SECTION 16010 – BASIC ELECTRICAL REQUIREMENTS

PART 1 -- GENERAL

1.1 SCOPE

A. The work to be performed under these specifications shall include the furnishing of all labor, materials, equipment and services required for a complete electrical system as specified herein and as shown by the Drawings. A state of Louisiana licensed Electrical Contractor shall perform the work specified herein. The work includes but is not limited to:

1. Furnishing and installing a new 120/208 Volt, 3-phase, 4-wire service as shown on the Drawings, including coordinating with Entergy and including all associated costs in bid.
2. Furnishing and installing underground conduits with conductors from service entrance service rack to the equipment as shown on the drawings.
3. Furnishing and installing service entrance rated disconnect switch, power panels, and disconnect switches.
4. Furnishing and installing lighting fixtures, receptacles, toggle switches, and special outlet boxes for electrical systems shown on Drawings.
5. Furnishing and installing lighting controls, low-voltage switches, occupancy sensors, and control wiring.
6. Furnishing and installing electrical conduit and wiring required for connection of mechanical equipment furnished under other sections of these specifications.
7. Furnishing and installing light fixtures.
8. Furnishing and installing a new complete control panel for the new tilting weir actuators as shown on the Drawings and listed in these specifications.
9. Furnishing and installing a new complete SCADA panel as shown on the Drawings and listed in these specifications, including coordinating with the owner’s SCADA representative.
10. Installation of temporary construction power required by the General Contractor and Sub-Contractors during the construction period.

1.2 GENERAL CONDITIONS

A. The General Conditions and Supplementary General Conditions are a part of this section of these Specifications. The Contractor is cautioned to read and be thoroughly familiar with all provisions of the General Conditions. These conditions shall be complied with in every aspect. The word "shall" where used, is to be understood, as mandatory and the word "should" as advisory. "May" is used in the permissive sense.

1.3 GENERAL REQUIREMENTS

A. The Contractor is referred to all of the Drawings for building construction as well as the electrical Drawings.

B. The Contractor shall examine the site and shall verify to his own satisfaction the location of all utilities, and shall adequately inform himself as to their relation to his work before entering into a Contract and he shall base his bid on any conditions, which may be encountered during the progress of the work.

C. The Contractor shall furnish and install properly all materials, devices, equipment, supports, controls, appurtenances, etc., mentioned or required to make complete or

satisfactory installations in working order whether shown or not. All electrical equipment shall be connected in accordance with manufacturer's instructions. All work shall be executed in a workmanlike manner and shall present a neat and mechanical appearance when completed.

1.4 MINIMUM STANDARDS

A. Applicable rules of the National Electrical Code apply as a minimum standard for this contract, but do not replace or reduce any specific requirement herein.

1.5 DRAWINGS

A. Plans and detail sketches are submitted to limit, explain, and define structural conditions, specified requirements, conduit sizes, and manner of erecting work. The Contractor is cautioned to field check and verify all existing conditions before bidding, as no extra compensation will be allowed for conditions found different than represented in the construction drawings and/or specifications. Written approval of the Architect shall be obtained prior to any alterations or additions to specified work.

B. Structural or other conditions may require certain modifications from the manner of installation shown, and such deviations are permissible and shall be made as required, but specified sizes and requirements necessary for satisfactory operations shall remain unchanged.

C. The drawings and these specifications are complementary to each other and what is called for by one shall be binding as if called for by both.

D. General arrangement of work is indicated on plans. Due to the small scale of the drawings, offsets, fittings, and boxes required are not all indicated; provide fittings, boxes, etc., as needed in accordance with codes and accepted practices.

1.6 SUPERVISION

A. The Contractor shall personally or through an authorized and competent representative, constantly supervise the work from beginning to completion and final acceptance. So far as possible, he shall keep the same foreman and workmen throughout the project duration.

B. During its progress, the work shall be subject to inspection by representatives of the Architect, at which times the Contractor shall furnish required information.

C. It is not the Architect's or Engineer's duty to direct or guarantee the work of the Contractor, but to assist the Owner in obtaining a complete building in accordance with plans, specifications and addenda and to furnish engineering services in accordance with recognized practices.

1.7 PRIOR APPROVALS

A. The Contractor shall base his proposal on materials as specified herein. Any references to a specific manufacturer or trade name is made to establish a standard of quality and to define a type of product and in no way is intended to indicate a preference for a particular manufacturer. It is the intent of these specifications to allow all manufacturers of equipment, products, etc., judged equal to the specified product to bid on a competitive basis.

1.8 **MEASUREMENTS**

A. The Contractor shall verify all measurements and shall be responsible for the correctness of same, before ordering any materials or doing any work. No extra charge or compensation will be allowed for any differences between the actual measurements and those indicated on the drawings.

1.9 **LAWS, PERMITS AND FEES**

A. The entire electrical work shall comply with the rules and regulations of the City, Parish, and State, including the State Fire Marshal and State Board of Health, whether so shown on plans or not. The Contractor shall pay fees for permits, inspections, etc., and shall arrange with the inspecting authorities all required inspections.

1.10 **SITE INSPECTION**

A. The Contractor shall visit the site and familiarize himself with difficulties attendant to the successful execution of the work before bidding. Failure to visit the site shall not relieve the Contractor of the extent or conditions of the work required of him.

PART 2 -- PRODUCTS

2.1 **MATERIAL AND EQUIPMENT**

A. All materials, equipment, and accessories installed under this Contract, whether approved or not, shall be new and shall conform to all rules, codes, etc., as recommended or adopted by the National Association(s) governing the manufacture, rating and testing of such materials, equipment, and accessories.

2.2 **SHOP DRAWINGS**

A. The Contractor shall submit to the Architect complete descriptive and dimensional data on the following items for review and approval:
   1. Panelboards
   2. Service Entrance Disconnect Switch
   3. Tilting Weir Motor Information
   4. Disconnect Switches
   5. Lighting Fixtures
   6. Control Panels
   7. SCADA Panels

PART 3 -- METHODS OF INSTALLATIONS

3.1 **CONTRACTOR COORDINATION**

A. The Drawings are diagrammatic in nature. Cooperate with other trades so the interferences of facilities and equipment will be avoided.

3.2 **OPENINGS, CUTTING AND PATCHING**

A. Cut all openings as required for the electrical work. Patching will be done by the various crafts whose work is involved. Furnish and install all necessary sleeves, thimbles, hangers, inserts, etc., at such times and in such a manner as not to delay or interfere with the work of other Contractors. Caulk, flash or otherwise make weatherproof all penetrations through the roof and exterior walls.

B. Where conduit, cable or other items that are provided for under this contract penetrate fire rated walls or floors, the Contractor is to seal around the item to maintain the integrity of the rated system.

3.3 PAINTING

A. Painting shall be performed as described in the painting specifications. No painting will be required by the Contractor except for touch-up of factory finishes on equipment furnished under this contract.

3.4 APPLICABLE GENERAL CODES AND REGULATIONS

A. All electrical work and equipment, in whole or in part, shall conform to the applicable portions of the following specifications, codes and regulations in effect on that date of invitation for bids, and shall form a part of this specification.
1. National Electrical Code, 2014 Edition
2. National Electrical Manufacturers Association Standards
3. National Fire Protection Association Recommended Practices
4. Local, City and State Codes and Ordinances
5. National Board of Fire Underwriter's Recommended Practices
6. Life Safety Code, 2012 Edition
7. International Building Codes

B. Equipment that has been inspected and approved by the Underwriter's Laboratory shall bear its label or appear on its list of approved apparatus.

3.5 TESTS AND INSPECTIONS

A. The Contractor shall assist in making periodic inspections or tests required by the Architect or Engineer. When requested, the Contractor shall provide the assistance of foremen and qualified craftsmen for reasonable duration of each test, etc.

3.6 SAFETY PRECAUTIONS DURING CONSTRUCTION

A. It shall be the Contractor's responsibility to furnish and install proper guards and instruction signs for prevention of accidents and to provide and maintain for the duration of construction any installations needed for safety of life and property.

3.7 HEATING AND AIR CONDITIONING SYSTEM

A. This Contractor shall be responsible for providing electrical service to all devices of the heating and air conditioning system, and is referred to the mechanical plan for the exact location of the various devices.

3.8 EQUIPMENT NAMEPLATE

A. Each item of electrical equipment installed by the Contractor shall be provided with an engraved nameplate noting the equipment's function or designation. Nameplates shall be engraved laminated plastic with black letters on a white background. Letters shall be 1/4" high, all caps.

3.9 PANELBOARD SCHEDULES

A. The Contractor shall provide and affix typed panelboard schedules for each panelboard. Schedule will accurately list equipment served by each branch circuit, and not simply

indicate “LIGHTING” or “RECEPTACLES”, etc. Schedules shall indicate rooms served and device or devices connected to the circuit.

3.10 COMPLETION

A. The Contractor shall leave all electrical equipment with proper connections, and in proper working order. He shall test the entire electrical system to show that it is properly installed. Contractor shall leave all panels and switches completely fused or complete with circuit breakers.

3.11 RECORD DRAWINGS

A. The Contractor shall furnish one (1) complete set of drawings on which any changes in the work shall be shown. These drawings must be turned over to the Architect prior to final acceptance of the work.

3.12 GUARANTEE

A. The Contractor shall guarantee to keep the entire electrical system as installed by him or his subcontractors in repair and in perfect working order for one (1) year from the date of the final Certification of Final Acceptance, and shall furnish free of cost to the Owner, all material and labor necessary to comply with the above guarantee; said guarantee shall be based upon defective material and workmanship. In any case where equipment has a factory warranty exceeding this one-year limit, the full extent of the warranty shall apply.

3.13 CLEANING

A. When all work has been finally tested, the Contractor shall clean all fixtures, equipment, conduits, ducts, and all exposed work. All cover plates and other finished products shall be thoroughly cleaned.

3.14 INSTRUCTION MANUALS

A. The Contractor shall provide three (3) operating and maintenance instruction manuals on all systems and equipment installed in the electrical work.

3.15 CONTRACTOR SPECIAL NOTE

A. The Contractor is again cautioned to refer to all parts of these Specifications and all Drawings, not just electrical sections, and the individual cross references made to other standard specifications or details describing any electrical work, which may be required under these other sections. The Contractor is cautioned to note carefully any other sections which may reference electrical work in order for this Contractor to fully understand the wiring requirements and electrical work that is required. Any conflicts found between the electrical sections of these Specifications or Drawings shall be immediately directed to the General Contractor for clarification. Contractor is responsible for electrical work not only called out in the electrical sections of these specifications but is also responsible for electrical work called out in the sections of other Divisions.

B. These Specifications and the electrical Drawings size equipment, wire, conduit, etc. based on the horsepower of motors and/or wattages of equipment as shown on the plans or specified herein. The Contractor shall install electrical raceways, conductors, fuses, safety switches, breakers, contactors, starters or any other electrical equipment with the capacities to suit the horsepower and/or wattages of the equipment actually

furnished and installed. The Contractor shall not furnish or install any electrical raceways, conductors, safety switches, contactors or motor starters of sizes smaller than those shown on the Drawings or specified herein. The Contractor shall coordinate with the various sections of the Specifications and/or Drawings and with the various Sub-Contractors to provide the properly sized equipment without additional cost to the Owner.

C. The Contractor shall be required to install electrical services underground. Existing underground utilities should be disconnected. Refer to the electrical and mechanical drawings for demolition plans. However, some existing underground utilities may remain in service at the site. Contractor is cautioned to exercise extreme care when digging to not damage any existing utilities or equipment. Contractor shall be required to repair any utilities or equipment he may damage during construction.

- END OF SECTION -

SECTION 16400 – SERVICE AND DISTRIBUTION

PART 1 -- GENERAL

1.1 SYSTEM VOLTAGE

A. The service from the service entrance rack shall be 120/208V, 3 phase, 4 wire.

1.2 TERMINATIONS

A. All wiring shall be sized based on 75^{o}C rated conductors. All connectors shall be rated for 75^{o}C in accordance with N.E.C. Article 110-14 requirements.

PART 2 -- PRODUCTS

2.1 SAFETY SWITCHES

A. Furnish and install safety switches as shown on the Drawings. All switches shall be fused NEMA Heavy Duty Type HD and Underwriter's Laboratories listed. All switches shall have blades that are fully visible in the "OFF" position with the door open. Switches shall be dead-front construction with permanently attached arc suppressers. Lugs shall be UL listed for copper and aluminum conductor and front removable. All current carrying parts shall be plated to resist corrosion. Switches shall be quick-make, quick-break type. During operation of the switch, the movable contacts shall not be able to be restrained by the handle once the closing or the opening action of the contacts has been initiated. Switches shall have cover interlocks to prevent opening of the switch door while the switch is in the "ON" position or closing the switch with the door open. Switch shall have padlocking capabilities in the "OFF" position.

B. Safety switches shall be rated 600 volts for 480 volt service and rated 240 volts for 208 volt service. Switches shall be motor rated when used for motor loads. Switches shall be NEMA 1 enclosed for indoor applications and NEMA 3R for outdoor or wet area locations.

C. Switches used for service entrance shall be service entrance rated. Safety switches shall be furnished complete with fuses.

D. Safety switches shall be Square D Heavy Duty Class 3110 type, Eaton Heavy Duty type, or prior approved equal.

2.2 FUSES

A. All fuse holders shall be provided with dual-element, time-lag fuses as scheduled on the Drawings or as recommended by the equipment manufacturer. Fuses shall be rated 200,000 AIC. Fuses shall be Buss Fusetron, Economy Econ, or Gould Shawmut Tri-Onic for component protection and Buss Limitron, Economy Econolin, or Gould Shawmut Amp-Trap for circuit protection.

2.3 CIRCUIT BREAKER PANELBOARDS

A. Panelboards shall be sized as shown on the drawings and schedules, and shall be the bolted breaker panelboard type. Panelboards shall have copper bussing. Panelboards shall have door-in-door trim.

B. All branch breakers are to be quick-make, quick-break (over center toggle device) with trip indication and common trip on all multiple breakers. Trip indication shall be clearly shown by breaker handle taking a position between "ON" and "OFF" position. Breakers shall be ambient compensated to carry full NEC load in 120 degree F room temperature. Panelboards shall have distributed phase busing throughout. Any two adjacent single pole breakers shall be replaceable by a two pole breaker, and any three adjacent single pole breakers shall be replaceable by a three pole breaker.

C. Minimum interrupting capacity of breakers shall be as shown on panel schedules. No breakers shall be rated less than 10,000 RMS symmetrical amperes.

D. Branch breakers shall be numbered 1, 3, 5, etc. from top to bottom beginning at the top of the left hand column so that #1 shall be on phase A, #3 on phase B, and #5 on phase C.

E. All breakers shall be bolt on type. Panelboards for 120/208 volt or 120/240 volt service shall be Square D type NQ, Eaton Pow-R-Line series, or prior approved equal. Panelboards for 480/277 volt service shall be Square D type NEHB, Eaton Pow-R-Line series, or prior approved equal.

PART 3 -- EXECUTION

3.1 COORDINATION

A. Contractor shall coordinate all service and distribution work with other crafts on the project.

3.2 TEST AND BALANCING

A. At such times as the Architect directs, the Contractor shall conduct in the Architect's presence operating tests to demonstrate the electrical systems are installed and will operate properly and in accordance with the requirements of the specifications. The Contractor shall furnish instruments and personnel required for such tests. Any work that is found to be defective, or material that are found to vary from the requirements of the drawings or specifications shall be replaced by the Contractor without additional cost of the Owner.

3.3 EMERGENCY CIRCUITS

A. All wiring for emergency power and lighting circuits shall be run in conduits independent of all other circuits or conductors. Emergency circuit installations shall be made in accordance with National Electrical Code Article 700.9.

3.4 EQUIPMENT FUSING

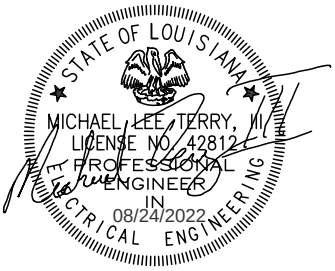
A. All equipment shall be furnished complete with fuses as described herein and/or as shown on the Drawings. Contractor shall furnish one set of spare fuses for each size fuse furnished on the project. Fuses shall be delivered to Owner prior to acceptance of project.

B. Fusing for protective equipment shall be of the type specifically designed for the intended application. Fuses for service entrance rated equipment shall be Class L. Fuses for branch circuit protection shall be Class RK5 unless specified otherwise. Provide protective fuses as specifically required by the equipment manufacturer.

3.5 **INSTALLATION**

A. Disconnecting means shall be provided for each motor and motor controller, and shall be located within sight from the controller and motor locations in accordance with National Electrical Code Article 430.102 requirements.

- END OF SECTION -



SECTION 16401 – OVERCURRENT PROTECTIVE DEVICE SHORT-CIRCUIT STUDY

PART 1 -- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
   1. Short-circuit study input data, including completed computer program input data sheets.
   2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
      b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Short-Circuit Study Specialist and Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 **QUALITY ASSURANCE**

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Short-Circuit Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 -- PRODUCTS

2.1 **COMPUTER SOFTWARE**

A. Manufacturers: Subject to compliance with requirements, provide products by the following:
   1. SKM Systems Analysis, Inc.
   2. ETAP

B. Comply with IEEE 399 and IEEE 551.

C. Analytical features of fault-current-study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 **SHORT-CIRCUIT STUDY REPORT CONTENTS**

A. Executive summary.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:
   1. Protective device designations and ampere ratings.
   2. Cable size and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Comments and recommendations for system improvements, where needed.

E. Protective Device Evaluation:
   1. Evaluate equipment and protective devices and compare to short-circuit ratings.
   2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
   3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
   4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
   5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.

G. Short-Circuit Study Output:
   1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
      a. Voltage.
      b. Calculated fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. Equivalent impedance.
   2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
      a. Voltage.
      b. Calculated symmetrical fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. Calculated asymmetrical fault currents:
         1) Based on fault-point X/R ratio.
         2) Based on calculated symmetrical value multiplied by 1.6.
         3) Based on calculated symmetrical value multiplied by 2.7.
   3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
      a. Voltage.
      b. Calculated symmetrical fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. No AC Decrement (NACD) ratio.
      e. Equivalent impedance.
      f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.

g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Obtain all data necessary for the conduct of the study.
   1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Engineer.
   2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
   3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.
   4. Obtain all arc flash information from the local utility in a timely manner. No extension of the contract time shall be permitted due to coordination with the local utility.

B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Obtain electrical power utility impedance at the service.
   3. Power sources and ties.
   4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
   5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
   6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
   7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
   8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
   9. Motor horsepower and NEMA MG 1 code letter designation.
   10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

3.2 SHORT-CIRCUIT STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Calculate short-circuit currents according to IEEE 551.

C. Base study on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin short-circuit current analysis at the service, extending down to the system overcurrent protective devices as follows:
   1. To normal system low-voltage load buses where fault current is 10 kA or less.
   2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.
   1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:
   1. Electric utility's supply termination point.
   2. Incoming switchgear.
   3. Unit substation primary and secondary terminals.
   4. Low-voltage switchgear.
   5. Motor-control centers.
   6. Control panels.
   7. Standby generators and automatic transfer switches.
   8. Branch circuit panelboards.
   9. Disconnect switches.

3.3 ADJUSTING

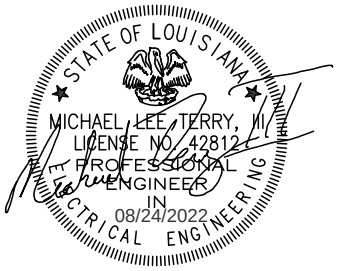
A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

3.4 DEMONSTRATION

A. Train Owner's operating and maintenance personnel in the use of study results.

- END OF SECTION -

SECTION 16402 – OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY



PART 1 -- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
   1. Coordination-study input data, including completed computer program input data sheets.
   2. Study and equipment evaluation reports.
   3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1. 5 **INFORMATIONAL SUBMITTALS**

A. Qualification Data: For Coordination Study Specialist and Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 **CLOSEOUT SUBMITTALS**

A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
      a. The following parts from the Protective Device Coordination Study Report:
         1) One-line diagram.
         2) Protective device coordination study.
         3) Time-current coordination curves.
      b. Power system data.

1.7 **QUALITY ASSURANCE**

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 -- PRODUCTS

2.1 **COMPUTER SOFTWARE DEVELOPERS**

A. Software Developers:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. SKM Systems Analysis, Inc.
      b. ETAP

B. Comply with IEEE 242 and IEEE 399.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
   1. Optional Features:
      a. Arcing faults.
      b. Simultaneous faults.
      c. Explicit negative sequence.
      d. Mutual coupling in zero sequence.

2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

A. Executive summary.

B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.

C. One-line diagram, showing the following:
   1. Protective device designations and ampere ratings.
   2. Cable size and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center, and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study:
   1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
      a. Phase and Ground Relays:
         1) Device tag.
         2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value
         3) Recommendations on improved relaying systems, if applicable.
      b. Circuit Breakers:
         1) Adjustable pickups and time delays (long time, short time, ground).
         2) Adjustable time-current characteristic.
         3) Adjustable instantaneous pickup.
         4) Recommendations on improved trip systems, if applicable.
      c. Fuses: Show current rating, voltage, and class.

G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream

devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
    a. Power utility's overcurrent protective device.
    b. Medium-voltage equipment overcurrent relays.
    c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    f. Cables and conductors damage curves.
    g. Ground-fault protective devices.
    h. Motor-starting characteristics and motor damage points.
    i. Generator short-circuit decrement curve and generator damage point.
    j. The largest feeder circuit breaker in each motor-control center and panelboard.
5. Series rating on equipment allows the application of two series interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Both devices share in the interruption of the fault and selectivity is sacrificed at high fault levels. Maintain selectivity for tripping currents caused by overloads.
6. Provide adequate time margins between device characteristics such that selective operation is achieved.
7. Comments and recommendations for system improvements.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.
    1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 PROTECTIVE DEVICE COORDINATION STUDY

A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.

B. Comply with IEEE 399 for general study procedures.

C. The study shall be based on the device characteristics supplied by device manufacturer.

D. The extent of the electrical power system to be studied is indicated on Drawings.

E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:
   1. To normal system low-voltage load buses where fault current is 10 kA or less.
   2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Transformer Primary Overcurrent Protective Devices:
   1. Device shall not operate in response to the following:
      a. Inrush current when first energized.
      b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
      c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
   2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

H. Motor Protection:
   1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
   2. Select protection for motors served at voltages more than 600 V according to IEEE 620.

I. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

J. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.

K. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.
   1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.

L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:
   1. Electric utility's supply termination point.
   2. Switchgear.
   3. Unit substation primary and secondary terminals.
   4. Low-voltage switchgear.
   5. Motor-control centers.
   6. Standby generators and automatic transfer switches.
   7. Branch circuit panelboards.

M. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to short-circuit ratings.
2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

3.3 LOAD-FLOW AND VOLTAGE-DROP STUDY

A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
   1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
   2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
   3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

3.4 MOTOR-STARTING STUDY

A. Perform a motor-starting study to analyze the transient effect of the system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of the motor starting on the power system stability.

B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141 and voltage sags so as not to affect the operation of other utilization equipment on the system supplying the motor.

3.5 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the overcurrent protective device study.
   1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Engineer.
   2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
   3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Electrical power utility impedance at the service.
   3. Power sources and ties.
   4. Short-circuit current at each system bus, three phase and line-to-ground.
   5. Full-load current of all loads.
   6. Voltage level at each bus.

7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Maximum demands from service meters.
13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
14. Motor horsepower and NEMA MG 1 code letter designation.
15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of the downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.6 FIELD ADJUSTING

A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.7 DEMONSTRATION

A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:
   1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
   2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
   3. Adjust, operate, and maintain overcurrent protective device settings.

- END OF SECTION -

SECTION 16403 – OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY

PART 1 -- GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.

C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.

D. SCCR: Short-circuit current rating.

E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

1.4 ACTION SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.
   1. Arc-flash study input data, including completed computer program input data sheets.
   2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.
      a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Arc-Flash Study Specialist and Field Adjusting Agency.

B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.

B. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.

B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
   1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.

C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the International Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

PART 2 -- PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

A. Software Developers:
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. SKM Systems Analysis, Inc.
      b. ETAP

B. Comply with IEEE 1584 and NFPA 70E.

C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

A. Executive summary.

B. Study descriptions, purpose, basis and scope.

C. One-line diagram, showing the following:
   1. Protective device designations and ampere ratings.
   2. Cable size and lengths.
   3. Transformer kilovolt ampere (kVA) and voltage ratings.
   4. Motor and generator designations and kVA ratings.
   5. Switchgear, switchboard, motor-control center and panelboard designations.

D. Study Input Data: As described in "Power System Data" Article.

E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."

F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."

G. Arc-Flash Study Output:
   1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
      a. Voltage.
      b. Calculated symmetrical fault-current magnitude and angle.
      c. Fault-point X/R ratio.
      d. No AC Decrement (NACD) ratio.
      e. Equivalent impedance.
      f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
      g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis

H. Incident Energy and Flash Protection Boundary Calculations:
   1. Arcing fault magnitude with and without required Arc Energy Reduction methods.
   2. Protective device clearing time.
   3. Duration of arc.
   4. Arc-flash boundary.
   5. Working distance.
   6. Incident energy.
   7. Hazard risk category.
   8. Recommendations for arc-flash energy reduction.

I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

2.3 ARC-FLASH WARNING LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.

B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
   1. Location designation.
   2. Nominal voltage.
   3. Flash protection boundary.
   4. Hazard risk category.
   5. Incident energy.
   6. Working distance.
   7. Engineering report number, revision number, and issue date.

C. Labels shall be machine printed, with no field-applied markings.

PART 3 -- EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

A. Comply with NFPA 70E and its Annex D for hazard analysis study.

B. Preparatory Studies:
   1. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 16402 "Overcurrent Protective Device Coordination Study."

C. Calculate maximum and minimum contributions of fault-current size.
   1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
   2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.

D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.

E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.

G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted

or decremented with time. Fault contribution from motors and generators shall be decremented as follows:

1. Fault contribution from induction motors should not be considered beyond three to five cycles.
2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).

H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
   1. When the circuit breaker is in a separate enclosure.
   2. When the line terminals of the circuit breaker are separate from the work location.

I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.
   1. Verify completeness of data supplied on the one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to the attention of Engineer.
   2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
   3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.

B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
   1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
   2. Obtain electrical power utility impedance at the service.
   3. Power sources and ties.
   4. Short-circuit current at each system bus, three phase and line-to-ground.
   5. Full-load current of all loads.
   6. Voltage level at each bus.
   7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
   8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
   9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
   10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.

11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

3.4 LABELING

A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:
   1. Motor-control center.
   2. Low-voltage switchboard.
   3. Switchgear.
   4. Medium-voltage switch.
   5. Control panel.

3.5 APPLICATION OF WARNING LABELS

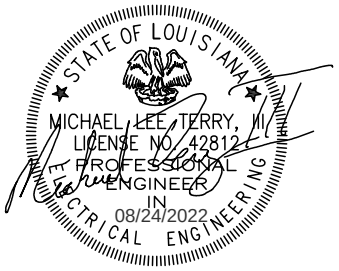
A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

3.6 DEMONSTRATION

A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

- END OF SECTION -

SECTION 16410 – SURGE PROTECTION DEVICES



PART 1 -- GENERAL

1.1 SCOPE

A. This section describes the materials and installation requirements for surge protective devices (SPD) for the protection of all AC electrical circuits.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section. Other sections that may relate to the work in this section include, but are not limited to, the following:
   1. Section 16050 – Basic Electrical Materials and Methods

1.3 SUBMITTALS

A. Submit shop drawings and product information for approval and final documentation in the quantities listed according to the Conditions of the Contract. Customer name, customer location, and customer order number shall identify all transmittals.

B. Submittals shall include UL 1449 3rd Edition Listing documentation verifiable by visiting www.UL.com, clicking “Certifications” link, searching using UL Category Code: VZCA.
   1. Short Circuit Current Rating (SCCR)
   2. Voltage Protection Ratings (VPRs) for all modes
   3. Maximum Continuous Operating Voltage rating (MCOV)
   4. I-nominal rating (I-n)
   5. SPD shall be Type 1 UL listed and labeled

C. Upon request, an unencapsulated but complete SPD formally known as TVSS shall be presented for visual inspection.

D. Minimum of ten (10) year warranty

1.4 RELATED STANDARDS

A. The following codes and standards shall be referenced:
   1. IEEE C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and Less) AC Power Circuits,
   2. IEEE C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits,
   3. IEEE C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
   4. National Electrical Code: Article 285
   5. UL 1283 - Electromagnetic Interference Filters
   6. UL 1449, Third Edition, effective September 29, 2009 – Surge Protective Devices

1.5 LISTING REQUIREMENTS

A. SPD shall bear the UL Mark and shall be Listed to most recent editions of UL 1449 and UL 1283. “Manufactured in accordance with” is not equivalent to UL listing and does not meet the intent of this specification.

B. SPD and performance parameters shall be posted at www.UL.com under Category Code: VZCA. Products or parameters without posting at UL.com shall not be approved.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm with at least ten (10) years' experience in manufacturing transient voltage surge suppressors.

B. Manufacturer shall be ISO 9001 or 9002 certified.

C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (10) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

D. The SPD shall be compliant with the Restriction of Hazardous Substances (RoHS) Directive 2002/95/EC.

1.7 DELIVERY, STORAGE AND HANDLING

A. Handle and store equipment in accordance with manufacturer's Installation and Maintenance Manuals. One (1) copy of this document to be provided with the equipment at time of shipment.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Provide internally mounted transient voltage suppressors as described herein.

B. Manufacturer and/or manufacturer's model number listed in this Specification are used to establish general style, type, character, and quality of product desired. Similar items manufactured by manufacturers other than those listed will be considered, providing submittals are made according to Pre-Bid Approval requirements of Instructions to Bidders.

C. Where no manufacturer or model number are given, any product meeting performance or design criteria, or referenced trade association standard may be used and Pre-Bid Approval is not required.

D. Subject to compliance with the specified requirements, provide products by one of the following manufacturers:

Advanced Protection Technologies

2.2 SURGE PROTECTIVE DEVICE FEATURES

A. SPD shall be UL 1449 labeled with 200kA Short Circuit Current Rating (SCCR). Fuse ratings shall not be considered in lieu of demonstrated withstand testing of SPD, per NEC 285.6.

B. SPD shall be UL 1449 labeled as Type 1 intended for use without need for external or supplemental overcurrent controls. Internal overcurrent and thermal overtemperature controls shall protect every suppression component of every mode, including N-G.

SPDs relying upon external or supplementary installed safety disconnectors do not meet the intent of this specification.

C. SPD shall be UL 1449 labeled with 20kA I-nominal (I-n) (verifiable at UL.com) for compliance to UL 96A Lightning Protection Master Label and NFPA 780.

D. Suppression components shall be heavy duty 'large block' MOVs, each exceeding 30mm diameter.

E. Standard 7 Mode Protection paths: SPD shall provide surge current paths for all modes of protection: L-N, L-G, L-L, and N-G for Wye systems; L-L, L-G in Delta and impedance grounded Wye systems.

F. If a dedicated breaker for the SPD is not provided in the switchboard, the service entrance SPD shall include an integral UL Recognized disconnect switch. A dedicated breaker shall serve as a means of disconnect for distribution SPD's.

G. SPD shall meet or exceed the following criteria:
   1. Minimum surge current capability (single pulse rated) per phase shall be:
      a. Service Entrance applications:
         Eaton Model SPD300 Series with Maximum surge current capability of 300kA per phase.
         Advanced Protection Technologies Model TE_XAS30 series with Maximum 7-Mode surge current capability of 300kA per phase.
      b. Distribution applications:
         Eaton Model SPD200 Series with Maximum surge current capability of 200kA per phase.
         Advanced Protection Technologies Model TE_XAS20 series with Maximum surge current capability of 200kA per phase
      c. Branch Panel applications:
         Eaton Model SPD100 Series with Maximum surge current capability of 100kA per phase.
         Advanced Protection Technologies Model TE_XDS104 series with Maximum surge current capability of 100kA per phase
   2. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

VOLTAGE	L-N	L-G	N-G
208Y/120V	700V	700V	700V
480Y/277V	1500V	1500V	1500V

H. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277V	20%	320V

I. SPD shall include a serviceable, replaceable module (excluding Distribution).

J. Service Entrance SPD shall have UL 1283 EMI/RFI filtering with minimum attenuation of -50dB at 100kHz.

K. SPD shall have a warranty for a period of ten (10) years, incorporating unlimited replacements of suppressor parts if they are destroyed by transients during the warranty period.

