

**TECHNICAL SPECIFICATIONS
FOR
WEST SHREVEPORT LIFT STATION IMPROVEMENTS
SHREVEPORT, LA
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TECHNICAL SPECIFICATIONS WEST SHREVEPORT LIFT STATION IMPROVEMENTS

The City of Shreveport “Standard Plans and Specifications for Infrastructure Improvements, 2015 Edition” shall govern this project, including Part 1 – General Provisions as well as the Water & Sewerage specifications. The above referenced specifications shall be referenced for all applicable work items. The following is a (not necessarily comprehensive) list of standard specifications that are hereby referenced:

<u>Specification No.</u>	<u>Description</u>
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The above referenced standard specifications shall be supplemented with the following supplemental technical specifications:

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SECTION S-001

BRIDGE REPAIRS

S-001.1 **GENERAL.** Work under this section consists of furnishing labor, equipment, and materials and performing all operations necessary for all required bridge repairs. The work shall be performed in accordance with the requirements herein specified, and subject to the conditions of the contract.

S-001.2 **SIGNAGE.**

S-001.2.1 **Regulatory.** Based on the load rating, the bridge traffic should be restricted to loads no greater than 10 tons for single-unit trucks (2- or 3-axle configurations) and 15 tons for combination trucks (5-axle configurations). The bridge should be posted with signage based on the Manual of Uniform Traffic Control Devices (MUTCD). The required weight limit sign is R12-5, depicting both the 10 Ton/15 Ton load limits and the correct symbology.

S-001.3 **EXECUTION.**

S-001.3.1 **Installation.** The following repairs shall be performed in conformance with standard practice for timber pile bridge construction.

S-001-3.1.1 Precast slab unit rod in Span #1. Securing unit is missing and should be replaced. This rod is the southernmost rod in span #1, near abutment #1 at south end of bridge.

S-001-3.1.2 Utility support in mid-span #1 is missing and should be replaced. Utility support in mid-span of span #3 is broken and should be replaced.

S-001-3.1.3 The wood brace at Bent #2, Pile #2 is rotten at the ground line and should be replaced with new brace of like kind and size.

END OF SECTION S-001

SECTION S-002

ALUMINUM PLATFORMS

S-002.1 GENERAL. This item shall consist of all construction and materials necessary to build and install aluminum platforms as designated in the plans. This construction shall be in accordance with these specifications, and in conformity to the plans or as required by the City.

S-002.1.1 Quality Assurance. The aluminum platforms must be a product of Sapa Extrusions, LLC. (REDD Team), or approved equal.

Design of the aluminum members shall conform to the current edition of the Aluminum Association Specifications and Guidelines for Aluminum Structures.

Aluminum welding shall be in accordance with the ANSI/AWS D1.2-97. GMAW process shall be performed by experienced operators.

All exposed surfaces shall be smooth and free of sharp or jagged edges.

The system design shall be under direct supervision of a professional engineer.

The manufacturer shall warrant the platform materials to be free from manufacturing defects for a period of 24 months from the date of Final Completion. Warranty does not cover damage caused by conditions beyond the control of the supplier.

S-002.2 PRODUCTS.

S-002.2.1 Stairways. Stair treads and stringers shall be designed for a uniform live load of 100 pounds per square foot.

Materials

- Stair treads, stringers, and risers shall be constructed using 6000 series aluminum alloy with 6061-T6 for primary structural components.
- Slip-resistant punched aluminum planks
- Stair treads shall be prefabricated in typical 2'-8" width.

Stairways shall be prefabricated to match the threshold height indicated in the plans.

S-002.2.2 Landings. Landings shall be designed for a uniform live load of 100 pounds per square foot. Guard rails designed for 200 lbs force applied at any point along top rail.

Materials

- Landings shall be constructed using 6000 series aluminum alloy with 6061-T6 for primary structural components.
- Slip resistant punched aluminum planks.

S-002.2.3 Legs. The legs shall be designed to support the stair and landing sections.

Materials

- Legs shall be constructed using 6061-T6 aluminum alloy.
- All bolt hardware shall be stainless steel grade 304.
- All legs shall be thru bolted using stainless steel bolts grade 304 and nylon lock nuts.
- Legs shall be secured to the concrete pads as recommended by the manufacturer.

S-002.2.4 Landing Rails and Stair Rails. Handrails shall be designed to resist a concentrated load of 200 pounds applied at any point and in any direction at the top of the rail.

Handrails shall be designed to resist a load of 50 pounds per linear foot applied in any direction at the top of the rail.

All landing rails and stair rails shall be aluminum construction alloy 6061-T6 and 6063-T5.

Stair rail gripping surface shall be smooth and continuous.

Stair hand rail shall be 36" high from the nose of the tread to top of the rail (measured perpendicular from the tread nose).

Stair top rail shall be 1 1/4", schedule 40 aluminum pipe.

42" guardrail height with intermediate rail and toe plate.

S-002.2.5 Finishing. Landing rails and stair rails shall be mill finish.

S-002.2.6 Decking. Decking shall be slip-resistant, punched aluminum planks.

S-002.3 EXECUTION.

S-002.3.1 Construction Methods.

S-002.3.1.1 Work Area. The area where the platform and stairs are installed shall have a one (1) foot wide concrete slab, troweled smooth and level. Platform legs placed in areas that are smooth and level shall have base plates to ensure that platform and stair columns are anchored adequately. The entire surface of a base plate shall be in contact with the slab to ensure an even transfer of column loads and minimize sway. The concrete areas where platform column

placement occurs shall be capable to withstand the loads specified by the platform manufacturer.

S-002.3.1.2 Work and Inspection. Working areas shall be inspected and cleaned of all debris to ensure that adequate access is provided to the installers.

S-002.3.1.3 Installation. Erection of the platforms, stairways, and accessories shall be in accordance with the manufacturer specifications and instructions contained in the installation drawings. The installation plan is based on the specifications, dimensions, and approval of the City. All drawings must be reviewed carefully prior to installation.

- Bolt Tightening - Bolts are installed in properly aligned holes, but need only be tightened to the snug tight condition. The snug tight condition is defined as the tightness that exists when all plies in a joint are in firm contact. This may be obtained by an impact wrench or the full effort of a man using an ordinary spud wrench. Once the installation of the platforms is complete, all bolts should be verified. It should be verified during actual installation in the assembled product that the wrench adjustment selected by the calibration does not produce a nut or bolt head rotation from snug tight greater than 1/3 turn. When securing all hardware, make sure that end of bolt is flush with, or exceeds the face of nut.
- On-Site Modifications - Any modifications required during installation (on-site) of any products shall be proposed to and approved by the Manufacturer. Manufacturer shall not guarantee any products modified without the consent from the Manufacturer.

END OF SECTION S-002

SECTION S-003

SLUICE GATES AND ACTUATORS

S-003.1 GENERAL. The Contractor shall furnish all labor, materials, tools, and equipment, and perform all work and services necessary for, or incidental to, furnishing and installation, complete, of all new sluice gates and actuators as shown on drawings and as specified in accordance with provisions of the Contract Documents and completely coordinated with work of all other trades.

S-003.1.1 Work Included. Items required in project include, but are not necessarily limited to, the following:

60" x 60" Sluice Gates with Actuator	2
12" Sluice Gate with Actuator	1

Although such work is not specifically shown or specified, all supplementary or miscellaneous items, appurtenances and devices incidental to, or necessary for, a sound, secure, complete, and compatible installation shall be furnished and installed as part of this work.

Make electrical connections of field wiring to actuator terminal under provisions of these specifications.

S-003.1.2 Quality Assurance. Furnish sluice gates, actuators, and accessories of type and configuration shown on drawings and as specified. Provide equipment which is a product of a reputable manufacturer regularly engaged in this work with at least 20 years of experience.

Insure that sluice gates and accessories operate safely, properly, and with a practical degree of water tightness as defined in S-003.4.1.11. Design parts of frames, guides, stems, disc, hinges, floor stands and all other appurtenances and operating devices to carry to strains of use without springing or bursting with a factor of safety of not less than five (5) times any force which may come upon the equipment under specification head and conditions of use. Design to prevent chattering of gate or springing of lifting jack.

S-003.2 SUBMITTALS.

Shop Drawings: Submit for approval project specific detailed drawings, data, and descriptive literature on all sluice gates, actuators, and appurtenances. Submit Installation drawings showing all details of construction, details required for installation, dimensions and anchor bolt locations.

Certificates: Where specified or otherwise required by the City submit test certificates for sluice gates, actuators, and appurtenances provided under this Section.

Operation and Maintenance Data: Submit detailed operation and maintenance data for all sluice gates and appurtenances provided under this Section.

Actuator Data: Include internal schematic and wiring diagrams for actuators.

S-003.3 PRODUCT DELIVERY, STORAGE, AND HANDLING.

Handle all sluices gates, actuators, and appurtenances with care. Gates, frames, and appurtenances which are cracked, chipped, distorted or otherwise damaged or dropped shall not be acceptable. Protect all threads, seats, ends, etc. from damage and corrosion.

Frames shall be shipped fully assembled with the invert member welded to the side frames and the slide installed in the frame.

Store all equipment and appurtenances in approved enclosed shelter and off the ground.

S-003.4 EQUIPMENT.

S-003.4.1 Stainless Steel Sluice Gate. This section covers all sluice gates required on this project. Each sluice gate shall be furnished and installed complete with operating stem, operating floorstand, and other appurtenances or accessories as specified in accordance with the latest edition of AWWA C561 Standard for Fabricated Stainless Steel Slide Gates as modified herein. The sluice gates shall be as manufactured by Whipps Inc., or an approved equal.

Sluice gates shall be stainless steel, and shall utilize self-adjusting seals. Due to the difficulty of accessing gates when they are in service, gates that utilize adjustable wedges, wedging devices or pressure pads are not acceptable. All gate components shall be designed to safely withstand the heads listed in the Sluice Gate Schedule.

Sluice Gate Schedule

Quantity	Size	Design Seating Head (ft)	Design Unseating Head (ft)	Operating Head (ft)	Type Operation
1	60"x60"	21	21	21	Actuator
1	60"x60"	21	21	21	Actuator
1	12"	10	10	10	Actuator

S-003.4.1.1 Design. Working stresses shall not exceed the lower value of: one third of the yield strength or one fifth of the ultimate strength of the material. The sluice gates and appurtenances shall be designed for installation in the structures shown on the plans.

S-003.4.1.2 Workmanship. All work shall be performed in accordance with AWWA C561 Standards. All parts shall have accurately machined mounting and bearing surfaces so that they can be assembled without fitting, chipping, or re-machining. All parts shall conform accurately to the design dimensions and shall be free of all defects in workmanship or material that shall impair their service. The sluice gates shall be completely shop assembled to insure proper fit and adjustment of all parts.

S-003.4.1.3 Materials. All materials used in construction of the gates and appurtenances shall be the best suited for the application and shall conform to the following specifications:

<u>Components</u>	<u>Materials</u>
Frame Assembly and Retainers	Stainless Steel, Type 304L, ASTM A240
Slide and Stiffeners	Stainless Steel, Type 304L, ASTM A240
Stem	Stainless Steel, Type 304, ASTM A276
Anchor Studs, Fasteners and Nuts	Stainless Steel, Type 316, ASTM A276
Invert Seal (Upward Opening Gates Only)	Neoprene ASTM D-2000 or EPDM
Seat/Seals and Facing	Ultra-High Molecular Weight Polyethylene ASTM D4020
Lift Nuts	Bronze ASTM B584
Pedestals and Wall Brackets	Stainless Steel, Type 304L, ASTM A240

S-003.4.1.4 **Frame.** All structural components of the frame shall be fabricated of stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service.

Frame design shall allow for embedded mounting, mounting directly to a wall with stainless steel anchor bolts and grout. Mounting style shall be as shown on the Plans. All wall mounted shall have a flange frame.

The structural portion of the frame that incorporates the seat/seals shall be formed into a one-piece shape for rigidity. Guide member designs where water loads are transferred through the assembly bolts are specifically not acceptable. Gussets shall be provided as necessary to support the guide members in an unseating head condition. The gussets shall extend to support the outer portion of the guide assembly and shall be positioned to ensure that the load is transferred to the anchor bolts.

The frame shall extend to accommodate the entire height of the slide when the slide is in the fully opened position on upward opening gates.

On self-contained gates, a yoke shall be provided across the top of the frame. The yoke shall be formed by two structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide. A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flushbottom type on upward opening gates. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.

S.003.4.1.5 **Disc or Slide.** All structural components of the slide shall be fabricated of stainless steel having a minimum thickness of 1/4-inch and shall have adequate strength to prevent distortion during normal handling, during installation and while in service. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the outside of the horizontal stiffeners for additional reinforcement. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

S-003.4.1.6 Seals. All gates shall be provided with a self-adjusting seal system to restrict leakage in accordance with the requirements listed in this specification. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide. The seat/seals shall extend to accommodate the 1-1/2 x the height of the slide when the slide is in the fully closed or fully opened position. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member or the bottom of the slide and it shall be held in place with stainless steel attachment hardware. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable. The seals shall be mounted so as not to obstruct the water way opening. Gates that utilize rubber "J" seals or "P" seals are not acceptable. The seal system shall have been factory tested to confirm negligible wear (less than 0.01") and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.

S-001.4.1.7 Stems. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. On rising stem gates, the threaded portion shall engage the operating nut in the motor actuator. The threaded portion of the stem shall have a minimum outside diameter of 1-1/2 inches. Stem extension pipes are not acceptable. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi. The stem shall be threaded to allow full travel of the slide. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the crank or handwheel with a safety factor of 2, using the Euler column formula. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the crank or handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material. The threaded portion of the stem shall have machine rolled threads of the full Acme type with a 16 microinch finish or better. Stub threads are not acceptable. Stems of more than one section shall be joined by stainless steel or bronze couplings. The coupling shall be bolted to the stems.

S-003.4.1.8 Stem Guides. Stem guides shall be provided to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings. Guides shall be adjustable in two directions.

S-003.4.1.9 Anchor Bolts. Anchor bolts shall be provided by the gate manufacturer for mounting the gates and appurtenances. Quantity and location shall be determined by the gate manufacturer. If epoxy type anchor bolts are provided, the gate manufacturer shall provide the studs and nuts. Anchor bolts shall have a minimum diameter of 1/2-inch.

S-003.4.1.10 Leakage. The sluice gates shall be substantially watertight under design head conditions. Leakage shall not exceed 0.05 gpm/ft of wetted seal perimeter in seating head and unseating head conditions.

S-003.4.1.11 Shop Testing. The completely assembled gate shall be shop inspected for proper seating. The gate disc shall be fully opened and closed in its guide system to insure that it operates freely. Floorstands and benchstands shall be shop operated to insure proper assembly and operation.

The sluice gate equipment and appurtenances shall be installed in accordance with the Installation Manual furnished by the gate manufacturer. Extreme care should be used in the handling, storage, and

installation of this equipment to prevent damage or distortion of the equipment and to insure proper performance.

S-003.4.2 Actuator. The actuators shall be suitable for use on a nominal 480 volt, 3 phase, 60 Hz power supply and are to incorporate motor, integral reversing starter, local control facilities and terminals for remote control and indication connections housed within a self contained, sealed enclosure.

As a minimum the actuators should meet the requirements set out in EN15714-2 and ISA SP96.02.

In order to maintain the integrity of the enclosure, setting of the torque levels, position limits and configuration of the indication contacts etc. shall be carried out without the removal of any actuator covers and without mains power. Sufficient commissioning tools shall be provided with the actuators and must meet the enclosure protection and certification levels of the actuators. Commissioning tools shall not form an integral part of the actuator and must be removable for secure storage / authorised release. In addition, provision shall be made for the protection of configured actuator settings by a means independent of access to the commissioning tool.

The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel irrespective of the connection sequence of the power supply.

S-003.4.2.1 Actuator Sizing. The actuator shall be sized to guarantee sluice gate closure at the specified differential pressure and temperature as listed herein. The safety margin of motor power available for seating and unseating the valve shall be sufficient to ensure torque switch trip at maximum valve torque with the supply voltage 10% below nominal. For linear operating valves, the operating speed shall be such as to give sluice gate closing and opening at approximately 10-12 inches per minute unless otherwise stated in the data sheet. For 90° valve types the operating time shall be specified.

S-003.4.2.2 Environmental. Actuators shall be suitable for indoor and outdoor use. The actuator shall be capable of functioning in an ambient temperature ranging from -33°C (22°F) to 70°C (140°F), up to 100% relative humidity.

Actuators shall have a minimum differential pressure of 10 psi to ensure the sluice gate's ability to close.

S-003.4.2.3 Enclosure. Actuators shall be o-ring sealed, watertight to IP66/IP68 7m for 72hrs, NEMA 4, 6. The motor and all other internal electrical elements of the actuator shall be protected from ingress of moisture and dust when the terminal cover is removed for site for cabling, the terminal compartment having the same ingress protection rating as the actuator with the terminal cover removed.

Enclosure must allow for temporary site storage without the need for electrical supply connection.

All external fasteners shall be plated stainless steel. The use of un-plated stainless steel or steel fasteners is not permitted.

S-003.4.2.4 Motor. The motor shall be an integral part of the actuator, designed specifically for valve actuator applications. It shall be a low inertia high torque design, class H insulated with a class B temperature rise giving a time rating of 15 minutes at 40°C (104°F) at an average load of at least 33% of maximum valve torque. Temperature shall be limited by 2 thermostats embedded in the motor end windings and integrated into its control. Motor shall be water proof.

Electrical and mechanical disconnection of the motor should be possible without draining the lubricant from the actuator gearcase.

S-003.4.2.5 **Motor Protection.** Protection shall be provided for the motor as follows:

- Stall - the motor shall be de-energized within 8 seconds in the event of a stall when attempting to unseat a jammed sluice gate.
- Over temperature - thermostat shall cause tripping of the motor. Auto-reset on cooling
- Single phasing - lost phase protection.
- Direction – phase rotation correction.

S-003.4.2.6 **Gearing.** The actuator gearing shall be totally enclosed in an oil-filled gearcase suitable for operation at any angle. Grease lubrication is not permissible. All drive gearing and components must be of metal construction and incorporate a lost-motion hammerblow feature. For rising spindle valves the output shaft shall be hollow to accept a rising stem, and incorporate thrust bearings of the ball or roller type at the base of the actuator. The design should be such as to permit the opening of the gearcase for inspection or disassembled without releasing the stem thrust or taking the valve out of service. For 90° operating type of valves drive gearing shall be self locking to prevent the valve back-driving the actuator.

S-003.4.2.7 **Hand Operation.** A handwheel shall be provided for emergency operation, engaged when the motor is declutched by a lever or similar means, the drive being restored to electrical operation automatically by starting the motor. The handwheel or selection lever shall not move on restoration of motor drive. Provision shall be made for the hand/auto selection lever to be locked in both hand and auto positions. It should be possible to select hand operation while the actuator is running or start the actuator motor while the hand/auto selection lever is locked in hand without damage to the drive train.

