May 15, 2017

BOARD OF COUNTY COMMISSIONERS
ORANGE COUNTY, FLORIDA
ADDENDUM NO. 1 / IFB NO. Y17-763-PH

NORTHWEST WATER RECLAMATION FACILITY REUSE WATER STORAGE IMPROVEMENTS

BID OPENING DATE: June 8, 2017

This addendum is hereby incorporated into the bid documents of the project referenced above. The following items are clarifications, corrections, additions, deletions and/or revisions to and shall take precedence over the original documents. Additions are indicated by **<u>underlining</u>**, deletions are indicated by ~~strikethrough~~.

A. The Bid Opening is June 8, 2017at 2:00 P.M.

B. <u>Bidder Questions</u>

Question 1. I couldn't find the Ground Storage Tank spec in the documents. Is it to be included in our proposal?

Yes. Insert Section 13320 Prestressed Concrete Tanks in its entirety. Reference the attached Section 13320 Prestressed Concrete Tanks.

Question 2. The Electrically Actuated Valve Schedule on 15390-6 shows the MOV-337 as a 10" Valve. Drawing M06 shows this as a 12" Valve. Can we confirm the valve is 12"?

Valve MOV-337 is a 12-inch valve. In Specification Section 15390, Page 6 Electrically Actuated Valve Schedule, reference Valve DesignationMOV-337 and in the column Size, replace "10" with "12".

Question 3. Drawing E-10 shows a MOV 70-V-41 to be connected to LCP-4-RIO and 80-MCC-2. Is this a New or Existing Valve Actuator?

A new electric valve actuator is required for existing valve 70-V-41 which is currently not electrically actuated. Once the new electric actuator is installed, the valve tag will become MOV 70-V-41.

C. PART C Revise Part C Page D-2

Failure to use the attached <u>Revised D-2 Bid Schedule</u> will result in your bid being found non-responsive .

D. PART H SPECIFICATIONS

1. Add Section 13320 Prestressed Concrete Tank
2. Add Section 15390 Schedules

E. ACKNOWLEDGEMENT OF ADDENDA

a. The Proposer shall acknowledge receipt of this addendum by completing the applicable section in the solicitation or by completion of the acknowledgement information on the addendum. Either form of acknowledgement must be completed and returned not later than the date and time for receipt of proposal.
All other terms, conditions and specifications remain the same.

Receipt acknowledged by:

_____ _____
Authorized Signature Date Signed

_____
Title

_____
Name of Firm

To the Board of County Commissioners
Orange County, Florida

The Undersigned, hereinafter called "Bidder", having visited the site of the proposed project and familiarized himself with the local conditions, nature and extent of the work, and having examined carefully the Contract Form, General Conditions, Supplementary Conditions, Plans and Specifications and other Contract Documents, with the Bond requirements herein, proposes to furnish all labor, materials, equipment and other items, facilities and services for the proper execution and completion of: **NORTHWEST WATER RECLAMATION FACILITY REUSE WATER STORAGE IMPROVEMENTS** in full accordance with the drawings and specifications prepared in accordance with the Contract Documents and, if awarded the Contract, to complete the said work within the time limits specified for the following LUMP SUM BASE BID.

A. **BASE BID:** $_____

B. Hauling Excess Soil Material At NWRF

DESCRIPTION	UNIT	EST QTY	UNIT COST	TOTAL COST
Excess Soil Removal	CY	20,000	$_____	$_____

C. Total BASE BID: (A plus B equals C)

_____DOLLARS
(In Words)

$_____

In the event the Contract is awarded to this Bidder, he/she will enter into a formal written agreement with the County in accordance with the accepted bid within ten (10) calendar days after said Contract is submitted to him/her and will furnish to the County a Contract Payment and Performance Bond with good and sufficient sureties, satisfactory to the County, in the amount of 100% of the accepted bid. The Bidder further agrees that in the event of the Bidder's default or breach of any of the agreements of this proposal, the said bid deposit shall be forfeited as liquidated damages.

Failure of the Bidder to provide pricing for all unit priced items and/or the Base Bid and ALL requested additive/deductive bid items, or alternate bids shall be cause for rejection of the bid as non-responsive **REVISED D-2**

SECTION 15390

SCHEDULES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. Reference Section 15000, Basic Mechanical Requirements.

1.02 PIPING SYSTEM SCHEDULES

A. Piping requirements for this Section are outlined on the Drawings, and in the Piping System Schedule. In the absence of a specified test pressure, pipe shall be tested at a pressure 50 percent greater than the normal operating pressure as determined by the ENGINEER or 10 psig, whichever is greater unless the Schedule indicates that no test is required.

B. If the pipe material is not shown on the Piping System Schedule or otherwise specified, the following materials shall be used:

Pipe Size	Material	Type of Joint	Class/Design	Test Pressure
4-in and larger	DIP	Flanged (Exposed)	53	(1)
4-in through 24-in	DIP	Restrained (Buried)	Pressure Class 350	(1)
30-in and greater	DIP	Restrained (Buried)	Pressure Class 300	(1)
Less than 4-in	PVC	Socket	Sch 80	(1)
(1) Test at 150 percent of normal operating pressure or 100 psi, whichever is greater.				