L. Service Entrance SPDs shall be equipped with the following diagnostics:
   1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
   2. Audible alarm with on/off silence function and diagnostic test function (excluding branch).
   3. Form C dry contacts
   4. Surge Counter
   5. No other test equipment shall be required for SPD monitoring or testing before or after installation.

M. Distribution Panels and Branch Panels SPDs shall be equipped with the following diagnostics:
   1. Visual LED diagnostics including a minimum of one green LED indicator per phase, and one red service LED.
   2. No other test equipment shall be required for SPD monitoring or testing before or after installation.

N. Surge protection devices installed for individual equipment items shall meet or exceed the following criteria:
   1. Minimum surge current capability (single pulse rated) per phase shall be:
      a. Advanced Protection Technologies Model S50A series with dry contact and surge current capability shall be 50kA per phase.
   2. UL 1449 Listed Voltage Protection Ratings (VPRs) shall not exceed the following:

VOLTAGE	L-N	L-G	N-G
208Y/120V	600V	1000V	1000V
480Y/277V	1200V	2000V	1000V

   3. UL 1449 Listed Maximum Continuous Operating Voltage (MCOV) (verifiable at UL.com):

System Voltage	Allowable System Voltage Fluctuation (%)	MCOV
208Y/120	25%	150V
480Y/277V	20%	320V

   4. Furnished with NEMA 4X Polycarbonate enclosure.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. The installation shall meet the following criteria:
   1. Install per manufacturer's recommendations and contract documents.
   2. Install units plumb, level and rigid without distortion
   3. One primary suppressor shall be installed internal to the service entrance in accordance with manufacturer instructions.
   4. Service Entrance SPD shall be installed on the line or load side of the main service disconnect.
   5. Service Entrance SPD ground shall be bonded to the service entrance ground.
   6. At Service Entrance or Transfer Switch, a UL approved disconnect switch shall be provided as a means of servicing disconnect if a 60A breaker is not available.
   7. One SPD shall be installed internal to each designated distribution panelboard.
   8. At Distribution, MCC and Branch, TVSS shall have an independent means of servicing disconnect such that the protected panel remains energized. A 30A breaker (or larger) may serve this function.
   9. SPD shall be installed per manufacturer's installation instructions with lead lengths as short (less than 24") and straight as possible. Gently twist conductors together.

10. Installer may reasonably rearrange breaker locations to ensure short & straightest possible leads to SPDs.
11. Before energizing, installer shall verify service and separately derived system Neutral to Ground bonding jumpers per NEC.

3.2 ADJUSTMENTS AND CLEANING

A. Remove debris from SPD and wipe dust and dirt from all components.

B. Repaint marred and scratched surfaces with touch up paint to match original finish.

3.3 TESTING

A. Check tightness of all accessible mechanical and electrical connections to assure they are torqued to the minimum acceptable manufacture's recommendations.

B. Check all installed panels for proper grounding, fastening and alignment.

3.4 WARRANTY

A. Equipment manufacturer warrants that all goods supplied are free of non-conformities in workmanship and materials for one year from date of initial operation, but not more than eighteen months from date of shipment.

- END OF SECTION -

SECTION 16450 - EMERGENCY POWER SYSTEMS

PART 1 -- GENERAL

1.1 SCOPE

A. Provide, install, and acceptance test a complete and operable Emergency/Standby electric generating system, including all devices and equipment specified herein, as shown on the drawings, or required for the service. Equipment shall be new, factory tested, and delivered ready for installation.

1.2 APPROVED MANUFACTURERS

A. The equipment, documentation, and services described in the generator portion of this specification and as shown on the plans are as provided by Cummins Power Generation Corporation and Taylor Power Systems (see product description for equipment part numbers). The equipment, documentation, and services described in the transfer switch portion of this specification and shown on the plans are as provided by ASCO Power Technologies 300 series, or Cummins Power Generation Corporation OTPC series.

B. Proposed substitutions shall include complete submittal data, as specified herein, clearly denoting any and all deviations and/or exceptions to the equipment specified. The complete proposal must be submitted for approval/disapproval not less than 10 days prior to the scheduled bid date. Proposed manufacturer shall be certified under ISO 9001.

C. Submittals for proposed substitutions for generators must include complete engine data sheets and alternator data sheets that accurately describe the proposed products and shall include the alternator motor starting curves.

1.3 SUBMITTALS

A. After award of contract, provide three sets of submittal documents. One set will be retained by the engineer and the remaining sets will be returned to contractor. Contractor will include two sets with the close out documents at the end of the project construction. Contractor shall submit additional copies for engineer's review if required for use by Contractor or Contractor's sub-contractors. Submit the following information for review:

1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements. Included in this submittal shall be alternator data sheets with motor starting curves, and engine data sheets including engine size and motor horsepower ratings.
2. A paragraph-by-paragraph specification compliance statement, describing the differences between the specified and the proposed equipment.
3. Manufacturer's certification of prototype testing.
4. Manufacturer's published warranty documents.
5. Shop drawings showing plan and elevation views with certified overall dimensions, as well as wiring interconnection details.
6. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
7. Manufacturer's installation instructions.

1.4 **WARRANTY**

A. The Contractor shall warrant the completed emergency power system wiring and equipment, including generator and automatic transfer switch, for a period of one year after the date of final acceptance.

1.5 **MANUALS**

A. Operators and spare parts manuals shall be provided for all system equipment. The manuals shall include outline, interconnection, wiring, and control drawings accurately describing the equipment provided. Provide ladder logic for all programmable logic controllers in the system. Contractor shall furnish two copies of the operation, maintenance and spare parts manuals at the completion of the project to be included in the project close out documents. Also, provide an electronic copy of the operation, maintenance and spare parts manuals for User Agency's use.

1.6 **CODES AND REGULATIONS**

A. The emergency power system shall comply with the following codes and regulations:
   1. NFPA 70, National Electrical Code.
   2. NFPA 30, Flammable and Combustible Liquids Code.
   3. NFPA 37, Standards for the Installation and Use of Stationary Combustion Engines and Gas Turbines.
   4. NFPA 110, Standard for Emergency and Standby Power Systems
   5. International Building Codes (IBC).
   6. Local and State Building Codes.
   7. Genset shall be Underwrites Laboratory UL220 Listed.

PART 2 -- PRODUCTS

2.1 **DIESEL ENGINE-GENERATOR SET**

A. Generator set Ratings: The diesel engine-generator set shall meet the following general parameters:
   1. The generator set shall operate at 1800 rpm and at a voltage of 120/208 Volts AC, three phase, four-wire, 60 hertz.
   2. Site conditions: Altitude 1000 ft., ambient temp. 105 degrees F.
   3. Temp Rise: 125 degree C

B. Generator set Ratings: The 30 kW generator set shall meet the following parameters:
   1. The generator set size: 30 kW, 37.5 kVA at 0.8 PF, standby rating.
   2. Motor starting KVA: minimum 71 SKVA at 20% voltage dip. Furnish alternator motor starting curves for review and approval.
   3. Engine Displacement: minimum 199 cu in..
   4. The engine shall have 4 cylinders and a minimum displacement of 199 cubic inches.

C. Performance:
   1. Voltage regulation shall be provided with electronic voltage regulator and shall be plus or minus 1.0 percent for any constant load between no load and rated load for both parallel and non-parallel applications. Random voltage variation with any steady load from no load to full load shall not exceed plus or minus 0.5 percent.
   2. Frequency regulation shall be isochronous from steady state no load to steady

state rated load. Random frequency variation with any steady load from no load to full load shall not exceed plus or minus 0.25%.

3. The engine-generator set shall be capable of single step load pick up of 100% nameplate kW and power factor, less applicable de-rating factors, with the engine-generator set at operating temperature.
4. Motor starting capability shall have a minimum gross horsepower rating as listed above.
5. The alternator shall produce a clean AC voltage waveform, with not more than 5% total harmonic distortion at full linear load, when measured from line to neutral, and with not more than 3% in any single harmonic. Telephone influence factor shall be less than 40.

D. Construction: The engine-generator set shall be mounted on a heavy-duty steel base to maintain alignment between components. The base shall incorporate a battery tray with hold-down clamps within the rails.

E. Connections: The generator set load connections shall be composed of silver or tin-plated copper bus bars, drilled to accept mechanical or compression terminations of the number and type as shown on the drawings. Sufficient lug space shall be provided for use with cables of the number and size as shown on the drawings. Power connections to auxiliary devices shall be made at the devices, with required protection located at a wall-mounted common distribution panel. Generator set control interfaces to other system components shall be made on a common, permanently labeled terminal block assembly.

F. The engine shall be natural gas fueled, radiator and fan cooled. The horsepower rating of the engine at the unit's minimum tolerance level shall be sufficient to drive the alternator and all connected accessories. Furnish alternator motor starting curves for review and approval.

G. Engine accessories and features shall include:
1. The engine shall be diesel, 4-cycle; 2-cycle engines are not acceptable.
2. Complete engine fuel system, including all pressure regulators, strainers, and control valves. The fuel system shall be plumbed to the generator set skid for ease of site connections to the generator set.
3. An electronic governor system shall provide automatic isochronous frequency regulation.
4. Skid-mounted radiator and cooling system rated for full load operation in 104 degrees F (40 degrees C) ambient as measured at the generator air inlet, based on 0.5 in H_2O external static head. Radiator shall be sized based on a core temperature, which is 20F higher than the rated operation temperature, or prototype tested to verify cooling performance of the engine/radiator/fan operation in a controlled environment. Radiator shall be provided with a duct adapter flange. The equipment manufacturer shall fill the cooling system with a 50/50-ethylene glycol/water mixture. Rotating parts shall be guarded against accidental contact.
5. Electric starter(s) capable of three complete cranking cycles without overheating.
6. Positive displacement, mechanical, full pressure, lubrication oil pump.
7. Full flow lubrication oil filters with replaceable spin-on canister elements and dipstick oil level indicator.
8. Replaceable dry element air cleaner with restriction indicator.
9. Flexible fuel lines.
10. Engine mounted battery charging alternator, 40-ampere minimum, and solid-state voltage regulator.

11. Provide vibration isolators, spring/pad type, quantity as recommended by the generator set manufacturer. Isolators shall include seismic restraints if required by site location.
12. Starting and Control Batteries shall be lead acid antimony type, 24 volt DC, sized as recommended by the engine manufacturer, complete with battery cables and connectors.
13. Provide critical grade exhaust silencer of size and type as recommended by the generator set manufacturer and approved by the engine manufacturer. Exhaust system shall be installed according to the engine manufacturer's recommendations and applicable codes and standards. Breaker shall be factory mounted.

H. Engine Mounted Breaker: The generator shall include an engine-mounted breaker as shown on the drawings. Breaker shall be used to feed the main emergency service entrance rater transfer switch. Field mounted breaker shall not be acceptable.

I. Coolant heater:
1. Engine mounted thermostatically controlled, coolant heaters for each engine. Heater voltage shall be as shown on the project drawings. The coolant heater shall be UL499 listed and labeled.
2. The coolant heater shall be installed on the engine with silicone hose connections. Steel tubing shall be used for connections into the engine coolant system wherever the length of pipe run exceeds 12 inches. The coolant heater installation shall be specifically designed to provide proper venting of the system. The coolant heaters shall be installed using quick disconnect couplers to isolate the heater for replacement of the heater element. The quick disconnect/automatic sealing couplers shall allow the heater element to be replaced without draining the engine cooling system or significant coolant loss.
3. The coolant heater shall be provided with a 24VDC thermostat, installed at the engine thermostat housing. An AC power connection box shall be provided for a single AC power connection to the coolant heater system.
4. The coolant heater(s) shall be sized as recommended by the engine manufacturer to warm the engine to a minimum of 100F (40C) in a 40F ambient, in compliance with NFPA110 requirements, or the temperature required for starting and load pickup requirements of this specification.

J. The AC generator shall be synchronous, four pole, 2/3 pitch, revolving field, drip-proof construction, single pre-lubricated sealed bearing, air cooled by a direct drive centrifugal blower fan, and directly connected to the engine with flexible drive disc. All insulation system components shall meet NEMA MG1 temperature limits for Class H insulation system. Actual temperature rise measured by resistance method at full load shall not exceed 125 degrees Centigrade.

K. The generator shall deliver rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage.

L. A permanent magnet generator (PMG) shall be included to provide a reliable source of excitation power for optimum motor starting and short circuit performance. The PMG and controls shall be capable of sustaining and regulating current supplied to a single phase or three-phase fault at approximately 300% of rated current for not more than 10 seconds. A 120-volt generator condensation heater shall be provided. The heater shall be sized as recommended by the equipment manufacturer. The contractor shall provide a branch circuit sized to match heater requirements.

M. The sub transient reactance of the alternator shall not exceed 12 percent, based on the

standby rating of the generator set.

N. A sub-base fuel tank shall be provided for generator. The fuel tank shall be a UL listed, double wall construction, sub-base mounted tank, and shall be designed, constructed, and installed in accordance with NFPA standards for storage and handling of double wall No. 2 diesel oil. Fuel tank shall include leak detectors in the double wall lining of the tank and a low fuel alarm and shall sound an alarm at the remote alarm panel. Tank shall be sized for 100% load for 72-hours. Tank shall have four extra 2" ports and fuel port located outside of the genset enclosure. All fuel gauges shall be easily accessible and visual.

O. Generator set housing shall be provided factory-assembled to generator set base and radiator cowling. Housing shall provide ample airflow for generator set operation at rated load in the ambient conditions previously specified. Housing shall provide vertical air discharge. The housing shall have hinged side-access doors and rear control door. All doors shall be lockable. The enclosure shall be level 1 (69.7dBA @23'). All sheet metal shall be primed for corrosion protection and finish painted with the manufacturer's standard color using a twostep electro-coating paint process, or equal meeting the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating, which meets the following requirements:
   1. Primer thickness, 0.5-2.0 mils. Topcoat thickness, 0.8-1.2 mils.
   2. Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.
   3. Crosshatch adhesion, per ASTM D3359-93, 4B-5B.
   4. Impact resistance, per ASTM D2794-93, 120-160 inch-pounds.
   5. Salt Spray, per ASTM B117-90, 1000+ hours.
   6. Humidity, per ASTM D2247-92, 1000+ hours. Water Soak, per ASTM D2247-92, 1000+ hours.

P. Include in generator housing lights at the engine and at the alternator and control panel. Provide step down transformer with fused protection, and toggle switches as required for proper operation of lights.

Q. Painting of hoses, clamps, wiring harnesses, and other non-metallic service parts shall not be acceptable. Fasteners used shall be corrosion resistant and designed to minimize marring of the painted surface when removed for normal installation or service work.

R. Diesel engine-generator sets shall be:
30KW/37.5KVA – Cummins model C30 D6 w/Sound Level 1 Enclosure (69.7dBA @ 23') with a 80 Gallon UL 142 Sub-Base Tank or equal.

S. Automatic Transfer Switch Shall be;
100A OTPC Transfer Switch, 3ph, 3-Pole, 208V, NEMA 3X, Open Transition or equal.

2.2 ENGINE-GENERATOR SET CONTROLS

A. Engine-Generator Set Control: The generator set shall be provided with a microprocessor-based control system designed to provide automatic starting, monitoring, and control functions for the generator set. The control system shall also be designed to allow local monitoring and control of the generator set, and remote monitoring and control as described in this specification. The control shall be mounted

at the location shown on the project drawings for medium voltage applications, and on the generator set for 600 volt and lower applications. When mounted on the generator set the control shall be vibration isolated and prototype tested to verify the durability of all components in the system under the vibration conditions encountered. The control shall be UL508 listed and labeled, CSA282-M1989 certified, and meet IEC8528 part 4. All switches, lamps and meters shall be oil-tight and dust-tight, and the enclosure door shall be gasketed. There shall be no exposed points in the control (with the door open) that operate in excess of 50 volts. The controls shall meet or exceed the requirements of Mil-Std 461C part 9, and IEC Std 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions. The entire control shall be tested and meet the requirements of IEEE587 for voltage surge resistance. The generator set mounted control shall include the following features and functions:

1. Three-position control switch labeled RUN/OFF/AUTO. In the RUN position the generator set shall automatically start, and accelerate to rated speed and voltage. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage.
2. Red "mushroom-head" push-button EMERGENCY STOP switch. Depressing the emergency stop switch shall cause the generator set to immediately shut down, and be locked out from automatic restarting.
3. Push-button RESET switch. The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.
4. Push-button PANEL LAMP switch. Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

B. Generator Set AC Output Metering: The generator set shall be provided with a metering set with the following features and functions:
   1. 2.5-inch, 90-degree scale analog voltmeter, ammeter, frequency meter, and kilowatt (KW) meter. These meters shall be provided with a phase select switch and an indicating lamp for upper and lower scale on the meters. Ammeter and KW meter scales shall be color coded in the following fashion: readings from 0-90% of generator set standby rating: green; readings from 90-100% of standby rating: amber; readings in excess of 100%: red.
   2. Digital metering set, 0.5% accuracy, to indicate generator RMS voltage and current, frequency, output current, output KW, KW-hours, and power factor. Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to neutral or line to line) simultaneously.

C. Generator Set Alarm and Status Message Display: The generator set shall be provided with alarm and status indicating lamps to indicate non-automatic generator status, and existing alarm and shutdown conditions. The lamps shall be high-intensity LED type. The lamp condition shall be clearly apparent under bright room lighting conditions. The generator set control shall indicate the existence of the following alarm and shutdown conditions on a digital display panel:
   1. low oil pressure (alarm)
   2. low oil pressure (shutdown)
   3. oil pressure sender failure (alarm)
   4. low coolant temperature (alarm)
   5. high coolant temperature (alarm)
   6. high coolant temperature (shutdown)

7. engine temperature sender failure (alarm)
8. low coolant level (alarm or shutdown--selectable)
9. fail to crank (shutdown)
10. overcrank (shutdown)
11. overspeed (shutdown)
12. low DC voltage (alarm)
13. high DC voltage (alarm)
14. weak battery (alarm)
15. low fuel-daytank (alarm)
16. high AC voltage (shutdown)
17. low AC voltage (shutdown)
18. under frequency (shutdown)
19. over current (warning)
20. over current (shutdown)
21. short circuit (shutdown)
22. ground fault (alarm)(optional--when required by code or specified)
23. over load (alarm)
24. emergency stop (shutdown)

D. In addition, provisions shall be made for indication of two customer-specified alarm or shutdown conditions. Labeling of the customer-specified alarm or shutdown conditions shall be of the same type and quality as the above specified conditions. The non-automatic indicating lamp shall be red, and shall flash to indicate that the generator set is not able to automatically respond to a command to start from a remote location.

E. Engine Status Monitoring: The following information shall be available from a digital status panel on the generator set control:
1. engine oil pressure (psi or kPA)
2. engine coolant temperature (degrees F or C)
3. engine oil temperature (degrees F or C)
4. engine speed (rpm)
5. number of hours of operation (hours)
6. number of start attempts
7. battery voltage (DC volts)

F. Control Functions: The control system provided shall include a cycle cranking system, which allows for user selected crank time, rest time, and # of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest period between cranking periods.

G. The control system shall include an idle mode control, which allows the engine to run in idle mode in the RUN position only. In this mode, the alternator excitation system shall be disabled.

H. The control system shall include an engine governor control, which functions to provide steady state frequency regulation as noted elsewhere in this specification. The governor control shall include adjustments for gain, damping, and a ramping function to control engine speed and limit exhaust smoke while the unit is starting. The governor control shall be suitable for use in paralleling applications without component changes.

I. The control system shall include time delay start (adjustable 0-300 seconds) and time delay stop (adjustable 0-600 seconds) functions.

J. The control system shall include sender failure monitoring logic for speed sensing, oil pressure, and engine temperature that is capable of discriminating between failed sender or wiring components, and an actual failure conditions.

K. Alternator Control Functions: The generator set shall include an automatic voltage regulation system that is matched and prototype tested with the governing system provided. It shall be immune from mis-operation due to load-induced voltage waveform distortion and provide a pulse width modulated output to the alternator exciter. The voltage regulation system shall be equipped with three-phase RMS sensing and shall control buildup of AC generator voltage to provide a linear rise and limit overshoot. The system shall include a torque-matching characteristic, which shall reduce output voltage in proportion to frequency below a threshold of [58-59] HZ. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments shall be broad range, and made via digital raise-lower switches, with an alphanumeric LED readout to indicate setting level.

L. The voltage regulation system shall include provisions for reactive load sharing and electronic voltage matching for paralleling applications. Motorized voltage adjust pot is not acceptable for voltage matching.

M. Controls shall be provided to monitor the output current of the generator set and initiate an alarm when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when output current level approaches the thermal damage point of the alternator.

N. Controls shall be provided to monitor the KW load on the generator set, and initiate an alarm condition when total load on the generator set exceeds the generator set rating for in excess of 5 seconds.

O. Controls shall include a load shed control, to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

P. An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdown of the generator set when alternator output voltage exceeds 110% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

Q. A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 10VDC or more than 16 VDC. During engine starting, the low voltage limit shall be disabled, and if DC voltage drops to less than 7 volts for more than two seconds a "weak battery" alarm shall be initiated.

R. When required by National Electrical Code or indicated on project drawings, the control system shall include a ground fault monitoring relay. The relay shall be adjustable from 100-1200 amps, and include adjustable time delay of 0-1.0 seconds. The relay shall be for indication only, and not trip or shut down the generator set. Note bonding and grounding requirements for the generator set, and provide relay which will function correctly in system as installed.

S. Control panel shall be Cummins Power Systems Power Command PCC 2100, or equal.

2.3 AUTOMATIC TRANSFER SWITCH

A. The Electrical Contractor shall furnish and install automatic transfer switches as described herein and as shown on the Drawings. The unit shall work together as a system for detecting normal power failure, starting the stand-by power system, and transferring the loads. The unit shall be UL listed and shall have a 24-hour continuous duty rating.

B. Transfer switch shall include a 2-year, comprehensive warranty.

C. Sequence of Operation: When the voltage on any phase of the normal source is reduced to 70% of rated voltage for 3 seconds a pilot contact shall close to initiate starting of the standby plant. When the standby plant is delivering not less than 90% of rated voltage and 95% of rated frequency, the load shall be transferred to the emergency source. When the normal source has been restored to not less than 90% of rated voltage on all phases, the load shall be transferred to the normal source after a time delay of 0 to 30 minutes (adjustable). The standby plant shall run for 10 minutes (adjustable) unloaded and then automatically shut down and be ready to start upon the next failure of the normal source. If the standby plant should fail while carrying the load, retransfer to the normal source shall be made instantaneously upon restoration of the normal source on all phases. Inspection and operational tests shall be conducted in the presence of the Architect, to indicate that the switch satisfies the specifications.

D. The transfer switch shall be furnished with an accessories package containing the following items:
   1. Auxiliary contacts operate on normal line failure.
   2. Auxiliary contact closed on emergency.
   3. Auxiliary contact closed on normal.
   4. Pilot light to indicate switch is in emergency position.
   5. Pilot light to indicate switch is in normal position.
   6. Solid state undervoltage sensing - three phase.
   7. Adjustable time delay on retransfer to normal.
   8. Adjustable time delay on transfer to emergency.
   9. Push-Button retransfer to normal.
   10. Push-Button transfer to emergency.
   11. In-phase transfer monitor.

E. Construction and Performance: The automatic transfer switch shall be a double throw switch operated by a reliable electrical mechanism momentarily energized. There shall be a direct mechanical coupling to facilitate transfer in 3 cycles or less. The normal and emergency contacts shall be mechanically interlocked such that failure of any coil or disarrangement of any part shall not permit a neutral position.

F. The ATS shall be a 3-Pole, Solid Neutral transfer switch, with a time delay neutral position or in-phase monitor. The neutral conductor shall not be switched. ATS shall have a delayed neutral position to allow motor voltage transients to decay before transferring two live sources.

G. The contact structure shall consist of a main current carrying contact, which is a silver alloy with a minimum of 50% silver content. The main current carrying contacts shall be protected by refractory arcing contacts on all sizes. Main and arcing contacts shall be fully visible without major disassembly to facilitate inspection and maintenance. All relays shall be continuous duty industrial type with wiping contacts. All Owner interface

contacts shall be rated 10 amperes minimum. All coils, relays, timers and accessories shall be readily front accessible.

H. A manual handle shall be provided for maintenance purposes. A disconnect switch shall be provided to defeat automatic operation during maintenance, inspection or manual operation. The switch shall be mounted in a NEMA enclosure suitable for the environment in which it is installed.

I. Switches composed of molded case breakers, motor starters or other components not specifically designed for automatic transfer switch duty will not be approved.

J. The transfer switch shall be Asco 300 series, or Onan OTPC series, or approved equal.

K. Automatic Transfer Switch Shall be;
100A OTPC Transfer Switch, 3ph, 3-Pole, 208V, NEMA 3X, Open Transition or equal.

2.4 SUB-BASE DIESEL FUEL TANK

A. The subbase fuel tank shall be UL 142 listed, with decking and handrails and have a capacity of 80 gallons (or as required for 24 hours of operation of the generator at 100% load). It shall be UL 142 listed and labeled. The tank shall have the following features:
1. Tank rails and lifting eyes rated for the full dry weight of the tank, genset, and enclosure.
2. Electrical stub ups.
3. Normal and emergency vents
4. Lockable fuel fill
5. Mechanical fuel level gauge
6. High and low level switches to indicated fuel level
7. Leak detector switch.
8. The sub base tank shall include a welded steel containment basin, sized at minimum of 110% of the tank capacity to prevent escape of fuel into the environment in the event of a tank rupture.
9. Fill port with overfill prevention valve.
10. 5 gallon fill/spill dam or bucket
11. Tank design shall meet the regional requirements for the Project location.

2.5 FUEL MAINTENANCE SYSTEM

A. The subbase fuel tank shall have a fuel maintenance system: AXI #STS-6000-SX-F. The system shall have a minimum flow rate of 3,600 gallons per day and be powered by a 120V, 1P electrical connection.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Installation shall comply with applicable codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products.

B. Installation of equipment shall include furnishing and installing all interconnecting wiring between all major equipment provided for the on-site power system. The contractor shall also perform interconnecting wiring between equipment sections (when required),

under the supervision of the equipment supplier.

C. Equipment shall be installed on concrete housekeeping pads. Equipment shall be permanently fastened to the pad in accordance with manufacturer's instructions and seismic requirements of the site.

D. Equipment shall be initially started and operated by representatives of the manufacturer.

E. All equipment shall be physically inspected for damage. Scratches and other installation damage shall be repaired prior to final system testing. Equipment shall be thoroughly cleaned to remove all dirt and construction debris prior to final testing of the system.

3.2 COORDINATION OF CONTROLS

A. The contractor shall install control wiring as required to properly start and stop the new generator. Contractor shall also be responsible for coordinating the installation of control wiring between the existing transfer switches in the individual buildings with the new service entrance transfer switch to properly start and stop the new generator. Contractor will need to contact the manufacturers of the new and the existing transfer switches to insure the correct control wiring is installed, terminated, and any required start/stop sequencing controls are properly programmed.

3.3 FACTORY TESTS

A. Equipment supplied shall be fully tested at the factory for function and performance.

B. Generator set factory tests on the equipment shall be performed at rated load and rated PF. Generator sets that have not been factory tested at rated PF will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and function of safety shutdowns. Provide a certified factory test report to engineer.

C. Transfer equipment factory tests: Each transfer switch supplied shall be factory tested before shipment. Factory tests shall include a complete functional test of the transfer switch controls, including calibration of the voltage sensors.

3.4 TRAINING

A. The equipment supplier shall provide training for the facility operating personnel covering operation and maintenance of the equipment provided. The training program shall be not less than 4 hours in duration and the class size shall be limited to 5 persons. Training date shall be coordinated with the facility owner.

- END OF SECTION -

SECTION 16500 – LIGHTING

PART 1 -- GENERAL

1.1 LIGHTING SCHEDULE

A. The Contractor shall install lighting fixtures and accessories as shown on the drawings and/or described herein. The Contractor shall also install lamps for all fixtures.

PART 2 -- PRODUCTS

2.1 LED LIGHTING

A. Lighting fixtures with LED light sources shall meet the following fixture and light source requirements:
   1. LED Color Temperature – Cool White (CW), 5800K nom., CRI > 70
   2. Line Voltage – Universal Voltage 120-277 volts
   3. Governmental Standards – LM79 and LM80 Compliant
   4. Expected Lamp Life – LED Life Rating (L_{70} B_{10}) to be 60,000 hours to 100,000 hours; Defined as time of operation (in hours) to 30% lumen depreciation (i.e. 70% lumen maintenance), derived from Luminaire in-situ temperature measurement testing (i.e. LED chip package temperature (T_S) measurement obtained with the LED chip package operating in given luminaire and in a given stabilized ambient environment) under UL1598 environments and directly correlated to LED package manufacturers IESNA LM-80-08 data. Predicted (L_{70} B_{10}) Limits (@ 25°C luminaire ambient operating environment): Greater than 60,000 hours @ 350mA Drive Current
   5. Driver – Components must be fully encased in potting material for moisture resistance, and must comply with IEC and FCC standards
   6. Surge Protection – Surge protection must be provided including separate sure protection built into electronic driver
   7. Mechanical – Luminaire LED system components to be low copper aluminum, with high performance heat sink(s) designed specifically for LED luminaires. No active cooling features (Fans, etc.). Luminaire configuration must allow for modular upgradability and/or field repair of all electrical components (i.e. LED modules, Driver(s), etc.). Drivers and vertical light bars must be all mounted to a twist-lock tool-less assembly for ease of installation and trouble- shooting.

2.2 OCCUPANCY SENSORS

A. Sensor shall be a self-contained dual voltage ceiling mounted device capable of directly switching loads upon detection of human activity. Sensor must be circular, and mount to either a single gang enclosure, or surface mount to a round pancake box.

B. Sensor must be rated for 120 through 277 VAC and be capable of switching zero to 1200 watts of electronic ballast loads. Sensors must be capable of parallel wiring for multi-sensor applications.

C. Sensor time delay shall be factory set for typical applications, and field adjustable from 30 seconds to 20 minutes. Sensor must provide a green LED motion indicator. Red LED denoting life safety shall not be permitted.

D. PIR sensing must utilize a high density Fresnel domed lens, providing a circular view pattern of at least 360 degrees by 56 degrees.

E. Passive Dual Technology (PDT) sensing must incorporate PIR with Microphonics, which utilizes a passive microphone with automatic gain control (AGC) to sense both occupants moving and sounds. The PIR must be used to initiate an on condition, once on the PIR or Microphonics shall keep the load on. After the time delay expires and the load goes off, the Microphonics shall remain active up to 10 seconds as a back-up grace period.

F. Wall box mounted occupancy sensors shall mount in a standard utility box. Sensor shall have self-contained relay (no power pack required), utilize PIR and microphonics detection, and include auto sensitivity adjustment. Wall box sensor shall be intrinsically grounded and include ON/OFF switch and adjustable time delay.

G. Occupancy Sensor:
   1. Ceiling mount for offices and restrooms – Lutron #LOS-CUS-1000-WH / PP-DV; Wattstopper UT-305-2/BZ-50; Sensor Switch CM PDT9
   2. Wall mount for offices, storage rooms, etc. – Lutron #MS+OPS6M-DV-color; Wattstopper WD-170-FINISH; Sensor Switch WSX
   3. Ceiling mount in large rooms – Lutron #LOS-CDT-2000WH, with #PP-DV universal power pack; Wattstopper DT-205 / BZ-50; Sensor Switch CM PDT10 with PP16
   4. Wall/ceiling mount at end of corridors – Lutron #LOS-WIR-WH / PP-DV 1600'ft coverage; Wattstopper CX-105 / BZ-50; Sensor Switch WV16 with PP16
   5. Wall/ceiling mount at center of corridors – Watt Stopper #CX-100-3 series, with #BZ-50 universal power pack; Sensor Switch WV16 with PP16
   6. Room controllers – Wattstopper #LMRC-101; nLight #nPP 16

2.3 FIXTURES

A. Fixtures as described in the Fixture Schedule on the drawings shall be furnished by the Contractor and shall be properly installed.

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Unless otherwise specified, lighting fixtures shall be permanently installed and connected to the wiring system.

B. The Contractor shall support each fixture, independently from the building structure. Ceiling framing members shall not be used to support fixtures except in specified areas where ceiling supports for this purpose have been specified elsewhere in these specifications. Each fixture shall have at least two fixture supports.

