TECHNICAL SECTION
DIVISION 16 – ELECTRICAL
SECTION 16010 – GENERAL SPECIFICATIONS FOR ELECTRICAL INSTALLATION

PART 1 – GENERAL

1.01 SCOPE

The Electrical Drawings and Specifications under this division shall be made a part of the Contract Documents. The drawings and specifications of other Divisions of this Contract, as well as supplements issued thereto, information to Bidders and pertinent documents issued by the Owner's representative are a part of these Drawings and Specifications and shall be complied with in every respect. All the above documents will be on file at the office of the Owner's representative and shall be examined by all Bidders. Failure to examine all documents shall not relieve the responsibility or be used as a basis for additional compensation due to omission of details of other Sections from the Electrical documents.

The Contractor shall furnish all work, labor, tools, superintendence, material, equipment and operations necessary to provide for complete and workable electrical systems as defined by the Contract Documents. The Contractor shall be responsible for visiting the sites and checking the existing conditions and ascertaining the conditions to be met for installing the work and adjusting his bid accordingly.

It is the intent of the Contract Documents that upon completion of the electrical work, each entire system shall be in a finished, workable condition.

All Work that may be called for in the specifications but not shown on the drawings; or, all Work that may be shown on the drawings but not called for in the specifications, shall be performed by the Contractor as if described in both. Should work be required which is not set forth in either document, but which work is nevertheless required for fulfilling of the intent thereof; then, the Contractor shall perform all Work as fully as if it were specifically set forth in the Contract Documents.

The definition of terms used throughout the Contract Documents shall be as specified by the following agencies:

A. Underwriters Laboratories (UL)
B. National Electrical Manufacturers Association (NEMA)
C. American National Standards Institute (ANSI)
D. Insulated Cable Engineers Association (ICEA)
E. National Electrical Code (NEC)
F. National Fire Protection Association (NFPA)

The use of the terms: "as (or where) indicated"; "as (or Where) shown"; "as (or Where) specified"; or "as (or where) scheduled" shall be taken to mean that the reference is made to the Contract Documents, either on the drawings or in the specifications, or both documents.

The use of the words "furnish," provide," or "install" shall be taken to mean that the item or facility is to be both furnished and installed under this Section unless stated to the contrary that the item or facility is to be either furnished under another Section or under another Contract, furnished under this Section and installed under another Section or under another Contract.

1.02 PERMITS, CODES, AND REGULATIONS

Secure all permits, licenses, and inspection as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, rules, regulations and contract requirements bearing on the Work.

The minimum requirements of the electrical systems installations shall conform to the latest edition of the National Electrical Code as well as state and local codes.

Codes and ordinances having jurisdiction and specified codes shall serve as minimum requirements; but, if the Contract Documents indicate requirements which are in excess of those minimum requirements, then the requirements of the Contract Documents shall be followed. Should there be any conflicts between the Contract Documents and codes, or any ordinances, report these with bid.

Determine the exact requirements for the utility service connections and metering facilities as set forth by the utilities that will serve the Project, and pay for and perform all work as required by those utilities.

1.03 STANDARDS

All materials and equipment shall conform to the requirements of the Contract Documents. They shall be new, free from defects, and they shall conform to the following standards where these organizations have set standards:

A. Underwriters Laboratories, Inc. (UL)
B. National Electrical Manufacturer's Association (NEMA)
C. American National Standards Association (ANSI)
D. Insulated Cable Engineers Association (ICEA)

The same manufacturer shall supply all material and equipment of the same class, unless specified to the contrary.

All products shall bear UL labels where standards have been set for listing.

1.04 SHOP DRAWINGS AND SUBMITTALS

Shop drawings shall be taken to mean detailed drawings with dimensions, schedules, weights, capacities installation details, and pertinent information that will be needed to describe the material or equipment in detail.

Submittals shall be taken to mean catalog cuts, general descriptive information, catalog numbers, and manufacturer's name.

Submit for review in sextuplicate within sixty days after award of Contract, all shop drawings and submittals as hereinafter called for.

Review of submittals or shop drawings shall not remove the responsibility for furnishing materials or equipment of proper dimensions, quantity and quality; nor will such review remove the responsibility for error in the shop drawings or submittals.

Assume all costs and liabilities, which may result from the ordering of any material or equipment prior to the review of the shop drawings or submittals, and no work shall be done until the shop drawings or submittals have been reviewed. In case of correction or rejection, resubmit until such time as they are accepted by the Owner's representative and such procedures will not be cause for delay. After the final review, 6 copies will be supplied if requested.

Shop drawings and submittals will be returned unchecked if the specific items proposed are not clearly marked, or if the general Contractor's approval stamp is omitted.

1.05 ACCEPTANCE AND SUBSTITUTIONS

All manufacturers named are a basis as a standard of quality and substitutions of any equal product will be considered for acceptance unless prohibited under other divisions of these Specifications. The Engineer shall make the judgment of equality of product substitutions.

Substitutions after award of Contract shall be made only within sixty days after the award of Contract. Furnish all required supporting data. The submittal of substitutions for review shall not be cause for time extensions.

Where substitutions are offered, the substituted product shall meet the product performance as set forth in the specified manufacturer's current catalog literature, as well as meeting the details of the Contract Documents.

The details on the drawings and the requirements of the specifications are based on the first listed item of material or equipment; if any other than the first listed materials or equipment is furnished, then assume responsibility for the correct function, operation, and accommodation of the substituted item. In the event of misfits or changes in Work required, either in this section or other sections of the Contract, or in both; bear all costs in connection with all changes arising out of the use of other than the first listed item specified.

Substitutions of products under another section may occur. Make necessary adjustments and additions to Work under this section to accommodate those substitutions. Such adjustments and additions shall be performed in compliance with specifications at no additional charge.

1.06 RECORD DRAWINGS

At the start and during progress of the job, Contractor shall keep one separate set of blue-line prints for making construction notes and mark-ups, and shall:

Show conduit routing and wiring runs as constructed and identify each.
Show all terminal number and schematic changes.
Record all deviations from the Contract Documents.
Submit set of marked-up drawings for review.

1.07 OPERATIONS AND MAINTENANCE MANUALS

Six weeks prior to the completion of the project, compile an operations and maintenance manual on each item of equipment. These manuals shall include detailed instructions and maintenance as well as spare parts lists.

Submit six (6) copies for review.

1.08 AS BUILT DRAWINGS

Within 30 days after final inspection, the electrical contractor shall submit to the Engineer a clearly marked set of as built drawings showing all changes to the project. Included shall be terminal numbers of all cable terminations on the project. Information shall be submitted in a form such that it can be easily interpreted by a computer draftsman and require minimum engineering input.

1.09 ELECTRICAL EQUIPMENT REQUIREMENTS

The plant electrical system is custom designed to the specific requirements of the Owner and the Engineer using a sophisticated control system. The vendors shall custom design their electrical equipment and panels to match these electrical requirements. This means that it is highly unlikely that the vendor's standard panels and electrical equipment will be compatible with the requirements of this Project. Shop drawings shall be submitted showing external wiring terminals and shall properly identify the devices to which that they are to be interconnected. At a minimum the drawings shall be prepared with the same engineering effort as can be expected to be utilized in motor control center class 2, type B wiring. Wiring and elementary and control drawings shall be prepared using drawing sizes sufficient to show wiring details clearly and shall have the Owner's name and project on each sheet. All options furnished shall be identified. Any item not furnished shall be entirely deleted from the drawing. Drawings that indicate such things as "if supplied" "these models only" "optional" etc. will be rejected. Any drawings submitted where it is obvious that no effort was made to properly prepare them for easy checking by the Engineer will be rejected.

Shop drawings, unless mark-ups are very trivial, will not be returned, "approved as noted". They will be returned for re-submittal as many times as necessary. Therefore make every effort to comply with the requirements of this Project on the first submittal in order to avoid project delays.

The Contractor shall include monies in his bid to strictly adhere to the above.

1.10 CERTIFICATIONS

The General Contractor via his subcontractors shall submit the following certifications upon completion of the Project.

A. All motor overload heaters and circuit breakers have been properly selected and installed. Attach a completed form "Motor Overload Heater and Circuit Breaker Data Sheet".

B. All wiring has been properly connected to all equipment in accordance with the manufacturer's recommendations and the plans and specifications.

C. All electrical systems and subsystems are operating properly and have been operationally tested by simulations of all possible operating conditions.

D. All electronic instruments and switches are calibrated and functioning properly.

E. The emergency generation system and transfer switch (if specified) is operating properly and has been tested at maximum expected operating conditions.

F. The Graphic Display Panel (if specified) has been tested and is functioning properly.

G. The Distributed Control System (if specified) has been properly connected to all required equipment, is operating properly and has been operationally tested by simulation of all possible operating conditions.