Clockwise operation of the handwheel shall give closing movement of the sluice gate unless otherwise directed by City personnel. For linear valve types the actuator handwheel drive must be mechanically independent of the motor drive and should be such as to permit valve operation in a reasonable time with a manual force not exceeding 400N through stroke and 800N for seating/unseating of the valve.

S-003.4.2.8 **Drive Interface.** The actuator shall be furnished with a drive bushing easily detachable for machining to suit the sluice gate stem or gearbox input shaft. The drive bush shall be positioned in a detachable base of the actuator. Thrust bearings shall be sealed for life and the base shall be capable of withstanding five times the rated thrust of the actuator.

S-003.4.2.9 **Local Controls.** The actuator shall incorporate local controls for Open, Close and Stop and a Local/Stop/Remote mode selector switch lockable in any one of the following three positions: local control only, stop (no electrical operation), remote control plus local stop only. It shall be possible to select maintained or non-maintained local control.

The local controls shall be arranged so that the direction of sluice gate travel can be reversed without the necessity of stopping the actuator.

The local controls and display shall be rotatable through increments of 90 degrees to suit valve and actuator orientation.

S-003.4.2.10 Torque and Limits. Torque and turns limitation to be adjustable as follows:

- Position setting range – multi-turn: 2.5 to 8,000 turns, with resolution to 7.5 deg. of actuator output.
- Position setting range – direct drive part turn actuators: 90° +/-10°, with resolution to 0.1 deg. of actuator output.
- Torque setting: 40% to 100% rated torque.

Position measurement – Absolute position measurement should be incorporated within the actuator. The technology must be capable of reliably measuring position even in the case of a single fault. The design must be simple with the minimum amount of moving parts. Limit switches shall be included for end positions OPEN and CLOSED.

Measurement of torque shall be from direct measurement of force at the output of the actuator. Methods of determining torque-using data derived from the motor such as motor speed, current, flux, etc. are not acceptable.

A means for automatic “torque switch bypass” to inhibit torque off during sluice gate unseating and “latching” to prevent torque switch hammer under maintained or repeated control signals shall be provided.

The electrical circuit diagram of the actuator should not vary with sluice gate type remaining identical regardless of whether the sluice gate is to open or close on torque or position limit.

S-003.4.2.11 Integral Starter and Transformer. The reversing starter, control transformer and local controls shall be integral with the sluice gate actuator, housed to prevent breathing and condensation. The starter shall be designed for 60 starts per hour and of rating appropriate to motor size. The controls supply transformer shall be fed from two of the incoming three phases and incorporate overload protection. It shall have the necessary tapping and be adequately rated to provide power for the following functions:

- Energizing of the contactor coils.
- 24V DC or 110V AC output for remote controls (maximum 5W/VA).
- Supply for all the internal electrical circuits.

S-003.4.2.12 Wiring and Termination. Internal wiring shall be tropical grade PVC insulated stranded cable of appropriate size for the control and 3-phase power. Each wire shall be clearly identified at each end. The terminals shall be embedded in a terminal block of high tracking resistance compound.

The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal and shall be provided with a minimum of 3 threaded cable entries with provision for an additional 5 extra conduit entries.

All wiring supplied as part of the actuator to be contained within the main enclosure for physical and environmental protection. External conduit connections between components are not acceptable. A durable terminal identification card showing a plan of terminals shall be provided attached to the inside of the terminal box cover indicating:

- Serial number
- External voltage values
- Wiring diagram number
- Terminal layout

The code card shall be suitable for the Contractor to inscribe cable core identification alongside terminal numbers.

S-003.4.2.13 Commissioning Kit. Each actuator shall be supplied with a start-up kit comprising installation instruction manual, electrical wiring diagram and cover seals to make good any site losses during the commissioning period. In addition, sufficient actuator commissioning tools shall be supplied to enable actuator set up and adjustment during sluice gate/actuator testing and site installation commissioning.

S-003.4.2.14 Performance and Test Certificate. Each actuator must be performance tested and individual test certificates shall be supplied free of charge. The test equipment should simulate a typical sluice gate load, and the following parameters should be recorded.

- Current at maximum torque setting
- Torque at max. torque setting
- Flash test voltage
- Actuator output speed or operating time.

In addition, the test certificate should record details of specification such as gear ratios for both manual and automatic and second stage gearing if provided, drive closing direction, wiring diagram number.

S-003.5 INSTALLATION.

S-003.5.1 Installation of the gates and appurtenances shall be done in a workmanlike manner. It shall be the responsibility of the Contractor to handle, store and install the equipment specified in this Section in strict accordance with the manufacturer's recommendations.

S-003.5.2 The Contractor shall review the installation drawings and installation instruction prior to installing the gates.

S-003.5.3 The gate assemblies shall be installed in a true vertical plane, square and plumb.

S-003.5.4 The Contractor shall fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.

S-003.5.5 The Contractor shall add a mastic gasket between the gate frame (when applicable) in accordance with the manufacturer's recommendations.

S-003.5.6 Connect all electric-operated drives to electrical service. Refer to included electrical sections.

S-003.6 FIELD TESTS AND ADJUSTMENTS.

S-003.6.1 After installation, all gates shall be field tested in the presence of City personnel to ensure that all items of equipment are in full compliance with this Section. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting.

Gates shall be tested by Contractor according to AWWA C561 Fabricated Stainless Steel Slide Gates, at the discretion of the City personnel by flooding structures containing sluice gates with City provided water. The gates shall not exceed maximum leakage rates previously mentioned in this Section for a period of one (1) hour.

S-003.7 WARRANTY. Each gate and actuator shall be warranted for 24 months following the date of final completion. This warranty shall be held in effect regardless of pre-commissioning conditions in a typical indoor or outdoor environment as long as the actuator is not abused or disassembled.

END OF SECTION S-003

SECTION S-004

MANHOLE BYPASS PUMPING

S-004.1 MANHOLE BYPASS PUMPING OPERATIONS. Provide continuous sewer service to users of sewer systems while maintenance or construction operations are in progress by diverting flow around construction locations. Maintain sewer flow to prevent backup or overflow onto streets, yards and other unpaved areas, and into buildings, ditches, storm drains and waterways. Do not divert sewage outside of the sanitary sewer system. The bypass shall be made by plugging lines at an upstream manhole and pumping the sewer flow into a downstream manhole or an adjacent sewer system. Provide and operate the necessary systems including bulkheads, plugs, hoses, piping, pumps and special features where pipes or hoses cross roadways and driveways.

Contractor shall identify and provide systems with sufficient capacity to maintain average and peak flow rates. Where flow rates of 1,500 GPM or higher are anticipated, provide a separate emergency bypass pumping system on site and ready for immediate startup. When pumps are operating, provide an experienced operator on site to monitor operation, adjust pumps, prevent clogging, make minor repairs to the system, and report problems. When a bypass pumping system is scheduled to operate 5 days or longer, provide a monitoring system capable of remote notification of high level conditions and pump failures. The monitoring system shall include a cellular telephone based notification system capable of remote communications with Contractor and City representatives. Provide 24-hour "on call" service with capability to provide onsite service within 2 hours of notification.

For systems that bypass sanitary sewer line segments 15 inches in diameter and larger, develop and submit a manhole bypass pumping plan to demonstrate that the proposed pumping system has sufficient capacity for average and peak flows at each location. The Engineer may furnish information on anticipated flow rates when available, for the Contractor's use in properly sizing each component of the system. The Contractor is responsible for providing systems with adequate capacity for each manhole bypass pumping operation.

Provide piping, joints and accessories to withstand at least twice the maximum system pressure or 50 psi, whichever is greater. In the event of an accidental leakage, spill or overflow, take immediate action to clean up and disinfect the discharge. Promptly notify the City Field Operations Center or Dispatch Office (318-673-7600) and follow the required documenting and reporting procedures to assure that EPA is properly notified in a timely manner.

Maintain all manhole bypass pumping operations within City owned property, public and/or dedicated right-of-way. Provide additional signs and barricades as necessary to protect the public as well as the Work for the duration of the operations. Provide equipment with sufficient noise abatement systems to mitigate sound and meet requirements of City regulations for noise and sound levels.

S-004.2 FLOW.

West Shreveport Lift Station Flow – 1,900 gpm

S-004.3 LOCATIONS.

Location of Upstream Manhole – 691,697.1210 N, 2,864,472.9220 E

Location of Downstream Manhole – 691,561.5076 N, 2,864,985.3455 E

Location of Force Main Outlet at Flow Equalization Basin – 692,011.3510 N, 2,864,825.6540 E

END OF SECTION S-004

SECTION S-005

MANHOLE REHABILITATION

S-005.1 GENERAL. Contractor shall furnish all labor, materials, equipment and incidentals required to rehabilitate manholes. This specification may include materials, techniques and work for manhole rehabilitation that may not apply to all projects. Contractor shall perform manhole rehabilitation work as indicated in the Contract Documents. This specification shall be used in conjunction with the Specification S-006, for work involving installation of monolithic manhole liners.

S-005.2 SCOPE OF WORK. Furnish all labor, materials, equipment and incidentals required to rehabilitate manholes as noted on the Drawings and as specified herein.

Contractor shall clean the manhole, dispose of the sludge, deposits, debris etc. in accordance with local, State and Federal regulations, patch manhole exterior; stop infiltration with chemical grout; rebuild invert and benching; reset or replace manhole frame and cover assemblies; install chimney seals and/or locate and/or raise manhole frame and cover assemblies, and perform other pertinent work as directed by the City/Engineer. Complete this work in accordance with the Contract Documents.

Remove manhole steps unless otherwise directed by the City or Engineer. Eliminate active infiltration observed in the frame seal, chimney, cone, wall, bench, invert, holes, or pipe connections prior to applying the manhole lining system. Reinstall existing manhole rings and covers removed to allow the completion of the rehabilitation work. Restore the site to its pre-maintenance condition as approved by the City or Engineer.

Maintain sewer flows as specified in the City's Standard Specifications Section 2200.

S-005.3 REFERENCES. The publications listed below form a part of this specification to the extent referenced, the publications are referred to within the text by the basic designation only. All publications are of most recent version unless otherwise noted.

ASTM INTERNATIONAL (ASTM)

ASTM C94	Standard Specification for Ready-Mix Concrete.
ASTM C109	Standard Test Methods for Compressive Strength of Hydraulic Cement Mortars (Using 2-in Cube Specimens)
ASTM C150	Standard Specification for Portland Cement.
ASTM C267	Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes.
ASTM C293	Standard Test Method for Flexural Strength of

	Concrete” (Using Simple Beam with Center-Point Loading).
ASTM C309	Standard Specification for Liquid Membrane Forming Compounds for Curing Concrete.
ASTM C496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
ASTM C579B	Standard Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts and Monolithic Surfacing
ASTM C596	Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
ASTM C882	Standard Test Method for Bond Strength of Epoxy-Resin Systems used with Concrete by Slant Shear.
ASTM C1244	Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
ASTM D395	Standard Test Methods for Rubber Property Compression Set.
ASTM D412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
ASTM D573	Standard Test Method for Rubber-Deterioration in an Air Oven.
ASTM D746	Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
ASTM D1149	Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Environment.
ASTM D2240	Standard Test Method for Rubber Property-Durometer Hardness.

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

The revision of the above standards that is in effect at the time of bid opening shall apply.

S-005.4 SUBMITTALS. Identify the staging area for deployment of manhole repair equipment for each work area.

Submit to the Engineer, shop drawings and product data for all manhole rehabilitation materials specified in this Section for each manhole to be rehabilitated.

1. Information on all materials that shall be used, the installation method(s), and equipment. For the materials that shall be used, identify and furnish references for successful use of the materials in similar applications.
2. Method for sealing pipes at manholes.

S-005.5 QUALITY ASSURANCE. The Contractor or Subcontractor, or their personnel, to perform the manhole rehabilitation and manhole lining shall be fully qualified, experienced and equipped to complete the work in a timely and satisfactory manner. Submit the following information to the Engineer for review and approval before any work is performed.

The number of years of experience Contractor or applicator have in performing this type of specialized work; with a minimum of 5 years of experience.

Contractor, or their personnel, shall have successfully installed the proposed lining system in a minimum of 500 manholes.

Name of the manufacturer and supplier for this work and previous work performed. The Contractor, or their personnel, shall be certified by the manufacturer to install the monolithic lining system.

A list of all municipal installations performed by the manufacturer and Contractor, or their personnel, over the past 5 years along with the contact name, telephone number, and brief description of work performed.

The Contractor shall also be capable of providing crews as needed to complete this work without undue delay.

The City reserves the right to disapprove the use of the Contractor, sub-contractor, or their personnel, based on the submitted qualifications.

S-005.6 GUARANTEE. All manhole rehabilitation work shall be guaranteed by the Contractor for a period of two years from the date of final completion. During this period, all defects in the lining shall be repaired in a manner satisfactory to the Engineer or the lining shall be re-applied at no cost to the City. In the months following final completion of the manhole rehabilitation work (but within 24 months), the City shall inspect all of this work to ensure proper performance. If any deficiencies are found during these inspections, the Contractor shall repair them at no additional cost to the City.

S-005.7 DELIVERY, STORAGE AND HANDLING. Care shall be taken in shipping, handling and placing to avoid damaging the chemical grouts, cementitious materials, and other manhole rehabilitation products. Extra care may be necessary during cold weather construction. Any lining product or material damaged in shipment shall be replaced as directed by the Engineer.

The Contractor shall promptly inspect all delivered materials for damage. Any materials showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work. While stored, the materials shall be adequately packaged and protected. The materials shall be stored in a manner as recommended by the manufacturer.

S-005.8 PRODUCTS AND MATERIALS.

S-005.8.1 Materials to Stop Active Leaks. To stop active leaks in the manhole, the Contractor must use the following materials and procedures to stop the active leaks prior to lining.

Premixed Fast-Setting, Volume-Stable Waterproof Cement Plug - This material shall consist of hydraulic cement, graded silica aggregates, special plasticizing and accelerating agents. It shall not contain chlorides, gypsums, plasters, iron particles, aluminum powder or gas-forming agents, or promote the corrosion of steel it may come in contact with. The cement plug should have the following minimum requirements:

Minimum Requirements		
Compressive Strength	ASTM C109	>1000 psi, 1hr. >2500 psi, 24 hrs.
Sulfate Resistance	ASTM C267	No weight loss after 15 cycles @ 2000 ppm
Freeze/Thaw	ASTM C666 "Method A"	100 cycles
Pull Out Strength		14,000 lbs.
Set Time		<5.0 minutes

Obtain the Engineer's approval of materials to stop active leaks before starting the Field Work. Obtain the Engineer's approval of application equipment prior to starting the Field Work.

S-005.9 PATCHING, REPOINTING, FILLING AND REPAIRING NON-LEAKING HOLES, CRACKS AND SPALLS IN CONCRETE MANHOLES.

A quick-setting cementitious material shall be used as a patching material and is to be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

Physical Properties		
Compressive Strength	ASTM C109	>1800 psi, 1 hr. >2600 psi, 24hr. >3000 psi, 28 days
Bond	ASTM C882	>1600 psi, 28 days
Applied Density		105 lbs. pcf ± 5 lbs.
Shrinkage	ASTM C596	0% at 90% R.H.
Placement Time		5 to 10 minutes
Set Time		15 to 30 minutes

The water used to mix product shall be clean and potable. Questionable water shall be tested by a laboratory per ASTM C94 procedure. No material (other than water) shall be used with or added to the patching product without approval or recommendation from manufacturer.

S-005.10 COATINGS FOR ALL INVERTS. A quick-setting material shall be used to coat the invert and is to be mixed and applied according to manufacturer's recommendations and shall have the following minimum requirements:

Physical Properties		
Compressive Strength	ASTM C109	>1800 psi, 1 hr. >2600 psi, 24hr. >3000 psi, 28 days
Bond	ASTM C882	>1600 psi, 28 days
Applied Density		105 lbs. pcf ± 5 lbs.
Shrinkage	ASTM C596	0% at 90% R.H.
Placement Time		5 to 10 minutes
Set Time		15 to 30 minutes

Water used to mix product shall be clean and potable. Questionable water shall be tested by a laboratory per ASTM C94 procedure. No material (other than water) shall be used with or added to the patching product without approval or recommendation from manufacturer.

S-005.11 INTERIOR FLEXIBLE CHIMNEY SEALS. Provide a flexible seal to provide corrosion protection and to prevent infiltration through the interior of the manhole frame and chimney area of the manhole.

Provide materials for Interior flexible chimney seal to prevent leakage of water into the manhole through the frame joint area and the area above the manhole cone including all extensions to the chimney area. The seal shall remain flexible allowing for repeated vertical or horizontal movements of the frame due to frost lift, ground movement, or the thermal movement of pavement. The final liner material shall be made no less than 170 mils of corrosion resistant flexible urethane resin coating to be applied to the inside wall of the entire chimney area as described above. Mil thickness may vary depending on the local climate. The product shall have a minimum elongation of 800% and a Durometer hardness of 75. Final liner shall have a minimum tensile and adhesion strengths of 1150 psi and 175 lb./in. respectively.

The manhole sealant shall conform to the physical requirements of ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension. Sealant shall be "Flex-Seal" as manufactured by Sealing Systems, Inc., Loretto, MN or approved equal.

S-005.12 MANHOLE FRAME AND COVERS. Manhole frames and covers shall be cast iron. Cast Iron Manhole frames and covers shall be of good quality, strong, tough, even grained, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. See City's Standard Specification Sections 209 and 2200 for more details.

S-005.13 EXECUTION.

S-005.13.1 General. Each manhole to be rehabilitated shall be thoroughly cleaned and then inspected for loose or missing bricks, loose mortar, holes, etc. Any protrusions or obstructions into the manhole shall be completely removed. All leaks shall be eliminated prior to applying the manhole lining system.

Damage incurred to the manhole or pipe segments due to methods and equipment employed by the Contractor is the responsibility of the Contractor. Damage to public and private property from sewer surcharging that results from material or equipment left in the manhole or sewer or from any flow blockage is the responsibility of the Contractor. The cost to repair the manhole or pipe segments and expenses incurred by the City as a result of the damage shall be the responsibility of the Contractor.

S-005.14 SURFACE PREPARATION. Pre-rehabilitation surface preparation – any area to be repaired which requires bonding of new cementitious, epoxy, chemical or waterproofing material to existing cement or masonry shall be prepared as follows.

Clean the area with high-velocity water cleaning equipment to remove all foreign matter, oil, grease, wax and dirt. This includes removal of bitumastic coatings. The water cleaning pressure shall not be so high as to cause permanent damage to the existing manhole walls or other parts of the structure.

