2011 Low Water Crossing Remediation (Prj. No. 23-04-07-0001)

SPECIFICATIONS AND GENERAL REQUIREMENTS

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010: DEFINITION OF TERMS:

1. Definitions: Wherever in these specifications or on the plans, the following terms, or pronouns in place of them are used, the intent and meaning shall be interpreted as follows:

1. County: The County of Bexar, Texas.

3. City: The City of San Antonio, Texas.

4. City Engineer: The Department Head of the City of San Antonio Capital Improvements Management Services Department.

5. Engineer: The duly authorized representative of the City Engineer or Director of the Public Works Departments.

6. Director: The Director of the City of San Antonio Public Works Department

7. Inspector: The authorized representative of the City Engineer or Director of the Public Works Department assigned to supervise and inspect any or all parts of the project and the materials to be used therein.

8. Bidder: An individual, partnership, corporation, etc., with which the contract is made by the City.

9. Contractor: The individual partnership, corporation, etc., with which the contract is made by the City.

10. Superintendent: The representative of the Contractor authorized to receive and fulfill instructions from the Inspector and who shall supervise and direct the construction.

11. Laboratory: The testing laboratories that may be designated or approved by the City Engineer, the Director of Public Works or their designee.

22. Bid Form: The offer of the bidder, made out in triplicate on the prescribed forms, giving prices for performing the work described in the plans and specifications.

33. Plans: The drawings approved by the Engineer, or true reproductions thereof, which show the location, character, dimensions, and details of the work and which are a part of the contract.

44. Specifications: The direction, conditions and requirements contained herein, supplemented by such "change orders" as may be issued or made pertaining to the method and manner of performing the work, or to quantities and qualities of materials to be furnished under the contract. Where phrases "directed by", "ordered by" or "to the satisfaction of" "the Engineer" or "the Inspector" occur, it is to be understood that the directions, orders, or instructions to which they relate are within the limitation of, and authorized by the Contract. Where reference is made to specifications of A.S.T.M., AASHTO, Texas Highway Department Standard Specifications, etc., it shall be construed to mean the latest or tentative standard in effect on the date of the Bid Form.

55. Change Order: Written agreements entered into between the Contractor and the City, properly executed, covering alterations, changes, additions or deletions to the plans which are necessary for the proper completions of the work, referred to as "Field Alteration Request."

66. Contract: The agreement between the City and the Contractor covering the furnishing of materials and performance of the work. The contract will include Plans, Specifications, Bid Form, Contract Bonds and Change Orders.

77. The Work: The work shall include the furnishing of all labor, materials, equipment and other incidentals necessary or convenient to the successful completion of the project and carrying out of all the duties and obligations.

88. Working Day: As outlined and set forth in the General Conditions and Special Conditions of these specifications.

99. Instructions to Bidders: Instructions of a general nature outlining the duties and responsibilities of a bona fide bidder.

20. General Conditions: Additional instructions to the Contractor, of a more specific nature, pertaining to his responsibilities and the City's responsibilities for proper execution of the work.

21. Special Conditions: Detailed instructions to the Contractor setting forth his responsibility and the City's responsibility for proper execution of the particular work.

102. Wage Rates: The general prevailing wage rates are established by the most current General Decision Number for Heavy Construction, listing Bexar County, State of Texas. A copy of the general prevailing wage rates is included in and shall become a part of these specifications.

113. Sequence of Construction: The logical and proper order in which the work shall become accomplished, by stages and phases, by the Contractor, unless ordered to do otherwise by a properly executed change order.

124. Technical Conditions: The specific instructions to the Contractor as to the manner, quality, methods, and procedures of labor and materials to be employed in the prosecution of the various items of work.

135. Supplemental Special Conditions: Detailed instructions to the Contractor setting forth his additional responsibilities for a special nature particular to an individual project not covered elsewhere.

146. ASTM: American Society for Test Materials.

157. AASHTO: American Association of State Highway and Transportation Officials.

168. THD Test Method: Texas Highway Department Materials and Test Division manual outlining testing methods and procedures.

179. OSHA: Occupational Safety and Health Administration.

100. GOVERNING SPECIFICATIONS AND GENERAL REQUIREMENTS:

SCOPE:
The City of San Antonio is soliciting bids for a contractor to furnish materials, equipment, software and training to improve 6 Low Water Crossings in San Antonio Area. The improvements include some if not all of the following: High Water Detection System HWDS, Manual and Automated Gates. The HWDS will need to tie in with the Citys existing HWDS. The citys HWDS and Early Flood Warning System are integrated into one operational system to meet compliance standards in accordance with the National Weather Service A.L.E.R.T. (Automated Local Evaluation in Real Time) data protocol. Where feasible and compatible, existing equipment from the current system shall be utilized in order to improve effectiveness of the City of San Antonio's Storm Response Plan and storm data collection efforts.

