

**EXHIBIT C**  
**ITB #18-010**  
**Specifications**

**Scope of Work**

The project will include replacing two (2) vertical pumps (Filtration 1 and Filtration 2) for supply to the Zero Depth Pool, two (2) vertical pumps (Flume 1 and Flume 2) for supply to flume slides in the Zero Depth Pool, and replacing one (1) vertical pump for supply to Waterplay feature in the Zero Depth. The pumps are to be replaced with flooded suction pumps and include Variable Frequency Drives. The village will remove all existing equipment prior to start of the project. The project must conform to design and engineering specifications provided by Innovative Aquatic Design, LLC.

**PUMP REPLACEMENT**

**PART 1 – GENERAL**

1.1 SECTION INCLUDES

- A. Pool mechanical systems, including piping, circulation pump.
- B. Equipment start-up, closing, and instruction of Owners personnel.

1.2 REFERENCES

- A. ASTM D1785 – Specification for Standard specification polyvinyl chloride (PVC) plastic pipe schedules 40, 80, and 120.
- B. ASTM D1784 – Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride (CPVC) Compounds.
- C. ASTM D2564 – Specifications for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings.
- D. ASTM D2855 – Practice for Making Solvent-Cemented Joints with PVC Pipe and Fittings.
- E. NSF – Seal for Potable Water.

1.3 DEFINITIONS

- A. The term “pool” as used in this section shall refer to the Zero Depth Pool.
- B. The term “Engineer” as used in this section shall refer to the pool pump system design only.

1.4 SYSTEM DESCRIPTION

- A. Provide all labor and materials necessary for replacement of the existing filtration, slide and feature pumps. The above will be complete will all equipment as indicated on the construction documents. Construction shall be in accordance with State and Local Codes.

1.5 SUBMITTALS

- A. Product Data: Provide Manufacturer’s/Installer’s written installation instructions.
- B. The Contractor shall submit for approval to the Engineer complete lists, including descriptions catalog cuts, etc., and where applicable dimensioned shop drawings of all material, fixtures and equipment to be furnished and installed under this specification. Submittal shall adequately and completely describe the equipment, including where necessary or requested complete construction and installation dimensions, complete capacity and performance data, all accessories and auxiliary equipment, and all pertinent details of manufacture. Shop drawings for equipment shall be submitted and approval of shop drawings shall be obtained

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before proceeding with fabrication. Shop drawings shall not be “doctored” reproduces of Engineer’s drawings.

- C. Shop Drawings:
  - 1. Submit shop drawings as required by Parts 2 and 3 of this Section.
  - 2. The drawings accompanying this specification are essentially diagrammatic in nature and show the general arrangement of all equipment and piping. Because of the small scale of the drawings, it is not possible to show all offsets, fittings and accessories which may be required. The Contractor shall carefully investigate the structural and finish conditions of all his work and shall arrange such work accordingly, furnish all fittings, pipe and accessories that may be required to meet such conditions. Where conditions necessitate a rearrangement, the Contractor shall obtain the Engineer’s approval. Locate all valves for maximum operation accessibility.
- D. Operation and Maintenance Manuals: Submit 4 copies of the operation and maintenance manuals for the filter, pump and heat exchanger.
- E. Required Submittals:
  - 1. Pump, Strainer
  - 2. Variable Frequency Drive
  - 3. Gauges, Flow Sensors
  - 4. Piping Materials, Valves
  - 5. Test Results:
    - a. Piping Pressure Testing
  - 6. Guarantees Warrantees:
    - b. Standard (1) Year
  - 7. Close Out Documents:
    - a. O&M Manuals
    - b. Owners Certification Of Instruction

1.6 QUALITY ASSURANCE

- A. Qualifications of Pool Contractor: Work of this Section shall be performed by a contractor who has a proven record of competence and experience in the construction of similar facilities of this size and complexity for not less than 5 years. Contractor must be prequalified by the Illinois Dept. of Public Health. References will be required by the Owner.
- B. Performance Criteria: Certain sections of the Specifications contain performance criteria rather than product descriptions. It shall be the obligation of the contractor to insure that all criteria are satisfied and the burden or proof of conformance shall rest with the contractor. The Engineer shall require past performance records and, if required, inspection trips of similar facilities to substantiate conformance with these criteria. The Engineer shall be sole judge of conformance. The Pool Contractor is cautioned that he will be required to provide a finished product meeting all stated criteria and meeting or exceeding Department of Health requirements.