If foreign material remains after high-velocity water blasting, clean the manhole surface using an acid wash. The acid wash shall be muriatic acid (hydrochloric acid) at a ratio of 1 part acid (HCl) to 10 parts of water. The mixing, application and removal of the acid solution shall be in strict accordance with the manufacturers' recommendations and safety procedures. The acid solution shall remain on the manhole surface until all signs of foreign material have been removed. Afterward, the acid solution shall be completely washed off with water.

Chip or chisel away all loose or defective material from the areas to be repaired. Furnish a firm mechanical key by undercutting whenever possible.

Allow interior surfaces of the manhole to dry thoroughly before applying. Any large voids including holes left by the manhole rung removal shall be filled with quick setting patching mix. Remove protruding rubber gaskets between wall joints. Surface preparation shall be incidental to the manhole rehabilitation costs.

Existing manhole rungs/steps shall be removed, ground smooth and patched and not replaced. Step removal shall be incidental to the manhole restoration costs.

Sewer Line Protection – Place covers over the invert to prevent extraneous material from entering the sewer lines.

Conduct a visual inspection of each manhole after it is cleaned. All active, hydrostatic infiltration leaks shall be plugged or sealed with an appropriate grout compatible with the lining. Remove all loose mortar and rubble of existing chimney, cone, walls, benches and inverts. Prepare manhole to receive lining as necessary by reshaping and repairing benches, inverts, cone, walls, and corbelling where required. All interior surfaces shall be prepared as recommended by the lining manufacturer. Minimum requirements are as listed below:

All cracks and other voids shall be repaired and filled with suitable non-shrinking cements, sealants or grouts, including all voids between the existing sewer pipes and manhole walls. All patches shall be smooth and even with the manhole wall.

All surfaces shall be suitably prepared for the required bonding of the lining as recommended by the manufacturer.

S-005.15 SEALING OF LEAKS IN INVERTS, BENCHES, WALLS, AND CONE

Premixed fast-setting, volume-stable waterproof cement plug – seal unsealed lifting holes, unsealed step holes, and voids larger than ½ inch in thickness with a waterproof, quick setting mortar. Place water proof mortar according to manufacturer’s instructions.

Manhole Preparation – Repair the manhole frame and rings, and complete structural repairs before grouting the manhole. Cut roots and trim roots before grouting the manhole. Remove cracked or deteriorated material from the area to be grouted.

Sealing Active Leaks – Use the Expanded Gasket Procedure, drilling and injection procedure and/or chemical curtain grouting to stop active leaks.

Expanded Gasket Procedure – The Expanded Gasket Procedure (EGP) shall be performed per ASTM F2414 and the chemical grout manufacturers recommended installation methods. This is performed by soaking dry Oil Free Oakum with hydrophilic polyurethane chemical grout. The resulting oakum/resin plug shall be forced into the opening until it sets. Perform the EGP to:

1. Control flowing water in larger cracks, joints, or pipe to manhole boots.
2. Seal drop or lateral connections, slip line terminal seals and open joints in RCP manholes.
3. Seal between the corbel and manhole rings.
4. Seal between the manhole rings and manhole frame.

Drilling and Injection Procedure – The drilling and injection procedure shall be performed per ASTM F2414 and the chemical grout manufacturers recommended installation methods to seal the manhole with chemical grout. Drill injection holes through the manhole at locations recommended by the manufacturer. Inject the chemical grout through the holes under pressure. Injection pressure shall not cause damage to the manhole structure or surrounding surface features. Inject chemical grout through the lowest holes first. Repeat the procedure until the manhole is externally sealed. Grout travel shall be verified by observation of grout to defects or adjacent injection

holes. Drill additional injection holes as necessary to ensure grout travel. Do not inject grout from the ground surface. After chemical grout injection is complete, clean injection holes with a drill and patch with a waterproof, quick setting mortar for brick and concrete manholes. Perform the drilling and injection procedure to control flowing water in cracks.

S-005.16 INVERT CHANNEL COATING. All invert channels shall be coated with a material that is compatible with the manhole lining system per the manhole lining manufacturer's recommendations to prevent infiltration and to build up the invert channel to the invert elevations of the new sewer main or cured-in-placed lined sewer; to fill all voids, cracks, holes, etc.; and to form a smooth flow channel. The entire channel shall be coated. The coating shall be troweled uniformly onto the invert at a minimum ½ inch in thickness or as recommended by the manufacturer. The coating shall extend out onto the bench of the manhole sufficiently to tie into the monolithic liner.

The material used for the invert channel shall be suitable for the intended purpose and shall be compatible with the materials used for the manhole lining system. The material for the invert channel shall be as recommended by the cementitious liner manufacturer and installed in accordance with the manufacturer's recommended installation instructions and procedures. Coating the invert may be waived when the invert is in excellent condition and upon approval by the City or Engineer

S-005.17 LOCATING, RAISING, RESETTING, AND/OR REPLACING MANHOLE FRAME AND COVER ASSEMBLIES. Locate manhole frame and covers; remove existing manhole frame and covers; dispose of existing manhole frame and covers, if they are not being reused; and install new or reused manhole frame and covers as directed by the city and/or engineer. Repair any damage to the manhole chimney or corbelling caused by the removal of the existing manhole frame at no additional cost to the city.

Existing frames and covers to be reused shall be thoroughly cleaned before re-installation.

If the existing frames and covers are not to be reused, properly dispose of the materials in accordance with local laws.

When re-setting existing frames and covers, apply preformed flexible joint sealant Kent Seal No. 2 by Hamilton-Kent or equal.

Install new or reused frames so that the tops of the covers are at the required grade. Utilize precast concrete graderings to set the manhole frame and cover to the finished grade. Precast concrete graderings shall be set in a bed of butyl mastic sealant.

S-005.18 CEMENT EXTERIOR. For raised manholes with damaged exterior; masonry manholes without an exterior cement coating; manholes where frame and cover assemblies are being replaced or reset; where noted on the drawings; or as directed by Engineer, the Contractor shall repair existing or install new cement exterior coating for manholes as follows:

Contractor shall prepare the surface of the exterior of the manholes using the procedures outlined in Section S-005.14 above.

Following preparation of the surface, spray or hand trowel the exterior from existing/finished grade to above the frame/chimney seal using the product specified in Paragraph 2210.8.1 and in accordance with the manufacturer's installation instructions. A minimum finished thickness of two (2") inches shall be applied.

A curing compound shall be applied in accordance with ASTM C309 to the exterior cement.

S-005.19 FIELD TESTING AND ACCEPTANCE. The Engineer or City may enter the manholes to inspect the benching, invert channels, manhole wall/pipe connections, surface preparation, and other parts of the work.

Provide all equipment, hardware and materials, including but not limited to forced air ventilation, gas monitors and detectors, harnesses, lights, etc., necessary for the Engineer or City to enter the manhole and perform the inspection in complete accordance with OSHA requirements at no additional cost to the City.

The finished manhole surface shall be continuous and free from significant defects. Any defects which shall affect, in the foreseeable future, or warranty period, the integrity or strength of the manhole shall be repaired at the Contractor's expense, in a manner mutually agreed upon by the Engineer and the Contractor.

No Active infiltration into the manhole shall be observed in the manhole as confirmed by visual inspection of the City or Engineer. Any infiltration found shall be repaired by the Contractor immediately at no additional cost.

The Contractor is responsible for coordinating inspection times with the Engineer.

END OF SECTION S-005

SECTION S-006

MONOLITHIC MANHOLE LINING SYSTEMS

S-006.1 GENERAL. Contractor shall furnish all labor, materials, equipment and incidentals required to install monolithic manhole liners. This specification may include materials, techniques and work for manhole liners that may not apply to all projects. Contractor shall install the monolithic lining system as indicated in the Contract Documents. This specification shall be used in conjunction with the City's Standard Specification Section S-005, for manhole preparation and rehabilitation.

S-006.2 SCOPE OF WORK. For interceptor manholes or when the Contract documents specifically require a monolithic manhole lining system, the Contractor shall furnish all labor, materials, equipment and incidentals required and install and test manhole monolithic cementitious system for the purpose of eliminating infiltration and exfiltration, providing corrosion protection, repair of voids and restoration of the structural integrity of the manhole as a result of applying a monolithic liner to the wall and bench surfaces of brick, concrete or any other masonry construction material. Lining should extend from invert to top of cone, as specified.

The Contractor shall accurately field measure and size each individual manhole. The Contractor is reminded that each existing sewer manhole designated to receive the monolithic lining may have a different configuration and varying field dimensions. All field measurements shall conform to the requirements of the monolithic lining manufacturer.

The manhole lining shall not be installed until other manhole rehabilitation as specified on the drawings and in Section S-005 – Manhole Rehabilitation work is complete. Procedures for manhole preparation and cleaning are included in specification Section S-005 – Manhole Rehabilitation.

The Contractor is advised that the presence or absence of leakage through manhole walls noted on the manhole inspection reports and as seen in the Contractor's independent inspection of manholes prior to bidding is dependent upon the ground water levels and conditions at the time of the inspections. High ground water levels in the project area can vary with rainfall in any given year. The Contractor shall reflect his/her assumptions and judgments on leakage through manhole walls based on this information in the unit prices bid for lining manholes. All leakage shall be stopped prior to lining manholes. No additional payment shall be made to the Contractor for repairing leaks not visible prior to bidding or sewer rehabilitation.

S-006.3 REFERENCE.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars.
ASTM C150	Standard Specification for Portland Cement.

ASTM C267	Standard Test Method for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing.
ASTM C293	Test Method for Flexural Strength of Concrete.
ASTM C321	Test Method for Bond Strength of Chemical-Resistant Mortars.
ASTM C496	Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.
ASTM C579B	Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts and Monolithic Surfacing.
ASTM C596	Test Method for Drying Shrinkage of Mortar Containing Portland Cement.
ASTM D638-98	Standard Test Method for Tensile Properties of Plastics.
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
ASTM D695-96	Standard Test Method for Compressive Properties of Rigid Plastics.
ASTM D790	Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics.
ASTM D870	Practice for Testing Water Resistance of Coatings Using Water Immersion.
ASTM C1244	Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
ASTM D2247	Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
ASTM D2240	Standard Test Method for Rubber Property Durometer Hardness.
ASTM F2414	Standard Practice for Rehabilitation of Sewers Using Chemical Grouting.

ASTM D4787	Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
ASTM D6132	Standard Test Method for Nondestructive Measurement of Dry Film Thickness of Applied Organic Coatings Using an Ultrasonic Gage.
ASTM D7234	Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.

Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

S-006.4 SUBMITTALS. Submit to the Engineer, shop drawings, product data, and installation methods. Submittals shall include but are not limited to the following:

1. Manufacturer's product data, including physical properties, surface preparation, repair, application, curing, and field quality control procedures.
2. Manufacturer and applicator qualifications as specified in paragraph 2220.5 below.
3. Type of monolithic lining system to be installed for each manhole.
4. Diameter, depth (rim to invert), and material for each manhole.
5. All design calculations shall be sealed by a Registered Professional Engineer in the State of Louisiana.
6. A list of all municipal installations performed by the manufacturer and Contractor over the past 5 years along with the contact name, telephone number, and brief description of work performed.

Submit to the Engineer, within 10 days of the Effective Date of the Agreement, the name of the supplier (manufacturer), installer and a list of materials to be furnished.

Submit a step-by-step description of the methods, practices, intervals, etc. to be used in the application and curing of the monolithic lining system to meet the requirements of this specification section.

S-006.4.1 Test Reports. Prior to each shipment of materials, submit certified test reports that the materials for this Contract were manufactured and tested in accordance with the ASTM Standards specified herein.

S-006.5 QUALIFICATIONS. The Contractor performing the work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner. The Contractor shall submit the following information to the Engineer for review and approval before any work is performed.

The Contractor shall be certified by the manufacturer to install the monolithic lining system.

The Contractor and/or applicator shall have a minimum of 5 years experience or 500 manholes in performing this type of specialized work. This may be waived by the City through their product approval process with documented demonstration projects.

The Contractor shall also be capable of providing crews as needed to complete this work without undue delay.

The City reserves the right to disapprove the use of the Contractor based on the insufficient qualifications.

S-006.6 GUARANTEE. All monolithic lining placed shall be guaranteed by the Contractor for a period of two years from the date of final completion. During this period, all defects discovered in the monolithic lining, as determined by the City or Engineer, shall be repaired or replaced in a satisfactory manner at no cost to the City. Such repair or replacement shall include the cost of removal and reinstallation. In the months following final completion of the manhole lining (but within 24 months), the City/Engineer shall inspect all of this work to ensure proper performance. If any deficiencies are found during these inspections, the Contractor shall repair them at no additional cost to the City.

The Contractor is responsible for stopping all leaks prior to the installation of the monolithic lining system.

S-006.7 QUALITY ASSURANCE. The supplier shall be responsible for the provisions of all test requirements specified in the above referenced ASTM Standards as applicable. In addition, all monolithic lining products to be installed under this Contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by the City. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspections approved for this Contract shall be borne by the City.

Inspections of the lining products and materials may also be made by the Engineer or other representatives of the City after delivery. The lining products and materials shall be subject to rejection at any time on account of failure to meet any of the Specification requirements, even though samples may have been accepted as satisfactory at the place of manufacture. Lining materials rejected after delivery shall be marked for identification and shall be removed from the job at once.

The Contractor shall furnish the services of the cementitious manhole liner manufacturer's field service technician, who has complete knowledge of manhole rehabilitation, to advise and assist the cementitious manhole lining installation and provide instruction to the Contractor for rehabilitation of the first five (5) manholes. The field service technician shall be fully qualified and experienced in manhole rehabilitation work including cementitious manhole lining systems depending on the proposed lining system.

S-006.8 DELIVERY, STORAGE AND HANDLING. Care shall be taken in shipping, handling and placing to avoid damaging the lining products. Extra care may be necessary during cold weather construction. Any lining product or material damaged in shipment shall be replaced as directed by the Engineer.

Any lining product showing deterioration, or which has been exposed to any other adverse storage condition that may have caused damage, even though no such damage can be seen, shall be marked as rejected and removed at once from the work.

While stored, the lining products shall be adequately packaged and protected. The lining products shall be stored in a manner as recommended by the manufacturer.

Materials shall be stored, shipped and handled according to their material safety data sheet and the Manufacturer's recommendations.

S-006.9 SAFETY AND SITE CONDITIONS. The Contractor and all Subcontractors shall comply with and enforce all Federal, State, and Local safety regulations. The Contractor's personnel shall be certified for confined space entry.

S-006.10 PRODUCTS. The monolithic manhole lining system shall be designed and installed to protect concrete, brick, mortar, and other manhole surfaces from corrosion. The products shall be designed to stop infiltration, root intrusion, and further deterioration in the manhole. The interior surfaces to be protected shall include the walls, benches, inverts, pipe junctions and the chimney. Contract shall use the following liner:

1. Calcium Aluminate Cementitious Liner: Mild to harsh hydrogen sulfide conditions, pH of 2.0 or higher.

S-006.10.1 Cementitious Manhole Monolithic Lining System. The manhole lining system shall be a monolithic, Portland based or calcium aluminate cementitious liner system suitable for use as a trowel- or spray-applied monolithic surfacing in sewer manholes.

The minimum thickness for Portland based cementitious lining shall be 1-inch thick. The minimum thickness for Calcium Aluminate based cementitious lining shall be 1-inch thick.

The cementitious lining system shall be:

Calcium Aluminate Cementitious Liner mild sulfide conditions (substrate surface of pH 2.0 or higher)

- Strong MS-2C Quadex
- Alumina liner
- Standard Cement Maximum CA
- Permacast CR-9,000
- Mainstay ML-CA
- SewperCoat
- Or equal

The calcium aluminate cementitious liner product shall be used to form a structural monolithic liner covering all interior substrate surfaces and shall have the following minimum requirements:

Minimum Requirements – Type 2 Cementitious Manhole Lining System			
Compressive Strength	ASTM C109	28 days	>9000 psi
Tensile Strength	ASTM C496	28 days	>800 psi
Flexural Strength	ASTM C293	28 days	>1500 psi
Shrinkage @90% R.H.	ASTM C596	28 days	0%

Bond	ASTM C882	28 days	>2000 psi
Density, When Applied	-		134 ± 5lbs/ft ³
Freeze/Thaw	ASTM C666	N/A	300 cycles no visible damage

The calcium aluminate cementitious liner shall be made with calcium aluminate cement and shall be used according to manufacturer's recommendations in applications where there is mild sulfide conditions (substrate surface of pH 2.0 or higher). The liner product shall be reinforced with alkaline resistant fiberglass rods or other similar fibers not less than 1/2 inch in length. The material should meet or exceed industry standards and shall not have any basic ingredient that exceeds EPA maximum allowable limits for any heavy metals. Water used to mix product shall be clean and free from contaminants. Questionable water shall be tested by a laboratory per ASTM C94 procedure.

When cured, the monolithic cementitious lining shall form a continuous, tight-fitting, hard, impermeable surface which is suitable for sewer system service and chemically resistant to any chemicals or vapors normally found in domestic sewage.

The monolithic cementitious lining shall cover the complete interior of the existing sewer manhole including the benches (shelves). The lining shall effectively seal the interior surfaces of the sewer manhole and prevent any penetration or leakage of groundwater infiltration.

The lining shall be compatible with the thermal condition of the existing sewer manhole surfaces. Surface temperatures shall range from 20 degrees F to 100 degrees F. Provide test data on shrinkage of the cementitious lining based on ASTM C596.

If an internal flexible chimney seal is called for in the Drawings, then the lining shall be installed 1-inch below the bottom of the manhole frame. If no internal flexible chimney seal is called for in the drawings, then the lining shall be installed to 2 to 3 inches above the bottom of the manhole frame. The termination of and surface of the lining shall be suitable for proper installation of the manhole frame-chimney seal specified in Section S-005.

The cured system shall be continuously bonded to all brick, mortar, concrete, chemical sealant, grout, pipe and other surfaces inside the sewer manhole.

Chemical sealants, grouts or patching materials used to seal active manhole leaks, to patch cracks, to fill voids and to otherwise prepare the manhole surface prior to application of the system shall be fully compatible with the system.

The system shall provide a minimum service life of 25 years.

S-006.10.2 Cementitious Manhole Lining Installation. The Contractor shall notify all property owners who discharge sewage directly to the manhole being surfaced that their service shall be discontinued while the lining is being placed and cured, and active pipe and service connections are reopened. The Contractor shall notify individual property owners at least 72 hours in advance, giving the date, start time and estimated completion time for the work being conducted. This notification shall be coordinated with the distribution of door hangers.

When cured, the monolithic lining shall form a continuous, tight-fitting, hard, impermeable surfacing which is

suitable for sewer system service and chemically resistant to any chemicals or vapors normally found in domestic sewage.