C. Non-critical gravity lines such as drains, floor drains, roof drains, etc., do not typically require a pressure test.

1.03 PIPING SCHEDULE ABBREVIATIONS

A. Service:

CLS - Sodium Hypochlorite Solution (Chlorine Solution)

DR - Drain

RW - Reuse Water

SA - Sample Piping

B. Material:

CPVC	-	Chlorinated Polyviyl Chloride
DI	-	Ductile Iron
PVC	-	Polyvinyl Chloride
SS	-	Stainless Steel

C. Thickness, Class or Schedule:

CL	-	Class
PC	-	Pressure Class
Sch	-	Schedule

D. Type of Joints:

Flg	-	Flanged
MJ	-	Mechanical Joint
RJ	-	Restrained Joint
SW	-	Solvent Welded
Thd	-	Threaded
Grv	-	Grooved Coupling

E. Type of Fittings:

CPVC	Chlorinated Polyvinyl Chloride
DI	Ductile Iron
PVC	Polyvinyl Chloride
SS	Stainless Steel

G. Interior Protective Coating:

CML	Cement Mortar Lined

H. Exterior Protective Coating:

AC	Asphalt Coated
P	Painted

1.04 PIPING SCHEDULE

Service	Nominal Pipe Diameter (Inches)	Material	Thickness Class or Schedule	Design Pressure (PSIG)	Test Pressure (PSIG)	Type of Joints	Type of Fittings	Protective Coating		Remarks
								Interior	Exterior	
RW Piping										
Above Ground	4 inch and above	DI	CL 53	125	150	Flg	DI	CML	P	
Below Ground	4 inch to 24 inch	DI	PC 350	125	150	RJ	DI	CML	AC	2
Below Ground	Greater than 24 inch	DI	PC 300	125	150	RJ	DI	CML	AC	2
CLS Piping										
Above Ground	3 inch and less	PVC	Sch 80	100	150	Thd or SW	PVC	--	P	1
Below Ground	3 –inch and less	PVC	Sch 80	100	150	SW	PVC	--	--	
Drain Piping										
Below Ground Concrete Encased	4 inch and greater	DI	CL 53	--	--	RJ	DI	--	AC	
Below Ground 2 feet beyond concrete encasement	4 inch and greater	PVC	SDR	--	--	SW	PVC	--	--	
Sample Lines										
Above Ground	3 inch and less	316L SS	Sch 40S	--	--	Thd	316L SS	--	--	
Below Ground	3 inch and less	PVC	Sch 80	50	75	SW	PVC	--	--	

Notes:

1. *Solvent cement shall be silica free and suitable for sodium hypochlorite service per Specification Section 15008.*
2. *Wrap pipe with polyethylene per Specification Section 15006.*

1.05 VALVE SCHEDULES

A. Performance Affidavits shall be required for all valves listed in the valve schedule(s). Performance Affidavits shall be provided in accordance with Section 11000, Equipment General Provisions and Section 01300, Submittals. All valves shall be tagged by the manufacturer according to the control valve designations listed in the Schedule.

B. Valves not listed in the valve schedule(s) shall be manually operated, unless otherwise shown on the Drawings.

C. The following abbreviations are used in the schedule:

1. System:

CLS	-	Sodium Hypochlorite Piping (Chlorine Solution)
DR	-	Drain Piping
RW	-	Reuse Water
SA	-	Sample Piping

2. Ends:

Flg	-	Flanged
Thd	-	Threaded
DU	-	Double Union

3. Materials Body/Trim:

CI	-	Cast Iron
DI	-	Ductile Iron
PVC	-	Polyvinyl Chloride
SS	-	Stainless Steel

(Continued on Next Page)

General Valve Schedule								
System	**Function**	**Valve Type**	**Description**	**Ends**	**Size (Inches)**	**Materials Body/Trim**	**Spec. No.**	**Notes**
RW Piping	Check	Check	Rubber Flapper	Flg	10	CI/SS	15105	1
	Isolation Above Grade	Butterfly	NRS Resilient Seat	Flg or MJ	8 - 16	CI/DI	15101	2
	Air Release Valve	Air Release	--	Thd	½ - 1 ½	CI/SS	15114	
	Drain	Butterfly	NRS Resilient Seat	MJ	8	CI/DI	15101	
	Isolation Below Grade	Gate	AWWA C509 or C515	MJ	8 to 16	CI/DI	15108	
CLS Piping	Isolation	Ball	Double Union PVC	DU	½ - 2	PVC/Viton	15104	3
SA Piping	Isolation	Ball	3 Piece	Thd	½ - 2 ½	316L SS	15104	

Notes:

1. *With external position indicator and switch*
2. *Flanged ends for above ground and mechanical joint ends for below ground.*
3. *Vented ball and Viton O-rings for sodium hypochlorite service.*

ELECTRICALLY ACTUATED VALVE SCHEDULE

VALVE DESIGNATION	TYPE VALVE	TYPE OPERATOR	SIZE (INCHES)	MAXIMUM FLOW (GPM)	MAX. DIFFERENTIAL PRESSURE (PSI)	CLASS	SERVICE	LOCATION	NEW OR EXISTING ELECTRIC ACTUATOR
MOV-211	*BUTTERFLY VALVE*	*OPEN/CLOSE*	*24*	*27,000*	*15*	*150*	*PAR TANKS ISOLATION*	*EXISTING YARD VALVE*	*EXISTING*
MOV-214	GATE VALVE	OPEN/CLOSE	12	13500	15	150	TANK 1 INLET	*EXISTING YARD VALVE*	NEW
MOV-221	GATE VALVE	OPEN/CLOSE	12	13500	15	150	To TANK 2 INLET	*EXISTING YARD VALVE*	NEW
MOV-212	GATE VALVE	OPEN/CLOSE	12	6,550	15	150	TANK 1 RETURN	*EXISTING YARD VALVE*	NEW
MOV-213	GATE VALVE	OPEN/CLOSE	16	11,800	15	150	TANK 1 TO PUMPS	*EXISTING YARD VALVE*	NEW
MOV-222	GATE VALVE	OPEN/CLOSE	12	6,550	15	150	TANK 2 RETURN	YARD	NEW
MOV-223	GATE VALVE	OPEN/CLOSE	16	11,800	15	150	TANK 2 TO PUMPS	YARD	NEW
MOV-232	GATE VALVE	OPEN/CLOSE	16	11,800	15	150	PUMP SUCTION	*EXISTING YARD VALVE*	NEW
MOV-337	BUTTERFLY VALVE	MODULATING	~~10~~12	4,300	15	150	PUMP DISCHARGE	PUMP STATION	NEW

