communications, and performing all work or other operations required for the fulfillment of the Contract in strict accordance with the Contract Documents. The WORK shall be complete, and all other work, materials, and services not expressly indicated or called for in the Contract Documents, but necessary for the complete and proper construction of the WORK shall be provided by the CONTRACTOR, at no increase in cost to the DISTRICT.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The WORK of this Contract comprises the construction and testing of one (1) Lake Wales Surficial Aquifer monitor well (LW SA MW-1), one (1) Lake Wales Upper Floridan Aquifer monitor well (LW UFA MW-1), one (1) Lake Wales dual-zone Lower Floridan aquifer (LW LFA DZMW-1) monitor well, and ancillary piping and appurtenances, in accordance with the specifications and Contract Documents.

B. The WORK is located at the CITY OF LAKE WALES Tractor Lake permanent easement located in central southeast Polk County, Florida, in the City of Lake Wales.

1.3 CONTRACT METHOD

A. The WORK hereunder shall be constructed under a contract payment for all WORK, materials and equipment specified in this section will be included in the appropriate unit price or lump sum items as stated in Contractors Unit Price Bid Schedule.

1.4 WORK BY OTHERS

A. Where two or more contracts are being performed at one time on the same Site or adjacent land in such manner that work under one contract may interfere with work under another, the DISTRICT will determine the sequence and order of the Work in either or both contracts. When the Site of one contract is the necessary or convenient means of access for performance of work under another, the DISTRICT may grant privilege of access or other reasonable privilege to the contractor so desiring, to the extent, amount, and in manner, and at time, that the DISTRICT may determine. No DISTRICT determination of method, time, sequence, order of the work, or access privilege shall be the basis for a claim for delay or damage, except under provisions of the General Conditions for temporary suspensions of the work. The CONTRACTOR shall conduct its operations so as to cause a minimum of interference with the work of such other contractors, and shall cooperate fully with such contractors to allow continued safe access to their respective portions of the Site, as required to perform work under their respective contracts.

B. Interference With Work On Utilities: The CONTRACTOR shall cooperate fully with all utility forces of the DISTRICT or forces of other public or private agencies engaged in the relocation, altering, or otherwise rearranging any facilities which interfere with the progress

of the WORK, and shall schedule the WORK so as to minimize interference with said relocation, altering, or other rearranging of facilities.

1.5 WORK SEQUENCE

A. Mobilization and Site Preparation: The CONTRACTOR is hereby advised that the following construction related activities are representative of the WORK, but their sequence may be changed by the ENGINEER/GEOLOGIST relative to order of occurrence, or deletion. The proposed WORK sequence is as follows:

1. Install temporary services.

2. Construction of temporary fluid containment pad and install surface casing to CONTRACTOR selected depth for LW SA MW-1, LW UFA MW-1, and LW LFA DZMW-1 as shown on the drawings.

3. Mobilize drilling and other required materials and equipment required for construction.

4. Excavate fill materials and install pit casings to the depth required for the drilling of LW SA MW-1, LW UFA MW-1, and LW LFA DZMW-1, subject to the approval of the ENGINEER/GEOLOGIST and in accordance with **Section 33 22 11**. Excavated fill materials shall be stockpiled onsite at the location designated by the DISTRICT.

B. Surficial Aquifer Monitor Well Drilling and Testing: The CONTRACTOR is hereby advised that the following construction related activities are representative of the WORK, but the sequence of testing such as straddle-packer testing, and geophysical logging, etc., may be changed by the ENGINEER/GEOLOGIST relative to order of occurrence, or deletion, or additional testing that may be added. No drilling or testing on the LW SA MW-1 shall take place until Part 1.5 A., above is complete for the LW SA MW-1 to the satisfaction of the ENGINEER/GEOLOGIST.

1. Mobilize to well site in accordance to **Section 01 05 00**.
2. Using the hollow stem drilling method or alternate drilling method, drill nominal 10-inch diameter pilot hole to approximately 70 feet bls and collect lithology samples at intervals in accordance with **Section 33 22 10**.
3. Install approximately 20 feet of 4-inch diameter SCH 40 PVC final casing and approximately 50 feet of 0.010-inch slot size slotted PVC screen to approximately 70 feet bls in accordance with **Section 33 22 11**.
4. Install gravel pack two feet above the screened interval, followed by 2 feet of bentonite seal and cement 4-inch diameter PVC final casing from approximately 14 feet bls to land surface in accordance to **Section 33 22 12**.
5. Develop Well. Collect and analyze water quality samples in accordance to **Section 33 22 15, Group 1 and Field**. Dispose of produced water in accordance to **Section 33 22 20.**
6. Complete final wellhead and pad in accordance to **Section 33 22 21**.
7. Install temporary transducer.

8. Demobilize and mobilize to LW UFA MW-1 site in accordance with **Section 01 50 00**.

C. Upper Floridan aquifer Monitor Well/Supply Well Drilling and Testing: The CONTRACTOR is hereby advised that the following construction related activities are representative of the WORK, but the sequence of testing such as straddle-packer testing, and geophysical logging, etc., may be changed by the ENGINEER/GEOLOGIST relative to order of occurrence, or deletion, or additional testing that may be added. No drilling or testing on the LW UFA MW-1 shall take place until Part 1.5 A., above is complete for the LW UFA MW-1 to the satisfaction of the ENGINEER/GEOLOGIST.

1. Mobilize to well site in accordance with **Section 01 50 00**.
2. Using the mud rotary drilling method, drill nominal 12-inch diameter pilot hole to approximately 285 feet bls while recording mechanical deviation surveys and collect lithology samples at intervals in accordance with **Section 33 22 10**.
3. Conduct geophysical logging in accordance to **Section 33 22 14** to approximately 285 feet bls (XYC, GR, DIL with SP, and BHCS with VDL).
4. Ream 16-inch diameter borehole to approximately 285 feet bls via the mud rotary drilling method, while recording mechanical deviation surveys at intervals in accordance with **Section 33 22 10**.
5. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC and GR) to approximately 285 feet bls.
6. Install and cement 6-inch diameter PVC final casing to approximately 275 feet bls with neat cement in accordance to **Section 33 22 11** and **Section 33 22 12**.
7. Switch drill rig from mud rotary to reverse air drilling technique in accordance to **Section 33 22 10**.
8. Drill out cement plug with nominal 5-inch diameter drill bit via the reverse air drilling method in accordance with **Section 33 22 10**.
9. Drill 5-inch diameter pilot hole to approximately 400 feet bls via the reverse air drilling method while recording mechanical deviation surveys and collecting lithology samples at intervals in accordance with **Section 33 22 10**.
10. Develop Well and collect water quality samples in accordance to **Section 33 22 15, Group 1 and Field**. Dispose of produced water in accordance to **Section 33 22 20.**
11. Conduct final suite of geophysical logging in accordance to **Section 33 22 14** to total depth of well (XYC, GR, DIL with SP, BHCS with VDL, and CTVS). Dispose of produced water in accordance to **Section 33 22 20.**
12. Complete final wellhead and pad in accordance with **Section 33 22 21**.
13. Install permanent Sampling Pump and temporary transducers in accordance with **Section 43 20 00** and **Section 43 24 03**.
14. Demobilize and mobilize to Exploratory LFA Well/DZMW Site in accordance with **Section 01 50 00**.

D. Lower Floridan Aquifer Dual Zone Monitor Well Construction and Testing: The CONTRACTOR is hereby advised that the following construction related activities are representative of the WORK, but the sequence of testing such as straddle-packer testing, and geophysical logging, etc., may be changed by the ENGINEER/GEOLOGIST relative to order of occurrence, or deletion, or additional testing that may be added. No drilling or testing on the LW LFA DZMW-1 shall take place until Part 1.5 A., above is complete to the satisfaction of the ENGINEER/GEOLOGIST.

1. Mobilize to well site in accordance with **Section 01 50 00**.
2. Installation of pit casing, to be determined by drilling contractor in accordance with **Section 33 22 11**.
3. Drill 12.25-inch diameter pilot hole to approximately 110 feet bls via the mud rotary drilling method. Record mechanical deviation surveys and collect lithology samples at intervals in accordance with **Section 33 22 10**.
4. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC, GR, DIL with SP, and BHCS with VDL).
5. Ream nominal 42-inch diameter borehole to approximately 110 feet bls via the mud rotary drilling method. Record mechanical deviation surveys at intervals in accordance with **Section 33 22 10**.
6. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC and GR).
7. Install and cement 34-inch diameter surface steel casing to approximately 100 feet bls with neat cement in accordance with **Section 33 22 11** and **Section 33 22 12**.
8. Drill 12.25-inch diameter pilot hole to approximately 485 feet bls via the mud rotary drilling method. Record mechanical deviation surveys and collect lithology samples, at intervals in accordance with **Section 33 22 10**.
9. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC, GR, DIL with SP, and BHCS with VDL).
10. Ream nominal 34-inch diameter borehole to approximately 485 feet bls via the mud rotary drilling method. Record mechanical deviation surveys at intervals in accordance with **Section 33 22 10**.
11. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC and GR).
12. Install and cement 24-inch diameter intermediate steel casing to approximately 475 feet bls with neat cement in accordance with **Section 33 22 11** and **Section 33 22 12**.
13. Switch drilling system from mud rotary to reverse air drilling technique in accordance with **Section 33 22 10**.
14. Drill out cement plug with nominal 24-inch diameter drill bit in accordance with **Section 33 22 10**.
15. Drill 12.25-inch diameter pilot hole to approximately 1,425 feet bls. Record mechanical deviation surveys, collect up to three (3) rock cores, collect lithology samples, analyze air-lifted water samples, and conduct drill stem specific capacity testing during reverse-air drilling at intervals of 30 feet in accordance with **Section 33 22 10, Section 33 22 13,** and **Section 33 22 15,**

Group 1 and Field. Dispose of produced water in accordance to **Section 33 22 20.**

16. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC, GR, DIL with SP, BHCS with VDL, CTVS, and Optical Borehole Imager [OBI]).
17. Conduct up to 3 packer tests in accordance to **Section 33 22 17** and **Section 33 22 15**, **Group 2** and **Field**. Discharge produced settled water in accordance with **Section 33 22 20**.
18. Backplug pilot hole with lime rock from 1,425 feet to 1,410 feet bls and up to 6% bentonite cement from 1,410 feet to base of 24-inch diameter intermediate steel casing in accordance to **Section 33 22 12**.
19. Ream nominal 24-inch diameter borehole to approximately 1,425 feet bls. Record mechanical deviation surveys at intervals in accordance with **Section 33 22 10**.
20. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC and GR).
21. Install and cement 16-inch diameter intermediate steel casing to approximately 1,415 feet bls with neat cement in accordance with **Section 33 22 11** and **Section 33 22 12**.
22. Drill 12.25-inch diameter pilot hole to approximately 3,200 feet bls. Record mechanical deviation surveys, collect up to four (4) rock cores, collect lithology samples, analyze air-lifted water samples, and conduct drill stem specific capacity testing during reverse-air drilling at intervals of 30 feet in accordance with **Section 33 22 10, Section 33 22 13,** and **Section 33 22 15, Group 1** and **Field**. Dispose of produced water in accordance to **Section 33 22 20.**
23. Conduct geophysical logging in accordance to **Section 33 22 14** (XYC, GR, DIL with SP, BHCS with VDL, CTVS, OBI, Static and Dynamic Temperature, Fluid Resistivity, and Flow Meter Logs) to approximately 32,000 feet bls. Collect Thief Water Samples in accordance with **Section 33 22 15, Group 1** and **Field**.
24. Conduct up to 5 packer tests in accordance to **Section 33 22 17**, **Section 33 22 15**, **Group 2** and **Field**. Discharge produced settled water in accordance with **Section 33 22 20**.
25. Backplug pilot hole with neat cement from approximately 3,200 feet bls to approximately 2,600 feet bls in accordance with **Section 33 22 12.**
26. Install and cement 6-inch diameter FRP casing with a cement shoe at approximately 2,090 feet bls with neat cement to 1,700 feet bls in accordance with **Section 33 22 11** and **Section 33 22 12**.
27. Develop both UMZ and LMZ and geophysical logging (CTVS). Collect water quality samples in accordance to **Section 33 22 15, Field and Group 3**. Dispose of produced water in accordance to **Section 33 22 20.**
28. Complete final wellhead and pad in accordance with **Section 33 22 21**.
29. Upon completion of all three wells, two (2) step tests (each test consisting of four, three hour long steps (totaling 12 hours)) will be performed with the LW LFA DZMW-1 as the pumping well and collect water quality samples in accordance with **Section 33 22 15, Field** and **Group 2 and Section 33 22 16**. Dispose of produced water in accordance to **Section 33 22 20.**

30. Upon completion the two (2) step tests (each consisting of four, three hour long steps (totaling 12 hours)), an APT will be performed by pumping the LW UFA MW-1 with temporary transducers in accordance with **Section 33 22 16**.
31. Install permanent sampling pump **Section 43 20 00** and **Section 43 24 03**.
32. Demobilize all equipment and conduct site cleanup and restoration in accordance with **Section 01 50 00** and **Section 01 77 00**.

1.6 CONTRACTOR USE OF SITE

A. The CONTRACTOR's use of the Site shall be limited to its construction operations, including onsite storage of materials, onsite fabrication facilities, and field offices. The CONTRACTOR's use of Site is limited as indicated.

1.7 OUTAGE PLAN AND REQUESTS

A. Unless the Contract Documents indicate otherwise, the CONTRACTOR shall not remove from service, de-energize, or modify settings for any existing operating tank pipeline, valve, channel, equipment, structure, road, or any other facility without written permission from the DISTRICT.

B. Where the WORK requires modifications to existing facilities or construction of new facilities and/or connection of new facilities to existing facilities, the CONTRACTOR shall submit a detailed outage plan and schedule for the DISTRICT's and ENGINEER/GEOLOGIST'S approval a minimum of two (2) weeks in advance of the time that such outage is required.

C. A completed System Outage Request form (blank furnished by the ENGINEER/GEOLOGIST) shall accompany each outage plan. The outage plan shall be coordinated with the construction schedule and shall meet the restrictions and conditions of the Contract Documents. The outage plan shall describe the CONTRACTOR's method for preventing bypassing of other treatment units; the length of time required to complete said operation; any necessary temporary power, controls, instrumentation or alarms required to maintain control, monitoring, and alarms for the treatment plant processes; and the manpower, plant, and equipment, which the CONTRACTOR will furnish for proper operation of associated treatment units. All costs for preparing and implementing the outage plans shall be at no increase in cost to the DISTRICT.

D. The ENGINEER/GEOLOGIST shall be notified in writing at least one week in advance of the required outage if the schedule for performing the work has changed or if revisions to the outage plan are required.

E. The CONTRACTOR shall provide written confirmation of the shutdown date and time two (2) work days prior to the actual shutdown.

1.8 DISTRICT USE OF THE SITE

A. The DISTRICT may utilize all or part of the existing Site during the entire period of construction for the conduct of the DISTRICT's normal operations. The CONTRACTOR shall cooperate and coordinate with the DISTRICT to facilitate the DISTRICT's operations and to minimize interference with the CONTRACTOR's operations at the same time. In

any event, the DISTRICT shall be allowed access to the Site during the period of construction.

1.9 PROJECT MEETINGS

A. Preconstruction Conference

1. Prior to the commencement of WORK at the Site, a preconstruction conference will be held at a mutually agreed time and place. The conference shall be attended by the CONTRACTOR'S Project Manager, its superintendent, and its subcontractors as the CONTRACTOR deems appropriate. Other attendees will be:

   a. ENGINEER/GEOLOGIST and the Resident Project Representative,

   b. Representatives of DISTRICT,

   c. Principal Sub-Contractors

   d. Governmental representatives as appropriate, and

   e. Others as requested by CONTRACTOR, DISTRICT, or ENGINEER/GEOLOGIST.

2. The CONTRACTOR shall bring the preconstruction conference submittals in accordance with **Section 01 33 00** - Contractor Submittals.

3. The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The complete agenda will be furnished to the CONTRACTOR prior to the meeting date. However, the CONTRACTOR should be prepared to discuss all of the items listed below.

   a. Status of CONTRACTOR's, notice of commencement, insurance, and bonds,

   b. CONTRACTOR's tentative project schedule (work activities, critical path),

   c. Transmittal, review, and distribution of CONTRACTOR's submittals,

   d. Processing applications for payment,

   e. Maintaining record documents,

   f. Critical work sequencing,

   g. Authority for field decisions,

   h. Change Orders and processing requirements,

   i. Use of Site (field office, storage areas, security, housekeeping, and DISTRICT's needs),

   j. Major equipment deliveries and priorities,

k. CONTRACTOR's responsibility for safety and first aid, and personnel assignments,

l. Daily Report Form which the CONTRACTOR will furnish, and

m. Submittal Transmittal Form which the ENGINEER/GEOLOGIST will furnish.

4. The ENGINEER/GEOLOGIST will preside at the preconstruction conference and will arrange for preparing and distributing the minutes to all persons in attendance.

5. The duration of the preconstruction conference is anticipated to take no less than 2 hours; the CONTRACTOR and his respective subcontractors and personnel should plan accordingly.

B. Progress Meetings

1. The ENGINEER/GEOLOGIST will schedule and hold regular onsite progress meetings at least monthly and at other times as requested by CONTRACTOR or as required by progress of the WORK. The CONTRACTOR, ENGINEER/GEOLOGIST, and SUBCONTRACTORS active on the Site shall attend each meeting. CONTRACTOR may at its discretion provide for attendance by representatives of its suppliers and manufacturers, as appropriate.

2. The ENGINEER/GEOLOGIST will preside at the progress meetings and will arrange for preparing and distributing the minutes. The purpose of the meetings is to review the progress of the WORK, maintain coordination of efforts, review the CONTRACTOR’s schedule, discuss changes in scheduling, resolve other issue that may develop during the course of the project and include a two (2) week look ahead. During each meeting, the CONTRACTOR shall present any issues that may impact its progress with a view to resolve these issues expeditiously.

PART 2 -- PRODUCTS

2.1 CASING

A. Casing setting depths are approximate and are subject to approval by the ENGINEER/GEOLOGIST and may also require approval by the Florida Department of Environmental Protection. Casing diameters, thicknesses, and approximate casing setting depths are listed in the following summary table:

Surficial Aquifer Monitor Well (LW SA MW-1)

	Casing Diameter (inches)		Casing Wall Thickness (inches)	Casing Depth (Feet bls)
	Inside	Outside		
PVC Schedule 40	3.998	4.50	0.237	20
0.010-inch Slot Size PVC Schedule 40	3.998	4.50	0.237	70

Upper Floridan Aquifer Monitor Well/Supply Well (LW UFA MW-1)

	Casing Diameter (inches)		Casing Wall Thickness (inches)	Casing Depth (Feet bls)
	Inside	Outside		
Pit Steel Casing	12.0	12.75	0.375	TBD
Final PVC Casing	6.031	6.625	0.280	275

TBD – to be determined

Lower Floridan Aquifer Dual-Zone Monitor Well (LW LFA DZMW-1)

Construction and Testing

	Casing Diameter (inches)		Casing Wall Thickness (inches)	Casing Depth (Feet bls)
	Inside	Outside		
Pit Steel Casing	45.25	46.00	0.375	TBD
Surface Steel Casing	33.25	34.00	0.375	TBD
Intermediate Steel Casing	23.25	24.00	0.375	475
Final Steel Casing (Upper Monitor Zone)	15.25	16.00	0.375	1,415
FRP Tubing (Lower Monitor Zone)	5.43	5.85	0.22	2,090

PART 3 -- EXECUTION - NOT USED

- END OF SECTION -

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SECTION 01 29 00 - MEASUREMENT AND PAYMENT

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Payment for the various items of the Bid Schedule, as further specified herein, shall include all compensation to be received by the CONTRACTOR for furnishing all tools, equipment, supplies, and manufactured articles, and for all labor, operations, and incidentals appurtenant to the items of work being described, as necessary to complete the various items of the WORK all in accordance with the requirements of the Contract Documents, including all appurtenances thereto, and including all costs of permits and cost of compliance with the regulations of public agencies having jurisdiction, including Safety and Health Requirements of the Occupational Safety and Health Administration of the U.S. Department of Labor (OSHA). No separate payment will be made for any item that is not specifically set forth in the Bid Schedule, and all costs therefor shall be included in the prices named in the Bid Schedule for the various appurtenant items of work.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION

SECTION 01 29 73 - SCHEDULE OF VALUES

PART 1 -- GENERAL

1.1 THE SUMMARY

A. This Section defines the process whereby the Schedule of Values (lump sum price breakdown) shall be developed and incorporated into the cost loading function of the CPM Schedule in accordance with the requirements of **Section 01 32 16** – CPM Construction Schedule.

B. Monthly progress payment amounts will be determined from the monthly progress updates of the CPM Schedule activities.

C. Develop the Schedule of Values independent of but simultaneous with the development of the CPM Schedule activities and logic.

1.2 PRELIMINARY SCHEDULE OF VALUES

A. Submit a preliminary Schedule of Values for the major components of the WORK at the Preconstruction Conference in accordance with the requirements of **Section 01 10 00** – Summary of Work.

B. At a minimum, submit proposed values for the following major WORK components:

1. Mobilization;

2. the total value of electrical WORK;

3. the total value of instrumentation and control WORK;

4. the total value of protective coatings WORK;

5. the total value of yard mechanical WORK inclusive of excavation, pipe installation, testing and backfill of pipe, and all incidental WORK associated with underground pipe installations;

6. the total value of mechanical WORK:

   a. exclusive of yard mechanical WORK included in Item 5 above, but including piping, valves, equipment, tanks, and appurtenances at new and existing structures;

   b. break down this total value into separate values for each new and existing structure constructed or modified as a part of the WORK;

7. the total value of structural reinforced concrete WORK:

   a. inclusive of excavation, dewatering, subgrade preparation, backfill, and incidental WORK for new structures;

b. break down this total value shall be broken down into separate values for each new structure constructed as a part of the WORK;

c. miscellaneous and minor concrete WORK may be listed as one item in this breakdown;

8. the total value of pre-engineered metal buildings:

a. inclusive of architectural WORK, doors, windows and other incidental systems and features;

b. break down, this total value shall be broken down into separate values for each pre-enigneered metal building;

9. the total value of the Rain–for-Rent fractionation tanks;

10. the total value of site civil WORK, inclusive of clearing and grubbing, paving, grading and drainage WORK, and;

11. the total value of other WORK not specifically included in the above items.

C. Review and Revisions

1. The CONTRACTOR and ENGINEER\GEOLOGIST shall meet and jointly review the preliminary Schedule of Values and make any adjustments in value allocations if, in the opinion of the ENGINEER\GEOLOGIST, these are necessary to establish fair and reasonable allocation of values for the major WORK components.

2. Front-end loading will not be accepted.

3. The ENGINEER\GEOLOGIST may require reallocation of major WORK components from items in the above listing if in the opinion of the ENGINEER\GEOLOGIST such reallocation is necessary.

4. This review and any necessary revisions shall be completed within 15 Days from the date of Notice to Proceed.

1.3 DETAILED SCHEDULE OF VALUES

A. Prepare and submit a detailed Schedule of Values to the ENGINEER\GEOLOGIST within 30 Days from the date of Notice to Proceed.

B. Base the detailed Schedule of Values on the accepted preliminary Schedule of Values for major WORK components.

C. Because the ultimate requirement is to develop a detailed Schedule of Values sufficient to determine appropriate monthly progress payment amounts through cost loading of the CPM Schedule activities, furnish a sufficiently detailed breakdown in order to meet this requirement.

D. The ENGINEER\GEOLOGIST will be the sole judge of acceptable numbers, details and description of values established.

E. If, in the opinion of the ENGINEER\GEOLOGIST, a greater number of Schedule of Values items than proposed is necessary, add the additional items so identified by the ENGINEER\GEOLOGIST.

F. Submit the minimum detail of breakdown of the major WORK components as follows; furnish greater detail if requested by the ENGINEER\GEOLOGIST:

1. Mobilization: no breakdown required;

2. **Section 01 32 16** – CPM Construction Schedule: break down by submittal;

3. Break down the electrical WORK by structure and yard facilities, as follows:

    a. Break down structures electrical WORK into conduit and raceway installation, cable and wire installation, electrical equipment installation, terminations, and lighting; and,

    b. Break down yard facilities electrical WORK by duct bank designation and substations;

4. Break down instrumentation and control WORK by structure;

5. Protective Coating WORK:

    a. Break down protective coating WORK by structure and yard area;

    b. Where specific coating WORK at structures or yard areas may be critical to performing the WORK in order to meet milestone and Contract Times, such WORK shall be included as individual pay and Schedule activity items;

6. Yard Piping WORK:

    a. Break down into individual pipelines running from and to Contract termination points.

    b. Each pipeline shall be an individual pay item unless otherwise allowed by the ENGINEER\GEOLOGIST.

7. Break down mechanical WORK within each structure in order to identify individual piping systems, equipment installation by equipment name and number, and equipment testing and checkout.

8. Break down concrete structures into excavation, subgrade preparation, and appurtenant pre-foundation WORK, concrete foundation construction, slabs on grade, walls/columns, suspended slabs, stairs, and the like (provide sufficiently detailed breakdown in order to accommodate necessary Schedule detail), hydrostatic structure testing, where required, and backfill.

9. Break down pre-engineered metal buildings into building frame erection, roofs, decks, siding and soffit WORK, insulation, doors/windows/louvers, and other items determined to be necessary for the establishment of pay and schedule activity items.

10. Break down the sludge lagoons into excavation, earthwork subgrade protection and preparation, concrete base, sloped concrete, access ramps/roadways, and other

items determined to be necessary for the establishment of pay and schedule activity items.

11. Break down civil site WORK into individual drainage piping, drainage structures, site concrete, paving, excavation cut and fill, removal of existing pipe, clearing and grubbing, and other items determined to be necessary for the establishment of pay and schedule activity items.

12. Break down pre-commissioning and commissioning based on completion milestones for each.

13. Break down other WORK not specifically included in the above items, as necessary for the establishment of pay and schedule activity items.

G. Adjustments and Acceptance

1. The CONTRACTOR and ENGINEER\GEOLOGIST shall meet and jointly review the detailed Schedule of Values within 35 Days from the date of Notice to Proceed, at which time the value allocations and extent of detail shall be reviewed in order to determine if necessary adjustments to the values are required, and to determine if sufficient detail has been proposed in order to allow acceptable cost loading of the CPM Schedule activities.

2. Make necessary adjustments to the value allocation or level of detail, and submit a revised detailed Schedule of Values within 40 Days from the date of Notice to Proceed.

3. Following acceptance of the detailed Schedule of Values, incorporate the values into the cost loading portion of the CPM Schedule.

4. Concurrently develop the CPM activities and logic with the development of the detailed Schedule of Values; however, it shall be necessary to adjust the detailed Schedule of Values to correlate to individual Schedule activities.

5. It is anticipated that instances will occur, due to the independent but simultaneous development of the Schedule of Values and the CPM Schedule activities, where interfacing these 2 documents will require changes to each document.

6. Schedule activities may need to be added to accommodate the detail of the Schedule of Values, and Schedule of Value items may need to be added to accommodate the detail of the CPM Schedule activities.

7. Where such instances arise, propose changes to the Schedule of Values and to the CPM Schedule activities in order to satisfy the CPM Schedule cost loading requirements.

1.4 CROSS-REFERENCE LISTING

A. To assist in the correlation of the Schedule of Values and the CPM Schedule, provide a cross-reference listing to be furnished in 2 parts:

1. In the first part, list each scheduled activity with the breakdown of the respective valued items making up the total cost of the activity; and,

2. In the second part, list the valued item with the respective schedule activity or activities that make up the total indicated cost.

B. In the case where a number of schedule items make up the total cost for a valued item (shown in the Schedule of Values), indicate the total cost for each Schedule of Value item.

C. Update and submit these listings in conjunction with the CPM monthly submittals as indicated in **Section 01 32 16** – CPM Construction Schedule.

D. Incorporate approved Change Orders reflected in the CPM Schedule into the Schedule of Values as a single unit identified by the Change Order number.

1.5 CHANGES TO SCHEDULE OF VALUES

A. Changes to the CPM Schedule which additional activities not included in the original schedule but included in the original WORK (schedule omissions) shall have values assigned as approved by the ENGINEER\GEOLOGIST.

B. Reduce other activity values in order to provide equal value adjustment increases for added activities, as approved by the ENGINEER\GEOLOGIST.

C. In the event that the CONTRACTOR and ENGINEER\GEOLOGIST agree to make adjustments to the original Schedule of Values because of inequities discovered in the original accepted detailed Schedule of Values, increases and equal decreases to values for activities may be made.

1.6 LIQUIDATED DAMAGES

A. The Schedule of Values information is an integral part of the scheduling and reporting under **Section 01 32 16** – CPM Construction Schedule and the progress payment information.

B. As such, it is critical information to evaluating progress and the proper planning of the DISTRICT's and ENGINEER\GEOLOGIST's WORK related effort as well as their financial obligations associated with the Project.

C. Accordingly, if a submittal required by this Section is found to be incomplete or is submitted later than required, the DISTRICT will suffer financial loss and, accordingly, liquidated damages will be assessed against the CONTRACTOR in accordance with Article 3 of the Agreement.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 14 - BARCHART CONSTRUCTION SCHEDULE

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall schedule the WORK in accordance with the Contract Documents.

B. Where submittals are indicated, submit 4 copies of each item.

C. The CONTRACTOR is alerted to **Section 01 14 00** – Construction and Schedule Constraints.

1.2 INITIAL SCHEDULE SUBMITTALS

A. The CONTRACTOR shall submit 2 schedule documents at the Preconstruction Conference that shall serve as the CONTRACTOR's Plan of Operation for the initial 60 Day period of the Contract Times and shall identify the manner in which the CONTRACTOR intends to complete WORK within the Contract Time. The CONTRACTOR shall submit a 60 Day Plan of Operation Bar Chart Schedule and a Project Overview Bar Chart Schedule for WORK as indicated below.

1. 60 Day Bar Chart Plan of Operation Schedule: The bar chart shall show the CONTRACTOR's early activities (mobilization, permits, submittals necessary for early material and equipment procurement, submittals necessary for long lead equipment procurement, scheduling submittals, initial site work, and other submittals) required in the first 60 Days).

2. Project Overview Bar Chart Schedule: The Bar Chart shall indicate the major components of the WORK and the sequence relations between the major components and subdivisions of major components. The bar chart schedule shall indicate the relationships and time frames in which the various components of the WORK will be made substantially complete and placed into service in order to meet the Contract Times. Sufficient detail shall be included for the identification of subdivisions of major components according to such activities as mobilization, site dewatering, excavation, demolition, yard piping installation, placement of structural backfill, final site grading, and other important WORK for each major item within the overall project scope. Planned durations and start dates shall be indicated for each work item subdivision. Each major component and subdivision component shall be accurately plotted on time scale sheets not to exceed 36-inches by 60-inches in size. Not more than 4 sheets shall be employed to represent this overview information.

B. The ENGINEER/GEOLOGIST and the CONTRACTOR shall meet to review and discuss the 60 Day Plan of Operations and Project Overview Schedules within 5 Days after submittal. The ENGINEER/GEOLOGIST's review and comment on the schedules will be limited to conformance to the Contract Documents. The CONTRACTOR shall make corrections to the schedules necessary to comply with requirements and shall adjust the schedules to incorporate any missing information requested by the ENGINEER/GEOLOGIST.

1.3 CHANGE ORDERS

A. Upon approval of a change order or upon receipt of authorization to proceed with additional WORK, the change shall be depicted in the next submittal of the Project Overview Bar Chart Schedule.

1.4 STATUS REPORTING

A. The CONTRACTOR shall furnish monthly Project Overview Bar Chart Schedules and written narrative reports in the form indicated below.

B. The Project Overview Bar Chart Schedule shall be a summary of the current construction schedule for major project components (original and as updated and adjusted throughout the entire construction period). It shall be limited to not more than 4 sheets, each of which shall not exceed 36-inches by 60-inches. The major project components shall be represented as time bars which shall be subdivided into various types of WORK including dewatering, excavation, demolition, yard piping, placement of structural backfill, and final site grading.

C. Each major component and subdivision shall be plotted accurately on a time scale consistent with the early start and finish activity information contained in the latest update of the schedule. In addition, a percent completion shall be listed for each major component and subdivision. The CONTRACTOR shall amend the Project Overview Bar Chart Schedule as necessary to include any additional detail required by the ENGINEER/GEOLOGIST. The CONTRACTOR shall include any additional information requested by the ENGINEER/GEOLOGIST at any time during construction.

D. The CONTRACTOR shall prepare monthly written narrative reports of the status of the project for submission to the ENGINEER/GEOLOGIST. Status reports shall include:

1. The status of major project components (percent complete and amount of time ahead or behind schedule) and an explanation of how the project will be brought back on schedule if delays have occurred.

2. The progress made on critical activities indicated on the construction schedule.

3. Explanations for any lack of WORK on critical activities planned to be performed during the last month.

4. Explanations for any schedule changes, including changes to the logic or to activity durations.

5. A list of the critical activities scheduled for the next 2 months.

6. The status of major material and equipment procurements.

7. The value of materials and equipment properly stored at the Site but not yet incorporated into the WORK.

8. Any delays encountered during the reporting period.

9. An assessment of inclement weather delays and impacts to the progress of the WORK.

10. The CONTRACTOR may include any other information pertinent to the status of the project.

11. The CONTRACTOR shall include additional status information requested by the ENGINEER/GEOLOGIST.

1.5 INCLEMENT WEATHER PROVISIONS OF THE SCHEDULE

A. The construction schedule shall include lost days on the construction schedule due to inclement weather. Inclement weather delays shall be determined in accordance with **Section 00 73 13** - Supplementary General Conditions.

1.6 LIQUIDATED DAMAGES

A. If any submittal required by this Section is determined by the ENGINEER/GEOLOGIST to be incomplete or is submitted later than required, the DISTRICT will suffer financial loss and, accordingly, liquidated damages may be assessed against the CONTRACTOR in accordance with Article 3 of the Agreement.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

END OF SECTION

SECTION 01 33 00 - CONTRACTOR SUBMITTALS

PART 1 -- GENERAL

1.1 GENERAL

A. Wherever submittals are required in the Contract Documents, unless otherwise specified the CONTRACTOR shall submit seven (7) copies to the ENGINEER/GELOGIST.

B. Within 7 Days after the date of commencement as stated in the Notice to Proceed, the CONTRACTOR shall submit the following items to the ENGINEER/GELOGIST for review:

1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("Or-Equal") submittals listed in the Bid. Base the schedule of submittals on CONTRACTOR's priority, planned construction sequence and schedule, long-lead items, and size of submittal package. Allow time for resubmittals.

2. A list of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit and the expected date of submittal for the permit and required date for receipt of the permit.

3. A project overview Barchart schedule.

4. A mobilization plan including a Site layout plan with a clearly delineated construction area, proposed access routes, and areas identified as access only (no construction related activities shall be conducted).

1.2 PRECONSTRUCTION CONFERENCE SUBMITTALS

A. At the preconstruction conference of **Section 01 10 00 - Summary of Work**, the CONTRACTOR shall submit the following items to the ENGINEER/GELOGIST for review:

1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitute ("Or-Equal") submittals listed in the Bid.

2. A list of proposed equipment, vendors and material specifications to be used.

3. A list of permits and licenses the CONTRACTOR shall obtain, indicating the agency required to grant the permit, the expected date of submittal for the permit, and required date for receipt of the permit.

4. A preliminary schedule of values in accordance with **Section 01 29 73 - Schedule of Values**.

5. A 60-day plan of operation in accordance with **Section 01 32 14 - Barchart Construction Schedule**.

6. A project overview bar chart in accordance with **Section 01 32 14 – Barchart Construction Schedule**.

7. A mobilization plan including a Site layout plan with a clearly delineated construction area, proposed access routes, and areas identified as access only (no construction related activities shall be conducted).

8. A detailed layout of the field office required under **Section 01 52 00 - Field Office, Equipment, and Services**. The office shall not be shipped to the Site until the layout is approved.

1.3 SHOP DRAWINGS

A. Wherever called for in the Contract Documents or where required by the ENGINEER/GELOGIST, the CONTRACTOR shall furnish to the ENGINEER/GELOGIST for review 7 copies plus one reproducible copy, of each Shop Drawing submittal.

B. Shop Drawings may include detail design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items.

C. Whenever the CONTRACTOR is required to submit design calculations as part of a submittal, such calculations shall bear the signature and seal of an ENGINEER registered in the appropriate branch and in the state wherein the project is located, unless otherwise indicated.

D. Transmittal Form

1. Shop Drawing submittals shall be accompanied by the ENGINEER/GELOGIST's standard submittal transmittal form, a reproducible copy of which is available from the ENGINEER/GELOGIST.

2. A submittal without the form or where applicable items on the form are not completed will be returned for resubmittal.

E. Organization

1. Use a single submittal transmittal form for each technical specification Section or item or class of material or equipment for which a submittal is required.

2. A single submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components. Example: if a pump section references other sections for the motor, shop-applied protective coating, anchor bolts, local control panel, and variable frequency drive, a single submittal would be acceptable. A single submittal covering vertical turbine pumps and horizontal split case pumps would not be acceptable.

3. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components.

4. Relate the submittal components to specification paragraph and subparagraph, Drawing number, detail number, schedule title, room number, or building name, as applicable.

5. Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match those used in the Contract Documents.

F. Format

1. Minimum sheet size shall be 8.5 inches by 11 inches. Maximum sheet size shall be 24 inches by 36 inches.

2. Number every page in a submittal in sequence.

3. Collate and staple or bind, as appropriate, each copy of a submittal; the ENGINEER/GELOGIST will not collate sheets or copies.

4. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with complete pertinent data capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports.

5. Present a sufficient level of detail for assessment of compliance with the Contract Documents.

6. Numbering

a. Each submittal shall be assigned a unique number.

b. Number the submittals sequentially, with the submittal numbers clearly noted on the transmittal.

c. Original submittals shall be assigned a numeric submittal number followed by a letter of the alphabet to distinguish between the original submittal and each resubmittal. For example, if submittal 25-A requires a resubmittal, the first resubmittal will bear the designation "25-B" and the second resubmittal will bear the designation "25-C" and so on.

G. Disorganized submittals that do not meet the requirements of the Contract Documents will be returned without review.

H. ENGINEER’s Review

1. Except as may otherwise be indicated, the ENGINEER will return prints of each submittal to the CONTRACTOR with comments noted thereon, within 30 days following receipt by the ENGINEER.

2. It is considered reasonable that the CONTRACTOR will make a complete and acceptable submittal to the ENGINEER by the first resubmittal on an item.

3. The DISTRICT reserves the right to withhold monies due to the CONTRACTOR to cover additional costs of the ENGINEER's review beyond the first resubmittal.

4. The ENGINEER'S maximum review period for each submittal or resubmittal will be 30 days. Thus, for a submittal that requires 2 resubmittals before it is complete, the maximum review period could be 90 days.

I. If a submittal is returned to the CONTRACTOR marked "NO EXCEPTIONS TAKEN," formal revision and resubmission will not be required.

J. If a submittal is returned marked "MAKE CORRECTIONS NOTED," CONTRACTOR shall make the corrections on the submittal, but formal revision and resubmission will not be required.

K. Resubmittals

1. If a submittal is returned marked "AMEND-RESUBMIT," the CONTRACTOR shall revise it and shall resubmit the required number of copies.

2. Resubmittal of portions of multi-page or multi-drawing submittals will not be allowed. For example, if a Shop Drawing submittal consisting of 10 Drawings contains one Drawing noted as "AMEND - RESUBMIT," the submittal as a whole is deemed "AMEND - RESUBMIT," and 10 drawings are required to be resubmitted.

3. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.

L. Rejected Submittals

1. If a submittal is returned marked "REJECTED-RESUBMIT," it shall mean either that the proposed material or product does not satisfy the specification, the submittal is so incomplete that it cannot be reviewed, or is a substitution request not submitted in accordance with **Section 01 60 00 - Products, Materials, Equipment, and Substitutions**.

2. In the first 2 cases, the CONTRACTOR shall prepare a new submittal and shall submit the required number of copies to the ENGINEER for review.

3. In the latter case, the CONTRACTOR shall submit the substitution request according to **Section 01 60 00**.

4. Resubmittal of rejected portions of a previous submittal will not be allowed.

5. Every change from a submittal to a resubmittal or from a resubmittal to a subsequent resubmittal shall be identified and flagged on the resubmittal.

M. Fabrication of an item may commence only after the ENGINEER has reviewed the pertinent submittals and returned copies to the CONTRACTOR marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED."

N. Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as changes to the contract requirements.

O. Review by CONTRACTOR

1. Submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR prior to submission to the ENGINEER.

2. Each submittal shall be dated and signed by the CONTRACTOR as being correct and in strict conformance with the Contract Documents.

3. In the case of Shop Drawings, each sheet shall be so dated and signed.

4. Any deviations from the Contract Documents shall be noted on the transmittal sheet.

5. The ENGINEER will only review submittals that have been so verified by the CONTRACTOR.

6. Non-verified submittals will be returned to the CONTRACTOR without action taken by the ENGINEER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

P. Conformance

1. Corrections or comments made on the CONTRACTOR's Shop Drawings during review do not relieve the CONTRACTOR from compliance with Contract Drawings and Specifications.

2. Review is for conformance to the design concept and general compliance with the Contract Documents only.

3. The CONTRACTOR is responsible for confirming and correlating quantities and dimensions, fabrication processes and techniques, coordinating WORK with the trades, and satisfactory and safe performance of the WORK.

1.4 SAMPLES

A. Quantity

1. The CONTRACTOR shall submit the number of samples indicated by the Specifications.

2. If the number is not indicated, submit not less than 3 samples.

3. Where the amount of each sample is not indicated, submit such amount as necessary for proper examination and testing by the methods indicated.

4. Unless otherwise indicated, samples shall be submitted a minimum of 21 days prior to ordering such material.

B. Identification and Distribution

1. Individually and indelibly label or tag each sample, indicating the salient physical characteristics and the manufacturer's name.

2. Upon acceptance by the ENGINEER, one set of the samples will be stamped and dated by the ENGINEER and returned to the CONTRACTOR, one set of samples will be retained by the ENGINEER, and one set shall remain at the Site, in the ENGINEER's field office, until completion of the WORK.

C. Selection

1. Unless indicated otherwise, the ENGINEER will select colors and textures from the manufacturer's standard colors and standard materials, products, or equipment lines.

2. If certain samples represent non-standard colors, materials, products, or equipment lines that will require an increase in Contract Times or Price, the CONTRACTOR shall clearly state so on the transmittal page of the submittal.

D. The CONTRACTOR shall schedule sample submittals such that:

1. Sample submittals for color and texture selection are complete so the ENGINEER has 45 days to assemble color panels and select color and texture dependent products and materials without delay to the construction schedule, and

2. After the ENGINEER selects colors and textures, the CONTRACTOR has sufficient time to provide the products or materials without delay to the construction schedule.

3. The Contract Times will not be extended for the CONTRACTOR's failure to allow enough review and approval or selection time, failure to submit complete samples requiring color or texture selection, or failure to submit complete or approvable samples.

1.5 RECORD DRAWINGS

A. On-Site Drawings Set

1. Maintain one set of Drawings at the Site for the preparation of as-built Drawings.

2. On this set, mark every project condition, location, configuration, and any other change or deviation which may differ from the Contract Drawings at the time of award, including buried or concealed construction and utility features that are revealed during the course of construction.

3. Give special attention to recording the horizontal and vertical location of buried utilities that differ from the locations indicated, or that were not indicated on the Contract Drawings.

4. Supplement the as-built Drawings by any detailed sketches as necessary or as directed, in order to fully indicate the WORK as actually constructed.

5. The as-built drawings are the CONTRACTOR's representation of as-built conditions, shall include revisions made by addenda and change orders, and shall be maintained up-to-date during the progress of the WORK.

6. Use red ink for alterations and notes.

7. Notes shall identify relevant Change Orders by number and date.

B. Submittal

1. Paper copies of the record drawings shall be submitted on the 20th day of every third month after the month in which the Notice to Proceed is given as well as at completion of WORK.

2. Failure to submit complete record drawings on or before the 20th day will enact the liquidated damages clause for interim record drawing submittals described in Article 3 of the Agreement.

C. In the case of those drawings that depict the detail requirement for equipment to be assembled and wired in the factory, such as motor control centers and the like, the record Drawings shall be updated by indicating those portions which are superseded by change order Drawings or final Shop Drawings, and by including appropriate reference information describing the change orders by number and the Shop Drawings by manufacturer, Drawing, and revision numbers.

D. Unacceptable Drawings

1. Disorganized or incomplete record Drawings will not be accepted.

2. The CONTRACTOR shall revise them and resubmit within 10 days.

E. Record drawings shall be accessible to the ENGINEER during the construction period.

F. Final Payment

1. Final payment will not be acted upon until the record Drawings have been completed and delivered to the ENGINEER.

2. Up-to-date as-built Drawings shall be in the form of a set of prints with carefully plotted information overlaid and in electronic form as an Adobe Acrobat PDF file.

G. Upon Substantial Completion of the WORK and prior to final acceptance, the CONTRACTOR shall finalize and deliver a complete set of record Drawings to the ENGINEER for transmittal to the DISTRICT, conforming to the construction records of the CONTRACTOR. This set of Drawings shall consist of corrected Drawings showing the reported location of the WORK.

H. Information submitted by the CONTRACTOR will be assumed to be correct, and the CONTRACTOR shall be responsible for the accuracy of such information.

1.6 QUALITY CONTROL (QC) SUBMITTALS

A. Quality control submittals are defined as those required by the Specifications to present documentary evidence to the ENGINEER that the CONTRACTOR has satisfied certain requirements of the Contract Documents.