1.7 REGULATORY REQUIREMENTS

- A. All applicable local building and health codes.
- B. National Electrical Code (NEC)
- C. National Sanitation Foundation (NSF): Seal of approval program.
- D. Illinois Department of Public Health Swimming Pool and Bathing Beach Code

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1.8 REQUIRED PERMITS

- A. Illinois Department of Public Health by Engineer.
- B. Local Building Department: Pool Contractor.

1.9 DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials and equipment to the Work Site in original packages fully identified, with manufacturer's label.
- B. Protect plastic pipe from exposure to chemicals (aromatic hydrocarbons, halogenated hydrocarbons and other esters and ketones) that might attack the material. Protect all pipe from mechanical damage and long exposure to sunlight during storage.

1.10 WARRANTY

- A. Provide one (1) year warranty covering all pool workmanship, material and equipment.
- B. All standard manufacturer's warranties shall apply to all equipment and products provided by this Contractor.

**PART 2 - PRODUCTS**

2.1 PUMPS [FLOODED SUCTION]

- A. Furnish and install circulation pumps as manufactured by Marlow, Sulzer/Paco, Aurora or approved equal. See contract documents for horsepower, voltage, phase, flow rate, NPSH-A, pump and motor efficiency, VFD, flow meter and pipe size information.
- B. Furnish and install pressure and vacuum gauges where called for on Drawings and as required by Code. Pressure and vacuum gauges shall be Trerice #700 Liquid Filled, 0-60 PSI, vacuum 30 Hg – 30 PSI, all gauges with gauge cocks.
- C. To insure cavitation's-free operation, each pump's NPSH requirements must be low enough to permit stable, continuous operation at 120 percent or greater of best efficiency point.
- D. Pump casing shall be close grain cast iron fitted with a replacement bronze case wear ring. Minimum 1/4 inch NPT suction and discharge gauge taps. Pumps with a specific speed greater than 1600 shall have double volute casings with suction splitter to reduce radial loading and shaft deflection.
- E. Pump impeller shall be of the enclosed type of cast bronze, lead free, zinc free, aluminum bronze and shall be statically and dynamically balanced. Impeller diameter shall be trimmed for the specified design conditions.
- F. Pumps mounted vertically to have recirculation line pipe from seal cavity to suction of the pump.
- G. Pumps to be mounted on a cast iron fabricated steel base, epoxy coated, and stainless steel hardware.
- H. Pump shall be fitted with a leak less mechanical seal. John Crane type 1 BUNA elastomers ceramic stationary seat carbon rotating stainless steel metal parts.
- I. Shaft to have a replaceable lead free, zinc free, bronze shaft sleeve.
- J. Pump to have an epoxy coating on all interior cast iron parts. All pump fasteners to be 300 series stainless steel and should have a never seize application to threads prior to assembly, or approved equal.
- K. Pump motor to 3-phase, 60 cycle, Totally Enclosed Fan Cooled, with horse power and voltage as shown on drawings, 1.15 service factor, inverter duty, NEMA (MG-1) section IV,

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Part 30.2.2.8, 200v or 208v motor must be single voltage, tri-voltage motor not acceptable on 200v or 208v service.

- L. All pumping components capable of pumping heavy chlorinated pool water.

2.2 STRAINERS

- A. Furnish and install hair and lint strainers where call for on drawings. Strainers to be of PVC construction with a clear acrylic lid as manufactured by Neptune Benson or approved equal. Strainers shall be custom made with effluent connection at base.
- B. Strainer baskets shall be stainless steel construction with 5/32 inch perforations. Provide each strainer with two strainer baskets.