ELECTRICALLY ACTUATED VALVE POSITION SCHEDULE

Operating Scenario	Existing PAR Tanks Isolation Valve *MOV-211*	PAR Tank 1 Inlet *MOV-214*	PAR Tank 1 Recirculation Valve MOV-212	PAR Tank 1 Outlet to Recirculation Pumps *MOV-213*	PAR Tank 2 to Inlet MOV-221	PAR Tank 2 Recirculation Valve MOV-222	PAR Tank 2 Outlet to Recirculation Pumps MOV-223	PAR Tank 2 to PAR Service Pumps *MOV-232*	Recirculation Pump Flow Control Valve MOV-337
Both PAR Tanks out of service	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
Normal Operation both PAR Tanks In service	OPEN	OPEN	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	OPEN	CLOSED
Off-Spec Water Capture	OPEN	CLOSED	CLOSED	CLOSED	OPEN	CLOSED	CLOSED	CLOSED	CLOSED
Off-Spec Water Chlorinate or Recirculate	CLOSED	CLOSED	CLOSED	CLOSED	OPEN	OPEN	OPEN	CLOSED	OPEN to setpoint
PAR Tank 1 in service, PAR Tank 2 Out of Service	OPEN	OPEN	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED	CLOSED
Transfer water from PAR Tank 1 to PAR Tank 2	CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN	CLOSED	CLOSED	OPEN to setpoint
Transfer water from PAR Tank 2 to PAR Tank 1	CLOSED	OPEN	OPEN	CLOSED	CLOSED	CLOSED	OPEN	CLOSED	OPEN to setpoint

ISOLATION VALVE SCHEDULE
(DOES NOT INCLUDE MOTORIZED VALVES)

VALVE DESIGNATION	VALVE TYPE	SIZE (INCHES)	MAXIMUM FLOW (GPM)	MAX. DIFFERENTIAL PRESSURE (PSI)	CLASS	DESCRIPTION
ISV-215	*GATE*	*16*	*11,800*	*15*	*150*	*TANK 1 OUTLET EXISTING*
ISV-224	GATE	12	6,550	15	150	TANK 2 INLET
ISV-225	GATE	16	11,800	15	150	TANK 2 OUTLET
ISV-226	GATE	8	3,500	15	150	TANK 2 DRAIN
ISV-311	BUTTERFLY	10	4,300	15	150	PUMP 1 SUCTION ISOLATION
ISV-312	BUTTERFLY	10	4,300	15	150	PUMP 1 DISCHARGE ISOLATION
ISV-321	BUTTERFLY	10	4,300	15	150	PUMP 2 SUCTION ISOLATION
ISV-322	BUTTERFLY	10	4,300	15	150	PUMP 2 DISCHARGE ISOLATION

SECTION 13320

PRESTRESSED CONCRETE TANKS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The tank construction company (TCC) shall provide all labor, material, and equipment required to construct one (1) prestressed composite above ground storage tank (herein called tank), with a cast-in-place concrete membrane floor slab, prestressed composite wall, a dome roof and accessories as shown on the Drawings and as specified herein, suitable for reclaimed water storage.

B. The TCC shall be responsible for the structural design of the tank, including but not limited to: foundation slab, outlet sump, pipe penetrations, dome roof with parapet wall and wire prestressed composite wall. The prestressed concrete tanks shall in general conform to the applicable section of the "Design and Construction of Circular Wire and Strand-Wrapped Prestressed Concrete Structures" prepared by ACI committee 372 and AWWA Specification D110.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 2 - Sitework

B. Division 3 - Concrete

C. Division 5 - Metals

D. Division 7 - Thermal and Moisture Protection

E. Division 9 - Finishes

F. Division 15 - Mechanical Construction

1.03 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

A. Reference Specifications, Codes and Standards shall be as specified in Section 01090 entitled "Reference Standards".

1.04 SUBMITTALS

A. The TCC shall submit Shop Drawings, Operation and Maintenance Instructions, and other information as specified in accordance with Section entitled "Submittals".

B. Shop Drawings shall include Structural Drawings, complete erection, installation, and adjustment instructions and recommendations. All Drawings shall be signed and sealed by a Professional Engineer registered in the State of Florida. Drawings shall include:

1. Complete plan, elevation and sectional views showing critical dimensions.

2. Size, location and number of all reinforcing bars.

3. Thickness of all parts of the tank structure including floor, core, wall, dome, and cover coat.

4. Prestressing schedule including number and placement of prestressing wires on the tank wall and total applied force per foot of wall height.

5. Location and details of all accessories required.

C. The TCC shall submit the following in addition to the requirements specified herein:

1. Complete record of experience with sources of Engineers, Cities and dates of construction for no less than ten tanks of comparable size.

2. Copies of Shotcrete Nozzlemen Certificates.

D. Properly identified and neatly bound calculations, together with ample sketches and illustrations showing complete details of all required accessories and pipe penetrations shall be submitted to the Engineer for review and acceptance. All design data shall be listed, and references to the chapter, section, or paragraph of the applicable code(s) shall be noted at critical steps in the calculations to ascertain conformance thereto. Review by the Engineer shall not relieve the TCC from responsibility for the accuracy and completeness of its design. Structural calculations shall be reviewed and sealed by a currently registered Professional Engineer in the State of Florida. Computer printouts shall be substantiated with manual calculations verifying the accuracy of the outputs.

E. Copies of the reviewed shop drawings and submitted calculations shall be forwarded by the TCC to applicable permitting agencies for review and approval. The TCC shall be responsible for demonstrating the conformance of the design to the Florida Building Code and all applicable local requirements. The Owner or Engineer will not be responsible for additional costs over the Contract price for conforming the design to Code requirements.