Objectives:

Mediate six locations

- Lockhill and White Bonnet, Install High Water Detection, Flashing Lights, Signage and AutomaticGates
- Leslie Road Southwest of Braun Road, Install High Water Detection, Flashing Lights and Signage
- Old Seguin at Salado Creek, Install High Water Detection, Flashing Lights and Signage
- Southton Road, west of IH37, Install High Water Detection, Flashing Lights and Signage
- S. Hausman Road, north of Prue Road, Install High Water Detection, Flashing Lights and Signage
- 151 Access Road near Pinn off ramp, Install remote Flashing Light warning Pinn Road is closed due to Flooding
- Weather Station, Install weather station upstream of San Antonio River to alert COSA of server storms coming to the River Walk area.

120. SPECIAL CONDITIONS:

1. Traffic Control Devices: The Contractor shall furnish, place and maintain in good condition all traffic control devices as directed by the Engineer and in accordance with the Texas Manual on Uniform Traffic Control Devices for Streets and Highways, State Department of Highways and Public Transportation, Austin, Texas, dated 1980 and revisions thereto.

   Upon completion and acceptance of the work, all traffic control devices and evidence thereof shall be removed by the Contractor.

   All materials furnished and work performed under these provisions will not be paid for directly, but shall be considered as subsidiary work pertaining to the various bid items of the Contractor.

2. Governing Specifications: The "Standard Specifications for Construction and Maintenance of Highways, Streets and Bridges" and dated 2004, of the Texas Department of Transportation specifically applying to this contract shall be binding as part of this particular contract. The Engineer may, as deemed necessary, by addendum, and reference apply any item found on the "Standard Specifications" which is not cited herein and thereby such items become a part of the Contract Documents and shall be binding. Measurement and payment sections listed in each section of the Governing Specifications are not applicable to this project. Payment for materials furnished and work performed shall be included in the unit bid item no. 16800 Solar Powered Flood Sensor & High Water Detection System for Low Water Crossings, and 16801Operator Specialty Company, INC. – SG Gate Installation Guide.

3. Utility Location: It is the Contractor's responsibility to notify the appropriate utility companies 48 hours prior to construction to identify locations to determine possible conflicts.

4. Contractor shall coordinate and obtain all applicable building and ROW permits.

All specifications applicable to this project are identified as follows:

2004 TxDOT Standard Specifications for Construction of and Maintenance of Highways, Streets and Bridges with any revisions thereto where specified “TxDOT”.

TxDOT Standard Specifications can be accessed and downloaded at:
http://www.dot.state.tx.us/business/specifications.htm

ITEM	DESCRIPTION
351	FLEXIBLE PAVEMENT REPAIR
416	DRILLED SHAFT FOUNDATIONS
421	HYDRAULIC CEMENT CONCRETE
440	REINFORCING STEEL
442	METAL FOR STRUCTURES
490	TIMBER STRUCTURES
491	TIMBER FOR STRUCTURES
500	MOBILIZATION
502	BARRICADES AND TRAFFIC HANDLING
620	ELECTRICAL CONDUCTORS
622	DUCT CABLES
624	GROUND BOXES
628	ELECTRICAL SERVICES
681	CONDUIT
685	ROADSIDE FLASHING BEACON ASSEMBLIES
16800	SOLAR POWERED FLOOD SENSOR & AUTOMATED HIGH WATER DETECTION SYSTEM FOR LOW WATER CROSSINGS
16801	OPERATOR SPECIALTY COMPANY, INC'S SG GATE

125. SPECIAL SPECIFICATIONS

ITEM 16800
SOLAR-POWERED FLOOD SENSORS AND
AUTOMATED HIGH WATER DETECTION SYSTEM FOR
LOW WATER CROSSINGS

16800.1. Description. This Item shall govern the furnishing and installation of a solar powered flood sensor system and an Automated High Water System as shown in plans, as detailed in the special specifications and as directed by the Engineer. This system will be used to detect rising water levels and issue an alert regarding the possibility of roadway flooding.