C. Flexible conduit used for fixture whips shall be at least twelve (12) inches, but not more than 48 inches long.

3.2 CEILING COMPATIBILITY

A. Catalog numbers shown on the drawings or descriptions of lighting fixtures contained herein may indicate fixture compatibility with certain types of ceiling construction. Contractor shall determine exact type of ceiling actually to be furnished in each area and shall obtain fixtures to suit, deviation from specified catalogue numbers or descriptions only where necessary and only to the extent necessary to insure fixture/ceiling compatibility.

3.3 **LIGHT LEAKS**

A. The Contractor shall, at the end of this project, adjust all recessed lighting fixtures so that there will be no light leaks between the fixture trim and the ceiling. Contractor shall also adjust recessed fluorescent fixtures to eliminate any light leaks between fixture trim and ceiling grid member.

3.4 **LAMPS**

A. The Contractor shall install lamps in all fixtures and shall obtain replacement lamps should any not properly operate or become damaged during construction.

3.5 **EXIT FIXTURES**

A. Exit fixtures shall be installed according to Life Safety Code requirements, with face(s) plainly visible and directional arrows indicating the proper direction of egress.

- END OF SECTION -

SECTION 16800 – SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

PART 1 -- SCADA SYSTEM SCOPE OF WORK

1.1 OVERVIEW

A. The New River in Ascension Parish is receiving a tilting weir structure by this project and will have four (4) new tilting weirs installed.

B. The new weir structure will require water level monitoring and tilt weir open and closing.

1.2 SCADA SYSTEM EQUIPMENT

A. The Laurel Ridge Levee SCADA scope of work for this document will consist of the following for each outfall location:
   1. Installation of a concrete slab and panel rack
   2. Installation of power disconnect switch
   3. Installation of a control and communications panel
   4. Installation of a level transmitter and mounting brackets
   5. Installation of an electric actuator for the gate
   6. Cabling from the control and communication panel to the level transmitter and actuator

1.3 SCADA SYSTEM FUNCTION

A. Each control/communication panel will consist of the required equipment to perform the following:
   1. Monitor outfall water level
   2. Open/close weir as required to control outfall water level at a pre-determined level
   3. Communicate outfall water level to a central monitoring station
   4. Communicate outfall weir status (open/closed) to a central monitoring station
   5. Communicate equipment status, equipment failure, power failure to a central monitoring station
   6. Log water level, gate status, equipment status, power failure and communicate to a central monitoring station server for historization
   7. Trigger alarms and send SMS messages based on operational data

1.4 POWER

A. 208V, 3 Phase power and a meter will be provided on a pole close to each outfall location

PART 2 -- SCADA SYSTEM GENERAL INFORMATION

2.1 GENERAL

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, start-up and place in satisfactory operation a complete Supervisory Control And Data Acquisition (SCADA) System.

B. SCADA System shall be designed to control, monitor, store, display and log process and equipment operating information and to perform various process control functions and

generate various reports.

C. Specifications and Sections that describe the overall SCADA System functional and operational requirements are located throughout this document.

2.2 QUALITY ASSURANCE

A. General:
1. The SCADA System shall be furnished by a single CONTRACTOR who shall assume responsibility for providing a complete and integrated system.
2. All equipment, components, and materials required shall be furnished by the single CONTRACTOR who shall assume the responsibility for adequacy and performance of all items.
3. The CONTRACTOR shall supply its company's Quality Assurance Plan for the SCADA system and all equipment required by this project.

B. CONTRACTOR shall;
1. Be a financially sound firm having at least five years continuous experience in designing, implementing, supplying and supporting instrumentation and control systems that are comparable to this SCADA System in terms of hardware, software, cost and complexity.
2. Have been the principal integrator on standard lines of digital processing and control equipment and application software continuously for the last five years.
3. Have in existence at the time of bid advertisement, an experienced engineering and technical staff capable of designing, implementing, supplying and supporting the SCADA System and handling the SCADA System submittal and training requirements.
4. Provide system hardware components and software packages of fully developed, field proven standardized designs and therefore shall furnish a system that is not a highly unique, custom one-of-a-kind system.
5. Have a minimum of five years' experience in hardware application and programming of distributed microprocessor-based controllers and data highway systems.
6. Provide training in general process control applications and in operation, programming and maintenance of the control system and equipment.
7. Have a demonstrated record of prompt response to field failures.
8. Have a UL approved panel shop.
9. Have a record of prompt shipments in accordance with contract obligations required for previous projects.

C. Technical Proposal Requirements: The CONTRACTOR shall submit to OWNER a copy of a Technical Proposal. The Technical Proposal shall be submitted 10 days after the Notice to Proceed. The proposal shall be complete and contain all information as specified below.
1. Financial Statement: Include the value of distributed microprocessor-based control systems delivered during the last five fiscal years. Also, include the value of other process instrumentation and controls shipped during the period.
2. Experience:
   a. Provide evidence of compliance with the specific experience requirements listed in Paragraph B.1 and B.2 above, in the form of an experience certification signed by an officer of the company.
   b. Describe at least three completed municipal projects utilizing instrumentation and control equipment identical to or similar to this project. Indicate owner, value, and completion date.
3. Personnel: Provide a listing of those personnel committed to be assigned to the

Project. List shall include Field Engineer, Field Technician, and others as required.

4. Exceptions: List all exceptions and deviations from the requirements of these Specifications. Reference Section Number, Article, and Paragraph of proposed variance and provide an explanation of why the proposed substitution meets (or exceeds) the functional or equipment requirements specified.
5. SCADA Hardware and Software:
    a. Provide a general system configuration drawing and include designations for model numbers and types of the proposed SCADA System and all other proposed system components.
    b. Provide descriptive literature and manufacturer's catalog information covering all aspects of the hardware design, functions and capabilities of the specific system proposed for the SCADA System.
    c. Describe standard software packages proposed, including any customized software required to meet the functional intent of the system specifications. Descriptions shall address the following:
        1) Overview of system software including the functions, organization and interrelationship of the major software modules provided.
        2) Estimated memory requirements to accomplish the specified graphic display, logging, reporting and alarming functional requirements.
        3) Real-time data logging and reporting software features and capabilities including examples of logs and reports, procedures for automatic reporting and logging file setups, limitations on sampling and computing frequency for data acquisition and logging, and utilities for log file and report modifications and file maintenance.
        4) Alarm handling software features and capabilities including an alarm display example, methods of defining alarms and alarm files, automatic printing of alarms, acknowledgements and return to normal conditions, chronological sorting and time-tagging of alarms, and alarm file maintenance utilities.
        5) Distributed system programming and documentation software features and capabilities, including screen display and printout examples for a fully annotated and cross-referenced ladder diagram and ladder and function block elements.
        6) All PLC programs including database shall be provided to establish communication between the PLC and SCADA System that are provided independent of this Contract.
        7) All PLC programming and Human Machine Interface (HMI) software configuration documents, features and capabilities, including screen display and printout examples for a fully annotated and cross-referenced ladder function block diagram and the ladder and function block elements.
        8) Use of system level diagnostics for monitoring the performance of and detecting and reporting faults associated with the SCADA system.
6. Panel Mounted Devices: Provide descriptive literature and catalog cuts for each type of sensor, transmitter, indicator, and other such devices required by the Project.
7. Training: Provide information and literature as to the organization proposed to be utilized for the training specified.
8. Start-Up and Field Testing: Indicate how commissioning will be accomplished.
9. Maintenance: Provide the following information:
    a. Location of service facility along with minimum and maximum response time.
    b. Location of parts with estimated delivery time for all provided equipment.

D. CONTRACTOR Responsibility:

1. CONTRACTOR shall be responsible for the following:
    a. Design, fabrication, implementation and applications programming of the SCADA and all subsystems in accordance with the Contract Documents and all referenced standards and codes.
    b. Preparation, assembly and correction of all SCADA System submittals in accordance with the Contract Documents.
    c. Proper interfacing of the SCADA System hardware, software, field devices and panels, including required interfacing with packaged control systems furnished by other equipment suppliers, and with the plant electrical system.
    d. Supervision of the installation of SCADA System, instruments, panels, consoles, cabinets, wiring and other components required.
    e. Calibration, testing and start-up of the SCADA System.
    f. Handling of all warranty obligations for the control system components.
    g. Maintenance of two reproducible copies of the complete system and running software at the Supplier's facility for the duration of the warranty period. Software copies shall be maintained on the bulk storage medium used by the Supplier for system program development and shall be directly loadable on the supplied system.

E. Reference Standards:
1. The following organizations have generated standards that are to be used as guides in assuring quality and reliability of components and systems; govern nomenclature; define parameters of configuration and construction, in addition to specific details in the Contract Documents:
    a. The International Society of Automation, (ISA).
    b. Underwriters' Laboratories, Inc., (UL).
    c. National Electrical Manufacturers Association, (NEMA)
    k. Institute of Electrical and Electronic Engineers, (IEEE).
    l. National Electrical Code, (NEC).

2.3 COORDINATION AND PROGRESS MEETINGS

A. CONTRACTOR shall be responsible for scheduling and coordinating the system installation with regard to all other Work on the Site and in accordance with the provisions of the General Conditions. Said coordination shall be documented on the Project Schedule.

B. Routine progress and coordination meetings will be scheduled by ENGINEER. CONTRACTOR shall be required to attend meetings each month.

C. The purpose of the meetings shall be to review the progress of the work involving the SCADA System and provide coordination for installation of the equipment to ensure Project Schedule is met and to minimize disruption of current plant operations.

D. Representatives at the meetings shall have the competence and authority to make any and all necessary decisions. Decisions and statements made at the meetings shall commit CONTRACTOR to agreed procedures and schedules.

2.4 SCADA SYSTEM SUPPLIER PROJECT PERSONNEL

A. CONTRACTOR shall provide the following project personnel:
1. Field Engineer:
    a. The CONTRACTOR shall provide a Field Engineer with responsibilities as follows:

1) Installed system checkout, calibration, adjustment and start-up including tuning of every control loop.
2) Maintenance services during availability demonstration.
3) Involvement in the on-site system training of plant personnel.
4) Resolving of control problems encountered during initial start-up and testing of all SCADA System equipment.

b. The Field Engineer shall have a minimum of five years experience in systems engineering and start-up and shall have a thorough working knowledge of both the hardware and software supplied for the SCADA System.

2.5 SUBMITTALS

A. Shop Drawings:

1. General:
   a. Shop Drawing submittals shall be in accordance with the requirements of the Contract Documents.
   b. Shop Drawings preparation shall not commence until after the Pre-Submittal Conference specified below.
   c. Manufacture of the SCADA System shall not commence until related submittals have been approved by ENGINEER.
   d. Shop Drawings shall be submitted in complete packages grouped to permit review of related items as generally outlined in Paragraph 1.5.A.3, below.
   e. Review of Shop Drawings will be for conformance with Contract Documents and with regard to functions specified to be provided.
   f. Final and approved copies of all Shop Drawings shall be provided in AutoCAD or other approved format.
2. Pre-Submittal Conference:
   a. CONTRACTOR shall arrange and conduct a Pre-Submittal Meeting on the SCADA System within 20 business days of notification of preliminary acceptance by OWNER.
   b. Pre-Submittal Meeting shall be attended by representatives of CONTRACTOR, OWNER, and ENGINEER. The meeting shall be held in the ENGINEERS office.
   c. Purpose of the Pre-Submittal Meeting shall be to review informally and accept the manner in which the SCADA System Supplier intends to respond to the requirements of the Contract Documents before any submittals are prepared.
   d. CONTRACTOR shall prepare the items listed below for presentation at the Pre-Submittal Conference. The information shall be submitted to ENGINEER three weeks prior to the date of the conference.
      1) List of equipment and materials required for the SCADA System and the brand and model, which CONTRACTOR proposes to use for each item.
      2) List of proposed exceptions to the Contract Documents along with a brief explanation of each. Approval shall be subject to a formal submittal.
      3) Sample of each type of submittal specified herein. The samples may be submittals prepared for other projects.
      4) Schedule for all SCADA System related activities from the Pre-Submittal Meeting through start-up and training. Particular emphasis shall be given to dates relative to submittals, design, fabrication, programming, factory testing, deliveries, installation and field-testing. The schedule shall be subdivided to show activities relative to each

major item or group of items when everything in a given group is on the same schedule. The schedule should be prepared using Microsoft Project or other approved schedule development software.

5) General outline of the type of tests to be performed to verify that all sensors/transducers, instruments and digital processing equipment are functioning properly.

3. Submittal Requirements:

a. Product information for all sensors/transducers and field and panel instruments, include the following:

1) Manufacturer's product name, serial number and model number.
2) Instrument tag number.
3) Manufacturers standard catalog product data.
4) Performance and operation data.
5) Installation and mounting details, instructions and recommendations.
6) Dimensions.
7) Range of each device and calibration information.
8) Descriptions of materials of construction and a listing of NEMA ratings for all equipment.

b. SCADA System Information:

1) System Description:

a) Detailed block diagram showing system hardware configuration and identifying model numbers of system components.
b) Software language and organization.
c) Format, protocol and procedures for data highway communications and local communications with input/ output modules and peripheral devices.
d) Human-machine interfacing details.
e) Control and failure modes.
f) On-line and off-line capabilities for programming, system utilities and diagnostics.
g) Input/output point listing with I/O module cross-reference identification for each distributed controller.
h) Data base listing including all input/output points.
i) Suggested detailed format and configuration of all log reports, alarm summaries, printer outputs, screen displays and graphics.
j) List of spare parts and test equipment.

2) Equipment Hardware:

a) Layout drawings showing front, rear, end and plan views to scale of all processing equipment, I/O components, power supplies and peripheral devices.
b) Construction details, features and procedures.
c) Interconnection diagrams including termination details, cable identification list and cable length.
e) Plans showing equipment layout in control panels.
f) Installation requirements, instructions and/or recommendations.

3) PLC Description:

a) Standard technical documentation covering all aspects of the PLC system software functions and capabilities, including instruction set description and programming procedures related to control, monitoring, display, logging, reporting and alarming functions.
b) Standard technical and instructional documentation covering software for utility, system support, system documentation,

display, communications, data logging and storage and diagnostic functions.

c) Documentation for all PLC programming and Human Machine Interface (HMI) software configuration including features and capabilities, screen display and printout examples of a fully annotated and cross-referenced ladder diagram and the ladder diagram elements.

d) Documentation of all PLC programs including the databases to establish communication between the PLC and SCADA System that are provided independent of this Contract.

c. Panels, Consoles and Cabinets Information:

1) Layout Drawings include the following:

a) Front, rear, and internal panel views to scale.

b) Dimensional information.

c) Tag number and functional name of components mounted in and on panel, console or cabinet.

d) Product information on all panel components.

e) Nameplate location and legend including text, letter size and colors to be used.

f) Location of anchoring connections and holes.

g) Location of external wiring and/or piping connections.

h) Mounting and installation details.

i) Proposed layouts and sizes of graphic display panels.

j) Calculations for heating and cooling.

k) Subpanel layouts and mounting details for all items located inside control panels.

l) Calculations of estimated electrical power demand and expected run time of the Uninterruptible Power Supply (UPS).

2) Wiring diagrams include the following:

a) Name of panel, console or cabinet.

b) Wiring sizes and types.

c) Piping sizes and types.

d) Terminal strip numbers.

e) Color coding.

f) Functional name and manufacturer's designation for

d. Bill of Materials for each panel including tag number, manufacturer, model number and quantity.

e. Instrument loop diagrams for all control and monitoring loops

1) Layout Drawings include the following:

a) Shall be prepared using AutoCAD.

b) Dimensional information.

c) Construction materials.

d) Bill of Materials for each console.

e) Location of external wiring connections.

f) Mounting and installation details.

2) Panel internal point-to-point wiring diagrams, include the following:

a) Name of console.

b) Wiring sizes, types, and numbers.

c) Terminal strip and post numbers for all interconnections.

d) Color coding.

e) Functional name and manufacturer's designation for components

to which wiring and piping are connected.

f. SCADA I/O Loop Wiring Diagrams: Prepare drawings on a module-by-module basis and include the following information:
   1) Rack numbers, slot number, module type and module terminal point numbers. Also, include location and identification of all intermediate panel terminal block and strip numbers to which I/O wiring and power supply wiring is connected. Identify all power supply circuit numbers and ratings.
   2) Wiring sizes, types, wire numbers and color-coding.
   3) Location, functional name, tag numbers and manufacturer model numbers of panel and field devices and instruments to which I/O wiring is connected

g. System Software Documentation: Prepare and submit two copies of preliminary software documentation at least four weeks prior to expected initiation of factory testing. Software documentation shall include the following as a minimum:
   1) Complete hard copies of all ladder diagram and function block programming.
   2) Complete listing of external and internal I/O address assignments, register assignments and preset constant values along with functional point descriptions. Also, list all unused/undefined I/O and data table registers available.
   3) Complete hard copies of all program documentation for all types of
   4) Complete database listing including listings for log, report and alarm file setups.
   5) Hard copies of all system graphic displays and formats for all logs, reports and the alarm summary.
   6) User's manuals describing procedures and providing examples for use of operator's consoles, workstations and programming terminal, accessories and system utility routines to perform control, display and logging program generation, program modification, program verification, diagnostics, program documentation, loading and backup and other required system support functions.

B. System Operation and Maintenance Manuals:
   1. Furnish two (2) sets of Operation and Maintenance Manuals for the SCADA system.
   2. The Operation and Maintenance Manuals shall include the following:
      a. Name, address and telephone number of the SCADA system local service representative.
      b. Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided.
      c. Copy of all approved submittal information and system Shop Drawings as specified herein with corrections made to reflect actual system as tested and delivered to the site for installation. Half-size black line reproductions shall be provided for all Shop Drawings larger than 11 by 17-inches.
      e. As-built system documentation.
      f. Manufacturer's Hardware, Software and Installation, Operations Manuals for the control panels, air conditioners and peripheral devices, and all other control system components.

C. Record Drawings and Documentation:
   1. CONTRACTOR shall revise all system Shop Drawings, submittals and software

documentation to reflect as-built conditions in accordance with the requirements of the Contract Documents.

2. One copy of all revised Shop Drawings and documentation shall be submitted to the ENGINEER to replace outdated drawings and documentation contained in the System Operation and Maintenance Manuals. Half-size black line sets shall be provided for all drawings larger than 11 by 17-inches. Specific instructions for outdated drawing removal and replacement shall be provided with the Record Drawing submittal.
3. Half-size black line prints of wiring diagrams applicable to each control panel shall be placed inside a clear plastic envelope and stored in a suitable print pocket or container inside each control panel.
4. When applicable, updated electronic copies of Record Drawings and Documentation will be provided in AutoCAD or the original software.

D. Reports:
1. Two copies of the following reports shall be submitted to ENGINEER:
a. Factory Test Reports.
b. Installation Inspection, Field Calibration, and Field-Testing Reports.

2.6 EQUIPMENT DELIVERY, HANDLIND, AND STORAGE

A. CONTRACTOR shall make all arrangements for transportation, delivery and storage of the equipment and materials in accordance with Transportation and Handling of Products, requirements of the system Supplier, and requirements of equipment manufacturers.

B. SCADA equipment shall be packaged at the test facility prior to shipment to protect each item from damage during shipment and storage. Containers shall be protected against impact, abrasion, corrosion, discoloration and/or other damages. Clearly label contents of each container and provide information on the required storage conditions necessary for the equipment.

C. CONTRACTOR shall make arrangements to store SCADA equipment in accordance with Storage and Protection of Products, and manufacturer's instructions and relevant organization standards. CONTRACTOR shall notify OWNER and ENGINEER in writing of the storage requirements and recommendations for the equipment prior to shipment.

PART 3 -- GENERAL DESIGN REQUIREMENTS

3.1 SCADA SYSTEM

A. The system shall be designed such that it is easily expandable while the system is on-line, and a system shut-down is not required.

B. The system components shall be the latest version.

C. Equipment that is still manufactured but not supported, no longer manufactured but still stocked, or obsolete will not be considered or used for this project.

D. The system spare parts and support must be readily available.

3.2 PANELS

A. Panels and enclosures shall meet the NEMA requirements for the type specified.

B. CONTRACTOR shall furnish panels and enclosures amply sized to house all equipment,

instruments, front panel mounted devices, power supplies, power distribution panels, wiring, and other components installed within, as required.

3.3 POWER SUPPLIES

A. All electrically powered equipment and devices shall be suitable for operation on 208/120-volt ±10 percent, 60 Hz ±2 Hz power. If a different voltage or closer regulation is required, a suitable regulator or transformer shall be provided.

B. Appropriate power supplies shall be furnished by CONTRACTOR for all two wire transmitters, loops for monitoring discrete inputs and all necessary outputs. Power supplies shall be mounted in enclosures and installed in the appropriate control room or field panel.

C. Design all power supplies for a minimum of 130 percent of the maximum simultaneous current draw.

D. Furnish a power on-off switch or an air circuit breaker for each item requiring electrical power.

E. Provide isolation transformers, line voltage regulators and power distribution panels for the distributed digital portions of the SCADA System to eliminate electrical noise and/or transients entering on the primary power line.

3.4 SIGNAL REQUIREMENTS

A. The control system shall be designed to use 4 to 20 mA DC analog signals, unless otherwise specified.

B. Provide signal converters and repeaters where required. Analog inputs to the distributed control system shall be through appropriate repeaters to provide signal isolation where series looped with other devices and to allow the loop to maintain integrity even if the SCADA system is out of service. Power supplies shall be sized adequately for signal converter and repeater loads.

C. Signals shall be isolated from ground.

D. Signals shall not have a transient DC voltage exceeding 300 volts over one millisecond nor a DC component over 300 volts.

E. All panels are to provide separate grounding terminals for signal ground and signal shields.

F. All field dry contacts (sourced by 120V AC from each PLC control cabinet) shall not be neutral switched.

3.5 MISCELLANEOUS

A. All instrumentation and SCADA System components shall be heavy-duty types, designed for continuous service in a municipal water/wastewater treatment plant environment. The system shall contain products of a single manufacturer, when possible, and consist of equipment models that are currently in production. All equipment provided shall be of modular construction and be capable of field expansion through the installation of plug-in circuit cards and additional cabinets as necessary. Design all logic and control loops to fail-safe.

B. All instrumentation and SCADA System components shall be designed to return automatically to accurate measurement within 60 seconds upon restoration of power after a power failure or when transferred to standby power supply or within limit stated by equipment manufacturer.

C. Surge protection shall be provided for all instruments and all other SCADA System components that could be damaged by electrical surges.

D. All field-mounted instruments and SCADA System components shall be designed for installation in humid and corrosive service conditions. All field mounted instrument enclosures, junction boxes and appurtenances shall conform to NEMA 4X requirements, unless otherwise specified.

E. All relays with interconnections to field devices shall be wired through terminal blocks. Terminals as part of the relay base are not an acceptable alternate.

F. All panel mounted instruments, switches, and other devices shall be selected and arranged to present a pleasing coordinated appearance. All front of panel mounted devices shall be of the same manufacturer and model line.

G. All components furnished, including field and rear of panel instruments, shall be tagged with the item number and nomenclature as shown on the Contract Documents.

H. Ranges and scales specified herein shall be coordinated to suit equipment actually furnished.

3.6 ENVIRONMENTAL CONDITIONS

A. The control system shall be designed and constructed for continuous operation under the following temperature and humidity conditions:
   a. Control Rooms:
      1) Ambient Temperature: 60ºF to 80ºF normal range; 40ºF to 105ºF occasional maximum extremes.
      2) Relative Humidity: 80 percent, normal; 95 percent maximum.
   b. Indoor locations for digital processing equipment hardware, control panels and instruments:
      1) Ambient Temperature: 40ºF to 120ºF.
      2) Relative Humidity: 98 percent maximum.
   c. Outdoor locations for panels:
      1) Ambient Temperature: -10ºF to 120ºF.
      2) Relative Humidity: 100 percent maximum.

3.7 SYSTEM DESIGN

A. CONTRACTOR shall submit a recommendation to ENGINEER for review of all ranges, scales and set points.

PART 4 -- PANELS AND ENCLOSURES

4.1 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as

shown, specified and required to furnish, install, calibrate, test, start-up and place into satisfactory operation all control panels and enclosures.

4.2 QUALITY ASSURANCE

A. Standards, Codes and Regulations:
   1. Construction of panels and the installation and interconnection of all equipment and devices mounted within shall comply with applicable provisions of the following standards, codes and regulations:
      a. National Electrical Code, (NEC)
      b. National Electrical Manufacturer's Association Standards, (NEMA)
      c. Underwriters Laboratory, Inc. (UL)
      d. State and Local code requirements
      e. Where any conflict arises between codes or standards, the more stringent requirement shall apply
   2. All materials and equipment shall be new and all panels shall be built in an Underwriters Laboratory, Inc. (UL) approved panel shop and bear the UL label.

4.3 GENERAL CONSTRUCTION REQUIREMENTS

A. Provide all electrical components and devices, support hardware, fasteners, and interconnecting wiring required to make the control panels and/or enclosures complete and operational.

B. Locate and install all devices and components so that connections can be easily made and that there is ample room for servicing each item.

C. Components for installation on panel exterior shall be located generally as shown. Layouts shall be submitted for review in accordance with SCADA System, General Requirements.

D. Adequately support and restrain all devices and components mounted on or within the panel to prevent any movement.

E. Provide sub-panels for installation of all relays and other internally mounted components.

F. All wiring to panel connections from field instruments, devices, and other panels shall be terminated at master numbered terminal strips, unless otherwise specified.

G. Provide copper grounding studs for all panel equipment.

H. Provide the following inside of each control panel:
   1. One 120 VAC, 20A duplex, grounding type receptacle.
   2. Panel cooling device.
      a. Ensure that temperature inside the panel does not exceed the equipment manufacturer’s maximum operating temperature rating with an ambient temperature of 95 ^{0}F and humidity of 85%.
      b. Calculations based on the above temperature and humidity and incorporating all panel equipment BTU’s shall be provided.
      c. Forced convection or a protective shade cover are the preferred methods of cooling. Air conditioning can be proposed if forced convection or a protective shade cover will not meet cooling requirements.
      d. Provide thermostats to automatically control cooling requirements without the need of manual operation of a switch.

3. Duplex receptacle and panel cooling device shall have its own circuit breaker.

4.4 IDENTIFICATION

A. Provide laminated plastic nameplates for identification of panels and components mounted thereon as follows:
   1. Nameplates shall be of 3/32-inch thick laminated phenolic type with black matte finish surface and white letter engraving.
   2. Panel identification nameplates to have 1/2-inch high letter engravings.
   3. Panel mounted component (e.g., control devices, indicating lights, selector switches, etc.) identification nameplates to have 1/4-inch high letter engravings.
   4. Nameplates shall be attached to the panel face with two stainless steel self-tapping screws.
   5. Nameplate engravings shall include the instrument or equipment tag number and descriptive title as shown and specified.

B. Tag all internally mounted instruments in accordance with the following requirements:
   1. Tag numbers shall be as listed in the Contract Documents.
   2. The identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping screws of appropriate size.
   3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.
   4. Identification tag shall be installed so that the numbers are easily visible to service personnel.
   5. Front of panel mounted instruments shall have the tag attached to rear of device.

C. Tagging of the following items shall be accomplished with the use of adhesive plastic Brady USA, Inc. labels, or equal.
   1. Tag all electrical devices (e.g., relays, timers, power supplies) mounted within control panels and enclosures.
   2. Numerically tag all terminal blocks.
   3. Numerically tag wiring at each end.

4.5 REQUIREMENTS

A. General:
   1. Panels and enclosures shall meet the NEMA requirements for the type specified.
   2. CONTRACTOR shall furnish panels and enclosures amply sized to house all equipment, instruments, front panel mounted devices, power supplies, power distribution panels, wiring, and other components installed within, as required.
   3. CONTRACTOR shall fabricate and install racks in field at all levee gate locations.

B. Construction Features:
   1. Control panels located in field shall be NEMA 4X rated.
      a. Panels shall be Type 316L stainless steel construction with a minimum thickness of 12-gauge for all surfaces (except those areas requiring reinforcement) having a smooth brushed finish.
      b. Stainless steel screw clamp assemblies on three sides of each door.
      c. Rolled lip around three sides of door and along top of enclosure opening.
      d. Hasp and staple for padlocking.
      e. Provide a clear plastic, gasketed lockable hinged door to encompass all

non-NEMA 4 front of panel instruments.

f. Provide enclosure mounting supports as required for rack mounting.

g. Provide all holes and cutouts for installation of conduit and equipment. Cable and piping to enter the enclosure through the bottom, unless otherwise noted. All conduit and piping openings and all conduits shall be sealed watertight.

C. Electrical Systems:

1. Power Source and Internal Power Distribution:

a. General: Control panel power supply source, type, voltage, number of circuits and circuit ratings shall be determined by the CONTRACTOR and approved by the ENGINEER.

b. Panels shall be provided with an internal 120 VAC power distribution panel with number of circuits and separate circuit breakers sized as required to distribute power to the panel components. Distribution panel shall contain two spare breakers, minimum.

2. Wiring:

a. Internal wiring shall be Type MTW and THHN stranded copper wire with thermoplastic insulation rated for 600 V at 90ºC for single conductors, color coded and labeled with wire identification.

b. For DC panel signal wiring, use No. 16 minimum AWG shielded.

c. For DC power wiring, use No. 12 minimum AWG.

d. For AC signal and control wiring, use No. 16 minimum AWG.

e. For wiring carrying more than 15 A, use sizes required by NEC standards.

f. Separate and shield low voltage signal wiring from power and control wiring by a minimum of 6-inches.

g. Group or bundle parallel runs of wire using covered troughs. Maximum bundle size to be 1-inch. Troughs shall have 40 percent spare capacity.

h. Install wire troughs along horizontal or vertical routes to present a neat appearance. Angled runs are not acceptable. Wire ways to be manufactured by Panduit or equal.

i. Adequately support and restrain all wiring runs to prevent sagging or other movement.

j. Terminate all field wiring using compression type connectors (soldered type not acceptable) at 600 V rated barrier type terminal strips and permanently affixed numeric identifiers beside each connection. Identifiers to be self-stick plastic tape strips with permanent type, machine printed numbers. For DC field signal wiring, terminal strips shall be capable of handling No. 12 wiring (minimum). Provide terminal blocks manufactured by Wago.

k. All wiring shall be installed such that if wires are removed from any one device, power will not be disrupted to any other device.

l. All alarms generated external to the panel, spare alarm, and repeat contacts shall be wired out to terminal blocks.

m. For internal component-to-component wiring only, compression type terminal blocks are acceptable.

n. Provide spare terminals equal in number to 10 percent of the terminals used for each type of wiring (e.g., DC signal and AC power).

o. Provide a separate terminal for grounding each shielded cable.

p. Use separate 5/16-inch diameter copper grounding studs for instrument signal cable shields and AC power.

q. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.

r. When DC power and/or low voltage AC power is required, provide and

install the necessary power supplies and transformers in the panel.

s. Provide fused terminal blocks, which will provide an LED indictor for a blown fuse. Fused terminal blocks shall be manufactured by Schneider Electric / Square D or equal.

t. Provide complete wiring diagram showing "as-built" circuitry. Diagram shall be enclosed in transparent plastic and placed in easily accessible pocket built into panel door.

3. Surge Protection:

a. General: Surge protection shall be provided to protect the electronic instrumentation system from surges propagating along the signal and power supply lines. The protection systems shall be such that the protection level shall not interfere with normal operation, but shall be lower than the instrument surge withstand level, and be maintenance free and self-restoring. Instruments shall be housed in suitable metallic cases, properly grounded. Ground wires for all surge protectors shall be connected to a good earth ground and where practical each ground wire run individually and insulated from each other. These protectors shall be mounted within the instrument enclosure.

4.6 INSTALLATION

A. Install equipment in conformance with NEC.

B. Unless otherwise noted, install outdoor NEMA 4X panels on a reinforced concrete pedestal:

1. Minimum Thickness: Eight-inches with No. 4 steel reinforcing bars at 12- inches on centers, each way.
2. Minimum Size: Twelve-inches larger than outer dimensions of base, all sides.
3. Provide excavation and backfill work as required.

C. Install anchor bolts and anchors.

D. Provide a sunshade for all field panels as required.

4.7 TESTING AND ADJUSTMENTS

A. Perform system testing and make any adjustments necessary in accordance with this document.

B. Perform power supply, voltage adjustments to tolerances required by the appurtenant equipment.

PART 5 -- PANEL INSTRUMENTS AND DEVICES

5.1 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish, install, calibrate, test, adjust and place into satisfactory operation panel instruments and devices.
2. Contract Documents illustrate and specify functional and general construction requirements of the panel components and do not necessarily show or specify all components, wiring, piping and accessories required to make a completely integrated system. CONTRACTOR shall provide all piping, wiring, accessories and

labor required for a complete, workable and integrated system.