H. Other certifications as to proper electrical operation as deemed necessary by the Engineer.

1.11 ADDITIONAL REQUIREMENTS

Electrical wire and conduit schedules and interconnection drawings are prepared by the Engineer to assist the electrical contractors in estimating the cost of the Project and are based on the latest information available from the vendors at the time of design. Once shop drawings are received, changes may be required on the project external wiring to accommodate their latest design and to make the system function properly.

It shall be the Contractor's responsibility to check with the various vendors before bidding the Project and to include monies in his bid to accommodate these requirements since no changes to the contract price will be allowed for these changes.

PART 2 – PRODUCT

2.01 CONDUIT

Detail specifications will indicate the type of conduit system to be used.

Liquid tight flexible metallic conduit shall be U.L. listed and shall consist of a metallic interlocking core with an extruded thermoplastic cover.

2.02 CONDUIT FITTINGS

Conduit fittings shall be compatible with the conduit system used. Outdoor enclosures shall be weatherproof.

Insulating bushings shall be non-combustible high impact thermosetting phenolic with 150 degrees C temperature rating and shall not support combustion.

2.03 CONDUIT BODIES AND BOXES

Conduit bodies and boxes for pulling and installation of outlets shall be compatible with the conduit system and shall be as follows:

CONDUIT SYSTEM

Item	Galvanized Rigid Steel	Rigid Aluminum
Outlet Bodies	Threaded Zinc Coated	Threaded Copper Free
	Malleable Iron w/ Gasketed Cast Metal Crouse Hinds Form 7 or Equal	Aluminum w/Gasketed Sheet Aluminum Covers Crouse Hinds Form 9 or Equal
Outlet Boxes	Same as Above	Threaded Copper Free
	Except Crouse Hinds FD,FS and DS or Equal. Outdoor or Wet Locations To Have Outdoor Covers.	Aluminum w/Gasketed Cast Aluminum Outdoor Covers Crouse-Hinds FD, FS and DS or Equal

2.04 SUPPORT DEVICES

Single opening slotted channel supports shall be 2" deep x 1 5/8" wide. Double opening slotted channel supports shall be 4" deep x 1 5/8" wide. All slotted channel members shall be manufactured of ASTM 6063-T-6 aluminum. Furnish nuts, clamps, and hardware that shall be compatible with the slotted channel members.

Conduit clamps for use with slotted channel members shall consist of locking aluminum straps with aluminum hardware. All such straps and hardware shall be manufactured of hardened aluminum alloy with less than 0.5% copper content. After-set concrete inserts shall be expansion shield type with stainless steel hardware, 500 pounds minimum pull out resistance.

Beam clamps shall be hot-dipped galvanized malleable iron. Furnish right angle, edge, or parallel types as required. Nest back supports shall consist of one-hole pipe clamp with conduit wall spacer clamp back, all manufactured of hot dipped galvanized malleable iron. One-hole pipe clamps shall be manufactured of hot-dipped galvanized malleable iron. Surface mounted

swivel joints shall be double closed "U" brackets of plated malleable iron with attachment openings top and bottom.

Adjustable screw mounted swinging hangers shall be manufactured of plated steel. Mounting bracket shall have four screw holes. All thread rods shall be stainless steel, 3/8" diameter (min. size).

2.05 WIRE AND CABLE

Wire and cable shall be as follows:

A. Single Conductor - All single conductor wire for power and control 480 volts and below shall be stranded copper 600 volts U.L. type THW or THWN. Wire for 120 volt general lighting may be solid copper 600-volt type THW or THWN.

B. Multi-Conductor - Control cable shall be stranded copper 600-volt U.L. type TC 75 Degrees C wet, 90 degrees C dry and shall consist of individual color-coded conductors insulated with 15 mils pvc insulation and 4 mils clean nylon jacket, moisture resistant fillers, lapped core tape and overall pvc jacket.

C. Instrument Cable - Instrument cable for 4-20 man service unless specified otherwise herein or on drawings shall be single twisted pair stranded copper 90 degree C 600-volt U.L. with 21 mils pvc insulation and nylon jacket, aluminum polyester shield tape and 45 mils overall jacket. Size shall be #16 AWG unless shown otherwise or on drawings.

D. High Voltage Cable - High voltage cable shall be as specified in another section of these specifications.

2.06 CONNECTORS

Mechanical connectors shall be copper alloy bolted pressure type with bronze hardware. Such connectors unless otherwise indicated shall be Square D, OZ/Gedney, T&B, or equal.

TYPE	MANUFACTURER
Single conductor to flat plate connector	Square Type LU OZ Type XLH, or equal
Multiple conductors to flat place connector	Square LU Series T&B Type 32000 DB, or equal
One-bolt parallel connector	Type T or equal
Split-bolt parallel connector	Square D Type CPS, T&B

Type TP or equal	
Two-bolt parallel connector	Square D Type K.R.,
OZ Type 5TS or equal	
Splice connector	Square D Type SS
OZ Type XW or equal	
Cross-connector	Square D Type XP
OZ Type T, or equal	
Ground rod connector	Square D Type CG
OZ Type ABG, or equal	
Flush floor connector	Square D Type GCJ
OZ Type VG, or equal	

Insulated spring wire connectors shall be plated spring steel with thermoplastic jacket. Connectors shall be rated at 150 degrees C continuous. Insulated set-screw connectors shall consist of copper body with flame retardant, 600-V class insulated shell that threads over set screw body.

Terminal connectors for flathead terminal screws shall be locking spade type with vinyl insulated compression indent tubular wire shaft. Terminal strip connectors shall be channel-mounted type with tin plated solderless box lugs contained within nylon insulated separable carriers. Furnish terminal strips complete with channels, channel mounting hardware, and closures, and fitments.

2.07 INSULATING PRODUCTS

General-purpose electrical tape shall be 7-mil thick stretchable vinyl plastic with pressure adhesive backing, 3M "Scotch #33, Plymouth "Slipknot Grey", or equal.

Insulating void filling tape shall be stretchable ethylene propylene rubber with high tack and fast fusing surfaces. Tape shall be rated for 90 degrees C continuous, 130 degrees C overload and it shall be moisture proof. Void filling tape shall be 3M "Scotch #23," Plymouth "Plysafe", or equal.

Arc-proof tape shall be flame retardant, self-extinguishing compound. Tape shall be resistant to ultraviolet, water, salt water, raw sewage and acids. Arc-proof tape shall be "3M" Scotch #7700, Plymouth "Plyarc", or equal.

Insulation putty filler tape shall be elastic, moisture proof rubber compound suitable for bedding and rounding out irregular surfaces. Conduit insulation putty shall be waterproof, stretchable, non-hardening compound suitable for duct seal.

2.08 IDENTIFYING AND TAGGING

Individual phases and routing of each power and control circuit shall be identified by appropriate identifying permanent tags, at points near each end of the cables. Yellow plastic tags 2 1/2" x 3 1/2" available from Tags Unlimited. New Orleans, LA or others shall be used for cable I.D. A Sanford Sharpie or equal fine point marker shall be used for writing.

All equipment and electrical devices shall be identified. The Contractor and manufacturer shall be responsible for properly identifying and tagging equipment as to safe operation under adverse conditions by personnel normally associated with the proposed facility. Additional signs as the Engineer may require for safety shall be furnished and installed by the contractor at no additional costs.

Voltage warning labels where shown or required by N.E.C or local codes shall be waterproof vinyl with permanent red letters "DANGER 480V (or 240V)", or with other voltage designations. Letters shall be at least 2" high.

2.09 WIRING DEVICES

All wiring devices shall be specification grade and shall meet NEMA WD1-1971 requirements. Furnish types of wiring devices as follows:

A. 2P/3W grounding, 20A/125V, NEMA 6-20R; Single receptacle: Hubbell #5361, Arrow Hart #5361, or equal.

B. GFCI receptacle shall be Square D "GFSR-115-B" with NEMA 5-15R style receptacle or "GFSR-120-B" with NEMA 6-20R style receptacle. GFCI receptacle shall be in duplex configuration; that is, top half shall contain test and reset button and bottom half shall contain protected receptacle.

C. Single-pole, single-throw 20A tumbler switch: Hubbell #1223, Arrow Hart #1992, or equal.

D. Single-pole, double-throw (three-way) 20A tumbler switch: Hubbell #1224, Arrow Hart #1993, or equal.

E. Double-pole, double-throw (four-way) 20A tumbler switch: Hubbell #1224, Arrow Hart #1994, or equal.

F. Double-pole, single-throw 20A, tumbler switch: Hubbell #1222, Arrow Hart #1992 or equal.

G. Single-pole, single-throw, momentary center-off 20A tumbler switch: Hubbell #1556, Arrow Hart #1995, or equal.

H. Manual motor starters shall be furnished complete with overloads and shall be Square D Type KO-Z, Westinghouse MS-TO1, or equal.