B. Unless otherwise indicated, QC submittals shall be submitted:

1. Before delivery and unloading, for the following types of submittals:

a. Manufacturers' installation instructions

b. Manufacturers' and Installers' experience qualifications

c. Ready mix concrete delivery tickets

d. Design calculations

e. Affidavits and manufacturers' certification of compliance with indicated product requirements

f. Laboratory analysis results

g. Factory test reports

2. Within 30 days of the event documented for the following types of submittals:

a. Manufacturers' field representative certification of proper installation

b. Field measurement

c. Field test reports

d. Receipt of permit

e. Receipt of regulatory approval

C. The ENGINEER will record the date that a QC submittal was received and review it for compliance with submittal requirements, but the review procedures above for Shop Drawings and samples will not apply.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 35 53 – SITE SECURITY

PART 1 -- GENERAL

1.1 SECURITY PROGRAM

A. The CONTRACTOR shall:

1. Protect WORK, existing premises, and DISTRICT'S operations from theft, vandalism, and unauthorized entry.

2. Initiate program in coordination with CITY and DISTRICT'S existing security system at mobilization.

3. Maintain program throughout construction period until DISTRICT'S occupancy.

1.2 ENTRY CONTROL

A. The CONTRACTOR shall:

1. Restrict entry of persons and vehicles into Site and existing facilities.

2. Allow entry only to authorized persons with proper identification.

3. Maintain log of workmen and visitors and make log available to DISTRICT and CITY on request.

B. CONTRACTOR shall control the entrance of persons and vehicles to those related to the DISTRICT'S operations.

1.3 PERSONNEL IDENTIFICATION

A. The CONTRACTOR shall:

1. Maintain a list of authorized persons and submit copy to DISTRICT on request.

1.4 RESTRICTIONS

A. The CONTRACTOR shall not allow cameras on site or photographs taken except by written approval of DISTRICT.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

END OF SECTION

SECTION 01 42 13 - ABBREVIATIONS OF INSTITUTIONS

PART 1 -- GENERAL

1.1 GENERAL

A. Wherever in these Specifications references are made to the standards, specifications, or other published data of the various international, national, regional, or local organizations, such organizations may be referred to by their acronym or abbreviation only. As a guide to the user of the Specifications, the following acronyms or abbreviations which may appear shall have the meanings indicated herein.

1.2 ABBREVIATIONS

AA	Aluminum Association
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
AATCC	American Association of Textile Chemists and Colorists
ABMA	American Bearing Manufacturer's Association – ABMA
ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
AF&PA	American Forest and Paper Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AHA	American Hardboard Association
AHAM	Association of Home Appliance Manufacturers
AI	The Asphalt Institute
AIA	American Institute of Architects
AIHA	American Industrial Hygiene Association
AIIM	Association for Information and Image Management
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Movement and Control Association International, Inc
ANS	American Nuclear Society
ANSI	American National Standards Institute, Inc.
APA	The Engineered Wood Association
API	American Petroleum Institute
APWA	American Public Works Association
ARI	Air-Conditioning and Refrigeration Institute
ASA	Acoustical Society of America
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASQ	American Society for Quality
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWCI	American Wire Cloth Institute
AWI	Architectural Woodwork Institute
AWPA	American Wood Preservers Association
AWPI	American Wood Preservers Institute

AWS	American Welding Society
AWWA	American Water Works Association
BBC	Basic Building Code, Building Officials and Code Administrators International
BHMA	Builders Hardware Manufacturer's Association
CABO	Council of American Building Officials
CDA	Copper Development Association
CEMA	Conveyors Equipment Manufacturer's Association
CGA	Compressed Gas Association
CITY	City of Lake Wales
CLFMI	Chain Link Fence Manufacturer's Institute
CLPCA	California Lathing and Plastering Contractors Association
CMAA	A division/section of the Material Handling Industry of America
CRSI	Concrete Reinforcing Steel Institute
DASMA	Door and Access Systems Manufacturers Association International
DCDMA	Diamond Core Drilling Manufacturer's Association
DHI	Door and Hardware Institute
DIPRA	Ductile Iron Pipe Research Association
DISTRICT	Southwest Florida Water Management District
EI	Energy Institute
EIA	Electronic Industries Alliance
EPA	Environmental Protection Agency
ETL	Electrical Test Laboratories
FCC	Federal Communications Commission
FCI	Fluid Controls Institute
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FDOT	Florida Department of Transportation
FEMA	Federal Emergency Management Association
FHWA	Federal Highway Administration
FM	Factory Mutual System
FPL	Forest Products Laboratory
FRP	Fiberglass Reinforced Plastic
HI	Hydronics Institute, Hydraulic Institute
HSWA	Federal Hazardous and Solid Waste Amendments
IADC	International Association of Drilling Contractors
IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
ICCEC	Electrical Code
ICC-ES	International Code Council Evaluation Service
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IFC	International Fire Code
IFGC	International Fuel Gas Code
IMC	International Mechanical Code
IME	Institute of Makers of Explosives
IPC	International Plumbing Code, Association Connecting Electronic Industries
IRC	International Residential Code
ISA	Instrument Society of America

ISDI	Insulated Steel Door Institute
ISEA	Industrial Safety Equipment Association
ISO	International Organization for Standardization
ITE	Institute of Traffic Engineers
ITU-T	Telecommunications Standardization Sector of the International Telecommunications Union
IWCF	International Well Control Forum
LPI	Lightning Protection Institute
LRQA	Lloyd’s Register Quality Assurance
MBMA	Metal Building Manufacturer's Association
MIL	Military Standards (Department of Defense)
MPTA	Mechanical Power Transmission Association
MSS	Manufacturers Standardization Society
NAAMM	National Association of Architectural Metal Manufacturer's
NACE	National Association of Corrosion Engineers
NAPF	National Association of Pipe Fabricators
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors
NCCLS	National Committee for Clinical Laboratory Standards
NCMA	National Concrete Masonry Association
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NELAP	National Environmental Laboratory Accreditation Program
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association or National Fluid Power Association
NISO	National Information Standards Organization
NIST	National Institute of Standards and Technology
NLGI	National Lubricating Grease Institute
NRC	Nuclear Regulatory Commission
NRCA	National Roofing Contractors Association
NSF	National Sanitation Foundation
NWWDA	National Wood Window and Door Association
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PCI	Precast/Prestressed Concrete Institute
PPI	Plastic Pipe Institute
RCRA	Resource Conservation and Recovery Act
RIS	Redwood Inspection Service, a division of the California Redwood Association, CRA
RMA	Rubber Manufacturers Association
RVIA	Recreational Vehicle Industry Association
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SDI	Steel Door Institute, Steel Deck Institute
SWFWMD	Southwest Florida Water Management District
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
SPFA	Steel Plate Fabricator’s Association
SPIB	Southern Pine Inspection Bureau
SSBC	Southern Standard Building Code, Southern Building Code Congress
SSPC	Society for Protective Coating
SSPWC	Standard Specifications for Public Works Construction
STLE	Society of Tribologists and Lubricating Engineers

TAPPI	Technical Association of the Worldwide Pulp, Paper, and Converting Industry
TFI	The Fertilizer Institute
TIA	Telecommunications Industries Association
TPI	Truss Plate Institute
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
WCLIB	West Coast Lumber Inspection Bureau
WDMA	National Window and Door Manufacturers Association
WEF	Water Environment Federation
WI	Woodwork Institute
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 42 19 - REFERENCE STANDARDS

PART 1 -- GENERAL

1.1 GENERAL

A. **Titles of Sections and Paragraphs:** Titles and subtitles accompanying specification sections and paragraphs are for convenience and reference only and do not form a part of the Specifications.

B. **Applicable Publications:** Whenever in these Specifications references are made to published specifications, codes, standards, or other requirements, it shall be understood that wherever no date is indicated, only the latest specifications, standards, or requirements of the respective issuing agencies which have been published as of the date that the Contract is advertised for Bids shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth in the Specifications or shown on the Drawings will be waived because of any provision of or omission from said standards or requirements.

C. **Specialists, Assignments:** In certain instances, specification text requires (or implies) that specific WORK is to be assigned to specialists or expert entities who must be engaged to perform that WORK. Such assignments shall be recognized as special requirements over which the CONTRACTOR has no choice or option. These requirements shall not be interpreted so as to conflict with the enforcement of building codes and similar regulations governing the WORK; also they are not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of WORK is recognized as "expert" for the indicated construction processes or operations. Nevertheless, the final responsibility for fulfillment of the entire set of Contract requirements remains with the CONTRACTOR.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. The CONTRACTOR shall construct the WORK in accordance with the Contract Documents and the referenced portions of those referenced codes, standards, and specifications.

B. References to "Building Code" shall mean Florida Building Code: The latest edition of the codes as approved by the Municipal Code and used by the local agency as of the date that the WORK is advertised for Bids shall apply to the WORK herein, including all addenda, modifications, amendments, or other lawful changes thereto.

C. In case of conflict between codes, reference standards, drawings, and the other Contract Documents, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER/GEOLOGIST for clarification and direction prior to ordering or providing any materials or furnishing labor. The CONTRACTOR shall bid for the most stringent requirements.

D. References to "OSHA Regulations for Construction" shall mean **Title 29, Part 1926, Construction Safety and Health Regulations,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

E. References to "OSHA Standards" shall mean **Title 29, Part 1910, Occupational Safety and Health Standards,** Code of Federal Regulations (OSHA), including all changes and amendments thereto.

F. **Applicable Standard Specifications**: References in the Contract Documents to "Standard Specifications" or SSPWC shall mean the Standard Specifications for Public Works Construction, 1997 Edition.

1.3 REGULATIONS RELATED TO HAZARDOUS MATERIALS

A. The CONTRACTOR shall be responsible that all WORK included in the Contract Documents, regardless if indicated or not, shall comply with all EPA, OSHA, RCRA, NFPA, and any other federal, state, and local regulations governing the storage and conveyance of hazardous materials, including petroleum products.

B. Where no specific regulations exist and the DISTRICT has not waived the requirement in writing, chemical, hazardous, and petroleum product piping and storage in underground locations shall be double containment piping and tanks or be installed in separate concrete trenches and vaults with an approved lining that cannot be penetrated by the chemicals.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 45 00 - QUALITY CONTROL

PART 1 -- GENERAL

1.0 DEFINITION

A. Specific quality control requirements for the WORK are indicated throughout the Contract Documents. The requirements of this Section are primarily related to performance of the WORK beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

1.1 INSPECTION AT PLACE OF MANUFACTURE

B. Unless otherwise indicated, all products, materials, and equipment shall be subject to inspection by the ENGINEER\GEOLOGIST at the place of manufacture.

C. The presence of the ENGINEER\GEOLOGIST at the place of manufacturer, however, shall not relieve the CONTRACTOR of the responsibility for providing products, materials, and equipment which comply with all requirements of the Contract Documents. Compliance is a duty of the CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of the ENGINEER\GEOLOGIST.

1.2 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing will be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the DISTRICT reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the ENGINEER\GEOLOGIST will assure the DISTRICT that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver by the DISTRICT of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the testing or other quality assurance requirements originally indicated, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial WORK, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the ENGINEER\GEOLOGIST reserves the right to make independent investigations and tests, and failure of any portion of the WORK to meet any of the requirements of the Contract Documents, shall be reasonable cause for the ENGINEER\GEOLOGIST to require the removal or correction and reconstruction of any such WORK in accordance with the General Conditions.

1.3 INSPECTION AND TESTING SERVICE

A. Inspection and testing laboratory service shall comply with the following:

1. Unless indicated otherwise by the Technical Specifications, the DISTRICT will appoint, employ, and pay for services of an independent firm to perform inspection and testing or will perform inspection and testing itself.

2. The DISTRICT or independent firm will perform inspections, testing, and other services as required by the ENGINEER\GEOLOGIST under Paragraph 1.3C above.

3. Reports of testing, regardless of whether the testing was the DISTRICT'S or the CONTRACTOR'S responsibility, will be submitted to the ENGINEER\GEOLOGIST indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

4. The CONTRACTOR shall cooperate with the DISTRICT or independent firm and furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.

5. The CONTRACTOR shall notify ENGINEER\GEOLOGIST 24 hours prior to the expected time for operations requiring inspection and laboratory testing services.

6. Retesting required because of non-conformance to requirements shall be performed by the same independent firm on instructions by the ENGINEER\GEOLOGIST. The CONTRACTOR shall bear all costs from such retesting.

7. For samples and tests required for CONTRACTOR'S use, the CONTRACTOR shall make arrangements with an independent firm for payment and scheduling of testing. The cost of sampling and testing for the CONTRACTOR'S use shall be the CONTRACTOR'S responsibility.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Inspection: The CONTRACTOR shall inspect materials or equipment upon the arrival on the job site and immediately prior to installation, and reject damaged and defective items.

B. Measurements: The CONTRACTOR shall verify measurements and dimensions of the WORK, as an integral step of starting each installation.

C. Manufacturer's Instructions: Where installations include manufactured products, the CONTRACTOR shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in Contract Documents.

- END OF SECTION -

SECTION 01 50 00 - MOBILIZATION

PART 1 -- GENERAL

1.1 GENERAL

A. CONTRACTOR shall mobilize as required for the proper performance and completion of the WORK and in accordance with the Contract Documents.

B. Mobilization shall include at least the following items:

1. Moving onto the Site of CONTRACTOR's plant and equipment necessary for the first month of operations.

2. Establishing vertical and horizontal control with reference to NAVD 1988. Survey results shall be in NAD 1983 (1990 adjustment).

3. Installing temporary construction power, wiring, and lighting facilities.

4. Establishing fire protection system.

5. Developing construction water supply.

6. Providing field offices for the CONTRACTOR and the ENGINEER\GEOLOGIST, complete with furnishings, equipment, and utility services as specified.

7. Providing on Site communication facilities, including telephones, high-speed internet, and fax machines.

8. Providing on Site sanitary facilities and potable water facilities.

9. Arranging for and erection of CONTRACTOR's WORK and storage yards.

10. Constructing and implementing security features and requirements complying with **Section 01 35 53, Site Security**.

11. Obtaining all required permits.

12. Having OSHA required notices and establishing safety programs.

13. Having the CONTRACTOR's superintendent at the Site full time.

14. Submitting initial submittals.

2.1 PAYMENT FOR MOBILIZATION

A. Payment for mobilization will be as stated in **Section 01 29 00, Measurement and Payment.**

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 GENERAL

A. Set up well drilling equipment within the area designated by the ENGINEER/GEOLOGIST. Accomplish all required work in accordance with applicable portions of these Specifications.

B. Some obstructions may not be shown. The removal and replacement of minor obstructions such as electrical conduits, water, waste piping, and similar items shall be anticipated and accomplished, even though not shown or specifically mentioned.

3.2 CONTAMINATION PRECAUTIONS

A. Avoid contamination of the project area. Do not dump waste oil, rubbish, or other similar materials on the ground.

3.3 TEMPORARY DRILLING PAD

A. The CONTRACTOR shall construct and maintain a compacted lime-rock drilling pad as indicated, suitable to meet the needs of the drilling equipment and load capacity.

B. CONTRACTOR shall be responsible for construction of adequate temporary steel drilling and mud system pads for construction of wells as shown on the Drawings.

C. The CONTRACTOR shall submit copies of temporary drilling pad designs to the ENGINEER\GEOLOGIST prior to construction for approval.

D. The temporary drilling pad shall be able to retain all necessary quantities of fluids and cuttings from the well during construction and testing, without leakage or spillage, and serve as a work floor for all drilling activities. The CONTRACTOR shall review the design of the foundation for the drilling pad and verify the suitability for placement of their equipment. It is the CONTRACTOR's responsibility to notify the ENGINEER\GEOLOGIST if the pad, as designed, will not support the CONTRACTOR's equipment loads. It will be necessary to store all fuel or chemical tanks used during the well construction on this pad. The CONTRACTOR may modify the temporary drilling pad to accommodate its specific equipment with the approval of the ENGINEER\GEOLOGIST.

E. Any sumps or drains in the pads shall be sealed below, not to allow leakage beneath the pad (including "rat" or "mouse" holes used during drilling). Any sumps shall have 6-inch water stop material in all joints.

3.4 HORIZONTAL AND VERTICAL CONTROL

A. The CONTRACTOR shall retain the services of a land surveyor licensed in the State of Florida to provide horizontal and vertical control on the temporary drill pad adjacent to the pit casing. Vertical control shall be reported relative to the North American Vertical Datum of 1988 (NAVD, 88). Horizontal control shall be reported relative to the North

America Datum of 1983 (NAD, 83). Five copies of the final report, including field survey notes, shall be provided to the ENGINEER\GEOLOGIST.

3.5 SITE CLEANUP, PRESERVATION, AND RESTORATION

A. The CONTRACTOR shall perform clean-up work on a regular basis and as frequently as requested by the ENGINEER\GEOLOGIST. Basic site restoration in an area shall be accomplished immediately following installation or substantial completion of the required facilities in that area. In addition, such work shall be performed when requested by the ENGINEER/GEOLOGIST. If the CONTRACTOR fails to perform periodic clean-up and basic restoration of the site to the ENGINEER/GEOLOGIST's satisfaction, they may, receive written notice of non-performance. The CONTRACTOR shall address and remedy those concerns within five days of receipt of the written notice and employ such labor and equipment as they deem necessary.

B. Upon completion of work at the site, the CONTRACTOR shall promptly remove all their equipment and unused materials. They shall dismantle any temporary structures erected for their purposes that are not part of the final product. They shall promptly remove the temporary drill pad and retaining wall, fill the "rat", "mouse" holes, and leave the site in a manner acceptable to the ENGINEER/GEOLOGIST, within 2-week after the completion of drilling and testing operations.

C. Remove all excavated materials from grassed and planted areas, and leave these surfaces in a condition equivalent to their original condition.

D. The CONTRACTOR will be required to remove and dispose of drill cuttings in accordance with federal, state, and local regulations at an approved disposal site. The drill cuttings will not be stored on the site. The CONTRACTOR shall furnish the ENGINEER/GEOLOGIST, prior to beginning construction, the name, and location of the intended disposal site along with documentation that the site has been approved by the appropriate regulatory agencies.

E. Upon completion of the project, all areas used by the CONTRACTOR shall be properly graded to drain and blend in with the abutting property. Following grading, disturbed areas shall be fertilized and planted with new sod consistent with pre-work conditions. All ground preparation and sodding shall be done in accordance with the best-accepted practices for lawn planting. Sod shall be St. Augustine Floritam. The CONTRACTOR shall be responsible for obtaining a satisfactory grass turf/seed acceptable to the ENGINEER/GEOLOGIST.

F. Upon completion of sodding, the entire planted area shall be soaked to saturation by a fine spray. Contractor shall be responsible for watering the sod for 30 days.

G. Upon completion of the project, all contaminated material and hazardous waste product shall be removed by the CONTRACTOR and be properly disposed of in accordance with all applicable State and Federal regulations at the CONTRACTOR'S own expense.

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SECTION 01 51 00 - TEMPORARY UTILITIES

PART 1 -- GENERAL

1.1 GENERAL REQUIREMENTS

A. **Types:** The types of utility services required for general temporary use at the Site include the following:

1. Water service (potable for drilling)
2. Sanitary facilities
3. Fire Protection
4. Electrical Power Service for Trailers, Rig, and Equipment

1.2 JOB CONDITIONS

A. **Scheduled Uses:** The CONTRACTOR shall, in conjunction with establishment of the job progress schedule, establish a schedule for implementation and termination of service for each temporary utility at the earliest feasible time, and when acceptable to DISTRICT and ENGINEER/GEOLOGIST.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. The CONTRACTOR shall provide either new or used materials and equipment, which are in substantially undamaged condition and without significant deterioration and which are recognized in the construction industry, by compliance with appropriate standards, as being suitable for intended use in each case. Where a portion of the temporary utility is provided by a utility company, the CONTRACTOR shall provide the remaining portion with matching and compatible materials and equipment and shall comply with recommendations of the utility company.

PART 3 -- EXECUTION

3.1 INSTALLATION OF TEMPORARY UTILITY SERVICES

A. **General:** Wherever feasible, the CONTRACTOR shall engage the utility company to install temporary service to the project, or as a minimum, to make connection to existing utility service; locate services where they will not interfere with the total project construction WORK, including installation of permanent utility services; and maintain temporary services as installed for required period of use; and relocate, modify or extend as necessary from time to time during that period as required to accommodate the total project construction WORK.

3.2 WATER SUPPLY

A. **General:** The CONTRACTOR shall obtain the water supply necessary for construction of the facilities. The CONTRACTOR shall provide all facilities necessary to convey the water from the source to the points of use in accordance with the requirements of the Contract Documents. The CONTRACTOR shall be responsible for all costs and charges associated with the construction water supply.

3.3 INSTALLATION OF SANITARY FACILITIES

A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of CONTRACTOR's employees. Toilets at construction job sites shall conform to the requirements of Subpart D, Section 1926.51 of the OSHA Standards for Construction.

B. **Sanitary and Other Organic Wastes**: The CONTRACTOR shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR's operations shall be disposed of away from the Site in a manner satisfactory to the ENGINEER/GEOLOGIST and in accordance with all laws and regulations pertaining thereto.

3.4 INSTALLATION OF FIRE PROTECTION

A. **Fire Protection**: The CONTRACTOR shall develop a fire protection program. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the WORK, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR's fire protection program shall conform to state and local requirements and Subpart F of the OSHA Standards for Construction.

3.5 POWER SUPPLY

A. The CONTRACTOR shall coordinate with FPL for obtaining a power service connection at the site. The CONTRACTOR shall pay the fee for meters and all other charges for site power usage.

3.6 OPERATIONS AND TERMINATIONS

A. **Inspections:** Prior to placing temporary utility services into use, the CONTRACTOR shall inspect and test each service and arrange for governing authorities' required inspection and tests, and obtain required certifications and permits for use thereof.

B. **Protection:** The CONTRACTOR shall maintain distinct markers for underground lines, and protect underground lines from damage during excavating operations.

C. **Termination and Removal:** When need for a temporary utility service, or a substantial portion thereof has ended, or when its service has been replaced by use of permanent services, or not later than time of substantial completion, the CONTRACTOR shall promptly remove the utility installation unless requested by ENGINEER/GEOLOGIST to retain it for a longer period. The CONTRACTOR shall complete and restore WORK which may have been delayed or affected by installation and use of temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces.

D. **Removal of Water Connections:** Before final acceptance of the WORK on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to original condition or better, to the satisfaction of the ENGINEER/GEOLOGIST and to the agency owning the affected utility.

END OF SECTION

SECTION 01 52 00 - FIELD OFFICE, EQUIPMENT, AND SERVICES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide field offices and equipment and furnish related services at the Site.

B. The office shall be located close to the CONTRACTOR's field office, at a spot designated by the ENGINEER/GEOLOGIST.

1.2 FIELD OFFICE SCHEDULE

A. Field offices, equipped as indicated herein, shall be provided at the Site, ready for exclusive use by the ENGINEER/GEOLOGIST and the DISTRICT's representative and staff within 14 days after the commencement date stated in the Notice to Proceed. The CONTRACTOR's attention is directed to the condition that no payment for that portion of the Contract Price designated for mobilization, or any part thereof, will be approved for payment until the field office facilities indicated herein have been provided. The provisions for such payment are included in **Section 01 50 00 - Mobilization**.

B. Unless released earlier by the ENGINEER/GEOLOGIST in writing, field office(s) shall be maintained in full operation at the Site with all utilities connected and operable until the Notice of Completion has been executed or recorded. Upon execution or recordation of the Notice of Completion, or upon early release of the field office(s) by the ENGINEER/GEOLOGIST, the CONTRACTOR shall remove the field office(s) within 14 days from said date, and shall restore the Site occupied by the field office(s) to the condition indicated.

PART 2 -- PRODUCTS

2.1 OFFICE FACILITIES

A. **General:** The CONTRACTOR shall provide necessary electrical wiring, plumbing, toilet and lavatory fixtures, air conditioning and heating equipment, and shelving, and shall furnish light, heat, water, and weekly janitorial services in connection with the field office.

B. **Field Office:** The office shall be one separate, well lighted, air conditioned, electrically-heated field office with a toilet room containing a water closet and lavatory partitioned off from the working area. The water closet may be of the chemical type provided that it is a flush type with an approved holding tank. The toilet room door shall be provided with a latch set. The office shall have an outside door lock. Area of the field office shall not be less than 400 square feet, exclusive of toilet room area. Office shall be of the portable trailer type unless otherwise specifically authorized by the ENGINEER/GEOLOGIST in writing and shall be a separate unit, not attached or connected to any other structures. If electrical hookups are not available air conditioning/heating shall be run by a generator suitable for office space.

2.2 FIELD OFFICE FURNISHINGS

A. The CONTRACTOR shall furnish the following items in good condition in the field office:

1. Two (2) plan tables 4 feet by 6 feet, and eight (8) metal folding chairs.

2. One large garbage can.

3. One four (4)-drawer, legal size filing cabinet with lock and keys.

4. Provide and maintain on-site adequate firefighting equipment capable of extinguishing incipient fires, and comply with NFPA No. 241.

2.3 FIELD OFFICE SERVICES

A. Each field office shall be provided with sufficient lighting to produce not less than 50 foot-candles at desktop height at each desk location. Exterior lighting shall be provided over the entrance door.

B. The electrical service shall be a minimum of 100 amps. A minimum of four 110 VAC duplex grounded electric convenience outlets shall be provided in each office and common area. At least one such outlet shall be located on each wall. The electric distribution panel shall service not less than two 110 VAC circuits.

C. Where inside toilet facilities are not connected to outside plumbing, a flush-type chemical toilet with a holding tank shall be provided. Sanitary waste material shall be regularly pumped out and the chemicals recharged. Toilet paper and paper towels shall be furnished for each toilet facility.

D. Regular weekly janitorial services shall be furnished during working hours or as requested by the ENGINEER/GEOLOGIST. Offices shall be swept, dusted, and waste receptacles emptied. Toilet facilities shall be sanitized and cleaned daily, and paper supplies shall be replenished.

2.4 INTERNET SERVICE

A. Within 14 days after the commencement date stated in the Notice to Proceed, the CONTRACTOR shall provide at his expense, inclusive of monthly billings, in each of the field offices, one high-speed (DSL or equivalent) internet connection at each desk for the use of the DISTRICT's or ENGINEER/GEOLOGIST's employees in connection with the WORK.

2.5 ALL-IN-ONE PRINTER

A. The CONTRACTOR shall provide one new office all-in-one printer for the exclusive use of the ENGINEER/GEOLOGIST.

B. The all-in-one printer shall have the following functions:

1. Printer
2. Copier
3. Scanner
4. Fax

C. All-in-one printer shall employ a dry, electrostatic process and be capable of automatically feeding 8-1/2 by 11 and 11 by 17 originals and copying onto plain bond paper sheets at variable magnification from 50 percent to 200 percent. The paper tray for each size paper shall hold 100 sheets.

D. The CONTRACTOR shall furnish cartridges, paper, or other materials required for proper operation of the all-in-one-printer.

E. Manufacturers, or Equal: The copy machine shall be the latest model from:

1. **Epson**
2. **HP**
3. **Brother**

F. **Service Contract**: The CONTRACTOR shall obtain and pay for a service and repair contract with local representative of the dealer or manufacturer for on-call, daily, on-Site service.

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 55 00 - SITE ACCESS AND STORAGE

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall be responsible for the maintenance of traffic within the limits of the project for the duration of the construction and temporary suspensions of the WORK in accordance with the requirements of the Contract Documents. The term “Maintenance Of Traffic” includes all of such facilities, devices, and operations required for the safety and convenience of the public as well as for minimizing public nuisance.

1.2 CONTRACTOR SUBMITTALS

A. The CONTRACTOR shall develop a Traffic Control Plan (TCP) that complies with FDOT standard indices for maintenance of traffic and shall submit the TCP to the DISTRICT and ENGINEER/GEOLOGIST prior to commencement of WORK. All TCP plans submitted must be designated, signed and sealed by a Professional Florida Licensed Traffic Control Engineer.

1.3 CONTRACTOR'S WORK AND STORAGE AREA

A. The DISTRICT will designate and arrange for the CONTRACTOR's use a portion of the property adjacent to the WORK for its exclusive use during the term of the Contract as a storage and shop area for its construction operations on the WORK. At completion of WORK, the CONTRACTOR shall return this area to its original condition, including grading and landscaping.

B. The CONTRACTOR shall construct and use a separate storage area for hazardous materials used in constructing the WORK.

C. For the purpose of this paragraph, hazardous materials to be stored in the separate area are all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

D. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.

E. The CONTRACTOR shall develop and submit to the ENGINEER/GEOLOGIST a plan for storing and disposing of the materials above.

F. The CONTRACTOR shall obtain and submit to the ENGINEER/GEOLOGIST a single EPA number for wastes generated at the Site.

G. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials.

H. All hazardous materials which are delivered in containers shall be stored in the original containers until use. Hazardous materials which are delivered in bulk shall be stored in containers which meet the requirements of authorities having jurisdiction.

PART 2 -- PRODUCTS

2.1 Barricades, flashers, lights, and “Danger”, “Caution”, “Street Closed”, etc. signs shall meet the requirements of the FDOT and the Manual of Uniform Traffic Control Devices (MUTCD).

PART 3 -- EXECUTION

3.1 GENERAL

A. The CONTRACTOR shall implement the TCP. At the end of this project, the CONTRACTOR shall remove temporary equipment and facilities when no longer required, and restore grounds to original or improved conditions.

B. All WORK specified in this section will conform to the current edition of the MUTCD, the Florida Department of Transportation Roadway and Traffic Design Standards (600 Series), and the Florida Department of Transportation Standard Specifications for Road and Bridge.

C. The CONTRACTOR is responsible to communicate with the barricade company on any matters concerning deficiencies with the TCP at any time day or night. The CONTRACTOR shall be in possession of the barricade company’s 24-hour number. The barricade company’s representative shall be certified by the American Traffic Safety Services Association or the International Municipal Signal Association.

D. All existing drainage flow must be maintained to prevent flooding of roadways and adjoining property.

E. Access to private residences and commercial businesses shall be maintained at all times during construction. The CONTRACTOR shall coordinate with the DISTRICT on any temporary access closings prior to beginning WORK in the area.

F. The CONTRACTOR shall supply signage to identify driveways for affected businesses.

3.2 TRAFFIC CONTROL PLAN

A. The TCP shall be site specific and shall include maintenance of traffic plans for all construction within the right-of-way including travel lanes, turn lanes, medians, side streets, sidewalks, and all intersection WORK impacted by the construction project.

B. The TCP must show all signs, devices, tapers, and buffer zones listing the proper distances and lengths per the Manual of Uniform Traffic Control Devices and Florida Department of Transportation (Roadway and Traffic Design Standards Index Series 600).

C. The TCP must include a brief description of the WORK being done, along with the starting and completion dates, WORK hours, night activity, etc. It also must include a 24-hour emergency telephone number of the supervisor on the job responsible for the maintenance of the TCP.

D. The TCP shall cover the major construction operations for this project. The CONTRACTOR shall be responsible for the proper execution of the traffic control during related minor construction operations.

E. Locations for advance warning and other construction signs as depicted on the TCPs shall be approximate considering the existing field conditions.

F. For the protection of traffic in public or private streets and ways, the CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, flag men and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1) and the appropriate indexes (600-660) of the FDOT Roadway and Traffic Design Standards.

1. The CONTRACTOR shall take all necessary precautions for the protection of the WORK and the safety of the public. Barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The CONTRACTOR shall station guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. Signs, signals, and barricades shall conform to the requirements of Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.

2. The CONTRACTOR shall submit three copies of a TCP to the DISTRICT for review a minimum of 2 weeks prior to construction.

3. The CONTRACTOR shall remove traffic control devices when no longer needed, repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.

3.3 MAINTENANCE OF TRAFFIC

A. The CONTRACTOR shall take all necessary precautions to prevent injury to public.

B. All manholes, valve boxes, or other similar structures shall each be adequately barricaded and lighted if they pose a danger to the public.

C. Excavated material and construction materials shall not be stockpiled in such manner as to unnecessarily hinder or confuse traffic adjacent to WORK. Materials shall be stored **at least** 6 feet beyond the edge of pavement.

D. Toe boards will be provided to retain excavated material if required by FDOT.

E. Maintain all lanes that are being used for the maintenance of traffic, including those on detours and temporary facilities, under all weather conditions. Keep the lanes reasonably free of dust, and, when necessary to accomplish this, sprinkle them with water, or apply some other dust palliative.

F. The alteration of existing traffic patterns to create a WORK zone shall not commence until all labor and material are available for the construction in that area.

G. The CONTRACTOR shall repair all potholes immediately which develop within the project limits and shall maintain a supply of asphalt cold mix on the project site to expedite those repairs.

H. If during construction any manhole or valve box cover protrudes higher than one inch above the pavement, the contractor shall place an asphalt wedge around the cover per FDOT standards.

I. Throughout the project limits where sidewalks currently exist, pedestrian and wheelchair traffic shall be maintained on the project at all times. The travel-way shall be a minimum of 4 feet in width, smooth, but not slick with waterproof surface, and shall be ramped as necessary for continuity.

J. The CONTRACTOR shall maintain safe vehicular access to all adjacent property at all times.

K. Traffic disruptions which are not shown by the TCP, but which are necessary to construct the project shall be submitted in writing to DISTRICT for approval prior to commencement of WORK. Submitted material shall include sketches, calculations and other data.

L. During and after completion of construction, the CONTRACTOR shall provide all necessary temporary pavement markings (i.e. lane lines, arrows, crosswalks, stop bars, etc.) until permanent markings are installed.

M. Conflicting existing pavement markings shall be removed. Removal of existing pavement marking shall be accomplished by hydro blasting or by any other method approved by FDOT. Use of black paint to cover existing pavement markings shall be prohibited. Any conflicting existing pavement markings that have been removed shall be replaced upon completion of the project.

N. Arrows on the TCPs denote direction of traffic only and do not reflect pavement markings unless otherwise shown. Directional pavement arrows will be required for all turning lanes.

O. CONTRACTOR shall remove or cover any existing or proposed signs which conflict with the TCPs. When the conflict no longer exists, the CONTRACTOR shall restore the signs to their original condition. Unnecessary construction signs and markers that are no longer applicable are to be covered or removed at the end of each workday.

P. The CONTRACTOR shall repair and maintain roads and shoulders in the area of WORK, throughout the duration of the contract. Repairs shall be made to any low shoulders or rutted out shoulders and restored to the condition at which it was at the acceptance of the construction contract. Maintenance of roads shall be within 2” from the top of pavement, throughout the duration of the contract and will provide adequate driveability.

3.4 DETOURS

A. The CONTRACTOR shall provide at least two weeks notification to DISTRICT of the necessity to close any portion of a roadway carrying vehicles or pedestrians so that the final approval of such closings can be obtained at least 48 hours in advance. To the greatest extent possible, no more than one (1) lane of roadway shall be closed to

vehicles and pedestrians. With any such closings adequate provision shall be made for the safe expeditious movement of vehicles and pedestrians.

B. Traffic may only be detoured upon approval of DISTRICT. The CONTRACTOR shall construct and maintain detour facilities wherever it becomes necessary to divert traffic from an existing roadway. While traffic is detoured the CONTRACTOR shall expedite construction operations and periods when traffic being detoured will be strictly controlled by the DISTRICT.

C. The CONTRACTOR shall be responsible for notifying Police, Fire and Ambulance Departments and FDOT whenever roads are impassable.

D. Temporary travel lanes shall be no less than 10 feet in width, except as noted or directed by FDOT.

3.5 ACCESS REQUIREMENTS

A. The CONTRACTOR shall provide necessary facilities for access to residences, businesses, etc., along the project. Access to residential driveways will be provided to the property line by the end of the WORK day.

B. SITE access gate shall be locked with a combination lock, so that only the SWFWMD, CONTRACTOR, CONSULTANT, and ENGINEER/GEOLOGIST have accessibility.

3.6 MAINTENANCE, REMOVAL, AND REINSTALLATION OF EXISTING TRAFFIC SIGNS

A. The maintenance and/or removal and reinstallation of any existing traffic control sign, or street name sign, (hereinafter-termed Traffic Control Devices) within the area of the project will be the responsibility of the CONTRACTOR.

B. The CONTRACTOR shall conduct all operations such that they will in no way obstruct or interfere with the operation of any existing traffic control device.

C. The CONTRACTOR will be held responsible for any existing traffic control devices which are damaged or removed without approval by the DISTRICT, and will be charged for their replacement. This includes, but is not limited to, traffic signal loop, detector loops embedded in the street, signal conduits, cable, and pullboxes at signalized intersections.

D. The CONTRACTOR will be held liable for any damage from any accident resulting from the removal, relocation or failure of any existing traffic control devices by construction operations.

E. The CONTRACTOR shall coordinate with the appropriate jurisdiction.

F. The CONTRACTOR shall be responsible to construct, relocate, and maintain all traffic control signs, pavement markings, barriers, barricades and other devices to cover and or remove signs as needed, and to do all WORK necessary to maintain a safe WORK zone. The CONTRACTOR shall respond within 2 hours of notification by DISTRICT.

G. Barricades and obstructions will be illuminated at night and all lights will be kept burning from sunset until sunrise. Signs, signals and barricades will conform to the requirements of Subpart G. Part 1926 of the OSHA Safety and Health Standards for Construction, FDOT and MUTCD.

H. Existing permanent pavement markings will be maintained by the CONTRACTOR. Any temporary pavement markings required to reroute traffic during construction operations will be the responsibility of the CONTRACTOR.

I. Any permanent existing pavement markings that must be removed or obliterated in order to reroute traffic either initially or during continuing construction operations will be the responsibility of the CONTRACTOR.

- END OF SECTION -

SECTION 01 57 19 - TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 -- GENERAL

1.1 DUST ABATEMENT

A. The CONTRACTOR shall prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity of the Site. The CONTRACTOR shall be responsible for any damage resulting from dust originating from its operations. Dust abatement measures shall be continued until the CONTRACTOR is relieved of further responsibility by the ENGINEER/GEOLOGIST.

B. **Storage Piles**: Enclose, cover, water (as needed), or apply non-toxic soil binders according to manufacturer's specifications on material piles (i.e. gravel, sand, dirt) with a silt content of 5 percent or greater.

C. **Active Areas of Site**: Water active construction areas and unpaved roads as needed and as requested by ENGINEER/GEOLOGIST.

D. **Inactive Areas of Site**: Apply non-toxic soil stabilizers according to manufacturer's specifications to inactive construction areas, or water as needed to maintain adequate dust control.

E. **Vehicle Loads**: Cover or maintain at least 2-feet of freeboard vertical distance between the top of the load and the top of the trailer sides on trucks hauling dirt, sand, soil, or other loose materials off of the Site.

F. **Roads**: When there is visible track-out onto a paved public road, install wheel washers where the vehicles exit and enter onto the paved roads and wash the undercarriage of trucks and any equipment leaving the Site on each trip. Sweep the paved street at the end of each shift with a **Mobil Athey** or similar water spray pick-up broom-type street sweeper as necessary or as directed.

G. **Vehicle Speeds**: If watering of unpaved roads is not sufficient to control dust, reduce vehicle speeds to 15 mph or less on such roads.

1.2 SEDIMENTATION ABATEMENT

A. The CONTRACTOR shall be responsible for collecting, storing, hauling, and disposing of spoil, silt, and waste materials in compliance with applicable federal, state, and local rules and regulations and the Contract Documents.

B. Install and maintain erosion and sediment control measures, such as swales, grade stabilization structures, berms, dikes, waterways, filter fabric fences, and sediment basins.

C. Filter fabric barrier systems, if used, shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

D. Remove and dispose of sediment deposits at the designated spoil area. If a spoil area is not indicated, dispose of sediment off-Site at a location not in or adjacent to a stream or floodplain. Sediment to be placed at the spoil area should be spread evenly, compacted, and stabilized. Sediment shall not be allowed to flush into a stream or drainage way.

E. Maintain erosion and sediment control measures until final acceptance or until requested by the ENGINEER/GEOLOGIST to remove it.

1.3 RUBBISH CONTROL

A. During the progress of the WORK, the CONTRACTOR shall keep the Site and other areas for which it is responsible in a neat and clean condition and free from any accumulation of rubbish. The CONTRACTOR shall dispose of rubbish and waste materials of any nature and shall establish regular intervals of collection and disposal of such materials and waste. The CONTRACTOR shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of rubbish and surplus materials shall be off the Site in accordance with local codes and ordinances governing locations and methods of disposal and in conformance with applicable safety laws and the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.4 NOISE

A. The CONTRACTOR shall provide mufflers on equipment and take whatever other steps are necessary during drilling, pumping, testing and all other work incidental thereto, to ensure that noise levels conform to the local noise ordinance as required by the DISTRICT. Equipment storage and staging areas will be planned to be in areas away from homes, and traffic will be restricted to essential services during quiet hours, to preserve the rights of local homeowners.

1.5 SANITATION

A. **Toilet Facilities:** Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

B. **Sanitary and Other Organic Wastes:** The CONTRACTOR shall establish a regular daily collection of sanitary and organic wastes. Wastes and refuse from sanitary facilities provided by the CONTRACTOR or organic material wastes from any other source related to the CONTRACTOR's operations shall be disposed of away from the Site in a manner satisfactory to the ENGINEER/GEOLOGIST and in accordance with Laws and Regulations pertaining thereto.

1.6 CHEMICALS

A. Chemicals used on the WORK or furnished for facility operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. Use of such chemicals and disposal of residues shall be in strict accordance with the printed instructions of the manufacturer. In addition, see the requirements set forth in paragraph 6.11 of the General Conditions.

1.7 CULTURAL RESOURCES

A. The CONTRACTOR's attention is directed to the National Historic Preservation Act of 1966 (16 U.S.C. 470) and 36 CFR 800 which provides for the preservation of potential historical architectural, archaeological, or cultural resources (hereinafter called "cultural resources").

B. In the event potential cultural resources are discovered during subsurface excavations at the Site, the following procedures shall be instituted:

1. The DISTRICT will issue a temporary Notice to Suspend Work directing the CONTRACTOR to cease construction operations at the location of such potential cultural resources find.

2. The suspension Notice will contain the following:

a. A clear description of the WORK to be suspended

b. Instructions regarding issuance of further orders by the CONTRACTOR for material services

c. Guidance as to the action to be taken on subcontracts

d. Suggestions to the CONTRACTOR to minimize incurred costs

e. Estimated duration of the temporary suspension.

3. Such suspension shall be effective until such time as a qualified archeologist can assess the value of the potential cultural resources and make recommendations to the State Water Resources Control Board Cultural Resources Officer.

4. The DISTRICT will implement appropriate actions as directed by the State Board Cultural Resources Officer or Project Manager. The CONTRACTOR shall cease WORK in the area of a discovery until appropriate actions have been determined in accordance with this paragraph.

5. If human remains are discovered, WORK in the immediate vicinity of the find shall stop. The County Coroner shall be notified.

C. If the archeologist determines that the potential find is a bonafide cultural resource, at the direction of the State Water Resources Control Board Cultural Resources Officer, the DISTRICT will extend the duration of the suspension.

D. Changes to the Contract Price and Contract Times for suspension due to discovery of a potential cultural resource will be made in the following manner:

1. Contract Times

a. If the WORK temporarily suspended is on the “critical path”, the total number of Days for which the suspension is in effect will be added to the Contract Times.

b. If a portion of WORK at the time of such suspension is not on the “critical path”, but subsequently becomes WORK on the critical path, the Contract Times will be computed from the date such WORK is classified as on the critical path.

2. Contract Price

a. If, as a result of a cultural resources suspension, the CONTRACTOR sustains a loss that could not have been avoided by judicious handling of forces and equipment or redirection of forces or equipment to perform other WORK on the contract, there will be paid an amount based on time and materials for the loss in accordance with the following:

1) Idle Time of Equipment: Compensation for equipment idle time will be determined in accordance with the General Conditions for equipment time and equipment rental time.

2) Idle Time of Labor: Compensation for idle time of workers will be determined in accordance with the General Conditions for labor.

b. Costs of labor will be compensated only to the extent such cost was in fact caused by the suspension.

c. Compensation for loss due to idle time of either equipment or labor will not include markup for profit.

d. The hours for which compensation will be paid will be the actual normal working time during which such suspension lasts, but will in no case exceed eight hours in any single Day.

e. The days for which compensation will be paid exclude Saturdays, Sundays, and legal holidays during the suspension.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 01 60 00 - PRODUCTS, MATERIALS, EQUIPMENT, AND SUBSTITUTIONS

PART 1 - GENERAL

1.1 DEFINITIONS

A. The word "Products," as used in the Contract Documents, is defined to include purchased items for incorporation into the WORK, regardless of whether specifically purchased for the project or taken from CONTRACTOR's stock of previously purchased products. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form WORK. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items). Definitions in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

B. Neither "Products" nor "Materials" nor "Equipment" includes machinery and equipment used for preparation, fabrication, conveying, and erection of the WORK.

1.2 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible for each unit of WORK, the CONTRACTOR shall provide products, materials, and equipment of a singular generic kind from a single source.

B. Compatibility of Options: Where more than one choice is available as options for CONTRACTOR's selection of a product, material, or equipment, the CONTRACTOR shall select an option which is compatible with other products, materials, or equipment. Compatibility is a basic general requirement of product, material and equipment selections.

1.3 PRODUCT DELIVERY AND STORAGE

A. The CONTRACTOR shall deliver and store the WORK in accordance with manufacturer's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at the Site and overcrowding of construction spaces. In particular, the CONTRACTOR shall ensure coordination to ensure minimum holding or storage times for flammable, hazardous, easily damaged, or sensitive materials to deterioration, theft, and other sources of loss.

1.4 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid damage and shall be delivered in undamaged condition in manufacturer's unopened containers and packaging.

B. The CONTRACTOR shall provide equipment and personnel to handle products, materials, and equipment [including those furnished by DISTRICT, by methods to prevent soiling and damage.

C. The CONTRACTOR shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.5 STORAGE AND PROTECTION

A. Products shall be stored in accordance with manufacturer's written instructions and with seals and labels intact and legible. Sensitive products shall be stored in weather-tight climate controlled enclosures and temperature and humidity ranges shall be maintained within tolerances required by manufacturer's recommendations.

B. For exterior storage of fabricated products, products shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering and ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid flat surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. The CONTRACTOR shall periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.6 MAINTENANCE OF PRODUCTS IN STORAGE

A. Stored products shall be periodically inspected on a scheduled basis. The CONTRACTOR shall maintain a log of inspections and shall make the log available on request.

B. The CONTRACTOR shall comply with manufacturer's product storage requirements and recommendations.

C. The CONTRACTOR shall maintain manufacturer-required environmental conditions continuously.

D. The CONTRACTOR shall ensure that surfaces of products exposed to the elements are not adversely affected and that weathering of finishes does not occur.

E. For mechanical and electrical equipment, the CONTRACTOR shall provide a copy of the manufacturer's service instructions with each item and the exterior of the package shall contain notice that instructions are included.

F. Products shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document prior to final acceptance by the DISTRICT in accordance with the Contract Documents.