F. Design criteria and fully detailed working drawings for the prestressed concrete tank as specified.

G. Concrete and grout mix design and strength test results of trial mixes for all concrete per Section 03300.

H. Joint materials.

I. Mill certificates for prestressing wire and for appurtenant materials.

J. Details for dome mounted handrail and dome parapet wall construction.

1.05 QUALIFICATIONS

A. The TCC shall be a specialist in the design and construction of the wire wound circular prestressed composite tanks with at least ten years of experience in central Florida

which shall include the construction of no less than ten prestressed composite tanks of comparable size. The TCC shall give satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tanks in accordance with the quality required by these Specifications. The entire tank, including all portions of the floor, wall, and roof shall be built by the TCC using its own trained personnel and equipment.

B. The TCC shall have on its staff a full-time Professional Engineer registered in the State of Florida with no less than five years experience in design and field construction of circular prestressed composite tanks and who will be in responsible engineering charge of the work to be done. All working drawings and design calculations shall carry the seal of such registered Professional Engineer.

C. The TCC constructing the tank shall have built completely in its own name in the past five years, and be presently responsible for, a minimum of ten (10) dome-covered prestressed composite tanks of equal size or larger which meet these Specifications and which are now giving satisfactory service.

1.06 TCC'S RESPONSIBILITY

A. The TCC shall guarantee workmanship and materials entering into its portion of the Work for a period of five years from date of acceptance of the Work. In case leakage or other defects appear within the five-year period, the TCC shall promptly make required repairs at its own expense upon written notice by the Owner that such defects have been found. Leakage through the side walls shall be defined as the appearance of free liquid showing stream flow on the exterior tank surface, the source of which is from the inside of the tank. Leakage through the bottom shall be defined as the appearance of water flowing or dripping from tank subsurface system with groundwater below invert elevations.

B. The TCC shall be totally responsible for the structural integrity of the tank and adherence to all applicable codes (local and state).

C. Provide written warranty signed by Tank Construction Company and Contractor agreeing to repair or replace defective components and workmanship of the tanks as required to maintain the tanks in a water tight condition, at no expense to the owner, for a period of 5 years after date of substantial completion of the project.

1.07 SITE PREPARATION AND FOUNDATION DESIGN

A. The Contractor shall perform site preparation in the area of the tank. Surface preparation shall be in accordance with project specifications and to the satisfaction of the Tank construction Company. The Owner will retain the services of an independent testing laboratory to perform soil density tests as specified in section 02224 – Excavation and Backfill for Structures. Test reports will be forwarded to the TCC, the ENGINEER, and the Owner for review. The Tank Construction Company shall review the submitted test reports and ensure that Soil preparation is satisfactory to meet their design requirements and design assumptions for strength and serviceability of the tank structure. The tank construction company shall accept or reject the density tests reports in writing. In the event that the TCC requires additional soil preparation to meet the design requirements, the costs of such preparation shall be included in the contract price and will be at no additional cost to the Owner.

B. A separate geotechnical report is available for information purposes in the Appendices. The report identifies properties below grade and also offers recommendations. The recommendations shall not be construed as requirements of the Contract unless specifically referenced by the Contract Documents.

C. Prior to submitting its bid, the TCC shall examine the site and review the available geotechnical reports and subsurface information and/or undertake its own soil borings prior to submitting its bid, taking into consideration all conditions that may affect its Work. The Owner and Engineer will not assume responsibility for variations of sub-soil quality or conditions.

1.08 INSPECTIONS

A. The TCC shall provide the services of a qualified representative having a minimum of ten years experience in concrete tank construction projects in Florida (Special Inspections) who shall instruct and supervise the TCC's personnel in the construction of the tank. The qualified representative shall ensure that the construction is in accordance with the structural shop drawings reviewed and accepted by the Owner.

B. After the construction of the tank and testing, prior to acceptance by the Owner, the qualified representative shall issue a Certificate of Completion stating that the construction was in conformance with the structural shop drawings.

1.09 PRESTRESSED CONCRETE TANK DESCRIPTION

A. Tank shall consist of:

1. Cast-in-place concrete floor

2. Prestressed composite wall with steel diaphragm

3. Clear span dome roof with 16" high parapet wall (16" from top of tank sidewall to top of parapet wall)

4. Accessories include:

a. Exterior aluminum ladder with safety cage

b. Mechanical liquid level indicator

c. Interior fiberglass ladder with safety device

d. Roof ventilator at center of dome

e. Roof hatch

f. Sidewall entrance manhole

g. Precast concrete overflows with a positive slope between each overflow. Perimeter 16-inch high parapet wall to collect tank stormwater runoff and divert it into the tank through the concrete overflows.

h. Perimeter double rail handrail with kickplate

i. Fall protection system

j. Submerged pressure element level indicator system

5. The tank manufacture shall include a parapet wall and drain system to collect rainfall from the roof and divert it into the tank.

1.10 ACCEPTABLE MANUFACTURERS

A. Acceptable Tank Construction Companies are Crom Corporation, Precon Corporation or approved equal.

PART 2 - MATERIALS

2.01 GENERAL

A. The tanks shall be designed to the following general requirements. Refer to drawings for pipe penetrations, floor configuration, access details, etc.

Designation	*Storage Tank*
Capacity, MG	3
Inside diameter, feet	141
Tank floor elevation, feet	111.00
Top of wall elevation, feet	136.75
Elevation of top of dome, feet	143.00
Design water level in tank, feet	136.75
Maximum water level in tank, feet	136.75

B. The circular tanks shall be constructed of composite steel-shotcrete, wire wound prestressed construction as specified herein. The wire-prestressed composite wall shall consist of a shotcrete cover wall encasing a steel diaphragm continuous over the full wall height.

C. Dimensions and structural details shown on contract drawings are minimum requirements. The TCC shall provide whatever additional thicknesses, reinforcing, etc., to meet code and structural requirements.

D. Each entire tank, including all portions of the floor, wall, and roof, shall be built by the TCC using its own trained personnel and equipment.

2.02 DESIGN CRITERIA

e. Seasonal high groundwater conditions per the geotechnical report prepared for the project site.