2.3 VARIABLE FREQUENCY DRIVES

- A. The Variable Frequency Drives (VFD's) shall employ a Pulse Width Modulated (PWM) output waveform. Drive efficiency shall be 97% or better at full speed/load. The same manufacturer shall supply the Variable Frequency Drives for both Feature and Filter pumps. The Pump Supplier shall be responsible for providing as a system, the pumps, VFD's, flow meter and the set-point controller.
- B. The VFD shall be manufactured by Benshaw SG series, ABB, Model ACH 550, Square D Altivar Model 61 or approved equal. All items in this specification must be adhered to strictly. Any deviation must be submitted and approved in writing ten working days prior to bid date.
  - 1. This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.
  - 2. The drive manufacturer shall supply the drive and all necessary options as herein specified. VFD's that are manufactured by a third party and "brand labeled" shall not be acceptable. All VFDs installed on this project shall be from the same manufacturer.
  - 3. VFD's with Filter Packages will include: Non-fused main disconnect, chemical pump, Heater, inter lock relay, Backwash Timer, Filter Alarm light on door Auto/Off Backwash Selector Switch, and 115V Control Transformer.
  - 4. Drives to operate automatically with a 4 to 20 ma PID loop with the flow meter and show actual flow rate in GPM on the keypad.
  - 5. With a certified start up you will receive a 2-year warranty on all parts and labor.
- C. Reference Standards:
  - 1. Standar 519-1992, IEEE Guide for harmonic content and control
  - 2. UL508C
  - 3. ICS 7.0, AC Adjustable Speed Drives
  - 4. IEC 16800 Parts 1,2 and 3
  - 5. NEC 430.120, Adjustable-Speed Drive Systems
  - 6. IBC 2006 Seismic-referencing ACS 7-05 and ICC AC-156
- D. Qualifications:
  - 1. VFDs and options shall be UL listed as assembly. The base VFD shall be UL listed for 100 KAIC without the need for input fuses.
  - 2. CE Mark – The VFD shall meet product standard EN 61800-3 for the First Environment restricted level. (RFI / EMI Filter spec).
  - 3. The entire VFD enclosure, including the bypass shall be seismically certified and labeled in accordance with the IBC 2006 International Building Code:

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- a. VFD manufacturer shall provide Seismic Certification and Installation requirements at time of submittal.
  - b. Seismic importance factor of 1.5 rating is required, and shall be based upon actual shake test data as defined by ICC AC-156.
  - c. Seismic ratings based upon calculations alone are not acceptable. Certification of Seismic rating must be based on testing done in all three axis of motion by a certified lab.
- E. Submittals shall include the following information:
- 1. Outline dimensions, conduit entry locations and weight.
  - 2. Customer connection and power wiring diagrams.
  - 3. Complete technical product description including a complete list of options.
  - 4. Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
    - a. The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5% impedance reactors, no exceptions.
- F. The VFD Package as specified herein shall be enclosed in a UL Listed Type enclosure, (enclosures with only NEMA ratings are not acceptable.)
- 1. Environmental operating conditions: 0 to 400 C (32 to 1040 F) continuous. Altitude 0 to 3300 feet above sea level, less than 95% humidity, non-condensing. All circuit boards shall have conformal coating.
  - 2. Enclosure shall be UL rated and shall be UL listed as a plenum rated VFD.
- G. All VFDs shall have the following standard features:
- 1. All VFDs shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFDs.
  - 2. The keypad shall include Hand-Off-Auto selections and manual speed control. There shall be fault reset and “Help” buttons on the keypad. The Help button shall include “on-line” assistance for programming and troubleshooting.
  - 3. The VFD shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection from AC line transients.
  - 4. The input current rating of the VFD shall be no more than 3% greater than the output current rating. VFD’s with higher input current ratings require the upstream wiring, protection devices, and source transformers to be oversized per NEC 430.120.
  - 5. The VFD shall provide a programmable loss-of-load (broken belt / broken coupling) Form-C relay output. The drive shall be programmable to signal the loss-of-load condition via a keypad warning, Form-C relay output, and / or over the serial communications bus.
- H. Serial Communications
- 1. The VFD shall have an EIA-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2, Siemens Building Technologies FLN, and BACnet MS/TP. The use of third party gateways and multiplexers is not acceptable. All protocols shall be “certified” by the governing authority (i.e. BTL Listing for BACnet).
- I. EMI / RFI filters. All VFD’s shall include EMI/RFI filters. The onboard filters shall allow the entire VFD assembly to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted. No Exceptions.