I. Furnish other types of wiring devices as may be indicated and specified on the drawings.

2.10 GROUNDING SYSTEM

The Contractor shall furnish and install a complete grounding system as shown on the drawings consisting primarily of bare copper conductor and copper clad steel ground rods. All electrical equipment shall be tied to this system either with cable shown or the metallic conduit system per N.E.C. Attach grounding system to metallic buildings as required by N.E.C. weather specifically shown on drawings or not.

2.11 OVERLOAD HEATERS

The Contractor shall submit to the Engineer a form entitled "Motor Overload Heaters and Circuit Breaker Data Sheet" which shall contain actual nameplate information on the motors and motor starters, which he shall inspect and record. He shall use the appropriate charts and tables supplied with the starting equipment and select, for approval by the Engineer, the manufacturer's recommended overload heaters and circuit breaker settings. Along with the data sheet he shall also submit a copy of the manufacturer's charts and tables. Motors shall not be started until overload heaters and the Engineer approves circuit-breaker settings.

2.12 FLOOR BOXES

Floor boxes where shown on the plans shall be Walker or equal Type RFB with RAKM11 flush access hatch with carpet trim (or tile trim where tile is used). Unless exact dimensions are shown on the drawings, the Engineer shall approve the exact location of the boxes after the furniture type is selected.

Floor boxes shall be complete with all required receptacle, telephone, intercom, computer, etc. internal brackets and divider plates.

2.13 CONNECTING LUGS

In many instances, due to the long distances between equipment and voltage drop limitation, larger wire sizes may be required that would normally be expected for some items of equipment. The Contractor and equipment vendor shall identify these requirements and provide proper lugs to match the wire sizes.

2.14 MANUFACTURING OF ELECTRIC CONTROL PANELS

All electrical control panels including unit motor starters shall be factory assembled. In no case shall the electrician assemble and wire internal components in the field. The only onsite wiring that will be allowed inside panels is connections of external wiring to factory installed terminal strips.

2.15 NAMEPLATES

The electrical contractor shall install nameplates on all electrical equipment and devices including a remote operating station that clearly identifies the device. Nameplates shall be sized appropriately for the device and shall be attached with stainless steel screws of double sided tape suitable for outdoor use, 3M Scotch Brand Very High Bond 4930 or equal. Tape shall cover the entire surface of the nameplate.

A nameplate schedule indicating proposed wording and sizes shall be submitted to the Engineer for approval.

2.16 MISCELLANEOUS MATERIAL

Empty raceway pull cords shall be glass fiber reinforced tape that is foot-marked along its length, Thomas "True Tape", Greenlee "Foot-Marked", or equal.

Conduit thread compound for use with joining dissimilar metals and aluminum threads shall be conductive, non-galling, and corrosion inhibiting lithium based compound.

Cable pulling compound shall be non-injurious to raceways, conductors, and insulation. Compound shall be non-toxic, non-hardening type.

Ground rods shall be copper clad steel in lengths and diameters as indicated and shall be Blackburn, Hubbard, or equal.

PART 3 – EXECUTION

3.01 EXCAVATION AND BACKFILLING

Do all excavating and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them dry until the work in question has been installed. All shoring required protecting the excavation and safeguard employees should be properly performed.

All excavations shall be made to the proper depth, with allowances made for floors, slabs, forms, beams, piping, finished grades, etc. Ground under conduits shall be well compacted before conduits are installed. All backfilling shall be made with selected soil, free of rocks and debris and shall be tamped as required to prevent settlement. All excavated material not suitable and not used in the backfill shall be removed to the on site disposal area. Area shall be as directed by the Engineer.

Field check and verify the locations of all underground utilities prior to any excavating. Avoid disturbing these as far as possible. In the event existing utilities are broken into or damaged, they shall be repaired so as to make their operation equal to that before the trenching was started.

Where the excavation required the opening of existing walks, drives, or other existing pavement, these facilities shall be cut as required to install new lines and to make connections to existing lines. The sizes of the cut shall be held to minimum consistent with the work to be installed. After installation of new work is completed and the excavation has been backfilled in accordance with above, repair existing walks, drives or other existing pavement to match existing installation.

3.02 DUCT LINES AND PULL BOXES

The Contractor shall excavate, backfill, remove excess soil, and furnish material for and install duct lines wherever shown on the plans. Conduit encased in concrete shall have three-inch minimum covering of concrete on outside walls of ducts bank, and one-inch minimum of concrete between the outside walls of adjacent conduits. The top of the ducts shall in general be 1'-6" below ground unless specifically shown otherwise on the drawings or is required to be deeper by N.E.C. or other codes.

It shall be the electrical contractor's responsibility to determine in advance any conflicts of duct banks with underground obstructions of electrical or any other disciplines and report these anticipated conflicts to the Engineer well in advance of operations such that the conflicts can be easily and economically resolved by all parties.

Conduit shall be firmly secured by driving reinforcing rod 12" in ground and tying with No. 10 wire.

Where excavation has been made to a greater depth than that required, backfill shall be tamped solid and level to the required depth. All concrete forms shall be removed after the concrete has set, and all trenches shall be backfilled and tamped.

Pull boxes shall be installed as shown on the plans.

3.03 CUTTING AND PATCHING

Cutting and patching required under this section shall be done in a neat workmanlike manner. Cutting lines shall be uniform and smooth.

Use concrete saws for large cuts in concrete and use core drills for small round cuts in concrete.

Where openings are cut through masonry walls, provide lintel or other structural supports to protect the remaining masonry. Adequate support shall be provided during the cutting operations to prevent damage to masonry.

Where large openings are cut through metal surfaces, attach metal angles around the opening.

Patch concrete openings that are to be filled with non-shrinking cementing compound. Finished concrete patching shall be trolled smooth and shall be uniform with surrounding surfaces.

3.04 WATERPROOFING

Provide waterproof flashing for each penetration of exterior walls and roofs.

Flashing for conduit penetrations through built-up roofs shall be made with pitch pans filled full with pitch. Conduit penetrations through poured concrete roofs shall be made with sleeves and annulus caulked.

Penetrations through walls at below ground elevations shall be waterproofed by conduit sealing fittings or other methods as indicated. This includes all conduits that is located and/or terminated in areas that can transport sewer gases from raw sewage to control panels and other equipment. All local control panels, control stations and motors shall have conduit-sealing fittings installed.

Interiors of raceways that are likely to have water ingress such as runs from hand holes into below grade installations shall have water stops installed to prevent water from entering into installations.

3.05 INSTALLATION

Except where specifically noted or shown, the locations and elevations of equipment are approximate and are subject to small revisions as may prove necessary or desirable at the time the work is installed. Final locations shall be confirmed with the Engineer in advance of construction.

Where equipment is being furnished under another section, request from the Engineer accepted drawings that will show exact dimensions of required locations of connections. Install the required facilities to the exact requirements of the accepted drawings.

Qualified, careful electricians who are skilled in their trade shall do all work in the best and most workmanlike manner. The standards of work required throughout shall be of the first class only and electricians whose work is unsatisfactory to the Engineer shall be instantly dismissed from the work upon written notice from the Engineer. All work must meet the approval of the Engineer.

Unless shown in detail, the drawings are diagrammatic and do not give exact details as to elevations and routing of conduits, nor do they show all offsets and fittings; nevertheless, install the conduit system to conform to the structural and mechanical conditions of the construction. Unless locations and routing of exposed conduits are shown, confirm locations and routing prior to installation with the Engineer.

Holes for raceway penetration into sheet metal cabinets and boxes shall be accurately made with a hole punch. Cutting openings with a torch or other device that produces a jagged, rough-cut will not be acceptable.

Cabling inside equipment shall be carefully routed, trained and laced. Cables so placed that they obstruct equipment devices will not be acceptable.

Equipment shall be set level and plumb. Supporting devices installed shall be set and so braced that equipment is held in a rigid, tight fitting manner.

The Contractor shall verify the electrical capacities of all motors and electrical equipment furnished under other sections, or furnished by the Owner, and request wiring information from the Engineer if wiring requirements are different from that specified under this section. Do not make rough-ins until equipment verifications have been received.

The Contractor shall install all controllers, instruments, Distributed Control System Equipment (if specified), terminal boxes, pilot devices, and miscellaneous items of electrical equipment that are not integrally mounted with the equipment furnished under other sections. All such equipment shall be securely mounted and adequately supported in a neat and workmanlike manner.