1.7 PROPOSED SUBSTITUTIONS OR "OR-EQUAL" ITEM

A. Whenever materials or equipment are indicated in the Contract Documents by using the name of a proprietary item or the name of a particular manufacturer, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equal" indicating that a substitution is permitted, materials or equipment of other manufacturers may be accepted if sufficient information is submitted by the CONTRACTOR to allow the ENGINEER/GEOLOGIST to determine that the material or

equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitution product, material or equipment shall be upon the CONTRACTOR.

2. The ENGINEER/GEOLOGIST will be the sole judge as to the type, function, and quality of any such substitution and the ENGINEER/GEOLOGIST's decision shall be final.

3. The ENGINEER/GEOLOGIST may require the CONTRACTOR to furnish additional data about the proposed substitution.

4. The DISTRICT may require the CONTRACTOR to furnish a special performance guarantee or other surety with respect to any substitution.

5. Acceptance by the ENGINEER/GEOLOGIST of a substitution item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitution.

6. The CONTRACTOR shall pay all costs of implementing accepted substitutions, including redesign and changes to WORK necessary to accommodate the substitution.

B. The procedure for review by the ENGINEER/GEOLOGIST will include the following:

1. If the CONTRACTOR wishes to provide a substitution item, the CONTRACTOR shall make written application to the ENGINEER/GEOLOGIST on the "Substitution Request Form."

2. Unless otherwise provided by law or authorized in writing by the ENGINEER/GEOLOGIST, the "Substitution Request Form(s)" shall be submitted within the 35-day period after award of the Contract.

3. Wherever a proposed substitution item has not been submitted within said 35-day period, or wherever the submission of a proposed substitution material or equipment has been judged to be unacceptable by the ENGINEER/GEOLOGIST, the CONTRACTOR shall provide the material or equipment indicated in the Contract Documents.

4. The CONTRACTOR shall certify by signing the form that the list of paragraphs on the form are correct for the proposed substitution.

5. The ENGINEER/GEOLOGIST will evaluate each proposed substitution within a reasonable period of time.

6. As applicable, no shop drawing submittals shall be made for a substitution item nor shall any substitution item be ordered, installed, or utilized without the ENGINEER/GEOLOGIST'S prior written acceptance of the CONTRACTOR'S "Substitution Request Form."

7. The ENGINEER/GEOLOGIST will record the time required by the ENGINEER/GEOLOGIST in evaluating substitutions proposed by the CONTRACTOR and in making changes by the CONTRACTOR in the Contract Documents occasioned thereby.

C. The CONTRACTOR's application shall address the following factors which will be considered by the ENGINEER/GEOLOGIST in evaluating the proposed substitution:

1. Whether the evaluation and acceptance of the proposed substitution will prejudice the CONTRACTOR's achievement of Substantial Completion on time.

2. Whether acceptance of the substitution for use in the WORK will require a change in any of the Contract Documents to adapt the design to the proposed substitution.

3. Whether incorporation or use of the substitution in connection with the WORK is subject to payment of any license fee or royalty.

4. Whether all variations of the proposed substitution from the items originally specified are identified.

5. Whether available maintenance, repair, and replacement service are indicated. The manufacturer shall have a local service agency (within 50 miles of the site) which maintains properly trained personnel and adequate spare parts and is able to respond and complete repairs within 24 hours.

6. Whether an itemized estimate is included of all costs that will result directly or indirectly from acceptance of such substitution, including cost of redesign and claims of other contractors affected by the resulting change.

7. Whether the proposed substitute item meets or exceeds the experience and/or equivalency requirements listed in the appropriate technical specifications.

D. Without any increase in cost to the DISTRICT, the CONTRACTOR shall be responsible for and pay all costs in connection with proposed substitutions and of inspections and testing of equipment or materials submitted for review prior to the CONTRACTOR's purchase thereof for incorporation in the WORK, whether or not the ENGINEER/GEOLOGIST accepts the proposed substitution or proposed equipment or material. The CONTRACTOR shall reimburse the DISTRICT for the charges of the ENGINEER/GEOLOGIST for evaluating each proposed substitution.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01 77 00 - CONTRACT CLOSEOUT

PART 1 -- GENERAL

1.1 FINAL CLEANUP

A. The CONTRACTOR shall promptly remove from the vicinity of the completed WORK, all rubbish, unused materials, concrete forms, construction equipment, and temporary structures and facilities used during construction. Final acceptance of the WORK by the DISTRICT will be withheld until the CONTRACTOR has satisfactorily performed the final cleanup of the Site.

1.2 CLOSEOUT TIMETABLE

A. The CONTRACTOR shall establish dates for equipment testing, acceptance periods, and on-site instructional periods (as required under the Contract). Such dates shall be established not less than one week prior to beginning any of the foregoing items, to allow the DISTRICT, the ENGINEER\GEOLOGIST, and their authorized representatives sufficient time to schedule attendance at such activities.

1.3 FINAL SUBMITTALS

A. The CONTRACTOR, prior to requesting final payment, shall obtain and submit the following items to the ENGINEER for transmittal to the DISTRICT:

1. Written guarantees, where required.
2. Technical Manuals and instructions.
3. New permanent cylinders and key blanks for all locks.
4. Maintenance stock items; spare parts; special tools.
5. Completed record drawings.
6. Bonds for roofing, maintenance, etc., as required.
7. Certificates of inspection and acceptance by local governing agencies having jurisdiction.
8. Releases from all parties who are entitled to claims against the subject project, property, or improvement pursuant to the provisions of law.
9. Final survey with stamp of county courthouse which indicating the volume and page number of where the record will be filed and the date it was filed.

1.4 MAINTENANCE AND GUARANTEE

A. The CONTRACTOR shall comply with the maintenance and guarantee requirements contained in Article 13 of the General Conditions.

B. Replacement of earth fill or backfill, where it has settled below the required finish elevations, shall be considered as a part of such required repair work, and any repair or

resurfacing constructed by the CONTRACTOR which becomes necessary by reason of such settlement shall likewise be considered as a part of such required repair work unless the CONTRACTOR shall have obtained a statement in writing from the affected private owner or public agency releasing the DISTRICT from further responsibility in connection with such repair or resurfacing.

C. The CONTRACTOR shall make all repairs and replacements promptly upon receipt of written order from the DISTRICT. If the CONTRACTOR fails to make such repairs or replacements promptly, the DISTRICT reserves the right to do the WORK and the CONTRACTOR and its surety shall be liable to the DISTRICT for the cost thereof.

1.5 BOND

A. The CONTRACTOR shall provide a bond to guarantee performance of the provisions contained in Paragraph "Maintenance and Guarantee" above, and Article 13 of the General Conditions.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

SECTION 03 31 00 - CAST-IN-PLACE CONCRETE

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Provide cast-in-place concrete, as indicated in accordance with the Contract Documents.

B. The following types of concrete are covered in this Section:

1. Structural Concrete

a. Regular Mix: Roof, floor slabs, columns, walls, pavements, and other concrete items not indicated otherwise in the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with **Section 01 33 00** – Contractor Submittals.

B. Mix Designs

1. Prior to beginning the WORK and within 14 Days of the Notice to Proceed, submit preliminary concrete mix designs which shall show the proportions and gradations of materials proposed for each class and type of concrete.

2. Mix designs shall be checked through trial batch and laboratory testing by an independent testing laboratory acceptable to the ENGINEER/GEOLOGIST.

3. Costs related to laboratory testing shall be CONTRACTOR's responsibility as part of the WORK.

C. Delivery Tickets

1. Where ready-mix concrete is used, the CONTRACTOR shall furnish delivery tickets at the time of delivery of each load of concrete.

2. Each ticket shall show the state-certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, the amount of water in the aggregate added at the batching plant, and the amount allowed to be added at the Site for the specific design mix.

3. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the Site, when unloading began, and when unloading was finished.

D. Test Data: Test data relating to the cement, aggregate, and admixtures shall be less than 6 months old.

E. Furnish the following submittals in accordance with ACI 301 – Structural Concrete:

1. mill tests for cement

2. admixture certification, including chloride ion content

3. aggregate gradation test results and certification

4. materials and methods for curing

1.3 QUALITY ASSURANCE

A. General

1. Tests on component materials and for compressive strength and shrinkage of concrete shall be performed as indicated.

2. Tests for determining slump shall be in accordance with ASTM C 143 – Test Method for Slump of Hydraulic Cement Concrete.

3. Testing for aggregate shall include sand equivalence, reactivity, organic impurities, abrasion resistance, and soundness, according to ASTM C 33 – Concrete Aggregates.

4. The cost of trial batch laboratory tests on cement, aggregates, and concrete shall be the CONTRACTOR's responsibility.

5. The cost of laboratory tests on field-placed cement, aggregates, and concrete will be the DISTRICT'S responsibility.

6. The CONTRACTOR shall be responsible for the cost of any tests and investigations of WORK that is determined to be Defective WORK.

7. The testing laboratory shall meet or exceed ASTM C 1077 – Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Laboratory Evaluation.

8. Concrete for testing shall be furnished by the CONTRACTOR, and the CONTRACTOR shall assist the ENGINEER/GEOLOGIST in obtaining samples and disposal and cleanup of excess material.

B. Field Compression Tests

1. Compression test specimens shall be taken during construction from the first placement of each type of concrete and at intervals thereafter as selected by the ENGINEER/GEOLOGIST to insure continued compliance with the Specifications.

2. Each set of specimens shall be a minimum of 5 cylinders.

3. Compression test specimens for concrete shall be made in accordance with Section 9.2 of ASTM C 31 – Practices for Making and Curing Concrete Test Specimens in the Field.

4. Specimens shall be 6-inches diameter by 12-inches tall cylinders.

5. Compression tests shall be performed in accordance with ASTM C 39 – Test Method for Compressive Strength of Cylindrical Concrete Specimens.

6. One test cylinder shall be tested at 7 Days, and 2 test cylinders tested at 28 Days.

7. The remaining cylinders shall be held to verify test results, if needed.

8. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age.

9. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001 inch at each test age.

10. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004 inch, the results obtained from that specimen shall be disregarded.

11. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage.

12. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens.

13. These tests shall be considered a part of the normal compression tests for the project.

PART 2 -- PRODUCTS

2.1 CONCRETE MATERIALS

A. General

1. Concrete materials in contact with potable water shall be classified as acceptable for potable water use in accordance with NSF/ANSI Standard 61 as required by the authority having jurisdiction. Not all products listed herein are for use in contact with potable water.

2. Cement for concrete that will contact potable water shall not be obtained from kilns that burn metal rich hazardous waste fuel.

3. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage.

4. Cement reclaimed from cleaning bags or leaking containers shall not be used.

5. Cement shall be used in the sequence of receipt of shipments.

B. Materials for concrete shall conform to the following requirements:

1. Cement

a. Cement shall be standard brand Portland cement conforming to ASTM C 150 – Portland Cement, for Type II or Type V.

b. A minimum of 85 percent of cement by weight shall pass a 325 screen.

c. A single brand of cement shall be used throughout the WORK, and prior to its use, the brand shall be accepted by the ENGINEER/GEOLOGIST.

d. The cement shall be suitably protected from exposure to moisture until used.

e. Cement that has become lumpy shall not be used.

f. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling.

g. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to the ENGINEER/GEOLOGIST, if requested, regarding compliance with the Specifications.

2. Water

a. Water for mixing and curing shall be potable, clean, and free from objectionable quantities of silty organic matter, alkali, salts, and other impurities.

b. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies.

c. Agricultural water with high total dissolved solids (greater than 1000 mg/L TDS) shall not be used.

3. Aggregates

a. Aggregates shall be obtained from pits acceptable to the ENGINEER/GEOLOGIST, shall be non-reactive, and shall conform to ASTM C 33 – Concrete Aggregates.

b. The maximum size of coarse aggregate shall be as indicated, and the substitution of lightweight sand for fine aggregate will not be permitted.

c. Coarse Aggregates

1) Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock, or a combination thereof.

2) The coarse aggregates shall be prepared and handled in 2 or more size groups for combined aggregates, with a maximum size greater than 3/4 inch.

3) When the aggregates are proportioned for each batch of concrete, the 2 size groups shall be combined (also refer to the Article below entitled "Trial Batch and Laboratory Tests").

d. Fine Aggregates

1) Fine aggregates shall be natural sand or a combination of natural and manufactured sand that is hard and durable.

2) When tested in accordance with ASTM D 2419 – Test Methods for Sand Equivalent Value of Soils and Fine Aggregate, the sand equivalency shall not be less than 75 percent for an average of 3 samples, nor less than 70 percent for an individual test.

3) The gradation of fine aggregate shall conform to ASTM C 33 when tested in accordance with ASTM C 136 for the fineness modulus of the sand used, including the optional grading in Section 6.2.

4) The fineness modulus of sand used shall not be greater than 3.1.

5) When tested in accordance with ASTM C 33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

e. Combined Aggregates

1) Combined aggregates shall be well graded from coarse to fine sizes and shall be uniformly graded between screen sizes to produce concrete that has optimum workability and consolidation characteristics.

2) Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

3) When tested in accordance with ASTM C 33, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions or 10.5 percent after 100 revolutions.

f. When tested in accordance with ASTM C 33, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.

g. When tested in accordance with ASTM C 33, the loss resulting after 5 cycles of the soundness test shall not exceed 10 percent for fine aggregate and 12 percent for coarse aggregate when using sodium sulfate.

4. Ready-mixed concrete shall conform to the requirements of ASTM C 94 – Ready Mixed Concrete.

5. Admixtures

a. Admixtures shall be compatible and shall be furnished by a single manufacturer capable of providing qualified field service representation.

b. Admixtures shall be used in accordance with manufacturer's recommendations.

c. If the use of an admixture is producing an inferior end result, the CONTRACTOR shall discontinue use of the admixture.

d. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.

e. Air Content

1) An air-entraining agent meeting the requirements of ASTM C 260 – Air Entraining Admixtures for Concrete shall be used.

2) Concrete floors to receive a dry-shake floor hardener shall have an air content not to exceed 3 percent.

3) The DISTRICT reserves the right, at any time, to sample and test the air-entraining agent.

4) The air-entraining agent shall be added to the batch in a portion of the mixing water.

5) The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

6) Air content shall be tested at the point of placement.

7) The air entraining agent shall be Micro-Air by Master Builders; Daravair by W.R. Grace; Sika AEA-15 by Sika Corporation; or equal

f. Other Admixtures

1) Flyash

a) Flyash shall not be used for concrete sections containing process water in water or wastewater treatment plants or potable water.

b) For other concrete, fly ash may be substituted for not more than 15 percent, by weight, of cement in structural concrete and not more than 30 percent, by weight, for sitework concrete, and not more than 50 percent, by weight, of cement in other concrete.

c) Fly ash shall conform to ASTM C618 and shall not have loss-on-ignition greater than 3 percent.

d) The water/cement ratio shall be calculated based on cement plus fly ash.

2) Ground Blast Furnace Slag Cement

a) Slag cement shall not be used for concrete sections containing process water in water or wastewater treatment plants or potable water.

b) Slag cement shall conform to ASTM C989 – Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars, Grade 100 or 120.

c) Blended cements shall conform to ASTM C595 – Blended Hydraulic Cements, Type 1S, or ASTM C1157 – Performance Specification for Hydraulic Cement.

d) Slag cement substitution, if used, shall be not less than 25, nor more than 50 percent by weight of cement.

e) Slag cement substitution shall not be used with fly ash substitution.

f) The water/cement ratio shall be calculated based on cement plus slag cement.

g. Silica Fume

1) Silica fume shall conform to ASTM C 1240.

2) Use Force 10,000S Silica Fume by W.R. Grace, Sikacrete 950 by Sika Corporation, Rheomac SF 110 by Master Builders, or equal.

3) Blended cements with interground silica fume will not be accepted.

4) The water content of liquid slurry silica fume admixtures shall be considered as part of the mixing water when calculating the water/cement ratio, which shall be calculated based on cement plus silica fume.

5) Batching

a) Silica fume shall be added at the batch plant as recommended by the manufacturer.

b) Regardless of the type of mixing equipment, mix times shall be increased by 40 percent over the minimum mix time required to achieve mix uniformity as defined by ASTM C 94.

c) For truck-mixed and central-mixed concrete, the maximum allowable batch size shall be 80 percent of the maximum in accordance with ASTM C 94.

2.2 CURING MATERIALS

A. General: Curing compounds shall be resin-based and shall be compliant with local VOC requirements, unless otherwise indicated herein.

B. Regular Curing Compound

1. Regular curing compound shall be white-pigmented and shall conform to ASTM C 309 - Liquid Membrane-Forming Compounds for Curing Concrete, Type 2, Class B.

2. Sodium silicate compounds will not be accepted.

3. The concrete curing compound shall be:

a. Kurez VOX White Pigmented by Euclid Chemicals Company;

b. L&M Cure R-2 by L&M Construction Chemicals;

c. 1200-White by W.R. Meadows;

d. Kure-N-Seal WB White Pigmented by Sonneborn/Degussa Building Systems;

e. or equal.

C. Concrete Curing Blanket

1. Polyethylene Sheets

a. Polyethylene sheets for use as concrete curing blanket shall be white and shall have a nominal thickness of 6 mils.

b. The loss of moisture when determined in accordance with ASTM C 156 – Test Method for Water Retention by Concrete Curing Materials, shall not exceed 0.055 grams per square centimeter of surface.

2. Polyethylene-Coated Waterproof Paper

a. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, shall have a nominal thickness of 2-mils, and shall be permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A – Building Paper, Vegetable Fiber (Kraft, Waterproofed, Water Repellant and Fire Resistant).

b. The loss of moisture, when determined in accordance with ASTM C 156, shall not exceed 0.055 gram per square centimeter of surface.

3. Polyethylene-Coated Burlap

a. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mils thick, with white opaque polyethylene film impregnated or extruded into one side of the burlap.

b. The burlap shall weigh not less than 9 ounces per square yard.

c. The loss of moisture, when determined in accordance with ASTM C 156, shall not exceed 0.055 grams per square centimeter of surface.

D. Curing Mats

1. Curing mats for use in Curing Method 6, below, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center.

2. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

2.3 CONCRETE DESIGN REQUIREMENTS

A. General

1. Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated.

2. The exact proportions in which these materials are to be used for different parts of the WORK shall be determined during the trial batches.

3. In general, the mix shall be designed to produce a concrete capable of being deposited to obtain maximum density and minimum shrinkage, and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface.

4. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items.

5. The proportions shall be changed whenever necessary or desirable to meet the required results, and such changes shall be subject to review by the ENGINEER/GEOLOGIST.

B. Fine Aggregate Composition

1. In mix designs for structural concrete, except for 1/2-inch and 3/8-inch maximum size aggregate, the percentage of fine aggregate in total aggregate by weight shall be as indicated in the following table:

FINE AGGREGATE	
Fineness Modulus	Percent (maximum)
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.1	44

2. For other concrete, the maximum percentage of fine aggregate of total aggregate by weight shall not exceed 50 percent.

C. Water/Cement Ratio

1. The indicated water/cement ratio is for a saturated-surface dry condition of aggregate.

2. Throughout every Day, the added batch water shall be adjusted for the total free water in the aggregates, which shall be determined as follows:

   a. The total moisture content of all aggregate shall be calculated by ASTM C 566 – Test Method for Total Moisture Content of Aggregate by Drying.

   b. Subtract the moisture absorbed by the coarse aggregate, calculated by ASTM C 127 – Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Coarse Aggregate.

   c. Subtract the moisture absorbed by the fine aggregate, calculated by ASTM C 128 – Standard Test Method for Density, Relative Density (Specific Gravity) and Absorption of Fine Aggregate.

STRUCTURAL CONCRETE				
Type of WORK	Regular Mix (roof, floor slabs, walls, pavements, and other concrete items not categorized elsewhere)	Thick Section Mix (12-inch and thicker walls, slabs on grade, pavements, and footings)	Congested Section Mix (Use where indicated or at the CONTRACTOR's option and approved by the ENGINEER/GEOLOGIST)	Pea Gravel Mix (concrete at the bottom 6 inches of waterstopped walls) At the CONTRACTOR's option, superplastic Regular Mix may be substituted for the first lift
Min 28 Day Compressive Strength, psi	4000	4000	5000	5000
Max Aggregate Size, in	1	1-1/2	1/2	3/8
Cement Content per cubic yard, lb, minimum	564	564	600	752
Water content per cubic yard, lb, maximum	254	254	240	301
Max W/C Ratio by weight	0.45	0.45	0.40	0.40
Total Air Content, percent	3 to 6, all others	3 to 6, all others	3 to 6, all others	4.5 to 7.5, all others
Slump	4 inches +/- 1 in with high-range water reducer: 7 inches +/- 2 in	4 inches +/- 1 in with high-range water reducer: 7 inches +/- 2 in	with high-range water reducer: 7 inches +/- 2 in	with high-range water reducer: 7 inches +/- 2 in

D. Adjustments to Mix Design

1. The CONTRACTOR may elect to decrease the water/cement ratio to achieve the strength and shrinkage requirements and/or add water reducers, as required to achieve workability.

2. The mixes shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish, and the

CONTRACTOR shall be entitled to no additional compensation because of such changes.

3. Any changes to the accepted concrete mix design shall be submitted to the ENGINEER/GEOLOGIST for review and shall be tested again in accordance with the indicated requirements.

2.4 CONSISTENCY

A. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete that can be worked properly into place without segregation and which can be compacted by vibratory methods to give the desired density, impermeability, and smoothness of surface.

B. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, in order to maintain uniform production of a desired consistency.

C. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143 – Test Method for Slump of Hydraulic Cement Concrete.

D. The slumps shall be as indicated with the concrete properties.

2.5 TRIAL BATCH AND LABORATORY TESTS

A. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch testing requirements.

B. Before placing any concrete, a testing laboratory selected by the ENGINEER/GEOLOGIST shall prepare a trial batch of each class of structural concrete, based on the preliminary concrete mixes submitted by the CONTRACTOR.

C. Aggregate Proportions

1. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties.

2. If one size range produces an acceptable mix, a second size range need not be used.

3. Such adjustments will be considered refinements to the mix design and will not be the basis for extra compensation to the CONTRACTOR.

4. Concrete shall conform to the indicated requirements whether the aggregate proportions are from the CONTRACTOR's preliminary mix design or whether the proportions have been adjusted during the trial batch process.

5. The trial batch shall be prepared using the aggregates, cement, and admixture proposed for the project.

D. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 3 drying shrinkage and 6 compression test specimens from each batch.

E. The determination of compressive strength shall be made by testing 6-inch diameter by 12-inch high cylinders, which have been made, cured, and tested in accordance with

ASTM C 192 – Practice for Making and Curing Concrete Test Specimens in the Laboratory, and ASTM C 39.

F. The testing schedule shall be 3 compression test cylinders tested at 7 Days and 3 at 28 Days.

G. The average compressive strength for the 3 cylinders tested at 28 Days for any given trial batch shall be not less than 125 percent of the indicated compressive strength.

H. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136 – Method for Sieve Analysis of Fine and Coarse Aggregates, and values shall be provided for percent passing each sieve.

2.6 SHRINKAGE LIMITATION

A. General

1. The CONTRACTOR shall only use a mix design for construction that has first met the trial batch shrinkage requirements.

2. Shrinkage limitations shall apply only to structural concrete.

B. Maximum Shrinkage

1. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-Day drying age or at 28-Day drying age, shall be 0.036 percent or 0.042 percent, respectively.

2. Standard deviation will not be considered.

3. The maximum concrete shrinkage for specimens cast in the field shall not exceed the trial batch maximum shrinkage requirement by more than 25 percent.

C. If the required shrinkage limitation is not met during construction, the CONTRACTOR shall take any or all of the following actions to reestablish compliance:

1. changing the source of aggregates, cement and/or admixtures;

2. reducing water/cement ratio;

3. washing of coarse and/or fine aggregate to reduce fines;

4. increasing the number of construction joints;

5. modifying the curing requirements; or

6. other actions to minimize shrinkage or the effects of shrinkage.

2.7 MEASUREMENT OF CEMENT AND AGGREGATE

A. The amount of cement and of each separate size of aggregate entering into each batch of concrete shall be determined by direct weighing equipment furnished by the CONTRACTOR and acceptable to the ENGINEER/GEOLOGIST.

B. Weighing Tolerances

Material	Percent of Total Weight
Cement	1
Aggregates	3
Admixtures	3

2.8 MEASUREMENT OF WATER

A. The quantity of water entering the mixer shall be measured by a suitable water meter or other measuring device of a type acceptable to the ENGINEER/GEOLOGIST and capable of measuring the water in variable amounts within a tolerance of one percent.

B. The water feed control mechanism shall be capable of being locked in position in order to constantly deliver the required amount of water to each batch of concrete.

C. A positive, quick-acting valve shall be used for a cut-off in the water line to the mixer, and the operating mechanism shall prevent leakage when the valve is closed.

2.9 READY-MIXED CONCRETE

A. General

1. At the CONTRACTOR'S option, ready-mixed concrete may be used if it meets the indicated requirements as to materials, batching, mixing, transporting and placement, and is in accordance with ASTM C 94 and the following supplementary requirements.

2. Ready-mixed concrete shall be delivered to the WORK, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever occurs first.

3. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted.

4. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted.

5. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the ENGINEER/GEOLOGIST.

B. Counters

1. Truck mixers shall be equipped with electrically-actuated counters by which the number of revolutions of the drum or blades may be readily verified.

2. The counter shall be of the resettable, recording type and shall be mounted in the driver's cab.

3. The counters shall be actuated at the time of starting the mixers at mixing speeds.

C. Mixing

1. Each batch of concrete shall be mixed in a truck mixer for not less than 70 revolutions of the drum or blades at the rate of rotation designated by the manufacturer of equipment.

2. Additional mixing, if any, shall be at the speed designated by the manufacturer of the equipment as agitating speed.

3. Materials, including the mixing water, shall be in the mixer drum before actuating the revolution counter for determining the number of revolutions of mixing.

D. Uniformity

1. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading.

2. If slump tests taken at approximately the 1/4- and 3/4-point of the load during discharge result in slumps differing by more than one inch when the required slump is 3 inches or less, or if they differ by more than 2 inches when the required slump is more than 3 inches, the mixer shall not be used on the WORK unless the causative condition is corrected and satisfactory performance is verified by additional slump tests.

3. Mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

E. Each batch of ready-mixed concrete delivered to the Site shall be accompanied by a delivery ticket that is furnished to the ENGINEER/GEOLOGIST in accordance with the Paragraph in Part 1 of this Section entitled "Delivery Tickets."

PART 3 -- EXECUTION

3.1 PROPORTIONING AND MIXING

A. Proportioning of the mix shall conform to ACI 301.

B. Mixing shall conform to ACI 301.

C. Slumps shall be as indicated.

D. Re-tempering of concrete or mortar that has partially hardened will not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. General

1. Earth surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon.

2. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Vapor Retarder

1. The vapor retarder shall be installed under the entire floor slabs-on-grade.

2. Aggregate base on which the vapor retarder is placed shall be at least 6-inches thick within the floor slab-on-grade line after compaction. Aggregate base surface shall be flat and level with a tolerance of plus zero inches to minus ¾-inch.

3. Place, protect, and repair defects in sheet according to ASTM E 1643 – Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs, and the manufacturer's written instructions.

4. Seams shall be lapped a minimum of 6 inches and sealed in accordance with ASTM E 1643, and as recommended by the vapor retarder manufacturer.

5. Take precautions to avoid damaging the vapor retarder while placing the slab. Keep the vapor retarder dry and place concrete directly on the vapor retarder unless otherwise noted on the Construction Documents.

3.3 HANDLING, TRANSPORTING, AND PLACING

A. General

1. The placement of concrete shall conform to the applicable portions of ACI 301 and the indicated requirements.

2. No aluminum materials shall be used in conveying any concrete.

B. Non-Conforming WORK or Materials

1. Concrete which during or before placing is found not to conform to the indicated requirements will be rejected and shall be immediately removed from the WORK.

2. Concrete that is not placed in accordance with these requirements or which is of inferior quality shall be removed and replaced.

C. Unauthorized Placement

1. No concrete shall be placed except in the presence of an authorized representative of the ENGINEER/GEOLOGIST.

2. The CONTRACTOR shall notify the ENGINEER/GEOLOGIST in writing at least 24 hours in advance of the placement of any concrete.

D. Placement in Slabs

1. Concrete placement in sloping slabs shall proceed uniformly from the bottom of the slab to the top for the full width of the placement.

2. As the WORK progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.

E. Temperature of Concrete

1. The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 50 degrees F.

2. For sections less than 12 inches thick, the temperature of concrete when placed shall be not less than 55 degrees F.

F. Hot or Cold Weather Procedures

1. If required by the ENGINEER/GEOLOGIST, the CONTRACTOR shall submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of concrete during hot or cold weather.

2. The submittal shall include procedures to be implemented upon abrupt changes in weather conditions or equipment failures.

3. The CONTRACTOR shall not be entitled to additional compensation for satisfying the hot weather placement or the cold weather placement requirements below.

G. Hot Weather Placement

1. If the temperature of the concrete is 85 degrees F or greater, the time between introducing the cement into the aggregates and discharge shall not exceed 45 minutes.

2. If the concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the CONTRACTOR shall employ effective means such as pre-cooling of aggregates, using ice as mixing water, or placing at night as necessary to maintain the temperature of the concrete below 90 degrees F as it is placed.

3. During the curing period, the maximum temperature decrease measured at the surface of the concrete shall not exceed 50 degrees F in 24 hours nor 5 degrees F in one hour.

H. Cold Weather Placement

1. The placement of concrete shall conform to ACI 306.1 – Cold Weather Concreting, and the following requirements:

   a. Remove snow, ice, and frost from the surfaces, including reinforcement, against which concrete is to be placed.

   b. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches.

   c. Reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.

   d. Maintain the concrete temperature above 50 degrees F for at least 72 hours after placement.

   e. Concrete ingredients shall not be heated more than necessary to prevent the temperature of the mixed concrete, as placed, from falling below the minimum temperature criterion.

3.4 PUMPING OF CONCRETE

A. General: If the pumped concrete does not produce satisfactory end results, the CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

B. Pumping Equipment

1. The pumping equipment shall have 2 cylinders and shall be designed to operate with one cylinder in case the other one is not functioning.

2. In lieu of this requirement, the CONTRACTOR may have a standby pump on the Site during pumping.

3. The minimum diameter of the hose conduits shall be in accordance with ACI 304.2R – Placing Concrete by Pumping Methods.

4. Pumping equipment and hose conduits that are not functioning properly shall be replaced.

5. Aluminum conduits for conveying the concrete will not be permitted.

C. Field Control: Concrete samples for slump, air content, and test cylinders shall be taken at the placement end of the hose.

D. Concrete Surfaces

1. The surface of the concrete shall be level whenever a run of concrete is stopped.

2. For a level, straight, intermediate joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces.

3. The concrete shall be carried approximately 1/2 inch above the underside of the strip.

4. The strip shall be removed one hour after the concrete is placed, and any irregularities in the edge formed by the strip shall be leveled with a trowel and laitance shall be removed.

3.5 TAMPING AND VIBRATING

A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted throughout the entire depth of the layer which is being consolidated, into a dense and homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete.

B. Vibrators

1. Vibrators shall be Group 3 in accordance with ACI 309 – Consolidation of Concrete, high speed power vibrators (8000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit as required.

2. Group 2 vibrators may be used only at specific locations when accepted by the ENGINEER/GEOLOGIST.

3.6 FINISHING CONCRETE SURFACES

A. General

1. Concrete surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface.

2. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions are defined as tolerances and shall be as indicated.

3. These tolerances are to be distinguished from irregularities in finish as indicated.

4. Aluminum finishing tools shall not be used.

B. Formed Surfaces

1. No treatment shall be required after form removal except for curing, repair of defective concrete, and treatment of surface defects.

C. Unformed Surfaces

1. General

a. After proper and adequate vibration and tamping, unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools.

b. Immediately after the concrete has been screeded it shall be treated with a liquid evaporation retardant, and the retardant shall be used again after each operation as necessary to prevent drying shrinkage cracks.

2. The classes of finish for unformed concrete surfaces are defined as follows:

a. Finish U4

1) Trowel the Finish U3 surface to remove local depressions or high points.

2) In addition, the surface shall be given a light broom finish with brooming perpendicular to drainage unless otherwise indicated.

3) The resulting surface shall be sufficiently rough to provide a nonskid finish.

b. Unformed surfaces shall be finished according to the following schedule:

3.7 CURING AND DAMPPROOFING

A. General: Concrete shall be cured for not less than 7 Days after placement, in accordance with the methods indicated below for the different parts of the WORK.

B. Method 1

1. Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removal.

2. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed.

3. If forms are removed within 7 Days of placing the concrete, curing shall be continued in accordance with Method 6, below.

3.8 PROTECTION

A. The CONTRACTOR shall protect the concrete against damage until final acceptance.

B. Weather Protection

1. Fresh concrete shall be protected from damage due to rain, hail, sleet or snow.

2. The CONTRACTOR shall provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

3.9 CURING DURING COLD WEATHER

A. Water curing of concrete may be reduced to 6 Days during periods when the mean daily temperature in the vicinity of the Site is less than 40 degrees F, provided that during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing has been temporarily discontinued.

B. Compound-Cured Concrete

1. Concrete that is to be cured by an application of curing compound shall require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces.

2. Otherwise, the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F.

C. Concrete cured by water shall be protected against freezing temperatures for 72 hours immediately following the 72 hours of protection at 50 degrees F.

D. Discontinuance of Protection

1. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours.

2. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive Days, the required 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F, provided that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

3.10 TREATMENT OF SURFACE DEFECTS

A. General

1. Surface defects are defined in Finishing Concrete Surfaces, above.

2. As soon as forms are removed, the exposed concrete surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in order to secure a smooth, uniform, and continuous surface satisfactory to the ENGINEER/GEOLOGIST.

3. Plastering or coating of surfaces to be smoothed will not be permitted.

4. No repairs shall be made until after inspection by the ENGINEER/GEOLOGIST.

5. In no case will extensive patching of honeycombed concrete be permitted.

6. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as indicated below.

7. Concrete containing extensive voids, holes, honeycombing, or similar depression defects shall be completely removed and replaced..

8. Repairs of surface defects shall be performed promptly.

B. Preparation

1. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of 1/2-inch over the entire area.

2. Feathered edges will not be permitted.

3. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of laitance and soft material, plus not less than 1/32-inch depth of the surface film from hard portions by means of an efficient sandblast.

4. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar such that while the repair material is being applied the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends.

C. Materials

1. The material used for repair shall consist of a mixture of one sack of cement to 3 cubic feet of sand.

2. For exposed walls, the cement shall contain such a proportion of Atlas White Portland cement as is required to make the color of the patch match the color of the surrounding concrete.

3.11 CARE AND REPAIR OF CONCRETE

A. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed WORK, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be repaired or removed and replaced with acceptable materials to the satisfaction of the ENGINEER/GEOLOGIST.

END OF SECTION

SECTION 03 60 00 – GROUTING

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide grout, complete and in place, in accordance with the Contract Documents

B. The following types of grout are covered in this Section:

1. Cement Grout

2. Non-Shrink Grout - Class I (cement-based)

3. Non-Shrink Grout - Class II (cement-based)

4. Non-Shrink Epoxy Grout

5. Epoxy Anchor Grout for Post Installed Adhesive Anchors

6. Topping Grout and Concrete/Grout Fill

7. Structural Repair Grout

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with **Section 01 33 00** - Contractor Submittals.

1. Certified testing lab reports for tests indicated herein.

2. Test results and service report from the field tests and the demonstration and training session verifying the requirements indicated herein.

3. Certifications that grouts used on the project contain no chlorides or other chemicals that cause corrosion.

4. Manufacturer’s literature containing instructions and recommendations on the mixing, handling, placement, curing, and appropriate uses for each type of grout used in the WORK, and location of use. The current ICC-ES or IAPMO-UES report shall be submitted for all epoxy anchor grouts for adhesive anchors.

5. Manufacturer’s certification that its non-shrink grout does not contain aluminum, zinc, or magnesium powders as a method of expansion.

6. Submit manufacturer's written warranty as indicated herein.

7. Name and telephone number of grout manufacturer's representative who will give on-Site service. The representative shall have at least one year of experience with the indicated grouts.

1.3 QUALITY ASSURANCE

A. Field Tests

1. Compression test specimens will be taken from the first placement of each type of grout, and at intervals thereafter selected by the ENGINEER/GEOLOGIST. The specimens will be made by the ENGINEER/GEOLOGIST or its representative.

2. Compression tests and fabrication of specimens for cement grout and cement based non-shrink grout will be performed in accordance with ASTM C 1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink), at intervals during construction selected by the ENGINEER/GEOLOGIST. As a minimum, a set of 3 specimens will be made for testing at 7 Days, 28 Days, and each additional time period as appropriate.

3. Compression tests and fabrication of specimens for topping grout and concrete/grout fill will be performed in accordance with **Section 03 31 50** - Cast-in-Place Concrete, at intervals during construction selected by the ENGINEER/GEOLOGIST.

4. The cost of laboratory tests on grout will be paid by the DISTRICT except where test results show the grout to be defective. In such case, the CONTRACTOR shall pay for the tests, removal and replacement of Defective Work, and re-testing, all as part of the WORK.

5. The CONTRACTOR shall assist the ENGINEER/GEOLOGIST in obtaining specimens for testing and shall furnish materials necessary for fabricating the test specimens.

B. Construction Tolerances: Construction tolerances shall be as indicated in **Section 03 31 50** unless indicated otherwise.

C. Pre-Installation Demonstration and Training

1. Cement and Epoxy-Based Non-Shrink Grouts

a. The grout manufacturer shall give a demonstration and training session for the cement based non-shrink and epoxy grouts to be used on the project, before any installation of grout is allowed.

b. Training session shall use a minimum of 5 bags of cement-based non-shrink class I grout mixed to fluid consistency. Tests shall be conducted for flow cone and bleed tests. Six cubes for testing at 1, 3, and 28 Days shall be made. The remaining grout shall be placed, and curing may be initiated on actual project placements such as baseplates and tie holes to provide on-the-job training for the CONTRACTOR and ENGINEER/GEOLOGIST. The CONTRACTOR employees who will be doing the grouting shall participate in this training and demonstration session. The training session shall include methods for curing the grout.

c. The manufacturer shall mix enough cement-based non-shrink class II grout for a minimum of 15 tie holes and shall train the CONTRACTOR'S employees in how to perform the WORK and cure the grout. The CONTRACTOR shall have the employees assisting in the mixing and sealing of the tie holes.

d. The CONTRACTOR shall transport the test cubes to an independent test laboratory, obtain the test reports, and report these demonstration and training test cube strengths to the ENGINEER/GEOLOGIST.

1.4 SPECIAL CORRECTION OF DEFECTS PROVISIONS

A. Manufacturer's Warranty

1. Furnish one year warranty for WORK provided under this section.

2. Manufacturer's warranty shall not contain a disclaimer limiting responsibility to the purchase price of products or materials.

PART 2 -- PRODUCTS

2.1 APPLICATION

A. Unless indicated otherwise, grouts shall be provided as listed below whether indicated on the Drawings or not.

Application	Type of Grout
Anchor bolts, anchor rods and reinforcing steel required to be set in grout in which the average working or operating temperature will be over 100 degrees F or in high fire risk areas.	Non-Shrink - Class I
Any application not listed above, where grout is indicated	Non-Shrink Class I, unless specifically indicated otherwise

2.2 CEMENT GROUT

A. Cement grout shall be composed of one part cement, 3 parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 Days shall be 4000 psi.

B. Cement grout materials shall be as indicated in **Section 03 31 50**.

2.3 NON-SHRINK GROUTS (cement-based)

A. General

1. Cement-based non-shrink grout shall be a prepackaged, inorganic, fluid, non-gas liberating, non-metallic, cement type grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used.

2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout shall be as recommended by the manufacturer for the particular application.

3. Grout shall not contain chlorides or additives that may contribute to corrosion.

4. Grout shall be formulated to be used at any consistency from fluid to plastic.

5. Cement-based non-shrink grout shall have the following minimum properties when tested at a fluid consistency, at 28 Days:

    a. Minimum tensile splitting strength of 500 psi per ASTM C 496 - Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

    b. Minimum flexural strength of 1000 psi per ASTM C 580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes.

    c. Minimum bond strength (concrete to grout) of 1900 psi per modified ASTM C 882 - Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.

    d. Grout shall be certified for use in a marine environment.

    e. Grout shall be certified for use in freeze/thaw environments.

B. Non-Shrink Grout – Class I

1. Non-Shrink Grout – Class I shall have a minimum 28 Day compressive strength of 5000 psi when mixed at a fluid consistency.

2. Non-Shrink Grout – Class I shall meet the requirements of ASTM C 1107, Grade B or C, when mixed to fluid, flowable, and plastic consistencies.

3. Non-Shrink Grout – Class I shall have a maximum early age height change of 4.0 percent expansion, and shall have no shrinkage (0.0 percent) in accordance with ASTM C 827 – Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures. The grout when tested shall not bleed or segregate at maximum allowed water.

4. Non-Shrink Grout – Class I shall have no shrinkage (0.0 percent) and a maximum of 0.3 percent expansion in the hardened state when tested in accordance with ASTM C 1090 – Standard Test Method for Measuring Changes in Height of Cylindrical Specimens from Hydraulic-Cement Grout.

5. Furnish certification that the non-shrink property of grout is not based on gas production or gypsum expansion.

2.4 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is defined such that the grout is plastic and moldable but will not flow.

B. The slump for topping grout and concrete/grout fill shall be adjusted to match placement and finishing conditions but shall not exceed 4-inches.

2.5 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurements shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 -- EXECUTION

3.1 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Grout shall be stored in accordance with manufacturer's recommendations.

3.2 GENERAL

A. CONTRACTOR shall arrange for the manufacturer of prepackaged grouts to provide on-Site technical assistance within 72 hours of request, as part of the WORK.

B. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized otherwise by the ENGINEER/GEOLOGIST.

C. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of the saturation period, excess water shall be removed with clean, oil free compressed air prior to grouting. Concrete substrate shall not be wet prior to placement of epoxy grouts.

D. Surface preparation, curing, and protection of cement grout shall be in accordance with Section 03 31 00.

E. Surfaces that will be in contact with grout shall be free of dirt, loose rust, oil, wax, grease, curing compounds, laitance, loose concrete, and other deleterious materials.

F. Shade the WORK from sunlight for at least 24 hours before and 48 hours after grouting.

G. Contact the grout manufacturer's representative for assistance on hot and cold weather grouting techniques and precautions if applicable.

3.3 GROUTING PROCEDURES

A. General: Mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

END OF SECTION

SECTION 05 50 00 – MISCELLANEOUS METALWORK

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Provide miscellaneous metalwork and appurtenances, complete and in place, as indicated in accordance with the Contract Documents.

1.2 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Federal Specifications

MIL-G-18015 A (3)	(Ships) Aluminum Planks. (6063-T6)
MIL-PRF-907F	Antiseize Thread Compound, High Temperature

B. Commercial Standards

AA-M32C22A41	Aluminum Assn.
AISC	Manual of Steel Construction
AISI	Design of Light Gauge, Cold-Formed Steel Structural Members
ASTM A 193	Alloy Steel and Stainless Steel Bolting Materials for High Temperature Service
ASTM A 194	Carbon and Alloy Steel Nuts for Bolts for High Pressure and High Temperature Service
ASTM A 307	Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 325	Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 500	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 992	Steel for Structural Shapes for Use in Building Framing
ASTM F 1554	Standard Specification for Anchor Bolts, Steel, 36, 55 and 105-ksi Yield Strength
ANSI/AWS D1.1	Structural Welding Code - Steel
ANSI/AWS D1.2	Structural Welding Code - Aluminum
ANSI/AWS QC1	Qualification and Certification of Welding Inspectors

1.3 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of **Section 01 33 00** - Contractor Submittals.

B. Shop Drawings

1. Shop Drawings shall conform to AISC recommendations and specifications, and shall show holes, and the like, as may be required for other parts of the WORK.

2. Shop Drawings shall include complete details of members and connections, anchor bolt layouts, schedules for fabrication procedures, and diagrams for the sequence of erection.

C. Grating

1. Submit layout drawings for grating, showing the direction of span, type and depth of grating, size and shape of grating panels, seat angle details, and details of grating hold down fasteners.

2. Submit load and deflection tables for each style and depth of grating used.

1.4 QUALITY ASSURANCE

A. Weld procedures and welder qualifications shall be available in the CONTRACTOR's field office for review.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Steel

Wide Flange Shapes	ASTM A 992
Shapes, Plates, Bars	ASTM A 36
Pipe, Pipe Columns, Bollards	ASTM A 53, Type E or S, Grade B standard weight unless indicated otherwise
HSS	ASTM A 500 Grade B

B. Corrosion Protection

1. Unless otherwise indicated, fabricated steel metalwork which will be used in a corrosive environment and/or will be submerged in water or wastewater shall be coated in accordance with the requirements of **Section 09 96 00** - Protective Coating, and shall not be galvanized prior to coating.

2. Other miscellaneous steel metalwork shall be hot-dip galvanized after fabrication.

C. Stainless Steel

1. Unless otherwise indicated, stainless steel metalwork and bolts shall be fabricated from Type 316 stainless steel.

2. Where anaerobic conditions are noted, Type 304 stainless steel shall be used.

D. Aluminum

1. Unless otherwise indicated, aluminum metalwork shall be fabricated from Alloy 6061-T6.

2. Aluminum in contact with concrete, masonry, wood, porous materials, or dissimilar metals shall have contact surfaces coated in accordance with the requirements of **Section 09 96 00** - Protective Coating.

2.2 BOLTS AND ANCHORS

A. Standard Service (Non-Corrosive Application)

1. Bolts, anchor rods, anchor bolts, washers, and nuts shall be fabricated from steel as indicated.

2. Threads on galvanized bolts, rods and nuts shall be formed with suitable taps and dies such that they retain their normal clearance after hot-dip galvanizing.