(1) General Operation. When the water level monitored by the "flood sensor" reaches a threshold level, the wireless data and control system will activate two flashing beacons. A rain gauge for measurement and recording of rainfall data will be included in this installation. The flood warning system reports water level in near real-time without significant delay. The flood sensor may be one of several acceptable technologies that avoid direct electrical contact with the water. The flood sensor signal is processed for action and transmission by the Master Gauge Station. The Master Gauge Station controls up to eight (8) Remote Advance Warning Stations equipped with flashing beacons. The Advance Warning Station confirms it has been activated by sending a message back to the Master Gauge Station. The Master Gauge Station in turn provides updated status message to the Base Stations for display and sending of various alarm notifications. The flood sensors report via wireless means to a base station for operation and control. Base stations will be located at four City of San Antonio Facilities.

16800.2 Materials. Furnish materials unless otherwise shown on the plans. Provide materials on the type and grade as shown on the plans and specifications and in accordance with the TxDOT items specified in section **120. Special Conditions**.

16800.3. Equipment. The Solar-Powered Flood Sensor and Automated Flood Warning System for Low Water Crossings shall be defined by its major functional components: Flood Sensor, Master Gauge Station, Advance Warning Station, Communications System, Solar Power System, Load Control, Mounting, Conduit and Cabling, Optional Gauging, and Monitoring and Control. One or more of these functional components may be physically combined with others for installation of the Automated Flood Warning System.

(1) Flood Sensor. The flood sensor may be one of several acceptable technologies and must report via wireless means to a base station for operation and control. Suitable sensor types include: Pressure Transducer, Bubbler Sensor, Radar Sensor, and Laser Sensor. A Ball Float Mechanism will be provided for redundancy only.

In any case, sensor technology must be of a reliable industry proven design and commercial availability, with resolution of not less that 0.1 foot (Ball Float Mechanism excepted) in order to support providing meaningful water level and trend data. For reliability and public safety the sensor shall provide electrical isolation from the water being measured. Sensors exposed to the measured waterway shall withstand ±4kV in contact with unit per IEC 61000-4-2: Testing and measurement techniques - Electrostatic discharge immunity tests.

Suitable signal conditioning shall be provided to properly condition the raw sensor signal for processing by the controller.

(2) Master Gauge Station. The Master Gauge Station shall consist of a solid state microprocessor based controller, a communications device such as a radio or modem, solar power system, sensor signal conditioning and mounting hardware in a water tight enclosure. The master gauge station accurately captures data from up to two flood sensors of similar or differing technologies in near real-time, and stores the data for transmission by wireless or wired connection.

(a) The Master Gauge Station shall operate on 12Volts DC power with negative ground. Normal Power consumption shall be less than one (1) Watt, when idle.

(b) The equipment automatically activates and de-activates alternately flashing beacons at remote Advance Warning Sites (AWS), and/or locally at the Master Gauge Station itself, when water reaches operator pre-set threshold levels. The equipment can activate a second warning device, if equipped, based on a second operator pre-set level.

(c) The controller enables an operator to activate and de-activate the flashing beacons remotely from the Base Station. The controller will report the status of the flashing beacons and flood sensor to the Base Station when status is requested from the Base Station. The controller will report its current state, including battery level at a programmable self report interval. The controller will report each change of state, when it occurs.

If a base station command is sent to “Turn Lights On” or “Turn Lights Off”, local sensor control will be disabled until an “Enable Sensor Control” command is sent.

(d) The controller shall support being programmed to manage control commands and replies to as many as eight (8) remote AWS units. The Master Gauge Station will relay commands from the base station and/or create commands based on response to local sensor thresholds.

(e) For each remote AWS that is enabled, the Master Gauge Station will send command messages to set the remote AWS into the same state as the Master Gauge Station and wait for a response from the remote AWS to confirm the change of state. If the response is not received, the Master Gauge Station will retry to command the remote AWS for a programmable number of retries (typically 5), up to 255.

(f) The conditioned flood sensor signal shall be digitized to not less than 2047 steps in order to provide flood sensor level data of sufficient resolution for accurate reporting.

(3) Advance Warning Station. The Advance Warning Station’s purpose is to provide timely and adequate warning to approaching motorists that a flooded roadway conditions exists further up the road. This is accomplished via alternately flashing LED Beacons. The Advance Warning Station shall consist of a solid state microprocessor controller, a communications device such as a radio or modem, solar power system, warning sign, LED beacons and mounting hardware with a water tight enclosure. The Advance Warning Station responds to communications from its associated Master Gauge Station.

(a) The Advance Warning Station shall operate on 12Volts DC power with negative ground. Normal Power consumption shall be less than one (1) Watt, when idle. The equipment, when commanded from its associated Master Gauge Station, activates and de-activates warning devices, such as alternately flashing beacons, when water reaches an operator pre-set threshold level. The equipment can activate a second warning device, if equipped, based on a second operator pre-set level. Once commands are executed, the controller will send a confirming status message to its associated Master Gauge Station.