3.06 PROTECTION

The Contractor shall provide suitable protection for all equipment, work and property against damage during construction.

The Contractor shall assume full responsibility for material and equipment stored at the site.

Conduit openings shall be closed with caps during installation. All outlet boxes and cabinets shall be kept free of concrete, plaster, dirt and debris.

Equipment shall be covered and tightly sealed against entrance of water, dust, dirt and debris.

All dry transformers prior to energization shall be protected against moisture and dirt absorption by a suitable covering. Also, maintain heat inside the covering by suitable means to prevent condensation.

Interiors of electrical equipment shall be kept clean and dry prior to energization.

3.07 COOPERATION

Cooperate with all other trades so as to facilitate the general progress of the work. Allow all other trades every reasonable opportunity for the installation of their work and the storage of

their materials.

The Work under this section shall follow the general building construction closely. Set all pipe sleeves, inserts, etc., and see that openings for cases, pipes, etc. are provided before concrete is placed or masonry installed.

Work with other trades in determining exact locations or outlets, conduits, fixtures, and pieces of equipment to avoid interference with lines as required to maintain proper installation of other work.

Make such progress in work that will not delay the work of other trades. Schedule the work so that completion dates as established by the Engineer are met. Furnish sufficient labor or work overtime to accomplish these requirements if necessary or directed to do so.

3.08 CLEAN-UP

Remove all temporary labels, dirt, paint, grease and stains from all exposed equipment. Upon completion of work clean equipment and the entire installation so as to present a first class job suitable for occupancy. No loose parts or scraps of equipment shall be left on the premises.

Equipment paint scars shall be repaired with paint kits supplied by the equipment manufacturer, or with an approved paint.

Clean the interiors of each item of electrical equipment. At completion of work all equipment interior shall be free from dust.

3.09 TESTS

Each run of power and control wiring shall be tested prior to connection of line and load. Make tests with 1000V dc hand-crank megger. Each run of wiring shall be tested phase-to-phase and/or phase-to-neutral, and phase-to-ground. Test results for each test shall be equal to or greater than 5 megohms with 1000V dc applied. Defective wiring shall be replaced and retested. All tests shall be made in the presence of the Engineer.

High voltage cables, where used, shall be Hi-Pot tested in accordance with test procedures as outlined in other sections of these specifications or as directed.

All equipment shall be put through a trial run-in test to ascertain the performance complies with the intent of the specifications. All run-in tests shall be made in the presence of the Engineer.

3.10 RACEWAY INSTALLATION

Install the raceway system to provide the facility with the utmost degree of reliability and maintenance free operation. The raceway system shall have the appearance of having been installed by competent workmen. Kinked conduit, conduit inadequately supported or carelessly installed does not give such reliability and maintenance free operation and will not be accepted.

Raceway shall be installed for all wiring runs except as otherwise indicated.

Exposed raceways shall be installed with their lines parallel to the lines of the building or structure to which they are attached.

Conduit runs that enter bottom of floor-mounted enclosures that are open on the bottom shall be each equipped with grounding bushing on each conduit. Conduit entries into sheet metal enclosures located inside shall be made with double locknuts and capped with molded bake-lite grounding type bushings. Threaded penetration shall expose enough threads to adequately thread on bushing. Conduit entries into NEMA 3, 3R, 4 or 12 enclosures located outside and in wet or damp location inside, shall be made with field applied watertight hubs. Install locknut inside and cap each conduit with grounding bushing. Conduit runs into boxes, cabinets, and the like shall be set in a neat manner. Vertical runs shall be set plumb. Conduits set crooked or out of plumb shall be replaced.

Conduits entrances into enclosures shall be carefully planned. Cutting away of enclosure structure, torching and/or cutting away sills, braces and structural members of the enclosure will not be acceptable.

Use approved hole-cutting tools for entrances into sheet metal enclosures. Use of cutting torch or incorrect tools will not be acceptable. Holes shall be carefully planned and then cleanly cut and they shall be free from burrs, jagged edges, and torn metal.

Makeup of some conduit runs will require union fittings or split couplings. Install such fittings where required.

Liquid tight conduit shall be used for connections to motors, solenoids, pressure switches, limit switches, unit heaters, fans, motorized louvers, and other devices that may need to be removed for servicing. Each run of liquid tight flex shall be joined with liquid tight flex connectors. Make up each connection tightly; finished connector shall have minimum of 100 pounds pull out resistance.

Empty conduits shall have pull tape installed the length of each run. Identify each terminal as to location of other end. Use blank waterproof label with waterproof ink. Cap exposed open ends of empty conduits.

Conduit bodies shall be installed in exposed runs of conduit where indicated and also wherever required to overcome obstructions and to provide access to wires. Covers for such fittings shall be accessible and unobstructed by the adjacent construction.

All raceway systems shall be adequately and safely supported. Loose, sloppy and inadequately supported raceways will not be acceptable and shall be replaced. Supports shall be installed at intervals not greater than those set forth under Article 300 of N.E.C. unless shorter intervals are otherwise indicated; or, unless conditions require shorter intervals of supports.

3.11 WIRING INSTALLATION

Conductors for power and control wiring shall be sized as indicated and where no size is given, the conductor size shall be #12 AWG.

Color of power wire insulation and color of phase indicating tape shall be as follows:

Conductor	Wire Color	Tape Color
Phase A	Black or Red	Red
Phase B	Black or Red	Yellow
Phase C	Black or Red	Blue
Neutral	White	-
Equipment Ground	Green	-

All wiring shall be installed in raceways, except as otherwise specified. No wire or cable shall be drawn into a raceway until the raceway run has been completed, swabbed, and outfitted with specified bushings and fitments.

Do not exceed wire and cable manufacturer's recommended pulling tensions. Cable pulling compound shall be used as a lubricant for difficult pulls.

Carefully handle wire and cable, do not kink, scrape or damage conductors or their insulation.

Feeder and branch circuit wiring shall be installed from supply to load without splice, unless otherwise indicated. Branch circuits may be spliced for receptacle, lighting, and small appliance load inside appropriate junction boxes, and inside lighting fixtures.

Except as otherwise specified, taps and splices with #10 AWG, and smaller shall be made with insulated spring wire connectors. Such connectors in damp or wet locations shall have opening in wire nut filled with silicone rubber cement and then wrapped with a layer of EPR tape or spring wire connectors manufactured for this use shall be used.

Motor connections made with #10 AWG and smaller wire shall be made up with set-screw copper lugs and with threaded on set screw copper lugs and with threaded on insulating jacket. Where motors are located in damp or wet locations, fill opening under jacket with silicone rubber and cover connector with a layer of EPR tape.

Taps and splices in #8 AWG and larger wires shall be made up with copper alloy connectors. Apply over each connector a bedding of insulation putty. Then, apply at least four layers, half lapped each layer of EPR tape. Finally, apply at least four layers half lapped each layer of electrical tape.

Each wiring connection shall be made up tightly so that resistance of connection is as low as one-foot length of associated largest conductor resistance.

Numbered marking labels shall be installed to identify circuit numbers from panel boards and to identify control wiring. Install labels on each wire in each panel board, junction, and pullbox, and device connection. See "Identifying and Tagging" sections of these specifications.

Install numbered marking labels on each control wire termination at each terminal strip. Number selected shall correspond to manufacturer's terminal numbers.

Where control wiring terminates onto flat head type terminals, equip each such wire with crimp type locking spade connector.

All wiring inside enclosure shall be neatly trained and laced. Bundle wires into groups and lace with plastic tie wraps.

Install "DANGER 480V (or 240V)" labels on motor control equipment, and on other enclosures such as safety switches, wire-ways, and large enclosures that contain 480V (or 240V) wiring.

Install wiring devices where indicated. Each wiring device shall be set with axes plumb and installed with its yoke screws so as to adequately support device and provide grounding means to box. Where ganged devices are shown, install them into ganged boxes.

Each item of equipment shall be adequately and thoroughly grounded. Comply with Article 250 of N.E.C.

Equipment grounding conductors into equipment shall be grounded to equipment ground bus or ground lug. Where no ground lugs are provided install ground lug and bond EGC thereto.

Where grounding bushings are installed, bond EGC there to end and furthermore ground each bushing lug to equipment ground bus or ground lug.

END OF SECTION

TECHNICAL SPECIFICATIONS
DIVISION 16 – ELECTRICAL
SECTION 16200 – DETAIL SPECIFICATIONS FOR ELECTRICAL INSTALLATION

1.01 SCOPE

The work covered by this section shall include furnishing and/or installation of all electrical and instrumentation equipment and necessary wiring systems required to provide the Owner with a complete and operating system and shall consist of the following basic items of Work:

A. Control Panels
B. Circuit Breakers
C. Mini Power Zone
D. Wire-way
E. Heater
F. Disconnect Switches
G. Service Entrance Work
H. Lighting
I. Mounting Poles and Racks
J. Wire, Conduit and Fittings
K. Duct Lines & Pull Boxes
L. Grounding System

All work shall be in strict accordance with NEC NFPA 70 and NFPA 20 latest editions, and local codes. Refer to NEC article 695 - Fire Pumps.