3. Except as otherwise indicated, steel for bolt material, anchor rods, anchor bolts, and cap screws shall be in accordance with the following requirements:

a. Structural Connections: ASTM A 307, Grade A or B, hot-dip galvanized

b. Headed Anchor Rods and Anchor Bolts: ASTM F1554, Grade 36, hot-dip or mechanically galvanized with Grade A matching nuts

c. High-Strength Bolts, where indicated: ASTM A 325

d. Pipe and Equipment Flange Bolts: ASTM A 193, Grade B-7

B. Corrosive Service

1. Bolts, anchor rods, anchor bolts, nuts, and washers in the locations listed below shall be fabricated from stainless steel as indicated.

a. buried locations

b. submerged locations

C. Unless otherwise indicated, stainless steel bolts, anchor rods, anchor bolts, nuts, and washers shall be fabricated from Type 316 stainless steel, Class 2, conforming to ASTM A 193 for bolts and to ASTM A 194 for nuts.

D. Buried pipe flange bolts and nuts on pipe of Class 275 and greater shall be in accordance with ASTM A193/A194, Grade B7.

E. Coating

1. Threads on stainless steel bolts and rods shall be protected with an antiseize lubricant suitable for submerged stainless steel bolts, meeting government specification MIL-A-907E.

2. Buried bolts in poorly drained soil shall be coated the same as the buried pipe.

3. Antiseize lubricant shall be classified as acceptable for potable water use by the NSF.

4. Antiseize lubricant shall be "PURE WHITE" by **Anti-Seize Technology,** Franklin Park, IL, 60131, **AS-470** by **Dixon Ticonderoga Company,** Lakehurst, NJ, 08733, or equal.

F. Bolt Requirements

1. The bolt and nut material shall be free-cutting steel.

2. The nuts shall be capable of developing the full strength of the bolts.

3. Threads shall be Coarse Thread Series conforming to the requirements of the American Standard for Screw Threads.

4. Bolts and cap screws shall have hexagon heads and nuts shall be Heavy Hexagon Series.

5. Bolts and nuts shall be installed with washers fabricated from material matching the base material of bolts, except that hardened washers for high-strength bolts shall conform to the requirements of the AISC Specification.

6. Lock washers fabricated from material matching the bolts shall be installed where indicated.

7. The length of each bolt shall be such that the bolt extends at least 1/8 inch beyond the outside face of the nut before tightening, except for anchor bolts which shall be flush with the face of the nut before tightening.

G. Adhesive Anchors

1. General

a. Unless otherwise indicated, drilled concrete or masonry anchors shall be adhesive anchors.

b. No substitutions will be considered unless accompanied with a current ICC-ES or IAPMO-UES report verifying strength and material equivalency.

2. Epoxy Anchors

a. Epoxy adhesive anchors are required for drilled anchors for outdoor installations, in submerged, wet, splash, overhead, and corrosive conditions, and for anchoring handrails and reinforcing bars.

b. Epoxy shall be in accordance with the requirements of **Section 03 60 00** - Grouting.

c. Threaded rod shall be galvanized for general purpose applications and fabricated from Type 316 stainless steel for use in corrosive applications.

d. Epoxy anchors shall not be permitted in areas where the concrete temperature is in excess of 100 degrees F or higher than the limiting temperature recommended by the manufacturer, whichever is lower.

e. Epoxy anchors shall not be used where anchors are subject to vibration or fire.

f. Minimum substrate temperatures shall be maintained during the full curing period as required by the manufacturer.

3. Unless otherwise noted, threaded rod shall be galvanized steel.

PART 3 -- EXECUTION

3.1 FABRICATION AND INSTALLATION REQUIREMENTS

A. **Fabrication and Erection:** Except as otherwise indicated, the fabrication and erection of structural steel shall conform to the requirements of the American Institute of Steel Construction "Manual of Steel Construction."

3.2 WELDING

A. Method

1. Welding shall be performed by the metal-arc method or gas-shielded arc method as described in the American Welding Society "Welding Handbook" as supplemented by other pertinent standards of the AWS.

2. The qualification of the welders shall be in accordance with the AWS Standards.

B. Quality

1. In assembly and during welding, the component parts shall be adequately clamped, supported, and restrained in order to minimize distortion and for control of dimensions.

2. Weld reinforcement shall be as indicated by the AWS Code.

3. Upon completion of welding, remove weld splatter, flux, slag, and burrs left by attachments.

4. Welds shall be repaired in order to produce a workmanlike appearance, with uniform weld contours and dimensions.

5. Sharp corners of material that is to be painted or coated shall be ground to a minimum of 1/32 inch on the flat.

END OF SECTION

SECTION 26 05 10 - ELECTRIC MOTORS

PART 1 -- GENERAL

1.1 THE SUMMARY

A. General: The CONTRACTOR shall provide electric motors, accessories, and appurtenances complete and operable, in conformance to the Contract Documents.

B. The provisions of this Section apply to low voltage 3 phase, AC squirrel cage induction motors throughout the Contract Documents, except as indicated otherwise.

C. The CONTRACTOR shall assign to the equipment supplier the responsibility to select suitable electric motors for the equipment. The choice of motor manufacturer shall be subject to review by the ENGINEER/GEOLOGIST. Such review will consider future availability of replacement parts and compatibility with driven equipment

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with **Section 01 33 00** - Contractor Submittals.

B. Complete motor data shall be submitted with the driven machinery Shop Drawings. Motor data shall include:

1. Machine name and specification number of driven machine
2. Motor manufacturer
3. Motor type or model and dimension drawing. Include motor weight.
4. Nominal horsepower
5. NEMA design
6. Enclosure
7. Frame size
8. Winding insulation class and temperature rise class
9. Voltage, phase, and frequency ratings
10. Service factor
11. Full load current at rated horsepower for application voltage
12. Full load speed
13. Guaranteed minimum full load efficiency. Also nominal efficiencies at 1/2 and 3/4 load.
14. Type of thermal protection or overtemperature protection, where included

15. Bearing data. Include recommendation for lubricants of relubricatable type bearings.

16. Power factor at 1/2, 3/4 and full load.

17. Recommended size for power factor correction capacitors to improve power factor to 0.95 percent lagging when operated at full load.

C. If water cooling is required for motor thrust bearings, the Shop Drawing submittals shall indicate this requirement.

PART 2 -- PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electric motors driving identical machines shall be identical.

B. Maximum motor loading shall be equal to nameplate horsepower rating or less, exclusive of service factor and be verifiable from the submittal data of the driven machinery.

2.2 DESIGN REQUIREMENTS

A. General: Electric motors shall comply with NEMA MG-1 - Motor and Generator.

B. NEMA Design: Electric motors shall be NEMA Design B unless otherwise indicated. In no case shall starting torque or breakdown torque be less than the value in NEMA MG 1. Motors shall be suitable for the indicated starting method.

C. Motor Voltage Ratings: Low voltage motors shall have voltage ratings in accordance with the following, unless otherwise indicated:

1. Motors 1/2 HP and larger shall be rated 460 volts, 3 phase, 60 Hz. Dual voltage motors rated 230/460 volts or 208/230/460 volts are acceptable, provided every lead is brought out to the conduit box.

D. Insulation: Single phase motors shall have Class F insulation with temperature rise not to exceed the insulation class. Motors to be operated from adjustable frequency drives shall be provided with insulation systems to withstand 1600 volt spikes, with dV/dT as defined in NEMA MG 1-31. The adjustable frequency drive manufacturer shall coordinate with the motor manufacturer to determine when additional dV/dT protection is required. Where required, it shall be furnished and installed as per the manufacturer’s written instructions.

2.3 ACCESSORY REQUIREMENTS

A. Nameplate: Motors shall be fitted with permanent stainless steel nameplates indelibly stamped or engraved with NEMA Standard motor data, in conformance with NEMA MG-1-10.40. Inverter duty motors shall be clearly identified as such.

B. Where motors are indicated by elementary schematics or specifications to have zero speed switches, the switches shall be factory mounted integral to the motors. Switches shall close the contacts when the motor is at zero speed.

C. The motor manufacturer shall furnish for installation by the CONTRACTOR power factor correction capacitors for each motor 10 HP and larger, and started with FVNR, FVR, FVNR-AT (auto-transformer) or FVTS (two-speed, high speed winding corrected) starters

only. Motors started with VFDs shall not have capacitors. Reduced voltage, solid state starters shall be provided with capacitors, where specifically shown. The capacitors shall be fused, with internal resistors, suitably enclosed for mounting adjacent to the starter, MCC, or the motor, and sized to improve power factor to not less than 95% at full load. Size shall be as recommended by the motor manufacturer. The capacitors shall be wired to the motor starter output terminals. Dieletric fluid shall be non-PCB, biodegradable and non-flammable.

2.4 MOTOR BEARINGS

A. General: Bearings shall conform to **Section 46 01 00** - Equipment General Provisions, except as indicated herein.

B. Motors greater than 2 HP shall have bearings designed for 17,500 hours (belted) or 100,000 hours (coupled) L-10 life.

C. Fractional Horsepower: Motors with fractional horsepower through 2 HP shall be provided with lubricated-for-life ball bearings.

D. Vertical Motors Over 2 HP: Vertical motors larger than 2 HP shall be provided with relubricatable ball, spherical, roller, or plate type thrust bearings. Lubrication shall be per manufacturer's recommendation for smooth operation and long life of the bearings.

E. Water Cooled Motors: If water cooling is required for the thrust bearings, cooling water lines shall be provided complete with shut-off valve, strainer, solenoid valve, flow indicator, thermometer, throttling valve, and, (where subject to freezing), insulation with heat tracing.

F. Inverter Duty Motors: Provide an insulated bearing to prevent circulating bearing currents.

2.5 MANUFACTURERS, OR EQUAL

A. **U.S. Motors/Nidec**

B. **Baldor**

C. **WEG**

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Motor installation shall be performed in accordance with the motor manufacturer's written recommendations and the written requirements of the manufacturer of the driven equipment. Shaft grounding devices shall be connected to the grounding system in accordance with the manufacturer’s recommendations.

B. Related electrical WORK involving connections, controls, switches, and disconnects shall be performed in accordance with the applicable sections of Division 26.

3.2 FACTORY TESTING

A. Motors rated 100 HP and larger shall be factory tested in conformance with IEEE 112, IEEE 43 - Recommended Practice for Testing Resistance of Rotating Machinery, and NEMA MG-2. Except where specific testing or witnessed shop tests are required by the

specifications for driven equipment, factory test reports may be copies of routine test reports of electrically duplicate motors. Test report shall indicate test procedure and instrumentation used to measure and record data. Test report shall be certified by the motor manufacturer's test personnel and be submitted to the ENGINEER/GEOLOGIST.

3.3 FIELD TESTING

A. The CONTRACTOR shall perform the following field tests:

1. Inspect each motor installation for any deviation from rated voltage, phase, frequency, and improper installation.

2. Visually check for proper phase and ground connections. Verify that multi-voltage motors are connected for proper voltage. Verify shaft grounding devices are properly grounded.

3. Check winding and bearing temperature detectors and space heaters for functional operation. Verify RTD monitors are properly programmed and protection setpoints are correct and enabled.

4. Test for proper rotation prior to connection to the driven equipment.

5. Visually check that motor overload heaters are properly sized and that MCP breaker settings are correct for the motor installed.

6. Test insulation (megger test) of new and re-used motors in accordance with NEMA MG-1. Test voltage shall be 1000 VAC plus twice the rated voltage of the motor.

END OF SECTION

SECTION 31 10 00 - SITE PREPARATION

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The WORK of this Section includes measures required during the CONTRACTOR's initial move onto the Site to protect existing fences, houses and associated improvements, streets, and Utilities down slope of construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing and stripping; and re-grading of certain areas to receive embankment fill.

1.2 SITE INSPECTION

A. Prior to moving onto the Site, the CONTRACTOR shall inspect the Site conditions and review maps of the existing plant site and off-site pipeline routes and facilities delineating the DISTRICT's property and right-of-way lines.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION

3.1 PRIMARY PLANT SITE ACCESS

A. The CONTRACTOR shall develop any necessary access to the Site, including access barriers to prohibit entry of unauthorized persons.

B. **Utility Interference:** Where existing utilities interfere with the WORK, notify the Utility DISTRICT and the ENGINEER/GEOLOGIST before proceeding in accordance with the General Conditions.

3.2 CLEARING, GRUBBING, AND STRIPPING

A. Construction areas shall be cleared of grass and weeds to at least a depth of 6-inches and cleared of structures, pavement, sidewalks, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the WORK, create a hazard to safety, or impair the subsequent usefulness of the WORK, or obstruct its operation. Loose boulders within 10-feet of the top of cut lines shall be incorporated in landscaping or removed from the Site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction, as directed by the ENGINEER/GEOLOGIST.

B. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Septic tanks, drain fields, and connection lines and any other underground structures, debris or waste shall be removed if found on the Site. All objectionable material from the clearing and grubbing process shall be removed from the Site and wasted in approved safe locations.

C. Unless otherwise indicated, native trees larger than 3-inches in diameter at the base shall not be removed without the ENGINEER/GEOLOGIST's approval. The removal of any trees, shrubs, fences, or other improvements outside of rights-of-way, if necessary for the

CONTRACTOR's choice of means and methods, shall be arranged with the DISTRICT of the property, and shall be removed and replaced, at no additional cost to the DISTRICT.

3.3 OVEREXCAVATION, REGRADING, AND BACKFILL UNDER FILL AREAS

A. After the fill areas have been cleared, grubbed, and excavated, the areas to receive fill will require over-excavation, re-grading, and backfill, consisting of the removal and/or stockpiling of undesirable soils. The ground surface shall be re-contoured for keying the fill and removing severe or abrupt changes in the topography of the Site.

- END OF SECTION -

SECTION 31 35 26 - EROSION CONTROL BARRIER

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide erosion control barriers, complete and in place, in accordance with the Contract Documents

1.2 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with **Section 01 33 00 - Contractor Submittals**.

B. Plan: Submit plan for erosion control measures to Engineer for approval prior to installing erosion and sedimentation control measures.

C. **Product Data:** Manufacturer's catalog sheets on geotextile fabrics.

PART 2 -- PRODUCTS

2.1 FABRIC

A. Fabric may be woven or non-woven, made from polypropylene, polyethylene, or polyamide, and shall contain sufficient UV inhibitors so that it will last for 2 years in outdoor exposure.

B. Fabric shall have the following properties:

Parameter	Standard Method	Value
Grab tensile strength	ASTM D 4632	100 lbs
Burst strength	ASTM D 3786	200 psi
Apparent opening size	ASTM D 4751	Between 200 and 70 sieve size

C. Fabric Manufacturer, or equal

1. Mirafi

2.2 POSTS

A. Posts shall be wood, at least 2 inches by 2 inches, at least 6 feet long.

2.3 FENCING

A. Woven wire fabric fencing shall be galvanized, mesh spacing of 6 inches, maximum 14-gauge, at least 30 inches tall.

2.4 FASTENERS

A. Fasteners to wood posts shall be steel, at least 1 1/2 inches long.

PART 3 -- EXECUTION

3.1 PREPARATION

A. Provide erosion control barriers at the indicated locations and as required to prevent erosion and silt loss from the Site.

B. CONTRACTOR shall not commence clearing, grubbing, earthwork, or other activities which may cause erosion until barriers are in place.

3.2 INSTALLATION

A. Barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire fencing to the posts that are spaced a maximum of 6 feet apart and embedded a minimum of 12 inches. Install posts at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. Lay fabric along the edges of the trench. Backfill and compact.

D. Securely fasten the fabric materials to the woven wire fencing with tie wires.

E. Reinforced fabric barrier shall have a height of 18 inches.

F. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

3.3 MAINTENANCE

A. Regularly inspect and repair or replace damaged components of the barrier. Unless otherwise directed, maintain the erosion control system until final acceptance; then remove erosion and sediment control systems promptly.

B. Remove sediment deposits when silt reaches a depth of 6 inches or 1/2 the height of the barrier, whichever is less. Dispose of sediments on the Site, if a location is indicated on the Drawings, or at a Site arranged by the CONTRACTOR which is not in or adjacent to a stream or floodplain.

- END OF SECTION -

SECTION 32 31 13 – CHAIN LINK FENCING

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide chain link fencing and gates and appurtenant WORK, complete and operable, in accordance with the Contract Documents.

B. Single Manufacturer: Chain link fencing, gates, accessories, fittings, and fastenings shall be products of a single manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. General: Furnish submittals in accordance with **Section 01 33 00** - Contractor Submittals.

B. Shop Drawings

1. Manufacturer's technical data, product specifications, standard details, certified product test results, installation instructions and general recommendations.

2. Scale layout of fencing, gates, and accessories. Drawings shall show fence height, post layout, including sizes and sections; post setting and bracing configuration, details of gates and corner construction; and other accessories which may be necessary.

C. Samples: Samples of proposed fence components, at least 12-inches long, to illustrate the selected color and finish.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Dimensions indicated herein for roll-formed pipe and H-sections are outside dimensions, excluding coatings.

B. Fence fabric height shall be 6-feet unless otherwise indicated.

C. Fencing materials shall be hot-dip galvanized after fabrication.

D. PVC coatings, if indicated, shall be the color indicated; selected by the ENGINEER/GEOLOGIST from the manufacturer's standard colors. PVC coatings shall be made from virgin PVC resin with plasticizer, stabilizers, and ultraviolet inhibitor. Coatings shall have a tensile strength of 2500 psi, maximum elongation of 200 percent, and a shore durometer hardness of 40 to 46.

2.2 STEEL FABRIC

A. Fence fabric shall be No. 9 gauge steel wire, 2-inch mesh, with top selvages knuckled and bottom selvages twisted and barbed.

2.3 FRAMING AND ACCESSORIES

A. Steel Framework, General: Unless otherwise indicated, framework components shall be fabricated of galvanized steel conforming to ASTM A 53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless, or ASTM A 123 - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products, with not less than 1.8 ounces zinc per square feet of coated surface.

1. Fittings and accessories shall be galvanized in accordance with ASTM A 153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware, with zinc weights per Table I of that standard, except that no coating shall be less than 1.8-ounce zinc per square foot of coated surface.

B. End, Corner and Pull Posts: Posts shall be one-piece without circumferential welds, 3-inch schedule 40 pipe, 5.79 pounds per linear foot.

C. Line Posts: Line posts shall be spaced no more than 10-feet on center and shall be 2-1/4 inch “H” column section, 4.1-pounds per linear foot, or schedule 40, 2-1/2 inch pipe, 3.65-pounds per linear foot.

D. Gate Posts: Gate posts shall be 4-inch schedule 40 pipe, 9.1-pounds per linear foot.

E. Top Rail: Top railing shall be provided in manufacturer’s longest lengths, with expansion type couplings, approximately 6-inches long, for each joint. Fence design shall provide positive, secure attachment of top rail to each gate post, corner post, pull post and end post. Top rail and braces shall be 1-5/8 inch schedule 40 pipe, 2.27-pounds per linear foot, or 1-1/2 inch “H” column section, 2.00-pounds per linear foot.

F. Tension Wire: Tension wire shall be located at the bottom of the fabric and shall consist of No. 7 gauge coated coil spring wire of metal and finish to match fabric. Tension wire shall be interlaced with the fabric or attached to the fabric along the extreme bottom of the fence. Tension wire attachment shall be with fabric tie wires at a spacing of no more than 24-inches apart.

G. Fabric Tie Wires: Fabric tie wires shall be No. 9 gauge galvanized steel wire of the same finish as the fabric. Aluminum ties shall not be used. Ties shall be spaced 14-inches apart on posts and 24-inches apart on rails.

H. Post Brace Assembly: Post brace assembly shall be manufacturer’s standard adjustable brace assembly provided at each end post, gate post and at both sides of each corner post and intermediate brace post. Material used for brace shall be same as top rail. Truss bracing between line posts shall be achieved with 0.375-inch diameter rod and adjustable tensioner.

I. Post Tops: Post tops shall be weather-tight closure caps, designed for containment of top rail and positive permanent attachment to post. One cap shall be provided for each post.

J. Stretcher Bars: Stretcher bars shall be one-piece lengths equal to the full height of the fabric, with minimum cross-section of 3/16-inch by 3-1/2 inch. One stretcher bar shall be provided for each gate and end post, and 2 for each corner and intermediate brace post.

K. Stretcher Bar Bands: Stretcher bar bands shall be one-piece fabrications designed to secure stretcher bars to end, corner, intermediate brace, and gate posts. Bands shall have a minimum cross-section of 1/8-inch by 3/4-inch. Stretcher bar bands shall be spaced no more than 15-inches on center.

L. Barbed Wire Supporting Arms: Supporting arms shall be manufacturer's standard fabrication, of metal and finish to match fence framework, with provision for anchorage to each post and attachment of three rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap. Supporting arm shall be single 45-degree arm type and shall be capable of withstanding 250 pounds of downward pull at outermost end.

M. Barbed Wire: Barbed wire shall be 2-strand, No. 12-1/2 gauge zinc-coated steel or iron wire with four-point, 14-gauge barbs spaced no more than 5-inches apart.

2.4 GATES

A. Fabrication: Perimeter frames of gates shall be fabricated from same metal and finish as fence framework. Gate frames shall be assembled by welding or with fittings and rivets for rigid, secure connections. Welds shall be ground smooth. Gate frames and any ungalvanized hardware, shall be hot-dip galvanized after fabrication. Horizontal and vertical members shall be provided to ensure proper gate operation and attachment of fabric, hardware and shall be hot-dip galvanized after fabrication.

1. Fabric for gates shall match fence fabric, unless otherwise indicated. Fabric shall be installed with stretcher bars at all perimeter edges. Stretcher bars shall be attached to gate frame with stretcher bar bands spaced no more than 15-inches on center.

2. Each gate shall be diagonally cross-braced with a 3/8-inch diameter adjustable length truss rod to ensure frame rigidity without sag or twist.

3. Where barbed wire is indicated above gates, vertical members shall be extended and fabricated as required to receive barbed wire supporting arms.

B. Swing Gates: Perimeter frames of swing gates shall be constructed of the same pipe or "H" column members as the top rails and shall be fabricated by welding. Welds shall be ground smooth prior to hot-dip galvanizing.

1. Hardware and accessories shall be provided for each gate, galvanized in conformance with ASTM A 153, and in accordance with the following:

a. Hinges: Hinges shall be of size and material to suit gate size, non-lift-off type, offset to permit 180-degree gate opening.

b. Latch: Latch shall be forked type or plunger-bar type, permitting operation from either side of the gate, with padlock eye as an integral part of the latch.

2.5 RELATED ITEMS

A. Concrete: Concrete shall be provided according to **Section 03 31 00** - Cast-In-Place Concrete.

B. Nuts, bolts and screws shall be steel, minimum size 3/8-inch diameter, hot-dip galvanized after fabrication.

2.6 MANUFACTURERS

A. Manufacturer's Qualifications: Chain link fencing and gates shall be products of a single manufacturer which has been successfully engaged in the production of such items for a period of at least 5 years.

B. Installer's Qualifications: Installation of the chain link fence shall be by the manufacturer or by a firm accepted and licensed by the manufacturer.

C. Manufacturers, or equal

1. **American Fence Corp.**

2. **Anchor Fence, Inc.**

3. **United States Steel**

PART 3 -- EXECUTION

3.1 INSPECTION

A. Prior to commencing installation, require Installer to inspect all areas and conditions within which WORK of this Section will be performed. Dimensions and clearances shall be verified. Final grading shall be completed and all earth, brush, or other obstructions which interfere with the proper alignment and construction of fencing shall be removed.

3.2 INSTALLATION

A. General: Unless otherwise indicated, all posts shall be set in concrete. Gate and related posts, corner posts, and other critical elements shall be provided with concrete foundations which are designed by an ENGINEER/GEOLOGIST to safely accommodate the loads to which they will be subjected.

B. Excavation: Holes for posts shall be drilled or hand excavated to the diameters and spacings indicated, in firm, undisturbed or compacted soil. Post foundations which are not designed by an ENGINEER/GEOLOGIST shall comply with the following:

1. Holes shall be excavated to a diameter not less than 12-inches or not less than 5 times the largest dimension of the item being anchored, whichever is larger.

2. Depth for holes shall be not less than 40-inches; excavated approximately 4-inches lower than the post bottom, with bottom of posts set not less than 36-inches below finish grade surface.

C. Setting Posts: Line posts shall be spaced at not more than 10-foot intervals, measured from center to center of the posts, parallel to the ground slope. Posts shall be set plumb and shall be centered in holes, 4-inches above the bottom of the excavation, with posts extending not less than 36-inches below finish grade surface.

1. Corner posts shall be installed where changes in the fence lines equal or exceed 15 degrees, measured horizontally.

2. Each post shall be properly aligned vertically and its top aligned parallel to the ground slope. Posts shall be maintained in proper position during placement and finishing operations.

D. Concrete

1. Concrete for footings may be placed without forms, providing the ground is firm enough to permit excavation to neat line dimensions. Prior to placing concrete, the earth around the hole shall be thoroughly moistened.

2. Encasement concrete for footings shall be placed immediately after mixing in a manner such that there will be no concentration of the large aggregates. The concrete shall be consolidated by tamping or vibrating.

3. Concrete footings shall have a neat appearance and shall be extended 2-inches above grade and troweled to a crown to shed water.

4. A minimum of 7 days shall elapse after placing the concrete footings before the fence fabric or barbed wire is fastened to the posts.

E. Bracing: Bracing shall be provided at all ends, corners, gates, and intermediate brace posts. Corner posts and intermediate brace posts shall be braced in both directions. Horizontal brace rails shall be set midway between the top rail and the ground, running from the corner, end, intermediate brace or gate post to the first line post. Diagonal tension members shall connect tautly between posts below horizontal braces.

1. Braces shall be so installed that posts remain plumb when diagonal rod is under proper tension.

F. Intermediate Brace Posts: Where straight runs of fencing exceed 500-feet, intermediate brace posts shall be installed, spaced equally between ends or corners; with additional posts provided as required, such that the spacing between intermediate brace posts does not exceed 500-feet. Intermediate brace posts shall be equivalent in size to corner posts and shall be braced with horizontal brace rails and diagonal tension members in both directions.

G. Top Rails: Top rails shall be run continuously through post caps, bending to radius for curved runs. Expansion couplings shall be provided as recommended by the fencing manufacturer.

H. Center Rails: Center rails shall be provided where indicated. Rails shall be installed in one piece, between posts and flush with posts on fabric side, using special offset fittings where necessary.

I. Tension Wire: Continuous bottom tension wire shall be stretched tight with turnbuckles at end, gate, intermediate, and corner posts. Tension wire shall be installed on a straight grade between posts, with approximately 2-inches of space between finish grade and bottom selvage, unless otherwise indicated. Tension wire shall be tied to each post with not less than 6 gauge galvanized wire.

J. Fabric

1. Chain-link fabric shall be fastened on the secured side of the posts.

2. Fabric shall be stretched and securely fastened to posts. Between posts, top and bottom edges of the fabric shall be fastened to the top rail and bottom tension wire, respectively.

3. Fabric shall be stretched and anchored in such a manner that it remains in tension after the pulling force is released.

K. Tie Wires: Tie wire shall be bent to conform to the diameter of the pipe to which it is attached, clasping pipe and fabric firmly with ends twisted at least two full turns. Ends of wire shall be bent back to minimize hazard to persons or clothing.

1. Fabric shall be tied to line posts with tie wires spaced at 12-inches on center.

2. Fabric shall be tied to rails and braces with tie wires spaced at 24-inches on center.

3. Fabric shall be tied to tension wires, with hog rings spaced 24-inches on center.

L. Stretcher Bars: Fabric shall be fastened to end, corner, intermediate brace, and gate posts with stretcher bars. Bars shall be threaded through or clamped to fabric at 4-inches on center and secured to posts with stretcher bar bands spaced no more than 14-inches on center.

M. Fasteners: Nuts for tension bands and hardware bolts shall be installed on the side of fence opposite the fabric side. Ends of bolts shall be peened or the threads scored to prevent removal of nuts.

N. Galvanized coating damaged during construction of the fencing shall be repaired by application of Galvo-Weld; Galvinox; or equal.

O. Damage to PVC coating shall be repaired with material equivalent in color and thickness to the original coating.

END OF SECTION

SECTION 33 22 10 – WELL DRILLING

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. This section covers the Work, material, and equipment necessary for drilling the well bore, complete.

B. The following information and requirements, though not all-inclusive, are provided to assist the CONTRACTOR in the evaluation of the work required to meet the project objectives. The procedure for selecting rotary drill rig and equipment shall be in accordance with API Bulletin D-10.

C. Specific tasks not completely described in this Section that are necessary or normally required as part of the work described, or that are necessary or required to make the installation satisfactorily or legally operable, shall be performed by the CONTRACTOR as incidental work without extra cost. The expense of such work shall be included in the applicable unit or lump sum prices for the work described

D. The CONTRACTOR shall perform a due diligence investigation to determine anticipated subsurface conditions and consider this information in regards to on site drilling and testing operations and construction activities. This information shall also be factored into the submitted unit costs, as necessary. Submitted unit costs shall be balanced and reflect all costs incurred plus profit to provide the specific service(s) and/or material. Claims for unit cost increase and/or damages related to differing subsurface conditions will not be considered.

E. Wells shall be drilled into aquifers containing saline water under pressure. The shallow aquifer contains potable water at the well site; it is required that the saltier water from the deep aquifers be handled so that there will be no spills upon the ground. Requirements will be set forth in these specifications regarding the handling of salty water, drilling fluids, and cuttings. Requirements also are set forth for controlling the flow of the well during construction and providing a closed, steel lined circulation system for all drilling operations. Drilling pads will be required and shall be constructed to retain spillage of water from drilling and related operations. Precautions should be taken to prevent spills; any spillage of fluids shall be returned to the closed circulation systems.

F. At the completion of drilling, the CONTRACTOR shall remove the closed circulation system and its appurtenances which are not part of each completed well and leave each site in good condition acceptable to the ENGINEER/GEOLOGIST.

G. Information regarding subsurface conditions is intended to assist the CONTRACTOR in establishing a price for the Work. The OWNER does not guarantee its accuracy or that it is necessarily indicative of conditions to be encountered in drilling the well. The CONTRACTOR shall satisfy himself regarding all local conditions affecting his work by personal investigation and neither the information on local geology, nor that derived from maps or plans nor from the OWNER or his agents or employees shall act to relieve the CONTRACTOR of any responsibility hereunder or from fulfilling any and all of the terms and requirements of the Contract Documents.

H. All work shall be performed by a certified water well contractor, licensed by the State of Florida. CONTRACTOR shall construct the well in strict conformance with all laws, rules, regulations, and standards related to the construction of wells in the State of Florida, SWFWMD, and Polk County.

I. The CONTRACTOR shall furnish sound proofing barriers, provide mufflers on equipment, and take whatever other steps necessary during drilling, pumping, testing, and all other Work incidental thereto to ensure that noise levels conform to any applicable noise ordinances.

J. The CONTRACTOR shall take necessary measures to limit access to drilling sites to minimize hazards to the public.

1.2 REMEDIAL WORK

A. If remedial work proves to be necessary to make a well acceptable and come within the governing regulations and/or Contract Documents because of an accident, loss of tools, defective material or for any other cause, the CONTRACTOR shall propose a method of correcting the problem, in writing. Suggested methods shall be reviewed and accepted by the ENGINEER/GEOLOGIST before work proceeds. Such work shall be performed at no additional cost to the OWNER and it shall not extend the length of the Contract. The CONTRACTOR is notified that all requirements of the Contract Documents shall be met, including borehole straightness and setting of casings to the points designated by the ENGINEER/GEOLOGIST.

1.3 GUARANTEE

A. The CONTRACTOR guarantees that the work and service to be performed under the Contract and all workmanship, materials, and equipment performed, furnished, used, or installed in the work shall be free from defects and flaws, and shall be performed and furnished in strict accordance with the Contract Documents; that the strength of all parts of all manufactured equipment shall be adequate and as specified; and that performance test requirements of the Contract Documents shall be fulfilled. The CONTRACTOR shall repair, correct, or replace all damage to the work resulting from failures covered by the guarantee. The guarantee shall remain in effect for one year from the date of final acceptance by the OWNER.

1.4 CALIBRATION DATA

A. Calibration Data: Calibration records for each measuring instrument used in the construction of the well shall be submitted to the ENGINEER/GEOLOGIST for review prior to the installation or use of the instruments. Calibration of instruments shall have been performed within 60 days prior to use in testing. The calibration records shall contain the following information:

1. Inclination Tools: Each down-hole instrument used in testing the well during construction shall demonstrate calibration acceptable to the ENGINEER/GEOLOGIST before use. Where possible, this calibration record shall be included on the output of the test or on the log.

PART 2 – PRODUCTS

2.1 GENERAL

A. All equipment shall be in good working condition before drilling operations commence. Operate and maintain all equipment in conformance with manufacturer's specification. The CONTRACTOR shall submit information regarding the equipment and materials planned for use in this project before mobilization.

B. The CONTRACTOR selected shall furnish the materials, equipment, and labor to drill the Surficial Aquifer Monitor Well, Upper Floridan Aquifer Monitor Well, Lower Floridan Aquifer Dual Zone Monitor Well using both standard closed-circulation mud rotary and open-circulation reverse air drilling methods. Actual casing depths of the wells shall be determined by the ENGINEER/GEOLOGIST after pilot-hole drilling, geophysical logging operations, and aquifer testing. Total depths shall be based on drilling, geophysical logging, and hydraulic test results as determined by the ENGINEER/GEOLOGIST.

2.2 DRILLING EQUIPMENT

A. Provide a commercially available rotary type drilling rig with required hook-load capacity and equipment capable of performing closed-circulation mud rotary and open-circulation reverse air drilling operations in accordance with API Bulletin D-10.

B. The CONTRACTOR shall certify that the present hook load/weight capacity of the derrick and draw works meets the original manufacture's specifications or at a minimum 1.5 times the heaviest load anticipated to complete the work. The CONTRACTOR shall submit test results that are certified by a State of Florida licensed Professional Engineer regarding the equipment planned for use in this project before mobilization in accordance API Specification 7K.

C. The CONTRACTOR shall furnish, install and operate a steel rotating control header as manufactured by Washington Rotating Control Heads Inc., or equivalent or blow out preventer (BOP) of suitable size on the wells to control drilling and/or formation fluids during drilling and testing conducted within the Floridan aquifer. The CONTRACTOR shall demonstrate proficiency using the flow control equipment to the satisfaction of the ENGINEER/GEOLOGIST.

D. Provide, secure storage facility, and all tools, drilling bits, and all other necessary equipment to conduct drilling operations.

E. In order to ensure the drilling of the wells to alignment specifications, the CONTRACTOR shall furnish and employ a self-checking mechanical drift indicator to measure borehole deflection. The mechanical indicator shall be an M/D Totco Controlled Vertical Drift Indicator (CVD) available from National Oil Well Varco, or equivalent. A 3-degree unit shall be used with the indicator and the survey record shall be capable of being read to the nearest 0.1 degree.

2.3 DRILLING FLUID

A. The CONTRACTOR shall provide high-yield, fine-grained sodium bentonite (manufactured by Baroid Industrial Drilling Products or equivalent) during mud rotary drilling operations meeting API Spec 13A. The CONTRACTOR shall provide all drilling fluid additives and lost circulation material, as required. Review drilling fluids and potential additives, itemize all products, and include the appropriate material safety data sheet (MSDS) to be used during the course of drilling operations. The CONTRACTOR shall submit these items to the ENGINEER/GEOLOGIST before drilling operations commence.

B. Provide an adequate potable water supply for mixing operations. Supply to the ENGINEER/GEOLOGIST in writing documentation identifying the proposed source of water prior to the start of construction, which shall conform to local Department of Health requirements.

C. CONTRACTOR shall use only drilling fluids and additives specifically recommended by the manufacturer for use in water well drilling. Avoid contamination of the samples or the aquifer. Do not introduce muds, clays, or drilling aids into the well or use lime, cement, organic matter, or other material to stop circulation losses of the drilling fluid, without reviewing the proposed program with the ENGINEER/GEOLOGIST.

D. Off Site discharge of fluids during the well construction and testing shall be controlled by CONTRACTOR at all times. Drilling mud and cuttings generated during mud rotary drilling shall be retained within steel mud tubs. Unlined or plastic lined pits will not be allowed. Fluids from reverse air circulation drilling and testing shall be conveyed to the fractionation tank(s) to be mixed with source water from the LW UFA MW-1 and conveyed to fractionation tank(s) for settling and recirculated into the well in accordance with **Section 33 22 20 Formation Water Control and Discharge System.**

E. Water will require mixing with LW UFA MW-1 source water to lower TDS concentrations. ENGINEER/GEOLOGIST must approve methods of mixing prior to commencing drilling, packer testing, development, and step testing, APT. CONTRACTOR is responsible for meeting TDS requirements at discharge point into fractionation tank(s) for settling in accordance with **Section 33 22 20, Formation Water Control and Discharge System.** No discharges into surface water are allowed without the ENGINEER/GEOLOGIST's approval. No discharges into surface water or ground are allowed without the ENGINEER/GEOLOGIST's approval.

F. Water will require settling to reduce turbidity prior to disposal. ENGINEER/GEOLOGIST must approve methods of settling excess turbidity prior to commencing each pumping test. CONTRACTOR is responsible for meeting turbidity requirements prior to conveyance to from the settling fractionation tank(s) into Tractor Lake in accordance with **Section 33 22 20, Formation Water Control and Discharge System.** No discharges to surface water bodies are allowed without the ENGINEER/GEOLOGIST's approval.

2.4 TESTING AND SAMPLING EQUIPMENT

A. The CONTRACTOR shall provide equipment to manually measure drilling fluid properties including a Marsh Funnel and a fluid density balance.

B. The CONTRACTOR shall provide 3x5-inch cloth sample bags as manufactured by Forester Supplies or equivalent. Duplicate samples will be collected from each well. ENGINEER/GEOLOGIST will provide one set for delivery to the DISTRICT.

C. The CONTRACTOR shall provide water sampling containers as acceptable to the ENGINEER/GEOLOGIST.

D. The CONTRACTOR shall provide all equipment required for all testing activities.

E. The CONTRACTOR shall provide all temporary transducers required for all drilling and testing activities. All temporary transducers shall be properly maintained, calibrated, and stored when not in use. All transducers shall be in proper work order at all times. All transducers in completed wells during construction shall be recording at agreed upon intervals with ENGINEER/GEOLOGIST throughout construction with equally agreed upon data downloads with ENGINEER/GEOLOGIST to prevent data loss. During testing all transducers will be programmed, recording throughout testing, and data will be downloaded at agreed upon times with ENGINEER/GEOLOGIST.

PART 3- EXECUTION

3.1 GENERAL:

A. Drilling equipment shall be inspected, maintained and repaired in accordance with API Recommended Practice (RP-7L).

B. The CONTRACTOR shall be required to provide direct and reliable telephone service with the on Site-drilling superintendent at all times during drilling, construction, and testing operations. Daily progress reports shall be written and communicated from the drilling superintendent to the ENGINEER/GEOLOGIST. Cellular phone communication is the required method. The CONTRACTOR shall also provide a telephone list of individuals directly involved in the daily progression of work.

C. The CONTRACTOR shall be responsible for measuring (using industry standards) drilling parameters and drilling fluid properties during the progression of work. These parameters shall include; weight on bit (WOB), drill string weight, rate of penetration (ROP), mud density (mud in – mud out), drilling depth, mud flow rates (flow in – flow out), mud resistivity, and mud pump pressure. Equipment shall be calibrated and certified by the manufacturer or appropriate testing facility before the start of drilling, and shall be operational throughout drilling. Improper operation or lack of measured and recorded data is sufficient cause to suspend drilling, at ENGINEER/GEOLOGIST'S discretion.

3.2 DRILLING

A. The ENGINEER/GEOLOGIST shall be given at least 5 days (weekends and holidays excluded) notice with a schedule of activities prior to mobilization. All drilling activities shall be performed on a 12-hour basis (7am to 7pm) Monday through Friday or as approved by the ENGINEER/GEOLOGIST. The CONTRACTOR shall provide adequate lighting during night time work activities. Lighting levels shall comply with applicable federal and state regulations.

B. The well is to be of the type and characteristics described in **Section 01 10 00, Summary of Work.** The exact depth of well and length of casings are to be determined in the field in accordance with information obtained from the pilot hole drilling operations. Casing seats shall be determine in the field by ENGINEER/GEOLOGIST.

C. The well shall be drilled by the rotary method using mud circulation through the unconsolidated and soft formations to a depth of approximately 275 feet bls or when the UFA is encountered, with the exception of the Surficial Aquifer Monitor Well. Closed circulation reverse-air shall be used below the depth of approximately 275 feet bls or from the top of the UFA to total depth of the well. Drilling mud shall be completely removed from the borehole and casing prior to beginning reverse-air drilling.

D. Drill a maximum 12.25-inch diameter pilot hole in stages in accordance with detailed construction sequence provided in **Section 01 10 00, Summary of Work,** and as determined by the ENGINEER/GEOLOGIST. Prepare the borehole for geophysical logging. Borehole preparation shall include, but not be limited to:

1. Continuation of circulation until drill cuttings have been removed from the borehole, and

2. Circulation of the drilling mud in the borehole until it is uniform and the drill pipe has been removed from the borehole. The CONTRACTOR shall make all reasonable efforts to leave the borehole free from obstructions in preparation for geophysical logging.

E. Drill the boreholes of the dimensions and at the location shown on the well construction drawing.

F. The boreholes shall be drilled (straight and plumb) to permit the installation of the casing to the tolerances specified in this Section under 3.3 and **Section 33 22 11, Well Casing**.

G. Use only drilling fluids and additives specifically recommended by the manufacturer for use in water well drilling. Avoid contamination of the samples and the aquifer. Do not introduce muds, clays, or drilling aids into the well or use lime, cement, organic matter, or other material to stop drilling fluid loss, without reviewing the proposed program with the ENGINEER/GEOLOGIST. Additives to reduce drilling fluid loss may require approval by the FDEP and/or TAC. No standby time shall be charged by the CONTRACTOR during review and approval of CONTRACTOR's plan for use of special drilling fluid additives to control fluid loss.

H. CONTRACTOR shall prevent cuttings from entering the well during closed circulation reverse-air drilling. Linear shakers, hydrocyclones, settling tanks, etc., shall be used as needed, based on conditions encountered.

I. It is the intent of this Contract that no drilling fluids or groundwater produced during construction escape the confines of the drilling pad, fractionation(s), or conveyance/piping system.

J. Periodically, but at least daily during reverse-air drilling, the CONTRACTOR shall measure the static water level in the borehole. CONTRACTOR shall measure the static water level in all wells daily, prior to and after work is complete, and any other time when safely

possible; including prior to and after testing and development. Water level and the time measurement was taken shall be recorded on the daily drilling report for all wells.

3.3 ALIGNMENT REQUIREMENTS

A. Pilot and reamed boreholes shall be drilled round, straight, and plumb throughout so casings are installed without sticking or binding.

B. A mechanical drift indicator shall be run in the pilot hole and reamed boreholes at intervals no greater than 60 feet. The tool shall be centralized in the drill pipe during the survey.

C. The drift from vertical shall not be more than 0.5 of one degree between any two consecutive surveys, and not more than one degree over the entire well length. The CONTRACTOR at his own expense shall correct borehole deviation in plumbness. Drift indicator data (e.g., sure shot discs) and plots shall be maintained by the CONTRACTOR for the duration of this project and shall be supplied to the ENGINEER/GEOLOGIST as part of the driller's daily logs. The ENGINEER/GEOLOGIST may inspect the tool, and require that it be disassembled, recalibrated, or tested at any time during the project, with or without cause. Any deviation from plumbness greater than 0.5 of one degree shall be corrected by the CONTRACTOR at his sole expense.

D. The ENGINEER/GEOLOGIST may modify the requirements for plumbness and straightness if, in his judgment:

1. Deviations are due to subsurface conditions and the CONTRACTOR has exercised all possible care to avoid deviations,

2. The deviations will not materially affect the usefulness or performance of the well or further drilling operations, including setting of casings and future testing.

3.4 COMPLIANCE WITH GOVERNMENTAL REGULATIONS

A. The CONTRACTOR shall fully inform themselves of all local ordinances, state and federal laws and regulations, and interpretations of these laws, ordinances and regulations by a governmental body or agency, including but not limited to, the Florida Department of Environmental Protection (FDEP), the Technical Advisory Committee of FDEP, the United States Environmental Protection Agency (USEPA), the SWFWMD, City of Lake Wales and applicable County regulations, which in any manner affect the work specified herein.

B. The CONTRACTOR shall at all times comply with said ordinances, laws and regulations, and protect and indemnify the ENGINEER/GEOLOGIST and their officers and agents against any claim or liability arising from or based on the violation of such laws, ordinances, or regulations. All permits, licenses, and inspection fees necessary for protection and completion of the work shall be secured and paid for by the CONTRACTOR unless otherwise specified.

C. The CONTRACTOR shall acquire all SWFWMD, National Pollutant Discharge Elimination System (NPDES), generic surface water discharge permits, and permissions necessary to enter onto the site and perform the work. The CONTRACTOR shall obtain any other local,

state, or federal drilling permits or occupational licenses and provide notifications to local municipalities prior to the start of well construction activities.

D. The CONTRACTOR shall also conform to any local or county ordinances pertaining to noise levels and working hours, etc. to avoid any unnecessary delays. It is not anticipated, but should a delay in the project occur due to permit acquisition, the CONTRACTOR will not receive additional compensation.

3.5 FORMATION SAMPLES AND TESTING

A. Formation samples shall be collected at 10-foot intervals during pilot hole drilling of the LW SA MW-1, LW UFA MW-1, and the LW LFA DZMW-1 and at changes of formations. The CONTRACTOR shall collect representative cuttings samples in order to provide an indication and classification of geological formations penetrated.

B. The CONTRACTOR shall take two large representative samples of the cuttings from the interval or new formation, and shall label and preserve each sample in a sturdy container. All sample containers shall be labeled to indicate well number, date, time, and the exact depth from which the sample was taken. Samples shall be stored in a manner to prevent damage or loss. Two (2) sets of geologic samples should be collected by the CONTRACTOR and stored in cloth sample bags as directed by the ENGINEER/GEOLOGIST.

1. The CONTRACTOR will be responsible for sending, at the direction of the ENGINEER/GEOLOGIST, one complete labeled set of geologic cuttings to DISTRICT.
2. The second complete set of geologic cuttings will be delivered to Stantec, 777 S Harbour Island Blvd, Suite 600, Tampa, FL 33602.