(b) The controller enables an operator to activate and de-activate the flashing beacons remotely. The controller will report the status of the beacons to its associated Master Gauge Station when status is requested from the Base Station. The controller will report its current state, including battery level at a programmable self report interval. The controller will report each change of state, when it occurs.

(c) The system configuration shall be available in the form of an advance flood warning assembly with two 12-in. signal beacons. Specific configurations shall be as shown in drawings.

(d) TxDOT pre-qualified 12-in. light-emitting-diode (LED) signal beacons (signal heads and LED unit) and mounting hardware shall be provided. Color of indications shall be yellow. LED shall conform to the chromaticity limits outlined in the ITE Standards for Vehicle Traffic Control Signal Heads, Section 8.04, "ITE 98 Interim Specification, and Limits of Chromaticity Coordinates." The power rating of any beacon shall not exceed 35 W maximum. Provide self-regulating beacon with input voltages of 10.5 to 35 volt DC. Supply either clear or tinted UV-stabilized acrylic lamp lens. Indicate the "TOP" mount position on the lamp. Provide a 24-in., color-coded wiring harness (red for positive and black for negative) in the beacon. Provide strain relief on wiring harness. Supply signal beacons in an optical system that conforms to ITE Standards for Flashing Beacons, Section 4-E-5, "General Design and Operations of Beacons," and to TMUTCD for all operating voltages above manufacturers designed cut-off voltage.

(e) Provision shall be made to support an optional additional environmental sensor at each Advance Warning Site. The conditioned sensor signal shall be digitized to not less than 2047 steps in order to provide data of sufficient resolution for accurate reporting.

(4) Communications System. Communications shall be engineered to provide dependable service, especially in times of inclement weather or power/infrastructure outage. A radio path study, provided by the contractor, is required to determine optimization of antennae heights used on the project.

Communications between Master Gauge Station and Advance Flood Warning Stations shall be via VHF Hydrological monitoring frequencies, while communications with Base Station shall be via 900 MHz Spread-spectrum radio.

RF and modem equipment shall be Federal Communications Commission (FCC) certified and comply with limits for a Class A digital device, pursuant to FCC rules, Part 15, or appropriate Spectrum Management Authority. RF and modem equipment shall not interfere with any known equipment. Contractor shall provide Licensing assistance where applicable.

Provide lightning suppressors on each coaxial cable leading to external antennas. Provide lightning protection for external modem connections.

In solar powered applications, radio or modem equipment shall be powered down, when appropriate to minimize power drain.

(5) Solar Power System. Power shall be supplied by a solar powered rechargeable battery system. Unless specified otherwise, battery capacity shall be engineered to supply 48 hours of reserve capacity, based on specific configurations as shown in drawings.

(a) Provide a system-sizing report detailing the photovoltaic array, battery bank, array-to-load ratio analysis, system availability analysis, battery state-of-charge report, battery depth of

discharge (DOD), and monthly isolation information for the specified region, based on specific configurations as shown in drawings.

(b) Solar panel(s) shall be photovoltaic (PV) array type. Solar Panel shall be positioned for maximum direct exposure to sunlight. Size the system solar generator to provide an array-to-load ratio of 1:1 or greater. Provide a system-average state of charge 90% or greater throughout the entire year. The system-loss-of-load probability shall remain 0% throughout the entire year. PV modules shall provide 12 volt DC and be capable of recharging the system to full capacity after six hours of continuous operation and in 3 hr. ± 0.5 hr. during optimum sun conditions. Supply industrial-grade, polycrystalline-type solar modules, incorporating bypass diodes in each solar module. Construct PV module with a low-iron tempered glass surface and an industrial grade anodized aluminum frame that completely surrounds and seals module laminate. Ensure construction is consistent with demands of installation near humid salt air environments. Provide an ultraviolet (UV) resistant, weatherproof junction box with wire termination for up to No. 8 AWG wiring with the PV module. Design and construct PV module mounting assembly of galvanized steel (ASTM A-153 Class A) or aluminum. PV electrical harness shall not exceed 2% total voltage drop between the solar module and the charge control circuit.