E. The thickness of the prestressed shotcrete walls and concrete core walls shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.

F. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.

G. The design of the circular prestressed walls shall be in conformance with American Concrete Institute (ACI) Title 372R-W "Design and Construction of Circular Wire and Strand Wrapped Prestressed Concrete Structures," and currently accepted engineering principles and practices for the design of such facilities.

H. Shotcrete: f'_g shall be equal to or greater than 4000 psi at 28 days

f_{ci} shall be equal to or less than 0.55 f_{ci} at winding

I. Prestress Wire: f_s, wall = 115,000 psi

f_s, dome ring = 120,000 psi

f_{si} = 145,600 psi or no greater than 0.70 f'_s

f'_s shall be equal to or greater than 231,000 psi

J. If requested, the TCC shall furnish certified statements from an approved testing laboratory for wire used. Concrete and shotcrete testing requirements shall be as specified herein.

2.03 CONCRETE

A. As specified in Section 03300 – Cast-in-Place-Concrete for class A concrete. Maximum size of aggregate for floor concrete shall be 3/4 –inch. Maximum size of aggregate for dome concrete shall be 3/8-inch.

2.04 REINFORCING STEEL (Other Than Prestressing Wire)

A. As specified in Section 03200 – Concrete Reinforcement.

B. Reinforcing steel shall have a minimum yield strength (f_y) of 60,000 psi.

C. Reinforcing steel shall have an allowable tensile stress of 18,000 psi.

2.05 MESH REINFORCEMENT

A. Geotechnical Considerations

1. A separate geotechnical report is included in the Appendices that outlines the subsurface conditions to be expected on site. The Tank Construction Company shall review the soil borings and the Specifications for soil preparation to develop the foundation design criteria required for each tank.

2. Differential settlement can be expected for the structures. All new structures can be expected to undergo an overall settlement of 1-inch and a differential settlement of 1/2-inch. Foundations shall be designed for the anticipated settlements.

B. Groundwater

1. All structures shall be designed for the high groundwater elevations based on the geotechnical report prepared for the project site. The design seasonal high groundwater elevation is approximately 4 feet below grade. All structures shall have a twenty-percent safety factor against uplift under high groundwater conditions.

2. The Tank Construction Company shall design and furnish the tanks structures for all combination of loads per applicable building codes.

3. No pressure relive valves shall be utilized in the construction of any prestressed concrete tanks valves if the structural dead load will not compensate for the design uplift forces.

C. Contract Drawings

1. The Contract Drawings show wall thicknesses, reinforcing steel and construction details at some locations. These details are meant to establish minimum standards and are not intended to represent the Tank Construction Company's scope of work. Modifications shall be made as required by the structural design. Details of tank geometry shall be coordinated and revised as required by the Contractor with the various equipment, piping, and electrical submittals.

D. Load Criteria

1. The tanks shall be designed for the worst case of the following load conditions or its combinations:

   a. Interior high water level, as shown on the Drawings, to top of tank.

   b. Wind Load: 135 mph based on a 3-second gust per Florida Building Code (FBC) and ASCE 7-02, Exposure Category C.

   c. Roof Live Load: Minimum 12 psf as specified by the Florida Building Code.

   d. Equipment loads.

A. The wire mesh used shall be electrically welded and shall comply with ASTM Designation A 185 (latest revision), not galvanized.

2.06 PRESTRESSING WIRE

A. Wire size shall have a minimum diameter of 0.162 inches for 8 gauge and 0.192 inches for 6 gauge but shall not exceed 0.250 inches, for either gauge wire.

B. Prestressing wire shall comply with the latest revision of ASTM Designation A 821 Class B and shall have a minimum ultimate tensile strength (f'_s) of 231,000 psi or greater for 8 gauge and a minimum ultimate tensile strength of 222,000 psi or greater for 6 gauge.

2.07 SHOTCRETE

A. The TCC shall submit detailed information regarding the proportions and preparation of the shotcrete to the Engineer before the material is to be used. The shotcrete shall be so proportioned as to be sound, dense, waterproof, and durable.

B. Fine Aggregates (Sand):

1. Saturated, surface dry, hard, dense, uncoated rock fragments free from injurious amounts of foreign or deleterious substances as specified in Section 03300 – Cast-in-Place-Concrete.
2. Fineness Modulus for Sand: Range from 2.40 to 3.00 with maximum particle size of 1/4 inch.
3. Maintain sand at 3 to 6 percent moisture content; dampen or dry with sand dryers if necessary.
4. Gradation:

Sieve Size	Percent Passing by Weight
No. 4	97-100
No. 8	90-98
No. 16	70-85
No. 30	35-55
No. 50	12-25
No. 100	2-8

C. Screen sand for finish coat to produce uniform dense surface in texture and appearance.

D. The mortar shall have the following minimum compressive strengths:

	7 Days	28 Days
Individual minimums	2400 psi	4000 psi
Average minimums	3000 psi	5000 psi

E. The shotcrete shall have the following allowable compressive stress (f_g):

1250 + 75t with 0.45 f'_g maximum
where t = thickness of the core wall

F. The shotcrete shall have the following allowable compressive stress due to initial prestressing (f_{gi}):

0.5 f'_{gi} or less, with a maximum of 2,250 psi (where f'_{gi} is defined as compressive strength at the time when the initial prestressing force is applied).

G. The TCC shall take one set of three test cylinders per 50 cubic yards of shotcrete mix applied per day, or fraction thereof and have tested at an independent materials testing laboratory acceptable to the Engineer. Test all shotcrete using standard 6 x 12 cylinders in accordance with ASTM C 39 and C 94. All cost associated with the shotcrete testing shall be included in the TCC bid price.