The monolithic lining shall cover the complete interior of the existing sewer manhole including the benches (shelves) and inverts. The lining shall effectively seal the interior surfaces of the sewer manhole and prevent any penetration or leakage of groundwater infiltration.

The lining shall be compatible with the thermal condition of the existing sewer manhole surfaces. Surface temperatures shall range from 20 degrees F to 100 degrees F. Provide test data on shrinkage of the lining based on ASTM C596.

The Contractor shall provide any necessary bypass pumping of sewage flows where and when the rehabilitation work is being performed, as specified in Section S-004.

The Contractor shall place covers over invert to prevent extraneous material from entering the sewer lines.

The Contractor shall clean each sewer manhole to be surfaced and shall dispose of any resulting material as specified in Section S-005 Manhole Rehabilitation.

The Contractor shall conduct a visual inspection of each manhole after it is cleaned. All active, hydrostatic infiltration leaks shall be plugged or sealed with grout as specified in Section S-005 Manhole Rehabilitation. Remove all loose mortar and rubble of existing benches and inverts. Remove any protruding rubber gaskets between wall seams. Prepare manhole as necessary by reshaping and repairing benches, inverts, and wall where required. Protect all pipe connections. All interior surfaces shall be prepared as recommended by the manufacturer.

1. All cracks and other voids must be repaired and filled with suitable non-shrinking cements, sealants or grouts.
2. All surfaces shall be clean and structurally sound.
3. Manhole rungs/steps shall be removed, ground smooth and patched and not replaced. Step removal shall be incidental to the manhole restoration costs.

The Contractor shall remove interior drop connections anchored to manhole walls prior to installing the lining system. After installation and proper curing of the lining, the Contractor shall re-install interior drop connections to their condition prior to removal. If the drop connection is already damaged and cannot be reused, the Owner and the Engineer shall be informed immediately to decide the best course of action.

The liner mix shall be mixed as specified by the manufacturer for 30 seconds to 1 minute after all materials have been placed in the mixing hopper. Mixing shall be accomplished such that the mix can be sprayed in a continuous manner without interruption until each application is complete.

The surface shall be clean and free of all foreign material and shall be damp without noticeable free water droplets or running water, but totally saturated, just prior to application. Materials shall be applied to a minimum uniform thickness, to insure that all cracks, crevices and voids are filled and a relatively smooth surface remains after light troweling. The light troweling is performed to compact the material into voids and to set the bond.

If a flexible chimney seal is called for in the Drawings, then the lining shall be installed 1-inch below the bottom of the manhole frame. If no flexible chimney seal is called for in the drawings, then the lining shall be installed to 2 to 3 inches above the bottom of the manhole frame. The termination of and surface of the lining shall be suitable for proper installation of the manhole frame-chimney seal, if specified.

The covers placed over the invert shall be removed and the bench sprayed such that a gradual slope is produced from the walls to the invert with the thickness at the edge of the invert being no less than 1/2 inch. The wall/bench intersection shall be rounded to a uniform radius the full circumference of the intersection.

Caution shall be taken to minimize exposure of applied product to sunlight and air movement. At no time shall the finished product be exposed to sunlight or air movement for longer than 15 minutes before replacing the manhole cover. In extremely hot and arid climates the manhole shall be shaded while reconstruction is in process. The final application shall have a minimum of four (4) hours cure time before being subjected to active flow. Traffic shall not be allowed over manholes for 24 hours after reconstruction is complete.

No applications shall be made to frozen surfaces or if freezing is expected to occur inside the manhole within 24 hours after application. If ambient temperatures are in excess of 95 degrees F, precautions shall be taken to keep the mix temperature at the time of application below 90 degrees F. Mix water temperature shall not exceed 85 degrees F. Chill with ice if necessary.

After all preparation has been completed the Contractor shall remove all loose material and wash the walls again. Any bench, invert or service line repairs shall be made at this time using the quick setting patching mix and shall be used per the manufacturer's recommendations.

S-006.11 FIELD TESTING AND ACCEPTANCE.

S-006.11.1 General. The Engineer or City may enter the manhole(s) to inspect the benching, invert channels, manhole wall/pipe connections, surface preparation, and other parts of the work. Provide all equipment, hardware and materials, including but not limited to forced air ventilation, gas monitors and detectors, harnesses, lights, etc. for the Engineer or City to enter the manhole and perform the inspection in complete accordance with OSHA requirements at no additional cost to the City.

The finished manhole surface shall be continuous and free from significant defects. Any defects which shall affect, in the foreseeable future, or warranty period, the integrity or strength of the manhole shall be repaired at the Contractor's expense, in a manner mutually agreed upon by the Engineer and the Contractor.

There shall be no cracks, voids, pinholes, uncured spots, dry spots, lifts, delaminations or other type defects in the liner. If any defects are discovered after liner has been installed, it shall be repaired or replaced in a satisfactory manner within 72 hours and at no additional cost to the City. This requirement shall apply for the entire guarantee period.

Active infiltration through the lining system shall be zero.

The Contractor is responsible for coordinating testing times with the City/Engineer.

S-006.11.2CementitiousManholeMonolithicLiningSystem. The cementitious lining shall provide a continuous monolithic surfacing with uniform thickness throughout the manhole interior. The Contractor shall work with the Field Representative to develop an easy method for measuring the liner thickness. This method should be such that the Field Representative does not have to enter the manhole to measure the thickness. One possible method would be to install pins (such as masonry nail) at four quadrants around the manhole spaced every 4 feet vertically. The pins would protrude slightly less than 1 inch from the wall. The lining would be installed to cover the pins, and the Field Representative could verify the thickness by checking that no pins are exposed without entering the manhole. The Contractor may develop other methods. The costs associated with measuring the liner thickness shall be included in the unit bid price. If the thickness of the lining is not uniform or is less than specified, it shall be repaired or replaced at no additional cost to the Owner.

The Contractor shall visually verify the absence of leaks and perform a vacuum test. The Vacuum test shall be performed as follows:

1. Vacuum Test - Test all rehabilitated manholes using the vacuum test method, following the manufacturer's recommendations for proper and safe procedures. Vacuum testing of manholes and structures shall be performed after curing of linings. Vacuum testing shall not be required on manholes with sewer lines greater than 16-inches in diameter due to safety concerns. Any visible leakage in the manhole or structure, before, during, or after the test shall be repaired regardless of the test results. Vacuum test shall be performed in accordance with ASTM C1244 - Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum).

END OF SECTION S-006

SECTION S-007

REHABILITATION OF WEST SHREVEPORT LIFT STATION

S-007.1 GENERAL. Furnish all labor, materials, equipment and incidentals required for removal and satisfactory disposal and/or salvaging of internal pumps, piping, and other appurtenances, and install and commission a new duplex submersible pump lift station that utilizes the existing wet well in accordance with the plans and these specifications. Work shall include constant speed submersible solids handling pumps, motors, guide rails, valves, control panels, control systems, fiberglass enclosure, aeration blower system, and appurtenances as specified herein. This station shall contain at least two (2) pumps, each with 100% design capacity.

S-007.1.1 References. The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only. The most recent version of the references shall apply.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C104	Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
AWWA C110	Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch (75mm through 1200mm) for Water and Other Liquids.
AWWA C115	Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
AWWA C151	Ductile-Iron Pipe, Centrifugally Cast for Water and Other Liquids.
AWWA C500	Metal-Seated Gate Valves for Water Supply Service.
AWWA C508	Swing-Check Valves for Waterworks Service, 2-inch (50mm) through 24-inch (600mm) NPS.

ASTM INTERNATIONAL (ASTM)

ASTM A48	Standard Specification for Gray Iron Castings
ASTM A307	Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
SSPC-SP6	Surface Preparation Specification No. 6 Commercial Blast Cleaning.

American Bearing Manufacturer's Association (ABMA)
American National Standards Institute (ANSI)
Hydraulics Institute (HI)
Joint Industrial Council Standards (JIC)
National Electrical Manufacturers Association (NEMA)
National Electrical Code (NEC)
Underwriters Laboratories (UL)

S-007.1.2 Quality Assurance. All the equipment specified herein shall be furnished by the pump station manufacturer and shall be products of manufacturers regularly engaged in the production of such equipment for over ten (10) years.

The pumps and other equipment covered by this specification shall be standard production units of the manufacturers currently available and listed in the respective manufacturer's catalog. The pumps furnished shall be in accordance with the Hydraulic Institute Standards and shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

Controls shall not be assembled on site. System supplier shall be a UL 508 certified facility and shall be regularly engaged in the manufacture of controls for the municipal industry. The system specified herein shall be the product of a manufacturer having at least ten (10) years' experience in the construction of such control equipment.

S-007.2 SUBMITTALS. The Contractor shall provide five (5) hard copies of the following submittal / information for review and approval:

Shop and erection drawings showing all important details of construction, dimensions and anchor bolt installation requirements.

Descriptive literature, bulletins, and/or catalogs of the equipment. Sufficient data shall be submitted to document previous production of each pump model proposed for use on this Contract.

Data on the characteristics and performance of each pump. Data shall include guaranteed performance curves based on actual factory tests of similar units, which show that they meet the specified requirements for head, flow rate, efficiency, NPSH, submergence and horsepower. Curves shall be submitted on 8-1/2-inch by 11-inch sheets, at as large a scale as is practical. Catalog sheets showing a family of curves shall not be acceptable.

The total weight of the equipment including the weight of the single largest item.

Complete wiring diagrams and schematics of all power and control systems showing wiring requirements between all system components, motors, sensors, control panels and related systems.

Complete motor data, including, but not limited to:

1. Type of enclosure design
2. Rated horsepower
3. Rated voltage
4. Full Load Amps (FLA)
5. Starting current
6. Locked Rotor Amperes (LRA)
7. Locked Rotor Kilo Volt Amperes (LR KVA)
8. NEMA starting code letter and insulation code letter
9. RPM
10. Input power in kW at nameplate rating
11. Starting calculations
12. Cable size
13. Efficiency at 50%, 75%, and 100% load, and power factor at 50%, 75%, and 100% load
14. Speed torque curves
15. Recommended trip and alarm settings for temperature protective devices

A complete, total bill of materials of all equipment.

A list of the manufacturer's recommended spare parts, with the manufacturer's current price for each item. Include gaskets, seals, etc. on the list. List bearings by the bearing manufacturer's numbers only.

Certified agreement to the conditions of the warranty. Submit description of factory test plan including test procedures and equipment. Submit for approval certified test reports of factory testing and field testing.

Contractor shall provide five (5) hard copies and one (1) electronic copy of record drawings and corrected shop drawings of the installation upon completion of the construction, but prior to final completion.

Record drawings shall incorporate all changes and modifications effected. An additional full-size Record Drawing set shall be placed in the control panel. A waterproof reduced copy of the master "Record" wiring diagram shall be laminated in clear plastic and permanently fastened to the inside of the panel door.

In the event that the equipment offered does not conform to all of the detailed requirements of this specification, describe completely all nonconforming aspects. Failure to describe any and all deviations from the specifications shall be cause for rejection.

S-007.3 EQUIPMENT

S-007.3.1 Tools and Spare Parts. The Contractor shall provide the following tools and spare parts:

Provide one set of all special tools as required for the proper servicing of equipment specified. Provide one complete set of the manufacturer's standard set of spare parts, including at least the following spare parts for the pumping units.

1. Two complete sets of both radial and thrust bearings
2. Two shaft sleeves with keys, nuts and accessories
3. Two complete sets of wearing rings
4. Two sets of packing glands and pump seals complete with rings, nuts and bolts
5. Two sets of gaskets for each casing joint
6. Two sets of all special bolts, nuts and screws
7. One completely assembled rotating assembly

The following spare parts shall be furnished for the electrical system.

1. One box of control power fuses of each size furnished.
2. Two complete sets of starter contacts for every starter of each NEMA size installed.
3. Four starter coils for every starter of each NEMA size installed, if applicable.
4. Two sets of overload relay heaters of every size furnished, if applicable.
5. Two boxes of pilot lights.

Collect and store all spare parts in an area to be designated by the City. Furnish the Engineer with an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivery cost.

Spare parts shall be packed in cartons properly labeled with indelible markings with complete descriptive information including manufacturer, part number, part name and equipment for which the part is to be used, and shall be properly treated for one year of storage.

S-007.3.2 Operating Instructions. The Contractor shall provide five (5) hard copies and one (1) electronic copy of Operating and Maintenance Manuals. The manuals shall be prepared specifically for equipment furnished and installed on this contract and shall include all required cuts, drawings, equipment lists, programming and controls descriptions, etc. that are required to instruct operating and maintenance personnel unfamiliar with such equipment.

The Contractor shall include in his bid price the services of the equipment supplier's /authorized representative for two (2) separate site visits. The duration of these visits shall be as necessary to accomplish the following work. The first site visit shall be to inspect for proper installation, testing the installed equipment, and assisting the City during start-up.

The second site visit shall be to instruct the City's personnel for proper operation and maintenance of the pumps, valves and associated controls. Two separate training sessions shall be provided to accommodate the City's personnel work schedules. The Contractor shall coordinate testing, start-up, and instruction sessions between the City and the equipment supplier/manufacturer.

S-007.3.3 Warranty. The pump manufacturer shall guarantee all parts to be of quality construction, free from defects in material and workmanship for a minimum of two (2) years from the date of final completion.

The interior equipment, apparatus, and parts furnished shall be guaranteed for a period of two (2) years, excepting only those items that are normally consumed in service, such as light bulbs, oil, grease, packing, gaskets, O-rings, etc. The pump manufacturer shall be solely responsible for the guarantee of the pump and all components included.

Major components, such as pumps, pump motors, etc., failing to perform as specified; or as represented by the manufacturer; or proven defective in service during the guarantee period, shall be replaced, repaired or satisfactorily modified by the manufacturer at no additional cost to the City.

S-007.4 EQUIPMENT. The material specified herein is intended to be standard equipment of proven ability and as manufactured by reputable concerns having experience in the production of such equipment.

The equipment furnished shall be designed, constructed, and installed in accordance with best practice and methods and shall operate satisfactorily when installed. It is implied that all named products and materials listed herein shall include "or approved equal" at the end of each reference.

All equipment shall be designed and proportioned to have liberal strength, stability and stiffness, and to be especially adapted for the intended service. All equipment and piping shall be rigidly and accurately anchored into position and all necessary foundation bolts, plates, nuts, and washers shall be furnished and installed. All bolts, nuts, washers and other appurtenances shall be of 316 stainless steel.

S-007.4.1 Pumps and Appurtenances.

S-007.4.1.1 Submersible Pumps. Furnish all labor, materials, equipment, and incidentals to install two (2) submersible non-clog wastewater pumps. Each pump shall be furnished with an eight (8) inch discharge connection and shall be selected to deliver 1,900 GPM at a design dynamic discharge head of 30 feet. Submersible pumps shall be manufactured by Gorman Rupp, ABS, Flygt, or approved equal.

Each pump shall be equipped with a maximum 35 HP electric NEMA Premium Efficiency motor with a minimum efficiency of 70%, wired for operation for 460 volts, 3 phase, 60 Hz electric service, with 50 feet of submersible type GGC or SOOW cable, approved by UL and/or CSA, and sized per NEC standards. Each pump shall be fitted with 30 feet of stainless steel lifting chain. The working load of the lifting system shall be 50% greater than the pump unit weight.

Each pump shall be capable of operating in a continuous submerged condition; while up to one-half the motor housing may be non-submerged.

Pumps being installed in a wet pit without permanent discharge connection shall be automatically connected to the discharge piping by lowering the pump by guide rails or guide cables, without the necessity of personnel entering the wet pit. Each pump shall be provided with a replaceable cast gray iron slide rail guide shoe attached to pump discharge flange. A replaceable neoprene seal shall be provided as an integral part of the guide shoe to form a seal with the base plate connection and eliminate the possibility of leakage and erosive wear during operation. The seal shall contact mating

faces in a static position and shall have adequate flexibility to flex under pumping pressure to increase seal efficiency. Metal-to-metal contact at the discharge connection shall not be acceptable.

The pump manufacturer must be ISO 9001:2008 revision certified, with scope of registration including design control and service after sales activities.

The pump manufacturer must be registered to the ISO 14001 Environmental Management System standard and as such is committed to minimizing the impact of its activities on the environment and promoting environmental sustainability by the use of best management practices, technological advances, promoting environmental awareness and continual improvement.

The pump casing shall be of gray iron, ASTM A-48, Class 30, or ductile iron, Class 65-45-12, with a 125# Flange. Casing shall be easily removable from the motor for full inspection of impeller.

All pump openings and passages shall be of adequate size to pass a minimum 3" diameter spheres and any trash or stringy material which can pass through an average house collection system.

The impeller shall be enclosed non-clog channel design, incorporating multiple vanes with wide flow channels. It shall be ductile iron, Class 65-45-12, with designed counter weight mass for dynamic balancing to eliminate vibration. Balancing shall not deform or weaken the impeller. The impeller shall be driven by means of a key slotted into the shaft. Impeller fasteners shall be non-corroding. The axial suction clearance between the impeller and pump casing shall be fully adjustable to maintain peak operating efficiency of the pump. The adjustment shall be easily accomplished using four (4) external adjusting screws.

All other major pump components such as motor housing, seal housing, and bearing brackets shall be of gray iron, ASTM A-48, Class 30. All external surfaces coming into contact with pumped media shall be protected by water-based epoxy primer and a waterborne enamel top coat with a minimum 8 mil thickness. All exposed fasteners and lock washers shall be of 300 series stainless steel.

The pump/motor shaft shall be constructed of Type 416, 420 or Type 431 stainless steel. The shaft shall rotate on permanently lubricated ball bearings properly sized to withstand the axial and radial forces. The ABMA Minimum L-10 bearing life shall be at least 30,000 hours rated at the pump BEP. Two (2) separate mechanical seals shall be provided, arranged in tandem. The upper seal shall have a carbon rotating face and ni-resist stationary face. The lower seal shall incorporate silicon carbide on both the rotating and stationary faces. Cage and springs shall be of stainless steel and elastomers of Viton or Buna-N.

The rotating seal faces shall be lubricated from an oil filled reservoir between pump and motor; the oil serving as both lubricating and a cooling media. The reservoir shall have two oil fill and drain plugs to insure accuracy when measuring lubricant level, and for ease of maintenance.

Seal shall require no special maintenance or routine adjustment; however, shall be easily inspected or replaced. No seal damage shall result from operating the pump for short periods of time without liquid.

A seal failure electric probe sensor shall be installed in the seal chamber. The sensor shall be capable of sensing leakage into the seal chamber and the sensitivity level shall be set in the control panel.

Pumps and motors shall be shop prepared and painted. Surface preparation shall be in accordance with SSPC-SP-10. Primer shall be one coat of 3.5 to 4.5 mil DFT epoxy, following which two coats of 4 to 6 DFT (per coat) epoxy paint shall be applied. Paint shall be by Tnemec, Carboline or approved equal.