(c) Provide 12 volt DC batteries. Use valve-regulated, lead-acid batteries rated for a minimum of 2000 cycles with 10% capacity withdraw. Use lead-calcium for the plate alloy. Use T881-type terminal element post designed for 1/4-in. bolt termination or insert, threaded female terminal for ¼-in. bolt termination. Use absorbent glass mat technology for efficient gas recombination of up to 99% and freedom from electrolyte maintenance. Alternately, provide spill-proof gel cell battery to allow installation in any position. Gelled electrolyte shall contain sulfuric acid, fumed silica, pure demineralized and deoinized water, and a phosphoric-acid additive. Depth of Discharge (DOD) for the system shall not exceed 80%.

(d) Batteries may be mounted within the equipment enclosures, or in separate ground battery box with apron, per drawings.

(e) Provide 5-ampere fuse at positive lead of each battery. Fuses shall be equipped with solderless connectors and installed as close to positive battery terminal as feasible. Fuses shall be easily accessible and positioned so that rating markings are visible.

(f) The Solar Charge Controller shall be all solid-state, microprocessor-based, charge-control circuit to ensure proper charging of system Batteries via a three stage Pulse Width Modulation (PWM) charging algorithm. The solar charger shall optimize power delivered to the batteries and incorporate thermal compensation in charge-control circuit to adjust battery charge rate to variances in temperature as defined by Battery manufacturer. Set bulk charge voltage and float voltage as defined by Battery manufacturer at temperature specified by Battery manufacturer. Provide an LED or LCD to indicate solar-panel charging. Provide a programmable, microprocessor-controlled, low-voltage-disconnect (LVD) circuit in charging controller. LVD shall disconnect Batteries when battery voltage reaches voltage specified by Battery manufacturer. Provide LED indication for LVD circuit. Illuminate LED when LVD circuit is active. Overload and Short Circuit Protection shall be provided.

(g) Sites, for redundancy purposes, will optionally be powered by 120Volts AC to suit system design, by inclusion of an AC power supply. Equipment operation shall not be affected by transient voltages, surges and sags normally experienced on commercial power lines. Contractor is responsible for checking local power service to determine if any special

design is needed for equipment. The extra cost, if required, shall be included in the bid of this Item.

(h) Master Gauge Stations, Advance Warning Stations will be primarily solar powered with an AC power backup. Base Station components will be AC powered.

(6) Load Control. Load control shall include a microprocessor-controlled, 2-circuit, flasher circuit of solid-state design with no electro-mechanical devices for the 2-circuit flasher.

(a) Load Control shall operate at 12 Volts DC and provide alternate flashing in accordance with TMUTCD standards. Load Control shall provide for initiation and termination of the flashing operation by toggle switch, as well as for automatic operation via contact closure or logical low

(b) Load control shall provide Overload and Short Circuit Protection

(c) Automatic night dimming shall be provided. Automatic dimming, if enabled, shall dim the LED beacons by 75% at light levels below 5 foot-candles illumination per TxDOT TO-4051 Solar-Powered Photovoltaic Flasher Assembly & DMS-11150)

(d) Alternate flashing of Load Control may be disabled in order to provide a constant 12Volt DC output for the purpose of controlling a dynamic or changeable message sign.

(e) Overload and Short Circuit Protection shall be provided.

(f) Load Control circuitry may be integrated with the charge controller or may be provided as a stand alone component.

(7) Equipment Mounting. Master Gauge Station and Advance Warning Station equipment shall be completely enclosed in weather-resistant enclosures for control electronics and batteries, with controlled access for maintenance. Mounting structures shall be located outside the waterway and away from traffic. Flood Sensors shall be securely mounted and connected to the Master Station through conduit.

(a) Pole Mount configuration. Suitable for Master Gauge Station and Advance Warning Stations. This configuration includes a suitable pole with enclosure and provisions for mounting solar panels, antennas, beacons and signs.

(b) For single pole mounting, provide a threaded four (4) inch threaded schedule 40 steel or aluminum pipe in a plumb position for use as a roadside flashing beacon assembly. Supply a pedestal Pole Base per TxDOT DMS, TRF-4100.001 Pedestal Pole Base. The Pedestal Pole Base shall meet the breakaway requirements of the latest revision of the AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaries and Traffic Signals" and interim revisions thereto. Base may be via auger type installation, or via poured concrete foundation as specified in drawings.

(c) Provide an aluminum NEMA 4X cabinet with a minimum thickness of 1/8 in. Size the cabinet to provide adequate space for the control electronics and required number of batteries, or both. Supply stainless-steel, aluminum, or other non-rusting alloy door hinge with stainless-steel hinge pin. Weatherproof cabinet to prevent entry of water. Provide vent openings in cabinet to allow adequate convection cooling of electronic components and prevention of accumulation of gasses. Design and locate vents atop to prevent entry of water. Screen vents to minimize infiltration of dust and insects. Provide police lock with a metal keyhole cover as an integral part of each door. Provide one brass key with each cabinet. Provide tamper-resistant exposed hardware including screws, bolts, rivets, hubs,

etc. Provide two brackets for strap-type mounting on a wood or metal pole. Mount back panel with Master Station or Advance Warning Station components inside cabinet.