2.08 TANK FLOOR AND FOUNDATION

A. Each concrete tank floor and foundation shall be constructed as a membrane floor slab conforming to Section 03300 – Cast-in-Place Concrete and other applicable sections of these Contract Documents. Concrete membrane floors shall be thickened to a minimum of 8 inches over all pipe encasements and around sumps. Reinforcement shall extend a minimum of 2 feet into the adjacent floor slab.

B. Each tank floor slab shall be concrete or shotcrete construction, minimum 4-inch thickness, containing no less than 0.60 percent reinforcing steel in each orthogonal direction. Reinforcement shall extend a minimum of 2 feet into the adjacent floor slab. The Tank Construction Company shall be responsible for design and shall provide a sufficiently thick reinforced floor slab, including the foundation slab beneath the walls for the vertical loading. The floor slab shall be capable of transferring loads from the wall, so that the load applied to the soil is as recommended in the geotechnical report.

C. A sliding water stop shall be used in the floor-wall joint. Load, shear, and deflection data to support shear and deflection must be included in the calculations for the base of the wall. Tests must have been generated for the particular water stop configuration proposed. Maximum allowable foundation bearing pressure shall be selected as a result of a review of the available soils information and tests conducted by the TCC, but in no case shall be greater than 3200 psf.

D. All below grade piping that falls within the foot print of the foundation slab shall be encased in reinforced concrete as shown on the Drawings.

E. Floors shall be vibratory screeded to affect consolidation of concrete and proper encasement of floor reinforcing steel.

F. Floors shall be continuously water cured utilizing potable water until tank construction is completed.

G. Differential Settlement: 0.5-inches.

H. Total Settlement: 1.0-inches.

2.09 CORE WALL

A. The core wall shall be constructed of shotcrete placed in accordance with standard practices. A description of shotcrete practice is contained in ACI 506R, "Guide to Shotcrete." Core wall thickness at the top of the tank shall be not less than 3-1/2 inches. Base-of-wall thickness shall be determined by design calculations to resist the initial compressive stresses of the prestressing wire, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. Horizontal sections of the wall shall form true circles without flats, excessive bumps, or hollows. All prestressing shall be done with high tensile wire, permanently bound to the tank wall in which a substantial allowance shall be made for loss of prestress due to shrinkage and plastic flow in the shotcrete and to relaxation in the steel. Provide a minimum 2-inch thick section with defined 90 degree angled edge to thicken areas for all materials, supports, equipment, etc. requiring anchorage to the tank wall.

2.10 STEEL SHELL DIAPHRAGM

A. A 26 gauge full height steel tank shell shall, complying with ASTM A 366 (latest revision) for Commercial Quality Cold Rolled Steel, shall be used throughout the core wall providing a positive waterstop. A shotcrete coat, not less than one-inch thick, shall cover and protect the steel shell diaphragm at all places. The steel shell shall be so formed and erected that a strong mechanical key between shotcrete and shell will be created. The sheets of steel diaphragm shall be continuous from top to bottom of wall. Only vertical joints will be permitted.

2.11 DOME ROOF

A. The dome roof shall be a circumferentially prestressed free-span dome of concrete or shotcrete construction with a minimum thickness of three inches and a minimum of 0.25 percent reinforcing steel in each orthogonal direction.

B. Dome shell reinforcement shall consist of reinforcing steel bars or welded wire fabric meeting ASTM A-185, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic tipped. Wire ties shall be galvanized.

C. The dome shell shall be designed as a free span, spherical thin shell, with a one-twelfth (1/12) rise. The dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have a cross section suitable to accept the applied prestressing forces. All surfaces in the wall/dome ring girder joint shall be coated with an approved bonding epoxy.

D. Overflow outlets shall be installed on the dome roof in such numbers as will provide an overflow open area at least three times the area of the largest tank pipe.

E. Design and construct a 16-inch high parapet wall around the dome perimeter and slope concrete surfaces using grout to drain dome runoff water into the overflow outlets.

2.12 VERTICAL REINFORCING

A. Vertical reinforcing to compensate for shrinkage, temperature, and vertical bending moments in the core wall shall be as follows:

Inside face - A 26 gauge steel shell diaphragm continuous the full wall height without horizontal splices. Additional vertical and horizontal reinforcing steel bars as required by design computations.

Outside face - Vertical reinforcing steel: minimum of #4 bars at 12 inches center to center. Additional vertical and horizontal reinforcing steel bars as required by design computations.

2.12 WATER STOPS

Water stops shall be PVC and shall meet the minimum requirements in accordance with CRD-C572.

2.13 NEOPRENE BEARING PAD

In accordance with AWWA D110, paragraph 2.5.

2.14 SPONGE FILLER

In accordance with AWWA D110, paragraph 2.5.3.

2.15 EPOXY INJECTION SEALANT

The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C881/C881M, Type III, Grade 1 and shall be a 100% solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.

2.16 TANK ACCESSORIES

A. Tank accessories shall be furnished by the TCC as shown on the Drawings and specified herein.

1. Wall manhole shall be provided as shown on the drawings. The wall thimble shall be ¼ inch minimum thickness and the cover shall be ½ inch minimum thickness. The cover shall be gasketed for a watertight seal. All metal shall be 316 stainless steel.

2. Piping Brackets, Grating, and Vortex Shedding Device: Provide piping brackets for all vertical risers supplied under Division 15 to rigidly support the piping to the nearest wall. Stainless steel vortex shedding device on tank outlet shall be as shown on the Drawings. Grating over drain outlet shall be fiber glass.

3. Interior ladders shall conform to Owner, state, and OSHA requirements. Equip the interior ladders with a ladder-centered notched safety climbing tube of ASTM A276, Type 316 Stainless Steel. Provide storage brackets and box mounted on the handrail for the removable portion of the tube which extends above the roof

hatch. Provide three sets of safety belts and sleeves. Construct the interior ladder of fiberglass with Type 316 Stainless Steel fasteners.

4. Exterior ladders shall conform to Owner, state, and OSHA requirements Construct the exterior ladders of T6061 aluminum with Type 316 Stainless Steel fasteners safety cage and safety climbing device conforming to applicable OSHA standards.