1.02 PUMP CONTROL PANELS

The contractor shall furnish and install control panels with automatic controls as specified in these specifications, and as shown on the Drawings. The Fire Pump, Jockey Pump and Diesel Pump Control Panels are specified in other sections these specifications.

1.03 GROUND STORAGE TANK CONTROL PANEL (GSTCP)

The contractor shall furnish and install a control panel for the ground storage tank (GST). Panel shall be in a NEMA 4X fiberglass enclosure and contain 2 opti-float dual modules, 1 power supply, main circuit breaker and terminals. Furnish a total of 3 weighted opti-floats 100 feet long. Mount control panel on a single post rack at the bottom of the tank close to the location where the floats enter the top of the tank.

1.04 CIRCUIT BREAKERS

The contractor shall furnish and install circuit breakers as shown on the drawings. Breakers shall have a minimum interrupting rating of 35,000 amps at 480 volts.

1.05 MINI POWER ZONE

The contractor shall furnish and install a mini power zone combination transformer/panel-board as shown on the drawing. MPZ shall be Square D type MPZ or approved equal.

1.06 BUILDING HEATER

The contractor shall furnish and install a building freeze protection heater as shown on the drawings.

1.07 LIGHTING

The contractor shall furnish all lighting equipment as follows:

Type A Surface/Pendant Mount Units As Follows:

1. Watts	32W per lamp, 4 lamps
2. Type	Fluorescent 8 feet
3. Ballast	Electronic
4. Lamps	T8
5. Voltage	120V
6. Lens	Enclosed and gasketed wet location rated
7. Mfg.	Lithonia TDMW or approved equal.

Type D Wall Mounted Units as Follows:

1. Watts	175W
2. Lamp	MH
3. Voltage	120V
4. Lens	Prismatic glass w/guard
5. Access	Photocell (In outdoor units only)
6. Case	Die cast aluminum
7. Exposed Parts	Non corrosive
8. Mfg.	Cooper MH-WL-175-MT-LL-GRY-WG/WL-PE/MT or approved equal.

Type E Emergency Units as Follows:

1. Watts	Twin 9W
2. Type	Twin Beam Lead-Calcium battery w/ charger and test switch.
3. Mfg.	Lithonia ELM2 or approved equal for indoor units

Type X1 Exit Lights as Follows:

1. Lamp	LED
2. Voltage 120V	
3. Housing	Die cast aluminum
4. Battery Ni-Cad	
5. Type	Light Guard LADNUGWA or approved equal.

1.08 CONDUIT

All conduit on this project shall be as follows:

A. Underground in dug trenches - Schedule 40 PVC.
B. Underground bored – Schedule 80 PVC or UL Listed Schedule 80 HDPE.
C. In pump house slab – Rigid galvanized steel.
D. All other areas – Rigid galvanized steel.

All underground conduits shall be a minimum of 2'-0" below ground, 2'-6" under roads and drives and 3'-0" for service entrance wiring. Mark trenched conduit with electrical warning tape 12" above conduit. Accurately mark duct bank locations on as built drawings. Service conduit shall utilize long radius elbows. All outlet boxes shall be cast metallic.

1.09 GROUNDING

The contractor shall furnish and install a complete grounding system to provide a safe operating environment.

1.10 Submittals

Submittal data shall include, but not be limited to the following requirements.

A. Complete materials list and items proposed to be furnished and installed.
B. Enclosure dimensions materials of construction and NEMA ratings.
C. A description of operation for the control system.
D. Circuit Breaker Interrupting Ratings
E. All electrical drawings so that the system can be checked for compatibility with other systems to which it interfaces.
F. One drawing entitled "External Wiring Interface". It shall clearly identify all terminal strips including physical location and terminal numbers and shall also show external wiring and function.

Any submittals that are not complete, causes the engineer to ponder or where it is obvious that no effort was made to properly prepare them for easy checking by the engineer will be rejected in their entirety.

Submittals sent to engineer for processing that require information on equipment has not been previously submitted for approval may or may not be reviewed before dependant submittals are sent. An example would be motor starter submittals sent before actual motor nameplate data is submitted on the motors that they are to control.

1.11 SUBSTITUTIONS

On any proposed substitute to the specified item, it shall be the responsibility of the Contractor to show proof to the Engineer, that the proposed substitute is equal to the specified item by making written evaluation comparisons on material, performance, workmanship, maintenance features, energy use, durability, appearance and the effect on compatibility with the other elements of the system which the item will be used. All changes required in the wiring and other electrical modifications shall be the responsibility of the contractor.

1.12 GUARANTEE

All equipment shall be guaranteed against defects in material and workmanship for a period of one year from date of owner's final inspection and acceptance, except equipment specifically indicated in these specifications as having an extended warranty period, to the effect that any defective equipment shall be repaired or replaced without cost or obligation to the Owner.

1.13 COORDINATION WITH FACTORY SERVICEMAN

The contractor shall coordinate his work with the factory serviceman of the various vendors and shall provide whatever assistance is necessary to place the entire system in operation.

1.14 COORDINATION WITH POWER COMPANY

All work on the service entrance from weatherhead or pad mounted transformer to utilization equipment shall be per local power company requirements where new services are to be installed. Where there is conflict with plans and specifications with the power company requirements then the power company requirements shall govern. The contractor shall notify the engineer in advance of making a change for the engineer's approval. In some instances larger wire and conduit sizes may be required. The contractor shall anticipate this requirement and include it in the bid price.

The contractor shall coordinate all work with the local power company including scheduling and applying for service, furnishing and (or) installing all metering equipment, and installing all service entrance weatherheads at elevation as required by power company and NEC.

Seal all conduits entering panels with duct seal where it is possible that water or moisture can enter the conduit due to its location or in case of damage to the conduit (use silicon where shown on drawings or indicated in these specifications). Utilize weather heads for all overhead service wire entering conduit. Where service conduit is installed by power company, the contractor shall furnish a properly sized weather head to the power company to prevent water from entering any panel in which it terminates.

1.15 DEMOLITION

The contractor shall disconnect and remove all existing electrical and instrumentation equipment that is not to remain in service at the completion of this project and which is located in buildings or areas to be renovated. Verify that the equipment is not being used and not going to be used. All removed equipment shall be turned over to the owner for selection of items that he wishes to keep in stores. All other items shall be properly disposed of by the contractor.

1.16 OTHER PROVISIONS

Mechanical and other systems specified and furnished under other sections of these specifications that contain electrical systems shall be connected, wired, and tested by the contractor in accordance with the drawings or as required by the manufacturer for a complete and operating system.

Electrical wire and conduit schedules, and interconnection drawings are prepared by the engineer to assist the electrical contractors in estimating the cost of the project and are based on the latest information available from the vendors at the time of design. Once shop drawings are received, changes may be required on the project external wiring to accommodate their latest design and to make the system function properly. Conduit sizes shown are to be the minimum sizes utilized. Verify that the selected wire and cable will meet the NEC if installed in these conduits; otherwise increase conduit sizes as required. It shall be the contractor's responsibility to check with the various vendors before bidding the project and to include monies in his bid to accommodate these requirements since no changes to the contract price will be allowed for these changes. Also, certain items of equipment shown on drawings that are to be furnished by a specific vendor may actually be furnished by another "or equal" vendor. Wiring changes required by this action shall be done at no additional cost and must be approved by the engineer.

Where there are conflicts between various sections of the electrical specifications and/or drawings and/or other sections of the specifications, then the more stringent wording for a particular product, material, item of work or guarantee shall apply unless approved otherwise by the engineer. Should a discrepancy occur, notify the engineer before proceeding.

Provide a 4" high housekeeping curb beneath all free standing electrical equipment. Provide with 6" horizontal clearance all around.

The electrical drawings show the general locations of the equipment. The contractor shall refer to the mechanical and civil drawings to obtain more accurate and the latest location of the equipment as well as to scale the drawings for distances.

Should the contractor deem that a manhole or pull box is required to pull wires and cables then he shall install as shown on the drawings or, if not on drawings, provide a drawing of the proposed installation that meets the requirements of the NEC for the engineer's approval. Installation shall be at no additional cost to the owner.

All conduit entrances into NEMA 3R, 4, and 4X panels shall be made using Meyer (or equal) hubs with approve gaskets. No penetration into the top of this type of enclosure will be allowed.