Provide corrosion resistant mounting hardware and brackets to facilitate mounting of mounting solar panels, antennas, beacons and signs.

(d) Each installation shall incorporate a ground rod electrode installed in accordance with *National Electrical Code* 250.52. Ground rods shall be not less than 2.5 meters (8 feet) in length, and shall bear the appropriate (U.L. or other) listing mark, clearly visible after installation.

(8) Conduit and Cabling.

(a) Provide weather-resistant connections between Flood Sensor and Master Gauge Station.

(b) Conduit shall be buried when feasible. Exposed conduit shall be positioned and appropriately secured to the bridge, wing wall, foundation or other natural or man-made structure to prevent dislodging by floating debris or vandalism.

(c) An access or pull box shall be provided near the flood sensor location in order to facilitate future removal for maintenance or repair.

(d) Exposed Conduit: Rigid metallic conduit.

(e) Direct Buried Conduit: Either PVC-Coated rigid metallic conduit or corrosion tape wrapped rigid metallic conduit.

(f) Provide cable suitable for installation in an underground conduit environment including constant immersion in water. Wiring shall meet National Electric Code requirements. Provide insulated conductors and cables with minimum 600 volt rated jackets. Wires shall be cut to proper length before assembly. No wire shall be doubled back to take up slack. Wires shall be neatly laced into cable with nylon lacing or plastic straps. Cables shall be secured with clamps. Service loops shall be provided at all connections. Connectors shall be keyed to preclude improper connection. Wires to and from connectors shall be color-coded and/or appropriately marked. Connectors utilizing solder type connections shall have each soldered connection covered by a piece of heat shrink tubing securely shrunk to insure that it protects the connection.

(g) No electrically active component or part of a sensor shall be permitted to come in contact with the environment, be exposed, or immersed in water.

(h) Where cable must traverse a roadway, pavement cut and restoration will be the responsibility of the contractor. In these cases a buried cabled depth of 24” minimum and a cut width of 8” maximum must be attained.

(9) Optional Gauging. Provisions shall be provided to accommodate one additional environmental sensor at the Master Gauge Station. Environmental Data from this sensor shall be reported in back to the Master Gauge Station based on change specified during setup for that site.

(a) Rain Gauge. Designated flood sensors shall be equipped with a tipping bucket rain gauge of standard manufacture. Accuracy of the rain gauge shall be 2.0% for precipitation rates up to 10 in. per hour. The precipitation collection aperture shall be not less than 8 in. in diameter. The rain gauge shall be connected to the controller which shall have the ability to transmit precipitation data when queried by the base station.

General Requirements:

(b) Electronics. Printed circuit boards shall be coated with clear-coat moisture and fungus resistant material (conformal coating). Connectors shall be keyed to preclude improper connection. No circuit cuts shall be allowed on circuit boards in any equipment supplied. Any wire jumpers included on circuit boards shall be placed in plated through-holes specifically designed to contain them. Jumpers that are tack soldered to circuit traces or are added to correct board layout errors are not acceptable.

(c) Timeliness of Data. System shall provide monitored data in near-real-time, with delays due only to software processing of captured data and transmission time.

(d) System Component Condition. Equipment and component parts furnished shall be new, corrosion resistant, of the latest design and manufacture, and in an operable condition at time of delivery and installation. Parts shall be of high quality workmanship.

(e) Assembly and Safety. Design shall be such as to prevent reversed assembly or improper installation of connectors, fasteners, etc. Contractor shall use latest available installation machinery, cable pulling machinery (with appropriate tension monitors), splicing equipment, testing equipment, and other miscellaneous tools when installing cable, splicing it, attaching connectors, and mounting hardware in equipment enclosures. Equipment shall be designed to protect personnel from exposure to high voltage during its operation, adjustments, and maintenance.

(f) System Failures. Equipment shall be designed such that failure of one component shall not cause failure of any other component. Design mean time between failures (MTBF) of system's electronic components, operating continuously, shall be 10 years or longer.

(g) System Labeling/Identification. Major component and subassemblies shall be clearly identified with name and model number and any other pertinent information required facilitating equipment identification and maintenance. Each Major assembly shall be serialized and clearly labeled.