B. Coordination: Coordinate the installation of all items specified herein and required to ensure the complete and proper interfacing of all the components and systems.

5.2 QUALITY ASSURANCE

A. Acceptable Manufacturers:
   1. Furnish instruments and devices by the named manufacturers or equal equipment by other manufacturers.
   2. The named manufacturers have been specified to establish the standard of quality and performance of the equipment to be supplied.
   3. Obtain all instruments or devices of a given type from the same manufacturer.

B. Manufacturers' Responsibilities and Services:
   1. Design and manufacture the instruments and devices in accordance with the applicable general design requirements and the detailed Specifications herein.
   2. Field supervision, inspection, start-up and training in accordance with the requirements of this document.

5.3 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Instruments and devices shall not be assembled in the panels until all product information and system Shop Drawings for respective components have been approved by the ENGINEER and OWNER.

5.4 IDENTIFICATION TAGS

A. All panel instruments and devices shall have an identification tag meeting the following requirements:
   1. Tag numbers shall be as listed per table located in Section IV.
   2. Identifying tag number shall be permanently etched or embossed onto a stainless steel tag which shall be fastened to the device housing with stainless steel rivets or self tapping stainless steel screws of appropriate size.
   3. Where neither of the above fastenings can be accomplished, tags shall be permanently attached to the device by a circlet of 1/16-inch diameter stainless steel wire rope.
   4. All instruments and devices mounted within panels shall have the stainless steel identification tag installed so that the numbers are easily visible to service personnel. Front of panel mounted components shall have the tag attached to the rear of the device.
   5. Front of panel mounted components shall have nameplates, which comply with the requirements specified in Section 13430, SCADA System, Panels and Enclosures.

5.5 POWER SUPPLIES

A. General: Single unit power supply, located in remote terminal units and field panels as required.

B. Single Unit Required Features:
   1. Solid state circuitry.
   2. DIN Rail mounting.

3. Input Power: 208/120 VAC ±10 percent, 60 Hz.
4. Output Voltage: 24 VDC or as required.
5. Output Power: 120W or as required.
6. Output Current: 5A or as required.
7. Line/Load Regulation: ±0.005 percent.
8. Ripple: 0.25 mV RMS.
9. Polarity: Floating output.
10. Ambient Temperature: -4 degrees F to 160 degrees F
11. Response Time: <20µS.
12. Overload Protection: Internal preset.
13. Include mounting brackets, fuse, and mating connector for AC power plug.

C. Products and Manufacturers: Provide one of the following:
1. Model PSB24-120s - manufactured by Rhino.
2. Or approved qual.

5.6 UNINTERRUPTIBLE POWER SUPPLY

A. Uninterruptible Power Supply (UPS) shall be furnished to provide a reliable source of uninterruptible power with no break in AC output power during a complete or partial interruption of incoming line power. UPS shall include audio/visual alarms. UPS shall be UL listed.

B. Rating: 120 VAC, 60 Hz, 1.4KVA/1.0KW minimum to provide uninterrupted conditioned power, fully loaded conditions for 10 minutes.

C. Description: On line dual track power conditioner and true (0 ms transfer time) uninterruptible power supply providing isolation, line regulation and conditioning, using sealed 48 VDC maintenance free batteries and switch mode power supply for uninterrupted power with 0.5 to 0.7 power factor and 2.7 to 3.5 crest factor.

D. Required Features:
1. Lighting and Surge Protection: Inherent 2000: One spike attenuation.
2. Regulation: One to three percent load regulation with less than 2pF effective coupling capacitance for line to load.
3. Output Waveform: Computer grade sine wave with three percent maximum single harmonic and five percent maximum total harmonic distortion.
4. Output Frequency: 60 Hz ±0.5 Hz.
5. Operating Temperature: 34 degrees F to 104 degrees F.
6. Relative Humidity: Five to 90 percent non-condensing.
7. Computer Interface: RS232 port for display of 22 meter functions and 15 alarm functions.
8. Input Protection: Independent battery charger fuse and DC fuses.
9. Output Protection: Inherently current limited ferro-resonant transformer.
10. Battery Charger: Two-step charger, 8 A and 2 A.
11. AC Input: 120 VAC, 60Hz, single phase, +15 percent, -20 percent.
12. AC Output: 120 VAC, 60Hz, single phase, +3 percent, -3 percent.

E. Products and Manufacturers: Provide one of the following:
1. Model BK350, as manufactured by APC.
2. Or approved equal.

5.7 SELECTOR SWITCHES, PUSHBUTTONS, AND INDICATING LIGHTS

A. Selector switches, pushbuttons and indicating lights shall be supplied by one manufacturer and be of the same series or model type.

B. Type:
   1. Heavy duty, oil tight.

C. Provide legend plate for indication of each switch, pushbutton or light function (e.g., "OPEN-CLOSED", "HAND-OFF-AUTO").

D. Mounting: Flush mounted on control panel front, unless otherwise noted.

E. NEMA rated to match panel in which mounted.

F. Selector Switches:
   1. Type: Provide selector switches with number of positions as required to perform intended functions as shown and specified.
   2. Contacts:
      a. Provide number and arrangement of contacts as required to perform intended functions specified, but not less than one single pole, double throw contact.
      b. Type: Double break, silver contacts with movable contact blade providing scrubbing action.
      c. Rating: Compatible with AC or DC current with devices simultaneously operated by the switch contacts, but not less than 10 A resistive at 120 VAC or DC continuous.
   3. Switch Operator: Standard black knob.

G. Pushbuttons (Standard or Illuminated):
   1. Type: Provide momentary lighted and/or unlighted, single and/or dual type pushbuttons as required to perform intended functions specified and shown.
   2. Contacts: Comply with the requirements specified for selector switches.

H. Indicating Lights:
   1. Type: Compact, LED type.
   2. Lamps: Six-volt, long life (20,000 hours minimum).

I. Button and Lens Colors:
   1. Green for indication of open, on, running.
   2. Red for indication of closed, off (ready), stopped.
   3. Amber for indication of equipment malfunction, process trouble and alarms (e.g., "HIGH LEVEL", "LOW LEVEL", etc.).
   4. Blue for indication of electrical control power on.
   5. Contacts:
      a. Gold-flashed contacts housed in mechanical contact blocks with number and arrangement of contacts as required to perform intended functions.
      b. Contact Rating: Compatible with AC or DC through-put current of signals and devices simultaneously operated by the switch contacts, but not less than 20A at 600 VAC or 250 VDC continuous.
   6. Switch Operator: Standard black knob.

5.8 CELLULAR RTU

A. Provide a complete and functioning cellular wireless interface communication system for secure Ethernet communication.

B. Required Features:
   1. General:
      a. DIN mounted
      b. Multiple-Carrier, 4G, LTE connectivity
      c. Operating Temp: -40 to 167 ^{O}F
      d. Humidity: 5 to 95% non-condensing
      e. Shock – IEC60068-2-27
      f. Vibration – IEC60068-2-6
   2. Wireless Interface:
      a. AT&T with fallback to HSPA+
      b. Generic with fallback to HSPA+
      c. Verizon with fallback to EVDO+
   3. Power Input:
      a. Input voltage – 8-30 VDC (12 or 24 VDC nominal)
      b. Output power (transmitting) – 2.6W – 6.9W
      c. Output power (stand-by) – 1.4W – 3.3W
   4. Secure Ethernet Capability
      a. Routing capability
      b. Stateful firewall, SSE, GRE, VPN
   5. Communication Ports
      a. Ethernet
      b. RS-232 Serial
      c. Occupied Bandwidth: 230 KHz.
   6. Routing protocols:
      a. OSPS
      b. BGP
      c. RIP

C. Manufacturer:
   1. RAM-6901-AT manufactured by Redlion
   2. Or approved equal.

5.9 ANTENNA

A. Required Features:
   1. 4G LTE MIMO, IP67 rated
   2. Cable – CFD-200 low loss cable

B. Manufacturer:
   1. ANT-MA741ABI001, manufactured by Redlion.

5.10 PROGRAMMABLE LOGIC CONTROLLER (PLC)

A. Hardware
   1. Major hardware components of the PLC system shall include:
      a. Central Processing Unit (CPU)
      b. Communications Modules

c. Input /Output Modules (I/O)
d. Power Supply and Chassis

2. General
   a. Provide a complete and functioning PLC for monitoring and control of the outfall gates.
   b. The PLC located in Control Panel shall perform monitoring and control of the Outfall Gates level transmitter. The PLC shall be Allen-Bradley MicroLogic 1000 series or approved equal.
   d. The PLC's shall be intelligent microprocessor-based devices that can collect data and process control functions.
   e. All components of the PLC system shall be normally recognized industry standards and regularly sold for industrial applications. The PLC components shall be assembled in structurally sound housings. All connecting cables, switches and other operator-controlled devices shall be constructed so as to withstand, without damage, all normal use and handling.
   f. Electrical supply voltage to the PLC shall be 115 VAC +/-15%, 48 -63 Hz. PLC system power supplies shall be fused for overload protection.
   g. The PLC shall be a digital solid-state logic system capable of performing the same functions as conventional relays, timers, counters, math functions, controllers, etc.
   h. The PLC system shall be of modular plug-in design and shall consist of a CPU, memory, I/O cards, racks, power supplies, interconnecting cables, communication lines and other items as necessary to meet the functional requirements of the specification. All components of the PLC system shall be marketed and supported by one PLC manufacturer. All necessary cable shall be provided.
   i. All products shall be designed, manufactured and tested in accordance with recognized industrial standards. All components shall have corrosion protection and shall have UL, CSA and FM approval. The PLC subsystems shall be approved for and adhere to the following agency and environmental specifications:
      1) Vibration - 3.5 mm Peak-to-Peak, 5-9 Hz: 1.OG, 9-150 Hz. The methods of testing are to be based upon IEC 68-2-6 and JIS C 0911 standards for vibration. The system shall be operational during and after testing.
      2) Shock - 15G, 11 msec. The method of testing is to be based upon IEC 68-2-27 and JIS C 0912 standards for shock. The system shall be operational during and after testing.
      3) Temperature -All PLC hardware shall operate at an ambient temperature of 0 to 55 °C, with a temperature rating for storage of 40 to 4o to 85 °C
      4) Relative Humidity -All PLC hardware shall function continuously in the relative humidity range of 5% to 95%, noncondensing.
      5) Noise Immunity -All PLC hardware shall be designed and tested to operate in a high electrical noise environment of an industrial plant as governed by the following regulations: EEE 472, IEC 801, MILSTD 461B, IEC 255-4, NEMA ICS 2-230.40 and ANSUIEEE C-37.90A-1978.
   j. The PLC manufacturer shall provide operating instruction manuals with adequate information for PLC operations.
   k. In a single chassis system, all system and signal power to the CPU and support modules shall be distributed on a single motherboard or backplane. Interconnecting wiring between modules via plug-terminated jumpers shall not be acceptable.
   l. All system modules on the main or expansion chassis shall be designed to

provide for free air flow convection cooling. Heat sinks shall be used to dissipate component heat. Internal fans shall not be permitted.

m. The PLC manufacturer or its authorized representative shall provide complete technical support for all of its products including a "1-800" phone line.

n. All major assemblies and sub-assemblies, circuit boards, components and modules shall be identified using permanent labels or markers, each of which indicates the manufacturer's catalog number and a product manufacturing date code.

B. Software

1. The Instrumentation Subcontractor shall provide as part of the PLC system, one software package to allow off-line or on-line program development, annotating and monitoring on a PC-based computer operator workstation. The software shall support multiple industry standard IEC 1131-3 programming languages. As a minimum, ladder diagram, structured text and Sequential Function Chart (SFC) programming shall be provided.
2. The software packages shall include a software license agreement allowing rights to utilize the software as required for any current or future modification, documentation or development of the PLC program.
3. The software shall provide as a minimum the following functions:
   a. Annotation of all ladder elements with at least 3 lines of 6 characters each.
   b. Annotation of all ladder rungs with at least 240 characters.
   c. Provide visual "power flow" monitoring of circuit elements (when connected to the PLC).
   d. Provide annotated ladder diagram printout on a standard computer printer for documentation purposes.
   e. On-line help facility.
   f. Download or upload program from the PLC to the computer workstation.
   g. Provide ladder element and I/0cross-reference table.
   h. Provide all monitoring, forcing, programming error detection, searching, configuration, etc. functions as required to allow an operator / programmer to completely program a PLC.
   i. The programming software shall allow the PLC to be programmed, debugged and downloaded from a computer workstation over the Ethernet data high-way.

5.11 INSTALLATION

A. Install each item in accordance with manufacturers recommendations and in accordance with the Contract Documents.

B. All items shall be mounted and anchored in compliance with Section 13430, SCADA System, Panels and Enclosures.

PART 6 -- SCADA SYSTEM INPUT / OUTPUT LIST / TAG NUMBERS

6.1 INPUT / OUTPUT LISTS

A. I/O Lists:

1. I/O lists are compiled for the following devices, each of which is listed separately:
   a. Control Panel #1
2. I/O lists are compiled in order by terminal block number, from top to bottom, as shown on the Drawings. The I/O lists for the existing PLC Panels list only the

new I/O added under this Contract.

6.2 TAG NUMBERS

A. Tag Numbers are per the table below:

NEW RIVER OUTFALL WEIR TAG NUMBERS					
OUTFALL WEIR #	CONTROL PANEL	SCADA	PLC	LEVEL TRANSMITTER	GATE ACTUATOR
1	CP-100	SCADA-100	PLC-100	LT-100	LCV-100

PART 7 -- FIELD EQUIPMENT SPECIFICATIONS

7.1 LEVEL TRANSMITTER - RADAR TYPE

A. Type: Non-contact.

B. Functions:
1. Antenna:
   a. Radiate radar signals from the transmitter towards the metered surface.
   b. Receive the reflected signal.
2. Transmitter:
   a. Generate and time the electrical pulses.
   b. Count and convert the pulse travel times into an analog output signal linearly proportional to level.

C. System Performance Requirements:
1. Accuracy: Not less than ±0.3 percent of full scale.
2. Operating range of not less than 30 feet with dead band; minimum operating range of 12-inches.
3. Transmitter Outputs: 4 to 20 mA DC, direct acting and isolated, into 750 ohms.
4. Ambient Temperature Range: -40 degrees F to 176 degrees F.
5. Power Consumption: 15 watts maximum.

D. Required Features:
1. Antenna: Horn with extension, length as required.
2. Transmitter:
   a. Solid state construction.
   b. Built-in digital filtering for EMI protection.
   c. Handheld calibrator for field rangeability and recalibration.
   d. Integral backlit LCD indicator scaled in engineering units.
   e. Designed for operation on 120 VAC ±15 percent, (60 Hz) or 24 VDC power supply.
   f. PVDF housing, NEMA 4/4X/IP66/IP67

E. Product and Manufacturer: Provide the following:
1. VegaPuls C21
2. Or approved equal.

7.2 TILT WEIR ACTUATOR

A. The type of actuator required is Rotork IQ25.

B. Type: Electric on-off valve actuator

C. Functions:
   1. Actuator:
      a. Provide mechanism to open and close outfall gates
      b. Provide feedback to determine tilt weir position
      c. Open and close weir within predetermined time

D. System Performance Requirements:
   1. Actuator type: On-Off
   2. Power: 208VAC, 60 Hz, Three Phase
   3. Design Specification
      a. EN 15714-2 Industrial Valves – Actuators
      b. ISA-SP96.02 – Electric Actuators
   4. Operating Temperature: -22 to +158 ^{O}F
   5. Rated Torque:
      a. IQ25 - 295 lb. ft.
   6. Rated Amps:
      a. IQ25 – 5.7 amps
   7. Flange Size:
      a. IQ25 – FA14
   8. Coupling:
      a. IQ25 – B4 – 1 ¼”
   9. Enclosure:
      a. IP68/NEMA 4

E. Required Features:
   1. Local Display
   2. Local Controls
   3. Hand Operator
   4. Torque Sensor
   5. Bluetooth
   6. Internal Battery

F. Product and Manufacturer: Provide the following:
   1. Rotork IQ25FA14 B4 WT(IP68) 115RPM 208/3/60
   2. No substitutions will be allowed

7.3 SPARE PARTS AND TEST EQUIPMENT

A. Furnish and deliver the manufacturer recommended spare parts and test equipment as outlined below for the level transmitter selected for this project.

B. Spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.

C. The following shall constitute the minimum test and calibration equipment.

1. All special calibration equipment required for system calibration.

PART 8 -- FACTORY TESTING

8.1 GENERAL

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to perform factory testing, before shipment, at the manufacturer's facility to verify that system components are functioning properly and that they meet the functional and performance requirements of the Contract Documents. The system includes, but is not necessarily limited to, the following major equipment.
   1. SCADA panel operation
   2. Level transmitter interface and function
   3. Control valve interface and function
   4. Overfall gate actuator
   5. Operator HMI screens interface and function

B. CONTRACTOR shall submit information on factory testing procedures to verify that testing shall fulfill the requirements as specified herein. Submittal to ENGINEER shall be made at least two months in advance of any scheduled testing and shall include dates of scheduled tests.

C. CONTRACTOR shall notify ENGINEER, in writing, at least four weeks before expected initiation of tests. OWNER and ENGINEER may elect to be present at CONTRACTOR'S facilities during operational test of system equipment, either for individual units or as an integrated system. Presence of OWNER and ENGINEER during testing does not relieve CONTRACTOR from conforming to the requirements of the Contract Documents and shall in no way imply acceptance of the equipment.

D. Factory Testing shall not begin until all related Supervisory Control And Data Acquisition (SCADA) System shop drawings have been submitted and approved.

8.2 INSPECTION

A. All panels and equipment shall be inspected. Inspection shall include, but not be limited to, the following:
   1. Nameplates and tags.
   2. Wire sizes and color coding.
   3. Terminal block contact ratings and numbers.
   4. Terminal block spares.
   5. Proper wiring practices and grounding.

8.3 SYSTEM HARDWARE OPERATIONAL TESTING

A. All input/output devices and components shall be tested to verify operability and basic calibration.

B. All system hardware components shall be tested to verify proper operation of the equipment as standalone units. Tests shall include, but not be limited to, the following:
   1. AC/DC power checks.
   2. Power fail/restart tests.
   3. Diagnostics checks.
   4. Test demonstrating that all specified equipment functional capabilities are working properly.

C. All PLC input/output devices shall be tested to verify proper operation and basic calibration. CONTRACTOR shall test all input and output points prior to the witnessed factory test and shall provide copies of signed and certified check lists or other documentation to demonstrate the completion of I/O testing. All I/O shall be tested during the witnessed factory test. PLC I/O testing shall include, as a minimum, the following:

1. Simulate a field digital input for each PLC input point at the terminal strip of the control panel and verify PLC response.
2. Simulate a field analog input for each PLC analog input point at the terminal strip of the control panel and verify PLC response.
3. Force an output for each PLC digital output point and verify the signal presence at the terminal strip in the control panel.
4. Simulate an analog output for each PLC analog output point and verify signal presence at the terminal strip in the control panel.

D. All system components shall be tested to verify that communication between units is working properly.

E. An integrated system test with all system equipment connected shall be performed to verify that all equipment is performing properly as an integrated system.

8.4 SYSTEM SOFTWARE DEMONSTRATION

A. CONTRACTOR shall demonstrate all system software utility and security programs incorporated into the system to illustrate the various functions and capabilities specified.

B. CONTRACTOR shall demonstrate the operation and display of all software. Demonstration shall show that the monitoring and control application software associated with the input/output points performs the functions intended.

C. System performance shall be tested using a fully integrated system, including all software and hardware if applicable. To achieve this, the entire control system, including all the peripheral devices and all interconnecting cables, shall be assembled on the factory test floor and simulated inputs applied. CONTRACTOR shall carry out a full system test, during which the entire system shall operate continuously without failure in accordance with the requirements of the Contract Documents. CONTRACTOR shall provide process I/O simulation panel prior to the test:

1. Toggle switches to simulate field or other input contacts.
2. Indicating lights to simulate outputs from tested panels.
3. Indications (Ma) to indicate every 4 to 20 mA DC output from tested panel.
4. Potentiometers to simulate 4 to 20 mA DC inputs to tested panel.
5. Every device shall have a nameplate containing the device under test's P&ID tag number and description. Nameplates shall be removable and interchangeable for reuse of the I/O simulator panel during the progression of the testing.

D. Demonstration of communication between processors or to remote I/O units shall be included in the Test Procedure, where applicable.

E. Operator Interfaces: Prior to the staging and testing of the system, the display environments shall have been configured in accordance with the agreed upon display structure, loaded and data base parameters linked to the specified fields. During this phase of the factory acceptance test, the overall display structure shall be

demonstrated, including environment configurations, passwords, security, etc. The memo display contents shall be reviewed to demonstrate how an operator navigates within the overall display structure. The assignment of displays to annunciator keys shall also be demonstrated. Each graphic display shall be reviewed for correctness in terms of the layout, symbols, color scheme, etc. The operation of standard alarm management displays (Current Alarm Display, Alarm History, etc.) shall also be demonstrated. A demonstration of each type of report specified shall be performed. Printing shall be an integral part of the report demonstration.

8.5 FACTORY TEST REPORTS

A. Panel, software and control component modifications and corrections required as a result of testing shall be completed and documented before shipment. Panels shall not be shipped from the factory, until two (2) copies of certified Factory Test reports indicating satisfactory performance have been submitted to and approved by ENGINEER. Factory Test reports shall include the following information:
   1. List of tests performed.
   2. Certified check lists or documentation verifying all I/O has been tested, as specified above.
   3. Documentation verifying all panel wiring has been checked.
   4. List of required modifications or corrections identified during the Factory Test and corrective action taken.
   5. Factory test reports shall be signed and dated by an authorized representative of the System Supplier and CONTRACTOR.

PART 9 -- START-UP AND FIELD TESTING

9.1 SYSTEM CHECK-OUT AND START-UP RESPONSIBILITIES

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all equipment and coordinate all activities necessary to perform check-out and start-up of the equipment.

B. CONTRACTOR shall provide personnel thoroughly knowledgeable about the installation, operation and maintenance of the SCADA and all other equipment being used by this project.

9.2 SYSTEM CHECKOUT AND START-UP

A. CONTRACTOR shall perform the following:
   1. Check and approve the installation of all SCADA System components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.
   2. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in this work, they should be included in the system checkout. All problems encountered shall be documented and promptly corrected to prevent any delays in start-up of the various unit processes.

B. CONTRACTOR shall provide all test equipment and software necessary to perform the testing during system checkout and start-up. CONTRACTOR shall, if requested by OWNER, transfer all test equipment and software to the OWNER after final testing and commissioning is completed.

C. CONTRACTOR shall be responsible for initial operation of monitoring and control system and shall make any required changes, adjustment or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended.

D. CONTRACTOR shall furnish ENGINEER an installation inspection report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both CONTRACTOR and the Supplier.

E. CONTRACTOR shall provide all software and licenses required to operate, troubleshoot, maintain and repair all systems provided under this contract.

9.3 INTEGRATED SYSTEM FIELD TEST

A. Following the SCADA System checkout and initial operation, CONTRACTOR, under the supervision of the SCADA System Supplier, shall perform a complete system test to verify that all equipment and programmed software is operating properly as a fully integrated system, and that the intended monitoring and control functions are fully implemented and operational. Any defects or problems found during the test shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.

B. Following demonstration of all system functions, the SCADA System including field sensors/transducers and instruments shall be running and fully operational for a continuous 48 hour period. The Operational Availability Demonstration specified below shall not begin until the continuous 48 hour integrated system test has been successfully completed and OWNER and ENGINEER agree that the Operation Availability Demonstration can begin.

9.4 OPERATIONAL AVAILABILITY DEMONSTRATION

A. Operational Availability Demonstration (OAD) shall begin following completion of the integrated system field test as specified above and shall continue until a time frame has been achieved wherein the system (both hardware and software) availability meets or exceeds 99.7 percent for 30 consecutive days and no system failures have occurred which result in starting the OAD over again. During the OAD the system shall be available to plant operating personnel for use in normal operation of the plant.

B. For the purpose of the OAD, the system will be defined as consisting of the following systems and components:
   1. SCADA radio communications to master station
   2. SCADA panel
   3. Level transmitter
   4. Gate positioner

C. The conditions listed below shall constitute system failures which are considered critical to the operability and maintainability of the system. The OAD shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 30 consecutive day OAD shall begin.
   1. Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.
   2. Recurrent hardware or software problems: if the same type of problem occurs three times or more or different problems occur to the same hardware or process.
   3. Software problem causing a processor to halt execution or malfunction.

D. The following conditions shall constitute a system failure in determining the system availability based on the equation specified in Paragraph 1.4.E., below:
   1. Loss of communications between devices on the communications network.
   2. Failure of one or more input/output components.
   3. Failures of any type affecting 50 percent of any PLC IO card.
   4. Failure of any type affecting one or more sequential control strategies thereby causing a loss of the automatic control of the process sequence operation.
   5. Failure of power supply. Where redundant power supplies are provided, failure of one power supply shall not constitute a system failure provided the backup power supply operates properly and maintains supply power. Failure of the backup supply to operate properly and maintain supply power shall constitute a system failure.
   6. Failure of three or more primary sensors/transducers or field instruments simultaneously.

E. The system availability shall be calculated based on the following equation:

$$A = \frac{TTO}{TTO + TTR} \times 100 \text{ percent}$$

where, A = system availability in percent
TTO = total time in operation TTR
= total time to repair

F. Time to repair shall be the period between the time that CONTRACTOR is notified of a system failure and the time that the system has been restored to proper operation in terms of hours with an allowance for the following dead times which shall not be counted as part of the time to repair period.
   1. Actual travel time for service personnel to get to the Site up to six hours per incident from the time CONTRACTOR is notified of a system failure.
   2. Time for receipt of spare parts to the plant site once requested up to 24 hours per incident. No work shall be done on the system while waiting for delivery of spare parts.
   3. Dead time shall not be counted as part of the system available period. The dead time shall be logged and the duration of the OAD extended for an amount of time equal to the total dead time.

G. Completion of a 30 consecutive day period without any restarts of the OAD and with a System availability in excess of 99.7 percent will constitute acceptance of the SCADA System by OWNER.

H. All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by CONTRACTOR at no additional cost to OWNER. If parts are obtained from the required plant spare parts inventory, they shall be replaced to provide a full complement of parts as specified.

I. A SCADA System Malfunction/Repair Reporting Form shall be completed by the plant personnel and ENGINEER to document system failures, to record CONTRACTOR notification, arrival and repair times and CONTRACTOR repair actions. Format of the form shall be developed and agreed upon prior to the start of the OAD.

PART 10 -- SCADA SYSTEM TRAINING

10.1 REQUIREMENTS AND RESPONSIBILITIES

A. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown,

specified and required to perform and coordinate all required training at times acceptable to OWNER. No part of the training shall be construed as a substitution for complete and comprehensive Operations and Maintenance (O&M) manuals, but should follow the same organizational structure as the O&M manuals.

B. CONTRACTOR shall provide all required materials, texts and required supplies.

C. All training shall be conducted to meet the needs of the OWNER personnel during all shifts.

10.2 **ON-SITE TRAINING**

A. Primary Sensors/Transducers and Field Instruments:
   1. Provide on-site operation and maintenance training by CONTRACTOR prior to placing the equipment in continuous operation.
   2. Training shall accomplish the following:
      a. Provide instruction covering use and operation of the equipment to perform the intended functions.
      b. Provide instruction covering procedures for routine, preventive and troubleshooting maintenance including equipment calibration.
      c. Explain procedures for placing the equipment in and out of operation and explain necessary actions and precautions to be taken regarding the overall plant monitoring and control system.

B. Training covering the field equipment:
   1. The CONTRACTOR shall provide operations training covering all system components.
   2. Training course shall accomplish the following:
      a. Provide all instructions necessary to operate and utilize all system components.
      b. Provide all instruction necessary to monitor and control the system processes from the designated control panel.
      c. Explain procedures for control of the system during scheduled or rescheduled shutdown and the subsequent start-up.
      d. Provide instructions for regular caretaking operations.

C. SCADA Training:
   1. The SCADA System Supplier shall provide training that covers the following:
      a. Provide an overview of system hardware and software.
      b. It shall train people in operation of the system.
      c. The emphasis shall be placed on how to perform diagnostics and upkeep of documentation.
      d. Instruction for hardware and software maintenance, trouble shooting and maintenance planning.

D. SCADA System Maintenance Training Course:
   1. Provide a course covering preventive and troubleshooting maintenance for the system components. The course shall familiarize the student with diagnostic capabilities of the system, both software and hardware, and also the routine maintenance procedures on the system and the common peripheral devices.

PART 11 -- EXECUTION

11.1 INSTALLATION

A. CONTRACTOR shall furnish the services of qualified personnel to perform the installation of the instrumentation and control system equipment.

B. Install each item in accordance with manufacturer's recommendations and in accordance with the Contract Documents. Transmitters and instruments, which require access for periodic calibration or maintenance, shall be mounted so they are accessible while standing on the floor. Care shall be taken in the installation to ensure sufficient space is provided between instruments and other equipment or piping to allow for easy removal and servicing.

C. All items shall be mounted and anchored using stainless steel hardware, unless otherwise noted.

D. All field instruments shall be rigidly secured to stands as required by the manufacturer and as shown.

E. Conform to all applicable provisions of the NEMA standards, NEC and local, State and Federal codes when installing the equipment and interconnecting wiring.

- END OF SECTION -

SECTION 16900 – PROCESS INSTRUMENTATION AND CONTROL

PART 1 -- GENERAL

1.1 WORK INCLUDED

The work covered under this section of the specifications includes the furnishing and installing of all instrumentation and control hereinafter specified to perform the intended function.

1.2 RELATED WORK

A. Section 16050 – Basic Electrical Material and Methods

B. Section 16800 – Supervisory Control and Data Acquisition (SCADA)

PART 2 -- PRODUCTS

2.1 SYSTEM SUPPLIER

A. All instrumentation and control systems equipment shall be furnished by a System Supplier. The System Supplier shall provide and be responsible for the proper operation of all Process Instrumentation and Controls and Control Panels. The System Supplier shall perform in house submittal drawings and assembly of products. Subcontracting submittal drawings and equipment assembly will not be permitted.

B. Substitutions of functions or equipment specified will not be acceptable.

C. The entire system shall be warranted for one year from date of substantial completion.

D. The Contractor shall assign full responsibility for the function operation of all new instrumentation and control systems to a System Supplier. This System Supplier shall be responsible for all coordination necessary in order to select, to furnish, to supervise installation and connections, to calibrate, and to place into operation all instrumentation and controls along with all other equipment and accessories as specified herein. The System Supplier shall be a licensed electrical contractor in the state of Louisiana.

E. The System Supplier shall be one of established favorable reputation who has designed and produced similar systems and components for a period of at least (10) ten years.

F. It shall be required of the System Supplier to execute and submit a guarantee to assume full responsibility as defined in Section 2.01, paragraph ‘A’ above. It is the duty of the Contractor to include this guarantee with his Bidding Documents.

G. Only the guarantee of the System Supplier whose name the Contractor has inserted in his Bidding Documents is required. Failure by a System Supplier to provide a written guarantee with his proposal shall be deemed by the Contractor as “NO BID” and that System Supplier will not be acceptable. The written guarantee shall be on the named System Supplier's letterhead and shall be signed by a responsible representative who will be primarily involved in the fulfillment of this guarantee. The written guarantee shall be stated as follows:

“... (Name of Single Source System Supplier)...guarantees that the proposal offered

provides for complete compliance with all requirements of this section of the project specifications without exceptions to these specifications.

Full responsibility will be placed upon... (Name of Single Source System Supplier)...for all coordination necessary to select, to furnish, to supervise installation and connections, to calibrate, and to place into operation Process Instrumentation and Controls, Control Panels, and all other equipment and accessories needed to provide a complete operating system to comply with requirements of this section of the project specifications.

... (Name of Single Source System Supplier)... guarantees to provide all submittal drawings, instruction manuals, and qualified personnel for specified field services and training, all as defined within this section of the project specifications."

... (Name of Single Source System Supplier)... is a licensed electrical contractor in the state of Louisiana; Certificate of Responsibility No._ _____, name of qualifying party ;

Guarantee on system function and equipment shall be one (1) year from date of substantial completion or partial acceptance.