C. Drill cuttings and drilling fluid from mud rotary drilling shall be removed from the drilling site by the CONTRACTOR by hauling to a FDEP approved disposal site. Fluids from reverse air circulation drilling and testing will be conveyed to settling in accordance to **Section 33 22 20.** Drill cuttings from reverse air techniques shall be removed from the drilling site by the CONTRACTOR by hauling to a FDEP approved disposal Site. The fluid displaced from the borehole during cementing operations shall be considered excess drilling fluid and shall be disposed of in the accepted manner. It shall be the CONTRACTOR's responsibility to obtain FDEP approval for the proposed disposal site, and submit a notice of FDEP approval to the ENGINEER/GEOLOGIST prior to commencing work.

D. The CONTRACTOR shall provide the ENGINEER/GEOLOGIST safe and unobstructed access to collect the formation samples at his discretion, in addition to the formation samples collected by the CONTRACTOR. The ENGINEER/GEOLOGIST representative reserves the right to evaluate the safety of the sample collection site and shall have the authority to stop drilling operations until the safety concerns are addressed and met.

3.6 CORES

A. CONTRACTOR shall provide all materials and equipment necessary for drilling and collection of rock core samples.

B. CONTRACTOR shall provide adequate workman and materials on site to complete the removal of core from the core barrel, delivery of the core sample to the CONSULTANT, and subsequent placement of the core sample into the core box for sample description by the CONSULTANT.

C. CONTRACTOR shall supply sturdy wooden boxes for the storage of cores. Cores shall be stored in boxes of proper size for the diameter of core collected.

D. The core barrel and bit shall be of appropriate size to recover (approximately 4-inch diameter) cores. The length of the core barrel shall not exceed 10 ft.

E. CONTRACTOR shall obtain up to seven (7) reasonable undisturbed and intact rock cores between ±485 feet to ±3,200 feet bls while pilot hole drilling. No payment will be made for less than fifty percent recovery. This percentage will apply to each 100 feet of hole.

F. Each core box shall be clearly labeled with the top and bottom depth intervals and recovery estimates calculated. Core boxes will be protected from the elements as to prevent deterioration of samples. CONTRACTOR will be responsible for ensuring protective covering is maintained acceptable to the CONSULTANT.

G. CONTRACTOR shall be responsible for loading core boxes into DISTRICT vehicle for transport.

3.7 WATER SAMPLES AND TESTING

A. While drilling with the reverse air circulation drilling method, the CONTRACTOR shall collect water quality samples every 30 feet (average length of drill rod) or as directed by the ENGINEER/GEOLOGIST. A reasonable amount of time (approximately 5 to 10 minutes) shall be given to the ENGINEER/GEOLOGIST to measure certain water quality parameters from the reverse air samples. The CONTRACTOR shall accommodate the ENGINEER/GEOLOGIST in retrieving representative samples, including but not limited to, moderating drill rates and circulation times as necessary.

B. Sample bottles shall be clearly labeled in an indelible way with the well name, depth, time, and date. It shall be the CONTRACTOR's sole responsibility to collect, protect, and deliver the water samples, properly labeled after collection, to the ENGINEER/GEOLOGIST.

C. Drill stem specific capacity testing will be conducted from the start of reverse air drilling operations to total depth on each well or as specified by the ENGINEER/GEOLOGIST. Static water levels shall be collected from the drilled well every morning. The CONTRACTOR shall run a short (at a minimum of 15 minute duration) specific capacity test at each break in drilling rod or at a minimum of every 30 feet while drilling with reverse air circulation. The planned method for running this test must be approved by the ENGINEER/GEOLOGIST prior to running the first test.

D. The CONTRACTOR shall assist the ENGINEER/GEOLOGIST in obtaining representative water samples prior to completion of each specific capacity test.

E. Native groundwater collected from the packer tests shall be delivered to the Florida Geological Survey in accordance with **Section 33 22 17, Packer Testing.**

F. Collect, store, and analyze (NELAP certified analytical laboratory) groundwater samples from development of all wells, UFA APT and step tests on the UMZ and LMZ of the LW LFA DZMW-1, and pilot hole drilling of the LW LFA DZMW-1 to total depth. Water quality analyses shall include the parameters listed in Supplemental Attachments A, B and C of **Section 33 22 15, Well Development and Sampling.**

3.8 PROTECTION OF WATER QUALITY

A. Take all necessary precautions to prevent brackish water, saltwater, diesel fuel, gasoline, or other deleterious substances from entering the well or surficial aquifer, either through the opening or by seepage through the ground surface. Maintain precautions during and after construction of the well until accepted by the ENGINEER/GEOLOGIST.

B. The drilling will be accomplished using circulation systems designed and constructed so that under no conditions shall there be an overflow. The CONTRACTOR is required to take all necessary steps to prevent accidental spillages from occurring. Aboveground, leak proof, steel, or fiberglass drilling fluid storage tanks shall be used during closed circulation mud rotary drilling operations. Tanks for the circulation system shall be constructed of steel or fiberglass and be leak-proof. The entire drilling and circulation system for each well shall be within the enclosed steel containment drilling pad. Before mobilization, the CONTRACTOR shall submit design drawings of the mud circulation system. The circulation system shall be capable of storing no less than 3,500 cubic feet (~25,000 gallons) of fluid and cuttings.

3.9 DRILLING AND WELL LOGS

A. The CONTRACTOR shall maintain a detailed daily log of his operations during the construction of the dual zone monitor wells. The log shall be on IADC (International Association of Drilling Contractors) Forms or equal as approved by the ENGINEER/GEOLOGIST and shall provide a brief and accurate description of the following: geologic materials and depths encountered, depths of lost circulation zone(s) and methods of regaining circulation, drilling rate, time, depth, description of any unusual occurrences or problems during drilling, diameters and lengths of casing installed, complete record of drilling fluids added, mud weights and viscosities, cementing operations, geophysical logs runs, repair time, static water levels, and any other work performed at the site. The CONTRACTOR shall keep the log up to date with the progress of drilling. The log shall also include tabulation of quantities for each unit price pay item and a description of all approvals made by the ENGINEER/GEOLOGIST. Failure to keep this record up-to-date (maximum 48 hours from occurrence) shall be grounds for the ENGINEER/GEOLOGIST to stop drilling operations.

B. Prepare a final well log which includes borehole diameters, depth of the borehole and casing seats, casing diameter and wall thickness, cemented zones and cement pumping summary, amount of sand removed during development and any/all information pertinent to well construction and testing activities.

C. The CONTRACTOR must submit copies of daily logs to the ENGINEER/GEOLOGIST on a daily basis. Additional copies of the daily logs shall be submitted with each request for partial payment as a condition of payment.

D. File all drilling and well records and reports with the proper agencies required by federal, state, county, and local permits, codes or regulations. Assist ENGINEER/GEOLOGIST, as necessary, with any additional well completion reports required by the regulatory agencies.

3.10 DRILLING FLUID AND SALTWATER DISPOSAL

A. During closed-circulation mud rotary drilling, no discharge of drilling fluid shall be allowed at the drill Site. Spent drilling fluids used during mud rotary drilling operations shall be disposed of by hauling the solid and liquid phases to a predetermined FDEP-approved disposal Site provided by the CONTRACTOR in accordance with **Section 33 22 20, Formation Water Control and Discharge System**.

B. During reverse air drilling, the drilling fluid shall be compressed air and water. Bentonite or other materials shall not be utilized without approval by the ENGINEER/GEOLOGIST. If utilization of these materials is necessary due to lost circulation or other drilling problems that may arise, the CONTRACTOR shall submit the procedure to the ENGINEER/GEOLOGIST for review. Adequate fluid tanks shall be employed by the CONTRACTOR to settle out drill cuttings and to ensure that a minimum of silt and clay is returned to the drill hole.

C. Some drilling mud and barite will be permitted during the drilling in the Upper Floridan aquifer, but no salt will be used in order to preserve the natural water quality in the aquifer as much as possible.

D. All produced water from drilling, testing, and development shall be tested for TDS levels. TDS levels shall be under 500 mg/L based on EPA Secondary Drinking Water Standards. If produced water has TDS levels above 500 mg/L it shall be mixed with UFA source water until TDS concentration is below 500 mg/L at point of discharge to fractionation tank(s) for settling. Mixed and settled water from testing may be recirculated into well. If permitted settled mixed water with TDS levels below 500 mg/L and other parameters, settled waters may be discharged into local Tractor Lake or may be recirculated into original source well if and only if permitted by ENGINEER/GEOLOGIST.

E. No discharge to land surface or of drilling fluid, saltwater, or produced groundwater will be allowed at the drilling Site.

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SECTION 33 22 11 – WELL CASING

PART 1 -- GENERAL

This Section covers the work, materials, and equipment necessary for furnishing and installing steel well casing, fiberglass reinforced plastic (FRP) casing and polyvinyl chloride (PVC) casing, complete.

1.1 THE REQUIREMENT

A. **Commercial Standards:** All work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

B. **State Standards**: SWFWMD and FDEP Rules and Regulations for Water Wells in the Florida Administrative Code (FAC).

C. **Commercial Standards**:

ANSI/ASTM A139	Specification for Electric-Fusion (Arc)-Welded Steel Pipe (sizes 4-inch diameter and over).
ANSI/AWS D1.1	Structural Welding Code – Steel.
ASTM A 53	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
API 5L	Specification for Line Pipe.
ASTMD1784	Specification for Rigid PVC Compounds and Chlorinated PVC Compounds.
ASTM D2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
ASTM D2996	Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D2310	Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM F480	Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40, and SCH 80.
AWWA A100	Standard for Water Wells.
AWWA C206	Field Welding of Steel Water Pipe.
API Spec. 10D	Specification for Bow-Spring Casing Centralizers.

1.2 CONTRACTOR SUBMITTALS

A. **General:** All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00** - Contractor Submittals, and the supplementary requirements specified. Each item listed in below shall be submitted to the ENGINEER/GEOLOGIST with a clear explanation or depiction of why or how the requirements, as listed, will be fulfilled by the products or services provided by the CONTRACTOR. This list is not considered all-inclusive and may be extended by the OWNER, ENGINEER/GEOLOGIST, or CONTRACTOR.

B. **Subcontractor's List:** The CONTRACTOR shall submit a complete list of all proposed subcontractors to be used in the Work. The CONTRACTOR may be required to submit additional information or a resume of qualifications for any of the subcontractors proposed.

A. **Welders**: Prior to the start of Work, the CONTRACTOR shall submit a list of the welders it proposes to use during well construction and the type of welding for which each has been qualified, along with current certification documents for each welder listed.

1. All welders and welding operators shall be qualified at the CONTRACTOR's sole expense by a qualified testing laboratory before performing any welding under this section. Qualification tests shall be in accordance with Section IX, Article III of the ASME Boiler and Pressure Vessel Code. Welders and operators shall be qualified for making groove welds in carbon steel and stainless steel pipe in positions 2G, 5G and 6G for each welding process to be used. Welders qualified for making groove welds in super duplex steel must be utilized for the final wellhead assembly.
2. Qualification tests may be waived if evidence of prior qualification is approved by the ENGINEER/GEOLOGIST. CONTRACTOR shall retest any welders at any time ENGINEER/GEOLOGIST considers the quality of the welder's work substandard. When the ENGINEER/GEOLOGIST requests the retest of a previously qualified welder, the labor costs for the retest will be at the OWNER's expense if the welder successfully passes the test. If the welder fails the retest, all costs shall be at the CONTRACTOR's expense.

C. **Mill Certificates**: Casing mill certificates shall be submitted to the ENGINEER/GEOLOGIST for all casings at least one week prior to the installation of the casing. Heat numbers on casing joints shall be readily visible and legible or the casing will not be accepted by the ENGINEER/GEOLOGIST. Any casing joint not having legible, traceable identification will be rejected.

D. **Fittings**: Provide all fittings; drive shoe and centering guides as specified or as necessary to complete the well.

E. **Operations**: The CONTRACTOR shall submit for the ENGINEER/GEOLOGIST's approval plans for cementing operation and

casing installation at least 72 hours prior to commencing work on those operations. These plans shall include the following information:

- tabulation of casing on site
- the length of each section,
- weight of each joint,
- cumulative string weight,
- order of installation of casing sections, and
- locations of centralizers and casing tabs.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Provide all materials and equipment necessary for joining and installing casing as specified.

B. Steel Casing, FRP and PVC casings shall be as follows for the surficial aquifer monitoring well, Upper Floridan aquifer monitor well, and the exploratory Lower Floridan aquifer well/dual zone monitor well:

Surficial Aquifer Monitor Well

	Casing Diameter (nominal inches)	**Casing Depth (Feet bls)**
PVC Casing	4	0 - 20
0.010-inch Slotted PVC Screen	4	20 - 70

Upper Floridan Aquifer Monitor Well

	Casing Diameter (nominal inches)	**Casing Depth (Feet bls)**
Pit Steel Casing	TBD	TBD
PVC Casing	6	275

Exploratory Lower Floridan Aquifer Well/Dual Zone Monitoring Well

	Casing Diameter (nominal inches)	**Casing Wall**	**Weight (lbs/Foot)**	

	Inside	Outside	Thickness (inches)		Casing Depth (Feet bls)
Permanent					
Pit Steel Casing	TBD	TBD	TBD	TBD	TBD
Surface Steel Casing	33.25	34.00	0.375	135	TBD
Intermediate Steel Casing	23.25	24.00	0.375	95	475
Final Steel Casing	15.25	16.00	0.375	63	1,415
FRP Casing	5.43	5.97	0.27	152	2,090

2.2 STEEL CASING:

A. **Pit Casing**: The CONTRACTOR shall furnish pit casing at the well Site to isolate surficial deposits from the borehole and to prevent collapse of the drilled hole. Costs for furnishing and installation shall be included in the CONTRACTOR's lump sum mobilization costs. The pit casing setting depth shall be installed to such a depth as CONTRACTOR judges necessary to prevent washout or undermining of the drill pad during construction of the wells. The pit casing may be driven, vibrated or grouted into place. If driven or vibrated into place, CONTRACTOR shall exercise care not to disturb existing structures adjacent to the Work area.

Depth and diameter of the pit casing is at the discretion of the CONTRACTOR. The casing shall be factory assembled in not less than 20 foot lengths. The ends of each joint shall be machine beveled perpendicular to the casing axis to ensure straightness of each assembled section. Casing joints shall be welded in accordance with ANSI/AWS D1.1. All casing material shall be new. No used or rusted casing will be accepted.

B. **Surface Casing and Intermediate Casing:** Permanent well casings shall be new black steel pipe having perfect roundness and uniform thickness. Steel casing shall meet the requirements of ASTM A53 Grade B or ASTM A139, Grade B, seamless or electric resistance welded, for black steel casing. Steel casing shall be factory assembled in not less than 20-foot lengths. The ends of each joint shall be machine beveled to ensure straightness of each assembled section. Casing joints shall be welded in accordance with ANSI/AWS D1.1. All casing material shall be new. No used or rusted casing will be accepted. The LW LFA DZMW-1 34-inch diameter surface steel casing setting depth shall be installed to such a depth as CONTRACTOR judges necessary to prevent washout or undermining of the drill pad during construction of the wells.

C. **Final Casing**: The upper-most section of the Exploratory Lower Floridan Aquifer Well/Dual Zone Monitoring Well shall be new, unused 316L stainless steel. Steel casing shall meet the ASTM A 53 Grade B. Steel casing shall be factory assembled in not less than 20-foot lengths. The ends of each joint shall be machine beveled to ensure straightness of each assembled section. Casing

joints shall be welded in accordance with ANSI/AWS D1.1. All casing material shall be new. No used or rusted casing will be accepted.

2.3. FIBERGLASS REINFORCED PLASTIC (FRP) CASING:

A. Fiberglass reinforced plastic casing shall be as follows:

Nominal Size (in)	Nominal OD (in)	Nominal ID (in)	Nominal Wall Thickness (in)	Max. Box Diameter (in)	Nominal Weight (lb/ft)	Min. Rated Tensile Load (psi)	Min. rated Internal Pressure (psi)	Collapse Pressure Resistance (psi)
6.625	5.97	5.43	0.27	8.51	152	30,000	1,250	590

C. **FRP Tubing:** The upper-portion (from land surface to no more than 10 feet bls) of the FRP tubing shall be new, unused 316L stainless steel. The pipe shall have long threaded and coupled connections that are precision-lathe cut, and factory milled and pressure tested to 1,570 psi for a minimum of 5 seconds prior to shipping. The fiberglass reinforced plastic tubing shall be connected with top stainless steel tubing using a 316L stainless steel AP18 threaded connection (316L steel transition pipe). The FRP shall be suitable for down-hole applications composed of corrosion resistant epoxy resin and premium fiberglass (manufactured by Future Pipe Industries or an equivalent) approved by the ENGINEER/GEOLOGIST. The lower monitor zone casing located between the upper and lower monitor zone and from the top of the upper monitor zone to surface as well as the upper monitor zone casing shall be manufactured with a rough coating. Rough coating applied after the epoxy has cured will not be accepted.

2.4. POLYVINYL CHLORIDE (PVC) CASINGS:

A. Well casing shall be new Johnson Screens PVC Schedule 40 flush joint threaded casing (or equal) and have an inside diameter of 4 or 6 inches and conform to ASTM Specification F480. Provide all fittings, splines and centering guides as necessary to complete the well as recommended by the manufacturer.

B. Well screen shall be new Johnson Screens PVC Schedule 40 flush threaded screen (or equal) and have an inside diameter of 4 inches and conforms to ASTM Specification F480. The screen slot width shall be 0.010-inches. Provide all fittings, splines and centering guides as necessary to complete the well as recommended by the manufacturer.

C. Well screen filter pack material shall consist of Standard Sand and Silica, Inc. (or equal) clean uniform silica sand with 20/30 grading.

2.4. FITTINGS

A. **Centralizers:** Casing centralizers shall be fitted on all casing using Halliburton Company, Duncan, OK; Pathfinder Oil Tool, Lawton, OK; Dowell, Tulsa, OK; or approved equal; or may be fabricated in the field from the same material as the casing to which they are welded. Centralizers for the FRP casing shall be constructed as per manufacturer's recommendations and have a minimum 2 to 1 safety factor of burst over rating.

B. **Transition adapter fittings:** Transition adapter fittings between FRP tubing and stainless steel wellhead piping shall be fabricated by the casing pipe manufacturer. Adapters shall be pressure rated equivalent to the casing pipe and shall provide NPT threading for acceptance of the stainless steel wellhead piping.

C. **Casing Makeup Services:**

A. The FRP casing fabricator shall furnish the services of a factory-trained representative during the installation of casing into the injection well and dual zone monitor well. The cost of the fabricator's onsite representative shall be included in the price stated in the Unit Bid Schedule.

B. FRP tubing shall be made up with the Weatherford Model 7625 power tong or equal with integral hydraulic backup specifically made for FRP tubing. The torque on each joint shall be controlled and recorded by a joint analyzer and makeup (JAM) system. These services shall be as provided by Weatherford, or equal, as approved by the ENGINEER/GEOLOGIST. The makeup service shall provide three field copies and three report quality copies of the casing running summary which presents the makeup and handling information for the casing.

C. It shall be the responsibility of the fabricator's representative to immediately notify the ENGINEER/GEOLOGIST verbally and in writing of casing already damaged or operational procedure which may damage the casing to a degree which would void all or part of the fabricator's guarantee or jeopardize the integrity of the completed project.

PART 3 -- EXECUTION

3.1 GENERAL

A. The Work shall be performed by a competent crew with equipment that is adequate to complete all phases of well construction.

B. All casing shall be installed by a method appropriate to Drawings as selected by the CONTRACTOR.

C. Casing lengths shall be joined watertight so that the resulting joint shall the same structural integrity as the casing itself.

D. Threaded and coupled joints shall be API or equivalent, made up so that when tight all threads will be buried in the lip of the coupling.

E. Installation of casing in boreholes:

1. Surface and intermediate casings shall be installed and cemented in a borehole not less than 7 inches larger than the nominal diameter of casing.

F. The depths and lengths for casings shall be as indicated unless otherwise determined by the ENGINEER/GEOLOGIST. Payment will be based on actual quantities furnished, installed, or constructed, in accordance with the schedule of values.

G. All work required to be repeated, resulting from the CONTRACTOR's performance, or lack thereof, including all additional materials, labor and equipment required, shall be furnished at the expense of the CONTRACTOR and no claim for additional compensation shall be made or be allowed therefore, except as specifically provided herein.

3.2 CASING

A. **Casing Installation**: When the reaming operation and geophysical logging has been completed, casing will be installed. The lengths and intervals of each casing type, except for the pit casings, will be determined by the ENGINEER/GEOLOGIST.

B. **Tension**: The casing shall be suspended in tension from the surface. The bottom of the casing shall be at a sufficient distance above the bottom of the reamed hole as to insure that none of the casing will be supported from the bottom of the hole. The casings shall be lowered into the borehole open-ended and the weight of the casing shall be supported by the drilling rig. The hook load of the drilling rig must exceed the maximum casing weight to be encountered during the construction of the well.

C. **Failure to Complete**: If the casing cannot be landed in the correct position or at a depth acceptable to the ENGINEER/GEOLOGIST, the CONTRACTOR shall construct another well immediately adjacent to the original location and complete this well in accordance with the Contract Documents at no additional cost to the OWNER. The abandoned hole shall be sealed in accordance with all State of Florida regulations.

D. **Collapsed Casing**: If the casing should collapse for any reason prior to well completion, it shall be withdrawn and replaced at the CONTRACTOR’s expense.

E. **Centralizers**: Centralizers shall be welded to steel casing and made of the same material as the casing. Centralizers shall be attached to the FRP injection tubing with stainless steel straps. Casing centralizers shall meet the requirements of API Specification 10D. All centralizer groups shall be vertically aligned one above the other in order to permit the passage of tremie pipes alongside the casing to the bottom of the borehole.

1. Fabricated centralizers for steel casing shall be constructed of a minimum of 12 inches long, 2 inches wide, a minimum of 0.5-inch thick with a radius of 12 inches and welded with the concave surface against the casing to provide a minimum of 3.5 inches of clearance around the casing.

2. Fabricated centralizers for the FRP shall be constructed as per manufacturer's recommendations and have a minimum of 2 to 1 safety factor of burst over rating

3. Spaced at 120 degrees for casing diameters 12-inches and smaller and at 90 degrees for casing larger than 12-inches in diameter.

4. Vertical separation of centralizers during casing installation are as follows:

   i. One at 5 feet above the bottom and top of the casing

   v. Approximately in 40 foot intervals

F. **PVC Casing and Screen Installation**: The well casing and riser shall be installed in accordance with the manufacturer's instructions. The well casing shall be lowered to the predetermined level and riser shall extend above grade 3 feet. Casing centralizers shall be places five feet below ground surface. The depth of the well screen shall be determined by the CONSULTANT. The screen length will be approximately 50 feet of 0.010-inch slot size slotted PVC screen to approximately 70 feet bls.

3.3 WELDING

A. The standards of the American Welding Society, Structural Welding Code (AWS D1.1) shall apply for all welded joint casing and accessories. All welds shall conform to the latest revision of ANSI B31.1.

B. All welded casing joints shall be made by welders certified in the State of Florida.

C. The certified welder shall perform and be responsible for the integrity of all steel casing welds. The CONTRACTOR must provide the ENGINEER/GEOLOGIST proof of welders' certifications 72 hours before any welding is performed.

D. Any surface defects that shall affect the weld shall be chipped or ground out. A power driven wire brush shall be used to thoroughly clean each layer of weld prior to each additional weld metal, including the final pass.

E. There shall be a minimum of three (3) weld passes on pipe sizes 6-inches and greater. Welded joints shall be allowed to cure for not less than 30 minutes before the weld is placed in contact with water or until the welded joint reaches a temperature equal to or less than 430 degrees Fahrenheit.

F. **Weld Reinforcement:** Weld reinforcement shall be as specified by the AWS code. Upon completion of welding, all weld splatter, flux, slag, and burrs left by attachments shall be removed. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions.

G. **Field Joints:** All field joints shall be welded during installation by qualified welders in accordance with the requirements of AWWA C206.

3.4 ALIGNMENT AND SPACING

A. The CONTRACTOR shall align pipe ends to be joined within commercial tolerance limits on diameters, wall thickness, and out-of-roundness.

B. The CONTRACTOR shall demonstrate that the installed casing is free hanging and can be easily rotated and reciprocated prior to grouting operations.

C. Centralizers shall be secured to the casing in a manner to prevent vertical or rotational movement on the pipe during grouting.

D. The shielded metal-arc process shall be used for all carbon steel field welding.

E. No welding shall be performed if there is impingement of any rain or high wind on the weld area, or if the ambient temperature is below 32°F. If the ambient temperature is less than 32°F, local preheating to a temperature that is warm to the hand is required.

F. Tack welds, if not made by a qualified welder using the same procedure as for the completed weld, must be completely removed. Tack welds which are not removed shall be made with an electrode that is the same as, or equivalent to, the electrode to be used for the first weld pass. Tack welds that have cracked shall be removed.

G. Each layer of deposited weld metal shall be thoroughly cleaned prior to the deposition of each additional layer of weld metal, including the final pass, with a power-driven wire brush. Surface defects which will affect the soundness of the weld shall be chipped out or ground out.

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SECTION 33 22 12 – WELL CEMENTING

PART 1 -- GENERAL

This Section covers the work, materials, and equipment necessary for furnishing the cement grout seal, complete.

1.1 THE REQUIREMENT

A. **Commercial Standards:** All Work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

B. **State Standards**: Southwest Florida Water Management District (SWFWMD) and Florida Department of Environmental Protection (FDEP) Rules and Regulations for Water Wells and Injection Wells in the Florida Administrative Code (FAC).

C. Commercial Standards:

ASTM C-150	Specification for Portland Cement.
AWWA A100	Standard for Water Wells.

D. The cost of cement, additives, and pumping equipment shall be paid at the unit price per sack as stated in the bid schedule forms. This unit price shall include all necessary equipment, materials, and subcontracted services required to properly cement the casing and/or tubing as specified in this section.

1.2 CONTRACTOR SUBMITTALS

A. **General:** All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00** - Contractor Submittals, and the supplementary requirements specified. Each item listed in **Section 01 33 00** - Contractor Submittals shall be submitted to the ENGINEER/GEOLOGIST with a clear explanation or depiction of why or how the requirements, as listed, will be fulfilled by the products or services provided by the CONTRACTOR. This list is not considered all-inclusive and may be extended by the OWNER, ENGINEER/GEOLOGIST, or CONTRACTOR.

B. **Subcontractor's List:** The CONTRACTOR shall submit a complete list of all proposed subcontractors to be used in the Work. The CONTRACTOR may be required to submit additional information, a resume or description of qualifications for any of the subcontractors proposed.

PART 2 -- PRODUCTS

2.1 GENERAL

A. The CONTRACTOR shall provide all materials and equipment necessary for placing cement grout in the annular space outside the casing or tubing.

2.2 PORTLAND NEAT CEMENT

A. Material used for sealing the casing shall consist of a cement grout using Type II Portland cement conforming to ASTM C-150. Neat cement grout shall contain no more than 5.2 to 5.6 gallons of water per 94 pound sack of cement.

2.3 BENTONITE AND OTHER ADDITIVES

A. Additives may be mixed with the Portland cement to speed setting time or to adjust the slurry volume or weight. They shall not exceed the following

1. Not more than 6 percent, by weight, bentonite.

2. Other additives as approved by the ENGINEER/GEOLOGIST.

Provide all high-yield, fine-grained, beneficiated sodium bentonite (manufactured by Baroid Industrial Drilling Products or equivalent) as required for cementing in the proportions specified and directed by the ENGINEER/GEOLOGIST.

B. Provide other cementing additives specifically formulated for use in water well cementing as required by the ENGINEER/GEOLOGIST. Material Data Safety Sheet shall be provided to the ENGINEER/GEOLOGIST for any proposed cement additives before the start of construction.

C. The cost of cement additives, including bentonite, shall be included in the cement grout unit cost.

2.4 MIXING WATER

A. The CONTRACTOR shall be responsible to provide a safe and reliable source of water for cementing, including storage and pumping equipment, to ensure cementing operations are accomplished as specified.

2.5 THIXOTROPIC CEMENT

A. Thixotropic cement may be required by the ENGINEER/GEOLOGIST to bridge lost circulation zones as a result of secondary permeability and porosity development. Where required for use, the cost of additives to formulate thixotropic cement grout shall be included in the unit cost for ASTM C-150 Type II cement.

B. Thixotropic cement formulations (e.g., Material Data Safety Sheet) shall be provided to the ENGINEER/GEOLOGIST for approval.

2.6 SAND – LIMESTONE GRAVEL

A. Provide silica sand for installation in the borehole using the tremie method. Material shall be 6/20 silica sand, be well graded, and free of deleterious material. Must conform in size to SWFWMD rules, regulations, or permit conditions for well abandonment and the borehole or casing diameter. The amount and placement of sand shall be determined by the ENGINEER/GEOLOGIST.

B. Provide limestone gravel for installation in the borehole using the tremie method. Gravel shall be 1/4 to 3/8-inch in diameter, well sorted, and free of deleterious material. The amount and placement of the limestone gravel shall be determined by the ENGINEER/GEOLOGIST.

C. Fine gravel or sand may be used during cement grouting activities to bridge through zones of lost circulation when approved by the ENGINEER/GEOLOGIST.

2.7 MONITORING EQUIPMENT

A. Provide a calibrated in-line magnetic fluid densometer (or equal) and digital flowmeter, including a certified calibration report of each performed in the last 60 days. This equipment shall be able to continuously monitor and record the density and the volume of cement grout blended and pumped during casing cementing operations.

B. The slurry density determination shall be conducted in accordance with the latest edition of API Spec 10.

C. Provide a pressurized mud scale for manual measurement of cement grout density.

PART 3 -- EXECUTION

3.1 GENERAL

A. The Work shall be performed by a competent well cementing crew with equipment that is maintained and of adequate capacity to complete all phases of well cementing operations.

B. **Cement**: Samples of cement shall be collected during the cement grout blending and pumping operations for all casings installed, with the CONTRACTOR collecting both dry and mixed (ready to pump) samples of the cement grout being used. Mixed cement samples shall include at least three (3) 2-inch cubes suitable for compressive strength tests, by the OWNER.

1. Cement grout samples shall be collected a minimum of three (3) times during each cementing operation: Prior to pumping, at the middle, and at the end of the cementing operation. The specified slurry density shall match the specified slurry density indicated on the delivery certificate or subcontract cementing service company's job proposal.
2. Only 2-inch cubes, suitable for tests of compressive strength, will be acceptable as representative cement samples.

C. **Operations**: The CONTRACTOR shall submit for the ENGINEER/GEOLOGIST's approval plans for cementing operation and casing installation at least 72 hours prior to commencing Work on those operations. These plans shall include the following information:

   1. Cementing Program: Top and bottom of each interval to be cemented, pre-flush and spacer, composition of cement to be used in each interval and volume to be pumped, method of emplacement of cement, expected fill-up, expected pressures, and any additives to be used.

D. All Work required to be repeated, resulting from the CONTRACTOR's unsatisfactory performance, including all additional materials, labor, and equipment required, shall be furnished at the expense of the CONTRACTOR and no claim for additional compensation shall be made or be allowed therefore, except as specifically provided herein.

E. The CONTRACTOR, or his subcontractor, shall be responsible for calculating cement volumes prior to and following grouting operations. The ENGINEER/GEOLOGIST shall review methods and volumes prior to commencing cement grout pumping.

3.2 CEMENTING OF CASING AND TUBING

A. Cementing of casing shall be accomplished to completely fill the annular space from the bottom of the casing or the top of the preceding cement stage, to the level shown on the Drawings, or as directed by the ENGINEER/GEOLOGIST.

B. It is the CONTRACTOR's responsibility to conduct the cementing operations. All piping and valving shall be capable of handling the required pumping rates and pressures. The CONTRACTOR shall select grout pipe sizes (and quantity) to obtain desired flow rates consistent with velocity limitations for the grout pipes.

C. Cement grouting operations shall be done in the presence of the ENGINEER/GEOLOGIST. Full access to all cementing equipment and gauges shall be provided to the ENGINEER/GEOLOGIST's representative by the CONTRACTOR before, during, and after pumping operations.

D. During all stages of cementing, the CONTRACTOR shall use a pre-flush or spacer of sufficient volume prior to pumping the cement grout. The CONTRACTOR shall submit the technical specifications of the pre-flush to the ENGINEER/GEOLOGIST as part of the cementing plan submittal.

E. Pressure grouting is the required initial method of cement grout placement for each casing, followed by tremie grouting in stages, if the initial cement stage does not cause cement returns at land surface.

F. A pressure retaining steel header and minimum 2.875-inch diameter steel tubing shall be installed and used during pressure grouting operations; the end of the tubing shall be placed within 30 feet of the casing bottom. No method shall be permitted that does not force grout from the bottom of the space to be grouted to the surface. The grouting shall be done in a continuous manner to ensure the entire filling of the annular space around the casing.

G. Grout slurry placed by the tremie method shall use externally flush or externally upset end 1.25-inch diameter steel tubing having an inside diameter of 1.0 inch or greater or size approved by the ENGINEER/GEOLOGIST and shall be pumped through two pipes positioned 180 degrees apart in the annulus. Grout pipe shall be withdrawn as the annulus is filled, and before the cement begins to set. Grout pipes shall be set not more than 5 feet above the top of the previous cement stage, as determined from tremie pipe hard tag and temperature geophysical log.

H. During and 8 hours following the placement of cement, a pressure of 100 psi shall be maintained in the casing. The heating and cooling of the cement may require water to be added or released from the casing to maintain the required internal casing pressure.

I. During the pumping of each cement stage, the CONTRACTOR shall be responsible for determining the density of a minimum of three grout samples. Grout samples shall be taken before pumping, at the midpoint, and near the end of each stage. The ENGINEER/GEOLOGIST reserves the right to disallow any cement grout not meeting these minimum specifications.

J. During the pumping of each cement stage, the CONTRACTOR shall utilize the monitoring equipment required in 2.7(A) of this section. Measurements of cement weight shall be provided to the ENGINEER/GEOLOGIST at frequent intervals prior to and during cementing operations using either a densometer or mud scale. Consistency and mixing shall be approved by ENGINEER/GEOLOGIST.

K. During the pumping of each cement stage, the CONTRACTOR shall supply a secondary means of measuring/determining cement volumes installed. This may include one or more of the following:

    1. Functional and accurate (calibrated) barrel counter readings with onsite verification,

    2. Before and after physical weight measurements of the bulk cement hopper at a certified weight station or copy of shipping manifest,

    3. Accurate volume measurement of displaced fluids from the annulus.

L. The cementing Contractor shall upon completion of cementing operations, immediately submit to the ENGINEER/GEOLOGIST the cementing contractor's written summary of the cement pumping operations. If cement pumping summary is not submitted before the cementing contractor leaves the site, the CONTRACTOR shall not be paid for the individual cementing job.

3.3 BOREHOLE BACK-PLUGGING

A. All exploratory boreholes (pilot hole) drilled on reverse-air circulation shall be plugged using Portland Type II cement with up to 6 percent bentonite by weight prior enlarging the hole for casing installation (see **Section 33 22 12** - Well Casing).

B. Limestone gravel may be used to isolate production intervals in the dual-zone monitor well, or in depth intervals where difficulties arise in obtaining cement fill up, as approved by the ENGINEER/GEOLOGIST. Drill cuttings shall not be used for backplugging under these circumstances. The depths and methods of the plugback shall be submitted by the CONTRACTOR for review and approval by the ENGINEER/GEOLOGIST.

C. Cement grout and placement methods shall be reviewed and approved by ENGINEER/GEOLOGIST.

3.4 SETTING TIME

A. No drilling operations will be permitted until the cement grout has thoroughly cured.

B. Following cement placement, the casing and borehole shall remain undisturbed for a minimum of 8 hours prior to temperature geophysical logging.

C. A minimum of 12 hours-setting time shall be required between successive cement lifts. Longer time shall be necessary when high-yield cement is used.

D. All cement grout lifts shall be physically tagged by an externally flush tremie pipe and confirmed using a temperature/gamma log conducted before pumping a subsequent lift.

E. The CONTRACTOR shall include cement grout curing time for each grout stage in the unit price of grout pumped in the Schedule of Values.

F. After cementing is completed on a casing, casing and well must remain undisturbed for at least 24 hours for setting of the cement prior to drilling out the cement plug in the well.

3.5 REMEDIAL WORK

A. The CONTRACTOR shall be responsible for all remedial Work and related expenses in order to meet regulatory requirements and the Technical Specifications at no additional cost to the ENGINEER/GEOLOGIST or OWNER. This shall include defective materials, accident, loss of equipment or equipment malfunction, or for any other cause directly attributable to the CONTRACTOR. The ENGINEER/GEOLOGIST shall be notified immediately in the event of a problem, and the following shall apply:

1. The CONTRACTOR shall, submit in writing to the ENGINEER/GEOLOGIST, a method of correcting the problem. The ENGINEER/GEOLOGIST shall review the method of corrective action; the CONTRACTOR shall not implement the corrective action until the plan is accepted by the ENGINEER/GEOLOGIST.

2. All remedial Work shall be conducted in accordance with all applicable local, state, and federal regulations.

3. Corrective Work shall be done at no additional cost to the ENGINEER/GEOLOGIST or OWNER and shall not extend the length of the Contract.

3.6 WELL ABANDONMENT

A. If the CONTRACTOR voluntarily stops Work, and/or fails to complete the well or borehole in accordance with governing regulations or the Contract Documents, the well will be considered abandoned. The CONTRACTOR shall not be paid for all or part of the well if declared abandoned by the ENGINEER/GEOLOGIST.

B. The CONTRACTOR shall propose their method of abandonment of the well or borehole in writing to the ENGINEER/GEOLOGIST. The ENGINEER/GEOLOGIST shall review the method of abandonment. The CONTRACTOR shall not proceed with well abandonment until the ENGINEER/GEOLOGIST provides written approval of the CONTRACTOR's plan. The cost of properly plugging and sealing the well or borehole, in accordance with applicable local, state, or federal regulations, shall be at the CONTRACTOR's sole expense. In addition, if a well or part thereof, does not have mechanical integrity, as defined by the appropriate regulatory authorities, it must be rectified before abandonment.

C. The cost of post-abandonment monitoring, if required, shall be at the CONTRACTOR's sole expense.

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SECTION 33 22 13 – CORING

PART 1 – GENERAL

1.1 WORK INCLUDED:

A. This section covers the Work, material, and equipment necessary to drill and collect rock core samples, complete.

B. All Work shall be performed by a certified water well contractor, licensed by the State of Florida. CONTRACTOR shall construct the well in strict conformance with all laws, rules, regulations, and standards related to the construction of wells in the State of Florida, County, and SWFWMD.

C. The CONTRACTOR shall provide adequate workman and materials on site to complete the removal of core from the core barrel, delivery of the core sample to the CONSULTANT, and subsequent placement of the core sample into the core box for sample description by the CONSULTANT.

D. CONTRACTOR shall obtain up to seven (7) reasonable undisturbed and intact continuous cores between ±485 feet to ±3,200 feet bls.

E. The CONTRACTOR shall submit the name of the laboratory to the ENGINEER for review before analyses. The report of analytical results shall be submitted to the ENGINEER within 45 days of CONTRACTOR's receipt of core samples from the ENGINEER.

F. The depth selection of the cores shall be determined by the ENGINEER.

PART 2 – PRODUCTS

2.1 GENERAL

A. CONTRACTOR shall provide all materials and equipment necessary for the drilling, collecting, storing, and shipping of core samples, as specified.

B. The CONTRACTOR shall make every effort to ensure the borehole is prepared for coring. The borehole shall be circulated clean to prevent cuttings and other material at the bottom of the test hole from entering the core barrel during the coring operation.

C. The cores shall have a 4-inch diameter, shall be at least 10-feet long, and shall be drilled at points designated by the ENGINEER**.**

D. The CONTRACTOR shall provide laboratory testing and results for core analyses of ENGINEER selected rock core samples. The ENGINEER will then select a maximum of 3 representative sections of each core on which the CONTRACTOR will have laboratory analyses performed to determine vertical and horizontal permeability, porosity, and specific gravity.

E. Upon completion of coring and upon authorization by the ENGINEER, the CONTRACTOR shall forward the core samples to the Florida Geological Survey in Tallahassee along with any appropriate well completion reports. If sample storage becomes a problem on the

Site, samples may be forwarded to the Florida Geological Survey as work progresses following procedures acceptable to the ENGINEER.

2.2 CORE BARREL AND BIT

A. A core barrel at least 10-feet long shall be used, as manufactured by the Christensen Diamond Products Company or approved equivalent. The core barrel shall be of a double tube design. The collection and distribution of the cores shall take place as described.

2.3 CORE BOXES

A. Cores shall be stored in sturdy wooden boxes, provided by the CONTRACTOR, of the proper size for the diameter of core collected. Each core box shall be a maximum of 6-feet in length and shall hold no more than 10 feet of 4-inch diameter core per core box.

PART 3- EXECUTION

3.1 GENERAL

A. The collection of the cores required as a part of this contract shall be observed by technicians from the manufacturer of the coring tool unless the CONTRACTOR can demonstrate previous experience of coring. Drilling and collection of the coring shall be observed by the ENGINEER.

B. During the pilot hole drilling of the injection well, 4-inch diameter rock cores, each 10 feet long, shall be collected at the following depths intervals with a minimum acceptable recovery of 50 percent:

i. Three (3) cores between 1,200 feet to 1,400 feet bls.

ii. Four (4) cores between 1,500 feet to 3,200 feet bls.

The exact depths of the interval to be cored will be selected by the ENGINEER based on the evaluation of rock cuttings and water quality from samples collected by the CONTRACTOR.

B. The method of coring and the sequence of coring and reaming the hole to full diameter are subject to the ENGINEER's approval and shall conform to the requirements stated in these Specifications.

C. Core handling procedures shall be in accordance with the "Sample Examination Manual," Methods in Exploration Series published by the American Association of Petroleum Geologists, Tulsa, OK 74101, or equal.

D. Cores shall be stored on Site, in sturdy wooden boxes of the proper size, until completion of the Work. All boxes shall be clearly and permanently labeled with the depth, the top, the bottom, and sections of the core sent to laboratory for analyses. Recovered core will be delivered to the ENGINEER for evaluation and selection prior to shipment to an approved laboratory for analysis at the CONTRACTOR's expense. A maximum of 3 representative sections of each core will be analyzed at the laboratory.

E. The laboratory analysis of a maximum of 3 representative sections of each core will include the measurement of the vertical and horizontal permeability, porosity, and specific gravity. The cost of laboratory analyses and shipping shall be included in the CONTRACTOR's unit prices for rock cores shown in the Bid Schedule.

F. A core analysis laboratory such as Ardaman and Associates Laboratories in Orlando, FL or equal will be acceptable. The CONTRACTOR shall identify the laboratory providing the core analyses for the ENGINEER's approval prior to core drilling.

G. The CONTRACTOR shall promptly ship cores for analysis to the approved laboratory and submit results to the ENGINEER within 21 days following core collection to avoid delaying drilling operations. It shall be the CONTRACTOR's responsibility to ship and keep track of the laboratory schedule for required core analyses.

H. Five hard copies of the final core laboratory report shall be submitted to the ENGINEER. The final core laboratory report shall also be submitted to the ENGINEER as an electronic file in a portable document format (*.pdf) file.

I. Upon completion of the work, the CONTRACTOR shall arrange for the shipment of the cores to the core section reliquary at the University of Miami at the Department of Geological Sciences, 43 Cox Science Building, Coral Gables, FL 33124-0401.

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SECTION 33 22 14 – GEOPHYSICAL LOGGING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. This section covers the work, materials, and equipment necessary to conduct geophysical logging and video surveys of the borehole and wells during construction and testing.

1.2 CONTRACTOR SUBMITTALS

A. **General:** All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00 - Contractor Submittals,** and the supplementary requirements specified. Each item listed below shall be submitted to the ENGINEER/GEOLOGIST with a clear explanation or depiction of why or how the requirements, as listed, will be fulfilled by the products or services provided by the CONTRACTOR. This list is not considered all-inclusive and may be extended by the OWNER, ENGINEER/GEOLOGIST, or CONTRACTOR.

B. **Geophysical Logging Firm:** All geophysical logs shall be performed by a company licensed and experienced in the performance of such logs. The geophysical logging firm must be pre-approved by the ENGINEER/GEOLOGIST.

C. **Specialty Geophysical Logging:** All specialty geophysical logs shall be performed by a USGS (ie the Optical Borehole Imaging (OBI) log) that is licensed and experienced in the performance of such logs.

D. **Geophysical Logging**: The CONTRACTOR shall submit 3 printed field copies of all geophysical logs and also provide electronic copies in Log ASCII Standard (LAS) and Portable Document File (*.pdf) format immediately following the completion of logging operations; one final (1) electronic copy shall be provided in Portable Document File (.pdf) on a flash drive. Unless otherwise directed by the ENGINEER/GEOLOGIST, for each geophysical logging suite performed, the CONTRACTOR shall obtain from the Logging Firm, a summary report describing the logs performed and an interpretation of the results of the log or logs which will include flow interpretation and total dissolved solids plots. These logging reports shall be submitted to the ENGINEER/GEOLOGIST within 72 hours of completion of logging.

E. Geophysical logging probe or sonde schematic drawing for each down-hole tool used.

F. Geophysical Logging Firm, as applicable, shall be identified in the CONTRACTOR'S list of specialty subcontractors as stated in the bid package instructions.

PART 2 -- PRODUCTS & EQUIPMENT

2.1 GENERAL

A. CONTRACTOR shall provide a sheave and appurtenances from which Geophysical Logging Firm may hang logging equipment that will be lowered into

the borehole or well; the equipment shall be designed for use in wireline logging and shall have a capacity to support the weight and loads resulting from the operation.

B. CONTRACTOR shall furnish and install temporary pumping equipment and discharge valves and piping for all dynamic (pumping or flowing) geophysical logging operations.

C. CONTRACTOR shall furnish and install a temporary stilling well fabricated from pipe or tubing to provide not less than a 1-inch inside diameter to allow for installation of a water level measuring device or other equipment by the ENGINEER/GEOLOGIST. The stilling well shall be open to water in the well or borehole to permit measurement of water fluctuations over time. The stilling well shall be installed in a manner with appropriately sized valves to prevent the flow of water under artesian conditions.

D. CONTRACTOR shall furnish and install all temporary flow control equipment required to contain and convey groundwater produced during geophysical logging operations either by pumping or from artesian flow.