(h) System Ruggedness/Weather Protection. Components shall be enclosed in rugged weatherproof enclosures and sealed to protect them from water infiltration, dust and airborne particles, and exposure to moisture (NEMA type 4X enclosure). Sealants shall not use silicone gels or other material that will deteriorate under prolonged exposure to ultraviolet radiation. Conduit used to connect components shall be sealed likewise. Cabling to and from components, where conduit is not used, shall be sealed at point of entry or exit in a likewise manner. System components exposed to the elements shall withstand wind up to 90 mph. System Sensors shall be mounted in such a manner as to avoid a direct strike from floating debris while still measuring accurate water levels. Parts shall be made of corrosion resistant material, such as plastic, stainless steel, anodized aluminum or brass. Materials used in construction shall be protected from fungus growth and moisture deterioration. Dissimilar metals shall be separated by an inert dielectric material.

(i) External Finishes. Components and structures exposed to the elements shall be powder-coated, stainless steel, or galvanized steel, as noted below.

(10) Installation Requirements. Contractor shall provide drawings and details showing locations of the flood sensors, Master Gauge Stations, Advance Warning Stations, etc. to be approved before any installation.

(a) A representative of the Contractor shall be present at the construction site at the appropriate time during construction to ensure the proper installation of the equipment and a trial run to ensure proper operation.

(b) The Manufacturer shall provide any training necessary to ensure proper operation of the system.

(c) The Contractor shall provide all saw cut joints, pavement replacement, foundation installation, and all other required installation procedures.

(d) A pre-work conference shall be held between the City and Contractor prior to any actual work being performed to go over the site and establish a time schedule. The contractor shall be responsible for arranging the flagging of any nearby underground utilities prior to construction.

(e) Installation, testing, and adjustments of the electrical and electronic components shall be performed by trained and experienced technicians. If installation is to be made by persons other than Manufacturer's technicians, Contractor shall submit qualifications of installer that sufficiently shows experience as an electronics technician, electrician with electronics background or equivalent experience, which is acceptable to Manufacturer. Non-Manufacturer installer shall show proof of having satisfactorily completed training with Manufacturer on the installation and connection of components, and their testing.

Installation personnel shall have three years experience in installation of electronic and electrical equipment. Installation personnel shall have installed at least two systems, of equal or more complexity to this specified system, where those systems have been in continuously satisfactory operation for at least one year. Contractor shall be responsible for providing necessary documentation of subcontractor qualifications pursuant to contract award.

(f) Use of New Parts and Equipment. Only new parts and equipment shall be installed as part of the permanent Automated Flood Warning System.

(g) Use of Industry Standards.

(1) Fabrication. Equipment design and fabrication shall utilize the latest available techniques with a minimum number of parts, subassemblies, circuits, cards, and modules to maximize standardization and commonality and minimize space requirements.

(2) Tools. Use only tools that have been designed for or are generally accepted in the industry for their intended use.

(h) Manufacturer's Involvement.

(1) Testing and Approval. System Manufacturer's representative shall be present for testing of their equipment for approval and shall be in agreement with the test results. Contractor shall be responsible for coordination of such tests and attendance of all required personnel.

(2) Technical Assistance. Contractor shall ensure that a manufacturer's technical representative is available on site to assist Contractor's technical personnel, at each installation site, with Automated Flood Warning System equipment installation and communication system configuration. Initial power-up shall not be executed without permission of manufacturer's representative.

(11) Documentation Requirements. Supply two copies of the following documentation with each Automated Flood Warning System: Complete and accurate schematic diagram, and complete users' manuals for the system. Include a final copy of as-built drawings of installed components including finished elevations.

(12) Sampling and Testing. The Automated Flood Warning System shall meet or exceed applicable Texas MUTCD, ITE Standards, and these Specifications. Complete testing of assemblies may be required at any time prior to acceptance. The Department will sample and test in accordance with "Tex-1170-T, Sampling and Environmental Testing of Traffic Signal Controller Assemblies: Traffic Signal Controllers and Conflict Monitors." Specific tests are normally indicated in conjunction with specific Specification requirements. However, the Department reserves the right to conduct whatever tests are deemed necessary to identify component materials and verify results of specific tests indicated in conjunction with Specification requirements. Sampling and testing costs are normally borne by the Department; however, the Contractor or supplier shall bear the costs for sampling and testing of failing materials. This cost shall be assessed at the rate established by the Director of TRF and in effect at time of testing. Amounts due the Department will be deducted from monthly or final estimates on contracts or from partial or final payments on direct purchases by the Department.