S-007.4.1.2 Motors. The motor and pump must be connected to form an integral unit. Motor shall be a squirrel-cage, induction type in an air-filled water tight enclosure, oil-filled motors shall not be acceptable. The motor shall conform to NEMA design standards, and incorporate Class H insulation materials to withstand a continuous operating temperature of 180°C (356°F). The pump and motor shall be capable of handling liquids with a maximum temperature of 40°C (104°F).

Motor shall be capable of sustaining a minimum of 10 starts per hour and shall be inverter duty rated in accordance with NEMA MG1. The motor shall not require a cooling jacket or any other means of auxiliary cooling during normal continuous operation.

Motor housing shall be of cast iron. The stator shall consist of copper windings with copper connectors applied to high grade electrical steel laminations. The stator shall be held securely in place by a heat-shrink fit into the motor housing. Any other means of securing the stator which would require penetration of the motor housing shall not be considered acceptable.

Combined rotor and shaft assembly shall be dynamically balanced for vibration-free operation. Rotor end bars and short circuit rings shall be of aluminum. The pump shaft shall be of 17-4 PH series stainless steel. The shaft shall be machined with shoulders or snap ring grooves for positive placement of bearings.

The upper and lower bearing shall be of heavy duty design, capable of supporting the shaft and rotor while under maximum radial and thrust loads. The bearings shall be permanently grease lubricated and sealed at the time of installation. The minimum B-10 bearing life shall be 50,000 hours over the normal operating range of the curve.

All static seals at watertight mating surfaces shall be of Buna-N or Viton rubber O-ring type. Use of auxiliary sealing compounds shall not be required.

The power and control cables shall enter the motor through a terminal housing. The entrance shall be sealed with a rubber grommet and clamp set which when compressed longitudinally causes a radial watertight seal. The individual leads of the power and control cables shall be separated by a compressible grommet, which shall provide protection from wicking through the cable. Any other cable entrance design requiring use of epoxies, silicones, or similar caulking materials shall be considered unacceptable.

The motor and sensor leads shall be mated to the cable leads through a group of quick-connect, color-coded cable connectors.

The pump and electrical cables shall be capable of continuous submergence without loss of waterproof integrity to a depth of 65 feet.

The watertight integrity of the motor housing and shaft seal shall be tested during manufacture by vacuum testing the completed pump assembly.

The motor shall be protected from thermal damage by a group of three separate thermostatic switches embedded into the stator windings, one per stator phase. Each switch shall open independently and terminate motor operation if temperature of the protected winding reaches the high temperature set point of 160°C (320°F) and shall automatically reset upon cooling of the winding. The thermal sensing device shall be connected to the pump control panel by the Contractor.

The pump shall utilize a single probe to monitor both the motor and seal chambers for moisture intrusion. The detection of moisture in either chamber shall send a signal to the control panel which shall be used to notify the user of the need for an inspection.

S-007.4.1.3 Aeration Blower System. A Thomas Industries model 5080 linear air blower or approved equal, capable of 5.5 psig discharge pressure and a flow of 4.3 standard cubic feet per minute, shall be installed inside the fiberglass enclosure. The blower shall be powered by an 85 watt linear motor operating on 115/1/60 power. Full load amp rating of the motor is 2.1. The blower shall be powered out of the duplex GFI located on the side of the pump station control panel. The pump station control panel shall be designed to accommodate this electrical load.

A ¾", schedule 80 PVC pipe shall be provided from the blower discharge, through the pump station accessory opening into the wetwell. This piping shall continue into the wetwell to a depth equivalent to the pump "off" level. The piping shall be strapped to the wetwell wall using stainless steel conduit strapping. A PCI HC-75 diffuser shall be installed at the end of the ¾" piping to provide for complete distribution of the air into the liquid volume. The diffuser shall be located midway between the two suction lines and on the opposite wetwell wall. The diffuser shall be strapped to the wetwell wall using stainless steel conduit strapping.

The wetwell aeration system shall operate 24 hours per day and shall be designed to for continuous operation. The blower shall be warranted for a period of 5 years.

S-007.4.1.4 Appurtenances. The pump discharge elbow connection shall be permanently installed in the wetwell along with the discharge piping. Each pump shall be automatically connected and sealed to its discharge connection elbow when lowered into place.

Each pump shall be mounted on a sliding guide bracket which can be used to guide the pump into place. The discharge connection shall be bolted to the floor of the wetwell and shall be designed to receive the pump connection without any need for bolts or nuts. The discharge connection shall be attached to the floor by means of Type 316 stainless steel anchor bolts. Each pump shall ride on dual guide bars and shall be standard weight ¾-inch Schedule 40 Type 316 stainless steel pipe.

Each pump shall be fitted with a Type 316 stainless steel lifting chain and a Type 316 stainless steel chain connector between the pump bail and chain. The lifting chain shall be rated for five times the pump weight(minimum). Unless noted otherwise, the lifting chain combined length shall be equal to the wet well depth (top slab finished grade to wet well bottom) plus six feet to permit raising the pump for inspection and removal. The lifting chain shall be attached to a lifting bail on the pump. Eyebolts shall not be considered as an acceptable alternate to a lifting bail.

Floats shall be located such that they are not affected by incoming flow. Floats shall be specified below.

Aboveground piping and valves shall be located in a fiberglass enclosure provided by the Contractor. The enclosure shall be sized as indicated in the Plans. The enclosure shall have minimum of two doors. All

doors shall have provisions for locks. Enclosure shall be fitted with ventilation assembly. Enclosure shall be secured to the top of the wet well slab as recommended by the manufacturer.

S-007.4.2 Piping and Valves

S-007.4.2.1 Bypass Connection. The lift station's common discharge forcemain header shall include a bypass arrangement to facilitate operation during times the pump(s) or the forcemain is not functioning.

The bypass arrangement shall be located inside of the fiberglass enclosure. Piping and valves shall be the same size and material as the common discharge forcemain and shall meet all pertinent requirements specified herein.

S-007.4.2.2 Ductile Iron Piping. Discharge lines from the pumps shall be sized as indicated in the plans to convey sanitary sewer flows at a minimum velocity of 3 fps. Piping shall be ductile iron pipe and shall conform to the physical and chemical requirements of AWWA C151, and shall have dimensions and wall thickness for a minimum pressure of 250 psi. Fittings shall be ductile iron or cast iron conforming to AWWA C110, 150 psi minimum pressure rating.

Flanged discharge piping shall be used in the fiberglass enclosure and shall be in conformance with AWWA C115, and shall be suitable for the maximum expected discharge pressures. Flanged joints shall be with factory applied screwed 125 lb. long hub companion flanges conforming to ANSI B16.1. Flanges shall be faced and drilled after being threaded to pipe, be true 90 degrees with the pipe axis and shall be flush with the end of the pipe. Flanged pipe shall be cut true to length. Ring gaskets shall be rubber with cloth insertion. Gaskets shall be 1/16-inch thick.

Buried ductile iron piping shall use restrained mechanical joints and shall be polywrapped in accordance with Standard Specification Section 209.

Coatings for pipe and fittings shall be in accordance with Specification Section 209. Piping shall be properly supported in the vault.

The piping shall be joined into a single restrained forcemain inside of the fiberglass enclosure by means of a tee fitting.

S-007.4.2.3 PVC Piping. All PVC service (not force main) piping, unless noted otherwise, shall be Schedule 80.

S-007.4.2.4 Valves. Check valves shall be swing type with lever arm and adjustable weights and shall meet the material requirements of AWWA C508. The valves shall be iron body, bronze mounted, single disc, 150 psi working water pressure, non-shock and hydrostatically tested at 300 psi. Ends shall be 125 lb. ANSI B16.1 flanges. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and spring. Springs with various tensions shall be provided. Swing check valves shall be as manufactured by Val-Matic, Pratt, Dezurik, or approved equal.

Plug valves with lever actuators shall be of offset disc type, 1/4 turn, non-lubricated, serviceable (able to be repacked) under full line pressure and capable of sealing in both directions at rated pressure. Disc

shall be completely out of flow path when open. Plug valve bodies shall be of cast iron, 30,000 psi tensile strength, ASTM A 126, Grade B, or of ductile iron, ASTM A 536 and of top entry, bolted bonnet design, cast with integral flanges conforming to connecting piping. Exposed bolts, nuts, and washers shall be zinc or cadmium-plated, except for submerged valves, which shall have Type 316 stainless steel hardware. Plug valves specified herein shall be manufactured by DeZurik, Pratt, or approved equal.

Air release valves, suitable for sewer service, shall be installed downstream of the swing check valves or per the Engineer's direction. The small orifice air release valves shall be furnished with reinforced nylon and stainless steel body. Discharge from the air release valves shall be directed to the wetwell. The float ball shall be constructed of foamed polypropylene and attached to a stainless steel rod. Float ball hangers shall be provided for all float ball assemblies, hangers shall be Type 316 Stainless Steel. Air release valves for sewer service shall be as manufactured by A.R.I. or approved equal.

Valves shall be located in dedicated fiberglass enclosure. Valves shall not be located inside the wet well.

S-007.4.2.5 Pressure Gauges and Transmitters. Each discharge line in the fiberglass enclosure shall be fitted with a pressure gauge. Pressure gauges shall be bronze bourdon tube Ametek U.S. Gauge, SOLFRUNT Duragauge Series 1980 Black Phenol Turret type with Type 316 stainless steel rack and pinion movement or approved equal. The gauges shall be glycerin filled. Gauges shall range from 0 psig to a minimum of 25 percent over the maximum expected head. Gauges shall be 4-1/2-inch diameter, furnished with 1/4-inch inlet. All fittings and cocks shall be Type 316 stainless steel. Pressure gauges shall be furnished with isolating pulsation dampers. Diaphragm seals shall be Teflon coated, oil filled, Type 316 stainless steel suitable for use with pressure gauges.

S-007.4.3 Pump Controls. The systems integrator should be located within a maximum of 150 mile radius of the City. The systems integrator shall have a minimum of 10 years' experience in designing, testing, building, and installing control panel and/or systems for submersible pumps. Experience on similar work other than lift stations shall not be considered equivalent. Replacement parts and equipment for the entire control system are to be in stock at all times by more than one local supplier within 30 miles of the City. The City's lift station personnel are currently licensed and trained for "Siemens Portal V12 or Higher", any other software to be used must be pre-approved and all license keys, development software and training (minimum of 40 hours) by the manufacturer's certified Engineer with a minimum of five (5) years' experience shall be included. The systems integrator that shall be working on the City's SCADA (located at Lucas Wastewater Treatment Plant) system shall be Citect certified (in Configuration). Citect certification shall be submitted along with the Controls System submittal. Prior to implementation of the controls system, the systems integrator shall spend a minimum of 40 hours with the City's Lift Station staff to discuss the controls system in detail.

The floats shall use fiber optic cable to transmit a beam of light from a transmitter in the control panel to the float where the beam makes and breaks depending on the tilt of the float. The receiver in the control panel shall detect the presence or absence of light and operate a relay in the receiver. The float shall have no electrical components or metallic wires that could cause arcs and sparks in an explosive atmosphere.

The float switch shall be mercury and lead free and shall be made of all safe, recyclable materials. The float switch housing shall be polypropylene. It shall be a simple robust device designed for many years of dependable service. The beam eclipser shall be stainless steel in an inert non-toxic dampening fluid that prevents chatter due to wave action. The viscosity of the fluid shall not change significantly over the

range of –50 to +155F (-45 to +70C). The transceivers (transmitter and receiver combination) shall be dual din rail mounted units capable of connection to 2 floats. Provide one dual transceiver for every 2 floats. The fiber optic cable shall be custom made for the float and shall consist of dual plastic fibers with an overall specially blended PVC sheath for flexibility. No special tools or experience shall be required for connection of the optical cable to the transceivers. The cable shall be connected and sealed at the float housing using a double seal method that shall prevent water from entering the float even if the outer sheath is damaged. The float color shall be two tone with the lighter color on the dome for easier viewing underwater when tilted up.

The transceivers shall operate in ambient temperatures of –15 to +130F (-25 to +55C). The transceivers shall operate at 12 VDC and shall be protected against accidental polarity reversal. The system shall operate in the visible and infrared light region with wavelengths between 400 and 1200 nm. The output relays in the receivers shall have the capability of being connected normally open or normally closed. The transceivers shall have a green led power-on light and red led lights on each channel indicating that the light beam is being received – float tilted up. The floats shall operate in liquid temperatures of +32 to +130F (0 to +55C). The floats shall have an ambient air standby operating temperature rating of –15 to +155C (-25 to +70C).

S-007.4.4 Control Panel. The control panel shall be NEMA 4X stainless steel construction and shall be located as indicated on the plans. The control panel assembly and level instruments shall be UL labeled for industrial control panels in accordance with UL-508. Power supply to the pump control panel shall be 480 Volt, 3 phase. Provide an individual thermal magnetic circuit breaker/disconnect switch interlocked with the door handle.

The control leads to and from the wetwell shall be low voltage, microwatt type designed to not exceed their normal voltage or current values due to system component failure. The panel shall include lamacoid nameplates, and the following displays, switches and alarm lights.

A. Panel Mounted Lights and display for the indication of:

1. High Motor Temperature Alarm (per pump) – Yellow Light
2. Motor Leakage Alarm (per pump) – Yellow Light
3. High Water Level Alarm – Red Light
4. Pump Failure Alarm (per pump) – Yellow Light
5. Pump Hour Meter

B. Panel Mounted Switches :

1. Hand/Off/Auto switch (per pump)

C. Isolated signals and dry contacts to interface with the SCADA system:

1. Pump Running (Discrete Output – per pump)
2. Pump Failure Alarm (Discrete Output – per pump)
3. High Water Alarm (Discrete Output)
4. Power Failure-SWEPCO Power
5. Low Level

D. Panel mounted push buttons

1. Alarm Horn Silence
2. Pump Failure Reset

The control panel shall communicate with the City's SCADA system through a radio connection depending on the location of the pump station and the City's preference. The Contractor shall coordinate with City to integrate lift station controls into the SCADA system. Radio shall be supplied by City. Contractor shall direct antennae in direction of Streets and Drainage Tower at Mansfield Road and Claiborne Avenue.

S-007.4.5 Electrical.

S-007.4.5.1 Control Panel Enclosure. Control panel enclosure shall be constructed from 12 gauge 316 stainless steel with a #4 finish. All hardware on exterior of panel shall be stainless steel. Exterior door shall be held shut with pad lockable, 3-point door latch by Austin, or approved equal. The padlock is to be provided by the City. Inner door shall be held shut with latch, Emka wingknob and cam, or approved equal. All doors shall be mounted to the enclosure with continuous hinges. Exterior door shall be gasketed to provide a watertight seal to the enclosure. Subpanel and inner door shall be 12 gauge mild steel primed and painted white. All control switches, pushbuttons, elapsed time meters, and indicator lights shall be mounted on or through the inner door. All panel wiring and equipment layout shall be performed per NEMA and JIC specifications. NEC gutter spacing shall be observed. A minimum of 6 inch additional D.I.N. rail shall be provided for future mounting expansion.

S-007.4.5.2 Power Distribution Block. Provide a main power distribution block sized for incoming power to the panel. Each pole of the block shall be supplied with a clear cover for operator protection. Power distribution block shall be by Ferraz Shawmut, or approved equal.

S-007.4.5.3 Surge Suppression. Provide a silicon oxide varistor surge/lightning suppressor connected to the power distribution block and sized for incoming voltage. Minimum ratings shall be 60,000 amps, 1500 Joules. Suppressor shall be by General Electric, Westinghouse, or approved equal.

S-007.4.5.4 Phase Monitor. Where three-phase motors are controlled, provide a plug-in style phase monitor designed to monitor phase loss, under voltage, and phase sequence with a SPDT contact to interrupt all control power in the event of phase loss. Phase monitor shall be supplied with fused protection of the three phase sensing circuit. Phase monitor shall be Diversified Electronics SLA series, or approved equal. Fuseholder shall be three-pole Ferraz Shawmut, or approved equal. Fuses shall be fastacting as manufactured by Ferraz Shawmut, or approved equal.

S-007.4.5.5 Circuit Breakers. Provide individual, properly sized, thermal-magnetic circuit breaker for each load served. Combination circuit breaker and overload mechanism shall not be allowed. Circuit breakers for motors and other loads shall have a minimum rating of 10,000 AIC (230 VAC breakers) or 14,000 AIC (480 VAC breakers).

Provide individual, properly sized, thermal-magnetic circuit breaker for each of the following:

- A. Transformer
- B. Each motor load

Provide 1-pole, 20-amp circuit breakers for the following loads:

- A. Control circuit
- B. Panel receptacle/condensation heater/service light.

S-007.4.5.6 Contactors/Overload Relay. A magnetic across the line horsepower/current rated motor contactor with ambient temperature compensated overload relay shall be provided for each motor load served. Contactor shall be by Cutler Hammer, ABB, or approved equal. Overload relay shall be Cutler-Hammer, ABB, or approved equal.

S-007.4.5.7 Transformer. A 120 and a 24 volt control circuit transformer with fuse protection shall be included. If 120 volt, single phase is not available, a minimum 2KVA dry-type transformer shall be supplied with primary and secondary short circuit protection. Control power shall be 120 volt. Control circuit shall be connected so that a power outage of any duration does not require manual re-start of system.

S-007.4.5.8 Fuseholders and Fuses. Provide a fuseholder and fuse for the control circuit, minimum rating 5 amps (ampacity not to exceed relay contact rating). Fuseholders for control fuses shall be finger safe with neon light indication for a blown fuse. Control fuse fuseholders shall be Ferraz Shawmut, Entrelec, or approved equal.

S-007.4.5.9 Terminal Blocks. Numbered terminal blocks shall be supplied for all field terminations. Current capacity of terminal strips shall be equal to the load served. Terminal blocks shall be suitable for minimum 12 AWG wire at not less than 300 volts. Terminal blocks for control interface shall be by Entrelec or approved equal.

S-007.4.5.10 Interior Service Light. Provide an interior 1600 lumens LED light bulb with safety lens fastened to the top of the enclosure with two-position "Off-On" selector knob to control. Incandescent light fixtures shall not be acceptable. Light shall be mounted without penetrating the panel outer skin with screws or fasteners.

S-007.4.5.11 Entry Switch. An entry switch shall be mounted in the panel, which shall close a contact wired to the telemetry unit when the exterior door of the enclosure is not closed. Switch shall be by Microswitch, or approved equal.

S-007.4.5.12 Receptacle. Provide a 20-amp G.F.I. duplex receptacle connected to a separate circuit breaker, as described elsewhere, and mounted on the control panel inner door.

S-007.4.5.13 Temperature Control. The control panel shall include an exhaust system to maintain a temperature below 105 degrees F. The exhaust system shall include an exhaust fan and appropriately sized air intake. Exhaust fan motors shall operate on 120 V, 60 Hz power and shall consist of an integral thermostat.