Utilize silicon sealant on conduits that exit chlorine areas to prevent gas travel down conduit.

The electrical drawings and specifications contain a design in accordance with the National Electrical Code. Some pump and/or motor manufacturers have additional requirements. The contractor shall provide all additional electrical devices, equipment, and materials as necessary for any particular manufacturer of equipment supplied on the project to maintain the warranty specified in the plans and specifications. Any changes and/or additions shall be reviewed by the engineer for conformity with the NEC at the time of shop drawing review. Any and all costs associated with these changes and modifications shall be included in the bid price.

1.17 LIST OF SUBMITTALS REQUIRED FOR E&I REVIEW

The following is a list of submittals that are to be submitted on this project. This list may or may not be complete but is to be used as a guide in preparation of the submittal packages. It in no way shall be construed to identify the only equipment or level of submittal details to be furnished in this project.

A. All Control Panels and Accessories
B. Terminal Boxes
C. Pull Boxes
D. Circuit Breakers
E. Lighting Equipment
F. Wire-ways
G. Heater
H. 600 Volt Wire
I. Conduit
J. Conduit Fittings
K. Any other devices that require electrical connections

Contractors are cautioned to read and supply to all of his vendors other articles in the electrical sections of the specifications relative to submittals.

END OF SECTION

APPENDICES

APPENDIX A

GEOTECHINICAL ENGINEERING REPORT

GEOTECHNICAL ENGINEERING SERVICES REPORT

PROPOSED AWG DISTRIBUTION CENTER
OLD MILITARY ROAD
PEARL RIVER, LOUISIANA

PSI PROJECT NO. 0254219

PREPARED FOR

ASSOCIATED WHOLESALE GROCERS, INC. (AWG)
P.O. BOX 2932
KANSAS CITY, KANSAS 66106

FEBRUARY 14, 2011

BY

PROFESSIONAL SERVICE INDUSTRIES, INC.
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PROJECT INFORMATION

Project Authorization

Professional Service Industries, Inc. (PSI) has completed a geotechnical exploration for the proposed AWG Distribution Center to be constructed near the intersection of Highway 1090 and Old Military Road in Pearl River, Louisiana. Our services were accomplished in general accordance with PSI Proposal No. 20747R, dated June 9, 2010. This report presents the results of our field exploration and laboratory testing from the Phase I and Phase II explorations, as well as foundation and pavement design recommendations including general site preparation guidelines.

Project Description

The site for the proposed construction encompasses about 68 acres of wooded property located near the intersection of Highway 1090 and Old Military Road in Pearl River, Louisiana. Based on information provided to PSI, it is understood that the site was previously used to excavate clay material for St. Joe Brick Works (SJBW). The site is mostly wooded; however, several pathways were noted throughout the project site. Several ridges and spoil banks from the excavation work were also noted throughout the site to heights ranging between 3 and 5 feet.

The project includes the construction of a single story dock-high structural steel framed warehouse building having a footprint of approximately 725,000 square feet and an adjacent future expansion of 125,000 square feet in area making the total building footprint approximately 850,000 square feet. In addition, a parking lot will be provided around the building. Based on information provided by AWG, PSI understands that maximum column load of less than 150 kips is expected. The floor slab load is anticipated to be less than 250 psf. The grading plan provided to PSI by J.V. Burkes and Associates (JVBA) indicates that, with the exception of the spoil banks, the existing grade in the footprint of the proposed building ranges from El. +20 to +22 feet. Finished floor elevation is planned at about El. +26 feet. Hence, about four (4) to six (6) feet of fill will be needed to achieve the building floor slab design elevation. Based on the information provided to us, it is understood that less than two (2) feet of fill will be placed in the parking lot area.

It is also understood that a ground-supported water storage tank will be constructed near the southwest corner of the site. The tank will be approximately 30 feet tall and 45 feet in diameter, supported by a concrete mat foundation approximately two (2) feet thick. The anticipated load from the tank and water is approximately 2,200 psf.

PSI previously performed a preliminary subsurface exploration (Phase I) at this site. A total of 15 soil borings (B-1 thru B-15) were drilled to depths ranging between 20 feet and 50 feet within the plan area of the proposed building. The results of the study were presented in PSI Report 0254219 - Phase I, dated June 17, 2010.

The geotechnical recommendations presented in this report are based on the available project information, building location, and the subsurface materials described herein. If any of the noted information is incorrect, please inform PSI in writing so that we may amend the recommendations presented in this report if appropriate and if desired by the client. PSI will not be responsible for the implementation of its recommendations when we are not notified of changes in the project.

Purpose and Scope of Services

The purpose of the study was to explore the subsurface conditions at the site to enable evaluation of acceptable foundation systems for the proposed construction. PSI explored the subsurface conditions at the site in two phases. Phase I included performing 15 soil borings (B-1 thru B-15) to depths ranging between 20 feet and 50 feet within the area of the proposed building. Phase II of the exploration included performing 20 soil borings (B-16 thru B-35) within the building pad area to a depth of 20 feet below the existing ground surface and 21 soil borings (P-1 thru P-21) within the proposed parking area to a depth of six (6) feet below existing ground. Additionally, one (1) boring (A-1) was drilled within the area of the water tank to a depth of 50 feet below the existing ground surface. Our scope of services included a reconnaissance of the project site, drilling the soil borings, select laboratory testing, and preparation of this geotechnical report. This report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and presents recommendations regarding the following:

- Site preparation and fill compaction recommendations;
- Building pad surcharge recommendations;
- Foundation types, depths, allowable bearing capacities, and an estimate of settlement;
- General pavement design criteria and pavement subgrade preparation; and
- Comments regarding factors that will impact construction and performance of the proposed construction.

It should be noted that the scope of geotechnical services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. Prior to development of this site, an environmental assessment is advisable.

In addition, PSI did not provide any service to investigate or detect the presence of moisture, mold, or other biological contaminates in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. The client acknowledges that mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. The client further acknowledges that site conditions are outside of PSI's control, and that mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible for the occurrence or recurrence of mold amplification.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The site for the proposed construction encompasses about 68 acres of wooded property located near the intersection of Highway 1090 and Old Military Road in Pearl River, Louisiana. The site is mostly wooded; however, several pathways were noted throughout the project site. The approximate project location is indicated in the Site Vicinity Plan included in the Appendix.

It is understood that the site was previously used to excavate clay material for St. Joe Brick Works (SJBW). Based on the information provided by Mr. Chris Schneider, Director of Plant Operations with SJBW, during a telephone conversation with Mr. Hari Vasudevan, PE (TX) with PSI on June 16, 2010, PSI understands that SJBW typically excavated the site to about 1.5 to three (3) feet deep. In some areas, SJBW excavated up to five (5) feet of soils at the site. The excavated areas were never backfilled. Consequently, multiple ridges and spoil banks exist throughout the site with heights ranging from three (3) to five (5) feet. In general, the height of these ridges tends to increase toward the southwest corner of the site.

Field Exploration

The field exploration, which was performed to evaluate the engineering characteristics of the foundation materials, included a reconnaissance of the project site by a PSI representative, drilling the soil borings in two phases (Phase I and Phase II), and recovering soil samples. Any groundwater encountered in the test borings was measured and recorded.

The project site was characterized by drilling a total of 57 soil borings (Phase I and II) drilled to depths ranging between six (6) feet and 50 feet below the existing ground surface. Fifteen (15) soil borings were drilled during the Phase I study and the remaining borings were performed as part of the Phase II exploration. A summary of the borings drilled at this site is presented in the following table:

Boring Location	Boring No.	Boring Depth (ft)
Building Area	B-2, B-4 thru B-9, B-11, B-12, B-15 thru B-35	20
	B-1, B-14	30
	B-3, B-10, B-13	50
Parking Lot	P-1 thru P-21	6
Water Storage Tank	A-1	50

The boring depths are in reference to the existing ground surface at the time of the field exploration. The borings were located in the field by J.V. Burkes and Associates (JVBA) personnel. Ground surface elevations were provided to PSI by JVBA. The approximate location of each boring is indicated on the Boring Location Plan included in the Appendix of this report.

Drilling and Sampling Procedures

The borings were drilled using an ATV-mounted drilling rig. Wet rotary drilling techniques were used to advance the boreholes. Samples were generally obtained continuously from the ground surface to a depth of 10 feet and at five (5) foot intervals thereafter to the boring completion depths. Drilling and sampling techniques were accomplished in general accordance with ASTM Standard Procedures.

Undisturbed samples of cohesive soils were generally obtained using thin-walled tube sampling procedures in general accordance with the procedures for "Thin-Walled Tube Geotechnical Sampling of Soils" (ASTM D-1587). These samples were extruded in the field with a hydraulic ram.