(13) Warranty. Guarantee that equipment furnished and installed for this Project will perform according to Manufacturer's published specifications. Warrant equipment against defects and/or failure in design, materials and workmanship in accordance with Manufacturer's standard warranty. Assign to the Department Manufacturers' normal warranties or guarantees on electronic, electrical, and mechanical equipment, materials, technical data, and products furnished for and installed on the Project. Repair or replace defective equipment, at Manufacturer's option, during warranty period at no cost to the Department. Include software and firmware updates as part of warranty. Provide equipment with 95% of Manufacturer's standard warranty remaining on date that equipment invoices are submitted by Contractor for payment.

Warrant that products supplier manufactures are free from defects in material and workmanship for a 3 year period. Batteries and other manufactures' products are under the warranty of that manufacturer. Provide a minimum of one year warranty from the date of shipment on all equipment. Warranty may be voided for equipment that has been altered without authorization, tampered with or vandalized.

(14) Annual Maintenance Equipment and Hardware Agreement. Contractor shall provide 2 concurrent 1-year maintenance agreements as part of the above item. The first 1-year maintenance agreement shall start at the time the project is accepted by written letter. The second 1-year maintenance agreement shall be optional and start at the conclusion of the first 1-year maintenance contract. If the second 1-year option is accepted, notification will be provided by written letter.

This contract must include at a minimum one site visit per six month period at each of the sites installed during which advanced warning beacons, flood sensors, and rain gauges shall be tested. Testing includes the verification of water surface measured at the base station. Also included in testing is the ability to demonstrate the systems functionality by setting off the lights at previously determined water surface elevations. A report shall be generated and provided to the City documenting the findings of each visit. This report should summarize the

state of the system for each component at each site and identify components which are inoperable and need replacement.

The Contractor shall be available on an “on-call” basis to provide emergency maintenance and calibration services, up to 4 events/visits, when sites are not functioning or generating questionable data. These events/visits are separate from emergency maintenance and calibration services required due to malfunction or issues covered under the Guarantees and Correction of Work after Substantial Completion condition. The Contractor must respond within 3 working days to emergency service requests submitted in written form via mail or email from the City. All travel expenses for visits shall be considered subsidiary to bid item No. 16800.

The Contractor shall be responsible for notifying the Director of Public Works or Representative two (2) months prior to the termination of each of the 1-year maintenance periods via Certified Mail. Should the City not receive the certified letter the maintenance period shall be extended on a month to month basis until receipt of the certified letter.

(15)Annual Maintenance Software Agreement. Contractor shall provide 2 concurrent 1-year maintenance agreements as part of the above item. The first 1-year maintenance agreement shall start at the time the project is accepted by written letter. The second 1-year maintenance agreement shall be optional and start at the conclusion of the first 1-year maintenance contract. If the second 1-year option is accepted, notification will be provided by written letter.

The agreement will include software upgrades on CD or downloaded from the Internet. The Contractor shall be available on an “on-call” basis via email and phone to provide instructional and diagnostic services to the City. The Contractor shall provide one hour response time 365 days per year, 24 hours per day. Further, the Contractor shall be available for up to 4 visits to the City for instructional and diagnostic services. All travel expenses for visits shall be considered subsidiary to bid item No. 16800.

The Contractor shall be responsible for notifying the Director of Public Works or Representative two (2) months prior to the termination of each of the 1-year maintenance periods via Certified Mail. Should the City not receive the certified letter the maintenance period shall be extended on a month to month basis until receipt of the certified letter.

16800.4. Measurement. This Item will be measured by low water crossing site as described on the summary sheet. This Item will be measured as each system furnished, installed and tested in accordance with this Special Specification and as directed by the Engineer.

16800.5.Payment. The work performed and materials furnished in accordance with this Item and measured as provided under “Measurement” will be paid for as a lump sum per site as described on the summary sheet. Item shall be bid as High Water Detection (HWDS) and Early Flood Warning Systems (EFWS) for Low Water Crossings. This price shall be full compensation for all equipment, tools, labor, training, warranty, and incidentals necessary to complete the work as specified.

130. CONTRACTOR'S ASSURANCE

(National Pollutant Discharge Elimination System [NPDES])

_____

(Name of Firm)

_____

(Address and Phone Number of Firm)

I do certify under penalty of law, that I understand the terms and conditions of the general National Pollutant Discharge Elimination System (NPDES) permit that authorizes the storm water discharges associated with industrial activity from the construction site identified as part of this certification.

_____

Signature

_____

Title

_____

Date