2.2 SUBMITTAL DRAWINGS

A. Descriptive literature and drawings for equipment and systems being furnished under this section shall be included in two submittals as a maximum. If two submittals are made, the first shall include all primary devices, transmitters, sensors, and field mounted equipment. The second submittal will include the balance of the submittal required. The submittal shall include as a minimum, equipment specifications, dimensional drawings, flow and other calculations, schematic drawings of each and every system within the complete offering, and such other information requested by the Engineer or considered necessary to the proper installation of the equipment. Furnish submittals in a Bound Booklet Form 8.5" X 11". No sheets shall be larger than 8.5" X 11". Foldout larger sheets will not be acceptable. This submittal shall include coordinated information and drawings for all items that the Single Source System Supplier is required to furnish under this section of the specifications, all in one integrated and coordinated manual. Each item of a submittal shall carry the appropriate title and be indexed against the appropriate specification item.

B. A quantity of eight (8) sets of submittals shall be furnished for the Engineer's approval.

2.3 INSTRUCTION MANUALS

Prior to 65% of the value of job completion, System Supplier shall furnish two (2) copies to the Engineer and one (1) copy to the Owner of all descriptive matter and complete system operation instruction manuals in separate indexed binders coordinated with the equipment that is furnished and installed for approval. System Supplier shall incorporate Engineer's comments and resubmit for approval within thirty (30) days of receipt of Engineer's comments. Once final approval is obtained, System Supplier shall furnish two (2) copies to the Owner and two (2) to the Engineer.

2.4 RELATED SYSTEM COMPONENTS

The attention of the System Supplier is called to sections concerned with electrical work, chemical feeders, valves, piping, etc., and such other devices not specified under this

section, but related to it.

PART 3 -- EXECUTION

3.1 ENGINEERING SUPERVISION

A. The services of a qualified representative of the selected Single Source System Supplier shall be provided to inspect the completed installation, suggest all adjustments necessary to place the system in proper operation, and instruct operating personnel in the care and operation of the equipment furnished. A minimum of one (1) day and one (1) trip start-up service and training operating personnel shall be included. The services shall be furnished by the Contractor as a part of the work included under this section of the specifications.

B. The System Supplier shall show satisfactory evidence that he maintains, a fully equipped factory organization capable of furnishing adequate service for the equipment furnished, included replacement parts. Suppliers employing outside organizations for “ON CALL” service shall not be considered.

3.2 GENERAL INSTALLATION

A. Installation of instrumentation and controls shall be in strict compliance with the manufacturer's instruction. The locations of these items as shown on the Contract Drawings are approximate only. Exact locations shall be as approved by the Engineer during construction. It is the duty of the Contractor to obtain, in the field, all relevant information required for proper placement of instrumentation and controls. In the case of interference with other work, proceed as instructed by the Engineer and provide all materials and labor required to prevent construction delays.

B. Execution of the installation shall be in full accordance with codes and local rulings. The Contractor shall be responsible for any expenses that are a result of work performed contrary to said codes and regulations.

C. The System Supplier shall coordinate with the Contractor the installation, the location of process equipment, and connections of process equipment to related equipment panels, subject to the Engineer's approval. The equipment being furnished with electrical controls or instrumentation must be submitted to the System Supplier for approval and coordination with all other control and instrumentation on this project. This engineer will not approve any equipment submittal until this coordination has been accomplished.

3.3 SPARE PARTS

A one-year supply of manufactures’ recommended spare parts shall be provided. The spare parts shall be packaged for long-term storage and shall be protected against humidity and temperature. A spare parts list shall be furnished listing manufacture, device model number, part number and quantity supplied.

3.4 DELIVERY AND HANDLING

After delivery to the jobsite, the Contractor shall store the control panel off of the ground in a dry location until such time as it is mounted and supplied with electrical service. The contractor shall also insure that the pump power and control cords, as well as control floats, are protected from submergence until they are properly installed and sealed.

3.5 CONTROL PANEL STAND (when required)

Each control panel stand shall be fabricated per the detail indicated in the plans. Control panel stand legs shall be cemented into the ground a minimum of three feet (3') deep. The control panel shall be bolted at all four corners to the control panel stand with stainless steel hardware. Control panels shall be installed following manufacturer's instructions properly leveled. When installed, the bottom of the control panel shall be approximately four feet (4') above finished grade elevation.

PART 4 -- CONTROL PANEL SPECIFICATIONS

4.1 GENERAL

A. Enclosure shall be constructed of a minimum 14 gauge, type 304 stainless steel. Seams shall be continuously welded and ground smooth. Provide a seamless form-in-place gasket to assure water tight and dust tight seal. Provide a rolled lip around three sides of door and all sides of enclosure opening to exclude liquids and contaminants. Provide a stainless steel driphood, internal 3-point latch and type 316L stainless steel padlocking powerglide handle to assure security and a water-tight seal while still allowing convenient access. Door shall be removable by pulling a stainless steel continuous hinge pin. Enclosure shall have a #4 brushed finish.

B. All power and control wires shall be stranded copper type MTW. All wiring shall be in covered plastic wireway.

C. All points necessary for external connection in the controller, whether power or control, shall be wired to a terminal strip located at the top or bottom of the enclosure as directed by the engineer. The terminal strip shall be permanently marked with the same designation as the wire connected to it.

D. All power and control wires shall be marked at both ends using self-adhering wire markers. No two wires having different functions within the control panel shall have the same markings.

E. All circuit breakers, starters, and other control devices mounted within the controller panel shall be labeled for identification both within the panel and on the wiring schematic with corresponding designations.

F. Control power shall be 120 volts and shall be protected by a correctly sized circuit breaker. If required, provide a properly sized control power transformer with primary over current protection.

G. Each starter shall be provided with overload protection in all three phases and each individual starter shall have phase failure protection.

H. All selector switches, pilot lights and control devices shall be visible and operable from the Controller exterior door or an interior deadfront panel when required. The deadfront panel shall be constructed of anodized aluminum and shall have a continuous aluminum hinge. An anodized aluminum deadfront shall be utilized when the Controller environment is not conducive to exposed controls or as specified on drawings.

I. All approval drawings shall be prepared per J.I.C. standards for engineers review prior to any fabrication of control equipment. The Controller shall be produced by a UL 508 listed shop. Proof of label availability shall be submitted with above drawing.

J. The controller manufacturer shall provide a written warranty with approval drawings covering all Control materials and parts furnished for a period ending one year after final acceptance of the project. This warranty shall cover all material replacement, all labor, and all travel expenses.

K. The controller manufacturer shall show satisfactory evidence that he maintains a fully equipped factory organization capable of furnishing adequate service for the equipment furnished, including replacement parts within a 200 mile radius of the job site. Suppliers employing outside organizations for "ON CALL" service shall not be considered.

L. The controller manufacturer shall have a service department capable to respond in emergency condition twenty-four/seven and three-hundred sixty-five days a year (24/7/365).

M. The quality establishing brand for the control panel(s) shall be that as manufactured by Control Systems, Inc. of Jackson, MS. All others shall be submitted for prior approval.

4.2 TILT WEIR CONTROL PANEL

A. SERVICE ENTRANCE: The control panel shall be designed for 120/208-volt, three-phase, four-wire power. The control panel shall be rated NEMA 4X stainless steel, as indicated on drawing.

B. MAIN BREAKER: Provide a properly sized Main Breaker, as shown on the drawings. In addition, provide a through the door operator mounted on the interior deadfront. The operator shall prevent the deadfront from being opened while the breaker is in the "ON" position.

C. SERVICE ENTRANCE SURGE PROTECTION DEVICE: Provide a service entrance rated Type 2, AC power distribution Surge Protection Device (SPD-1), per Component Specifications, designed to protect all types of loads fed from the distribution panels, branch panels and/or individual equipment panels. Units shall be UL listed and shall bear a UL label. Surge Protection Device shall be rated for 160kA per phase and 80kA per mode.

D. POWER MONITOR: Provide a service entrance rated Power Monitor (PM), per Component Specifications. Power monitor shall constantly monitor the three-phase voltages to detect harmful power line conditions, caused by single-phasing, low voltage, phase reversal, and voltage unbalance. When a harmful condition is detected, no three-phase motors shall be allowed to operate. Phase monitor shall be protected by 1 amp, 208 volt fuses on the primary side.

E. TILT WEIR ACTUATOR FEEDER BREAKERS: Provide four (4) 20 amp, 3 pole, 208 volt circuit breakers to feed Tilt Weir actuators no.1, no.2, no. 3, and no. 4.

F. TILT WEIR CONTROLLERS: Provide tilt weir interface modules (UM-TW1 thru UM-TW4) and necessary control relays, both per Component Specifications, to allow operator interface with the new tilt weir actuators. With the individual tilt weir actuator integrated control switches in the "remote" position, the interface modules shall incorporate the following features and functions for each tilt weir.

1. Close-Auto-Open selector switch to operate as follows:
   a. Close position shall close the Tilt weir

b. Open position shall open the Tilt weir
c. Auto position shall allow the Tilt weir to operate based on Operator input via the Owners existing SCADA system HMI.

2. Provide two (2) LED indicators, color and nomenclature as follows:
   a. Green – Tilt weir Open
   b. Red – Tilt weir Closed

G. BRANCH CIRCUIT BREAKERS: Provide the following 120 Volt, single pole circuit breakers as shown on the drawing.

1. 1 – 20 Amp, 1 pole for Control Power
2. 1 – 20 Amp, 1 pole for Area Lighting
3. 1 – 20 Amp, 1 pole for GFCI Duplex Receptacles
4. 1 – 20 Amp, 1 pole for SCADA/Telemetry Panel
5. 1 – 20 Amp, 1 pole for Control Panel A/C Unit
6. 1 – 20 Amp, 1 pole for SCADA panel A/C Unit

H. CONTROL POWER SURGE PROTECTOR: Provide an in-line (series) 120 volt, 20A continuous power Surge Protection Device (SPD-2), per Component Specifications, designed to protect all of the loads fed from the control power circuit. Maximum Rated Surge Current shall be 20kA per phase with a response time less than one (1) nanosecond.

I. SCADA TELEMETRY SIGNALS: The new tilt weir controls shall be capable of integrating with the Owners existing SCADA system. The following signals shall be terminated for ease of interface with separately mounted telemetry equipment.

Inputs from SCADA:
1. Tilt weir No.1 “Open” Command
2. Tilt weir No.1 “Close” Command
3. Tilt weir No.2 “Open” Command
4. Tilt weir No.2 “Close” Command
5. Tilt weir No.3 “Open” Command
6. Tilt weir No.3 “Close” Command
7. Tilt weir No.4 “Open” Command
8. Tilt weir No.4 “Close” Command

Outputs to SCADA:
1. Tilt weir No.1 in the “Open” Position
2. Tilt weir No.1 in the “Closed” Position
3. Tilt weir No.2 in the “Open” Position
4. Tilt weir No.2 in the “Closed” Position
5. Tilt weir No.3 in the “Open” Position
6. Tilt weir No.3 in the “Closed” Position
7. Tilt weir No.4 in the “Open” Position
8. Tilt weir No.4 in the “Closed” Position

PART 5 -- COMPONENT SPECIFICATIONS

5.1 **SERVICE ENTRANCE SURGE PROTECTION DEVICE:** The Surge Protection Device (SPD) shall be mounted in the control panel / motor control center section adjacent to the Main Breaker. The SPD is connected to the main bus in the panel with conductors of size and of no greater length than indicated in the Surge Protection Device

manufacturer's installation instructions. SPD shall be a Type 2 device ideal for distribution panels, branch panels and critical loads.

A. SPD shall provide transient voltage surge suppression and electrical high frequency noise filtering. Unit is designed for parallel connection to the main bus. SPD unit uses selenium cells and metal oxide varistors to achieve its performance. Products using gas tubes, spark gaps, silicon avalanche diodes or other components, which under failed conditions would cause system failure, are not acceptable.

B. Manufacturer qualifications: The product of a manufacturer engaged in the commercial design and manufacture of the type of product described herein for a minimum ten (10) years.

C. Standards: Product complies with the requirements of the following:

1. cUL
2. CE Compliant
3. UL 1449 3rd Edition
4. UL 1283 Listed
5. NEMA LS1 Compliance

D. Operating Voltage: 120/208 volts, 3-pahse, 4-wire + ground

E. Maximum Continuous Operating Voltage (MCOV): greater than 115 percent of nominal voltage for all products. All suppression filter systems comply with NEMA LS 1.

F. Frequency: Operating frequency range of 47 – 64 Hertz.

G. Protection Modes: all phases – phase to ground; all phases – phase to neutral; all phases – phase to phase; and neutral to ground.

H. Rated Single Pulse Surge Current Capacity: at rated voltage, no less than:

160,000 A Line to Line
80,000 A Line to Neutral
80,000 A Line to Ground
80,000 A Neutral to Ground

I. Tested Single Pulse Surge Current Capacity: Filter system is designed to withstand a single pulse surge current up to 150 percent of the design rating and tested at an independent test laboratory. In the absence of testing facilities capable of such testing, testing of individual components or sub-assemblies within a mode is accepted by ANSI C62.41-1991; the testing includes a Category C1 surge test followed by a second Category C1 test. The test results demonstrate the unit does not degrade by more than 10 percent from the initial test.

J. Clamping Voltage: Suppression filter system clamping voltages are in compliance NEMA LS1-1992.

K. High Frequency Filter: EMI-RFI noise rejection or attenuation values comply with test and evaluation procedures of NEMA LS1-1992.

L. Overcurrent Protection: Unit includes coordinated UL 489 or UL 198 listed or recognized overcurrent protection devices; if fuses are used unit incorporates non-encapsulated,

field replaceable fuses.

M. Documentation: Provide product data including equipment manual, electrical and mechanical drawings indicated dimensions weights, mounting provisions, connection details and layout diagram, certified tests of UL1449 Listing/Clamp Voltages and NEMA LS1 compliance, certified single pulse surge current capacity testing, and minimum repetitive surge current capacity testing.

N. Status Indicators: Unit has long-life, solid state, externally visible status indicators that monitor the on-line status of each phase of the unit.

O. Warranty: 15-years Unlimited Free Replacement for service entrance Surge Protection Device.

P. Service entrance Surge Protection Device system shall be equal to Surge Suppression Inc. Model SSMA16-3Y1.

TAG	SERVICE
SPD-1	Service Entrance Surge Protection Device

5.2 **PHASE FAILURE/UNBALANCE/UNDER VOLTAGE/REVERSAL RELAY:** Phase monitor shall be designed to protect 3-phase motors regardless of size and for use with 200 – 240 or 425 – 485 VAC, 50 to 60 Hz motors to prevent damage. The unit shall constantly monitor the three phase voltages to detect harmful power line conditions, caused by single phasing, low voltage, phase reversal and voltage unbalance. When a harmful condition is detected, an output relay is deactivated after a trip delay. The output relay shall reactivate after power line conditions return to an acceptable level for the specified Restart Delay. The trip delay shall prevent nuisance tripping due to rapidly fluctuating power line conditions. Phase monitor shall have the following features and functions.

A. Under Voltage:
Trip: -15% of setting for 230V (-10% for 480V)
Reset: -12% of setting for 230V (-8% for 480V)

B. Over Voltage:
Trip: -15% of setting for 230V (-10% for 480V)
Reset: -12% of setting for 230V (-8% for 480V)

C. Phase Unbalance:
Trip: 7% with 5 second trip delay
15% with 1 second trip delay
Reset: 6%

D. Trip Delay:
5 seconds (delay is reduced to 1 second if Phase Unbalance is 15% or greater)

E. Reset Delay:
2 seconds standard (5-60 seconds optional)

F. Voltage Range: 200V to 240V or 425V to 525V

G. Output Rating: 10A resistive @ 240VAC
6A resistive @ 240VAC

H. Operating Temp: -40ºC to +50ºC, -38ºF to +122ºF

I. Storage Temp: -45ºC to +85ºC, -47ºF to +185ºF

J. Enclosure: Lexan, surface mount

K. UL and cUL listed

TAG	SERVICE
PM	Electrical System Power Monitor

5.3 **UNIVERSAL MODULE:** Provide a Universal Module(s) including the following features and functions.

A. The Module shall be supplied with any combination of four selector switches, pilot lights or pushbuttons.

B. Pushbuttons, if used, shall have a rating of 3 amps at 125 Volts.

C. Selector Switches, if used, shall have a rating of 3 amps at 125 Volts.

D. Pilot Lights, if used, shall be multicolored LED type and have a 24 Volt rating.

E. The pilot lights shall be capable of being tested for operation via remote pushbutton.

F. The Module shall be a flush, front of panel mounted device.

TAG	SERVICE
UM-TW1	Tilt Weir No.1 Interface Module
UM-TW2	Tilt Weir No.2 Interface Module
UM-TW3	Tilt Weir No.3 Interface Module
UM-TW4	Tilt Weir No.4 Interface Module

5.4 **CONTROL POWER SURGE PROTECTION DEVICE (SPD):** The surge protection device shall be mounted in the control panel in series with the control power circuit. Provide a single-phase, in-line series AC power line surge protector with the following features:

A. Rated voltage shall be 120 VAC @ 60Hz.

B. Current rating shall be 20 Amps @ 40°C.

C. The protection circuitry shall automatically reset after the transient has passed.

D. Protection modes shall be: Line to Neutral, Line to Ground, and Neutral to Ground.

E. Provide three (3) Green LED indicators to indicate protection status of each mode when power is present (L-N, L-G, N-G).

F. Varistors with integral thermally activated elements shall be used to open in the event of overheating due to the abnormal overvoltage, limited current conditions outlined in UL1449. The lower inductance of the varistors shall result in improved clamping performance to fast overvoltage transients.

G. Metal Oxide Varistors (MOV) shall have cured, flame retardant epoxy polymer coating meeting UL94V-0 requirements.

H. Electromagnetic Interference (EMI) filtration shall be incorporated into the unit to dampen unwanted signals from the protected side of the unit.

I. Operating temperature shall be -40 to +70°C.

J. Screw terminals shall be provided for all wiring.

K. Maximum continuous operating VAC shall be 115% of rated line voltage.

TAG	SERVICE
SPD-2	Control Power Surge Protection Device

- END OF SECTION -

CONTRACT DRAWINGS FOR
NEW RIVER CHANNEL TILTING WEIR STRUCTURE
EAST ASCENSION CONSOLIDATED GRAVITY DRAINAGE DISTRICT NO.1
ASCENSION PARISH, LOUISIANA
PARISH PROJECT No. EAD 15-004
HDCA PROJECT NO. 2021-14

H. Davis Cole & Associates, LLC
Consulting Engineers

NEW ORLEANS OFFICE
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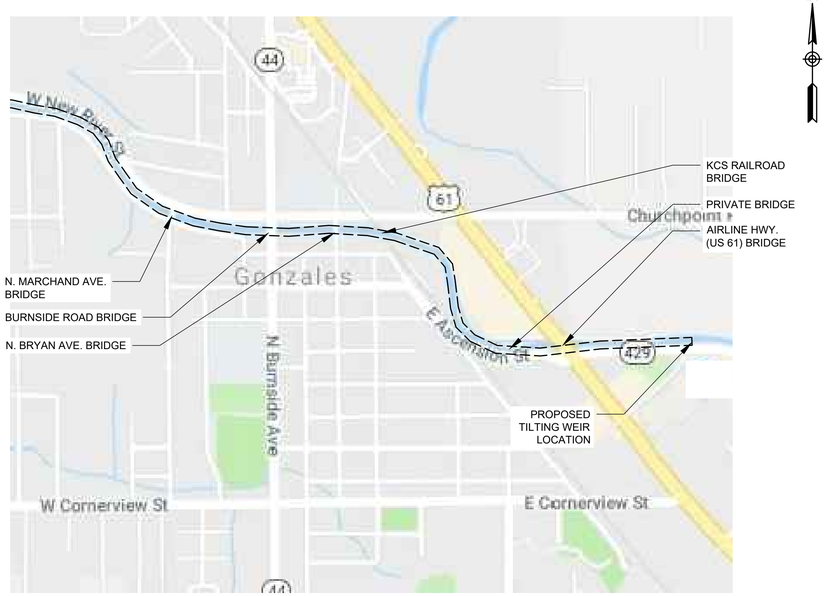

PROJECT AREA
SCALE: N.T.S.

EAST ASCENSION CONSOLIDATED GRAVITY DRAINAGE DISTRICT NO.1
42077 CHURCHPOINT ROAD
GONZALES, LA 70737

APPROXIMATE PROJECT SITE GPS COORDINATES
30° 14' 12.91" N
90° 54' 31.40" W

ISSUED FOR CONSTRUCTION
(ADDENDUM #1)

PREPARED FOR

EAST ASCENSION CONSOLIDATED
GRAVITY DRAINAGE DISTRICT NO.1
42077 CHURCHPOINT ROAD
GONZALES, LA 70737

PARISH PRESIDENT
CLINT COINTMENT

DIRECTOR-ASCENSION PARISH DPW
RON SAVOY, P.E.

PARISH COUNCIL

ALVIN THOMAS	DISTRICT 1
JOEL ROBERT	DISTRICT 2
TRAVIS TURNER	DISTRICT 3
COREY ORGERON	DISTRICT 4
DEMPSEY LAMBERT	DISTRICT 5
CHASE MELANCON	DISTRICT 6
AARON LAWLER	DISTRICT 7
TERI CASSO	DISTRICT 8
DAL WAGUESPACK	DISTRICT 9
JOHN CAGNOLATTI	DISTRICT 10, CHAIRMAN
MICHAEL MASON	DISTRICT 11

PREPARED BY AND RECOMMENDED FOR APPROVAL BY:
H. DAVIS COLE & ASSOCIATES, LLC

STATE OF LOUISIANA
HOWARD DAVIS COLE
License No. 30219
REGISTERED PROFESSIONAL ENGINEER
CIVIL ENGINEERING

30219
LICENSE No.

DATE

H. DAVIS COLE, P.E.
MANAGING MEMBER
PRINCIPAL ENGINEER

APPROVED BY:
ASCENSION PARISH GOVERNMENT

RON SAVOY
DIRECTOR, PUBLIC WORKS

DATE

LIST OF DRAWINGS

COVER SHEET

01-CO	COVER SHEET

GENERAL

G1	LIST OF DRAWINGS
G2	GENERAL NOTES AND PROJECT CONTACTS
G3	GENERAL NOTES AND SPECIFICATIONS
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CIVIL

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MECHANICAL

01-M1	TILTING WEIR MECHANICAL DETAILS
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STRUCTURAL

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S3	STRUCTURAL DETAILS
S4	STRUCTURAL DETAILS
01-S1	TILTING WEIR STRUCTURAL DETAILS
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01-S4	SHEET PILE CLOSURE STRUCTURE

ELECTRICAL

01-E1	ELECTRICAL SITE PLAN
01-E2	ELECTRICAL PLAN AND RISER DIAGRAM
01-E3	ELECTRICAL DETAILS AND PARTS SCHEDULES
01-E4	ELECTRICAL CONTROLS DIAGRAM

SUPPLEMENTAL

- SURVEY PREPARED BY BRYANT HAMMETT & ASSOCIATES, LLC

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" (BASED ON 22"X34" SHEET) THEN DRAWING IS NOT TO SCALE.

H. Davis Cole & Associates, LLC
Consulting Engineers
NEW ORLEANS, LA

REVISION RECORD

MARK	DESCRIPTION	DATE	BY	CHK'D
1	ADDENDUM #1	10/31/22	HDC	HDC

DESIGNED BY: HDC
DRAWN BY: RM
CHECKED BY: HDC
DATE: Oct-22
DETAILED BY: RM
HDC PROJECT NO. 2021-14

NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH
LIST OF DRAWINGS

SHEET ID
G1

SHEET SET
2 OF **30**

GENERAL

1) THESE NOTES AND SPECIFICATIONS ARE GENERAL AND APPLY TO THE ENTIRE PROJECT UNLESS THERE ARE SPECIFIC INDICATIONS OTHERWISE. NOTES AND SPECIFICATIONS ARE CONTINUED THROUGHOUT THE PLANS.

2) NOTIFY THE OWNER, ENGINEER, AND RESIDENT PROJECT REPRESENTATIVE, OWNER'S PROGRAM MANAGER, AND OPERATOR OF CONSTRUCTION A MINIMUM OF ONE WEEK PRIOR TO THE BEGINNING OF CONSTRUCTION. NOTIFY THE ENGINEER AT THE CONCLUSION OF CONSTRUCTION TO ALLOW FOR INSPECTION OF THE PROJECT.

3) IN THE EVENT OF DISCREPANCIES, CONFLICTS, OR OMISSIONS, IMMEDIATELY NOTIFY THE OWNER, ENGINEER, AND RESIDENT PROJECT REPRESENTATIVE AND OBTAIN WRITTEN INSTRUCTIONS FROM THE ENGINEER PRIOR TO PROCEEDING WITH AFFECTED WORK.

4) ASSUME COMPLETE AND SOLE RESPONSIBILITY FOR THE JOB SITE INCLUDING THE SAFETY OF PERSONS, PROPERTY, AND ADJACENT IMPROVEMENTS. ANY INSPECTION BY THE ENGINEER WILL BE SOLELY TO DETERMINE COMPLIANCE WITH THE PLANS AND SPECIFICATIONS AND WILL NOT INCLUDE ANY REVIEW OF THE ADEQUACY OF THE CONTRACTOR'S SAFETY MEASURES.

5) THESE DRAWINGS ARE SCALED FOR PRODUCTION ON 22" X 34" MEDIA (ANSI - D SHEET SIZE). SCALE PRINTS ON OTHER SIZED MEDIA ACCORDINGLY.

6) ASSUME RESPONSIBILITY FOR THE PROVISION OF ALL TEMPORARY UTILITIES NECESSARY FOR THE PROPER EXECUTION OF THE WORK IN THE MOST EFFICIENT MANNER PRACTICAL. INCLUDE THE COST OF PROVISION OF THESE TEMPORARY UTILITIES IN THE PRICE OF THE WORK.

7) USE NEW OR USED MATERIALS AND EQUIPMENT FOR TEMPORARY UTILITIES, WHICH ARE IN SUBSTANTIALLY UNDAMAGED CONDITION AND WITHOUT SIGNIFICANT DETERIORATION AND WHICH ARE RECOGNIZED IN THE CONSTRUCTION INDUSTRY, BY COMPLIANCE WITH APPROPRIATE STANDARDS, AS BEING SUITABLE FOR INTENDED USE IN EACH CASE. WHERE A PORTION OF A TEMPORARY UTILITY IS PROVIDED BY UTILITY COMPANY, PROVIDE THE REMAINING PORTION WITH MATCHING AND COMPATIBLE MATERIALS AND EQUIPMENT AND COMPLY WITH RECOMMENDATIONS OF UTILITY COMPANY.

8) PROVIDE POWER REQUIRED FOR OPERATIONS UNDER THE CONTRACT, AND PROVIDE AND MAINTAIN ALL TEMPORARY POWER LINES REQUIRED TO PERFORM THE WORK IN A SAFE AND SATISFACTORY MANNER.

9) PROVIDE A WEATHERPROOF, GROUNDED, TEMPORARY POWER DISTRIBUTION SYSTEM SUFFICIENT FOR PERFORMANCE OF ENTIRE WORK OF PROJECT. PROVIDE CIRCUITS OF ADEQUATE SIZE AND PROPER POWER CHARACTERISTICS FOR EACH USE; RUN CIRCUIT WIRING WHERE IT WILL BE LEAST EXPOSED TO POSSIBLE DAMAGE FROM CONSTRUCTION OPERATIONS AND WILL RESULT IN MINIMAL INTERFERENCE WITH PERFORMANCE OF THE WORK; PROVIDE RIGID STEEL CONDUIT OR EQUIVALENT RACEWAYS FOR WIRING WHICH MUST BE EXPOSED ON GRADE, FLOORS, DECKS, OR OTHER EXPOSURES TO DAMAGE OR ABUSE. INSTALL AND MAINTAIN WIRING FOR TEMPORARY ELECTRIC LIGHT AND POWER AND SECURELY FASTEN IN PLACE. PROVIDE TEMPORARY ELECTRICAL FACILITIES WHICH CONFORM TO THE REQUIREMENTS OF SUBPART K OF THE OSHA SAFETY AND HEALTH STANDARDS FOR CONSTRUCTION.

10) USE SUITABLE LIGHT TO INSURE PROPER WORK AND TO AFFORD ADEQUATE FACILITIES FOR INSPECTION AND SAFE WORKING CONDITIONS DURING WORK CONDUCTED AT NIGHT OR UNDER CONDITIONS OF DEFICIENT DAYLIGHT.

11) PROVIDE A GENERAL, WEATHERPROOF, GROUNDED TEMPORARY LIGHTING SYSTEM IN EVERY AREA OF CONSTRUCTION WORK, AS SOON AS PRACTICAL TO PROVIDE SUFFICIENT ILLUMINATION FOR SAFE WORK AND TRAFFIC CONDITIONS. RUN CIRCUIT WIRING IN LOCATIONS WHERE IT WILL BE LEAST EXPOSED TO POSSIBLE DAMAGE FROM CONSTRUCTION OPERATIONS.

12) PROVIDE AN ADEQUATE SUPPLY OF WATER OF A QUALITY SUITABLE FOR ALL DOMESTIC AND CONSTRUCTION PURPOSES. DO NOT MAKE ANY CONNECTION TO OR DRAW WATER FROM ANY FIRE HYDRANT OR PIPELINE WITHOUT FIRST OBTAINING PERMISSION OF THE AUTHORITY HAVING JURISDICTION OVER THE USE OF SAID FIRE HYDRANT OR PIPELINE AND FROM THE AGENCY OWNING THE AFFECTED WATER SYSTEM. FOR EACH SUCH CONNECTION MADE, FIRST ATTACH TO THE FIRE HYDRANT OR PIPELINE A VALVE AND A METER, IF REQUIRED BY THE SAID AUTHORITY, OF A SIZE AND TYPE ACCEPTABLE TO SAID AUTHORITY AND AGENCY. PAY ALL PERMIT AND WATER CHARGES AND INCLUDE ALL COSTS IN THE PRICE OF THE WORK.

13) INVESTIGATE THE CONDITION OF AVAILABLE PUBLIC AND PRIVATE ROADS AND OF CLEARANCES, RESTRICTIONS, BRIDGE LOAD LIMITS, AND OTHER LIMITATIONS AFFECTING TRANSPORTATION AND INGRESS AND EGRESS TO THE SITE OF THE WORK. CONSTRUCT AND MAINTAIN ANY HAUL ROADS REQUIRED FOR ITS CONSTRUCTION OPERATIONS.

14) WHEREVER NECESSARY, TO MAINTAIN VEHICULAR CROSSINGS, PROVIDE SUITABLE TEMPORARY BRIDGES OR STEEL PLATES OVER UNFILLED EXCAVATIONS, EXCEPT IN SUCH CASES AS THE WRITTEN CONSENT OF THE RESPONSIBLE INDIVIDUALS OR AUTHORITIES TO OMIT SUCH TEMPORARY BRIDGES OR STEEL PLATES. DELIVER EVIDENCE OF SUCH CONSENT TO THE ENGINEER PRIOR TO EXCAVATION. MAINTAIN ALL SUCH BRIDGES OR STEEL PLATES IN SERVICE UNTIL ACCESS IS PROVIDED ACROSS THE BACKFILLED EXCAVATION. CONFORM TO THE REQUIREMENTS OF THE AUTHORITY HAVING JURISDICTION IN EACH CASE, AND ADOPT DESIGNS FURNISHED BY SAID AUTHORITY FOR SUCH BRIDGES OR STEEL PLATES, OR SUBMIT DESIGNS TO SAID AUTHORITY FOR APPROVAL, AS MAY BE REQUIRED.

15) ASSUME FULL RESPONSIBILITY FOR MAKING ARRANGEMENTS FOR ANY NECESSARY OFF-SITE STORAGE OR SHOP AREAS NECESSARY FOR THE PROPER EXECUTION OF THE WORK.

16) PROTECT ALL EXISTING UTILITIES AND IMPROVEMENTS NOT DESIGNATED FOR REMOVAL AND RESTORE DAMAGED OR TEMPORARILY RELOCATED UTILITIES AND IMPROVEMENTS TO A CONDITION EQUAL TO OR BETTER THAN PRIOR TO SUCH DAMAGE OR TEMPORARY RELOCATION.