For cohesionless and semi-cohesive soils, Standard Penetration Tests (SPT) were performed to obtain standard penetration values (N value) of the soil. The standard penetration value (N) is defined as the number of blows of a 140 pound hammer, falling 30 inches, required to advance the split-barrel sampler one (1) foot into the soil. To perform the test and obtain a sample, the sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer. The number of blows is recorded for each of three (3) successive increments of six (6) inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density of cohesionless soils and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components. Samples of granular soils were obtained utilizing a two (2) inch O.D. split-barrel sampler in general accordance with procedures for "Penetration Test and Split-Barrel Sampling of Soils" (ASTM D-1586).

The samples were identified according to project number, boring number and depth, and were placed in plastic bags to protect against moisture loss, and were transported to the laboratory in containers to prevent against disturbance. Additionally, cohesive soils were wrapped in aluminum foil prior to placement in the bags in order to further protect against disturbance and moisture loss. All of the samples obtained from the field exploration were identified and evaluated by experienced geotechnical personnel upon arrival at the laboratory.

Laboratory Testing Program

A laboratory testing program was conducted to determine pertinent engineering characteristics of the subsurface soils necessary in evaluating the foundation system for the proposed construction. The laboratory testing program included visual classification and water content tests on all samples. Selected samples were subjected to unconfined compressive strength testing, Atterberg Limits, and percent finer than a #200 sieve tests. Additional estimates of undrained shear strength and unconfined compressive strength were made by the use of a torvane and pocket penetrometer, respectively.

All phases of the laboratory testing program were conducted in general accordance with applicable ASTM Specifications. The results of these tests are presented on the accompanying boring logs in the Appendix of this report. Subsurface soil profiles within the building footprint were generated and also included in the Appendix of this report.

Subsurface Conditions

Based on the borings, approximately 10 to 12 inches of topsoil was encountered on the site. In some borings, loose silt or firm lean to silty clay was encountered below the topsoil extending to a depth of about two (2) feet. The topsoil was typically underlain by firm to stiff lean clay to a depth of approximately eight (8) feet. This was followed by loose to medium dense silty sand or poorly graded sand to a depth of about 12 feet. The sand layer was underlain by soft fat clay and/or firm to stiff organic clay to a depth of approximately 22 feet. This was followed by medium dense to very dense silty sand soils to a depth of at least 50 feet below the existing ground surface, the maximum depth explored. An intermittent and discontinuous layer of lean clay was encountered between the granular strata in some of the borings.

The above subsurface descriptions are of a generalized nature to highlight the major subsurface satisfaction features and material characteristics. The boring logs included in the Appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistance, locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on these borings logs. The samples, which were not altered by laboratory testing will be retained for 60 days from the date of this report and then will be discarded.

Groundwater Information

Groundwater was measured in the test borings during and / or upon completion of drilling. A summary of the groundwater levels measured in the soil borings is presented in the following table:

	Boring No.	Surface Elevation (ft) [1]	Groundwater (GW) Level Upon Completion of Drilling / During Drilling	
			GW Depth [2] (ft)	GW Elev. (ft)
Phase I	B-1	22.1	4.2	17.9
	B-2	23.4	4.0	19.4
	B-3	23.4	4.2	19.2
	B-4	22.9	4.3	18.6
	B-5	22.3	4.0	18.3
	B-6	21.1	4.3	16.8
	B-7	19.6	3.5	16.1
	B-8	22.1	5.2	16.9
	B-9	19.6	3.0	16.6
	B-10	21.5	5.5	16.0
	B-11	22.3	7.5	14.8
	B-12	22.5	7.0	15.5
	B-13	21.5	4.5	17.0
	B-14	18.4	3.5	14.9
	B-15	20.3	5.7	14.6
Phase II	B-16	22.0	13.4	8.6
	B-17	22.5	1.3	21.2
	B-18	21.0	Not Encountered	Not Encountered
	B-19	21.5	Not Encountered	Not Encountered
	B-20	21.0	5.8	15.2
	B-21	21.5	10.0	11.5
	B-22	19.5	1.0	18.5
	B-23	21.5	9.0	12.5
	B-24	20.5	4.3	16.2
	B-25	21.8	3.3	18.5
	B-26	20.0	7.0	13.0
	B-27	22.0	5.3	16.7
	B-28	22.5	5.0	17.5
	B-29	22.2	3.8	18.4
	B-30	22.0	6.4	15.6
	B-31	23.0	7.7	15.3
	B-32	21.2	Not Encountered	Not Encountered
	B-33	19.0	5.2	13.8
	B-34	23.0	4.4	18.6
	B-35	22.5	Not Encountered	Not Encountered
	A-1	22.0	5.5	16.5

Notes:

(1) Existing ground surface elevations at the boring locations were provided to PSI by J.V. Burkes and Associates.

(2) Depth below existing grade at the boring location.

The groundwater levels presented in this report are the levels that were measured at the time of our field activities. It is possible that seasonal variations (tidal, temperature, rainfall, etc.) will cause fluctuation in the groundwater level. Additionally, perched water may be encountered in discontinuous zones within the overburden. Furthermore, some of the shallow groundwater measurements could have been influenced by the perched water condition from the rainfall experienced during the time of PSI's field exploration. It is recommended that the contractor determine the actual groundwater levels at the site at the time of the construction activities.

Soil pH and Resistivity

Although most of the utility lines and concrete elements are likely to be installed within the structural fill, estimated to be about five (5) feet, soil resistivity and pH tests were performed on selected soil samples of the existing soil to verify the soil corrosivity to ductile iron pipes and reactivity to concrete. The pH and soil resistivity tests were performed in general accordance with ASTM Standards and U.S. Agriculture Handbook 60, Chapter 6. Additional tests were performed on selected soil samples, including soluble chlorides (U.S. Agriculture Handbook 60, Chapter 6), soluble sulfates (U.S. Agriculture Handbook 60, Chapter 6), acid soluble sulfides (SW 9030B/9034), and Redox Potential (SM 2580B, Modified). Results of the laboratory testing are presented in the following table:

Boring No.	Depth (ft)	Soil Type	Soil Resistivity (ohm-cm)	pH	Soluble Chlorides (mg/kg)	Soluble Sulfates (mg/kg)	Acid Soluble Sulfides (mg/kg)	Redox Potential (mV)
P-2	0-2	Sandy Lean Clay	16,393	4.40	Not Detected	Not Detected	Not Detected	+346
B-23	2-4	Sandy Lean Clay	1,525	4.52	Not Detected	Not Detected	Not Detected	+148
B-33	4-6	Clayey Sand	40,000	4.22	Not Detected	Not Detected	Not Detected	+130

Based on the laboratory test results, it appears that the soils are low to moderately corrosive to ductile iron piping. Therefore, appropriate wrappings or cathodic protection may be necessary for buried ductile iron piping. The soils are moderately to highly reactive with respect to cement due to the low soil resistivity and low pH values measured. Type I Portland Cement may be used for construction at this site, which is the type of cement generally used in this area. However, since only a limited number of tests were performed, other soil conditions may be present throughout the site requiring the use of a different type of cement.

Seismic Conditions

The Standard Building Code, 1999 Edition, was reviewed to determine the seismic conditions at the site. As outlined in Section 1607, the subsurface conditions at the site correspond with a soil profile Type S_4 and a site coefficient (S) of 2.0. The International Building Code, 2006 Edition, was also reviewed to determine the site class. Although a site specific site classification was not performed, based on the subsurface soil conditions encountered in the soil borings and our experience with similar projects in the area, the site can be classified as Class D.

ENGINEERING ANALYSES AND RECOMMENDATIONS

General

The type and depth of foundation suitable for a given structure primarily depends on several factors including the subsurface conditions, the function of the structure, the loads it may carry, the cost of the foundation and the criteria set by the Design Engineer with respect to vertical and differential movement which the structure can withstand without damage.

As discussed previously, it is understood that the building area will receive approximately five (5) feet of fill to achieve the final site grade. The imposed load due to the fill will be about 600 psf. Based on field data and laboratory test results, very soft to soft fat clays were generally encountered in the borings at depths ranging from eight (8) to 12 feet below the existing ground surface. Additionally, an intermittent layer of firm to stiff organic clay was encountered in some locations beginning at depths ranging from 10 to 15 feet below the existing ground surface. Consequently, the use of a shallow foundation system will cause a significant amount of settlement within these layers from stress increases induced by about five (5) feet of fill and building structural loads. Hence, a surcharge program is recommended to improve the subsurface soil conditions and reduce post-construction settlements. Upon a successful completion of the surcharge program, a shallow foundation system could be used to support the building. Recommendations for site preparation, foundation and pavement recommendations, and general construction considerations are presented in subsequent sections of this report.