5. Roof Ventilator: Roof ventilator shall be provided as shown on the Drawings. All ventilator material shall be fiberglass or Type 316 Stainless Steel. Ventilator shall include polyester, removable 24/24 mesh insect screens.

6. Overflow Outlets: Dome shall include four integrally cast concrete "eyelet" type overflow outlets as shown on the Drawings complete with fiber glass "eyelid" covers and polyester, removable insect screens.

7. Miscellaneous Metals: All miscellaneous metals framing into the tank structure including brackets, fasteners, plates, angles, flanges, etc., shall be furnished and installed by the TCC. Supports and fasteners shall be supplied for all conduit and small pipe mounted to the tank walls or slabs. All fasteners shall be Type 316 Stainless Steel. Miscellaneous metals shall be in conformance to with requirements set forth in Division 5 – Metals of these Contract Documents.

8. Access Hatch: Provide dome mounted fiberglass access hatch as detailed on the drawings complete with all Type 316 stainless steel fasteners and hardware.

9. Mechanical Level Indicator: Provide a mechanical level monitoring device and connections to the tank wall as shown on the Drawings to provide visual indication of tank level that does not require power. Materials shall be fiberglass with Type 316 stainless steel fasteners.

10. Submerged pressure element system for continuous level monitoring in accordance with Section 13310.

11. Perimeter Handrail: Provide double rail aluminum handrail with kickplate as specified under Division 5 around the perimeter of the tank. TCC shall provide integrally cast bosses to mount handrail posts as required to facilitate installation of the handrail for level and rigid connection. Coordinate handrail design with perimeter parapet wall design. Fasteners and anchors shall be Type 316 stainless steel. Provide protective coating on aluminum surfaces that will be in contact with concrete.

12. Tank Hardware: All tank hardware (fasteners, bolts, nuts, anchor bolts, screws, etc) shall be Type 316 stainless steel.

13. Fall Protection System: the tank manufacturer shall provide the design and installation of a fall protection system around the perimeter parapet wall of the tank. The system shall be compliant with all current standards and design criteria dictated by the United Stated Occupational Safety & Health Administration and Orange County's Office of Risk Management. The basis of the system shall be perimeter cable system mounted along the roof of the tank at the parapet wall. The system will be for Operators to harness into with a typical personal fall arrest

system using body harness and locking snap hooks. The system shall be designed by an Engineer Licensed in the State of Florida with experience in design of safety systems to serve as the Safety System Design Engineer. The system shall be submitted for review by the Owner and Engineer as part of the submittal process. The submittal shall include all materials of construction, assumptions, loads, etc. and be signed and sealed by the Safety System Design Engineer. Following the construction of the tanks and prior to acceptance by the Owner, the Safety System Design Engineer shall inspect the installation by the Contractor and provide a Certification Letter confirming that the system was installed in accordance with design prepared and submitted.

PART 3 - INSTALLATION

3.01 CONCRETE WORK

A. The formwork, mixing, placement, finishing, etc., for concrete Work shall be as specified under applicable Sections of these Specifications.

3.02 STEEL DIAPHRAGM

A. The diaphragm shall be erected plumb and securely anchored and aligned to serve as a shooting form for the shotcrete mortar.

B. No holes, including nailholes, shall be made for any purpose, including the purpose of erection, before, during, or subsequent to erection, except for those required for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetration shall be sealed with an approved epoxy sealant. The diaphragm shall be interlocked, lapped, and completely sealed with an approved epoxy bonding material.

C. All vertical joints shall be sealed water tight by epoxy injection. This epoxy injection shall be carried out from bottom of the wall to top of wall, using a pressure pumping procedure, after the steel shell has been fully encased, inside and outside, with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel. The sealant shall conform to the requirements of ASTM C 881, Type III, Grade 1, and shall be a 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees Fahrenheit.

D. The diaphragm and the epoxy injection procedure must have demonstrated suitability through successful use in the ten-tanks required in the TCC's experience record. The final determination of suitability shall be determined solely by the Engineer.

E. Maximum dimension tolerances for core wall construction (including diaphragm as applicable) shall be as follows:

Thickness:	+/- 1/4 inch
Height:	1/4 inch in 100 feet not to exceed a total of 1/2 inch
Out-of-plumb:	1/4 inch in 10 feet of height

Out-of-round: +/- 1 inch per 100 feet diameter

3.03 PLACING SHOTCRETE

A. All shotcrete shall be applied by or under direct supervision of experienced nozzlemen certified by the American Concrete Institute (ACI) as outlined in ACI certification publication CP-60. Shotcrete nozzlemen shall provide proof of current certification in accordance with ACI certification publication CP-60 guidelines, "Certification of Shotcrete Nozzlemen." The nozzle shall be held at such a distance and position that the stream of flowing material shall be nearly perpendicular as practicable to the surface being covered. Any rebound or overspray or sags shall be immediately cut out and replaced with proper material.

B. The velocity of the material at impact shall be uniform and such as to produce a minimum rebound of sand and fully encase resteel. No shotcrete shall be placed when the temperature is below 40 degrees Fahrenheit or when other weather conditions are unfavorable. The surface to which shotcrete is applied shall be free from frost.

C. At the end of each day's Work, or similar stoppage period, the shotcrete shall be cut off as square as possible. Before resuming shooting, these exposed portions shall be thoroughly cleaned and wetted by means of air and water blast. Should the strengths of shotcrete shown by the test specimens made and tested in accordance with the above provisions fall below the values given, the Engineer shall have the right to require changes in the shotcrete mix for the remainder of the Work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the failing test specimens. In the event that such additional curing does not give the strength required, as evidenced by core and/or other tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The TCC shall have no claim for reimbursement for the required corrective measures.