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- J. **OPTIONAL FEATURES** – Optional features to be furnished and mounted by the drive manufacturer. All optional features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

2.4 POOL VALVES AND PIPING MATERIALS

- A. **Products:**
1. Provide valves of same manufacturer throughout where possible and practical.
  2. Provide valves with manufacturer's name and pressure rating clearly marked on outside of body.
- B. **Valve Connections:** Provide valves suitable to connect to adjoining piping as specified for pipe joint. Use pipe size valves.
- C. **Use of Valves:**
1. Pipe sizes 3" – 12", Butterfly.
  2. Miscellaneous valves ½" – 2", PVC True Union Ball Valves.
  3. All chemical lines and equipment – PVC True Union Ball Valves.
- D. **Butterfly Valves:**
1. Butterfly valves 3" – 12" shall be wafer or lug bodies and shall be suitable for use between ANSI 125 or 150 lb. Flanges.
  2. Bodies of the flangeless design shall be provided with at least four (2) bolt guides to center the valve in the pipeline.
  3. All butterfly valves shall have a cast iron body epoxy coated, ductile iron nylon 11 coated discs, stainless shaft with Buna-N or EPDM seat minimum 150 PSI rating.
  4. All butterfly valves 4" – 6" shall have 10 position locking handle, butterfly valves 8" – 12" shall have gear operators and chain operators as required.
  5. All valves shall be as manufactured by Bray Valve (713) 894 5454 or equal as approved by the Architect / Engineer.
- E. **Ball Valves:**
1. PVC True Union Ball Valves, Dual Union, Eslon, Assahi, or equal.
- F. **Check Valves:** Shall be ductile iron body, stainless steel spring trim, stainless steel dual disc, seal material EPDM, as manufactured by American Wheatley, or equal.

**PART 3 – EXECUTION**

3.1 PIPING AND PIPE FITTINGS – HANGERS AND SUPPORTS

- A. **Work Included:** Pipe, fittings, connections, wall penetrations, hangers and supports, equipment bases and supports.
- B. All plastic pipe, fittings and flanges shall be scheduled 80 PVC with neoprene gaskets where required.
1. All piping shall be schedule 80 or pressure rated PVC solvent weld.
- C. **Hangers and Supports:** Submit hanger locations and weights, hanger details on Shop Drawings.
1. All mechanical room piping must be properly supported.
  2. It shall be the Contractor's responsibility to properly support piping at all valves, pumps, equipment, overhead areas, etc.
  3. Use of the proper hanger for the conditions is essential. All piping must be supported laterally as well as vertically hung.
  4. All piping 8" or larger must be properly supported from the floor only.