S-007.4.5.14 Condensation Heater. Provide a 100 watt, 120 VAC silicone rubber self-adhesive condensation heater mounted on a flange with integral 40 degree thermostat. Heater shall be as manufactured by Watlow, or approved equal.

S-007.4.5.15 Alternator (If applicable). Provide an automatic electronic alternator for alternating pump operation on successive automatic cycles. Relay shall incorporate LED position indicators and a toggle switch to select pump #1 or pump #2 as the lead pump, or to allow automatic alternation. Alternator shall be by Autocon Industries, or approved equal.

S-007.4.5.16 Relays (If applicable). Relays shall be general purpose plug-in relays with standard mounting configurations. The relays shall have the number of poles as shown on the drawings with neon indicating lamp and test button integral to each relay. Relay contact ratings shall be minimum 5 amps.

S-007.4.5.17 Time Delay Relays (If applicable). Time delay relays shall be dial or D.I.P. switch selectable, and shall have contact ratings of not less than 10 amps. Switch settings shall be labeled on the relay. Time delay relays shall be by General Electric, or approved equal.

S-007.4.5.18 Selector Switches and Pilot Lights. Selector switches shall be 30 mm oil tight type with lever operators and 10 amp contacts. Knob operators shall not be accepted. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 VAC and 10 amps. Control switches shall be Cutler-Hammer or approved equal. Contact blocks shall be Cutler-Hammer or approved equal.

The following selector switches shall be included (per pump where applicable):

- A. Hand/Off/Auto
- B. Pump Selector with Auto option (Ex: Pump 1, Auto, Pump 2)

Pilot lights shall be push-to-test, oil-tight industrial units utilizing 120 volt bulbs (unless otherwise specified). Lenses shall be colored as shown on the drawings. Control panel lights shall be modular construction as manufactured by Cutler Hammer or approved equal. Contact blocks shall be Cutler-Hammer or, approved equal. LED type lights shall not be acceptable. Provide pilot lights for the following functions (per pump where applicable):

- | | |
|---------------------------|-------|
| A. Pump Off | Green |
| B. High Level | Red |
| C. Pump Run | Red |
| D. Motor Overload | Amber |
| E. Pump Seal Fail | Amber |
| F. Pump High Temp. | Amber |
| G. Backup Float Ball Mode | Red |

S-007.4.5.19 Pushbuttons. Pushbuttons shall be oil-tight industrial units. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 VAC and 10 amps. Control panel pushbuttons shall be modular construction as manufactured by Cutler Hammer or approved equal. Provide push-buttons for the following functions:

- A. Alarm horn silence
- B. Pump Fail Reset
- C. Backup Float Ball Reset

S-007.4.5.20 Elapsed Time Meters. Provide an elapsed time meter for each pump. Meter shall be 6-digit, non-resettable, reading in hours and tenths of hours. Elapsed time meter shall be by Eagle Signal, General Electric; Westinghouse, or approved equal.

S-007.4.5.21 Seal Fail Relay. Provide a conductance actuated moisture sensing relay for each submersible pump controlled with field adjustable sensitivity. Specialized relays/sensors, if required by the pump manufacturer, shall be supplied to the panel manufacturer by the pump manufacturer prior to panel construction. Seal Fail Relay shall be Diversified Electronics, Syrelec, or approved equal.

S-007.4.5.22 Alarm Light. Provide a red strobe light mounted to the top, exterior of the enclosure. Minimum ratings shall be 1.5 Joules at 70 flashes per minute. The strobe light shall be fully sealed to prevent water from entering the enclosure and be attached by mounting screws from inside the enclosure to prevent tampering.

S-007.4.5.23 Ground Buss/Lugs. Provide a ground lug sized for incoming power ground near the power distribution block. Provide a ground lug sized for pump ground near pump power wire terminations. Provide a ground buss for control equipment grounding, minimum 6 termination points.

S-007.4.5.24 Corrosion Inhibitor. Provide a corrosion inhibitor mounted inside the control panel. Corrosion inhibitor shall be Hoffman, or approved equal.

S-007.4.5.25 Wiring. Power distribution wiring on the line side of panel fuses or circuit breakers shall be sized for the load served, minimum 12 AWG, Control wiring shall be minimum #16 gauge SIS type stranded wire for internal control panel circuits. All control wires shall be numbered at each termination corresponding to the master wiring diagram with clip-sleeve or heat-shrink type wire markers. Wrap-on or adhesive wire markers shall not be allowed. All color coding for wires shall be per applicable NEC codes. All wiring shall be continuous between devices with no wire splices allowed in circuit runs.

S-007.4.5.26 Nameplates. Provide adhesive backed printed nameplates for all internal devices such as contactors, circuit breakers, and relays. Provide engraved phenolic nameplates, black letters on white background, for door-mounted devices such as selector switches, push-buttons, circuit breaker toggles, and pilot lights. Nameplates shall be secured firmly to the panel.

S-007.4.5.27 Control Panel Electrical Rack. An electrical equipment rack, as shown on drawings, shall be supplied by the manufacturer of the control panel for installation by the electrical Contractor. The equipment rack shall be constructed of double-back Unistrut™, Type 304 stainless steel material with required conduit connecting meterbase, fused disconnect switch, control panel, seal fittings, and fiberglass reinforced plastic (FRP) junction box. If a lightning arrestor for the control panel is specified elsewhere, it may be mounted on the exterior of the disconnect switch, in lieu of the control panel, if desired.

All wiring between components on the electrical rack shall be run in galvanized heavy wall conduit, minimum ½ inch diameter. All wire shall be not less than 12 AWG stranded type THHN/THWN, except control wiring, which may be 14 or 16 AWG stranded type THHN/THWN. All wiring shall be color coded by wire insulation.

S-007.5 EXECUTION. All equipment and accessories delivered to the job site shall be inspected for damage by both the Contractor and the City or their representative. Equipment shall be stored per the

manufacturer's recommendations. All equipment or materials found to have defects, whether before or after installation, shall be rejected and shall be repaired or replaced by the Contractor, at no additional cost to the City.

Installation shall be in accordance with the manufacturer's instructions and recommendations and as shown on plans. The pump assemblies shall be installed under the supervision of manufacturer's authorized representative. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations. Failure to comply with these specifications shall result in the rejection of the work by the City.

S-007.5.1 Installation of Structures. All structures such as the fiberglass enclosure, concrete bases and the control panel base shall be constructed as detailed on the plans and as called for in these specifications.

S-007.5.2 Pump and Motor Installation. The pump and motor units shall be carefully installed as recommended by the manufacturer and the seals between pumps and pump bases must mate as intended. The pump and motor units shall be properly wired and field checked to see that they can be easily removed and replaced by means of the lifting chains and do not bind on the guide rails.

S-007.5.3 Electrical and Controls. The electrical and control system shall be as specified herein before and shall all be installed in accordance with the NEC. The complete system shall be provided and installed by a single supplier. The Contractor shall contact the local power supplier and install all lines to the control panel, including metering in accordance with their requirements. The electric meter shall be installed as close to the station as allowed by the power utility. Seal all conduit penetrations with Perma Gum or Duct Seal. Provide separate conduit for each pump and float switch. Provide stainless steel hooks for float switches.

S-007.5.4 Installation of Piping. Piping shall be installed as shown on the plans and in accordance with the Standard Specifications of the City of Shreveport.

S-007.5.5 Start-Up and Testing. Prior to testing, all equipment shall be calibrated and verified by the pump station manufacturer's authorized representative. Contractor shall provide City completed Equipment Supplier's Certificate of Installation prior to startup and testing, blank form provided at the end of this specification. All tests shall be conducted in the presence of the City's representative. Contractor shall provide the City with one week written notice prior to testing.

Leakage tests performed on manholes shall be performed on the wetwell, see Specification 2300. Pump testing shall consist of pumping water out of the wetwell to ensure that the pumps operate as proposed. Pumping conditions shall be verified against the withdrawal rate of the wetwell and the pressure gauge reading. During pumping tests, the valves and the flow meter shall also be tested for proper operation, leaks, and performance. All controls and alarms shall also be tested. All alarm conditions shall be simulated and the City's SCADA system shall be programmed and shown to operate as intended. City's staff shall be present whenever testing water is needed to verify that proper backflow protection is installed and used. If defective work product or equipment is found during the course of testing, the Contractor shall repair/rectify such defects to the satisfaction of the City and repeat tests at no cost to the City. Following these tests, the pump station shall successfully operate for a period of 24 hours.

The City shall operate the lift station for a minimum of 30 calendar days to verify proper operation and performance of the facility. Any work items found during this time to not meet the specifications shall be rectified by the Contractor at no cost to the City.

S-007.5.6 Site Clean-up, Restoration and Grading. After work is completed, the site of the lift station rehabilitation shall be cleared of all construction material and other debris. Grading shall consist of providing proper drainage and all sites shall be left in a neat, clean, and acceptable condition. For all property the site shall be restored to a condition equal to, or better than, it's condition before the work was started. In any existing or proposed lawn areas, the final restoration shall include sodding.

END OF SECTION S-007

SECTION S-008

ACCESS HATCH

S-008.1 GENERAL. This item shall consist of all construction necessary to install aluminum access hatches with safety grates at the proposed wet well and the flow diversion structure as designated in the plans. This construction shall be in accordance with these specifications, and in conformity to the plans or as required by the Engineer.

S-008.2. MATERIALS.

S-008.2.1 Access Hatches. Access Hatches shall be Series S Access Doors by Halliday Products, or approved equal. This designation or specification shall not be construed to indicate exclusivity. The Contractor shall be free to submit equivalent materials for approval by the City.

S-008.2.2 Fasteners. Contractor shall provide four (4) concrete bolts per hatch to be used to secure the top lip of the Aluminum Access Hatch to the existing concrete floor. Similar, alternative fasteners may be used as approved by the City.

S-008.2.3 Safety Grate. Contractor shall provide a lockable safety grate with a minimum 300 pounds load rating per access hatch. Each grate shall include four stainless steel spring nuts used to mount pump brackets and cable holders.

S-008.3 EXECUTION.

S-008.3.1 Construction Methods.

S-008.3.2 Sawcut. Contractor shall full-depth sawcut existing concrete floor at the location and dimensions designated on the plans. The new access hole shall be cut so that the bottom lip of the Aluminum Access Hatch can fit freely through the hole, but the top lip should have a minimum of 2 inches of overlap with the concrete flooring. The removed flooring shall be removed from the site to a proper disposal facility.

S-008.3.3 Placement & Securing. The Aluminum Access Hatch shall be properly placed and centered in the new access hole in the flooring. The corners of the Aluminum Access Hatch shall be fastened to the existing concrete flooring by the concrete bolts, or whatever alternative fasteners are deemed acceptable by the City.

END OF SECTION S-008

SECTION S-009

WET WELL LINING SYSTEM

S-009.1 GENERAL. This specification may include wet well liner systems that may not apply to all projects. Contractor shall install a wet well liner system as indicated in the Contract Documents.

S-009.2 SCOPE OF WORK. The Contractor shall coat concrete wetwells as shown and specified within the Contract Documents using a Multi-Component Stress Panel Lining System, as directed by the Engineer.

This section covers all workmanship, materials and quality requirements for rehabilitation and lining work on the interior surfaces of wetwells. Contractor shall provide and apply resurfacing and lining materials as specified and as indicated on drawings and per manufacturer's instructions and design details.

Lining shall be applied to all interior surfaces of the wet well, wet well access manhole and basket screen structure including ceiling/roof (not including hatches) and walls. The lining system shall be terminated per manufacturer's recommendations at the floor of the structures.

S-009.3 REFERENCES. This section contains references to the documents listed below. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the more stringent of the requirements shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of receipt of Bids. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Referenced publications found within this specification shall be the latest revision unless otherwise specified; and applicable parts of the referenced publications shall become a part of this specification as if fully included.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 308.1

Guide to Curing Concrete

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASC Z9.4

Exhaust Systems Abrasive Blasting Operations
Ventilation and Safe Practices for Fixed Location
Enclosures

ASTM INTERNATIONAL (ASTM)

ASTM C109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
ASTM C348	Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
ASTM C403	Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance
ASTM C496	Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens
ASTM C666	Standard Test Method for Resistance of Concrete to Rapid Freezing and Thawing
ASTM C868	Standard Test Method for Chemical Resistance of Protective Linings
ASTM D412	Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers Tension
ASTM D2240	Standard Test Method for Rubber Property—Durometer Hardness
ASTM D3960	Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
ASTM D4060	Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
ASTM D4259	Standard Practice for Abrading Concrete
ASTM D4263	Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

ASTM E337	Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)
ASTM F1869	Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
ASTM F710	Standard Practice for Preparing Concrete Floors and Other Monolithic Surfaces to Receive Resilient Flooring

U.S GENERAL SERVICES ADMINISTRATION

F 595B	Federal Standard Colors
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INTERNATIONAL CONCRETE REPAIR INSTITUTE (ICRI)

ICRI Guideline No. 03732	Selecting and Specifying Concrete Surface Preparation for Coatings, Sealers, and Polymer Overlays
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NACE INTERNATIONAL (NACE)

NACE Pub. 6D-173	A Manual for Painter Safety
NACE Pub. 6F-163	Surface Preparation of Steel or Concrete Tank Interiors
NACE Pub. 6G-164	Surface Preparation Abrasives for Industrial Maintenance Painting
NACE Pub. TPC2	Coatings and Linings for Immersion Service
NACE RP0288	Inspection of Linings on Steel and Concrete
NACE RP0892	Coatings and Linings over Concrete for Chemical Immersion and Containment Service
NACE SP0188	Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC-SP12	Surface Preparation and Cleaning of Steel and
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Other Hard Materials by High- and Ultra High-Pressure Water Jetting Prior to Recoating

SSPC-SP13

Surface Preparation of Concrete

SSPC-Guide 12

Guide for Illumination of Industrial Painting Project

OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA)

OSHA 1915.35

Painting

OSHA- 29 CFR 1926.651

Specific Excavation Requirements

S-009.4 QUALITY ASSURANCE.

1. Do not use or retain contaminated, outdated, or diluted materials. Do not use materials from previously opened containers.
2. Use only products by approved manufacturers. All materials must be compatible. Provide same material product for touch-up as for original material.
3. If any requirements of this specification conflict with a referenced standard, the more stringent requirements shall apply.
4. Make available all locations and phases of the work for access by the City and the Engineer or other personnel designated by the Engineer. The Contractor shall provide ventilation and egress to safely access the coating work areas for inspection.
5. Conduct work so that the system is installed as specified herein. Inspect work continually to ensure that the system is installed as specified herein. The Contractor shall inspect the work to determine conformance with the specifications and referenced documents. The Contractor shall inform the Engineer of the progress and the quality of the work through daily reports as specified below. Any nonconforming lining system work shall be corrected as specified herein or as recommended by the manufacturer.
6. Summarize test data, work progress, areas covered, ambient conditions, quality control inspection test findings, and other information pertinent to the system installation in daily reports to be submitted to the Engineer.
7. Applicators shall have at least five years of experience performing lining work of similar size and complexity as the work specified in this Section and with the materials that are being used. Applicators shall be certified or approved by the lining system manufacturer. Submittals to verify these qualifications are to be made within thirty (30) days of the Notice-to-Proceed and are subject to approval by the Engineer.

S-009.5 CONTRACTOR SUBMITTALS.

Furnish submittals in accordance with City of Shreveport Standard Specifications.

Submit the following prior to commencing with any phase of the work covered by this Section:

1. Manufacturer's current printed recommendations and product data sheets for all lining system products supplied under this section including performance criteria, surface preparation and applications, volatile organic compound (VOC) data, and safety requirements.
2. Material Safety Data Sheets (MSDS) for any materials brought on-site including all resurfacing system materials, solvents, and abrasive blast media.
3. Storage requirements including temperature, humidity, and ventilation for resurfacing system materials.
4. Manufacturer's requirements, including application procedures for resurfacing materials shall be in writing and shall be followed in detail. All safety precautions recommended by the manufacturer shall be strictly adhered to at all times when work is in progress.
5. Submit applicators' certification that resurfacing materials comply with Federal, State, and Local regulations for VOC.
6. Submit daily reports that contain the following information: Substrate conditions, ambient conditions, application procedures, work completed and location thereof. Mark-up drawings that show location of work.
7. Submit letter(s) with associated product data signed by manufacturer certifying that submitted products are suitable for application on the surfaces to be resurfaced and for the service conditions.

S-009.6 DELIVERY AND STORAGE. Materials shall be stored in accordance with manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions. Flammable materials shall be stored in accordance with state and local codes. Materials exceeding storage life recommended by the manufacturer shall be removed from the site.

Store all materials only in area or areas designated by the Engineer solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of materials-related debris before authorized disposal, to these areas. All materials are to be stored on pallets or similar storage/handling skids off the ground in sheltered areas in which the temperature is maintained between 50°F and 90°F or as per manufacturer's recommendations.

Mix all materials in an enclosed mixing area. This enclosed area must protect the mixing operation and materials from direct sunlight, inclement weather, freezing, or other means of damage or contamination. Protect all other concrete and metallic surfaces and finishes from any spillage of material(s) within the mixing area. Do not use floor drains, dikes or storm drains for disposal of any materials.

The Contractor shall take all precautions and implement all measures necessary to avert potential hazards associated with the resurfacing system materials as described on the pertinent MSDS or container labels. Deliver all materials to the job site in their original, unopened containers. Each container shall bear the manufacturer's name and label.

Labels on all material containers must show the following information:

1. Name or title of product.
2. Federal Specification Number if applicable.
3. Manufacturer's batch number and date of manufacture.
4. Manufacturer's name.
5. Generic type of material.
6. Application and mixing instructions.
7. Hazardous material identification label.
8. Shelf life date.
9. Storage requirements.

All containers shall be clearly marked indicating any personnel safety hazards associated with the use of or exposure to the materials. All materials shall be handled and stored to prevent damage or loss of label. Material storage and mixing areas shall be designated by the Engineer. Do not use or retain contaminated, outdated, prematurely opened, diluted materials, or materials which have exceeded their shelf life.

S-009.7 COORDINATION OF WORK. The Contractor shall coordinate with the Engineer regarding availability of work areas, completion times, safety, access and other factors which can impact plant operations.

S-009.7.1 Safety. The Contractor's work forces should comply with the provisions outlined in the following documents:

1. SSPC-PA-3 - "A Guide to Safety in Paint Application"
2. NACE Pub. 6D-173 - "A Manual for Painter Safety"

The Contractor shall provide personnel with all safety equipment necessary to protect them during any phase of the work. This shall include, but not be limited to safety glasses, goggles, earplugs, hard hats, steel toed work shoes, appropriate personal protective clothing, gloves, and plant approved escape respirators (where required).