17) DO NOT COMMENCE OPERATIONS ADJACENT TO PROPERTIES OF RAILWAY AND UTILITY COMPANIES OR ADJACENT TO OTHER PROPERTY, DAMAGE TO WHICH MIGHT RESULT IN CONSIDERABLE EXPENSE, LOSS OR INCONVENIENCE UNTIL AFTER ALL ARRANGEMENTS NECESSARY FOR THE PROTECTION THEREOF HAVE BEEN MADE.

18) COOPERATE WITH OWNERS OF UTILITY LINES IN THEIR REMOVAL AND REARRANGEMENT, IN ORDER THAT THESE OPERATIONS MAY PROGRESS IN A REASONABLE MANNER, THAT DUPLICATION OF REARRANGEMENT WORK MAY BE MINIMIZED AND THAT SERVICES RENDERED BY THOSE PARTIES WILL NOT BE UNNECESSARILY INTERRUPTED.

19) IN THE EVENT OF INTERRUPTION OF UTILITY SERVICES DUE TO ACCIDENTAL BREAKAGE OR BEING EXPOSED OR UNSUPPORTED, PROMPTLY NOTIFY THE PROPER AUTHORITY AND COOPERATE WITH SUCH AUTHORITY IN RESTORATION OF SERVICE. IF UTILITY SERVICE IS INTERRUPTED, COOPERATE COMPLETELY WITH THE PROPER AUTHORITY UNTIL SERVICE IS RESTORED. UNDERTAKE NO WORK AROUND FIRE HYDRANTS UNTIL PROVISIONS FOR CONTINUED SERVICE HAVE BEEN APPROVED BY THE LOCAL FIRE AUTHORITY.

20) ESTABLISH AND MAINTAIN AN EFFECTIVE QUALITY CONTROL PROCESS. THE QUALITY CONTROL PROCESS CONSISTS OF PLANS, PROCEDURES, AND ORGANIZATION NECESSARY TO PROVIDE MATERIALS, EQUIPMENT, WORKMANSHIP, FABRICATION, CONSTRUCTION AND OPERATIONS WHICH COMPLY WITH THE CONTRACT REQUIREMENTS. THE PROCESS COVERS CONSTRUCTION OPERATIONS BOTH ONSITE AND OFFSITE, AND IS KEYED TO THE PROPOSED CONSTRUCTION SEQUENCE.

21) ASSUME FULL AND SOLE RESPONSIBILITY FOR THE PROTECTION OF THE SITE, AND ALL WORK, MATERIALS, EQUIPMENT AND EXISTING FACILITIES THEREON, AGAINST THEFT, VANDALS, AND OTHER UNAUTHORIZED PERSONS.

22) MAKE NO CLAIM AGAINST OWNER BY REASON OF ANY ACT OF AN EMPLOYEE OR TRESPASSER, AND MAKE GOOD ALL DAMAGE TO OWNER'S PROPERTY RESULTING FROM HIS FAILURE TO PROVIDE SECURITY MEASURES AS SPECIFIED.

23) USE SECURITY MEASURES THAT ARE AT LEAST EQUAL TO THOSE USUALLY PROVIDED TO PROTECT THE EXISTING FACILITIES DURING NORMAL OPERATION, BUT ALSO INCLUDE SUCH ADDITIONAL SECURITY FENCING, BARRICADES, LIGHTING, WATCHMAN SERVICES AND OTHER MEASURES AS REQUIRED TO PROTECT THE SITE.

24) PROMPTLY REMOVE FROM THE VICINITY OF THE COMPLETED WORK, ALL RUBBISH, UNUSED MATERIALS, CONCRETE FORMS, CONSTRUCTION EQUIPMENT, AND TEMPORARY STRUCTURES AND FACILITIES USED DURING CONSTRUCTION. FINAL ACCEPTANCE OF THE WORK BY THE OWNER WILL BE WITHHELD UNTIL THE CONTRACTOR HAS SATISFACTORILY PERFORMED THE FINAL CLEANUP OF THE SITE.

PROJECT LAYOUT

1) ASSUME RESPONSIBILITY FOR LAYING OUT THE WORK AND VERIFYING ALL MEASUREMENTS PRIOR TO AND DURING THE ENTIRE PERIOD OF CONSTRUCTION. CONTINUOUSLY VERIFY ALL MEASUREMENTS.

2) THE MEASUREMENTS, EQUIPMENT ARRANGEMENTS, LINES, AND GRADES SHOWN ON THE PLANS MAY BE VARIED SLIGHTLY BY THE ENGINEER IN THE FIELD IF CONDITIONS JUSTIFY SUCH A VARIATION.

METALS

1) VERIFY ALL DIMENSIONS AND MAKE ANY FIELD MEASUREMENTS NECESSARY. ASSUME FULL RESPONSIBILITY FOR ACCURACY AND LAYOUT OF WORK. REVIEW THE DRAWINGS, AND REPORT ANY DISCREPANCIES WITH ACTUAL DIMENSIONS TO THE ENGINEER FOR CLARIFICATION PRIOR TO STARTING FABRICATION.

2) UNLESS OTHERWISE INDICATED, COAT FABRICATED STEEL METALWORK WHICH WILL BE USED IN A CORROSIVE ENVIRONMENT AND/OR WILL BE SUBMERGED IN WATER/WASTEWATER AS SPECIFIED OR AS INDICATED AND DO NOT GALVANIZE PRIOR TO COATING. HOT-DIP GALVANIZE OTHER MISCELLANEOUS STEEL METALWORK AFTER FABRICATION.

3) UNLESS OTHERWISE INDICATED, USE TYPE 316 STAINLESS STEEL METALWORK AND BOLTS. WHERE ANAEROBIC CONDITIONS ARE NOTED, USE TYPE 304 STAINLESS STEEL.

4) UNLESS OTHERWISE INDICATED, USE ALLOY 6061-T6 ALUMINUM METALWORK. ALUMINUM IN CONTACT WITH CONCRETE, MASONRY, WOOD, POROUS MATERIALS, OR DISSIMILAR METALS COAT CONTACT SURFACES IN ACCORDANCE WITH SECTION 09800.

5) UNLESS OTHERWISE INDICATED, PROVIDE AND INSTALL IRON CASTINGS COMPLYING WITH THE REQUIREMENTS OF ASTM A 48, CLASS 50B OR BETTER.

6) PROVIDE AND INSTALL STRUCTURAL STEEL COMPLYING WITH THE TABLE BELOW:

WIDE FLANGE SHAPES	ASTM A 992
OTHER SHAPES, PLATES, BARS	ASTM A 36
PIPE, PIPE COLUMNS BOLLARDS	ATM A 53, TYPE E OR S, GRADE B STANDARD WEIGHT UNLESS NOTED OTHERWISE
HSS	ATM 500 GRADE B

7) UNLESS OTHERWISE INDICATED, USE STEEL BOLTS, ANCHOR BOLTS, WASHERS, AND NUTS AS INDICATED. USE BOLTS AND NUTS WITH THREADS FORMED BY SUITABLE TAPS AND DIES SUCH THAT THEY RETAIN NORMAL CLEARANCES AFTER HOT-DIP GALVANIZING. USE STEEL FOR BOLT MATERIAL, ANCHOR BOLTS AND CAP SCREWS IN ACCORDANCE WITH THE FOLLOWING:

- STRUCTURAL CONNECTIONS: ASTM A 307, GRADE A OR B, HOT-DIP GALVANIZED.
- ANCHOR BOLTS: ASTM A 307, GRADE A OR B, OR ASTM A 36, HOT-DIP GALVANIZED.
- HIGH STRENGTH BOLTS WHERE INDICATED: ASTM A 325.
- PIPE AND EQUIPMENT FLANGE BOLTS: ASTM A 193, GRADE B-7.

8) USE STAINLESS STEEL BOLTS, NUTS, AND WASHERS IN THE LOCATIONS LISTED BELOW AS INDICATED.

- BURIED LOCATIONS.
- SUBMERGED LOCATIONS.
- LOCATIONS SUBJECT TO SEASONAL OR OCCASIONAL FLOODING.
- INSIDE HYDRAULIC STRUCTURES BELOW THE TOP OF THE STRUCTURE.
- INSIDE BURIED VAULTS, MANHOLES, WET WELLS, AND STRUCTURES.
- CHEMICAL HANDLING AREAS.
- INSIDE TRENCHES, CONTAINMENT WALLS, AND CURBED AREAS.
- LOCATIONS INDICATED BY THE CONTRACT DOCUMENTS OR DESIGNATED BY THE ENGINEER TO BE PROVIDED WITH STAINLESS STEEL BOLTS.

9) UNLESS OTHERWISE INDICATED, USE TYPE 316 STAINLESS STEEL, CLASS 2, BOLTS, ANCHOR BOLTS, NUTS, AND WASHERS, CONFORMING TO ASTM A 193 FOR BOLTS AND TO ASTM A 194 FOR NUTS. PROTECT THREADS ON STAINLESS STEEL BOLTS WITH AN ANTISEIZE LUBRICANT SUITABLE FOR SUBMERGED STAINLESS STEEL BOLTS, TO MEET GOVERNMENT SPECIFICATION MIL-A-907E. COAT BURIED BOLTS IN POORLY DRAINED SOIL THE SAME AS THE BURIED PIPE. USE ANTI - SEIZE LUBRICANT CLASSIFIED AS ACCEPTABLE FOR POTABLE WATER USE BY THE NSF.

10) USE BOLT AND NUT MATERIAL OF FREE CUTTING STEEL.

11) USE NUTS CAPABLE OF DEVELOPING THE FULL STRENGTH OF THE BOLTS. USE COARSE THREAD SERIES CONFORMING TO THE REQUIREMENTS OF THE AMERICAN STANDARD FOR SCREW THREADS. USE BOLTS AND CAP SCREWS WITH HEXAGON HEADS AND HEAVY HEXAGON SERIES NUTS.

12) INSTALL BOLTS AND NUTS WITH WASHERS FABRICATED OF MATERIAL MATCHING THE BASE MATERIAL OF BOLTS. CONFORM TO THE REQUIREMENTS OF THE AISC SPECIFICATION FOR HARDENED WASHERS FOR HIGH STRENGTH BOLTS. INSTALL LOCK WASHERS FABRICATED OF MATERIAL MATCHING THE BOLTS WHERE INDICATED.

13) MAKE THE LENGTH OF EACH BOLT SUCH THAT THE BOLT EXTENDS AT LEAST 1/8-INCH BEYOND THE OUTSIDE FACE OF THE NUT BEFORE TIGHTENING, EXCEPT FOR ANCHOR BOLTS, MAKE FLUSH WITH THE FACE OF THE NUT BEFORE TIGHTENING.

14) ADHESIVE ANCHORS AND RODS: UNLESS OTHERWISE INDICATED, USE DRILLED CONCRETE OR MASONRY ANCHORS FOR ADHESIVE ANCHOR AND ROD SYSTEMS AS SPECIFIED BELOW.

A. USE ANCHORS AND RODS THAT EMPLOY AN INJECTABLE ADHESIVE. FURNISH ADHESIVE IN SIDE-BY-SIDE REFILL PACKETS THAT KEEP COMPONENTS SEPARATE PRIOR TO INSTALLATION. USE SIDE - BY - SIDE REFILL PACKETS THAT ACCEPT STATIC MIXING NOZZLES WHICH THOROUGHLY COMBINES COMPONENTS AND ALLOWS INJECTION DIRECTLY INTO DRILLED HOLE. USE ONLY INJECTION TOOLS AND STATIC MIXING NOZZLES AS RECOMMENDED BY MANUFACTURER. FOLLOW MANUFACTURER'S RECOMMENDED INSTRUCTIONS. USE HILTI - HY 500 MAX - SD OR EQUAL FOR INJECTION ADHESIVE.

B. FURNISH ANCHOR RODS WITH CHAMFERED ENDS SO THAT EITHER END WILL ACCEPT A NUT AND WASHER. ALTERNATIVELY, FURNISH ANCHOR RODS WITH AT 45 DEGREE CHISEL END ON ONE END TO ALLOW FOR EASY INSERTION INTO AN ADHESIVE - FILLED HOLE. USE ANCHOR RODS MANUFACTURED FROM AISI STAINLESS STEEL WITH A MINIMUM TENSILE STRENGTH OF 100 KSI AND A MINIMUM YIELD STRENGTH OF 65 KSI. USE TYPE 316 STAINLESS STEEL NUTS COMPLYING WITH ASTM F594. USE TYPE 316 STAINLESS WASHERS COMPLYING WITH ASTM A240, TYPE "A" (PLAIN).

15) DO NOT USE EXPANDING TYPE OR "WEDGE" ANCHORS.

16) USE HEAT-TREATED STEEL ALLOY FOR POWDER-DRIVEN PINS FOR INSTALLATION IN CONCRETE OR STEEL. IF THE PINS ARE NOT INHERENTLY SUFFICIENTLY CORROSION-RESISTANT FOR THE CONDITIONS TO WHICH THEY WILL BE EXPOSED, PROTECT IN AN ACCEPTABLE MANNER. USE PINS THAT HAVE CAPPED OR THREADED HEADS CAPABLE OF TRANSMITTING THE LOADS THE SHANKS ARE REQUIRED TO SUPPORT. USE LONGITUDINAL SERRATIONS AROUND THE CIRCUMFERENCE OF THE SHANK FOR PINS THAT ARE CONNECTED TO STEEL. POWDER-DRIVEN PINS TO BE INSTALLED BY A CRAFTSPERSON CERTIFIED BY THE MANUFACTURER AS BEING QUALIFIED TO INSTALL THE MANUFACTURER'S PINS. DRIVE PINS SHALL IN ONE INITIAL MOVEMENT BY AN INSTANTANEOUS FORCE THAT HAS BEEN CAREFULLY SELECTED TO ATTAIN THE REQUIRED PENETRATION. CONFORM DRIVEN PINS TO THE FOLLOWING REQUIREMENTS WHERE "D" = PIN'S SHANK DIAMETER.

MATERIAL PENETRATED BY PIN	MATERIAL MINIMUM THICKNESS	PIN SHANK PENETRATION IN SUPPORTING MATERIAL	MINIMUM SPACE FROM PIN'S CL TO EDGE OF PENETRATED MATERIAL	MINIMUM PIN SPACING
CONCRETE	16D	6D MINIMUM	14D	20D
STEEL	¼"	STEEL THICKNESS	4D	7D

17) USE EXPANSION TYPE ANCHOR FOR IMPACT ANCHORS IN WHICH A NAIL TYPE PIN IS DRIVEN TO PRODUCE THE EXPANSIVE FORCE. USE PIN WITH A ZINC SLEEVE WITH A MUSHROOM STYLE HEAD AND STAINLESS STEEL NAIL PIN. USE METAL HIT ANCHORS, MANUFACTURED BY HILTI, INC., RAWL ZAMAC NAILIN, MANUFACTURED BY THE RAWLPLUG COMPANY; OR EQUAL.

18) FABRICATE STRUCTURAL STEEL IN ACCORDANCE WITH THE DRAWINGS, AISC SPECIFICATIONS, AND AS SHOWN ON THE SHOP DRAWINGS. PROPERLY MATCH-MARK FABRICATED MEMBERS FOR FIELD ASSEMBLY. WHERE FINISHING IS REQUIRED, COMPLETE ASSEMBLY INCLUDING BOLTING AND WELDING OF UNITS, BEFORE START OF FINISHING OPERATIONS. BOLT OR WELD SHOP AND FIELD CONNECTIONS AS INDICATED. DEVELOP ALL CONNECTIONS FULL STRENGTH OF MEMBERS JOINED AND CONFORM TO AISC STANDARD CONNECTIONS. UNLESS OTHERWISE INDICATED, PROVIDE WELDS CONFORMING TO AISC LRFD SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS.

PROJECT AND UTILITY CONTACTS

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UTILITY/OTHER FACILITY OWNERS IN PROJECT AREA

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EATEL ..... TBD

REGIONAL NOTIFICATION CENTER ..... LOUISIANA ONE CALL
811
louisiana811.com

CONTACT EACH AGENCY AND/OR COMPANY LISTED PRIOR TO CONSTRUCTION TO ENSURE THAT THE FOLLOWING REQUIREMENTS ARE MET:

A) CONTACT EACH AGENCY AND COMPANY RELATIVE TO THE EXACT LOCATION OF ANY UNDERGROUND INSTALLATIONS PRIOR TO THE RELIANCE UPON THE ACCURACY OF SUCH LOCATIONS SHOWN ON THE DRAWINGS;
B) CONTACT EACH AGENCY AND COMPANY TO NOTIFY EACH AGENCY AND COMPANY OF THE START OF CONSTRUCTION;
C) CONTACT EACH AGENCY AND COMPANY TO VERIFY ANY PROPOSED CONSTRUCTION OR MODIFICATION BY ANY AGENCY AND COMPANY IN THE PROJECT AREA;
D) CONTACT EACH AGENCY AND COMPANY TO VERIFY ANY SPECIAL CONSTRUCTION REQUIREMENTS RELATED TO EACH COMPANY OR AGENCY'S FACULTY(IES).

CONTACT THE REGIONAL NOTIFICATION CENTER PRIOR TO CONSTRUCTION IN ACCORDANCE WITH THE REQUIREMENTS OF STATE LAW.

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" (BASED ON 22"X34" SHEET) THEN DRAWING IS NOT TO SCALE.

H. Davis Cole & Associates, LLC
Consulting Engineers
NEW ORLEANS, LA

MARK	DESCRIPTION	DATE	BY	CHK'D
1	ADDENDUM #1	10/31/22	HDC	HDC

REVISION RECORD

DESIGNED BY: HDC
DRAWN BY: RM
CHECKED BY: HDC
DETAILED BY: RM
DATE: Oct-22
HDC PROJECT NO. 2021-14

NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH

GENERAL NOTES AND PROJECT CONTACTS

SHEET ID
G2

SHEET SET
3 OF 30

METALS CON'T.

19) WELD USING THE METAL-ARC METHOD OR GAS-SHIELDED ARC METHOD AS DESCRIBED IN THE AMERICAN WELDING SOCIETY'S "WELDING HANDBOOK" AS SUPPLEMENTED BY OTHER PERTINENT STANDARDS OF THE AWS. ENSURE QUALIFICATION OF WELDERS ARE IN ACCORDANCE WITH THE AWS STANDARDS GOVERNING SAME. IN ASSEMBLY AND DURING WELDING, ADEQUATELY CLAMP, SUPPORT, AND RESTRAIN COMPONENT PARTS TO MINIMIZE DISTORTION AND FOR CONTROL OF DIMENSIONS. INSURE WELD REINFORCEMENT AS INDICATED BY THE AWS CODE. UPON COMPLETION OF WELDING, REMOVE WELD SPLATTER, FLUX, SLAG, AND BURRS LEFT BY ATTACHMENTS. REPAIR WELDS TO PRODUCE A WORKMANLIKE APPEARANCE, WITH UNIFORM WELD CONTOURS AND DIMENSIONS. GROUND SHARP CORNERS OF MATERIAL THAT IS TO BE PAINTED OR COATED TO A MINIMUM OF 1/32-INCH ON THE FLAT.

20) STRUCTURAL STEEL PLATES SHAPES, BARS, AND FABRICATED ASSEMBLIES REQUIRED TO BE GALVANIZED SHALL, AFTER THE STEEL HAS BEEN THOROUGHLY CLEANED OF RUST AND SCALE, BE GALVANIZED IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM A 123. ANY GALVANIZED PART THAT BECOMES WARPED DURING THE GALVANIZING OPERATION SHALL BE STRAIGHTENED. BOLTS, ANCHOR BOLTS, NUTS, AND SIMILAR THREADED FASTENERS, AFTER BEING PROPERLY CLEANED, SHALL BE GALVANIZED IN ACCORDANCE WITH THE REQUIREMENTS OF ASTM A 153. FIELD REPAIRS TO DAMAGED GALVANIZING SHALL BE MADE BY PREPARING THE SURFACE AND APPLYING A COATING. SURFACE PREPARATION SHALL CONSIST OF REMOVING OIL, GREASE, SOIL, AND SOLUBLE MATERIAL BY CLEANING WITH WATER AND DETERGENT (SSPC SP1) FOLLOWED BY BRUSH OFF BLAST CLEANING (SSPC SP7), OVER AN AREA EXTENDING AT LEAST 4-INCHES INTO THE UNDAMAGED AREA. COATING SHALL BE APPLIED TO AT LEAST 3-MILS DRY FILM THICKNESS. USE ZINC-CLAD XI BY SHERWIN-WILLIAMS, GALVAX BY ALVIN PRODUCTS, OR GALVITE BY ZRC WORLDWIDE.

21) DRILLED ANCHORS AND REINFORCING BARS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. HOLES SHALL BE ROUGHENED WITH A BRUSH ON A POWER DRILL, CLEANED AND DRY. DRILLED ANCHORS SHALL NOT BE INSTALLED UNTIL THE CONCRETE HAS REACHED THE REQUIRED 28-DAY COMPRESSIVE STRENGTH. ADHESIVE ANCHORS SHALL NOT BE LOADED UNTIL THE ADHESIVE HAS REACHED ITS INDICATED STRENGTH IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.

STRUCTURAL CONCRETE AND REINFORCEMENT

1) UNLESS NOTED OTHERWISE OR SPECIFIED OTHERWISE, CAST ALL STRUCTURAL CONCRETE IN PLACE. UNLESS NOTED OTHERWISE PROVIDE CONCRETE WHICH WHEN MOLDED AND CURED IN ACCORDANCE WITH DOTD TR 226 AND TESTED IN ACCORDANCE WITH DOTD TR 230, EXHIBITS A MINIMUM COMPRESSIVE STRENGTH NOT LESS THAN 4,000 PSI AT 28 DAYS.

2) PROVIDE GRADE 60 REINFORCING STEEL UNLESS NOTED OTHERWISE. BARS SMALLER THAN NO. 3 NEED NOT BE DEFORMED. SIZE W 5 WIRE MAY BE USED IN LIEU OF BARS SMALLER THAN NO 3. USE BILLET-STEEL DEFORMED AND PLAIN BARS COMPLYING WITH THE REQURIEMENTS OF ASTM 615 AND THAT ARE PRODUCED AT A MILL LISTED ON THE LDOTD AML (FORMERLY QPL 71). USE RAIL-STEEL AND AXLE-STEEL DEFORMED AND PLAIN BARS COMPLYING WITH ASTM A 996. USE COLD DRAWN STEEL COMPLYING WITH ASTM A 1064 WITH THE FOLLOWING AMENDMENT: FOR MATERIAL TESTING OVER 110,000 PSI TENSILE STRENGTH IN HIGH STRENGTH APPLICATIONS SUCH AS SPIRALS AND TIES, REDUCE THE 25 PERCENT MINIMUM REDUCTION IN AREA 5 PERCENT FOR EACH 10,000 PSI INCREMENT OF TENSILE STRENGTH EXCEEDING 110,000 PSI. USE WELDED STEEL WIRE FABRIC THAT CONFORMS TO ASTM A 1064. WHERE INDICATED, USE EPOXY COATED REINFORCING STEEL AND PATCHING MATERIALS COMPLYING WITH AASHTO M 284 AND LISTED ON THE LDOTD AML (FORMERLY QPL 51).

3) ADHERE TO THE FOLLOWING TOLERANCES IN PLACING REINFORCING:

   ± $\frac{3}{8}$" FOR MEMBERS WITH THICKNESS </= 8"

   ± $\frac{1}{2}$" FOR MEMBERS WITH THICKNESS > 8"

4) ADHERE TO THE FOLLOWING MINIMUM CONCRETE COVER IN PLACING REINFORCEING:

   FOR CONCRETE PLACED AGAINST EARTH - - - - - - - - - - - - - - - - - 3"

   FOR SURFACES IN CONTACT WITH WATER- - - - - - - - - - - - - - - - - 2$\frac{1}{2}$"

   FOR FORMED SURFACES IN CONTACT WITH EARTH- - - - - - - - - 2"

   FOR UNDERSIDE OF SLABS OVER WATER, BEAMS,

   AND COLUMNS NOT IN CONTACT WITH WATER OR EARTH - - - 2"

   FOR ALL OTHER SURFACES- 2"

5) WHERE WALLS AND SLABS ARE SHOWN WITH A SINGLE LAYER OF REINFORCEMENT, CENTER REINFORCEMENT IN THE WALL OR SLAB, UNLESS NOTED OTHERWISE.

6) ROUGHEN AND THOROUGHLY CLEAN ALL JOINT SURFACES.

7) HOLD DOWELS, PIPES, WATERSTOPS, AND OTHER EMBEDDED MATERIALS SECURELY IN POSITION WHILE CONCRETE IS BEING PLACED.

8) DO NOT PLACE REINFORCING BARS AND ACCESSORIES IN CONTACT WITH ANY PIPE, PIPE FLANGE, METAL CONDUIT, OR OTHER METAL PARTS EMBEDDED IN CONCRETE. PROVIDE A MINIMUM OF 2 INCHES CLEARANCE IN ALL CASES.

9) PLACE ALL ITEMS EMBEDDED IN CONCRETE ON CENTER AT LEAST 4 TIMES THEIR OUTSIDE DIMENSION. DO NOT ALLOW THE OUTSIDE DIMENSION TO EXCEED ONE THIRD OF THE MEMBER THICKNESS.

10) CONSTRUCT SLABS WITH SLOPING SURFACES WITH THE INDICATED SLAB THICKNESS MAINTAINED AS THE MINIMUM. SLAB BOTTOMS CAN EITHER SLOPE WITH THE TOP SURFACE OR BE LEVEL. PLACE REINFORCEMENT IN SLAB WITH SLOPING SURFACES AT THE REQUIRED CLEARANCE FROM THE SLAB SURFACE.

11) ASIDE FROM NORMAL ACCESSORIES USED TO HOLD REINFORCING BARS FIRMLY IN POSITION. ADD AT A MINIMUM THE FOLLOWING WHERE TWO CURTAINS OF REINFORCEMENT ARE REQUIRED:

A. IN SLABS, #4 RISER OR Z SHAPE SPACER BARS AT 36 INCHES O.C MAXIMUM EACH WAY TO SUPPORT TOP BARS.

B. IN WALLS, #3 U OR Z SHAPE SPACERS AT 72 INCHES O.C. MAXIMUM EACH WAY

12) SPLICE VERTICAL REINFORCEMENT FOR CONCRETE OR MASONRY WITH DOWEL BARS OF THE SAME SIZE AND SPACING FROM THE FOUNDATION USING A STANDARD SPLICE LENGTH. PROVIDE HORIZONTAL CORNER BARS, WITH FULL TENSION LAPS, MATCHING CONTINUOUS BAR SIZE AND SPACING.

13) PLACE SEALANT AT THE TOP OF ALL JOINTS RECEIVING EXPANSION JOINT FILLER. DO NOT ALLOW SEALANT DEPTH TO EXCEED JOINT FILLER THICKNESS.

14) PROVIDE ALL EXPOSED CONCRETE CORNERS WITH A ¾" CHAMFER.

15) CONFORM THE FABRICATIONS AND PLACING OF REINFORCING BARS TO THE MANUAL OF STANDARDS PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES, ACI 315, LATEST EDITION UNLESS OTHERWISE NOTED.

16) ENSURE THAT ALL LAP SPLICES ARE A MINIMUM OF 40 BARS DIAMETER UNLESS OTHERWISE NOTED. STAGGER SPLICES SUCH THAT NOT MORE THAN 50% ARE SPLICED WITHIN THE LAP LENGTH.

17) GIVE ALL SLABS A LIGHTLY BROOMED FINISH UNLESS OTHERWISE SPECIFIED.

18) PLACE CONCRETE PER THE REQUIREMENTS OF ACI 305 (HOT WEATHER CONCRETE PLACEMENT) AND ACI 306 (COLD WEATHER CONCRETE PLACEMENT.)

19) CURE AND TEST PER REQUIREMENTS OF ACI 318, LATEST EDITION UNLESS OTHERWISE SPECIFIED.

20) DO NOT USE CALCIUM CHLORIDE AND/OR CHLORIDE CONTAINING ADMIXTURES.

21) SUBMIT MIX DESIGN INCLUDING PROPORTIONS OF ALL COMPONENTS AND SOURCES OF ALL COMPONENTS FOR REVIEW PRIOR TO PLACEMENT OF CONCRETE.

GEOTECHNICAL

1) A GEOTECHNICAL EXPLORATION REPORT WAS PREPARED FOR THE PROJECT BY GULF SOUTH ENGINEERING AND TESTING, INC. AND IS DATED JULY 18, 2022. A COPY OF THE REPORT IS ATTACHED TO THE PROJECT SPECIFICATIONS AND IS HEREBY INCORPORATED INTO THE CONTRACT DOCUMENTS. THE CONTRACTOR SHALL FOLLOW ANY AND ALL REQUIREMENTS AND RECOMMENDATIONS SET FORTH IN SAID REPORT UNLESS SPECIFICALLY INSTRUCTED OTHERWISE BY THE ENGINEER.