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5. All piping connections and support hardware shall be stainless steel.
- D. Piping:
1. Cut all pipe with mechanical cutter without damage to pipe.
  2. Placing and laying: Inspect pipe for defects before installation. Clean the interior of pipe thoroughly of foreign matter and keep clean during laying operation.
  3. Threaded joints: After cutting and before threading, the pipe shall be reamed and shall have burrs removed. Screw joints shall be made with graphite or inert filler and oil or with an approved graphite compound applied to make threads only. Threads shall be full-cut and not more than 3 threads on the pipe remained exposed. Use Teflon II tape on the make threads of all threaded pipe joints. Caulking of threaded joints to stop or prevent leaks will not be permitted. Unions shall be provided where required for disconnection of exposed piping. Unions will be permitted where access is provided
  4. Solvent welded joints shall be made in accordance with the manufacturer's printed instructions and the following minimum standards:
    - a. All fittings shall fit easily on the pipe before applying cement. The outer surface area of pipe and inner wall of fitting shall be dry and clean. Cleaner is to be applied to the outer surface of the pipe and to the inner surface of the fitting. Cement is to be applied to the outer surface of the pipe, or on the male section of fittings only. When the outside surface area of the pipe is satisfactorily covered with cement allow ten (10) seconds open time to lapse before inserting pipe end into fittings. After full insertion of pipe into fitting, turn fitting around the pipe end approximately 1/8 to 1/4 of a turn. Wipe off excess cement at the joint in a neat cove bead. Follow manufacturer's instructions on solvents.
    - b. All joints shall remain completely undisturbed for a minimum of 10 minutes from time of jointing the pipe and fitting. If necessary to apply pressure to a newly made joint, limit to 10% of rated pipe pressure, during the first 24 hours after the joint has been made.
    - c. Full working pressure shall not be applied until the joints have set for a period of 24 hours.
  5. Make provisions for expansion and contraction by way of swing joints or snaking.
- E. Protect plastic pipe from exposure to aromatic hydrocarbons, halogenated hydro-carbons, and most of the esters and ketones that attack the material. Protect all pipe from mechanical damage and long exposure to sunlight during storage.
- F. No installation shall be made that will provide a cross connection or interconnection between distribution supply for drinking purposes and the swimming pool that will permit a backflow of water into the potable water supply. Pipe openings shall be closed with caps or plugs during installation. Equipment and pool fittings shall be tightly covered and protected against dirt, water and chemical or mechanical injury. At the completion of work the fittings, materials and equipment shall be thoroughly clean and adjusted for proper operation.
- G. Pipe Identification
1. Provide identification on all piping located in mechanical equipment, chlorine, acid rooms, heater courts, etc.
  2. Identify the pool that the line is serving (with multiple pools only), contents, direction of flow.
  3. Mark at least once on each line and at 20 ft. intervals on long pipe runs. Consult Health Department Code form minimum marking requirements.

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4. Color code per Health Department requirements. If code does not identify color coding requirements consult Architect/Engineer.
5. Brady, B-946, custom legend, self-sticking markers and arrows or equal.

3.2 TESTING/FIELD QUALITY CONTROL

- A. This Section requires the following tests to be performed by the Contractor.
- B. Testing and Flushing of Piping:
  1. Contractor shall be responsible for discovering leaks and making necessary repairs.
  2. After the piece is installed, the joints completed, test all pool piping per the Illinois Plumbing Code, Section 890.1930, Test Methods. Joints shall remain airtight under this pressure for a period of twelve hours. Provide test results to the Architect / Engineer.
  3. Leaks shall be repaired and tested repeatedly until leakage or infiltration is approved.

3.3 INSTRUCTION OF OWNER'S PERSONNEL

- A. The Pool Sub-contractor shall supply the services of an experienced swimming pool operator instructor for a period of not less than four (4) hours after the pool has been filled and initially placed in operation. During this period the Owner's designated representatives shall be thoroughly instructed in all phases of the pump operation.
- B. Prior to this instructor leaving the job, he shall obtain written certification from the Owner's designated representative acknowledging that the instruction period has been completed and all necessary operating information provided.
- C. Pool Sub-contractor shall deliver two complete sets of operating and maintenance instructions for the swimming pool equipment to the Engineer. Including, but not limited to the following:
  1. Bound together in a complete manual.
  2. Accurate parts list.
  3. Pump start-up instructions.
  4. Narrative on the pump operation through all sequences.
  5. Trouble shooting information.

3.4 CLEAN UP AND PROTECTION

- A. After work of this Section has been complete, clean-up work areas and remove all equipment excess materials and debris. Protect pool equipment from damage until time of Final Acceptance. Remove and replace finishes that are chipped, cracked, abraded, improperly adhered, or otherwise damaged.