E. CONTRACTOR is advised that the well is expected to be under artesian conditions during operations within the Floridan aquifer and static geophysical logging will require installation of a standpipe with wireline pack-off collar/lubricator.

2.2 GEOPHYSICAL LOGGING TOOLS

A. CONTRACTOR will provide continuous digital geophysical logging equipment capable of performing and recording digital data from the following standard geophysical logs:

1. **X-Y Caliper (CAL):** A four-arm (XY) caliper tool shall be used for logging. Response shall be recorded in inches in diameter and the caliper log report shall indicate borehole volume. Caliper logs shall be run under static conditions.

2. **Natural Gamma Ray (NGR):** Response shall be recorded in American Petroleum Institute (API) units. Gamma logs shall be run under static conditions.

3. **Dual-Induction (DIL), Laterolog, and Spontaneous Potential (SP):** These geophysical logs, otherwise described as electric logs, shall be run under static (no flow) conditions.

4. **Borehole Compensated Sonic Log with Variable Density Display (BHC/VDL):** The logging tool shall utilize two (2) receivers to record shear, compressional, and Stoneley waveforms. The tool shall be capable of accurately recording the compressional wave transit time in boreholes up to a 30-inch borehole. The BHC/VDL shall be run under static (no flow) conditions.

5. **Fluid Resistivity (static and dynamic):** Fluid resistivity logs shall be run under both static (no flow) and dynamic (flowing/pumped) conditions.

6. **Flowmeter (FM) (static and dynamic):** Flowmeter log shall be run under both static (no flow) and dynamic (flowing/pumped) conditions. A flow interpretation log will be required within 24 hours of the logging activities.

7. **Temperature (static and dynamic):** Temperature logs shall be run under both static (no flow) and dynamic (flowing) conditions.

8. **Color Video Survey with Side-Looking Rotating Camera:** The video shall be run under dynamic (pumped) conditions to ensure video clarity.

9. **Borehole Televiewer:** In the event that an acceptable video survey cannot be run, a borehole televiewer log shall be substituted. .

B. CONTRACTOR will provide the following services and accessibility for the United States Geological Survey (USGS) to conduct the following "specialty geophysical log":

1. **Optical Borehole-Imager (OBI):** Logs shall be run under static conditions.

C. Wireline Packoff/Lubricator Assembly:

1. The CONTRACTOR shall furnish and install a wireline pressure control device for use during geophysical logging operations conducted at depths within and below the base of the Floridan aquifer system and at times when it is necessary to conduct logging operations in pressurized well casing.

2. The wireline pressure control device shall be capable of being installed on both well casing and the pressure control stack (blowout preventer); appropriately sized and pressure rated crossovers and/or swedges shall be furnished.

3. The wireline pressure control device shall be provided with a flanged pump-in sub to allow introduction of fluids into the well and for casing pressurization. Ancillary equipment including bleed and isolation valves of equal pressure rating shall be furnished and installed for logging operations.

4. A manually operated wireline blowout preventer shall be furnished and installed on the pressure control stack for use during logging operations at depths below the base of the Floridan aquifer system. The pressure rating shall be equal to the pressure control stack installed on the well.

PART 3 -- EXECUTION

3.1 GENERAL

A. Geophysical logging shall be performed as soon as possible following drilling and preparing the borehole for geophysical logging. For open-hole logging, the depth intervals shall correspond to the total length of the open-hole unless otherwise directed by ENGINEER/GEOLOGIST. The CONTRACTOR shall, at his own expense, clean the borehole and rerun logs if they fail to survey within 5 feet of the bottom of the borehole as measured with the drill pipe.

B. To be acceptable to the ENGINEER/GEOLOGIST, each geophysical log must be run in a continuous manner between the top and bottom of the depth interval specified or selected by the ENGINEER/GEOLOGIST

C. CONTRACTOR shall provide ENGINEER/GEOLOGIST with a 24-hour notice prior to logging to facilitate coordination of the logging activities with OWNER and regulatory agencies; regulatory agencies may require attendance at geophysical logging events, as specified or identified in the Underground Injection Control (UIC) well construction permit.

D. The CONTRACTOR is responsible for preparing and conditioning the borehole prior to geophysical logging by circulating all drill cuttings from the borehole. The drilling fluid shall also be conditioned until field tested physical properties measured by the CONTRACTOR are adequate to prevent the borehole from collapsing and the well from flowing under artesian conditions.

E. Each log shall be recorded using a depth measurement that is accurate to within the depth measured by the drill pipe. Each log will be submitted to the ENGINEER/GEOLOGIST with a scale of:

- 1-inch = 100 feet
- 2-inches = 100 feet
- 5-inches = 100 feet

F. All logs shall be clearly labeled with all pertinent information regarding the well construction progress, location, borehole and casing depths, logging scales, dates, etc. Each log shall include a repeat section of not less than 200 feet to verify logging tool performance; the repeat section shall be performed in a depth interval where an on-scale and identifiable logging signature is present.

G. Each logging tool shall be calibrated in the presence of the ENGINEER/GEOLOGIST.

H. The CONTRACTOR is responsible for providing adequate access for geophysical logging during pumping tests. Coordinate with **Section 33 22 17- Packer Testing** and **Section 33 22 16 – Well Pump Testing.** No additional compensation will be granted for removal and reinstallation of pumps to facilitate logging.

I. CONTRACTOR shall provide access to the well for the purpose of water level measurements or otherwise as requested by the ENGINEER/GEOLOGIST during geophysical logging events. A temporary stilling well shall be installed by the CONTRACTOR in the well or borehole to allow measurement of water level and fluctuation resulting from pumping.

J. Pump Testing of the well may be conducted concurrent with geophysical logging events. It shall be the CONTRACTOR'S responsibility to assist the ENGINEER/GEOLOGIST as directed during logging events.

K. In the event that a geophysical tool or sonde becomes stuck in the well during logging operations, the CONTRACTOR shall develop a plan for retrieval. Where a nuclear source is involved in the retrieval operation, the CONTRACTOR shall provide notification and conduct retrieval or abandonment operations, as required, in

accordance with 10 CFR PART 39. The CONTRACTOR, at his sole expense, shall be responsible for all costs associated with retrieval (fishing) operations, notification, reporting, and plugging/abandonment, repair or replacement of logging tools and equipment, as required by the Contract Documents and governing regulations. The CONTRACTOR will not be paid standby time during this period.

L. The ENGINEER/GEOLOGIST or designated representative shall have the authority to specify up-hole/down-hole logging speeds of the individual geophysical logs.

M. No standby or additional rig time shall be paid to the CONTRACTOR during geophysical logging operations.

N. Standby time shall not be paid to the CONTRACTOR for any time spent reconditioning or relogging the borehole in the event that geophysical logs are not accomplished as specified.

O. Wireline packoff/lubricator assembly and blowout preventer shall be furnished, installed, operated, and tested by the CONTRACTOR. Equipment inspection and testing shall be conducted as required by the manufacturer and regulatory agencies having jurisdiction over the well drilling and construction operations.

3.2 GEOPHYSICAL LOGGING OPEN BOREHOLE

A. Geophysical logging, consisting of a combination caliper and gamma ray log, shall be completed on the reamed borehole after reaming to the final casing setting depth. If a caliper survey indicates the borehole is less than the specified diameter at any depth, the borehole shall be re-reamed and caliper and gamma ray log re-run. If corrective measures are required, the CONTRACTOR shall provide and pay for all corrective measures and additional geophysical logs. After the caliper and gamma ray log has been successfully run and accepted by the ENGINEER/GEOLOGIST, the CONTRACTOR may proceed with the installation of the well casing.

B. If the open borehole collapses prior to or during geophysical logging or is obstructed in any manner, the CONTRACTOR shall be responsible for satisfactorily clearing the borehole for logging operations. A digitally recorded color video survey of the entire well shall be made from land surface to the total depth of the well in the down-hole and up-hole directions. Each weld or casing connection shall be inspected using a sideward-looking camera with full 360° rotation capability; other features of interest, as directed by the ENGINEER/GEOLOGIST, may also be inspected. The quality of the picture shall be acceptable to the ENGINEER/GEOLOGIST for the entire depth of the survey. The survey shall be logged at a speed as approved by the ENGINEER/GEOLOGIST on DVD recording discs. The CONTRACTOR shall furnish the ENGINEER/GEOLOGIST with one DVD immediately at the completion of the video survey and 3 high quality replicates on DVD within 10 days of the video survey.

3.3 DYNAMIC GEOPHYSICAL LOGGING (PUMPING CONDITIONS)

A. Dynamic geophysical logs shall include flowmeter, temperature, fluid conductance, and color television survey, where indicated on the logging schedule. Dynamic geophysical logs shall be performed while flowing, if an adequate constant flow rate exists, or pumping groundwater from the borehole, as required.

B. The CONTRACTOR shall furnish and operate the temporary pumping equipment and appurtenances necessary to perform the dynamic logs. The geophysical logging shall be conducted under static and dynamic (minimum flow of 500 gpm) conditions as specified in the Geophysical Logging Schedules.

C. The static fluid resistivity and temperature logs shall be completed before any other geophysical logging is conducted.

D. The flowmeter logs shall include a calibration section on the log showing the tool response at four (4) different velocities with the tool moving up and at four (4) different velocities with the tool moving down.

E. CONTRACTOR shall prepare a Total Dissolved Solids (TDS) log using the BHC log and DIL to present an estimated formation TDS concentration with depth. The TDS log algorithm shall apply the equations for porosity developed by Archie (Journal of Petroleum Technology, 1942) and empirical relationships developed by Reese (WRI 94-4010, 1994).

F. Isolation of specific intervals within the open borehole for dynamic geophysical logging will be accomplished using a single-element packer, drill pipe, casing and cross-over to drill pipe, and a pump sized to accommodate the passage of geophysical logging tools (see **Section 33 22 17 - Packer Testing**).

G. Produced water disposal during dynamic geophysical logging shall be the responsibility of the CONTRACTOR. The CONTRACTOR shall perform water disposal in accordance with **Section 33 22 20 – Formation Water Control and Discharge.**

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3.5 GEOPHYSICAL LOGGING SCHEDULE

Surficial Aquifer Monitor Well	
Drilling Interval	**Geophysical Logs**
10-inch Diameter Pilot Hole to ±70 feet bls (Fluid: mud)	**Static Logs:** XY Caliper Natural Gamma

Upper Floridan Monitor Well	
Drilling Interval	**Geophysical Logs**
12-inch Diameter Pilot Hole to ±285 feet bls (Fluid: mud)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL
Nominal 16-inch Diameter Reamed Bore Hole to ±285 feet bls (Fluid: mud)	**Static Logs:** XY Caliper (with calculated borehole volume) Natural Gamma
5-inch Diameter Pilot Hole to ±475 feet bls (Fluid: mud)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL Color Television Survey

Exploratory Lower Floridan Aquifer Well/Dual Zone Monitor Well	
Drilling Interval	**Geophysical Logs**
During Dual Zone Monitor Well Construction	
12-inch Diameter Pilot Hole to ±210 feet bls (Fluid: mud)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL
Nominal 42-inch Diameter Reamed Bore Hole to ±210 feet bls (Fluid: mud)	**Static Logs:** XY Caliper (with calculated borehole volume) Natural Gamma
12-inch Diameter Pilot Hole to ±530 feet bls (Fluid: mud)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL
Nominal 34-inch Diameter Reamed Bore Hole to ±350 feet bls	**Static Logs:** XY Caliper (with calculated borehole volume)

(Fluid: mud)	Natural Gamma
12-inch Diameter Pilot Hole to ±1,425 feet bls (Fluid: reverse-air)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL Color Television Survey Optical Borehole Imager (USGS)
Nominal 44-inch Diameter Reamed Bore Hole to ±1,425 feet bls (Fluid: reverse-air)	**Static Logs:** XY Caliper (with calculated borehole volume) Natural Gamma
12-inch Diameter Pilot Hole to ±3,200 feet bls (Fluid: reverse-air)	**Static Logs:** XY Caliper Natural Gamma Spontaneous Potential Dual-Induction BHC Sonic with VDL Color Television Survey Temperature Fluid Resistivity Flowmeter Optical Borehole Imager (USGS) **Dynamic Logs:** Temperature Fluid Resistivity Flowmeter

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SECTION 33 22 15 – WELL DEVELOPMENT AND WATER QUALITY SAMPLING

PART 1 -- GENERAL

1.1 GENERAL REQUIREMENT

A. After the well has been completely constructed in accordance with the requirements of the Contract Documents, the CONTRACTOR shall notify the ENGINEER/GEOLOGIST and shall make the necessary arrangements for conducting well development.

B. **Commercial Standards:** All work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

C. **State Standards**: Southwest Florida Water Management District (SWFWMD) and Florida Department of Environmental Protection (FDEP) Rules and Regulations for Water Wells in the Florida Administrative Code (FAC).

D. **FDEP Standards**: All water quality samples collected during construction, testing, and development shall be collected and analyzed in accordance to FDEP Standard Operating Procedures (SOP) of the Quality Assurance Chapter 62-160 F.A.C. (Field Procedures SOP-001/01and Laboratory Procedures SOP-002/01).

- FA 1000-Regular Scope and Administrative Procedures for Use of DEP SOPs
- FC 1000-Cleaning/Decontamination Procedures
- FD 1000-Documentation Procedures
- FQ 1000-Field Quality Control Requirements
- FS 1000-General Sampling Procedures
- FS 2000-General Aqueous Sampling
- FS 2200-Groundwater Sampling
- FT 1000-Field Testing and Measurement

E. **Commercial Standards**:

A100 Standard for Water Wells American Water Works Association (AWWA)

1.2 CONTRACTOR SUBMITTALS

A. **General:** All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00** - **Contractor Submittals**, and the supplementary requirements specified. Each item listed below shall be submitted

to the ENGINEER/GEOLOGIST with a clear explanation or depiction of why or how the requirements, as listed, will be fulfilled by the products or services provided by the CONTRACTOR. This list is not considered all-inclusive and may be extended by the DISTRICT, ENGINEER/GEOLOGIST, or CONTRACTOR.

B. **Development and Test Records:** Development and test records of the LW SA MW-1, LW UFA MW-1, and the LW LFA DZMW-1 shall be maintained on an hourly basis, showing production rates, static water level, pumping level, drawdown, production of sand, silt, and all other information.

C. **Water Quality Analyses**: The CONTRACTOR shall submit an Adobe (.pdf) document and two (2) paper copies of the laboratory report for the analyses of the water quality samples within 30 days of receipt of samples by the laboratory.

1. All water quality analyses will be performed by a laboratory certified by the State of Florida for analysis of drinking water with a current Comprehensive Quality Assurance Plan (ComQAP) on file with FDEP in accordance with methods and reporting format approved by FDEP.
2. CONTRACTOR shall accommodate water quality sampling by CONSULTANT and configure a low flow discharge port along discharge line. CONTRACTOR shall assist CONSULTANT with the collection of all water quality samples.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. The CONTRACTOR shall furnish all equipment, compressors, piping, pumps, and appurtenances to develop the well by reverse-air circulation, straight-air, and over-pumping.

B. The CONTRACTOR shall furnish and install a submersible pump capable of continuously pumping from 25 to 500 gallons per minute against a total head no deeper than 120 feet with the pumping bowl set at 25 feet below land surface. It is anticipated that all wells will be developed at rates between 25 to 500 gpm.

C. The CONTRACTOR shall provide all necessary electrical pump, wiring, and control box; an engine-powered, noise suppressed electrical generator; and an onsite qualified operator for the duration of each pumping test.

D. The CONTRACTOR shall configure the pumping system so pumping rates may be adjusted through the specified flow range, as directed by the ENGINEER/GEOLOGIST.

E. The CONTRACTOR shall furnish and install an inline flowmeter with a flow rate indicator and totalizer calibrated within the last 60 days and capable of measuring discharge rates of up to 1,000 gallons per minute.

F. The CONTRACTOR shall furnish and install a valve on the discharge side of the pump, downstream of the flowmeter, to control the discharge rate, shut off flow, and stop siphon or artesian flow.

G. The CONTRACTOR shall furnish and install a discharge line to convey water to the fractionation tank(s) and from fractionation tank(s) to discharge point(s) into fractionation tank(s) for settling.

H. THE CONTRACTOR shall be responsible for providing and maintaining all necessary equipment, supplies, discharge lines, valves, and ports needed in the construction and maintenance of the discharge lines from any well (testing/developing) and from the LW UFA MW-1 to the fractionation tank (s) and from the fractionation tanks to the combined mixing lines that convey discharged water to the settling fractionation tank(s).

PART 3 -- EXECUTION

3.1 WELL DEVELOPMENT

A. **Development by Direct-Air Method (Airlifting):** After receiving the ENGINEER/GEOLOGIST's authorization to proceed, the CONTRACTOR shall commence to develop the well by pumping with direct-air and shall continue until sand production as measured using a 1,000 mL Imhoff cone and water quality has stabilized per FDEP requirements.

1. The CONTRACTOR shall furnish, install, and operate an air compressor with sufficient capacity to air-lift water from the well using a minimum of 120 feet of submerged air-line installed in the well.

2. The CONTRACTOR shall be responsible for providing and maintaining all necessary tanker trucks, fractionation tanks, dump trucks, pipes, pumps, and equipment necessary to pump and haul excess pad drainage, drilling fluid, settling tanks, drill cuttings, and pumped water to a pre-determined disposal site in accordance with federal, state and local regulations, or sub-contract with firm capable of providing these services when necessary.

3. THE CONTRACTOR shall be responsible for providing and maintaining all necessary equipment, supplies, discharge lines, valves, and ports needed in the construction and maintenance of the discharge lines from any well (testing/developing) and from the LW UFA MW-1 to the fractionation tank (s) and from the fractionation tanks to the combined mixing lines that convey discharged water to fractionation tank(s) for settling.

B. **Development by Pumping:** After completion of airlifting development, the CONTRACTOR shall commence well development by surging using the test pump. The CONTRACTOR shall NOT pump the well until the ENGINEER/GEOLOGIST and subcontract laboratory are onsite and prepared to collect water for the full-suite of water quality analyses. The sample shall be collected at a rate approved by the ENGINEER/GEOLOGIST to allow for field measurements during the initial pump development of the well. After collection of this sample, the pump development can proceed as directed below:

1. The initial pumping rate shall be restricted and gradually increased until the maximum rate is reached as directed by the ENGINEER/GEOLOGIST. The maximum rate will be determined by the ENGINEER/GEOLOGIST after consideration of the well's drawdown and discharge characteristics. At frequent intervals, the pump shall be stopped and the water in the pump column shall be allowed to surge back through the pump bowls.

2. The test pump used for well development on the final completed well shall be capable of stressing the well, as approved by the ENGINEER/GEOLOGIST, for up to 72 hours and shall also include a valve to regulate the flow rate during the tests. The pump shall be set to a depth that will allow for the test to be run at ENGINEER/GEOLOGIST approved rates without causing cavitation. The CONTRACTOR shall also provide and install a 1-inch minimum diameter access port to allow passage of a pressure transducer, a water level probe and provide a manometer tube assembly attached at the wellhead to monitor artesian water pressure during testing.

3.2 WATER SAMPLING – NPDES OR GENERIC DISCHARGE PERMIT

A. CONTRACTOR shall obtain a preliminary water sample from Tractor Lake to have tested for the required water quality parameters based on the required permit to be submitted with the permit. Water quality testing shall be performed by a laboratory certified by the State of Florida.

B. CONTRACTOR shall obtain all water quality samples from Tractor Lake as defined in the required permit. If at any time a water quality parameter is outstanding per required permit, discharge will cease until water quality parameter(s) return to limits.

C. Sample bottles shall be clearly labeled in an indelible way with the sample identification, sample depth, sample time, sample parameters and date.

3.3 WATER SAMPLING – LW SA MW-1, LW UFA MW-1, and LW LFA DZMW-1

A. **General**: The CONTRACTOR will be required to subcontract a State of Florida certified laboratory to collect water samples for analysis of water samples collected at the end of well development. All samples shall be properly collected, preserved, and analyzed within the required holding time limits. The analytical method detection limit shall be less than the drinking water maximum contaminant levels (MCL) for all analyses. All costs for water sample collection and analyses shall be paid by the CONTRACTOR. Any water samples taken during the course of this project shall follow the requirements outlined in the Section in 1.1 A through E. The laboratory shall be a Florida Department of Health (FDOH) and National Environmental Laboratory Accreditation Program (NELAP) certified analytical laboratory by FDEP and have a current approved ComQAP on file with FDEP with methods approved by FDEP.

B. **Reverse-Air Drilling Water Samples (LFA MW):** The CONTRACTOR shall be responsible to collect representative water samples from specific capacity testing at each change of drill pipe or at a minimum of every 30 feet while drilling with reverse-air circulation. The CONTRACTOR will also be responsible for collecting water samples from the wells at the ENGINEER/GEOLOGIST's direction at any time during construction. No payment will be made for water quality analyses that are not performed by an FDEP and FDOH certified water quality laboratory. Water quality samples will be collected and analyzed for Field and Group 1 parameters.

1. CONTRACTOR shall collect the samples and record the date, time, and drilling depth when the water sample was collected.

C. **Final Water Quality Analyses (LW LFA DZMW-1):** The final wells will be properly purged and sampled by the CONTRACTOR's approved subcontracted laboratory

and the water samples will be analyzed for Thief Water Quality, Field and Group 1 parameters by an FDEP and FDOH certified laboratory.

D. **Development:** All final wells will be purged to develop and sampled by the CONTRACTOR's approved subcontracted laboratory. After removal of a minimum of 3 well volumes from the well and after water quality has stabilized according to FDEP SOPs, the CONTRACTOR's approved subcontracted laboratory shall collect one (1) final water sample and one (1) duplicate water sample for ENGINEER/GEOLOGIST. All samples shall be properly collected, preserved, and analyzed within the required hold time limits. All costs for water sample collection and analyses shall be paid by the CONTRACTOR. Any samples taken during the course of this project shall follow the latest version of the FDEP-SOP procedures (FS 2200 Groundwater Sampling). and the water samples will be analyzed for the following parameters:

   1. **LW SA MW-1, and LW UFA MW-1-Field and Group 1**
   2. **LW LFA DZMW-1-Field and Group 3**

   CONTRACTOR shall provide water sampling station (ports if necessary) for the sampling and monitoring of all produced formation water conveyed to fractionation tank(s), at fractionation tank(s) discharge/outlet port to conveyance tubing, at a port on the LW UFA MW-1, at the mixing point of produced settled fractionation tank water and UFA source water prior to or at discharge point(s) into settling fractionation tank(s), at the beginning of the outlet that will be discharging into Tractor Lake.

E. **LW LFA DZMW-1 Packer Testing Water Quality Samples:** The CONTRACTOR shall be responsible to collect representative water samples at the end of each packer test for Field and Group 2 parameters. No cost may be incurred for samples that are not analyzed by a FDEP and FDOH certified laboratory. CONTRACTOR shall collect the samples and record the date, time, and drilling depth when the sample was collected.

F. **LW LFA DZMW-1 UMZ and LMZ Step Tests Water Quality Samples:** The CONTRACTOR shall be responsible to collect representative water samples at the end of the step test for Field and Group 2 parameters. No cost may be incurred for samples that are not analyzed by a FDEP and FDOH certified laboratory. CONTRACTOR shall collect the samples and record the date, time, and drilling depth when the sample was collected.

G. **LW UFA MW-1 APT Water Quality Samples:** The CONTRACTOR shall be responsible to collect representative water samples at the end of the APT for Field and Group 2 water quality parameters.

H. **Sample Bottles:** Samples for which laboratory analyses are required shall be collected in specially designated and approved sample containers provided by the CONTRACTOR's FDEP and FDOH certified laboratory.

I. **Labeling**: The sample containers shall be clearly labeled with the well identification, the depth or interval below land surface from which the sample was collected, and the time and date of sample collection.

J. **Delivery**: Samples shall be collected and stored in the appropriate manner as instructed by the laboratory, and delivered to the laboratory in accordance with the laboratory's instructions.

K. **Chain of Custody**: Chain of Custody forms shall be completed for all water samples. Copies of the Chain of Custody forms shall be submitted to the ENGINEER/GEOLOGIST within five days of final delivery of the samples to the laboratory. All persons handling the samples shall be required to sign the Chain of Custody form.

L. **Holding Times**: The CONTRACTOR shall be aware of applicable water sampling holding times for the samples for which he is responsible and ensure that the samples are transmitted to the laboratory within these time periods. For samples collected by the laboratory, the CONTRACTOR shall be responsible for the performance of the sub-contractor's service and analysis of the samples within established hold times.

3.4 WATER QUALITY SAMPLING PARAMETERS

Parameter	Field	Group 1	Group 2	Group 3
Temperature	x (field)	x (field)	x (field)	x (field)
pH (field)	x (field)	x (field)	x (field)	x (field)
Conductivity	x (field)	x (field)	x (field)	x (field)
Sulfate	x (field)	x	x	x
Chloride	x (field)	x	x	x
Dissolved Oxygen		x (field)	x (field)	x (field)
Turbidity (field)		x	x	x
pH (lab)		x (GDP)	x	x
Total Alkalinity		x	x	x
Evaporative TDS (at 180C)		x	x	x
Calcium		x	x	x
Copper		x (GDP)	x	x
Silica (reactive)		x	x	x
Turbidity (lab)		x	x	x
Total Suspended Solids		x	x	x
Silt Density Index (15 min)		x (field)	x (field)	x (field)
Hydrogen Sulfide		x (field)	x	x
Barium			x	x
Strontium		x	x	x
Iron (total)		x	x	x
Iron (dissolved)			x	x
Magnesium		x	x	x
Potassium		x	x	x
Fluoride			x	x
Manganese (total)			x	x
Manganese (dissolved)			x	x
Bromide			x	x
Total Organic Carbon		x (GDP)	x	x
Color			x	x
Bacterial Analyses (total plate count)				x
Nitrate + Nitrite				x
Phosphate (total)				x
Phosphate (ortho-P)				x (conc.)
Ammonium				x
Boron				x (conc.)
Aluminum				x (conc.)
UVA-254 and/or THMFP & HAAFP				x (conc.)
Radionuclides				x (conc.)
Remaining Primaries and Secondaries				x

x = lab analysis

x (field) = field measurement

x (conc.) = additional analysis to assist concentrate management assessment

x (GDP) = Generic Discharge Permit Parameters 62-621.300(2),FAC

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SECTION 33 22 16 – WELL PUMP TESTING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. This Section covers the Work, materials, and equipment necessary for performing aquifer performance tests and step rate pumping tests, complete.

B. The total estimated length of the interval tests (step-pumping tests) is 12 hours (a total of four, three hour long steps). Prior to testing there shall be a 2 hour background phase with a 2 hour long pretest phase to test pump with all pump rates. After completion of 12 hour step testing a recovery phase of at least 4 hours will be completed or until water levels recover to 99 percent of pre-pumping conditions. However, the ENGINEER/GEOLOGIST shall determine the actual length of each test and may increase or decrease the test duration as necessary to successfully complete each test.

C. The total estimated length of the aquifer performance test is 216 hours consisting of a 72-hour background phase, a 72-hour constant-rate drawdown phase and a 72-hour recovery phase. A pretest to determine the full range of pumping rates will be conducted for a period of 6 hours. However, the ENGINEER/GEOLOGIST shall determine the actual length of each test and may increase or decrease the test duration as necessary to successfully complete each test.

D. The internal surfaces of the drop pipe, casing and other fittings used for the pumping tests shall be free of rust, scale and other foreign material that could be dislodged and interfere with a test or test performance.

E. The CONTRACTOR shall be responsible for providing on site back-up equipment for all items necessary to perform a successful pumping test. In case of packer/pump failure, pipe blockage, and/or unsatisfactory performance of the CONTRACTOR'S equipment, the pumping test shall be rerun at no additional cost to the SWFWMD.

F. Groundwater sample collection in accordance to **Section 33 22 15** – Well Development and Sampling

G. Water level measuring devices utilized during testing.

1.2 CONTRACTOR SUBMITTALS

A. General: All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00, Contractor Submittals**, and the Supplementary requirements herein. All measurements for depth shall be referenced to existing pad surface at the well location, for which the elevation above NAVD 88 is available.

B. Subcontractors List: The CONTRACTOR shall submit a complete list of all proposed subcontractors to be used in the work. Each subcontractor shall be approved by the ENGINEER/GEOLOGIST. The CONTRACTOR may be required

to submit additional information or a resume of qualifications to the ENGINEER/GEOLOGIST for any of the subcontractors proposed. The ENGINEER/GEOLOGIST reserves the right to disapprove the use of any subcontractor proposed.

C. Instrument Calibrations: Calibration records for all measuring instruments used in the construction of the wells shall be submitted to the ENGINEER/GEOLOGIST for review prior to the installation or use of the instruments. Calibration of instruments shall have been performed within 60 days prior to use in testing. All calibration records shall be submitted to the ENGINEER/GEOLOGIST prior to use.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. GENERAL

i. The CONTRACTOR shall be responsible for providing on Site back-up equipment for all items necessary to perform a successful pumping test. In case of pipe blockage, and/or unsatisfactory performance of the CONTRACTOR'S equipment, the pump test shall be rerun at no additional cost to the ENGINEER/GEOLOGIST.

B. SMALL CAPACITY PUMPS

i. The CONTRACTOR shall be responsible for providing appropriate-sized submersible pumps necessary to successfully complete each pumping test. Two operational submersible pumps shall be on Site; one pump having the capability of pumping 1 to 50 gallon per minute (gpm) and the second pump having the capability of pumping 50 to 300 gpm.

a. The pump shall be fitted with a foot valve.

b. Provide a butterfly valve, or equal, on the discharge side of the pump downstream of the flowmeter for adjustment of flow rate if the test pump engine cannot be sufficiently throttled.

c. Provide a pumping unit prime mover, controls, and appurtenances capable of being operated without interruption for a 24-hour period.

d. Furnish engine-driven equipment or shall make their own arrangements for power for well pumping tests.

e. Install the pump, motor, and discharge head for access to run geophysical logs while pumping, and to provide access for water level measurements by the ENGINEER/GEOLOGIST.

C. LARGE CAPACITY PUMPS

i. The CONTRACTOR shall furnish and install a submersible or turbine pump capable of continuously pumping from 200 to 1,000 gpm against a total head of 200 feet with the pumping bowl set at 150 feet below land surface.

a. The pump shall be fitted with a foot valve.

b. Provide a butterfly valve, or equal, on the discharge side of the pump for adjustment of flow rate down to 500 gpm if the test pump engine cannot be sufficiently throttled.

c. Provide a pumping unit prime mover, controls, and appurtenances capable of being operated without interruption for a 24-hour period.

d. Furnish engine-driven equipment or shall make their own arrangements for power for well pumping tests.

e. Install the pump, motor, and discharge head for access to run geophysical logs while pumping, and to provide access for water level measurements by the ENGINEER/GEOLOGIST.

ii. The CONTRACTOR shall provide all necessary electrical pump wiring and control box, gas-powered, noise suppressed electrical generator, and an on Site qualified operator for the pump and generator for the duration of each pumping test.

iii. The CONTRACTOR shall configure the pumping system so pumping rates may be adjusted as directed by the ENGINEER/GEOLOGIST.

iv. Furnish and install a valve on the discharge side of the pump, downstream of the flowmeter to obtain the optimal discharge rate, shut off flow, and stop gravity drainage.

D. DISCHARGE PIPING

i. Furnish and install all piping and hardware necessary to provide a leak-proof seal at the wellhead and along the discharge line to convey the settled formation waters produced to a specified point of discharge (POD) as specified in **Section 33 22 20, Formation Water Control and Discharge System**.

E. FLOW MEASURING DEVICES

i. During pump testing, the CONTRACTOR shall furnish and install a 2-inch to 18-inch diameter, in-line flowmeter with a flow rate indicator and totalizer that has been calibrated within the last 60 days and a circular orifice weir capable of accurately recording total flow and estimated discharge rates of 25 to 1,000 gpm.

ii. The flowmeter and other meters for use in the pumping test shall have major gradations of 100 gpm and minor gradations of 10 gpm. Accuracy shall be ¼ of 1 percent of full scale.

F. WATER LEVEL MEASURING DEVICES

i. The CONTRACTOR will be responsible for supplying transducers (Insitu® Level Troll or equivalent) and data loggers capable of measuring and

recording water levels on a logarithmic time scale. The pressure transducers/data loggers shall be able to record data in logarithmic mode or at a minimum of 1-second intervals during drawdown and recovery stages. The equipment shall have an appropriate range and accuracy for the well as approved by the ENGINEER/GEOLOGIST prior to testing.

a. The pressure transducers/data loggers shall be calibrated in the well on the day that it is installed for monitoring the tests. The transducer pressure/data logger measurement shall be plotted against depth and a correction formula determined, if deemed necessary by the ENGINEER/GEOLOGIST.

ii. The CONTRACTOR will be responsible for providing access for water-level measurements using an M-scope tape or electronic probe. The CONTRACTOR shall furnish an electrical depth gauge, capable of indicating depths to water to the nearest one-hundredth foot, with a sounding tube placed to the maximum depth to water anticipated. The CONTRACTOR shall provide a clear, flexible plastic manometer tube capable of measuring all anticipated water levels above land surface.

PART 3 -- EXECUTION

3.1 GENERAL

A. Supervision by the CONTRACTOR of pumping tests shall be maintained on a constant basis by qualified personnel.

B. The test durations and pumping rates will be determined by the ENGINEER/GEOLOGIST. During the tests, the CONTRACTOR shall manually record the time, pumping level, and discharge rate at 5-minute intervals.

C. In addition to these measurements, the ENGINEER/GEOLOGIST may require the CONTRACTOR to periodically take and record field measurements (i.e. conductivity, temperature, pH) on the discharge water and/or collect water samples.

D. If the test is aborted or interrupted for any reason, the test shall be stopped, the water level allowed to recover and the test restarted. No payment will be made to the CONTRACTOR for interrupted pumping tests.

E. The CONTRACTOR shall furnish 2 copies of each test's records and results.

F. At the ENGINEER/GEOLOGIST'S discretion, a period of time (up to 12 hours) is required for pump shut down and water level recovery between the individual pump tests. There will be no additional payment for rig time or standby time during these periods of well recovery.

3.2 STEP PUMPING TESTS

A. The LW LFA DZMW-1 will have two step tests conducted, one on the UMZ and one on the LMZ.

B. Development: The CONTRACTOR shall develop the UMZ and LMZ of the LFA DZMW so that it is free of any drilling fluids (and producing representative formation water) and allow the water level in the pipes to return to static. The water produced during development and during the pumping test shall be settled and confined to the closed-circulation system or conveyed to the point of discharge, in accordance with **Section 33 22 20, Formation Water Control and Discharge System**.

C. Prior to pump testing, background water levels shall be recorded for a period of at least 2 hours or until water levels have stabilized as determined by the ENGINEER/GEOLOGIST.

D. Conduct a preliminary capacity test to determine full range of pumping rates for a period of 2-hours.

E. Operate equipment continuously at a rate and duration as specified by the ENGINEER/GEOLOGIST. The step test will be conducted in four continuous phases, development, background, pumping, and recovery. The duration of both step tests will be 12 hours and each step duration will be 3 hours, with respective target pump rates of up to 75 gpm, 175 gpm, 275 gpm, and 300 gpm or other suitable rates selected by the ENGINEER/GEOLOGIST.

F. Static water level shall be allowed to recover for approximately 4 hours or until water levels recover to 99 percent of pre-pumping conditions.

G. Upon completion of the interval test, the CONTRACTOR shall be responsible to pull/remove the submersible/turbine pump and drop pipe from the well, reseal the wellhead, and dismantle the discharge line, if necessary

3.3 AQUIFER PERFORMANCE TEST

A. The LW UFA MW-1 will have an APT conducted on the UFA.

B. Conduct a preliminary specific capacity test to determine full range of pumping rates for a period of 6-hours.

C. Operate equipment continuously at a rate (300 GPM) and duration (72-hours) as specified by the ENGINEER/GEOLOGIST. The CONTRACTOR shall also provide an onsite qualified operator to operate the pump and generator, if necessary, and to regulate a constant discharge rate for the duration of the pumping test.

D. Static water level shall be allowed to recover for approximately 72 hours or until water levels recover to 99 percent of pre-pumping conditions.

E. Upon completion of the aquifer performance test, the CONTRACTOR shall be responsible to pull/remove the submersible/turbine pump and drop pipe from the well, reseal the wellhead, and dismantle the discharge line, if necessary

3.4 WATER DISPOSAL

A. Disposal of water shall be the responsibility of the CONTRACTOR. CONTRACTOR's method of disposal shall follow an approved route, prevent re-circulation of discharged water into the interval tested until authorized to do so, and provide for erosion control and sedimentation along the entire flow route.

A. Water will require settling to reduce turbidity prior to disposal or re-circulation into the well following the test. ENGINEER/GEOLOGIST must approve methods of settling excess turbidity prior to commencing each pumping test. CONTRACTOR is responsible for meeting turbidity requirements prior to discharge water entering the receiving waters if that option is considered and approved by the ENGINEER/GEOLOGIST. The CONTRACTOR shall perform water disposal in accordance with **Section 33 22 20, Formation Water Control and Discharge**.

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SECTION 33 22 17 – PACKER TESTING

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. This Section covers the Work, materials, and equipment necessary for performing single packer and/or straddle-packer tests.

B. Single packer and/or straddle-packer test shall be performed in the open-hole section of the pilot-hole to determine the hydrologic properties of the formations and to collect representative formation water samples.

C. Packer testing will include straddle-packer tests of specific intervals and may also include single-packer tests to test zones above and/or below the packer.

D. Groundwater sample collection will occur during packer testing.

E. Water level measuring devices will be utilized during testing.

F. The CONTRACTOR shall provide all temporary transducers (at least 6) required for all drilling and testing activities. All temporary transducers shall be properly maintained, calibrated, and stored when not in use. All transducers shall be in proper work order at all times. All transducers in completed wells during construction shall be recording at agreed upon intervals with ENGINEER/GEOLOGIST throughout construction with equally agreed upon data downloads with ENGINEER/GEOLOGIST to prevent data loss. During testing all transducers will be programmed, recording throughout testing, and data will be downloaded at agreed upon times with ENGINEER/GEOLOGIST.

1.2 CONTRACTOR SUBMITTALS

A. General: All CONTRACTOR submittals shall conform to the applicable requirements of **Section 01 33 00, Contractor Submittals**, and the Supplementary requirements herein. All measurements for depth shall be referenced to existing pad surface at the well location, for which the elevation above NAVD 88 is available.

B. Subcontractors List: The CONTRACTOR shall submit a complete list of all proposed subcontractors to be used in the work. Each subcontractor shall be approved by the ENGINEER/GEOLOGIST. The CONTRACTOR may be required to submit additional information or a resume of qualifications to the ENGINEER/GEOLOGIST for any of the subcontractors proposed. The ENGINEER/GEOLOGIST reserves the right to disapprove the use of any subcontractor proposed.

C. Instrument Calibrations: Calibration records for each measuring instrument used in the construction of the wells shall be submitted to the ENGINEER/GEOLOGIST for review prior to the installation or use of the instruments. Calibration of instruments shall have been performed within 60

days prior to use in testing. All calibration records shall be submitted to the ENGINEER/GEOLOGIST prior to use.

PART 2 -- PRODUCTS

2.1 EQUIPMENT

A. GENERAL

i. The CONTRACTOR shall be responsible for providing on site back-up equipment for all items necessary to perform a successful pumping test. In case of packer/pump failure, pipe blockage, and/or unsatisfactory performance of the CONTRACTOR'S equipment, the packer test shall be rerun at no additional cost to the OWNER.

B. SMALL CAPACITY PUMPS

1. The CONTRACTOR shall be responsible for providing appropriate-sized submersible pumps necessary to successfully complete each packer pumping test. Two operational submersible pumps shall be on Site; one pump having the capability of pumping 1 to 50 gallon per minute (gpm) and the second pump having the capability of pumping 50 to 300 gpm.

i. The pump shall be fitted with a foot valve.

ii. Provide a butterfly valve, or equal, on the discharge side of the pump downstream of the flowmeter for adjustment of flow rate if the test pump engine cannot be sufficiently throttled.

iii. Provide a pumping unit prime mover, controls, and appurtenances capable of being operated without interruption for a 24-hour period.

iv. Furnish engine-driven equipment or shall make their own arrangements for power for well pumping tests.

v. Install the pump, motor, and discharge head for access to run geophysical logs while pumping, and to provide access for water level measurements by the ENGINEER/GEOLOGIST.

2. The CONTRACTOR shall provide all necessary electrical pump wiring and control box, gas-powered, noise suppressed electrical generator, and an onsite qualified operator for the pump and generator for the duration of each packer test.

3. The CONTRACTOR shall configure the pumping system so pumping rates may be adjusted as directed by the ENGINEER/GEOLOGIST.

4. Furnish and install a valve on the discharge side of the pump, downstream of the flowmeter to obtain the optimal discharge rate, shut off flow, and stop gravity drainage.

C. LARGE CAPACITY PUMPS

i. The CONTRACTOR shall furnish and install a submersible or turbine pump capable of continuously pumping from 200 to 1,000 gallons per minute against a total head of 200 feet with the pumping bowl set at 150 feet below land surface.

   a. The pump shall be fitted with a foot valve.

   b. Provide a butterfly valve, or equal, on the discharge side of the pump for adjustment of flow rate down to 500 gpm if the test pump engine cannot be sufficiently throttled.

   c. Provide a pumping unit prime mover, controls, and appurtenances capable of being operated without interruption for a 24-hour period.

   d. Furnish engine-driven equipment or shall make their own arrangements for power for well pumping tests.

   e. Install the pump, motor, and discharge head for access to run geophysical logs while pumping, and to provide access for water level measurements by the ENGINEER/GEOLOGIST.

D. DISCHARGE PIPING

1. Furnish and install all piping and hardware necessary to provide a leak-proof seal at the wellhead and along the discharge line to convey the mixed settled formation waters produced to a specified point of discharge (POD) as specifies in **Section 33 22 20, Formation Water Control and Discharge System**.

E. FLOW MEASURING DEVICES

1. During packer testing, the CONTRACTOR shall furnish and install a 2-inch to 18-inch diameter, in-line flowmeter with a flow rate indicator and totalizer that has been calibrated within the last 60 days and a circular orifice weir capable of accurately recording total flow and estimated discharge rates of 25 to 1,000 gpm.

2. The flowmeter and other meters for use in packer testing shall have major gradations of 100 gpm and minor gradations of 10 gpm. Accuracy shall be ¼ of 1 percent of full scale.

F. PACKERS AND TUBING

1. The inflatable packers shall be Baski, Tam J, or Lynes Models 303-04, dual seal open-hole packers, or equivalent of a diameter appropriate for the size of the hole actually drilled (ranging between 12 to 18-inches).

2. The pipe used between the inflatable packers shall consist of appropriate diameter steel pipe or tubing. The pipe/tubing shall be uniformly slotted; the slots shall be distributed near the top, middle, and bottom of the tubing with the slotted openings. The minimum separation between individual packers shall be 10 feet.

3. The inflatable packer assembly shall be connected to 6-inch internal diameter drill pipe. The CONTRACTOR shall ensure the appropriate steel pipe or tubing, joints and packer(s) do not leak during testing operations.

G. WATER LEVEL MEASURING DEVICES

1. The CONTRACTOR will be responsible for supplying transducers (Insitu® Level Troll or equivalent) and data loggers capable of measuring and recording water levels on a logarithmic time scale. The pressure transducers/data loggers shall be able to record data in logarithmic mode or at a minimum of 1-second intervals during drawdown and recovery stages. The equipment shall have an appropriate range and accuracy for the well as approved by the ENGINEER/GEOLOGIST prior to testing.

   i. The pressure transducers/data loggers shall be calibrated in the well on the day that it is installed for monitoring the tests. The transducer pressures/data loggers measurement shall be plotted against depth and a correction formula determined, if deemed necessary by the ENGINEER/GEOLOGIST.

2. The CONTRACTOR will be responsible for providing access for water-level measurements using an M-scope tape or electronic probe. The CONTRACTOR shall furnish an electrical depth gauge, capable of indicating depths to water to the nearest one-hundredth foot, with a sounding tube placed to the maximum depth to water anticipated. The CONTRACTOR shall provide a clear, flexible plastic manometer tube capable of measuring all anticipated water levels above land surface.

PART 3 -- EXECUTION

3.1 GENERAL

A. Supervision by the CONTRACTOR of packer tests shall be maintained on a constant basis by qualified personnel.

B. Prior to packer testing, background water levels shall be recorded for at least 2 hours or until water levels have proven stabile as determined by the ENGINEER/GEOLOGIST.

C. The test durations will be a minimum of 8-hours in duration and/or three well volumes and pumping rates will be determined by the ENGINEER/GEOLOGIST. During the tests, the CONTRACTOR shall manually record the time, pumping level, and discharge rate at 5-minute intervals. When the test is completed, the pump shall be stopped and the water level in the well shall be allowed to recover for a period of at least 24 hours or a duration determined by the ENGINEER/GEOLOGIST.

D. In addition to these measurements, the ENGINEER/GEOLOGIST may require the CONTRACTOR to periodically take and record field measurements (i.e. conductivity, temperature, pH) on the discharge water and/or collect water samples.

E. If the test is aborted or interrupted for any reason, the test shall be stopped, the water level allowed to recover and the test restarted. No payment will be made to the CONTRACTOR for interrupted pumping tests.

F. The CONTRACTOR shall furnish 2 copies of each test's records and results.

3.2 INFLATABLE PACKERS AND TUBING

A. The inflatable packers shall be Baski, Tam J, or Lynes Models 303-04, dual seal open-hole packers, or equivalent of a diameter appropriate for the size of the hole actually drilled (ranging between 12 to 18-inches).

B. The pipe used between the inflatable packers shall consist of appropriate diameter steel pipe or tubing. The pipe/tubing shall be uniformly slotted; the slots shall be distributed near the top, middle, and bottom of the tubing with the slotted openings occupying at least 25 percent of the surface area. The minimum separation between individual packers shall be 10 feet.

C. The inflatable packer assembly shall be connected to 6-inch internal diameter drill pipe. The CONTRACTOR shall ensure the stand pipe and joints do not leak during testing operations.

3.3 SINGLE AND/OR STRADDLE PACKER TESTS

A. Dual-Zone Monitor Well Packer Tests

Type of Packer	Maximum Number of Packer Tests	Testing Interval (feet bls)
Single/Straddle	Up to 3	475 – 1,425
Single/Straddle	Up to 5	1,415 – 2,600

B. Packer Testing: The internal surfaces of drill pipe, casings, and other fittings used for the tests shall be free of rust, scale, and other material that could be dislodged and interfere with the packer tests.