No work shall be performed until the appropriate Work Requests and lock-outs have been submitted to the Engineer. The Work Request system provides a mechanism to advise plant staff of a Contractor's work activities.

The Lockout system is a safety procedure to prevent unintended equipment activation.

Keep any flammable materials such as cleaning solvents, thinners, or resurfacing materials away from open flames, sparks or temperatures higher than 150⁰F. Drums containing flammable materials shall be grounded. No solvent in any quantity shall be allowed inside containment enclosures or permitted confined spaces at any time during resurfacing work.

Power tools are to be in good working order to avoid open sparking. No spark producing tools shall be utilized in restricted areas as indicated herein.

The Contractor shall fireproof all work areas by maintaining a clean work area and having Underwriter's Laboratories approved fire extinguishers on-hand. The Contractor shall furnish these fire extinguishers.

Complete the disposal process at the end of each day. Final disposal of these materials is the Contractor's responsibility.

Matches, smoking, flames, or sparks resulting from any source including welding, must be remote from the work area during coating work.

S-009.8 SITE CONDITIONS.

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with manufacturer's instructions.
2. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with manufacturer's instructions.
3. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
4. Wind: Do not spray coatings if wind velocity causes overspray of the coating materials. Contractor shall be responsible for rectifying all overspray claims.

S-009.9 MANUFACTURERS. Materials specified are those that have been evaluated for the specific service. Products shall be as manufactured by Tnemec Company, Inc., Dinjer, Warren Environmental, and CCI Spectrum, Inc or approved equal. As part of the proof of equality, the Engineer shall require at the cost of the Contractor, certified test reports from a nationally known, reputable and independent testing laboratory conducting comparative tests as directed by the Engineer between the product specified and the requested substitution.

Requests for substitution shall include manufacturer's literature for each product giving name, product number, and generic type, descriptive information, solids by volume, recommended dry film thickness and certified lab test reports showing results to equal the performance criteria of the products specified herein.

In addition, a list of five projects shall be submitted in which each product has been used and rendered satisfactory service.

S-009.10 MATERIALS.

S-009.10.1 Multi-Component Stress Panel Liner System.

1. The following list specifies the material requirements for multi-component stress panel liner systems. The approved products are as follows:

Moisture Barrier and Final Corrosion Barrier: Spectrashield, or approved equal.

2. Shall be a sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment – with the following typical chemical analysis:

“A” Component Viscosity,

77°F, cps.,	300-400
Physical State	Liquid
Color	Clear to amber
Hygroscopicity	Reacts with water B”

Component

Viscosity, 160°F, cps.,	400-600
Physical State	Liquid
Color	Flamingo Pink
Non-Volatile	100%

REACTION PROFILE (100 grams, 175° F sample)

Gel Time, seconds	1-2
Tack Free Time, seconds	15
Cure Time, seconds	30
A System / B System, volume ratio	1.00 / 1.00

TYPICAL PHYSICAL PROPERTIES

Tensile Strength (PSI)	ASTM D412	2670
Elongation (%)	ASTM D412	430
100% Modulus	ASTM D412	2200
300 % Modulus	ASTM D412	2600
Tear Strength (PLI)	ASTM D2240	280
Hardness (shore D)	ASTM D1737	42
Flashpoint (°F)	ASTM Pensky-Martens	>200
Taber Abrasion (mg loss)	ASTM D4060	25

3. Surfacers: Spectrashield, or approved equal, Polyurethane Rigid Structure Foam

Typical Chemical Analysis:

“A” Component

Viscosity, 77°F, cps.,	200
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PhysicalState	Liquid
Color	Dark Brown
Hygroscopicity	Reacts with water and evolves CO2 gas "B"

Component

Viscosity, 77° F, cps.,	600-1000
PhysicalState	Liquid
Color	Tan
Hygroscopicity	Absorbs water rapidly thus changing ratio

REACTION PROFILE (100 GRAMS, 77° F SAMPLE)

Cream Time, seconds	1-4
Tack Free time, seconds	5-8
Rise Time, seconds	6-10

Processing

A System/B System, volume ratio	1.00/1.00
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4. If dry or wet abrasive blast cleaning is the selected method of surface preparation, provide slag grit of a sieve size, gradation, and quality necessary to produce the degree of cleanliness and surface profile required herein.

S-009.11 EXECUTION.

S-009.11.1 General.

The Contractor shall be responsible for the cleanup of the wetwell, including disposal of wastes, sludge, debris, deposits, etc.

Hoisting, Scaffolding, Staging, and Planking:

1. Provide, set-up, and maintain all required hoists, scaffolds, and staging and planking, and perform all access related hoisting work required to complete the work of this section as indicated and specified.
2. Scaffolds shall have solid backs and floors to prevent dropping materials from there to the floors or ground below.

Environmental Requirements:

1. Comply with the manufacturer's recommendations as to environmental conditions under which materials can be applied.
2. Do not apply materials when dust is in work site.
3. The Contractor shall provide all temporary lighting during the work.

Protection:

1. Cover or otherwise protect finish work or other surfaces not being lined.
2. Erect and maintain protective tarps, enclosures and/or maskings to contain debris (such as dust or airborne particles resulting from surface preparation) generated during any and all work activities. This includes, but is not limited to, the use of dust/debris collection apparatus as required.

Initial Inspection of Surfaces to be lined:

1. It is the responsibility of the Contractor to inspect and report unacceptable concrete substrate surface conditions to the Engineer prior to the commencement of surface preparation activities.
2. Unacceptable concrete surface conditions are defined as the presence of water infiltration/inflow, cracked surfaces or concrete deteriorated to a depth of greater than one (1") inch or otherwise unable to withstand surface preparation as specified herein.
3. Verify that the pH of the cleaned concrete surfaces to be coated is within a range acceptable to the lining manufacturer. Application of coating materials outside this range shall not be permitted without written approval from the Engineer.
4. Unacceptable steel or ductile/cast iron surface conditions are defined as severely corroded and/or perforated metals and are unable to withstand surface preparation as specified herein.

Thinners and Solvents:

1. The Contractor shall use only solvents and thinners as recommended by the Manufacturer.

S-009.11.2 Application Requirements For Lining System.

General.

1. Areas not to be lined shall be masked using duct tape or other protection materials to prevent these surfaces from being resurfaced.

2. Ensure straight even termination of resurfacing/topcoat materials on wall edges and flush with embedded steel.
3. The Contractor must follow the minimum and maximum recoat limitation times and related temperature range restrictions between successive lifts for all products specified herein per Manufacturer's stated requirements.
4. All equipment and procedures used for lining system application shall be as recommended by the manufacturer.
5. Unless specified elsewhere herein, the Contractor shall comply with the manufacturer's most recent written instructions with respect to the following:
 - a. Mixing of All Materials.
 - b. Protection and Handling of All Materials.
 - c. Recoat Limitation and Cure Times.
 - d. Minimum Ambient and Substrate Temperatures, Substrate's Degree of Dryness, Relative Humidity, and Dew Point of Air.
 - e. Application.
 - f. Final Curing.
 - g. Use of Proper Application Equipment.
 - h. Curing of Resurfacing System.

The applied resurfacing system shall be protected from damage during curing and shall be cured as recommended by the manufacturer. Ambient conditions shall be controlled by the Contractor during the curing period to ensure that minimum air temperature and minimum relative humidity as required by the manufacturer is maintained.

S-009.11.3 Surface Preparation Requirements For Multi-Component Stress Panel Liner System.

All specified surface preparation shall be performed in accordance with the latest version of the SSPC, NACE, ICRI and other standards referenced in this section.

Corroded concrete surfaces shall be repaired to their original condition. Allow new concrete to cure a minimum of 28 days. Contractor may verify dryness by testing for moisture with a "plastic film tape down test." (Reference ASTM D 4263). If necessary for testing horizontal surfaces, Calcium Chloride test in accordance with ASTM F1869. If test results indicate moisture levels outside the acceptable range of the manufacturer, contact the manufacturer. Do not proceed with the coating application.

Prior to applying first layer, all existing areas that are scheduled to receive the chemical resistant lining shall be hydro-blasted using a minimum of 20,000 psi. Mechanically abrade all surfaces to be coated to remove laitance, curing compounds sealer and other contaminants and to produce a minimum surface profile equal to ICRI CSP 5 (medium-heavy shotblast). Reference SSPC-SP13.

Cleaning and resurfacing shall be scheduled so that dust and other contaminants from the cleaning process shall not fall on wet, newly resurfaced areas.

Cleaning / Surface Preparation:

All existing areas to be resurfaced shall be hydro-blasted with at least 20,000 psi to remove all loose materials, acid constituents, grease, oil, and other contaminants. Structures six feet (6') in diameter or greater, and those with large flat walls shall use a 40,000 psi hydro-blast to achieve the desired anchoring profile.

S-009.11.4 Installation Of Multi-Component Stress Panel Liner System.

Apply Moisture Barrier (Spectrashield, or approved equal). This layer of polyurea shall be spray applied at a nominal thickness of 70 mils to all surfaces one foot below the low flow line. Mechanical anchoring system shall be embedded and sprayed into the liner at all infiltration locations and at all wall/floor termination.

Apply Surfacer (Spectrashield, or approved equal). This layer of polyurethane rigid structure foam shall be spray applied to all surfaces previously lined with the moisture barrier. This layer shall be applied at a nominal thickness of 440 mils. This layer may be thicker depending on the condition of the substrate.

Apply Final Corrosion Barrier (Spectrashield, or approved equal) to all surfaces lined with the Surfacing layer shall be spray applied at a nominal thickness of 80 mils in accordance with manufacturer's instructions.

S-009.11.5 Safety and Ventilation Requirements.

Requirements for safety and ventilation shall be in accordance with SSPC Paint Application Guide No. 3.

S-009.11.6 Field Quality Control Inspection.

Inspection by the Engineer or others does not limit the Contractor's responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

Perform the quality control procedures listed below in conjunction with the requirements of this Section. Inspect all materials upon receipt to ensure that all are supplied by the manufacturer.

Provide specified storage conditions for the resurfacing system materials, solvents, and abrasives.

Inspect and record substrate profile (anchor pattern). Surfaces shall be abraded, as a minimum, equal to the roughness of 40 grit sand paper.

Measure and record ambient air temperature once every two hours of each shift using a thermometer and measure and record substrate temperature once every two hours using a surface thermometer.

Measure and record relative humidity every two hours of each shift using a sling psychrometer in accordance with ASTM E337.

Provide correct mixing of resurfacing materials in accordance with the manufacturer's instructions. Inspect and record that the "pot life" of resurfacing materials are not exceeded during installation. Verify curing of the resurfacing materials in accordance with the manufacturer's instructions.

Upon completion of the lining system installation the lined area shall be cleaned and prepared to permit close visual inspection by the Engineer or the Engineer's Representative. Any and all deficiencies or defective work (not in compliance with this section or related sections) shall be marked for repair or removal/replacement by the Contractor at no additional cost to the City.

S-009.12 ACCEPTANCE CRITERIA.

Acceptance Criteria for Surface Preparation Work:

All surfaces shall be prepared in accordance with the specification and referenced standards therein. Acceptance

Criteria for Coating System Application Work:

Acceptable coating work shall be based upon the following:

1. No pock-marks, trowel marks, depressions, unconsolidated areas, pinholes or holidays in either size or frequency.
2. No intercoat bond failures between lifts.
3. Proper curing of coatings.
4. Resurfaced areas shall pitch to drains. There shall be no areas that puddle when flood tested.
5. The Engineer or Engineer's Representative shall, at their discretion, inspect the following:
 - a. Profile and degree of cleanliness of substrate.
 - b. Thickness of materials/coverage rate confirmation.
 - c. Ambient temperature and humidity requirements and substrate temperature.
 - d. Curing and recoat times.
 - e. Proper curing of the lining materials.
6. Rework required on any holidays or any other inadequacies found by the Engineer or the Engineer's representative in the quality of the coating work shall be marked. Such areas shall be

recleaned and reworked by the Contractor according to these specifications and the manufacturer's recommendations at no additional cost to the City.

7. The Contractor is responsible for keeping the Engineer informed of all progress so that inspection for quality can be achieved.
8. The Contractor is ultimately responsible for the quality performance of the applied materials and workmanship. Inspections by the Engineer or the Engineer's Representative do not limit this responsibility.

S-009.13 FINAL INSPECTION.

Perform a final inspection to determine whether the resurfacing system work meets the requirements of the specifications. The Engineer and the Engineer's Representative shall conduct final inspection with the Contractor.

S-009.14 CLEANUP.

Upon completion of work, the Contractor shall remove surplus materials, equipment, protective coverings, and accumulated rubbish, and thoroughly clean all surfaces and repair any work-related damage. The surrounding surface areas including roadways and all other surfaces shall be restored to their pre-project condition.

S-009.15 WARRANTY.

The Contractor shall provide a minimum written five year warranty against failures. Failure includes any blistering, cracking or loss of adhesion of the coating to the existing concrete substrate. The coating system should not be damaged by any debris that enters the wet well. The warranty period shall start on the date of Final Completion.

END OF SECTION S-009

SECTION S-010

MISCELLANEOUS WATER APPURTENANCES

S-010.1 **GENERAL.** Work under this section consists of furnishing labor, equipment, and materials and performing all operations necessary for all miscellaneous water appurtenances as indicated on the Drawings. The work shall be performed in accordance with the requirements herein specified, the construction drawings, and subject to the conditions of the contract.

S-010.1.2 **Submittals.** Product Data for the following:

1. Yard Hydrant
2. Backflow Preventer

S-010.1.3 **Guarantees.** The Contractor guarantees, by signing the contract, all installed project equipment, apparatus, materials, and workmanship provided under the contract for a period of two (2) years from the date of Final Completion. All pertinent submittals shall be approved prior to final completion.

Instruction sheets that are required to be furnished by the manufacturer for installed project equipment, materials, supplies, and operation shall be delivered by the Contractor to the Engineer prior to final completion of the project, with the following written warranties and guarantees:

1. The manufacturer's standard warranty for each piece of installed project equipment or apparatus furnished under the contract.
2. The Contractor's guarantee that, during the guarantee period, necessary repair or replacement of the warranted equipment or apparatus will be made by the Contractor at no direct pay.
3. The Contractor's guarantee for satisfactory operation of installed project equipment including, but not limited to, the mechanical and electrical systems furnished and constructed under the contract for the guarantee period.

If it should be found that parts failed due to defective material or faulty workmanship, and if such parts should, within the manufacturer's warranty period, cause any breakdown or accident, the Contractor will not only be required to furnish and install the replacement part, but will also be held responsible to the City for all expenses due to accident or breakdown caused by such a failure. The Contractor shall insert one copy of all warranties and guarantees into the maintenance manuals specified. Routine maintenance during the guarantee period will be performed by the City.

S-010.2 **PRODUCTS.**

S-010.2.1 **Yard Hydrant.** Hydrant shall be self-draining, non-freezing, compression type. Inlet shall be 1" MNPT. Outlet shall be ¾" MNPT OR GHT, OR 1" MNPT.

Yard Hydrant shall have a steel, galvanized steel, stainless steel, or brass exterior casing pipe, a steel, galvanized steel, or brass interior operating rod with a cast iron, aluminum, or brass casing guard.

Principle interior operating parts shall be bronze and be removable from hydrant without excavating. Hydrant shall have a 4-spoke ball wheel operating handle.

Hydrants shall be set in 4 ft. of crushed stone to allow for proper drainage of the hydrant. Recommendations of the AWWA should be followed when installing the hydrant.

Post hydrants shall be Total Eclipse No. 1 Yard Hydrant as manufactured by John C. Kupferle Company, St. Louis, MO or approved equal.

S-010.2.2 **Backflow Preventer.** Backflow preventer shall be a reduced pressure principle backflow prevention assembly as indicated on the plans and as approved by Louisiana Department of Health and Hospitals, and other applicable local, state, and federal codes. It shall be installed above grade on a reinforced concrete foundation with approved locking insulated enclosure.

Backflow preventer shall be WATTS® LF009 RPZA, or FEBCO® LF860 RPZA, or approved equal.

S-010.3 **EXECUTION**

S-010.3.1 **Installation.** Hydrant and backflow preventer shall be installed as per manufacturer's recommendations, and at locations as shown on the plans.

Hydrant shall extend below grade level so that the centerline of the supply inlet is positioned at, or below, the frost line. Depth of bury shall be 3' below finished grade.

END OF SECTION S-010

SECTION S-011

GENERAL PROVISION FOR ELECTRICAL WORK

S-011.1 **GENERAL**

S-011.1.1 **Reference**

The general Conditions, Supplementary Conditions, Information to Bidders, the Civil Specifications and Structural Specifications and drawings, and all supplements issued thereto are a part of these specifications and the accompanying drawings and are binding upon all drawings as applicable.

Failure to examine and to be familiar with the Contract documents shall not relieve any contractor of responsibility or be used as a basis for additional compensation due to the omission of Civil or structural details from the electrical drawings or specifications. If not included herewith, all pertinent documents are available at the Civil's office.

S-011.1.2 **Drawings and Specifications**

The intent of the electrical specifications and drawings is to provide documents for installations which will be complete in every respect and which will operate properly. Any apparatus, appliance, material, appurtenance, or labor, not mentioned in the specifications or not shown on the drawings, that may be necessary to complete the work in accordance with the purpose of these documents, shall be furnished.

Drawings are diagrammatic and cannot show every connection or every line of piping in its exact location. Details are subject to the requirements of ordinances, structural, and Civil conditions. Carefully investigate structural and finish conditions affecting the Work and furnish all fittings and accessories required to give satisfactory operation.

Where discrepancies exist between the drawings or between the drawings and specifications, or where there is a conflict in the specifications, the Contractor shall base the bid upon, and furnish, the better quality or greater quantity of work or material called for, unless otherwise ordered in writing by the Owner.

The Contractor shall be responsible for properly using the information on the drawings and in the specifications. All dimensional information shall be obtained from the appropriate drawings for all new construction and by taking actual measurements at the site for existing facilities. In no case shall drawings be scaled for exact dimensions.

Visit the site, verify all existing items indicated on the drawings and in the specifications and become familiar with existing working conditions and local requirements. Contractors shall except conditions as they exist and each bid shall reflect all costs occasioned by these conditions. The lack of specific information on drawings in respect to site conditions shall not relieve the Contractor of this responsibility nor be reason for any extra charges after the contract is signed.

There shall be no deviations from the Contract Documents without written approval of the owner. Secure a written interpretation from the Civil for any questionable item in the Contract Documents, prior to installation.

S-011.1.3 Shop Drawings and Submittals

Refer to General Conditions of the Contract.

Submittals under this section shall include the following items, as applicable:

- Panelboards and disconnect switches.
- Lighting fixtures.
- Wiring and Outlets
- Switches

Submit a typewritten list of all other material to be furnished, including the following items

- Sealants and sleeves used for penetrations through walls, floors and ceilings.