SURVEY

1) A SURVEY OF THE PROJECT SITE WAS CONDUCTED BY BRYANT HAMMETT & ASSOCIATES, LLC. DATED FEBRUARY, 2022. A COPY OF SAID SURVEY IS ATTACHED AND HEREBY INCORPORATED INTO THESE CONTRACT DRAWINGS

STATE OF LOUISIANA
HOWARD DAVIS COLE
License No. 31394
REGISTERED
PROFESSIONAL ENGINEER
10/31/22

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H. Davis Cole & Associates, LLC
CONSULTING ENGINEERS
NEW ORLEANS, LA

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EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH
GENERAL NOTES AND SPECIFICATIONS

SHEET ID
G3

SHEET SET
4 OF **30**

- CONCRETE (PLAN AND SECTION)
- GROUT OR SAND (PLAN OR SECTION)
- BRICK (PLAN AND SECTION)
- CMU (PLAN AND SECTION)
- STEEL/ METAL/ FRP (SMALL SCALE SECTION)
- STEEL/ GRATING/ FRP (SMALL SCALE SECTION)
- CHECKERPLATE (SECTION)
- GRATING (PLAN)
- GRATING OR SOLID FRP GRATING (SECTION)
- SAFETY GRATING (PLAN)
- SAFETY GRATING (PLAN)
- SAFETY GRATING (PLAN)
- WOOD (ELEVATION OR PLAN)
- LUMBER (NOMINAL)
- LUMBER (TRIMMED)
- GLULAM (SECTION)
- GLULAM (ELEVATION)
- PLYWOOD (SMALL SCALE)
- STRUCTURE OR FACILITY
- EXISTING STRUCTURE OR FACILITY
- FUTURE STRUCTURE OR FACILITY
- OPENING
- SPAN ARROW
- EARTH/ GRADE
- GRAVEL/ LIMESTONE/ AGGREGATE BASE
- CENTERLINE
- CL — CENTERLINE
- PL — PROPERTY LINE
- R/W — RIGHT OF WAY
- ESMT — EASEMENT
- TEMP ESMT — TEMPORARY EASEMENT
- G — UTILITY LINE (SEE DIRECTORY BELOW)
- G — GAS LINE (SIZE NOTED WHERE LARGER THAN 3")
- HP GAS — HIGH PRESSURE GAS
- 2" W — WATER LINE (SIZE INDICATED)
- TEL — UNDERGROUND TELEPHONE
- HVAC — HIGH VOLTAGE AC POWER LINE
- 24" SS — SANITARY SEWER (SIZE INDICATED)
- OHW — OVERHEAD WIRES
- 24" SD — STORM DRAIN (SIZE INDICATED)
- FOC — FIBER OPTIC CABLE
- COMM — COMMUNICATION CABLE
- FENCE (NEW)
- FENCE (EXISTING)
- WATER COURSE
- TRAIL OF DIRT ROAD
- 125 — MAJOR CONTOUR LINE (NEW)
- 125 — MAJOR CONTOUR LINE (NEW)
- 125 — MAJOR CONTOUR LINE (NEW)

- SUPPLY OR OUTSIDE AIR DUCT (FIRST DIMENSION, DUCT WIDTH)
- EXHAUST OR RETURN AIR DUCT (FIRST DIMESION, DUCT WIDTH)
- SIZE / CFM — CEILING SUPPLY DIFFUSER (SIZE IN INCHES)
- SIZE / CFM — CEILING RETURN OR EXHAUST AIR GRILLE OR REGISTER (SIZE IN INCHES, WIDTH X HEIGHT)
- SIZE / CFM — EXHAUST OR AIR GRILLE OR REGISTER (SIZE IN INCHES, WIDTH X HEIGHT)
- SIZE / CFM — SUPPLY GRILLE OR REGISTER (SIZE IN INCHES, WIDTH X HEIGHT)
- AIR TURNING VANES IN DUCT
- DD — DEFLECTING DAMPER
- FHC — FIRE HOSE CABINET
- FE — FIRE EXTINGUISHER
- UNIT HEATER
- BALL VALVE
- DIAPHRAGM VALVE
- CHECK VALVE
- PRESSURE RELEASE VALVE
- BACK PRESSURE VALVE
- M / P — MOTOR OPERATOR FOR VALVE (M = ELECTRIC / P = PNEUMATIC)
- T — TEMPERATURE CONTROL VALVE
- S — SOLENOID VALVE
- MULTIPORT VALVE - 3WAYS
- MULTIPORT VALVE - 4WAYS
- FLOAT OPERATED VALVE
- NEEDLE VALVE
- PRESSURE RELIEF VALVE
- ANGLE VALVE
- HOSE BIBB (H/B)
- INJECTOR OR EDUCTOR
- AIR VACUUM AND AIR RELEASE ASSEMBLY
- PIPE ANCHOR
- POWER POLE
- PIPELINE (CIVIL SHEETS) 24" Ø AND LARGER
- PIPELINE (CIVIL SHEETS) 12" Ø TO 20" Ø
- PIPELINE (CIVIL SHEETS) 10" Ø AND SMALLER
- FLOW — FLOW DIRECTION
- VEGETATION

- ISOLATION VAULT & MAJOR BLOWOFF VAULT (IN PLAN)
- T — CATHODIC TEST STATION (IN PROFILE)
- T — CATHODIC TEST STATION (IN PROFILE)

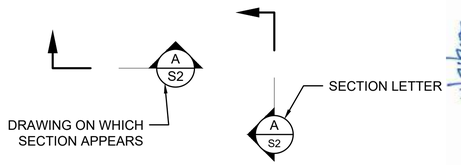
TYPES:	
CTS	CORROSION TEST STATION
CATS	CASING TEST STATION
IJTS	INSULATING JOINT TEST STATION
FPTS	FOREIGN PIPELINE TEST STATION
CSTS	CURRENT SPAN TEST STATION

- FH — FIRE HYDRANT
- MANHOLE
- PCOTG — PRESSURE CLEANOUT TO GRADE
- CTOG / CTOG — CLEANOUT TO GRADE
- REDUCER OR INCREASER (PROVIDED SIZE)
- ETS — ELECTROLYSIS TEST STATION
- WCO / WCO — WALL CLEANOUT
- FCO / FCO — FLOOR CLEANOUT
- HUB DRAIN
- FLOOR DRAIN
- FLOOR SINK
- CHANGE IN PIPING MATERIAL
- BACKWATER VALVE
- BACKFLOW PREVENTER
- STOP GATE
- SLIDE GATE
- SLUICE GATE
- GATE VALVE, BURIED WITH VALVE BOX
- BUTTERFLY VALVE, BURIED WITH VALVE BOX
- ECCENTRIC PLUG VALVE, BURIED VALVE BOX
- LUBRICATED PLUG VALVE, BURIED WITH VALVE BOX
- GATE VALVE
- BUTTERFLY VALVE OR DAMPER
- ECCENTRIC PLUG VALVE
- LUBRICATED PLUG VALVE
- GLOBE VALVE
- B — BUBBLE LEVEL CONTROL
- CENTRIFUGAL OR TURBINE PUMP OR FAN
- METERING PUMP

- PROGRESSIVE CAVITY, POSITIVE DISPLACEMENT PUMP
- PROGRESSIVE CAVITY, POSITIVE DISPLACEMENT PUMP
- G — PRESSURE GAUGE
- G — PRESSURE GAUGE WITH DIAPHRAGM SEAL
- S — PRESSURE SWITCH
- S — PRESSURE SWITCH WITH DIAPHRAGM SEAL
- FLANGED FITTING
- MECHANICAL - TYPE FITTING (GROOVED)
- SCREWED, WELDED, SOCKET-WELD, BELL & SPIGOT OR HUBLESS FITTING
- SLEEVE TYPE COUPLING
- FLANGED ADAPTER - SET SCREW TYPE
- MECHANICAL - TYPE COUPLING
- FLEXIBLE COUPLING
- UNION
- QUICK DISCONNECT COUPLING
- CAPPED END OR PLUGGED END
- BLIND FLANGE
- REDUCER OR INCREASER
- STRAINER OR 45° WYE
- DRAIN
- FLOW TUBE
- M M — MAGNETIC METER
- D M — DENSITY METER
- P M — PROPELLER METER
- U M — ULTRASONIC METER
- ORIFACE PLATE FLANGES
- ROTAMETER
- T — CONDENSATE TRAP
- PIPE SUPPORT ON PLAN
- PULSATION DAMPENER
- EXPANSION CHAMBER WITH RUPTURE DISC
- RUPTURE DISC
- FG — FLOW SIGHT GLASS

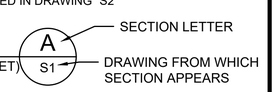
SECTION IDENTIFICATION

1) SECTION CUT ON DRAWING "S1"



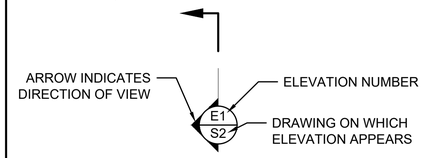
2) SECTION IDENTIFIED IN DRAWING "S2"

SECTION — SCALE: N.T.S. (22"x34" SHEET)



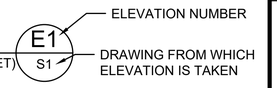
ELEVATION IDENTIFICATION

1) ELEVATION ON DRAWING "S1"



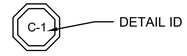
2) ELEVATION IDENTIFIED IN DRAWING "S2"

ELEVATION — SCALE: N.T.S. (22"x34" SHEET)



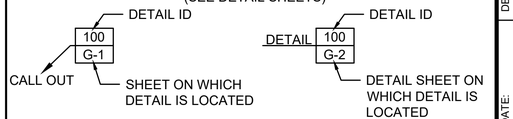
STANDARD DETAIL IDENTIFICATION

(SEE DETAIL SHEETS)



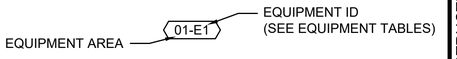
SPECIAL DETAIL IDENTIFICATION

(SEE DETAIL SHEETS)

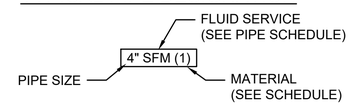


EQUIPMENT, PIPING & VALVE IDENTIFICATION

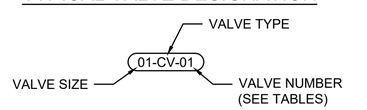
TYPICAL EQUIPMENT DESIGNATION



TYPICAL PIPE DESIGNATION



TYPICAL VALVE DESIGNATION



VALVE TYPES
CV - CHECK VALVE
PV - PLUG VALVE
GV - GATE VALVE
BV - BUTTERFLY VALVE
ARV - AIR RELEASE VALVE

EQUIPMENT/ VALVE AREAS
01- GENERAL

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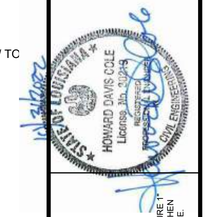
NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH
DRAWING STANDARDS AND SYMBOLS

SHEET ID
G4

SHEET SET
5 OF **30**

A	AIR
A/C	AIR CONDITIONING
AASHO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
AB	ANCHOR BOLTS
ABAN	ABANDON
ABAND	ABANDONED
ABBR	ABBREVIATION
ABS	ABSOLUTE TEMPERATURE
AC	ACTIVATED CARBON/ ASPHALTIC CONCRETE/ ALTERNATE CURRENT
ACI	AMERICAN CONCRETE INSTITUTION
ACOUS	ACOUSTIC/ ACOUSTICAL
ACP	ASBESTOS CEMENT PIPE/ ASPHALTIC CONCRETE PAVEMENT
ADD	ADDITION
ADH	ADHESIVE
ADJ	ADJUSTABLE
AER	AERATION
AFF	ABOVE FINISHED FLOOR
AFTS	AIR FLOW TEST STATION
AISC	AMERICAN INSTITUTION OF STEEL CONSTRUCTION
ALT	ALTERNATIVE
ALUM	ALUMINUM
AMB	AMBIENT
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
API	AMERICAN PETROLEUM INSTITUTE
APPD	APPROVED
APPROX	APPROXIMATE
APPURTS	APPURTENANCES
ARCH	ARCHITECTURE
AREA	AMERICAN RAILWAY ENGINEERING ASSOCIATION
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASPH	ASPHALT
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
AT	ACOUSTICAL TILE
ATM	ATMOSPHERE
AV/RV	AIR VACUUM AND AIR RELEASE VACUUM
AVE	AVENUE
AWPA	AMERICAN WOOD PRESERVERS ASSOCIATION
AWS	AMERICAN WELDING SOCIETY
AWWA	AMERICAN WATER WORKS ASSOCIATION
B&S	BELL AND SPIGOT
B/W	BACK OF WALL/ BACK OF WALK
BC	BEGIN CURVE/ BOLT CIRCLE/ BETWEEN CENTERS
BCR	BEGIN CURB RETURN
BD	BOARD
BDRY	BOUNDARY
BF	BLIND FLANGE/ BOTTOM OF FOOTING
BFP	BACK FLOW PREVENTER
BHP	BRAKE HORSEPOWER
BLDG	BUILDING
BLK	BLACK/ BLOCK
BLKG	BLOCKING
BLVD	BOULEVARD
BM	BEAM/ BENCHMARK
BO	BLOW-OFF ASSEMBLY
BOD	BIOCHEMICAL OXYGEN DEMAND
BOP	BOTTOM OF PIPE
BOT	BOTTOM
BPV	BACK PRESSURE VALVE
BRK	BRICK/ BREAK
BSMT	BASEMENT
BT	BOLT
BTU	BRITISH THERMAL UNIT
BV	BUTTERFLY VALVE
BVC	BEGIN VERTICAL CURVE
BWV	BACK WATER VALVE
C	CENTIGRADE/ CHANNEL/ CEMENT
C&G	CURB AND GUTTER
CAB	CABINET/ CRUSHED AGGREGATE BASE
CAP	CAPACITY
CATS	CASING TEST STATION
CB	CATCH BASIN/ CHALK BOARD/ CURB
CC	CLOSED CIRCUIT TV/ CENTER TO CENTER
CD	CEILING DIFFUSER
CEM	CEMENT
CF	CURB FACE OR CUBIC FEET
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CHEM	CHEMICAL
CHG	CHANGE
CHKD	CHECKED
CI	CAST IRON
CIP	CAST IRON PIPE/ CAST IN PLACE
CIPP	CAST IN PLACE PIPE
CJ	CONSTRUCTION JOINT
CL	CHLORINE GAS/ CHLORINATOR/ CENTERLINE
CLF	CHAIN LINK FENCE
CLG	CEILING
CLOS	CLOSET
CLR	CLEAR/ CLEARANCE
CM	CENTIMETER
CMB	CRUSHED MISCELLANEOUS BASE
CMC	CEMENT MORTAR-COATED
CML	CEMENT MORTAR-LINED
CML&C	CEMENT LINED AND COATED
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT
COL	COLUMN
COMP	COMPRESSOR
CONC	CONCRETE/ CONCENTRIC
COND	CONDENSER/ CONDENSATE
CONN	CONNECTION
CONST	CONSTRUCT/ CONSTRUCTION
CONT	CONTINUED/ CONTINUOUS
CONTR	CONTRACTOR
COORD	COORDINATE
COR	CORNER
COTG	CLEANOUT TO GRADE
CPLG	COUPLING
CPVG	CHLORINATED POLYVINYL CHLORIDE
CS	CAUSTIC SODA/ CAST STEEL
CSP	CORRUGATED STEEL PIPE
CSTS	CURRENT SPAN TEST STATION
CT	CERAMIC TILE
CTR	CENTER
CTS	CORROSION TEST STATION
CTSK	COUNTERSUNK
CU	COPPER/ CUBIC
CULV	CULVERT
CV	CHECK VALVE
CY	CUBIC YARD
CYL	CYLINDER
d	PENNY
DAD	DOUBLE ACTING DOOR
DAFT	DISSOLVED AIR FLOATATION THICKENER
DB	DIRECT BURY
DBL	DOUBLE
DC	DIRECT CURRENT
DEG	DEGREE
DET	DUCTILE IRON
DF	DRINKING FOUNTAIN/ DOUGLAS FIR
DH	DOUBLE HUNG
DI	DUCTILE IRON
DIA	DIAMETER
DIAG	DIAGONAL
DIAPH	DIAPHRAGM
DIFF	DIFFUSER/ DIFFERENTIAL
DIP	DUCTILE IRON PIPE
DIR	DIRECTION
DISCH	DISCHARGE
DISP	DISPENSER
DL	DEAD LOAD
DMH	DROP MANHOLE
DN	DOWN
DO	DISSOLVED OXYGEN/ DITTO
DPW	DEPT. OF PUBLIC WORKS
DR	DOOR/ DRAIN
DS	DRENCH SHOWER AND EYE WASH
DT	DRAIN TILE
DWG	DRAWING
DWLS	DOWELS
DWY	DRIVEWAY
E	EAST
E/O	EAST OF
EA	EACH
EB	EXPANSION BOLT OR ANCHOR
EC	END CURVE
ECC	ECCENTRIC
ECR	END CURB RETURN
EF	EACH FACE/ EXHAUST FAN
EFF	EFFLUENT
EG	EXHAUST GRADE/ EDGE OF GUTTER/ EXHAUST GRILLE
EGL	ENERGY GRADE LINE
EL	ELEVATION
ELEC	ELECTRICAL/ ELECTRONIC
EN	EDGE NAILING
ENCL	ENCLOSURE
ENG	ENGINE
ENGR	ENGINEER
ENT	ENTRANCE
EP	EDGE OF PAVEMENT
EPT	ETHYLENE PROPYLENE
EQ	EQUAL
EQUIP	EQUIPMENT
ESMT	EASEMENT
ETB	EMULSION TREATED BASE
ETC	ET CETERA
EVAP	EVAPORATOR
EVC	END VERTICAL CURVE
EW	EACH WAY/ EYE WASH
EX	EXISTING
EXC	EXCAVATION
EXH	EXHAUST
EX-HY	EXTRA HEAVY
EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERIOR/ EXTENSION
EXTR	EXTRUDE
F	FAHRENHEIT/ FINISH
F TO F	FACE TO FACE
F&C	FRAME AND COVER
F&I	FURNISH AND INSTALL
FA	FOUL AIR
FAB	FABRICATE/ FABRICATION
FAI	FRESH AIR INTAKE
FB	FLAT BAR/ FLOOR BEAM/ FIELD BOOK
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDR	FEEDER
FE	FIRE EXTINGUISHER/ FINAL EFFLUENT
FEM	FEMALE (PIPE THREAD)
FF	FLAT FACE/ FAR FACE/ FINISHED FLOOR
FG	FINISHED GRADE
FH	FIRE HYDRANT/ FLAT HEAD
FIG	FIGURE
FIN	FINISHED
FIX	FIXTURE
FL	FLOWLINE/ FLOOR
FLEX	FLEXIBLE
FLG	FLANGED/ FLOORING
FLGD	FLANGED
FLOCC	FLOCCULATOR/ FLOCCULATION
FLR	FLOOR
FLSG	FLASHING
FM	FACTORY MUTUAL (LAB APPROVED)/ FORCE MAIN
FMH	FLEXIBLE METAL HOSE
FN	FIELD NAILING
FND	FOUNDATION
FOC	FACE TO CONCRETE/ FIBER OPTIC CABLE
FOM	FACE OF MASONRY
FOS	FACE OF STUD
FOW	FACE OF WALL
FPC	FLEXIBLE PIPE COUPLING
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FPTS	FOREIGN PIPE TEST STATION
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FS	FIBERGLASS SURFACE/ FARSIDE/ FLOOR SINK/ FORGED STEEL/ FROTH SPRAY
FT	FEET/ FOOT
FTG	FOOTING
FUR	FURRING
FUT	FUTURE
FV	FIELD VERIFY
FWD	FORWARD
G	GAS
GA	GAGE/ GAUGE
GAL	GALLON
GALV	GALVANIZED
GANC	GUY ANCHOR
GB	GRADE BREAK
GEN	GENERAL/ GENERATOR
GFA	GROOVED FLANGE ADAPTER
GI	GALVANIZED IRON
GIP	GALVANIZED IRON PIPE
GL	GLASS/ GROUND LINE/ GRADE LINE
GLB	GLUE LAMINATED BEAM
GLV	GLOBE VALVE
GM	GAS METER
GP	GUY POLE
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS HER MINUTE
GR	GRADE
GRD	GRADE/ GROUND
GRTG	GRATING
GSP	GALVANIZED STEEL PIPE
GV	GATE VALVE
GYP	GYPSUM
H	HIGH/ HEIGHT
H&V	HEATING AND VENTILATING
H/B	HOSE BIBB
HC	HOUSE CONNECTION
HDR	HEADER
HDW	HARDWARE
HDWL	HEADWALL
HEX	HEXAGONAL
Hg	MERCURY
HGL	HYDRAULIC GRADE LINE
HGR	HANGER
HM	HOLLOW METAL
HORZ	HORIZONTAL
HP	HIGH POINT/ HORSE POWER/ HIGH PRESSURE
HPG	HIGH PRESSURE GAS
HR	HEAT RETURN/ HOUR
HTG	HEATING
HTR	HEATER
HV	HORIZONTAL AND VERTICAL CONTROL POINT
HVAC	HEATING, VENTILATION AND AIR CONDITION/ HIGH VOLTAGE AC POWER LINE
HW	HOT WATER/ HEADWORK
HWD	HARDWOOD
HWL	HIGH WATER LEVEL
HWO	HAND WHEEL OPERATED
HYD	HYDRAULIC/ HYDRANT
I&O	INSIDE AND OUTSIDE
ID	INSIDE DIAMETER
IF	INSIDE FACE
IJTS	INSULATING JOINT TEST STATION
IN	INCH
INCL	INCLUDE/ INCLUDING
INFL	INFLUENT
INSL	INSULATION
INSP	INSPECTION
INST	INSTRUMENT
INT	INT
IP	IRON PIE
IPS	IRON PIPE SIZE
IRRG	IRRIGATION
JAN	JANITOR
JT	JOINT
K	KELVIN/ KILO/ KARAT
KG	KILOGRAM
KM	KILOMETER
KV	KILOVOLT
KW	KILOWATT
KWH	KILOWATT HOUR
L	LITER/ LENGTH/ ANGLE
LAB	LABORATORY
LAM	LAMINATED
LAT	LATERAL
LAV	LAVATORY
LB	POUND
LCP	LOCAL CONTROL PANEL
LD	LOCAL DEPRESSION
LDG	LANDING
LDOTD	LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
LF	LINEAR FEET
LG	LENGTH/ LONG
LH	LAMP HOLE/ LEFT HAND
LL	LIVE LOAD
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LOC	LOCATION
LOL	LAYOUT LINE
LONG	LONGITUDINAL
LP	LOW POINT/ LOW PRESSURE/ LAMP POST
LSSRB	LOUISIANA STANDARD SPECIFICATION FOR ROADS AND BRIDGES
LT	LEFT/ LIGHT
LTS	LIME TREATED SOIL
LW	LOW WATER
LWL	LOW WATER LEVEL
LWR	LOWER
M	METER/ MALE (PIPE THREAD)
MACH	MACHINE
MAG	MAGNETIC
MAINT	MAINTENANCE
MAN	MANUAL
MAS	MASONRY
MATL	MATERIAL
MAX	MAXIMUM
MB	MAIL BOX/ MACHINE BOLT
MCC	MOTOR CONTROL CENTER
MCR	MIDDLE OF CURB RETURN
MEAS	MEASURE
MECH	MECHANICAL
MED	MEDIUM
MEMB	MEMBER
MFRD	MANUFACTURED
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MHT	MEAN HIGH TIDE
MHW	MEAN HIGH WATER
MI	MALLEABLE IRON/ MILE
MICRON	1/ 1,000,000TH METER
MIL	MILITARY/ 1/1,000TH INCH
MIN	MINIMUM/ MINUTE
MIR	MIRROR
MISC	MISCELLANEOUS
MK	MARK
MLW	MEAN LOW WATER
mm	MILLIMETER
MO	MOTOR OPERATED/ MASONRY OPENING
MOD	MODEL/ MODIFICATION
MON	MONUMENT/ MONITOR
MOR	MORTAR
MS	MOP SINK
MSL	MEAN SEA LEVEL
MTC	MECHANICAL-TYPE COUPLING
MTD	MOUNTED
MTG	MOUNTING
MTL	METAL
MTR	MOTOR
N	NORTH
NaOCl	SODIUM HYPOCHLORITE
NaOH	SODIUM HYDROXIDE (CAUSTIC SODA)
NBS	NATION BUREAU OF STANDARDS
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRIC CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NF	NEAR FACE
NFPA	NATION FIRE PROTECTION ASSOCIATION
NG	NATION GRADE/ NATURAL GAS
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN
NOM	NOMINAL
NPS	NOMINAL PIPE SIZE
NPT	NATIONAL PIPE THREAD
NRCP	NON-REINFORCED CONCRETE PIPE
NRS	NON-RAISING STEM
NS	NEAR SIDE
NTS	NOT TO SCALE
OBJ	OBJECT
OC	ON CENTER/ OVER-CROSSING
OD	OUTSIDE DIAMETER/ OVERALL DIMENSION
OE	OUTER EDGE
OF	OVERFLOW/ OUTSIDE FACE
OFD	OVERFLOW DRAIN
OFF	OFFICE
OH	OVERHEAD
OPER	OPERATOR/ OPERATING
OPNG	OPENING
OPP	OPPOSITE
ORIG	ORIGINAL
OS&Y	OUTSIDE SCREW & YORK
OSA	OUTSIDE AIR
OSHA	OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION
OWG	OIL, WATER, GAS
OZ	OUNCE
P	POLE/ PAGE/ PIPE
P/S	POLE AND SHELF
PA	PLANTING AREA
PART	PARTITION
PAVMT	PAVEMENT
PB	POLYBUTYLENE/ PULL BOX
PC	POINT OF CURVATURE/ PRIMARY CLARIFIER/ PORTLAND CEMENT
PCC	PORTLAND CEMENT CONCRETE/ POINT OF COMPOUND CURVE
PCCP	PRE-STRESSED CONCRETE CYLINDER PIPE
PCOTG	PRESSURE CLEANOUT TO GRADE
PCVC	POINT OF COMPOUND VERTICAL CURVE
PE	POLYETHYLENE/ PLANT EFFLUENT/ POLYELECTROLYTE POLYMER
PG	PRESSURE GAUGE
pH	HYDROGEN ION CONCENTRATION
PI	PLANT INFLUENT/ POINT OF INTERSECTION
PK	PARKING
PL	PLATE/ PROPERTY LINE/ PLACE
PLAS	PLASTER/ PLASTIC
PLT	PLANT
PLWD	PLYWOOD
PM	PRESSED METAL
PNEU	PNEUMATIC
PNL	PANEL
POB	POINT OF BEGINNING
POC	POINT OF CONNECTION
POT	POINT OF TANGENT
PP	POWER POLE/ POLYPROPYLENE
PPD	POUNDS PER DAY
PPH	POUNDS PER HOUR
PPM	POUNDS PER MINUTE
PR	PAIR
PRC	POINTS OF REVERSE CURVE
PRCT	PRECAST/ PERCENT
PREFAB	PREFABRICATED
PRESS	PRESSURE
PROF	PROFILE
PRV	PRESSURE REGULATING, RELIEF, OR REDUCING VALVE
PRVC	POINT OF REVERSE VERTICAL CURVE
PS	PRESSURE SWITCH
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAUGE
PT	POINT OF TANGENCY/ PAINT/ PRESSURE TREATED
PTFE	POLYTETRAFLUOROETHYLENE (TEFLON)
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE/ POLYVINYL CONDUIT (PIPE)
PVDF	POLYVINYLIDENE FLUORIDE (KYNAR)
QT	QUARRY TILE
QTY	QUANTITY
QUAD	QUADRANGLE/ QUADRANT
R	RADIUS/ RISER/ RATE OF SLOPE
R&O	ROCK AND OIL
R/W	RIGHT OF WAY
RAC	RECYCLED ASPHALT CONCRETE
RAG	RETURN AIR GRILLE
RAP	RECLAIMED ASPHALT PAVEMENT
RAS	RETURN ACTIVATED SLUDGE
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD/ ROOF DRAIN/ ROUND
RED	REDUCER/ REDUCING
REF	REFERENCE/ REFER/ REFRIGERATOR
REG	REGULATING
REINF	REINFORCE/ REINFORCED
REQD	REQUIRED
RESIL	RESILIENT
RET	RETAINING/ RETURN
REV	REVISION
RF	ROOF/ RAISED FOUNDATION/ ROUGH FACE
RFG	ROOFING
FGE	REGISTERED GEOTECHNICAL ENGINEER
RH	REDHEAD/ RIGHT HAND
RM	ROOM
RO	ROUGH OPENING
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RS	RAISING STEAM
RSL	RAW SLUDGE
RT	RIGHT
RTP	REINFORCED THERMOSETTING PLASTIC
RW	REDWOOD
RWL	RAINWATER LEADER
S	SOUTH/ SCUM/ SINK/ SECOND/ SLOPE/ SAND
S/O	SOUTH OF
SA	SAMPLE
SAN	SANITARY
SBR	STYRENE BUTADIENE (RUBBER)
SC	SPACE CHEMICAL/ SECONDARY CLARIFIER
SCCP	STEEL CYLINDER CONCRETE PIPE
SCD	SCREWED
SCFM	STANDARD CUBIC FEET PER MINUTE
SCH	SCHEDULE
SD	STORM DRAIN
SDR	STANDARD THERMOPLASTIC PIPE DIMENSION RATIO
SEC	SECONDARY/ SECTION
SER	SERIES
SETT	SETTING
SF	SQUARE FOOT
SH	SHOWER
SHELV	SHELVING
SHT	SHEET
SHTG	SHEATHING/ SHEETING
SIM	SIMILAR
SL	SLUDGE
SLDG	SLIDING
SLG	SLUICE GATE
SOG	SLAB ON GRADE
SOLN	SOLUTION
SP	STATIC PRESSURE
SPEC	SPECIFICATION
SPK	SPIKE
SQ	SQUARE
SST	STAINLESS STEEL
SSB	SELECT SUB-BASE
SSPWC	STANDARD SPECIFICATION FOR PUBLIC WORKS CONSTRUCTION
SSU	SECONDS SAYBOLT UNIVERSAL
ST	STREET/ STATE
STA	STATION
STC	SLEEVE-TYPE COUPLING
STD	STANDARD
STK	STAKE
STL	STEEL
STM	STEAM
STR	STRAIGHT/ STRUCTURAL
SUCT	SUCTION
SV	SOLENOID VALVE
SW	SIDEWALK
SWD	SIDEWALK DRAIN
SWGR	SWITCHGEAR
SWR	SIDEWALL REGISTER
SY	SQUARE YARD
SYM	SYMMETRICAL/ SYMBOL
SYS	SYSTEM
T	THERMOSTAT/ TREAD OF STAIR/ TANGENT/ TC
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
TAN	TANGENT
TB	TACK BOARD
TBE	THREAD BOTH ENDS
TBM	TEMPORARY BENCH MARK
TC	TOP OF CURB
TCV	TEMPERATURE CONTROL VALVE
TEL	TELEPHONE
TEMP	TEMPERATURE/ TEMPORARY
TF	TOP OF FOOTING
TH	TEST HOLE
THK	THICK/ THICKNESS
THR	THRESHOLD
THR'D	THREADED
TK	TANK/TACK
TL	TRAVERSE LINE
TOC	TOP OF CONCRETE
TOE	THREAD ONE END
TOL	TOILET
TOM	TOP OF MASONRY
TOP	TOP OF PIPE
TOPO	TOPOGRAPHIC
TOS	TOP OF STEEL
TOW	TOP OF WALL
TP	TELEPHONE POLE
TR	TRACT
TRANS	TRANSMITTER/ TRANSITION/ TRANSMISSION
TS	TRAFFIC SIGNAL
TSB	TOP SET BASE
TSC	TRAFFIC SIGNAL CONDUIT
TV	THERMOSTATIC VALVE/ TELEVISION
TW	THERMOMETER WELL/ TRAVELED WAY
TYP	TYPICAL
UB	UNION BONNET
UBC	UNIFORM BUILDING CODE
UC	UNDER-CROSSING
UG	UNDERGROUND
UGC	UNDERGROUND CONDUIT
UH	UNIT HEATER
UL	UNDERWRITER'S LABORATORIES
UNO	UNLESS NOTED OTHERWISE
UOI	UNLESS OTHERWISE INDICATED
UR	URINAL
USA	UNDERGROUND SERVICE ALERT
UDGS	UNITED STATES GEOLOGICAL SURVEY
V	VALVE/ VERTICAL/ VENT/ VOLT/ VOLUME
VAC	VACUUM
VAR	VARIES/ VARIABLE
VB	VALVE BOX
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VERT	VERTICAL
VOL	VOLUME
VPI	VERTICAL POINT OF INSERTION
VTC	VENT TO CEILING
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING
VWM	VERIFY WITH MANUFACTURER
W	WEST/ WASTE/ WIDTH/ WIDE FLANGE
W/	WITH
W/0	WEST OF/ WITHOUT
WC	WATER COLUMN/ WATER CLOSET
WCO	WALL CLEANOUT
WD	WOOD
WDW	WINDOW
WH	WATER HEATER/ WALL HEATER
WI	WROUGHT IRON
WM	WATER METER
WOG	WATER, OIL OR GAS
WP	WATERPROOFING/ WORKING PRESSURE/ WEAK POINT
WPJ	WEAKEN PLANE JOINT
WS	WATER SURFACE
WSTP	WATER STOP
WT	WEIGHT
WWF	WELDED WIRE FABRIC
WWP	WATER WORKING PRESSURE
WWTP	WASTE WATER TREATMENT PLANT
XCONN	CROSS CONNECTION
XS	EXTRA STRONG
XSEC	CROSS SECTION
XSS	DOUBLE EXTRA STRONG
YD	YARD
YR	YEAR
Z	ZERO/ ZONE
ZN	ZINC
#	POUND
&	AND
@	AT



WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" (BASED ON 22"x34" SHEET) THEN DRAWING IS NOT TO SCALE.