C. Packer Test Failure: Should a test fail because of the presence of any rust or scale, or other foreign material in the tools or pipe, or due to leakage past the packer, the CONTRACTOR will not be reimbursed for the test and he will be required to clean, repair or replace the pipe, reset it and the packer, and re-run the test successfully as part of the Contract requirements at his own cost. The CONTRACTOR will be given the opportunity to evaluate the ENGINEER/GEOLOGIST's packer depth selection before commencing packer setting. There will be no additional payment for rig time or standby time during these periods of well recovery.

D. Single Packer Test: A single packer will be set on open-ended drill pipe at a depth to be specified by the ENGINEER/GEOLOGIST for a single packer test. The pumped interval between the single packer and the bottom of the borehole shall

be equipped with a pressure transducer/data logger that will record changes in pressure. A pressure transducer/data logger shall also be located in the annular space to detect for leaks within the packer. The test is expected to be conducted for a period of 8-hours or until water levels have stabilized. The pressure data shall also be recorded in an electronic format for downloading as a Log ASCII Standard (*.las) file, Comma-Separated Values file (*.csv) and Portable Document Format (*.pdf) file to the ENGINEER/GEOLOGIST. There shall be a background period and a recovery period at length of time selected by the ENGINEER/GEOLOGIST.

E. Straddle Packer Test: The tests shall be performed using two inflatable packers with a section of perforated pipe between them installed in the borehole. The surface area of perforations shall meet or exceed the ID of the drill pipe. The pumped interval between the straddle packers shall be equipped with a pressure transducer/data logger that will record changes in pressure. The lower packer shall be equipped with a pressure transducer/data logger that shall display the down-hole pressure during the test. A pressure transducer/data logger shall also be located in the annular space to detect for leaks within the packer. The pressure data shall also be recorded in an electronic format for downloading as a Log ASCII Standard (*.las) file, Comma-Separated Values file (*.csv) and Portable Document Format (*.pdf) file to the ENGINEER/GEOLOGIST. The test is expected to be conducted for a period of 8-hours or until water levels have stabilized. There shall be a background period and a recovery period at length of time selected by the ENGINEER/GEOLOGIST.

F. Development: After successfully inflating and setting the packer and before the CONTRACTOR conducts a pumping and recovery test for each packer test, the CONTRACTOR shall develop each zone so that it is free of any drilling mud/fluids (and producing representative formation water) and allow the water level in the pipes to return to static. It is anticipated that rates of between 1 and 300 gpm will be obtained during the packer testing. The water produced during development and during packer testing shall be confined to the closed-circulation system or discharged to the discharge point as low turbidity water.

G. If considerable quantities of fines are pumped out of the well during the test, CONTRACTOR shall discontinue the test and resume well development. ENGINEER/GEOLOGIST shall be the sole judge as to whether such additional development is necessary.

H. After completion of the test, CONTRACTOR shall sound the well and remove any sand or silt accumulated in the well as a result of the test.

I. If, following development of a packer(s) interval intended to demonstrate confinement, the recovery period has extended to 6 hours with less than 50 percent recovery, the straddle packer will be deflated to allow the water level to return to within 95 percent of the static water level. Data loggers/pressure transducers shall be in operation during this procedure. Following re-inflation of the packer(s) a background period will begin and the test will immediately follow.

J. Operate equipment continuously at a rate and duration as specified by the ENGINEER/GEOLOGIST. Begin pumping the well at a constant-rate between 1 and 300 gpm for a period of 8 hours.

K. Just prior to completion of each packer test, after a minimum of three well volumes have been purged from the well, the CONTRACTOR shall collect a water sample from the discharge and have the following analyses performed by a State-certified laboratory approved by the ENGINEER/GEOLOGIST: List B in accordance to **Section 33 22 15, Well Development and Sampling**. The laboratory shall be certified by FDEP and have a current, approved QAPP (Quality Assurance Project Plan) on file with FDEP.

L. Just prior to completion of each packer test, after a minimum of three well volumes have been purged from the well and in accordance with **Section 33 22 15, Well Development and Sampling**, the CONTRACTOR shall collect a five-gallon water sample from the discharge. The sample shall be transmitted to Florida Geological Survey, ATTENTION: Hydrogeology Administrator, 903 West Tennessee Street, Tallahassee, Florida 32304.

M. Static water level shall be allowed to recover to 95 percent of pre-pumping conditions unless otherwise directed by the ENGINEER/GEOLOGIST. Remove all pressure transducers/data loggers and submersible pump from the standpipe.

N. Remove pumping equipment, deflate the packer(s), reset the next interval, inflate packer(s), and repeat packer testing as per above. The ENGINEER/GEOLOGIST reserves the right to require variable spacing between packers for each test. In case of packer failure, pipe blockage, and/or unsatisfactory performance of the CONTRACTOR'S equipment, the test shall be rerun at no additional cost to the OWNER.

3.4 WATER DISPOSAL

A. Disposal of water shall be the responsibility of the CONTRACTOR. CONTRACTOR's method of disposal shall follow an approved route, prevent re-circulation of discharged water into the interval tested until authorized to do so, and provide for erosion control and sedimentation along the entire flow route.

B. Water will require settling to reduce turbidity prior to disposal or re-circulation into the well following the test. ENGINEER/GEOLOGIST must approve methods of settling excess turbidity prior to commencing each pumping test. CONTRACTOR is responsible for meeting turbidity requirements prior to discharge water entering the receiving waters if that option is considered and approved by the ENGINEER/GEOLOGIST. The CONTRACTOR shall perform water disposal in accordance with **Section 33 22 20, Formation Water Control and Discharge.**

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SECTION 33 22 20 - FORMATION WATER CONTROL AND DISCHARGE SYSTEM

PART 1 – GENERAL

1.1 GENERAL

A. This section covers the Work, material, equipment, and temporary facilities necessary to meet the FDEP-issued National Pollutant Discharge Elimination System (NPDES) Generic Surface Discharge permit criteria regulating produced formation water discharges to surface water, or other locally regulated discharge requirements.

B. This section covers formation water to be discharged to Tractor Lake; produced during drilling and testing operations in accordance with **Section 01 10 00, Summary of Work**; **Section 33 22 11, Well Drilling**; **Section 33 22 15, Well Development and Sampling**; and **Section 33 22 16, Pump Testing**.

C. The CONTRACTOR may utilize equipment as detailed below. CONTRACTOR shall provide all piping, couplings, and valves to convey produced water to fractionation tank(s) and UFA source water and produced water to be mixed at discharge point(s) into the fractionation tank(s) to settle and to Tractor Lake and control flow rates so as not to surcharge the capacity of the fractionation tank(s).

1.2 THE REQUIREMENT

A. The CONTRACTOR shall submit to the ENGINEER/GEOLOGIST and the SWFWMD a plan for drilling, development, settling, mixing, conveyance and discharge water disposal. The plan shall consist of pipe lengths, diameters, and materials, meter installation locations; turbidity barrier and erosion control measure manufacturer, design and placement; monitoring station identification, location, sample method, laboratory, and list of water quality analyses and sample frequency in accordance with the requirements, if necessary, to meet local, state and federal regulations and requirements.

B. Multiple settling methods may be required by the CONTRACTOR before the mixed settled water can be allowed to discharge into Tractor Lake. The CONTRACTOR may consider using two or more methods simultaneously to meet permit requirements.

C. CONTRACTOR shall provide water sampling station (ports if necessary) for the sampling and monitoring of all produced formation water conveyed to fractionation tank(s), at fractionation tank(s) discharge/outlet port to conveyance tubing, at a port on the LW UFA MW-1, at the mixing point of produced settled fractionation tank water and UFA source water prior to or at discharge point(s) into fractionation tank(s) to settle, at the beginning of the outlet that will be discharging into Tractor Lake.

D. If any negative environmental impacts occur during this project as a result of well development, the well development process shall be immediately terminated and alternate arrangements shall be made to the satisfaction of the CONSULTANT.

PART 2 – PRODUCTS

2.1 GENERAL:

A. Provide all labor, materials, equipment, and temporary facilities to comply with local, state and federal regulations and requirements regulating mixed settled formation water discharges to Tractor Lake.

2.2 EQUIPMENT:

A. The CONTRACTOR shall furnish and install a discharge line to convey water to the fractionation tank(s) and from fractionation tank(s) to discharge point(s) into the fractionation tank(s) for settling.

B. THE CONTRACTOR shall be responsible for providing and maintaining all necessary equipment, supplies, discharge lines, valves, and ports needed in the construction and maintenance of the discharge lines from any well (testing/developing) and from the UFA SW to the fractionation tank (s) and from the fractionation tanks to the combined mixing lines that convey discharged water to settle in fractionation tank(s). Then to ultimately be conveyed to Tractor Lake.

C. The CONTRACTOR shall provide, maintain, and operate fractionation tanks with a minimum total capacity of 100,000 gallons for settling of solids from the formation water drilling and testing operation as specified. The multiple tanks shall be connected in series using the uppermost discharge port(s) to provide sufficient retention time for solid separation. A 5-micron bagged filtration system (can be multiple if multiple points) shall be used in-line after flow is mixed but before discharge to Tractor Lake. The CONTRACTOR may propose an alternate filtration and retention system by submitting to the ENGINEER/GEOLOGIST the applicable design drawings and material specifications. The proposed system shall conform to all local, state, and federal regulations and must be approved by the ENGINEER/GEOLOGIST.

D. The CONTRACTOR shall provide, maintain, and operate fractionation tank(s) for mixing and dilution of potential brackish LFA water produced during drilling, step testing, APTs, and well development.

E. All fractionation tanks shall be lined with an impermeable blanket with a surrounding berm contained with a silt fence.

B. The CONTRACTOR shall provide all necessary transmission piping, coupling, pumps, and other items needed to assemble, operate, and maintain the formation-water filtration-retention system and fractionation tank(s).

C. The CONTRACTOR shall provide, maintain, and operate de-silting/de-sanding cyclone-type separators in conjunction with mechanical filtration (e.g., bag system) devices in combination with the retention system to reduce formation water turbidity to acceptable levels prior to discharge.

D. Furnish and install the length of 12- or 16-inch diameter piping and appurtenances to convey the produced formation waters to the fractionation tank(s) to be mixed and settle, and from the fractionation tank(s) to Tractor Lake.

E. The CONTRACTOR shall furnish and install an in-line flowmeter with a flow rate indicator and totalizer that has been calibrated within the last 60 days and capable of measuring discharge rates of 100 to 4,000 gallons per minute.

PART 3- EXECUTION

3.1 GENERAL:

A. Configure and construct the temporary control and discharge system as appropriate to meet local, state and federal regulations and requirements. Bidders are advised to carefully inspect the proposed sites before preparing their bid submittal. The removal and replacement of minor above-ground obstructions such as fence posts, or concrete posts, conduit, and similar items shall be anticipated and accomplished.

B. Inspect and maintain filtration-retention-discharge system for leaks and make repairs as necessary or as directed by the ENGINEER/GEOLOGIST.

C. Clean fractionation tanks and tanks of solids and turbid waters using a vacuum truck and dispose of in accordance with local, state, and federal regulations. Accomplishing this task shall be considered incidental to the Work and will not result in additional compensation to the CONTRACTOR.

D. The CONTRACTOR shall coordinate formation water discharge activities with the ENGINEER/GEOLOGIST. Operate the system in conformance with local, state and federal regulations and requirements using water quality readings obtained from the onsite-monitoring program. If monitoring data indicates non-compliance, discharges shall be discontinued until parameter levels are below permitted limits. This time shall be considered incidental to the Work and will not result in additional compensation to the CONTRACTOR.

E. The CONTRACTOR shall monitor and maintain the in-line flowmeter installed on the discharge pipe at the POD. Flowmeter readings shall be obtained before the start of discharge activities and at the end of each workday. The drilling superintendent shall report these readings on the daily activity sheets. The CONTRACTOR shall ensure that the discharge line is full for accurate flowmeter reading by employing an appropriate back-pressure device such as orifice weir.

F. The control and discharge system may require modifications based on Site activity and associated quality and quantity of settled formation water (e.g., reverse-air drilling pump tests, etc.). The CONTRACTOR will not be compensated for these modifications and these costs should be considered as part of the lump sum associated with mobilization, demobilization, and site restoration.

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SECTION 33 22 21 – WELLHEAD AND WELL PAD

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. All work specified herein shall conform to or exceed the requirements of the applicable codes and standards relating to the referenced portions of the following documents only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

1.2 GENERAL

A. Like items of equipment specified herein shall be the end products of one manufacturer in order to achieve standardization for operation, maintenance, spare parts and manufacturer's service.

1.3 SUBMITTALS

A. Submittals shall be made in accordance with **Section 01 33 00, Contractor Submittals**.

PART 2 -- PRODUCTS

2.1 GENERAL:

A. The CONTRACTOR shall provide all materials, equipment, and appurtenances necessary to construct and install a 316L Stainless Steel, leak proof, wellhead, as specified and shown in the Drawings.

B. The CONTRACTOR shall provide all material and equipment to construct a reinforced concrete apron at the base of the wellhead as shown on the Drawings.

C. All valves shall be complete with all necessary operating handwheels, extension stems, worm and gear operators, operating nuts, chains and wrenches, which are required for the proper completion of the work included under this Section.

D. Renewable parts including discs, packing and seats shall be of types recommended by valve manufacturer for intended service.

E. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached plate in raised letters.

F. For the purpose of designating the type and grade of valve desired, a manufacturer's name and list or figure number is given in the following specifications. Valves of equal quality by other manufacturers will be considered in accordance with the General Conditions.

2.2 DESIGN FEATURES:

A. Brass and Bronze Components:

1. Brass and bronze components of valves and appurtenances, which have surfaces in contact with the water shall be alloys containing less than sixteen percent zinc and two percent aluminum.

2. Approved Alloys are of the Following ASTM Designations:

a. B61, B62, B98 (Alloy A, B, or D) B139 (Alloy A), B143

b. (Alloy 1-B), B164, B194, B292 (Alloy A), and B127.

3. Schedule 80 Super Duplex stainless steel may be substituted for bronze at the option of the manufacturer and with the approval of the ENGINEER/GEOLOGIST.

All gland bolts on iron body valves shall be bronze and shall be fitted with brass nuts.

2.3 VALVE OPERATORS

A. See previous Paragraph DESIGN FEATURES, for additional material requirements

B. All valve operators shall open by turning counterclockwise. Handwheel operators shall be provided unless otherwise shown or specified. Worm and gear operators used on manually operated valves shall be of totally enclosed design, so proportioned as to permit operation of the valve under full operating head with a maximum pull of forty (40) pounds on the handwheel or crank. The valve operators shall be of self-locking type to prevent the disc or plug from creeping. Self-locking worm gears shall be a one-piece design of gear bronze material, accurately machine cut. The worm shall be hardened alloy steel, with thread ground and polished. The reduction gearing shall run in a proper lubricant. Valve operators shall be provided with position indicators, where specified, to show the position of the valve disc or plug. Handwheels shall be galvanized and painted the same color as the valve and associated pipeline.

2.4 TAGGING REQUIREMENTS

A. Each valve operator shall be provided with a 1-1/2 inch minimum diameter heavy brass tag. Each tag shall bear the valve number as specified by the ENGINEER/GEOLOGIST.

B. The tags shall be attached to the operator with soldered split key rings so that ring and tag cannot be removed. The numbers and letters shall be of block type, with 1/4-inch high numbers and letters stamped thereon and filled with black enamel.

2.5 GATE VALVES

A. V120: Gate valves 2-1/2 inches and larger for water service shall be iron body, bronze mounted valves with flanged ends, solid wedge gate, and outside screw and yoke. Valves shall be rated 300-pound SWP, 350-pound WOG and shall be Walworth, Crane, or equal.

2.7 REINFORCING STEEL

A. Provide ASTM A615, Grade 60, No. 4 reinforce bar for concrete reinforcement.

2.8 FORMS:

A. Wood forms shall be of a rigidity and height as to produce straight, uniform edges to finished product. Pad shall have a broom finish.

2.9 EXPANSION JOINT FILLER:

A. ASTM D994, Bitumen type - 1/2-inch thick shall be installed between the well casing and the concrete pad.

PART 3 -- EXECUTION

3.1 GENERAL

A. Bolt holes of flanged valves shall straddle the vertical centerline of the pipe run. Prior to installing flanged valves, the flange faces shall be thoroughly cleaned. After cleaning, insert gasket and bolts, and tighten the nuts progressively and uniformly. If flanges leak under pressure, loosen or remove the nuts and bolts, reseat or replace the gasket, retighten and/or reinstall the nuts and bolts, and retest the joints. Joints shall be watertight at test pressures before acceptance.

B. Thoroughly clean threads of screwed joints by wire brushing, swabbing, or other approved methods. Apply approved joint compound to threads prior to making joints. Joints shall be watertight at test pressures before acceptance.

3.2 WELLHEAD PLACING

A. Generally, unless otherwise indicated on the Drawings, all valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor or grade shall be installed with their operating stems vertical. Valves installed in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the finish floor or grade shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems oriented to facilitate the most practicable operation.

3.3 WELL PAD COMPLETION

A. The CONTRACTOR shall construct permanent reinforced concrete well pads after development of the wells as indicated and in accordance with **Section 33 22 15, Well Development and Sampling**. Design of the permanent well pads shall conform to all applicable regulations.

B. The CONTRACTOR shall submit copies of the permanent well pad designs to the ENGINEER/GEOLOGIST prior to construction for approval.

3.4 TESTING

A. Wellhead fittings and valves shall be field tested for leaks. The test shall be performed at 150 psi for 30 minutes with no pressure loss. Joints shall show no visible leakage under test. Repair all joints that show signs of leakage prior to final acceptance. If there are any special parts of control systems or operators that might be damaged by the pipeline test, they shall be properly protected. The SUBCONTRACTOR will be held responsible for any damage caused by the testing.

B. If requested by the ENGINEER/GEOLOGIST, the valve manufacturer shall furnish an affidavit stating the materials option furnished and/or that he has complied with these and other referenced Specifications.

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SECTION 43 10 50 - PIPING, GENERAL

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. Provide the piping systems indicated, complete and operable, in accordance with the Contract Documents.

B. The provisions of this Section shall apply to piping sections in Divisions 33 and 43.

C. The mechanical Drawings define the general layout, configuration, routing, method of support, pipe size, and pipe type.

D. The mechanical Drawings are not pipe construction or fabrication Drawings.

E. Where pipe supports and spacing are indicated on the Drawings and are referenced to a Standard Detail, the CONTRACTOR shall use that Detail.

F. Where pipe supports are not indicated on the Drawings, it is the CONTRACTOR'S responsibility to develop the details necessary to design and construct mechanical piping systems to accommodate the specific equipment provided, and to provide spacers, adapters, and connectors for a complete and functional system.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with **Section 01 33 00** – Contractor Submittals.

B. Shop Drawings: Shop Drawings shall contain the following information:

1. Drawings: Layout Drawings including necessary dimensions, details, pipe joints, fittings, specials, bolts and nuts, gaskets, valves, appurtenances, anchors, guides, and material lists. Fabrication drawings shall indicate spacers, adapters, connectors, fittings, and pipe supports to accommodate the equipment and valves in a complete and functional system.

2. Thermoplastic Pipe Joints: Submit solvent cement manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.

3. Gasket Material: Submit gasket manufacturer's catalog indicating that the recommended product is suitable for each fluid service application.

4. Modular Seals for Pipe: Manufacturer's catalog sheet showing materials and installation procedures.

C. Samples

1. Performing and paying for sampling and testing as necessary for certifications are the CONTRACTOR'S responsibility.

D. Certifications

1. Necessary certificates, test reports, and affidavits of compliance shall be obtained by the CONTRACTOR.

2. A certification from the pipe fabricator that each pipe will be manufactured subject to the fabricator's or a recognized Quality Control Program. An outline of the program shall be submitted to the ENGINEER\GEOLOGIST for review prior to the manufacture of any pipe.

1.3 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. Piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground for protection against oxidation caused by ground contact.

B. Defective or damaged materials shall be replaced with new materials.

PART 2 -- PRODUCTS

2.1 GENERAL

A. Extent of Work

1. Pipes, fittings, and appurtenances shall be provided in accordance with the requirements of the applicable Sections of Divisions 33 and 43 and as indicated.

2. Materials in contact with potable water shall be listed as compliant with NSF Standard 61.

B. Inspection

1. Pipe shall be subject to inspection at the place of manufacture.

2. During the manufacture, the ENGINEER\GEOLOGIST shall be given access to areas where manufacturing is in progress and shall be permitted to make inspections necessary to confirm compliance with requirements.

C. Tests

1. Except where otherwise indicated, materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards.

2. Welds shall be tested as indicated.

3. The CONTRACTOR shall be responsible for performing material tests.

D. Welding Requirements

1. Qualification of welding procedures used to fabricate pipe shall be in accordance with the provisions of AWS D1.1 - Structural Welding Code or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.

2. Welding procedures shall be submitted for the ENGINEER/GEOLOGIST'S review.

E. Welder Qualifications

1. Welding shall be performed by skilled welders and welding operators who have adequate experience in the methods and materials to be used.

2. Welders shall be qualified under the provisions of AWS D1.1 or the ASME Boiler and Pressure Vessel Code, Section 9, whichever is applicable.

3. Machines and electrodes similar to those used in the Work shall be used in qualification tests.

4. Qualification testing of welders and materials used during testing is part of the Work.

2.2 PIPE FLANGES

A. General

B. Flanges shall be provided with flat faces and shall be attached with bolt holes straddling the vertical axis of the pipe unless otherwise indicated.

C. Attachment of the flanges to the pipe shall conform to the applicable requirements of AWWA C207.

D. Flange faces shall be perpendicular to the axis of the adjoining pipe.

E. Flanges for miscellaneous small diameter pipes shall be in accordance with the standards indicated for these pipes.

F. Pressure Ratings

1. 150 psig or less: Flanges shall conform to either AWWA C207 - Steel Pipe Flanges for Waterworks Service--Sizes 4 In. Through 144 In., Class D, or ASME B16.5 - Pipe Flanges and Flanged Fittings, 150 lb class.

2. 150 psig to 275 psig: Flanges shall conform to either AWWA C207 Class E or Class F, or ASME B16.5 150 lb class.

3. 275 psig to 700 psig: Flanges shall conform to ASME B16.5, 300 lb class.

4. Selection Based on Test Pressure

a. Do not expose AWWA flanges to test pressures greater than 125 percent of rated capacity.

b. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected.

G. Blind Flanges

1. Provide blind flanges in accordance with AWWA C207, or as indicated for miscellaneous small pipes.

2. Blind flanges for pipe sizes with a 12-inch diameter and greater shall be provided with lifting eyes in the form of welded or screwed eye bolts.

H. Flange Coating

1. Machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

I. Flange Bolts

1. Bolts and nuts shall conform to the requirements of **Section 05 50 00** – Miscellaneous Metalwork.

2. Use all-thread studs on valve flange connections where space restrictions preclude the use of regular bolts.

2.3 THREADED INSULATING CONNECTIONS

A. General

1. Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials

1. Threaded insulating connections shall be constructed of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.4 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. General

1. Provide cast mechanical-type couplings where indicated, conforming to the requirements of AWWA C606 - Grooved and Shouldered Joints.

2. Bolts and nuts shall conform to the requirements of **Section 05 50 00** – Miscellaneous Metalwork.

3. Gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations.

4. The wall thickness of grooved piping shall conform to the coupling manufacturer's recommendations to suit the highest expected pressure.

5. In order to avoid excessive load on equipment caused by pipe movement due to steady state or transient pressure conditions, equipment connections with mechanical-type couplings shall be provided with rigid grooved couplings or flexible type coupling with harness in sizes where rigid type couplings are not available, unless thrust restraint is provided by other means.

6. Mechanical type couplings shall be bonded.

7. The CONTRACTOR shall have the coupling manufacturer's service representative verify the correct choice and application of couplings and gaskets, and the workmanship, to assure a correct installation.

8. In order to assure uniform and compatible piping components, grooved fittings, couplings, and valves shall be furnished by the same manufacturer as the coupling.

9. Grooving tools shall be from the same manufacturer as the grooved components.

B. PVC Pipe Couplings Manufacturer, or Equal

1. **Gustin-Bacon, (Aeroquip Corp)**

2. **Victaulic Style 775**

Note: Couplings for PVC pipe shall be furnished with radius cut or standard roll grooved pipe ends.

2.5 SLEEVE–SPLIT TYPE COUPLINGS (**Depend-O-Lok**, or equal)

A. General

1. Provide sleeve-split type couplings where indicated.

B. Construction

1. Couplings shall be of the split-type, consisting of one- or 2-piece housing, gasket assembly, bolts and nuts, and end rings.

2. The double arch cross section that closes around the pipe ends shall be smooth in order to allow for expansion or contraction requirements.

3. The pipe ends with steel end rings affixed shall provide restraint requirements.

4. As the coupling closes, it shall confine the elastomeric gasket beneath the arches of the sleeve to create a radial seal.

5. The axial seal shall squeeze the closure plates as the bolts pull the coupling snug around the pipe.

6. The coupling shall permit angular pipe deflection, flexibility, contraction and expansion, as designed by the manufacturer.

7. The coupling housing shall be designed for internal pressure and external loads as determined by the design procedures of AWWA M-11.

8. The coupling shell thickness of the steel coupling shall be calculated using the formula:

$$T=PwDy/2Fs$$

Where:

T = steel coupling thickness, in.

Dy = pipe outside diameter, in.

Pw = Design working pressure, psi

Fs = 50 percent of minimum yield point of steel, psi

9. Coupling design calculations shall be stamped and signed by a registered engineer and shall be included in the Shop Drawing submittal for couplings.

10. The sealing members shall be comprised of 2 O-ring gaskets and an elastomer sealing pad bonded to sealing plate.

11. Internal pressure shall not be required to make the seal.

C. Materials

1. Unless otherwise indicated, the coupling housing material shall be the same material as the piping.

2. Couplings

   a. Carbon steel couplings shall be fabricated from ASTM A 36.

   b. Stainless steel couplings shall be fabricated from ASTM A 240, T-304, 304L, 316, or 316L.

3. End Rings

   a. Carbon steel end rings shall conform to ASTM A 108 Grade 1018.

   b. Stainless steel end rings shall conform to ASTM A 276 T-316L.

4. Bolts and nuts shall be in conformance with the requirements of Section 055000 – Miscellaneous Metalwork.

5. Gaskets

   a. Gaskets shall be composed of EPDM conforming to ASTM D 2000 for air service up to 240 degrees F.

   b. Gaskets for general water or sewerage service within the temperature range of minus 20 to plus 180 degrees F shall be composed of isoprene or EPDM conforming to ASTM D 2000.

6. Wrapping

   a. Couplings installed underground shall be provided with **Depend-O-Wrap** tape or equal.

   b. The application of wrapping material shall be in conformance with AWWA C209.

D. Pipe Preparation

1. Ends of pipes shall be prepared for the flexible split sleeve type couplings inspected and approved by the coupling manufacturer.

2. The pipe outside diameter and roundness tolerances shall comply with tolerances listed in AWWA C219.

3. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the end of the pipe.

4. End Rings

   a. Provide end rings with couplings when restraint is required.

   b. Carbon steel end rings shall be constructed of ASTM A 108 Grade 1018.

   c. Stainless steel end rings shall conform to ASTM A 276 T-316L.

5. Where the split-type coupling is used to take up thermal expansion or contraction (**Depend-O-Lok F X E** or equal) at the pipe joint, one end ring shall be fixed to one end of the pipe in order to keep the coupling in the proper location.

6. Fully-Restrained Joints

   a. Where the split-type coupling is used for a fully-restrained pipe joint (**Depend-O-Lok F X F** or equal) at the pipe joint, one end ring shall be welded to each of the pipe ends to fit beneath the coupling and shall be protected by the coating.

   b. Welding design and specification shall be in conformance with the coupling manufacturer's recommendations.

E. Sleeve-Split Type Couplings Manufacturer, or Equal

1. **Depend-O-Lok**

2.6 SLEEVE-TYPE COUPLINGS

A. General

1. Provide sleeve-type couplings where indicated.

2. The CONTRACTOR will not be allowed to substitute a sleeve-split coupling, or any other type in lieu of sleeve coupling unless approved by the ENGINEER.

B. Construction

1. Sleeve couplings shall be in accordance with AWWA C219 - Standard for Bolted Sleeve-Type Couplings for Plain-End Pipe.

2. Couplings shall be constructed of steel with steel bolts, without pipe stop.

3. Couplings shall be of sizes to fit the indicated pipe and fittings.

4. The middle ring shall be not less than 1/4-inch thick or at least the same wall thickness as the pipe to which the coupling is connected.

5. If the strength of the middle ring material is less than the strength of the pipe material, the thickness of the middle ring shall be increased to have the same strength as the pipe.

6. The coupling shall be either 5 or 7 inches long for sizes up to and including 30-inch and 10 inches long for sizes greater than 30-inch, for standard steel couplings, and 16 inches long for long-sleeve couplings.

7. The followers shall be single-piece contoured mill sections welded and cold-expanded as required for the middle rings, and of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling.

8. The shape of the follower shall be of such design as to provide positive confinement of the gasket.

9. Bolts and nuts shall be in accordance with the requirements of **Section 05 50 00** – Miscellaneous Metalwork.

10. Buried sleeve-type couplings shall be epoxy-coated at the factory as indicated.

C. Pipe Preparation

1. Where indicated, prepare the ends of the pipe for flexible steel couplings.

2. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with an outside diameter not more than 1/64 inch smaller than the nominal outside diameter of the pipe.

3. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, in order to proof-test the weld to the strength of the parent metal.

4. The weld of the middle ring shall be subjected to air test for porosity.

D. Gaskets

1. Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions.

2. Gaskets for wastewater and sewerage applications shall be composed of Buna N, Grade 60, or equivalent suitable elastomer.

3. The rubber in the gasket shall meet the following specifications:

   a. Color: jet black

   b. Surface: non-blooming

   c. Durometer Hardness: 74, plus and minus 5

   d. Tensile Strength: 1000 psi minimum

   e. Elongation: 175 percent minimum

4. The gaskets shall be immune to attack by impurities normally found in water or wastewater.

5. Gaskets shall meet the requirements of ASTM D 2000 - Classification System for Rubber Products in Automotive Applications, AA709Z, meeting Suffix B13 Grade 3, except as indicated above.

6. Where sleeve couplings are used in water containing chloramine or other fluids which attack rubber materials, gasket material shall be compatible with the piping service and fluid utilized.

7. Gasket materials used in water with chloramines shall be: **Gylon Style 3500** by **Garlock**; by **Crane**; or equal.

E. Piping Connection to Equipment

1. Where piping connects to mechanical equipment such as pumps, compressors, and blowers, bring the piping to the equipment connection aligned and perpendicular to the axis of the flange or fitting for which the piping is to be connected.

2. The piping shall not impose excessive stress to the equipment connection to cause misalignment of the equipment.

3. The CONTRACTOR shall assign the responsibility to the equipment manufacturer to review the piping connection to the equipment and submit any modifications to the ENGINEER for review.

2.7 PIPE THREADS

A. Pipe threads shall be in conformance with ASME B1.20.1 - Pipe Threads, General Purpose (inch), and be made up with Teflon tape unless otherwise indicated.

PART 3 -- EXECUTION

3.1 GENERAL

A. Install piping, fittings, and appurtenances in accordance with the requirements of applicable Sections of Division 33 and Division 43.

B. Proprietary manufactured couplings shall be installed in accordance with the coupling manufacturer's recommendation.

C. Care shall be taken to insure that piping flanges, mechanical-type couplings, sleeve-type couplings, flexible connectors, and expansion joints are properly installed as follows:

1. Gasket surfaces shall be carefully cleaned and inspected prior to making up the connection.

2. Each gasket shall be centered properly on the contact surfaces.

3. Connections shall be installed to prevent inducing stress to the piping system or the equipment to which the piping is connected.

4. Contact surfaces for flanges, couplings, and piping ends shall be aligned parallel, concentric, and square to each axis at the piping connections.

5. Flange Bolts

a. Flange bolts shall be initially hand-tightened with the piping connections properly aligned.

b. Bolts shall be tightened with a torque wrench in a staggered sequence to the AISC-recommended torque for the bolt material.

6. Harness, Thrust Restraint, and Tie Rod Bolts

a. Harness, thrust restraint, and tie rod bolts used for sleeve couplings, flange coupling adapters, or flexible joints shall be tightened gradually and equally at diametrically opposite sides until snug, in order to prevent misalignment and to insure that all studs carry equal loads.

b. In order to prevent induced stress or misalignment, do not over-torque connections to adjoining pump or equipment.

7. Groove ends shall be clean and free from indentations, projections, and roll marks in the area from the pipe end to the groove.

8. After installation, joints shall meet the indicated leakage rate.

9. Flanges shall not be deformed nor cracked.

D. Cleanup

1. After completion of the Work, cuttings, joining and wrapping materials, and other scattered debris shall be removed from the Site.

2. The entire piping system shall be handed over in a clean and functional condition.

- END OF SECTION -

SECTION 43 20 00 - PUMPS, GENERAL

PART 1 - GENERAL

1.1 THE SUMMARY

A. Provide pumps and pumping appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The provisions of this Section shall apply to pumps and pumping equipment throughout the Contract Documents, except where otherwise indicated.

C. Unit Responsibility

1. The pump manufacturer shall be made responsible for furnishing the pumps and motors as one package and for the coordination of design, assembly, testing, and installation of the WORK of each specific pump Section.

2. The CONTRACTOR shall be responsible to the DISTRICT for compliance with the requirements of each specific pump Section.

D. Single Manufacturer

1. Where 2 or more pump systems of the same type or size are required, provide pumps produced by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of **Section 01 33 00** – Contractor Submittals.

B. Shop Drawings

1. Submit pump name, identification number, and specification Section number.

2. Performance Information

a. Submit performance data curves showing head, capacity, horsepower demand, NPSHr3 required, and pump efficiency over the entire operating range of the pumps. Submit efficiency curves of motors and VFDs.

b. Require the equipment manufacturer to indicate the head, capacity, required horsepower, pump efficiency, and NPSHr corresponding to each flow condition indicated in the respective performance requirement paragraph of each individual pump specification section. Indicate on the pump curve the Allowable Operating Region (AOR), Preferred Operation Region (POR), and minimum submergence required at maximum flow for vertical and submersible pumps.

c. Submit performance curves at intervals no greater than 100 RPM from the specified minimum speed to maximum speed for each centrifugal pump equipped with a variable speed drive.

3. Operating Range

    a. Require the manufacturer to indicate the limits on the performance curves recommended for stable operation without surge, cavitation, or excessive vibration.

4. Submit assembly and installation drawings, including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.

5. Where lead containing materials are used for drinking water service pumps submit a calculation to demonstrate that the weighted average of lead content of wetted components do not exceed 0.25% to meet the requirement of the Reduction of Lead in Drinking Water Act.

6. Submit data, in accordance with the requirements of **Section 26 05 10** – Electric Motors, for the electric motor proposed for each pump.

7. Submit an elevation drawing of the proposed local control panel, showing panel-mounted devices, details of enclosure type, a single-line diagram of power distribution, current draw of the panel, and a list of terminals required to receive inputs or to transmit outputs from the local control panel.

8. Submit a wiring diagram of field connections, with identification of terminations between local control panels, junction terminal boxes, and equipment items.

9. Submit a complete electrical schematic diagram.

10. This WORK shall be performed prior to fabrication of the machinery, and it is subject to review by the ENGINEER\GEOLOGIST. No fabrication shall be started until the ENGINEER/GEOLOGIST has approved the analyses.

C. Technical Manual

1. Submit a Technical Manual containing the required information indicated in **Section 01 33 00** – Contractor Submittals and each specific pump Section.

D. Spare Parts List

1. Submit a spare parts list containing the required information indicated in **Section 01 33 00** – Contractor Submittals and each specific pump Section.

E. Factory Test Data

1. For pumps that shall be factory witness tested, submit factory test plan showing piping diameter sizes and lengths, locations of valves and instruments that will be used during testing as part of shop drawing submittal.

2. For pumps that shall be factory witness tested, submit current calibration certificates of test instruments prior to testing.

3. Submit signed, dated, and certified factory test data for each pump system which requires factory testing.

4. Submit these data before shipment of equipment.

F. Certifications

1. Submit the manufacturer's certification of proper installation.

2. Submit the CONTRACTOR's certification of satisfactory field testing.

PART 2 - PRODUCTS

2.1 GENERAL

A. Compliance with the requirements of the specific pump Sections may necessitate modifications to the manufacturer's standard equipment.

B. Performance Curves

1. Provide centrifugal pumps with a continuously rising pump curve, or with a pump curve that does not cross the system curve within the pump curve's "dip region."

2. Unless otherwise indicated, the required shaft horsepower for the entire pump assembly at any point on the performance curve shall not exceed the rated horsepower of the motor or engine or encroach on the service factor.

3. For VFD driven pumps, the rated horsepower of the selected motor shall be 110 percent of the maximum brake horsepower required by the pump.

C. Compatibility

1. Provide entirely compatible components of each pump system provided under the specific pump Sections.

2. In each unit of pumping equipment, incorporate basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings, and appurtenances.

D. Balancing

1. Unless otherwise specified the rotating assembly shall be dynamically balanced to ISO 1940 G6.3.

2.2 MATERIALS

A. Provide materials suitable for the intended application.

B. For materials not indicated, provide high-grade, standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended, and conforming to the following requirements:

1. Bowls and Casings

a. Provide cast iron pump casings constructed of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or equal. Unless otherwise indicated on the specific pump sections, cast iron-fitted pumps shall be epoxy lined and coated for better efficiency.

2. Impellers

a. Where individual pump sections indicate cast iron impellers, such impellers shall be epoxy coated and constructed of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or equal.

b. Where individual pump sections indicate stainless steel impellers, such impellers shall be constructed of Type 316 stainless steel.

c. Where individual pump sections indicate bronze impellers, or where the impeller material is not otherwise specified, such impellers shall be constructed of zero-lead aluminum bronze conforming to ASTM B 148 – Standard Specification for Aluminum-Bronze Sand Castings, or zero-lead, zincless nickel aluminum bronze ASTM –B 148-C95800.

3. Provide pump shafts constructed of Type 416 or 316 stainless steel.

4. Provide anti-friction bearings or zero-lead bronze bearings. Bronze bearings shall be Bismuth Tin Bronze ASTM B 584 C89835, or equal.

5. All elastomeric materials such as gaskets, seals, O-rings in contact with water with chloramine and ozone shall be Teflon, Viton-A or other materials compatible with the fluid service. Test certificate from a material testing laboratory to provide proof of test shall be made available to the ENGINEER/GEOLOGIST if requested.

6. Miscellaneous stainless steel parts shall be of Type 316.

7. Provide anchor bolts, washers, and nuts in standard service (non-corrosive application) of galvanized steel in accordance with the requirements of **Section 05 50 00** – Miscellaneous Metalwork.

8. Provide anchor bolts, washers, and nuts in corrosive service of stainless steel in accordance with **Section 05 50 00** – Miscellaneous Metalwork.

C. Materials in contact with potable water shall be listed as compliant with NSF Standard 61. Test certificate from a material testing laboratory to provide proof of test shall be made available to the ENGINEER/GEOLOGIST if requested.

2.3 PUMP COMPONENTS - GENERAL

A. Flanges and Bolts

1. Provide suction and discharge flanges conforming to ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, or ASME B16.5 - Pipe Flanges and Flanged Fittings dimensions. Pressure class shall be suitable for the application or as otherwise recommended by the pump manufacturer.

2. Provide flange bolts in accordance with the requirements of **Section 40 05 00** – Piping, General.

3. Flange gaskets shall be in accordance with **Section 40 05 00** - Piping, General

B. Lubrication

1. Vertical pump shafts for clean water pumps shall be product water-lubricated, unless otherwise indicated.

2.4 FACTORY TESTING

A. Conduct the following tests on each indicated pump system:

1. Motors

a. Test electric motors in accordance with the requirements of **Section 26 05 10** – Electric Motors.

b. Furnish test results to the pump manufacturer prior to the pump test.

2. Certified Factory Non-witnessed Test

a. Perform factory non-witnessed tests on centrifugal pumps with drives up to and including 125 hp in accordance with the ANSI/HI 14.6, Rotodynamic Pumps for Hydraulic Performance Acceptance Test.

b. For pumps with drives smaller than 15 hp, sump pumps, and sample pumps, pumps shall meet hydraulic acceptance criteria Grade "2U" unless otherwise indicated. Such tests shall, at a minimum, consist of the following:

1) Hydrostatic test;

2) Performance test at guaranteed design point or duty point documenting head, flow, bhp, and efficiency results.

3) Unless otherwise indicated, it is not required to test NPSHr in the factory. Instead, manufacturer shall submit the published NPSHr curve in accordance with the requirements of this specification section.

4) Additional tests as indicated in the specific pump specification sections.

c. For pumps with drives 15 hp and larger shall meet hydraulic acceptance criteria Grade "1U" unless otherwise indicated. Such tests shall, at a minimum, consist of the following:

1) Hydrostatic test;

2) Performance Test:

a) Conduct performance testing at maximum speed, obtain a minimum of 5 hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, and record on data sheets as defined by the Hydraulic Institute Standards;

b) For variable speed driven pumps, test each pump between maximum and minimum speed at intervals no greater than 100 RPM;

c) Submit pump curves showing head, flow, bhp, NPSHr and efficiency results. The manufacturer’s certification shall be visible on each submitted curve;

3) Mechanical testing shall be limited to observation during the hydraulic performance test for any abnormal bearing temperature and pump vibration. Any deficiencies shall be corrected by the manufacturer.

4) NPSHr3

a) Perform a net positive suction head required test (NPSHr3), if required by the specific pump Section.

b) Acceptance criteria shall be in accordance with ANSI/HI 14.6

c) If not required by the specific pump Section, submit the published manufacturer-calculated NPSHr3 curve.

5) Additional tests as indicated in the specific pump specification sections.

d. Perform tests using the completely assembled project pump, motor, and VFD system (if equipped with variable speed drive). Calibrated factory motor may be used in lieu of project motor subject to approval of the ENGINEER/GEOLOGIST.

e. Submit certification signed by a senior official of the pump manufacturer that the required pump shaft horsepower did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.

f. No equipment shall be shipped until the test data have been approved by the ENGINEER/GEOLOGIST.

3. Acceptance

a. In the event of failure of any pump to meet any of the requirements, make necessary modifications, repairs, or replacements in order to conform to the requirements of the Contract Documents, and re-test the pump until found satisfactory.

PART 3 - EXECUTION

3.1 MANUFACTURER'S SERVICES

A. Inspection, Startup, and Field Adjustment

1. Where required by the specific pump Section, furnish an authorized service representative of the manufacturer at the Site continuously to supervise the following items and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation:

a. installation of the equipment;

b. inspection, checking, and adjusting the equipment;

c. startup and field testing for proper operation; and

d. Performance of field adjustments to ensure that the equipment installation and operation comply with the indicated requirements.

B. Instruction of DISTRICT's Personnel

1. Where required by the individual pump Section, furnish an authorized training representative of the manufacturer at the Site for the number of Days indicated in the specific pump Section, to instruct the DISTRICTS's personnel in the operation and

maintenance of the equipment, including step-by-step troubleshooting with necessary test equipment.

2. Furnish instruction specific to the model of equipment provided.

3. Qualifications

   a. Furnish a representative with at least 2 years' experience in training.

   b. Submit a resume for the representative.

4. Schedule the training a minimum of 3 weeks in advance of the first session.

5. Lesson Plan Review

   a. Submit the proposed training material and a detailed outline of each lesson for review.

   b. Incorporate review comments into the material.

6. The trainees will keep the training materials.

7. The DISTRICT may videotape the training for later use with the DISTRICT's personnel.

3.2 INSTALLATION

A. General

1. Install pumping equipment in accordance with the manufacturer's written recommendations.

B. Alignment

1. Field-test the equipment in order to verify proper alignment and freedom from binding, scraping, shaft run out, or other defects.

2. Measure the pump drive shafts just prior to assembly in order to ensure correct alignment without forcing.

3. Ensure that the equipment is secure in position and neat in appearance.

3.3 FIELD TESTS

A. Field-test each pump system after installation simulating all of the operational scenarios as specified in order to demonstrate:

1. satisfactory operation without excessive noise and vibration;

2. no material loss caused by cavitation;

3. no overheating of bearings; and,

4. Meet indicated head, flow, and efficiency at the design point.

B. Conduct the following field testing:

1. Startup, check, and operate the pump system over its entire speed range.

2. If the pump is driven by a variable speed drive, test the pump and motor at 100-RPM increments.

3. If the pump is driven by constant speed, test the pump and motor at the maximum RPM.

4. Unless otherwise indicated, vibration shall be within the amplitude limits recommended by the Hydraulic Institute standards at a minimum of 4 pumping conditions defined by the ENGINEER/GEOLOGIST.

5. 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, at 100-RPM increments if equipped with a variable speed drive or at maximum RPM if equipped with a constant speed drive.

6. Check each power lead to the motor for proper current balance.

7. Ensure that electrical and instrumentation tests conform to the requirements of the Section under which that equipment is specified.

C. Witnessing

1. Field testing will be witnessed by the ENGINEER/GEOLOGIST.

2. Furnish 3 Days advance notice of field testing.

D. If the pumping system fails to meet the indicated requirements, modify or replace the pump and re-test as indicated above until it satisfies the indicated requirements.

E. Certification

1. After each pumping system has satisfied the requirements, certify in writing that it has been satisfactorily tested and that final adjustments have been performed.

2. Certification shall include the date of the field tests, a listing of persons present during the tests, and the test data.

F. The CONTRACTOR shall be responsible for costs of field tests, including related services of the manufacturer's representative, except for power and water, which the DISTRICT will bear.

G. If available, the DISTRICT'S operating personnel will provide assistance in field testing.

-END OF SECTION-

SECTION 43 24 03 – SUBMERSIBLE DEEP WELL TURBINE PUMPS

PART 1 -- GENERAL

1.1 THE SUMMARY

A. The CONTRACTOR shall provide submersible deep well turbine pumps, complete and operable, in accordance with the Contract Documents.