3.04 CURING CONCRETE AND SHOTCRETE

A. The TCC shall be responsible for the curing of all concrete masonry and shotcrete. Curing shall include protection such that the temperature at the surface does not fall below 50 degrees Fahrenheit and such that there is no loss of moisture from the surface for a period of seven days, where normal portland cement is used.

B. If low temperatures are anticipated, the TCC shall submit, for the approval of the Engineer, the method he proposes to use for protecting the concrete and shotcrete against low temperatures prior to placing.

3.05 HORIZONTAL PRESTRESSING

A. Circumferential prestressing of the tank walls shall be accomplished by applying continuously and uniformly a prestressing steel wire to the core wall in a helix of such pitch as to provide an initial predetermined force and unit compressive stress in the core wall per lineal foot of height equivalent to that derivable from the Drawings. Splicing of the wire shall be permitted only when terminating an application of one complete coil of wire or in the event a defective section of wire must be removed during application. A

machine shall be used for applying the wire, capable of continuously inducing a uniform initial force in the wire as it is laid on the tank wall. Force in the wire shall be induced by methods not dependent on cold working or re-drawing the wire. Only the aggregate force of all stressed wires per foot shall be considered rather than the force per individual wire. No circumferential movement of the wire along the tank wall will be permitted during or after stressing of the wire. The steel wire bands on the core wall and dome ring shall be so placed that the prestress "working force" per foot of wall height shall exceed the hydraulic ring tension forces by not less than five percent. The "work force" shall be defined as the force determined by multiplying the area of steel wire by the unit wire stress after an allowance for losses of 20,000 psi has been made from the initial unit wire stresses. Such initial unit wire stress readings shall be made the same day the wire is placed, or if made later and after some stress losses have already occurred due to creep of wire, plastic flow, and shrinkage of core wall, allowances shall be made for such losses. The clear space between adjacent wires is to be no less than one wire diameter.

B. No prestressing wire shall be installed until the concrete or shotcrete mortar core wall has been shown by test to have attained 75 percent of the 28-day compressive strength hereinbefore specified. No prestressing wire shall be applied when weather conditions are unfavorable.

C. Where more than one layer of wire is required, underlayers shall be covered with shotcrete of sufficient thickness to provide approximately 1/8-inch cover over the wire.

D. Attention is directed to the fact that prestressing wire is susceptible to failure through corrosion. Extreme care shall be used to protect the wire against leakage of water both from within and without the tank.

3.06 STRESS MEASUREMENT

A. The TCC, at its own expense, shall furnish special equipment at the construction site capable of measuring the stress in the wire after it is placed on the tank wall. This stress-measuring equipment shall consist of an electronic direct-reading stressometer accurate to within two percent, complete with calibrated dynamometers and a test stand to verify the accuracy of the stressometer from time to time if necessary. The initial tension in each wire shall be recorded.

3.07 EXTERIOR COVERCOAT

A. After circumferential prestressing wires have been placed by a wire winding machine, they shall be covered with shotcrete that will provide a minimum thickness over the wire of 1- inch. The shotcrete encasement shall completely encapsulate each wire and permanently bond the wire to the tank wall. When more than one layer of wire is required, under layers shall be covered with shotcrete of sufficient thickness to provide approximately 1/8-inch cover between layers.

3.08 WALL OPENINGS

A. At all openings through the sidewalls, the wires shall be placed equally above and below the opening. The displaced wires will be added to those for a foot or two above and

below the opening, leaving an entire strip around the tank which is unbanded. Such unbanded strip shall be no more than 36 inches high.

B. An axi-symmetric finite element shell analysis will be required for unbanded wall spaces having a vertical dimension greater than 36 inches.

C. All pipe sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

3.09 CLEANING

A. After construction of the tank has been completed and accessories installed, all trash, loose material and debris shall be removed from the tank. The tank should be thoroughly cleaned with a high pressure water jet, sweeping, scrubbing or equally effective means. All water and dirt or foreign material accumulated in this cleaning operation should be discharged from the tank or otherwise removed. All interior surfaces or the tank shall be kept clean until final inspection and acceptance.

3.10 FILLING AND TESTING

A. Filling and testing of the tank shall be carried out prior to placing backfill around the structure. Watertightness shall be tested and the tank disinfected in accordance with Section 02667 entitled "Hydraulic Structures Testing". Reuse water shall be used for filling and testing. Testing shall be performed after interior coatings are applied.

B. If the structure does not pass the hydraulic test, repairs shall be performed after acceptance of the repair procedure by the Engineer. The hydraulic test shall then be repeated. All costs including schedule impacts, costs of reuse or potable water and other indirect costs resulting from a re-test shall be borne by the Tank Construction Company.

3.11 PAINTING

A. Painting of all tank walls, roof and other exterior concrete surfaces as well as the interior of tank shall be coated as specified in Section 09900 entitled "Painting".

B. A uniform finish shall be provided for the tank exterior walls and roof. The standard of finish and colors shall be determined by the Owner. The surface to be painted shall be cured for a minimum of 28 days prior to application of paint materials.

3.12 DISINFECTION

A. Following the successful hydrostatic tests, the tanks shall be disinfected by the Contractor in accordance with AWWA C652-92, Disinfection for Water Storage Facilities, and FDEP requirements. Following disinfection the tanks shall be immediately put into service.

3.13 WARRANTY

The TCC shall provide a written warranty for workmanship and materials on the new 3 MG Ground Storage Tank for a period of five years from date of acceptance of the work.

In case leakage or other defects appear within the five-year period, the tank constructor shall make repairs upon written notice by the Owner that such defects have been found. Leakage is defined as damp spots where moisture can be picked up by touching with a dry hand on the exterior of the tank surface, the source of which is from the inside of the tank, or the continuous loss of water by volume measure which is determined to be penetrating the bottom slab. Any repair or corrective work shall be the responsibility of the Contractor at no cost to the Owner.

- END OF SECTION -

- THIS PAGE LEFT BLANK INTENTIONALLY -