H. Davis Cole & Associates, LLC
Consulting Engineers
NEW ORLEANS, LA

MARK	DESCRIPTION	DATE	BY	CHK'D
1	ADDENDUM #1	10/31/22	HDC	HDC

REVISION RECORD

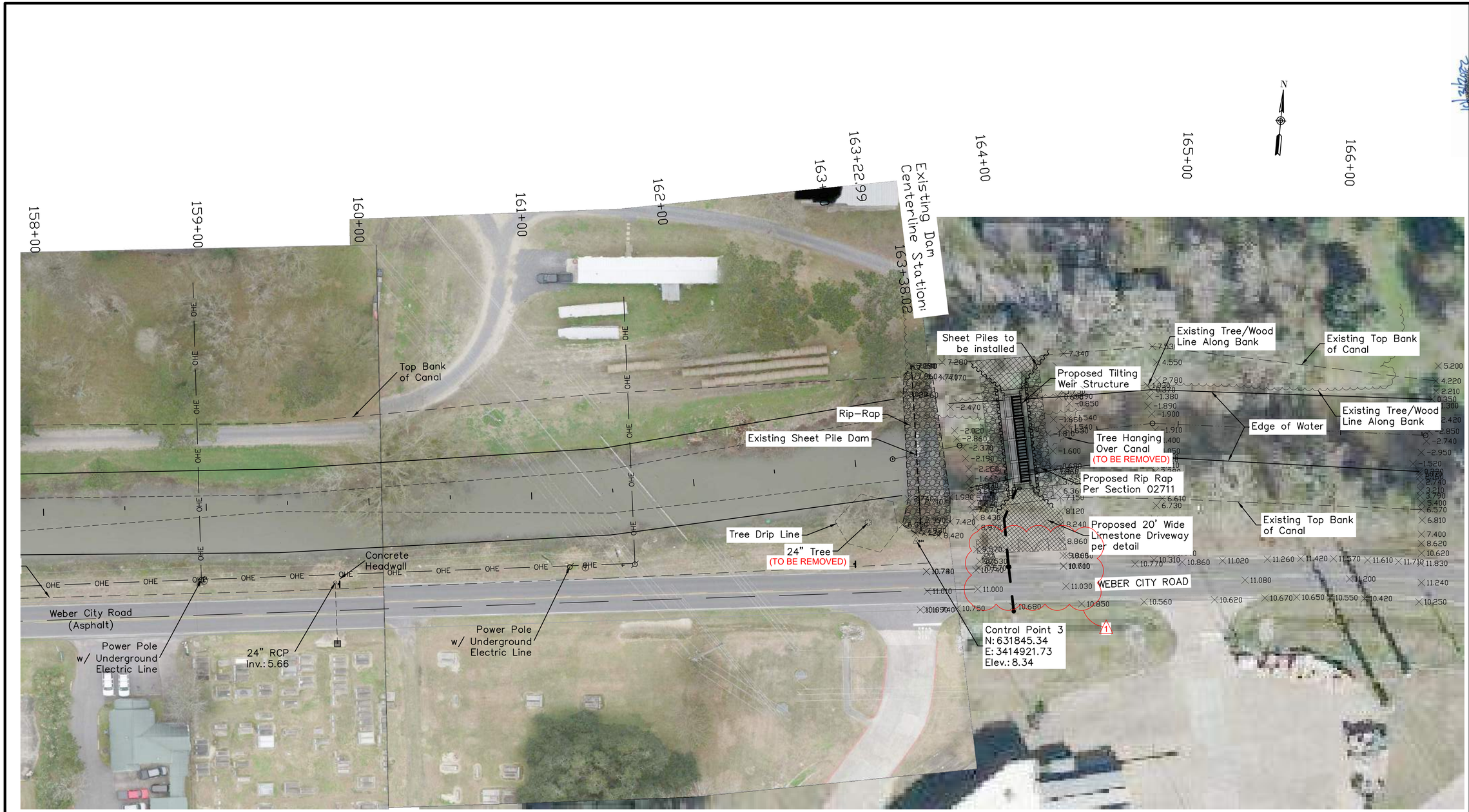
DESIGNED BY: HDC
DRAWN BY: RM
CHECKED BY: HDC
DATE: Oct-22
DETAILED BY: RM
HDC PROJECT NO. 2021-14

NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH

ABBREVIATIONS

SHEET ID
G5

SHEET SET
6 OF 30



PROJECT OVERVIEW / PROPOSED SITE PLAN

SCALE: 1" = 30'-0" (22"x34" SHEET)

HOWARD DAVIS COLE
License No. 31394
REGISTERED PROFESSIONAL ENGINEER
STATE OF LOUISIANA

WARNING

IF THIS BAR DOES NOT MEASURE 1" (BASED ON 22"x34" SHEET) THEN DRAWING IS NOT TO SCALE.

0 1/2 1

H. Davis Cole & Associates, LLC
Consulting Engineers
NEW ORLEANS, LA

MARK	DESCRIPTION	DATE	BY	CHK'D
1	ADDENDUM #1	10/31/22	HDC	HDC

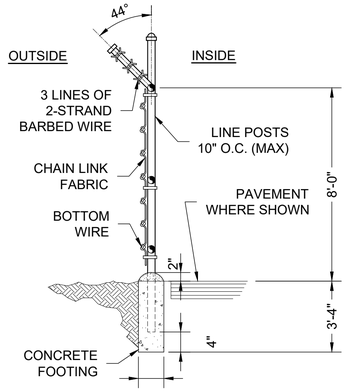
REVISION RECORD

DESIGNED BY: HDC
DRAWN BY: RM
CHECKED BY: HDC
DATE: Oct-22
DETAILED BY: RM
HDC PROJECT NO. 2021-14

NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH
PROJECT OVERVIEW / PROPOSED SITE PLAN

SHEET ID
G6

SHEET SET
7 OF **30**



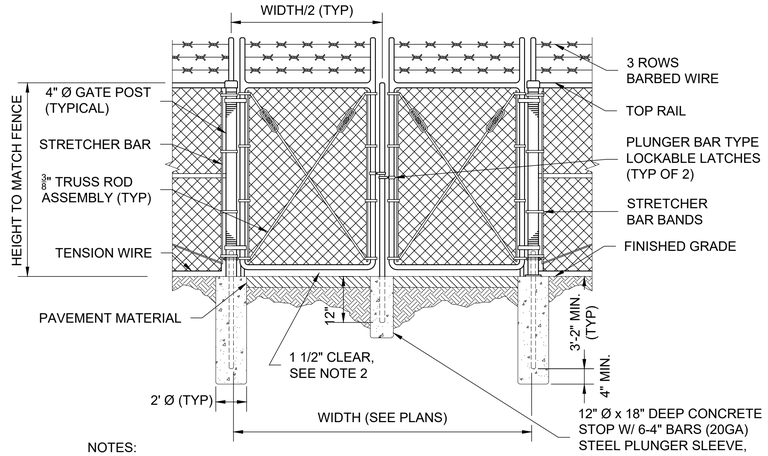
GATE POSTS SHALL BE 1'-0" Ø. OTHERS SHALL BE 12" OR 5x POST Ø,WHICHEVER IS GREATER

NOTES:
1. SEE SPECIFICATIONS FOR FENCE MATERIAL COATINGS, AND INSTALLATION REQUIREMENTS.
2. EXTENSION ARM MAY BE TURNED AT OPTION OF OWNER.

NOTE TO SPECIFIER

1) INCLUDE SECTION 02831- CHAIN LINK FENCING AND GATES IN CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS.

CHAIN LINK FENCE
SCALE: N.T.S. (22"x34" SHEET) C-101

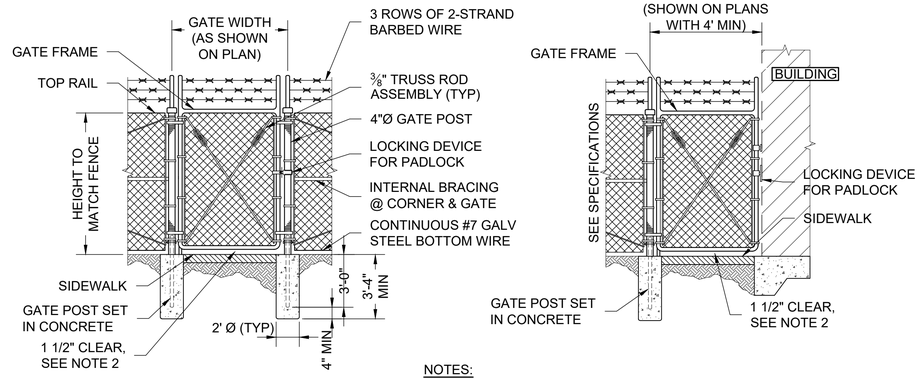


NOTES:
1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. SEE SPECIFICATIONS FOR CLEARANCE IN SNOW REGIONS

NOTES TO SPECIFIER

1) INCLUDE SECTION 02831 - CHAIN LINK FENCE & GATES IN TECHNICAL SPECIFICATIONS.

DOUBLE GATE
SCALE: N.T.S. (22"x34" SHEET) C-102

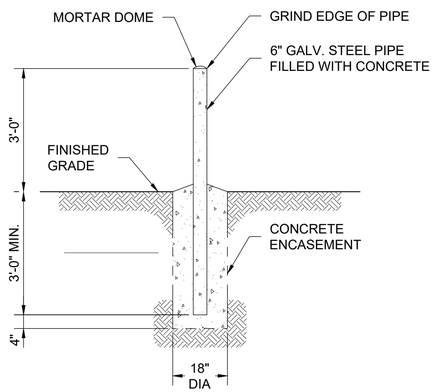


NOTES TO SPECIFIER

1) INCLUDE SECTION 02831 - CHAIN LINK FENCE & GATES IN TECHNICAL SPECIFICATIONS.

NOTES:
1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATING, AND INSTALLATION REQUIREMENTS.
2. SEE SPECIFICATIONS FOR CLEARANCES IN SNOW REGIONS.
3. DROP ROD ASSEMBLY TO SECURELY ENGAGE GATE STOP.
4. EACH GATE LEAF TO BE INSTALLED WITH KEEPER TO SECURE IN OPEN POSITION.
5. GATES LESS THAN 8'-0" IN WIDTH SHALL BE SINGLE LEAF.

PEDESTRIAN GATE
SCALE: N.T.S. (22"x34" SHEET) C-103



6" GUARD POST
SCALE: N.T.S. (22"x34" SHEET) C-130

WARNING
IF THIS BAR DOES NOT MEASURE 1" (BASED ON 22"x34" SHEET) THEN DRAWING IS NOT TO SCALE.
0 1/2 1"

H. Davis Cole & Associates, LLC
Consulting Engineers
NEW ORLEANS, LA

MARK	DESCRIPTION	DATE	BY	CHK'D
1	ADDENDUM #1	10/31/22	HDC	HDC

REVISION RECORD

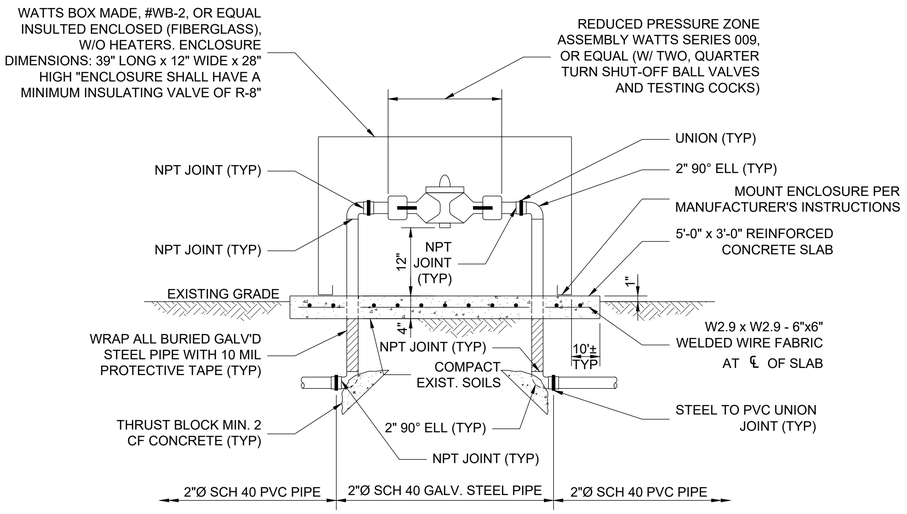
DESIGNED BY:	DRAWN BY:	CHECKED BY:
HDC	RM	HDC

DATE:	DETAILED BY:	HDC PROJECT NO.
Oct-22	RM	2021-14

NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH
CIVIL DETAILS

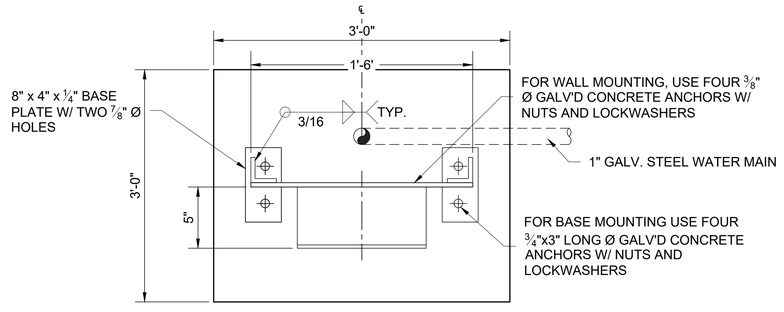
SHEET ID
C1

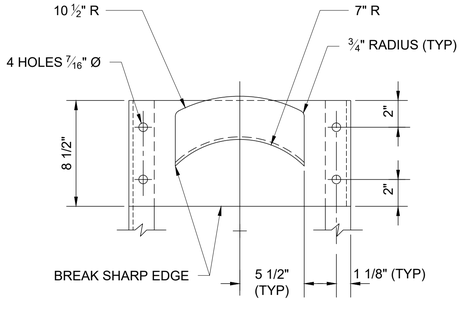
SHEET SET
8 OF 30



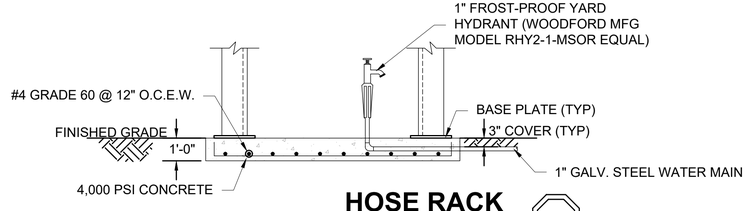
BACKFLOW PREVENTER

SCALE: N.T.S. (22"x34" SHEET) C-625



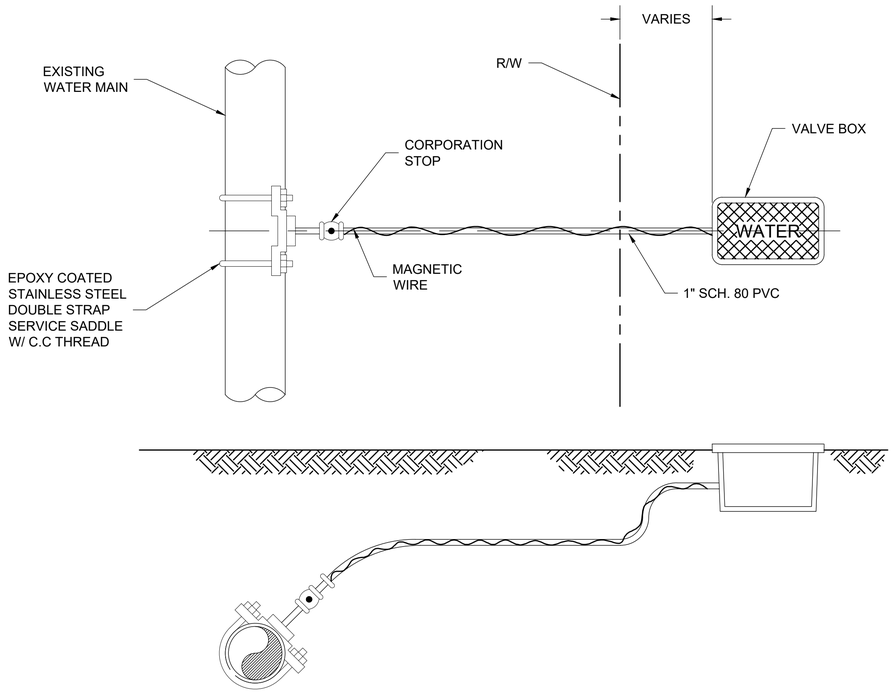


NOTES:
1. GALVANIZE ALL WELDED CONNECTIONS. 8 GAUGE STEEL SHEET GALV'D AFTER FABRICATION.
2. PROVIDE WITH EPPM WASHDOWN HOSE, 100' LONG x 3/4" DIAMETER.



HOSE RACK

SCALE: N.T.S. (22"x34" SHEET) M-905



NOTES:
1. BLUE 10 GAUGE THHN WIRE SHALL BE ATTACHED TO THE SERVICE LINE

2. WHERE SERVICES UNDER PAVEMENT ARE REQUIRED, THE POLYETHYLENE TUBING SHALL BE INSTALLED WITHIN SCHEDULE 40 P.V.C. CASING PIPE

3. 1" AND 3/4" METER SIZES SHALL REQUIRE A LOCKABLE METER VALVE (CURB STOP

4. MINIMUM COVER IN UNPAVED AREAS IS 18", IN PAVED AREAS OR PLANNED ROADWAYS OR SWALES MINIMUM COVER SHALL BE 36"

5. LOCATIONS PER OWNERS

WATER SERVICE DETAIL

SCALE: N.T.S. (22"x34" SHEET) C-650

H. Davis Cole & Associates, LLC
Consulting Engineers
NEW ORLEANS, LA

MARK	DESCRIPTION	DATE	BY	CHK'D
1	ADDENDUM #1	10/31/22	HDC	HDC

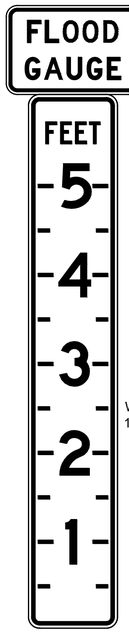
REVISION RECORD

DESIGNED BY: HDC
DRAWN BY: RM
CHECKED BY: HDC
DATE: Oct-22
DETAILED BY: RM
HDC PROJECT NO. 2021-14

NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH
CIVIL DETAILS

SHEET ID
C2

SHEET SET
9 OF 30



W8-19aTP
18x12

W8-19
12x72

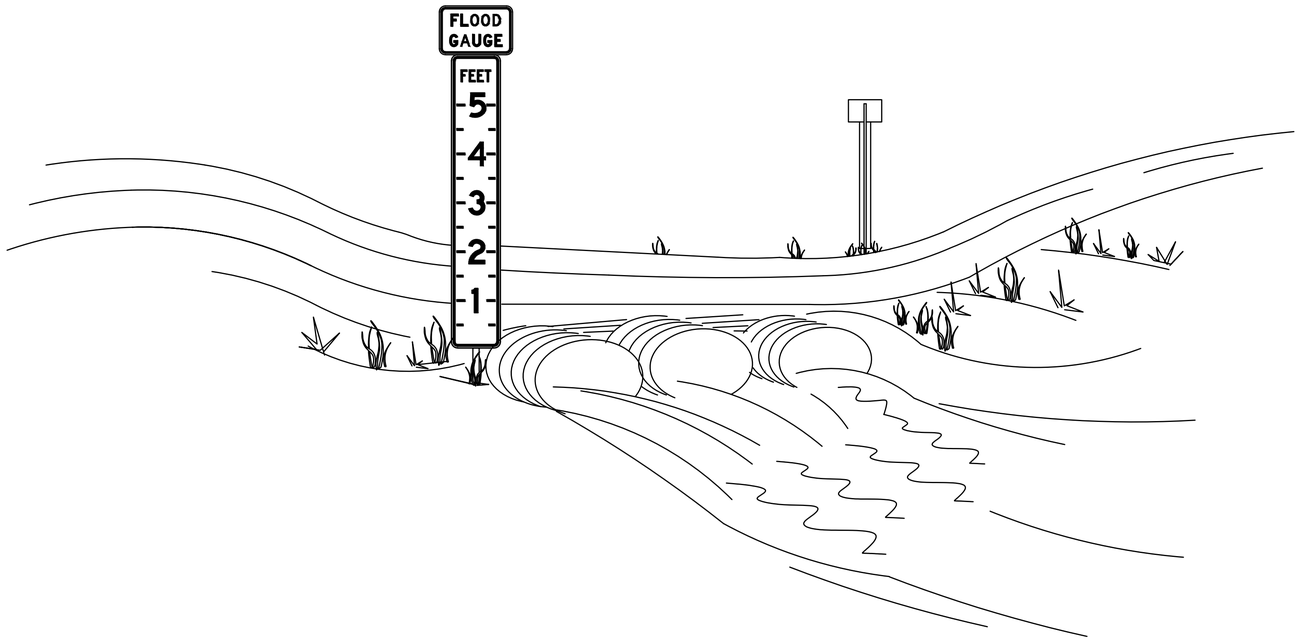
W8-18
36x36

W16-4P
18x12

DEPARTMENTAL MATERIAL SPECIFICATIONS	
ALUMINUM SIGN BLANKS	DMS-7110
SIGN FACE MATERIALS	DMS-8300

ALUMINUM SIGN BLANKS THICKNESS	
SQUARE FEET	MINIMUM THICKNESS
LESS THAN 7.5	0.0800
7.5 TO 15	0.1000
GREATER THAN 15	0.1250

SHEETING REQUIREMENTS		
USAGE	COLOR	SIGN FACE MATERIAL
BACKGROUND	FLUORESCENT YELLOW	TYPE B_{FL} & C_{FL} SHEETING
LEGEND AND BORDERS	BLACK	ACRYLIC NON-REFLECTIVE FILM



FLOOD GAUGE ASSEMBLY

SCALE: N.T.S. (22"x34" SHEET)

C-500

GENERAL NOTES:

1. EACH FLOOD GAUGE ASSEMBLY SHALL CONSIST OF THE FLOOD GAUGE SIGN (W8-19aTP) AND DEPTH MARKER (W8-19). TWO ASSEMBLIES SHOULD BE ERECTED, ONE ALONG EACH APPROACH, AT THE LOW WATER CROSSING LOCATION ON THE RIGHT SIDE OF THE ROADWAY.

2. THE FLOOD GAUGE ASSEMBLY SHOULD BE OF SUFFICIENT HEIGHT OT REGISTER DEPTH OF WATER TO A MINIMUM OF FIVE (5) FEET ABOVE THE LOWEST TRAVEL LANE PAVEMENT SURFACE. ACTUAL HEIGHT OF DEPTH MARKER REQUIRED FOR EACH LOCATION IS SHOWN ELSEWHERE IN THE PLANS, BUT SHOULD NOT BE IN EXCESS OF TEN (10) FEET.

3. THE FLOOD GAUGE ASSEMBLY SHOULD BE LOCATED NOT MORE THAN TEN (10) FEET FROM THE PAVEMENT EDGE. CONSIDERATION SHOULD BE GIVEN TO PLACEMENT WITH REGARD TO THE FOLLOWING FACTORS:
   A) ACCURATE REGISTER OF DEPTH OF WATER OVER ROADWAY
   B) DAYTIME AND NIGHTTIME VISIBILITY OF THE FLOOD GAUGE ASSEMBLY ALONG ROADWAY APPROACHES
   C) OUTSIDE THE MAIN FLOW OF WATER DURING BOTH NORMAL AND FLOOD CONDITIONS

4. IN AREAS WHERE FLOOD CONDITIONS WOULD LIKELY OBSCURE THE FLOOD GAUGE ASSEMBLY, A SECOND PAIR OF GAUGES, ONE ON EACH APPROACH, REGISTERING DEPTHS GREATER THAN SHOWN ON THE FIRST FLOOD GAUGE ASSEMBLY, IS RECOMMENDED.

5. THE ENGINEER WILL APPROVE ALL FLOOD GAUGE ASSEMBLY LOCATIONS BEFORE INSTALLATION.

6. THE ALPHABETS AND LATERAL SPACING BETWEEN LETTERS AND NUMERALS SHALL CONFORM WITH THE TEXAS "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS", LATEST EDITION, AND ANY APPROVED CHANGES THERETO. LATERAL SPACING OF TEXT SHALL PROVIDE A BALANCED APPEARANCE. ALL MATERIALS SHALL CONFORM TO DEPARTMENT SPECIFICATIONS.

7. FLOOD GAUGE SIGNS AND DEPTH MARKER SHALL BE MOUNTED IN ACCORDANCE WITH STANDARD SMD (SERIES). THE RECOMMENDED MOUNTING IS THREE (3) INCH FIBERGLASS REINFORCED PIPE (FRP) AS SHOWN ON STANDARD SMD (GEN) AND SMD (FRP). ROAD MAY FLOOD SIGN (W8-18) ALONG THE APPROACH ROADWAY MAY BE REQUIRED IN AREAS WHERE RAINFALL CAUSES FREQUENT ROADWAY FLOODING.

STATE OF LOUISIANA
HOWARD DAVIS COLE
License No. 31394
REGISTERED
PROFESSIONAL
ENGINEER
10/31/22

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" (BASED ON 22"X34" SHEET) THEN DRAWING IS NOT TO SCALE.

H. Davis Cole & Associates, LLC
Consulting Engineers
NEW ORLEANS, LA

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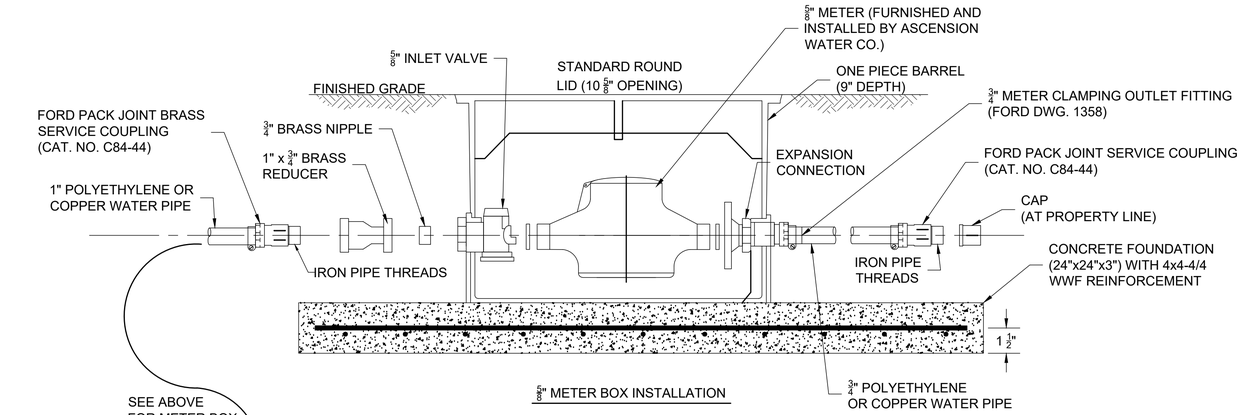
ASCENSION PARISH
LOUISIANA

EAST ASCENSION CONSOLIDATION GRAVITY
DRAINAGE DISTRICT 1
ASCENSION PARISH

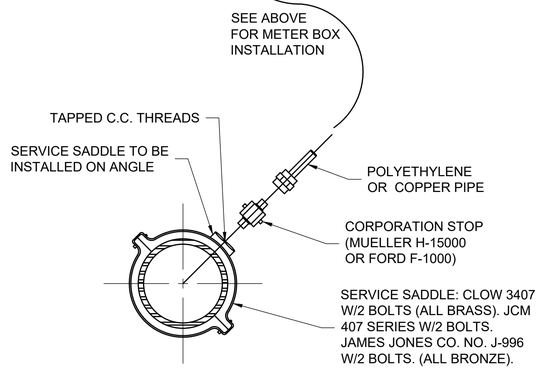
CIVIL DETAILS

SHEET ID
C3

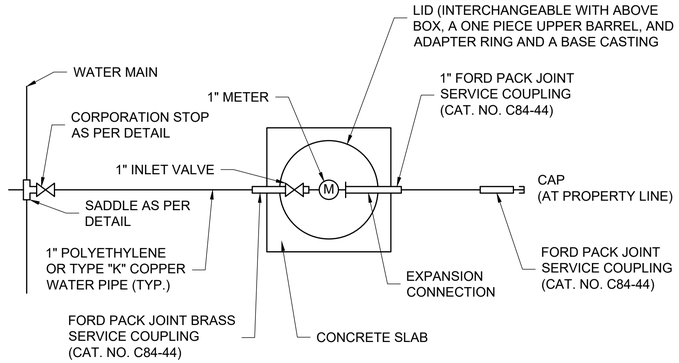
SHEET SET
10 OF 30



5/8" METER BOX INSTALLATION



SERVICE SADDLE



SCHEMATIC SKETCH
1" WATER METER SERVICE CONNECTION

NOTES:

1. TUBING MATERIAL SHALL BE TYPE "K" COPPER OR POLYETHYLENE PE 3406 AND SHALL CONFORM TO THE LATEST ISSUE OF ASTM D- 2737 AND D-1248 FOR TYPE 3 OR 4 GRADE P-34 CLASS "C".
2. WATER SERVICE CONNECTION TO BE NEAR CENTERLINE OF LOT, MIN. OF 5" HORIZONTALLY FROM SEWER H.C.
3. ALL BRONZE / BRASS FITTINGS, CONNECTORS, CORPORATION STOPS AND APPURTENANCES SHALL BE OF DOMESTIC MANUFACTURE, SHALL BE MADE OF LEAD FREE BRONZE / BRASS, AND MEET ALL REQUIREMENTS OF AWWA, ASTM, AND ANSI FOR USE IN THE POTABLE WATER DISTRIBUTION SYSTEMS.

SCHEMATIC SKETCH 1" WATER METER SERVICE CONNECTION

SCALE: N.T.S. (22"x34" SHEET)

C-652

H. Davis Cole & Associates, LLC
CONSULTING ENGINEERS
NEW ORLEANS, LA

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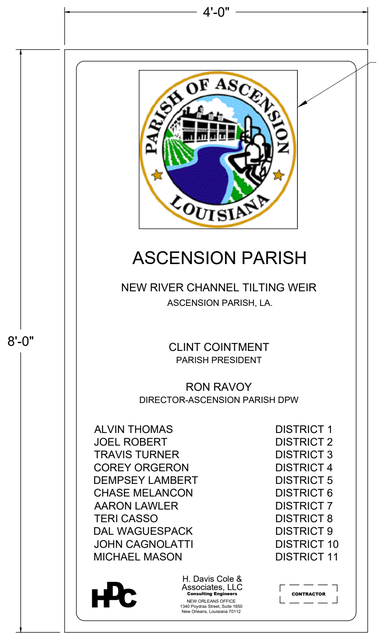
NEW RIVER TILTING WEIR STRUCTURE
ASCENSION PARISH LOUISIANA
EAST ASCENSION CONSOLIDATION GRAVITY DRAINAGE DISTRICT 1
ASCENSION PARISH
CIVIL DETAILS

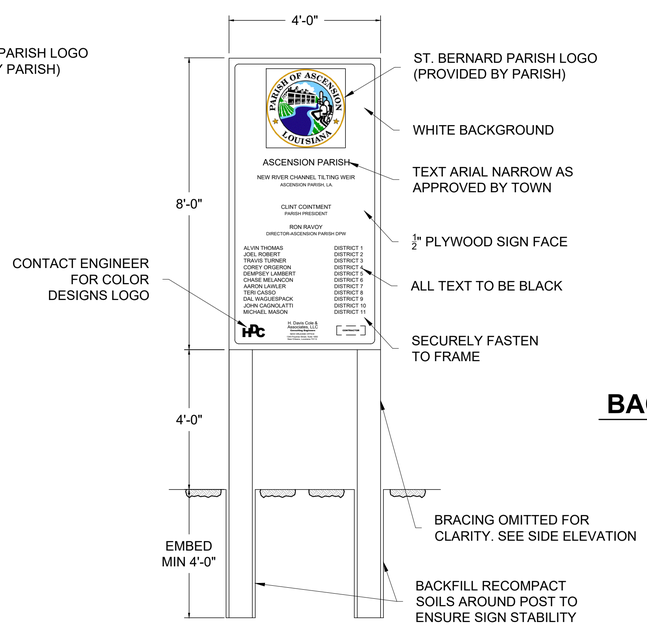
SHEET ID
C4

SHEET SET
11 OF 30

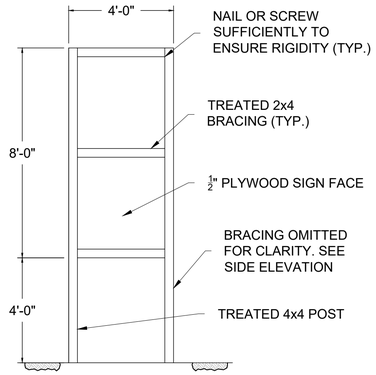


NOTES:
1. EMBED POSTS A MINIMUM OF 4' BELOW GRADE. BACKFILL AND COMPACT TO ENSURE RIGIDITY.
2. INSTALL SIGN NO LATER THAN 10 DAYS AFTER MOBILIZATION. SIGN TO BE REMOVED AT OWNER'S DIRECTION FOLLOWING CONSTRUCTION.
3. FIELD LOCATE PER OWNER IN FIELD.
4. SIGN FACE SHALL BE $\frac{1}{2}$" THICK PLYWOOD.
5. ALL TIMBER TO BE PRESSURE TREATED.

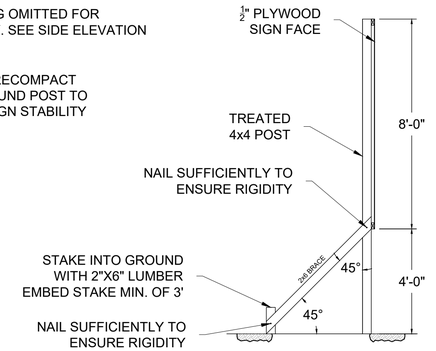
CONSTRUCTION SIGN
SCALE: N.T.S.



FRONT ELEVATION
SCALE: N.T.S.



BACK ELEVATION / FRAMING
SCALE: N.T.S.



SIDE ELEVATION
SCALE: N.T.S.

PROJECT SIGN
C-1000

WARNING
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0 1/2 1"

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ASCENSION PARISH
CIVIL DETAILS

SHEET ID
C5

SHEET SET
12 OF 30