B. The requirements of **Section 43 20 00** – Pumps, General, apply to this Section.

C. The Supplier shall examine the Site conditions, intended application, and operation of the pump system, and recommend the pump that will best satisfy the indicated requirements.

PART 2 -- PRODUCTS

2.1 GENERAL DESCRIPTION

A. Performance Requirements: Pump dimensions shall be in accordance with the requirements as indicated in the table at the end of this Specification Section.

2.2 PUMP REQUIREMENTS

A. Construction: Construction of submersible deep well turbine pumps shall conform to the following requirements:

Bowls	Cast-iron. Interior water passages and exterior surfaces coated with 10- to 12-mils vitreous enamel for sizes 18-inches and smaller; interior and exterior of sizes 20-inches and larger coated with fusion bonded epoxy in accordance with Section 09 96 00 - Protective Coating, except that DFT shall be 10- to 12-mils
Impeller (multi-stage vertical turbine)	Stainless steel, Type 316 statically and dynamically balanced
Impeller seal ring	stainless steel
Impeller shaft method of connection	Type 316 stainless steel impeller lock collet
Wear rings	Stainless steel, hard-faced replaceable
Bowl shaft	Stainless steel, Type 410, 416, or 316
Suction case and strainer	Type 316 stainless steel, Type 316 stainless steel shaft in max 10-ft lengths, turned, ground, and polished with min 8-mils thick hard chrome journals.

Column	Steel pipe, not less than Schedule 30, epoxy-lined and coated, in maximum 10-ft lengths, threaded
Motor Adaptor	Type 316 stainless steel
Suction case bearing	Stainless steel
Bowl bearing	Rubber with stainless steel
Pump to motor coupling	Stainless steel
Discharge elbow	Type 316 stainless steel epoxy-lined with flange, base plate, and fittings to connect sounding tube, power cables and other connections as indicated on drawings constructed to support 150% of the weight of all items in the well. Tapping for electrical wire, instrumentation, sounder tube and venting shall be provided. A screened vent cap shall be included. The discharge head shall have lifting eyes. The discharge head shall rest on a sole plate welded to the well casing. A .25-inch neoprene gasket and cadmium plated stainless steel bolts with nuts shall seal the discharge head to the sole plate. If the well casing below the discharge head is to be encased in concrete the sole plate shall have tapped bolt holes. The discharge outlet shall be as indicated.

B. Drive

1. Motor Design

a. Provide a squirrel cage induction motor designed for continuous underwater operation in conformance with NEMA standards.

b. Utilize a Kingsbury-type thrust bearing to carry the pump downthrust load.

c. Provide a bearing rated for a minimum of 130 percent of the maximum pump downthrust load.

d. Fill the motor with a water and propylene glycol solution for cooling and lubrication.

e. Do not use oils or grease lubrication.

f. Provide a flexible diaphragm in order to permit expansion of internal motor fluid.

g. The shaft seal shall be a Nitrite rubber lip seal or a Nitrite, carbon, carbide or ceramic face seal.

h. A mercury-type shaft seal will not be accepted.

i. Provide exterior material construction of Type 316 or 316L stainless steel

j. Do not exceed the nameplate horsepower shall not be exceeded at any point on the pump curve.

2. Electrical Cable

a. Provide necessary cables for power connection, control wires, and overload protection, sheathed, coded, and suitable for submersible pumps, and of sufficient length for direct and continuous connection from the motor to the terminal boxes located above ground or to the MCC as indicated.

b. Provide the surface plate with a power cable splice box that meets the requirements of the National Electrical Code.

c. If indicated, provide a junction box that meets the requirements of the National Electrical Manufacturer’s Association (NEMA).

d. Connect cables to the pumps and test at the factory.

e. If the cables are not assembled in the factory, the field connection of the cable to the motor shall be supervised and certified by the pump manufacturer's representative.

f. Splicing of cable between the motor and the terminal box will not be accepted.

g. The size and type of cable shall be determined by the pump manufacturer, suitable for the application.

h. Fully contain the motor lead-to-electrical cable within the water-tight motor housing and conform to IEEE and NEC standards.

i. Provide an electrical wire of annealed, bare, 19-stranded copper conductors insulated with PVC.

j. Jacket the power conductors plus a ground conductor in a flat heavy-duty PVC jacketing.

k. Provide UL-listed cable in accordance with UL83 Type TW Construction A, as Deep Well Submersible Cable.

l. Size power conductors to allow no more than 5 percent voltage loss in the entire length.

m. Size the grounding conductor in accordance with Table 24.3 of UL83.

n. Strap the electrical cable to the discharge column with stainless steel bands.

3. Motor Rating

a. Provide motors with a service factor of 1.25 or greater.

b. For motors driven by variable frequency drives, provide motors rated for inverter duty, or next larger standard motor size in order to provide longer motor life.

4. Provide the motor with a junction box capable of being sealed completely from the stator casing in order to prevent leakage through the junction box into the stator housing should a motor cable be damaged, or provide some other means to prevent leakage into the junction box under any condition.

5. Cable Entry

a. Design the cable entry water seal such that it precludes specific torque requirements in order to ensure a watertight and submersible seal.

b. It shall permit no entry of water into any high voltage area even if the cable is severed below the water level.

6. Motor Protection

a. Provide integral thermal sensors in the motors, one for each phase, to monitor stator temperatures.

b. Utilize these sensors in conjunction with and supplemented by external motor over-current protection located at the control panel.

2.3 FACTORY TESTING AND SHIPMENT

A. In addition to the factory tests in **Section 43 20 00**, perform the following procedures with the factory test prior to shipment:

1. Hydrostatically test the hydraulic end of pump assembled to the motor not less than 150 percent of the shutoff head of the pump.

2. Leak-Test

a. Leak-test the motor not less than 150 percent the maximum submergence at Site conditions.

b. If the motor is to be installed inside an artesian well, leak-test the motor at a test of pressure equal to at least 150 percent of the static pressure above the centerline of the motor.

3. Acceptance criteria for hydrostatic and leak test shall be zero leak..

4. Verify the pump characteristic curves by testing at shutoff head, 25, 50, 75, 100, and 125 percent of the indicated design flow, and at maximum "run-out" flow, and recording the measured head and motor current for each flow.

5. Verify cavitation-free service and absence of motor overheating during conditions simulating the actual operating conditions after installation.

6. Design the motor seals for complete water tightness at 150 percent of the actual maximum submergence at the Site for 30 minutes, and submit data on factory testing and quality control with the Shop Drawings.

7. Properly lubricate and protect parts such that no damage or deterioration will occur even during a prolonged delay from the time of shipment until installation is completed and the pumps are ready for operation.

8. Properly protect unpainted finished ferrous surfaces in order to prevent rust and corrosion.

9. Protect the finished surfaces of exposed flanges by strong wooden blind flanges.

10. Properly crate each pump o protect against damage during shipment.

2.4 PUMP CONTROLS

A. Pumps shall be controlled locally from a disconnect switch.

2.5 MANUFACTURERS, OR EQUAL

A. **Grundfos**

PART 3 -- EXECUTION

3.1 SERVICES OF MANUFACTURER

A. Inspection, Startup, and Field Adjustment

1. Furnish a service representative of the manufacturer to be at the Site continuously during installation in order to furnish the services required by **Section 43 20 00** – Pumps, General.

B. Instruction of OWNER'S Personnel

1. Furnish a training representative of the manufacturer to be present at the Site for 1 Day in order to furnish the services required by **Section 43 20 00** – Pumps, General.

C. For the purposes of this Paragraph, a Day is defined as an 8-hour period at the Site, excluding travel time.

D. The ENGINEER/GEOLOGIST may require that the inspection, startup, and field adjustment services, above, be furnished in 3 separate trips.

TABLE 1: SUBMERSIBLE PUMP DATA	
Capacity (gpm)	25
RPM	3450
HP	2
Motor (Volts/Phase/Hz)	480/3/60
Number Stages	1
Bowl Diameter	3
Discharge Dia (IN)	2

-END OF SECTION-

SECTION 43 30 00 - VALVES, GENERAL

PART 1 -- GENERAL

1.1 THE SUMMARY

A. Provide valves, actuators, and appurtenances, complete and operable, as indicated in accordance with the Contract Documents.

B. The provisions of this Section shall apply to all valves and valve actuators except where otherwise indicated.

C. Valves and actuators in particular locations may require a combination of units, sensors, limit switches, and controls, as indicated.

D. Support

1. Submit the support design, including drawings and calculations sealed by an engineer, with the Shop Drawings.

E. Unit Responsibility

1. The CONTRACTOR shall assign a single manufacturer to be responsible for the supply, coordination of design, assembly, testing, and furnishing of each valve; however, the CONTRACTOR shall be responsible to the OWNER for compliance with the requirements of each valve Section.

F. Single Manufacturer

1. Where 2 or more valves of the same type and size are required, the valves shall be furnished by the same manufacturer.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with the requirements of **Section 01 33 00** – Contractor Submittals.

B. Furnish the following information on Shop Drawings:

1. valve name, size, Cv factor, pressure rating, identification number (if any), and specification section number;

2. complete information on the valve actuator, hydraulic power units (HPU), pneumatic air supply system including size, manufacturer, model number, limit switches, and mounting;

3. cavitation limits for control valves;

4. assembly drawings showing part nomenclature, materials, dimensions, weights, and relationships of valve handles, hand wheels, position indicators, limit switches, integral control systems, needle valves, and control systems;

5. data in accordance with **Section 26 05 10** – Electric Motors, for electric motor-actuated valves;

6. complete wiring diagrams and control system schematics; and,

7. A valve-labeling schedule, listing the valves to be furnished with stainless steel tags, indicating in each case the valve location and the proposed wording for the label.

C. Furnish a technical manual containing the required information for each valve, as indicated.

D. Furnish a spare parts list, containing the required information for each valve assembly, as indicated.

E. Factory Test Data

1. Where indicated, submit signed, dated, and certified factory test data for each valve requiring certification, before shipping the valve.

2. Furnish a certification of quality and test results for factory-applied coatings.

F. Field Test Data

1. Submit signed, dated, and certified field test data for each valve.

PART 2 -- PRODUCTS

2.1 PRODUCTS

A. General

1. Provide valves and gates of new and current manufacture.

B. Valve Testing

1. As a minimum, unless otherwise indicated or recommended by the reference standards, test valves 3 inches in diameter and smaller in accordance with the manufacturer's standard procedure.

C. Certification

1. Prior to shipment of valves with sizes larger than 12-inches in diameter, submit certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, or ASTM.

D. Valve Markings

1. Permanently mark valve bodies in accordance with MSS SP25 - Standard Marking Systems for Valves, Fittings, Flanges, and Unions.

2.2 MATERIALS

A. General

1. Provide materials suitable for the intended application.

2. Provide materials in contact with potable water listed as compliant with NSF Standard 61.

3. Ensure that materials not indicated are of high-grade standard commercial quality, free from defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended.

4. Unless otherwise indicated, provide valve and actuator bodies conforming to the following requirements:

    a. Stainless Steel: Stainless steel valve and operator bodies and trim shall conform to ASTM A 351 - Steel Castings, Austenitic, for High-Temperature Service, Grade CF8M, or shall be Type 316 stainless steel

2.3 VALVE CONSTRUCTION

A. Bodies

1. Provide valve bodies that are cast, molded (in the case of plastic valves), forged, or welded, of the materials indicated, and with smooth interior passages.

2. Provide wall thicknesses uniform and in agreement with the applicable standards for each type of valve, without casting defects, pinholes, and other defects that could weaken the body.

3. Perform welds on welded bodies by certified welders and ground welds smooth.

4. Provide valve ends as indicated, and rated for the maximum temperature and pressure to which the valve will be subjected.

B. Valve End Connections

1. Unless otherwise indicated, valves 2-1/2 inches in diameter and smaller may be provided with threaded end connections.

C. Bonnets

1. Connect valve bonnets to the body by clamping, screwing, or flanging.

2. Provide bonnets of the same material, temperature, and pressure rating as the body.

3. Make provisions for the stem seal with the necessary glands, packing nuts, and yokes.

D. Internal Parts

1. Provide internal parts and valve trim as indicated for each individual valve.

2. Where not indicated, construct valve trim from Type 316 stainless steel or other material best-suited for the intended service.

2.4 MANUFACTURERS

A. Valve manufacturers shall have a successful record of not less than 5 years in the manufacture of the indicated valves.

PART 3 -- EXECUTION

3.1 VALVE INSTALLATION AND TRIAL OPERATION

A. General

1. Install valves, actuating units, stem extensions, valve boxes, and accessories in accordance with the manufacturer's written instructions and as indicated.

2. Adequately brace gates in order to prevent warpage and bending under the intended use.

3. Firmly support valves in order to avoid undue stresses on the pipe.

B. Access

1. Install valves in a manner to provide easy access for actuation, removal, and maintenance, and to avoid interference between valve actuators and structural members, handrails, and other equipment.

C. Trial Operation

1. After installation, schedule trial operation witnessed by the ENGINEER\GEOLOGIST and the OWNER representative.

2. All valves shall be cleaned thoroughly of all foreign materials and final adjustments made. The valves shall then be operated through one complete cycle from a fully closed position to a fully open position and back to a fully closed position to verify that the assembly is functional.

3. Test certificate shall be signed by the valve manufacturer and the CONTRACTOR and shall be submitted to the ENGINEER/GEOLOGIST.

END OF SECTION

SECTION 43 30 18 - BALL VALVES

PART 1 -- GENERAL

1.1 THE REQUIREMENT

A. The CONTRACTOR shall provide ball valves and appurtenances, complete and operable, in accordance with the Contract Documents.

1.2 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with **Section 01 33 00** - Contractor Submittals.

PART 2 -- PRODUCTS

2.1 METAL BALL VALVES (4-INCHES AND SMALLER)

A. **General:** Unless otherwise indicated, general purpose metal ball valves in sizes up to 4-inches shall have actuators.

B. **Body:** Ball valves up to and including 1-1/2 inches in size shall have bronze or carbon steel 2 or 3 piece bodies with screwed ends for a pressure rating of not less than 600 psi WOG. Valves 2-inches to 4-inches in size shall have bronze or carbon steel 2 or 3 piece bodies with flanged ends for a pressure rating of ANSI 125 psi or 150 psi unless otherwise indicated.

C. **Balls:** The balls shall be solid chrome-plated brass or bronze, or stainless steel, with standard port (single reduction) or full port openings.

D. **Stems:** The valve stems shall be of the blow-out proof design, of bronze, stainless steel, or other acceptable construction, with reinforced teflon seal.

E. **Seats:** The valve seats shall be of teflon or Buna-N, for bi-directional service and easy replacement.

F. Manufacturers, or Equal

1. **Conbraco Industries, Inc. (Apollo)**

2. **ITT Engineered Valves**

3. **Neles-Jamesbury, Inc.**

4. **Watts Regulator**

5. **Worcester Controls**

PART 3 -- EXECUTION

3.1 GENERAL

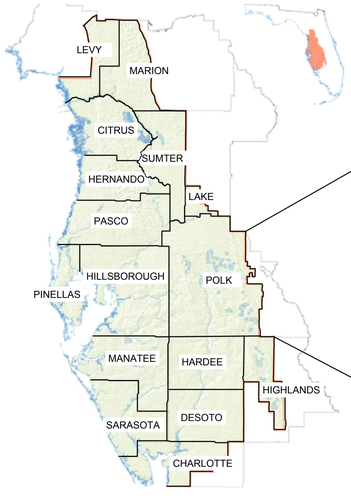
A. Valves shall be installed in accordance with the manufactures recommendations. Care shall be taken that valves in plastic lines are well supported at each end of the valve.

- END OF SECTION -

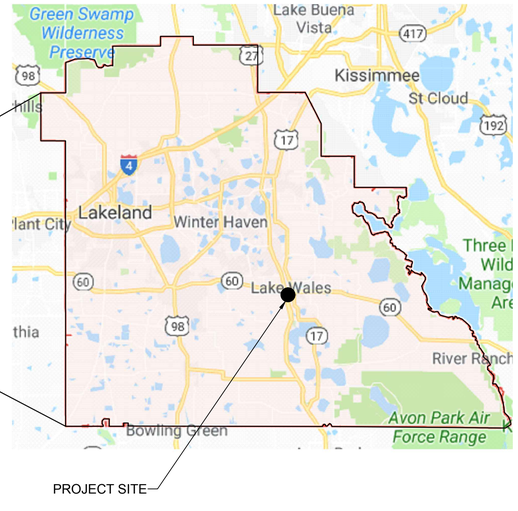
HYDROGEOLOGIC INVESTIGATION OF THE LOWER FLORIDAN AQUIFER IN POLK COUNTY-LAKE WALES SITE

SWFWMD LFA LAKE WALES WELL DESIGN

ISSUED FOR BID - MAY 2018



VICINITY MAP



LOCATION MAP

INDEX OF DRAWINGS

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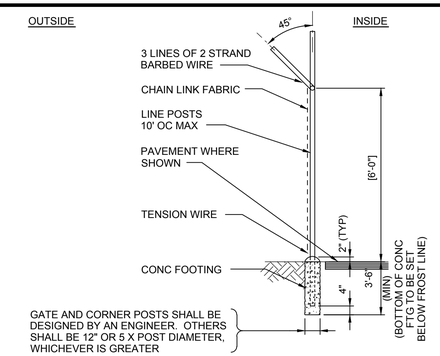
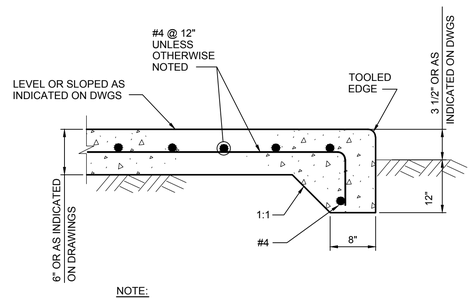


NOTES:

1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. EXTENSION ARM MAY BE TURNED IN AT OPTION OF OWNER.

CHAIN LINK FENCE

C-101

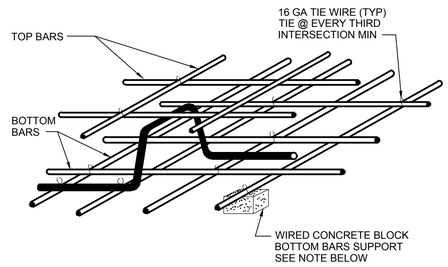


NOTE:

USE 2 MATS OF #5 @ 12" EW EF FOR SLABS 10" AND THICKER

SLAB-ON-GRADE

S-190

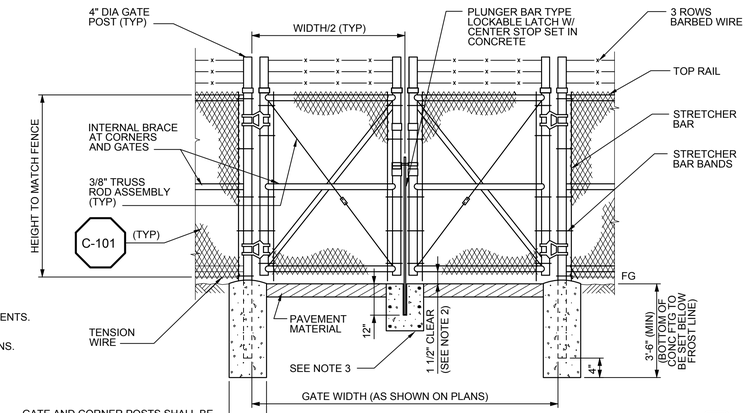


NOTE:

METAL BAR SUPPORTS, IF USED IN SLABS NOT ON GROUND, SHALL NOT MAKE CONTACT WITH FORMS

REINFORCEMENT SUPPORT

S-204



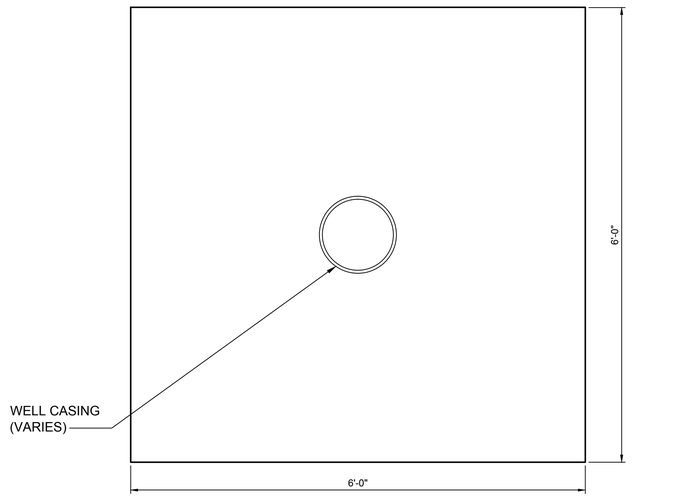
NOTES:

1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. SEE SPECIFICATIONS FOR CLEARANCES IN SNOW REGIONS.
3. 12" DIAMETER X 18" DEEP CONCRETE STOP W/ 20 GA STEEL PLUNGER SLEEVE, DIA = ROD OD +1/2".

DOUBLE LEAF GATE

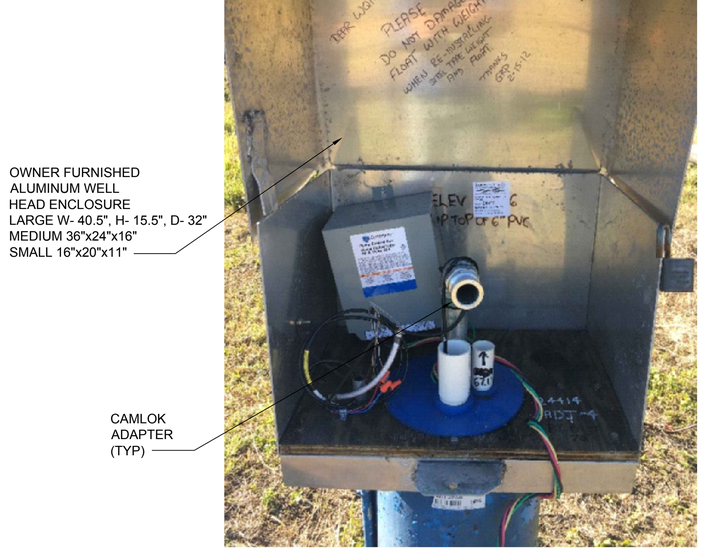
C-102

REV 110112



WELL PAD (TYP LFA AND UFA)

SCALE 1"=1'-0"



LOCKABLE WELL HEAD ENCLOSURE

REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

DESIGNED N SHARMA
DRAWN P KANASE
CHECKED H WINTZ

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SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
2379 Broad Street
Brooksville, FL 34604
(352) 796 -7211

SWFWMD LAKE WALES LFA WELL DESIGN
GENERAL CIVIL
WELL PAD AND STANDARD DETAILS

SHEET
GC-1
224401119

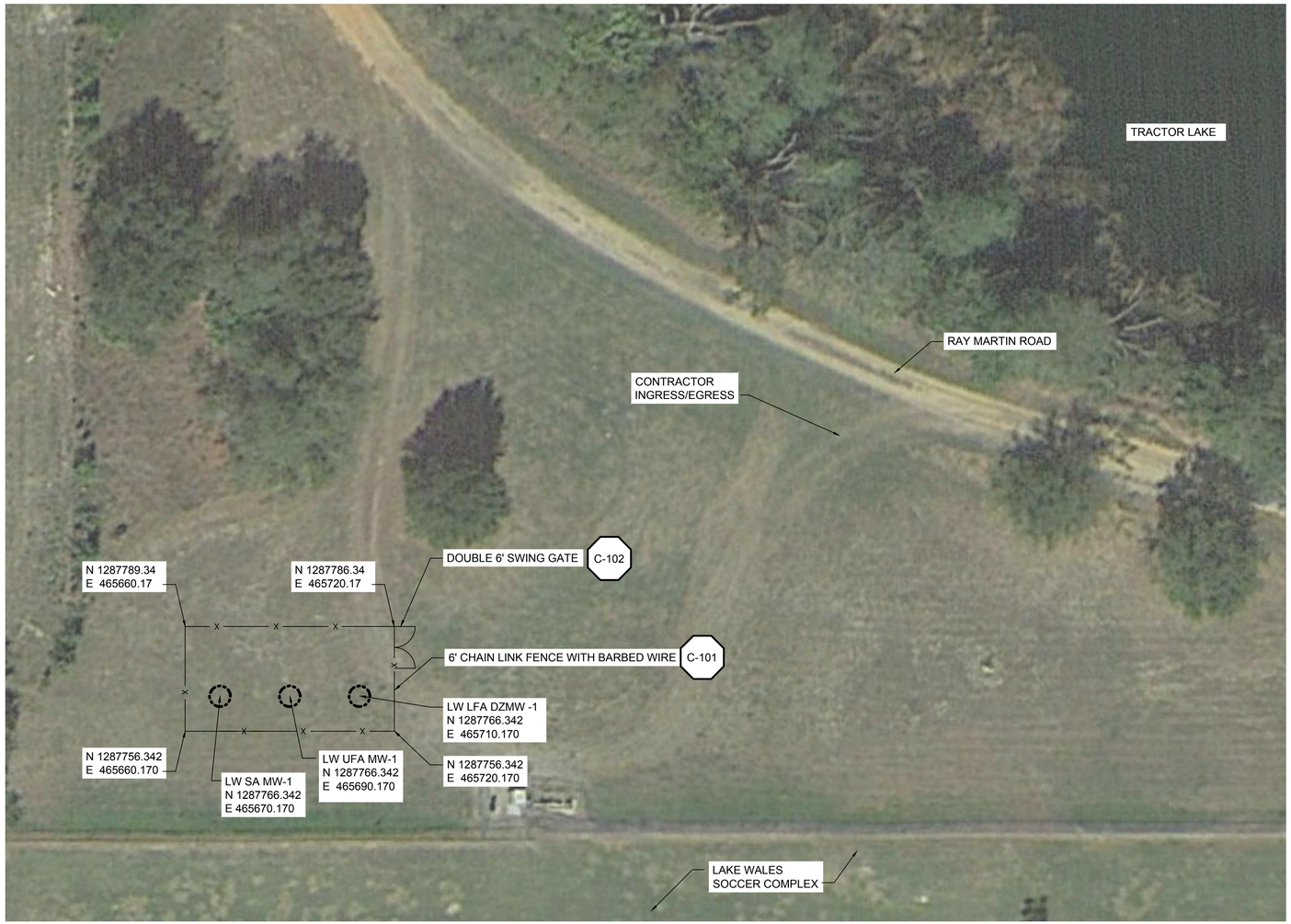
PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: KUBADE, RAJENDRA
DWG FILE: C:\pwworkdir\d0429013\LFA_GC-1.dwg

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: KUBADE, RAJENDRA
DWG FILE: C:\pwworkdir\d0429001\LFA_C-1.dwg

N

0 20 40

SCALE: 1" = 20'-0"



SITE PLAN

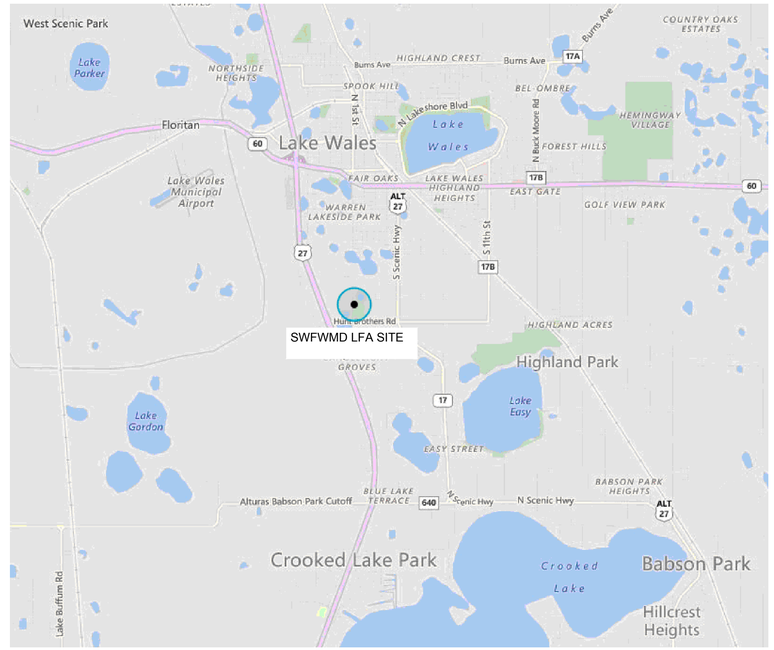
SCALE: 1" = 20'-0"

GENERAL SHEET NOTES

1. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
2. THE CONTRACTOR SHALL PROPERLY DISPOSE OF ALL DEBRIS FROM DEMOLITION AT CONTRACTORS EXPENSE.
3. THE CONTRACTOR SHALL DISPOSE OF ALL NON-ORGANIC WASTES SUCH AS OLD GUNITE, PIPING, ROCK RUBBLE ETC... AT AN APPROVED LANDFILL OR, OTHER SUITABLE DISPOSAL SITES AT THE CONTRACTOR'S EXPENSE.

EROSION CONTROL

4. THE CONTRACTOR SHALL SUBMIT AN EROSION CONTROL PLAN FOR WORK DURING THE CONSTRUCTION, SIGNED AND STAMPED BY A REGISTERED CIVIL ENGINEER PRIOR TO THE START OF CONSTRUCTION.
   a. ALL SLOPES SHALL BE PROTECTED FROM EROSION DURING ROUGH GRADING OPERATIONS AND THEREAFTER, UNTIL INSTALLATION OF FINAL GROUNDCOVER (SEE LANDSCAPE PLANS FOR FINAL GROUNDCOVER).
   b. ALL SLOPE PROTECTION SWALES SHALL BE CONSTRUCTED AT THE SAME TIME AS BANKS ARE GRADED.
   c. THE CONTRACTOR IS RESPONSIBLE FOR IMPLEMENTATION AND MAINTENANCE OF EROSION CONTROL MEASURES CONTAINED WITHIN THE CONTRACT SPECIFICATIONS OR AS REQUIRED BY THE CITY, DISTRICT, OR OTHER REGULATORY AUTHORITY. THE CONTRACTOR SHALL ALSO PROVIDE ANY ADDITIONAL EROSION CONTROL MEASURES (E.G. HYDROSEEDING, MULCHING OF STRAW, SAND BAGGING, DIVERSION DITCHES, ETC.) DICTATED BY FIELD CONDITIONS TO PREVENT EROSION OR THE INTRODUCTION OF DIRT, MUD, OR DEBRIS INTO EXISTING PUBLIC STREETS, WATERWAYS, OR ONTO ADJACENT PROPERTIES DURING ANY PHASE OF CONSTRUCTION OPERATIONS.



LOCATION PLAN

SCALE: NTS

REV	DATE	BY	DESCRIPTION

SCALE: AS SHOWN

WARNING: 0 ½ 1 — IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE

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DRAWN P KANASE
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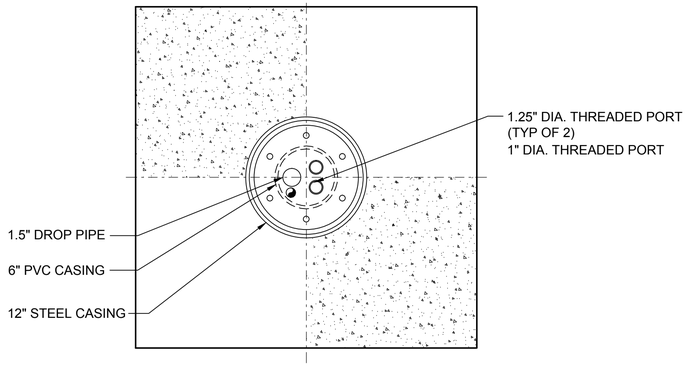
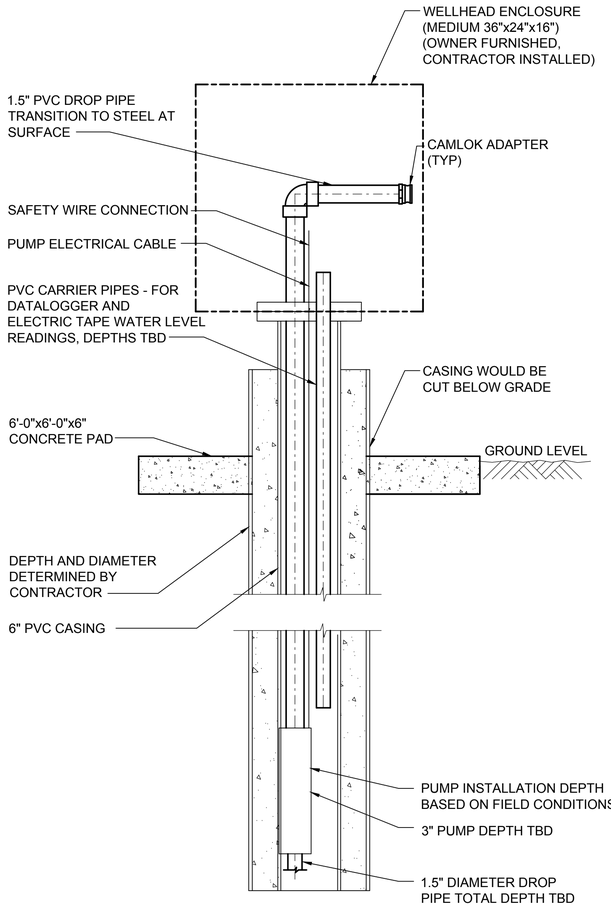
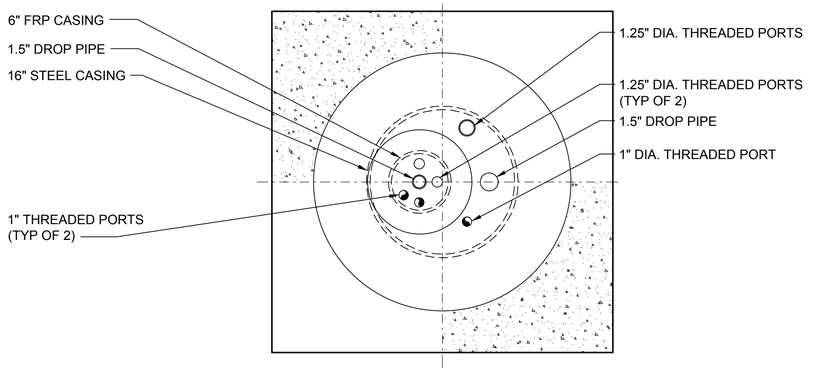
SWFWMD LAKE WALES LFA WELL DESIGN
CIVIL
LOCATION MAP
SITE PLAN

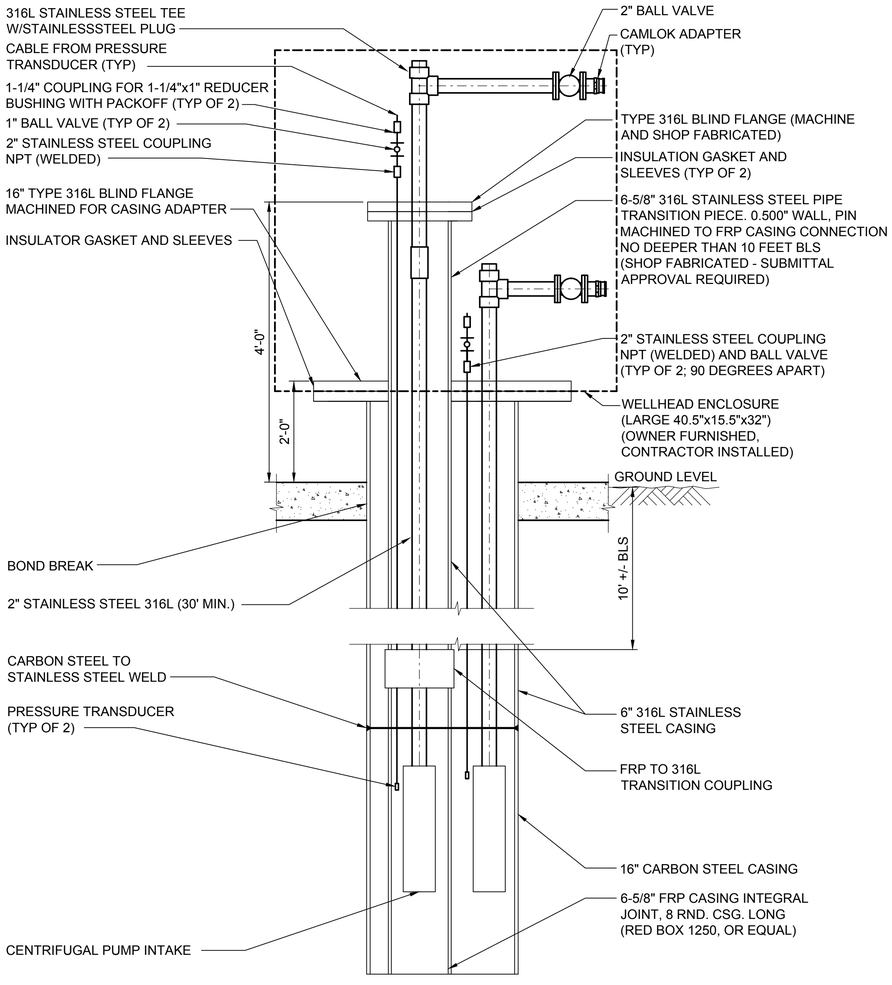
SHEET
C-1
224401119





SINGLE ZONE MONITOR WELL
(LW UFA MW-1)

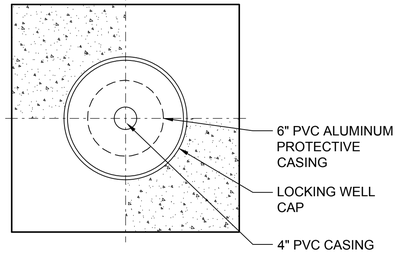


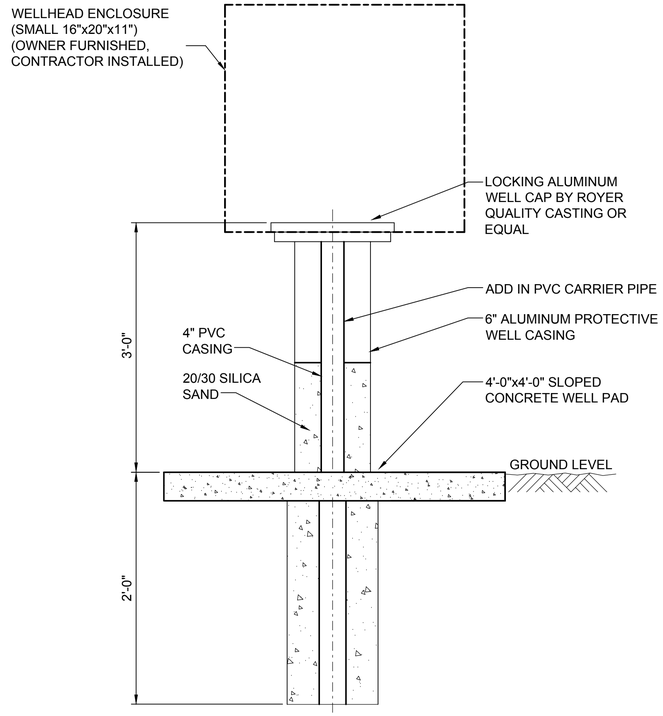


DUAL ZONE MONITOR WELL
(LW LFA DZMW-1)

GENERAL SHEET NOTES

1. PROCESS MECHANICAL EQUIPMENT AND PIPING LOCATIONS, DIMENSIONS AND LAYOUTS BASED ON THE EQUIPMENT SELECTED AND SPECIFIED BY THE ENGINEER. IF THE CONTRACTOR PROPOSES TO FURNISH EQUIPMENT THAT REQUIRES AN ARRANGEMENT OR SPACE OTHER THAN THAT INDICATED ON THE DRAWINGS OR AS SPECIFIED, THE CONTRACTOR SHALL PREPARE AND SUBMIT TO THE ENGINEER FOR APPROVAL DETAILED DRAWING AND EQUIPMENT LISTS (FOR IMPACTED DISCIPLINES) SHOWING EQUIPMENT AND PIPING LOCATIONS, DIMENSIONS AND LAYOUTS PROPOSED. THIS INFORMATION SHALL INCLUDES, BUT NOT BE LIMITED TO PLANS, SECTIONS, DETAILS AND SCHEMATIC OF EQUIPMENT AND APPURTENANCES REQUIRED. THE CONTRACTOR SHALL PROVIDE DETAILS OF CHANGES TO ADJACENT PIPE ROUTING TO ACCOMMODATE TIE-IN LOCATIONS FOR PROPOSED EQUIPMENT.
2. WHERE WELDING OF STAINLESS STEEL REQUIRED, PASSIVATE STAINLESS STEEL AFTER WELDING.





SINGLE ZONE MONITOR WELL
(LW SAMW-1)

REV	DATE	BY	DESCRIPTION

SCALE: NO SCALE

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DESIGNED N SHARMA
DRAWN P KANASE
CHECKED H WINTZ

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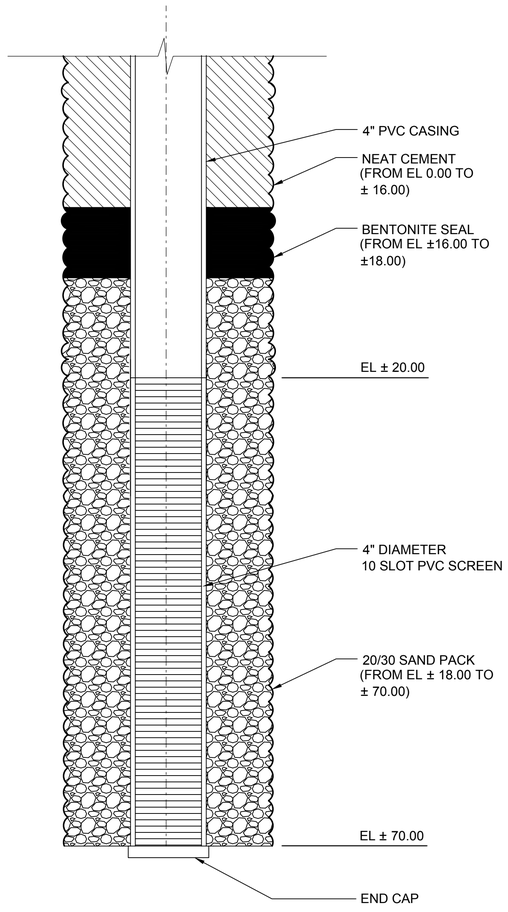
SWFWMD LAKE WALES LFA WELL DESIGN
MECHANICAL
WELLHEAD COMPLETION DETAILS

SHEET
M-1
224401119

PLOT DATE: Wednesday, May 25, 2016 1:37:44 PM
BY: KUBADE, RAJENDRA
DWG FILE: C:\pwworkdir\d0429041\LFA_M-1.dwg



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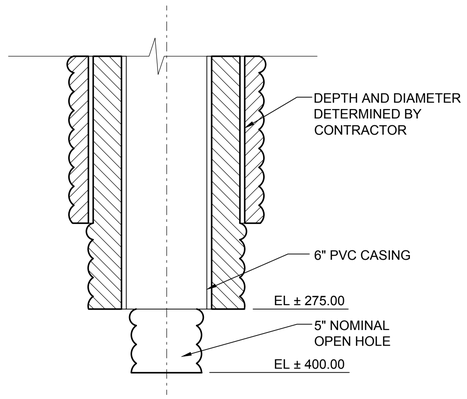

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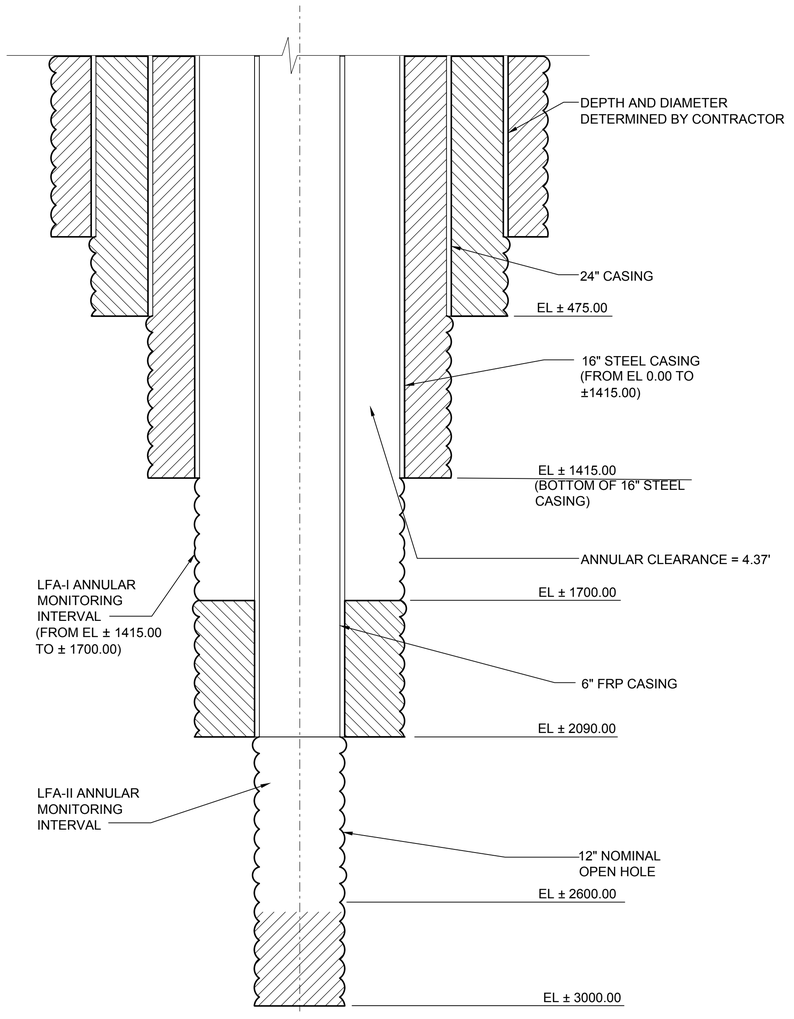

(LW LFA DZMW-1)

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REV	DATE	BY	DESCRIPTION

SCALE
NO SCALE

WARNING
0 ½ 1
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Brooksville, FL 34604
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SWFWMD LAKE WALES LFA WELL DESIGN
MECHANICAL
WELL SUBSURFACE CONSTRUCTION DETAILS

SHEET
M-2
224401119