Submit shop drawings, catalog data and diagrams for approval in all cases where deviations from the Contract Documents are contemplated because of substitution equipment or job conditions. Also submit detailed shop drawings for all special or custom-built items or equipment.

The Contract Documents are based on specific equipment, accessories, processes and arrangements. Approval of submittals indicates only the acceptance of the manufacturer and quality and in no way relieves the Contractor for errors or omissions in the submittals or for compliance with the intent of the Contract Documents.

S-011.1.4 Utility Lines and Elevations

Locations and elevations, along with the method of the tie-in of utilities as shown on the drawings have been obtained by conferences with the Owner, utility companies, or other sources, and are shown as a guide without guarantee as to accuracy. Responsibility for locating, uncovering, disposing of, or maintaining all existing utility lines shall rest solely with the Contractor, who shall plan and conduct his operations in a manner to insure safe conditions.

Examine the site, contact the local utility companies to obtain details of service requirements, and include all costs for requirements, fees, connections, and metering for complete service. Promptly repair all existing utility lines to be maintained in service, if damaged as a result of any work of this project, at no expense to the Owner. All valve boxes, manholes, or other appurtenances of utilities which are to remain in service shall be raised or lowered to meet the finished grades.

Verify at the site the exact location, size, elevation, direction of flow and operating pressure of all existing utility mains to which a connection is to be made. Any adjustments required shall be as directed by the Civil, without additional cost to the Owner.

S-011.1.5 **Delivery, Hoisting, Scaffolding, Storage**

Refer to General Conditions

S-011.1.6 **Industry Standards**

The following industry standards shall apply, as applicable to the Work of this section, except where the requirements of the Contract Documents are more stringent.

ASTM	American Society of Testing Materials
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IECC	International Energy Conservation Code
NBFU	National Board of Fire Underwriters
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
UL	Underwriter's Laboratories

S-011.1.7 **Codes and Ordinances**

Perform the Work in strict accordance with the local, state and national codes and ordinances; and the regulations and requirements of other ruling authorities having jurisdiction. The requirements of the codes, ordinances, and regulations of the authorities shall not relieve the Contractor from the responsibility of the requirements of the Contract Documents where specific conditions call for a higher quality or greater quantity of work than the requirements of the authority.

S-011.1.8 **Fees**

Obtain and pay for all permits, licenses, metering, and inspection fees required by all authorities having jurisdiction for work on the project.

S-011.1.9 **Guarantee**

All equipment, materials and labor shall be guaranteed against defects in material and installation for a period of two years from the date of final completion. The guaranteed shall include the replacement of equipment and associated components in subsequent to defective materials or faulty installation, without additional cost to the Owner.

Properly register the guarantees of equipment to protect the warranty. Contractor's and manufacturer's guarantees executed by the Contractor shall be presented to the Owner prior to final acceptance inspection.

S-011.2 PRODUCTS

S-011.2.1 Quality Assurance

Unless otherwise specified, all materials used on the project shall be new and of the quality specified. All like materials shall be of the same manufacturer and model unless otherwise specified.

All materials of a type for which the Underwriter's Laboratories have established a standard shall be listed by the Underwriter's Laboratories and shall bear the UL label.

By submitting a bid on the Work, the Contractors set forth that they have the necessary technical training and ability to perform the Work in a satisfactory manner by skilled workers, properly licensed and experienced in their respective trades, up to the best standard of the trade, complete and in good working condition.

S-011.2.2 Substitution of Equipment

The design of electrical system is based on equipment of specified manufacturers and information published in their standard catalogs. Substitution equipment shall be complete with all components, trim arrangements and other accessories which are cataloged as standard equipment by the specified manufacturer, whether or not these items are specifically scheduled in the drawings or specifications. Any additional items that may be required by the substitute equipment manufacturer for proper operation of equipment within the intent of the Contract Documents shall also be furnished. Optional items shall be included as required by the Contract Documents. Approval of submittal data shall not relieve the Contractor from this requirement.

Coordinate the substitute item with the work of other trades in regards to electrical characteristics, motor starters, horsepower, space requirements, ingress and egress, and other such characteristics peculiar to the substitute equipment that will effect the work of other trades.

The noise level of substitute equipment shall not exceed the noise level of specified equipment.

Contractor shall bear all costs in connection with any changes required by the individual characteristics of the substitute equipment.

Should any substitute equipment prove unsatisfactory during installation or during the guarantee period, the Contractor shall replace the substitute equipment with the specified equipment upon direction of the owner.

S-011.2.3 Equipment and Foundations

Each piece of equipment shall be provided with an approved base and foundation, as required by the Contract Documents.

S-011.2.4 Access Panels

A permanent access door or panel conforming to the interior surroundings and approved by the owner shall be provided for each piece of equipment or device concealed under the floor, above ceiling, in

walls or other inaccessible areas where access may be required for maintenance, inspection, or for emergency conditions. The access assembly shall be sized according to the intended use for the equipment or device served.

S-011.2.5 Electric Motors

Unless otherwise specified, all motors, motor starting equipment, pushbuttons and overloads shall be furnished by the trade furnishing the equipment. The installation of all power wiring, motor starting equipment and pushbuttons, unless a prewired component of major equipment, shall be performed under Division 16.

Supply all motors required to drive equipment specified. Motors shall be manufactured by General Electric, Reliance, Westinghouse, or Allis Chalmers in accordance with AIEE and NEMA standards, and shall be suitable for across the line starting unless otherwise specified.

Motors shall be of the size, speed, phase and voltage specified and of the type recommended by the manufacturer for the service intended.

S-011.3 EXECUTION

S-011.3.1 Manufacturer's Recommendations

Delivery, storage, protection and installation of all equipment shall be in strict accordance with the manufacturer's recommendations.

S-011.3.2 Excavation and Backfilling

Contractor shall perform all excavating, trenching and backfilling necessary for the installation of the Work, including shoring, bailing and pumping to maintain trenches and keep them in dry condition until the Work has been tested and approved.

Water, gas and sewer lines shall be laid in separate trenches with minimum spacing as required by code.

Trenches for pipe shall be excavated to required depths; the bottoms graded to produce the required fall. Rock shall be excavated to a depth of six inches below the bottom of the pipe and backfilled with pea gravel or sand.

After lines have been tested, inspected and approved by the Owner and ruling authorities, remove forms and debris and backfill in horizontal layers not to exceed six inch thickness.

S-011.3.3 Interferences

Furnish and install all necessary offsets and fittings in piping, ductwork, and other such items as required to install the Work as closely as possible to walls, ceilings, or structure in order to take up a minimum amount of space. Correct interferences with the work of other trades. Where space requirements conflict, the following order of precedence shall generally be observed.

- Structural members.

- Lighting fixtures.
- Soil and drain piping.
- Vent piping.
- Natural gas piping.
- Electrical conduit.

Piping which requires a stated grade for proper operation shall be given precedence where interferences occur.

S-011.3.4 Piping and Conduit

Pipe shall be square cut to fit, ends reamed, and cleaned inside and outside prior to installation.

All pipe shall be run concealed unless specifically indicated otherwise on the drawings.

Screwed joints shall be made with the best linseed oil and graphite or pipe dope, used on male threads only.

Each trade shall properly support all piping and conduit required for work. Protect all piping and conduit from straps or hangers.

Pipe openings shall be closed with caps or plugs to prevent mechanical injury or entrance of water or debris until final connection is made.

All unconcealed piping passing through floors, ceilings or walls shall be provided with chrome plated brass escutcheon plates of sufficient diameter to cover the sleeve opening and fit snugly around the pipe.

S-011.3.5 Construction Requirements

All piping, ductwork, conduit and other such items to be concealed shall be installed according to schedule to avoid the delay of the work of other grades and job progress. The Contractor is required to install work with relation to finish lines established by the General Contractor and shall be entirely responsible for the correctness of the Work with reference to finish, elevations, and fit.

All equipment and controls shall be located and arranged to provide for proper maintenance.

Contractor shall remove all surplus material and debris caused by his work.

All necessary cutting and patching of walls, floors, partitions and ceilings required for proper installation of work shall be by the Contractor providing the Work and at his expense. This Work shall be performed neatly and in a manner acceptable by the Architect.

S-011.3.6 Safety Guards

Furnish and install all safety guards required. All belt driven equipment, projecting shafts and other rotating parts shall be enclosed or adequately guarded.

S-011.3.7 **Location of Outlets**

All lighting outlets, receptacles, switches, and other devices shall be referenced to those established data points and located to present symmetrical arrangements with those points and facilitate the proper arrangements of panels or similar surfaces with respect to the electrical outlets. The final determination of the exact location of each outlet and the arrangements to be followed shall be acceptable to the Owner.

S-011.3.8 **Equipment Furnished By Others**

Install and connect equipment furnished by other trades or Owner where shown on drawings or specified. Coordinate with the supplier to have the equipment at the place of installation in accordance to schedule.

S-011.3.9 **Painting**

The protective painting of equipment and piping shall be provided by the trade furnishing the equipment or piping. All underground ferrous pipes shall be given a liberal coat of acid resisting paint having a bituminous base before backfilling. All ferrous uninsulated lines in concealed spaces shall be given two coats of black asphaltum varnish. Hangers and supports that will be subjected to exterior or damp conditions (other than those requiring a special finish) shall be given a coat of black asphaltum varnish.

Nameplates on equipment shall not be painted. Cover and protect the nameplates during the painting operation.

Electrical device covers shall be covered and protected during the painting operation to preserve the original factory bright new finish.

S-011.3.10 **Sleeves**

Furnish and install all sleeves shown on the drawings, as specified herein, as specified in the Architectural and Structural Specifications, and as required by codes.

Unless otherwise specified, sleeves shall be 26 gauge galvanized steel.

Oversized sleeves shall be provided for insulated lines to pass full thickness or insulation.

Where piping and conduit penetrate fire rated assemblies, sleeves shall be provided and the space between the pipe or insulation and a sleeve sealed with an approved firestop compound.

END OF SECTION S-011

SECTION S-012
ELECTRICAL SYSTEMS

S-012.1 **GENERAL**

S-012.1.1 **Description**

The Work covered under this section of the specifications shall include but not be limited to Work as outlined in the following sections. The titled sections will follow this section in the order listed.

S-013 Electrical Equipment
S-014 Electrical Devices
S-015 Conductors and Conduit
S-016 Lighting Fixtures

S-012.1.2 **References**

Refer to other sections, General Provisions for Electrical Work.

The Work covered consists of furnishing all labor, equipment, devices and materials for complete electrical systems.

- Verify the electrical capacities of all motors and equipment furnished under other divisions and provide power as required to completely connect equipment.

S-012.2 **PRODUCTS**

S-012.2.1 Products shall be as specified under the above listed sections.

S-012.3 **EXECUTION**

S-012.3.1 Unless the requirements are superseded by local ordinances, the local utility companies, other ruling authorities, or the drawings or specifications, the latest edition of the National Electrical Code shall be recognized as a minimum acceptable standard for work under this division.

S-012.3.2 All conduits, outlet boxes, cabinets and other such wiring devices shall be timely placed in walls, ceilings, slabs, beams and other areas as constructions progresses.

S-012.3.3 **Marking**

Contractor shall properly label all panel circuits, including disconnect switches and equipment they serve.

S-012.3.4 Testing

Contractor shall thoroughly test all systems and see that they are free from grounds, cross connections between conductors, and in proper working order.

S-012.3.5 Record For Owner

Prepare a neat brochure or packet folder to be delivered to the Civil. The packet shall contain the following:

- All warranties, guarantees and manufacturer's directions on equipment and materials covered by this contract.
- Approved fixture brochures, wiring diagrams, control diagrams, and as-built drawings.
- One-line diagram of building electrical system with fuse sizes noted at each fused switch.

END OF SECTION S-012

SECTION S-013

ELECTRICAL EQUIPMENT

S-013.1 **GENERAL**

S-013.1.1 **Description**

Furnish and install all electrical equipment as shown on the drawings, and as required for complete, properly operating systems, and in accordance with local codes and ordinances.

S-013.2 **PRODUCTS**

S-013.2.1 **Panelboards**

Panelboard shall have hinged doors and shall be bussed for 120/208 volt and 277/480V, 3-phase phase feed with solid neutral and thermal magnetic breakers equal to GE Powermark. Number of circuits and capacities shall be as required by code. Boxes shall be arranged for recessed mounting and constructed of code gauge steel. Exterior boxes shall be NEMA 4X.

Each load center shall have a clearly designated directory of circuits. Breakers shall be bussed for sequences phasing, and multiple pole breakers shall have common trips on all poles. Acceptable manufacturers are GE, Square D, Challenger, ITE, or approved equal.

S-013.2.2 **Disconnect Switches**

All disconnect switches shall be type ND unfused safety switches unless noted or required otherwise. General purpose enclosures shall be furnished except in damp locations and exposed to the weather where raintight enclosures shall be furnished. Acceptable manufacturers are GE, Square D, Challenger or ITE.

Furnish and install all fuses necessary for leaving the installation complete and in working order, including a complete set of fuses in each switch. All fuses shall be Bussman Fusetron of proper capacities.

S-013.3 **EXECUTION**

S-013.3.1 **Grounding**

All non-carrying metallic parts of electrical equipment and conduits shall be securely grounded to a common ground bus. Ground bus shall be connected to the water main with a copper wire. Jumpers shall be installed, by-passing all valves and water meters.

The neutral bus at the service entrance shall also be connected to the water main in the same manner as outlined above.

The grounding system shall conform to the requirements of N.E.C. Article 250, the local inspection authorities and the local power company.

S-013.3.2 Balance all phases at all load centers.

S-013.3.3 On completion of work, furnish and deliver to the Owner a full box of each size of fuses used; in no case less than four fuses of any size.

END OF SECTION S-013

SECTION S-014

ELECTRICAL DEVICES

S-014.1 **GENERAL**

S-014.1.1 **Description**

Furnish and install all electrical devices as shown on the drawings, and as required for complete, properly operating systems, and in accordance with local codes and ordinances.

S-014.2 **PRODUCTS**

S-014.2.1 **Outlet Boxes**

Provide at each outlet or device an outlet box in which raceways and conductors shall terminate. Outlet boxes shall be standard galvanized steel provided with knock-outs. Where grouped switches or receptacle are shown, use ganged boxes.

Sizes and type of outlet boxes shall be sufficient to accommodate structural conditions, number and size of raceways and conductors entering, device or fixture served, and splices contained therein.

S-014.2.2 **Wiring Devices**

Wiring devices shall be industrial grade equal to the following:

- Single pole switches: Leviton #1221-2-W, white
- Three way switches: Leviton #1223-2-W, white
- Duplex receptacles: Leviton #5362-W, white

Wall plates for devices shall be equal to White Nylon Leviton 80700 Series or approved equal. Ganged devices shall be installed under one cover plate.

Verify location of all outlets on jobsite with Owner's Agent. All outlets may be moved six feet as Owner's Agent directs, prior to rough-in, at no additional cost to Owner.

S-014.3 **EXECUTION**

S-014.3.1 Boxes shall be set plumb and true in building surface and furnished with suitable plaster rings where so required.

S-014.3.2 Outlet boxes for switches shall be mounted at standard height of 4'-4" from the floor unless indicated otherwise and shall be located on the strike side of doors. Boxes for receptacles shall be mounted at a height of 12" from the floor except where shown otherwise on the drawings or as directed otherwise.

S-014.3.3 Exterior mounted devices and fixtures shall have weathertight boxes.

S-014.3.4 Outlet boxes located on opposite sides of rated walls shall be offset by 24 inches where possible, in separate stud spaces. Outlets that are installed back to back shall be separated with fire rated gypsum board between boxes. Fire rated assembly shall be maintained at all times.

END OF SECTION S-014

SECTION S-015

CONDUCTORS AND CONDUIT

S-015.1 **GENERAL**

S-015.1.1 **Description**

Furnish and install all conductors and conduit as shown on the drawings, and as required for complete, properly operating systems, and in accordance with local codes and ordinances.

The contractor shall install conduits for primary electrical service and shall install conductors and conduit for the secondary service, and shall install transformer pad and required barriers. The utility company will install the primary conductors and the transformer.

S-015.2 **PRODUCTS**

S-015.2.1 **Conductors**

All conductors shall be type THWN /THHN copper, in conduit per City requirements. All conductors installed underground shall be type THWN in conduit.

No conductor, including switch legs, shall be smaller than #12 AWG except for low voltage control wiring. Wire sizes #8 AWG and smaller shall be solid members, #6 AWG and larger shall be stranded.

Mains and feeders shall run their entire length without joints or splices. Joints in branch circuits shall occur only where such circuits divide as shown on the drawings, and shall then consist of one through circuit to which shall be spliced the branch from this circuit in the splice box.

Install a separate equipment ground wire in each conduit sized in accordance with the NEC.

S-015.2.2 **Conduits**

All underground conductors shall be installed in schedule 40 PVC conduit with adaptors and elbows for transitions. All conduits shall bear the Underwriter's Laboratories Seal of Approval.

All exterior conduit shall be galvanized rigid steel.

S-015.3 **EXECUTION**

S-015.3.1 Number 6 size wire and larger shall be connected with "kerney type" connectors, not "Twist-lock". Wire smaller than number 2 shall be joined with Minnesota Mining Scotchlocks of insulated and metal shielded type. Special precaution shall be taken to insure all joints are made tight. Contax paste shall be used on all aluminum joints and terminations.

S-015.3.2

No wire shall be drawn into a conduit until all work of a nature which might cause injury to the conductor is completed. An approved cable pulling compound may be used as a lubricant where necessary but no materials which may be injurious to the wire covering or insulation shall be uses.

END OF SECTION S-015

SECTION S-016

LIGHTING FIXTURES

S-016.1 **GENERAL**

S-016.1.1 **Description**

Furnish and install all fixtures specified and shown on the drawings.

S-016.2 **PRODUCTS**

S-016.2.1 All light fixtures shall be as scheduled on the drawings or equal in every respect.

S-016.2.2 Install a lighting fixture at each lighting outlet shown.

S-016.2.3 All fixtures shall be complete with new lamps of either Westinghouse, GE, Sylvania, or approved equal.

S-016.2.4 Light pole shall be approved by the owner.

S-016.2.5 Light pole shall be installed as indicated on the plans.

S-016.3 **EXECUTION**

S-016.3.1 Install all fixtures in accordance with manufacturer's Instructions at locations indicated on the Drawings. Center fixtures on mounting surfaces, unless indicated otherwise.

S-016.3.2 Immediately before final inspection, thoroughly clean all fixtures. All trim shall fit properly to adjacent surfaces. Adjust optical devices and/or aim fixtures at night per Owner's direction.

S-016.3.3 Each light fixture and associated J-box shall be grounded per NEC 250.

END OF SECTION S-016