Site Preparation

The grading plan provided to PSI indicates that, with the exception of the spoil banks, the existing grade within the footprint of the proposed building is at approximately El. +20 to +22 feet. Finished floor elevation is planned at about El. +26 feet. Hence, roughly four (4) to six (6) feet of fill will be needed to achieve the building floor slab design elevation. It is understood that less than two (2) feet of fill will be placed in the parking lot area.

At the time of field exploration, portions of the site were observed to contain standing water. Therefore, a plan should be established to drain the site prior to construction. This may include ditches excavated to a depth of two (2) to three (3) feet to allow surface water to drain away from the building area and prevent ponding for extended periods.

Site preparation should include stripping and removal of any topsoil, organics, trees, roots systems, vegetation and other deleterious material from the areas of construction. Based on the borings, up to 12 inches of topsoil was encountered at this site. However, the actual depth of stripping should be determined by a representative of the geotechnical engineer at the time of construction. It is understood that two (2) existing structures are present within the subject property. It is recommended that the existing building shallow spread footings, pavement structures, and utility lines should be removed from the site. During wet weather, the silty clay or lean clay with silt present below the topsoil will likely be saturated and may not provide a good working platform, requiring additional undercutting or treatment in-place to improve its condition and provide a firm subgrade prior to placement of structural fill. Any voids resulting from removal of tree root systems, existing foundations, and/or any underground utilities should be backfilled with properly compacted structural fill.

It is understood that the site was previously used to excavate clay material for St. Joe Brick works (SJBW). Based on the information provided by Mr. Chris Schneider, Director of Plant Operations with SJBW, PSI understands that SJBW typically excavated the site to about 1.5 to three (3) feet deep. In some areas, SJBW excavated up to five (5) feet of soils at the site. The excavated areas were never backfilled. Consequently, multiple ridges and spoil banks exist throughout the site with heights ranging from three (3) to five (5) feet. Based on our field observations, the material stockpiled in the ridges and spoil banks generally consists of silty topsoil with organics and should be removed and hauled off site. This material is not suitable for use as structural fill.

The exposed subgrade in the building and parking areas should be proof-rolled with a loaded tandem axle dump truck or similar heavy rubber-tired vehicle. Soils which are observed to rut or deflect excessively under the moving load should be undercut and replaced with properly compacted structural fill. The proof rolling, undercutting, and filling activities should be witnessed by a representative of the geotechnical engineer and should be performed during a period of dry weather.

After subgrade preparation has been completed, fill placement may begin. The first layer of fill should be placed in a relatively uniform horizontal lift and be adequately keyed into the stripped and scarified subgrade soils. The structural fill materials should be free of organic or other deleterious materials, have a maximum particle size of less than two (2) inches and have a liquid limit less than 40 and a maximum plasticity index of 18. Sandy clays or clayey sands are recommended for use as structural fill.

The structural fill should be compacted to at least 95% of the soil's maximum dry density as determined by ASTM Designation D698 (Standard Proctor). The fill should be placed in maximum lifts of eight (8) inches of loose material and should be compacted within the range of one (1) percentage point below to three (3) percentage points above the optimum moisture content value. If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying. Each lift of compacted structural fill should be tested by a representative of the geotechnical engineer prior to placement of subsequent lifts. The edge of compacted fill should extend at least five (5) feet beyond the edge of the building prior to sloping. Adequate drainage must be provided prior to and during site work. The site should be graded to promote rapid runoff.

Shallow Foundation with Surcharge Program

General: As previously discussed, soft fat clays were generally encountered in the borings beginning at a depth of approximately 12 feet below the existing ground surface. These soils are normally to slightly pre-consolidated. Additionally, an intermittent layer of firm organic clay was encountered in some locations beginning at approximately 10 feet below the existing ground surface. The organic clay at this site is generally pre-consolidated. Analyses based on the field data and laboratory test results indicate that the total settlement caused by approximately five (5) feet of fill and building structural loads will be on the order of about six (6) to eight (8) inches. Consequently, a surcharge load consisting of at least six (6) feet of compacted fill (in addition to the approximately five (5) feet of fill required to achieve the design grade) is recommended to be placed in the building area. This should improve the subsurface conditions and reduce post-construction settlements. The rate of settlement will vary with the

frequency and continuity of the silty sand and sand layers encountered. Based on PSI's analyses and local experience, a period ranging from five (5) to six (6) months may be required for dissipation of about 90% of the estimated settlement of six (6) to eight (8) inches. However, we recommend that a waiting period of monitoring as discussed herein should be performed to quantify the actual rate of settlement. It should be noted that the above estimate is based on the assumption that approximately five (5) feet of fill will be required to achieve building floor slab design elevation.

Settlement Monitoring: Settlement monuments may consist of 2' x 2' x ½" steel plates with two (2) inch diameter or larger riser pipes that can be increased in length as the fill thickness increases. It is recommended that the plates be placed on the subgrade and spaced at approximately 200' x 200' grid over the building pad. The top of the flush-coupled rod should extend approximately 24 inches above the finished compacted fill grade. The initial 12 inches of fill material in the building pad should consist of clean free-draining sand containing less than 10 percent material passing the #200 sieve. Prior to placing any fill, a zero reading at each settlement plate must be obtained using a benchmark located at a sufficient distance from the pad as not to be influenced by fill placement.

Fill placement and settlement plates should be monitored by the geotechnical engineer or his representatives. Initial survey readings and subsequent surveys of the settlement plates must be secured by a licensed land surveyor once a week during fill placement and should continue for a period of at least five (5) to six (6) months, or until anticipated settlement has dissipated, whichever occurs first. The geotechnical engineer, working with the design team, will determine whether settlement due to the fill weight has reached a level that will allow tolerable post-construction settlements in a given area of the site.

Shallow Footings: Once the surcharge program is successfully completed, relatively shallow foundations may be used to support the structural loads of the new facility. Exterior and interior shallow footings should be placed a minimum depth of two (2) feet and 1½ feet below final grade, respectively. Spread footings for building columns and strip footings for bearing walls should be designed for a maximum net allowable soil bearing pressure of 2,400 psf and 2,000 psf, respectively, based on dead load plus design live load. Footings should be supported on the compacted structural fill. Spread and continuous footings should have a minimum width of 24 inches and 18 inches, respectively, even if the resulting bearing pressure is less than the design value. The purpose of the minimum footing size is to reduce the possibility of localized bearing/shear failure in an isolated weak zone.

The base adhesion/frictional resistance and the passive soil resistance will resist the horizontal loads on shallow foundations. For a footing cast against natural clay soil or compacted soil, the adhesion/frictional resistance and the passive soil resistance values for both transient and sustained loading conditions are given herein. For transient loading conditions, an ultimate base adhesion resistance of 550 psf and an ultimate passive resistance of 2,000 psf can be used. For sustained loading conditions, a frictional coefficient of 0.36 and an ultimate passive resistance of 250 psf per foot of depth is recommended. A factor of safety of 2.0 is recommended to arrive at the allowable values. Passive resistance from the upper two feet of soil should be neglected. Also the passive resistance of any uncompacted fill material should be neglected.

The foundation excavations should be observed by a representative of PSI prior to steel or

concrete placement to assess that the foundation materials are capable of supporting the design loads and are consistent with the materials discussed in this report. Soft or loose soil encountered at the bottom of the footing excavations should be removed to the level of firm soils or adequately compacted fill as directed by the geotechnical engineer. Cavities formed as a result of excavation of soft or loose soil zones should be backfilled with lean concrete or compacted select fill, as determined by the geotechnical engineer.

Footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. The foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, they should be protected to reduce evaporation or entry of moisture.

Footing Settlement: Provided that the site is prepared as discussed in the Site Preparation section and the surcharge program is completed successfully, single isolated footings with widths no larger than 10 feet should experience a settlement of approximately one (1) inch. If a cluster of closely spaced footings (i.e., if the center to center spacing of the footings is less than two times the width of the footing) are planned, PSI should be contacted to calculate the amount of settlement. Differential settlement is typically about 50 percent of the total settlement and could be as much as the total settlement. While settlement of this magnitude is generally considered tolerable for structures of the type proposed, the design of any masonry walls should include provisions for liberally spaced, vertical control joints to minimize the effects of cosmetic cracking.

Floor Slab

Provided that the site preparation recommendations are followed and the surcharge program is completed successfully, a slab-on-grade floor slab can be constructed bearing on compacted low plasticity structural fill. Preparation of the subgrade should be performed as recommended in this report to identify any soft or unstable soils which should be removed from the floor slab area prior to fill placement and/or floor slab construction.

Due to the anticipated floor loads, a six (6) inch layer of compacted 610 limestone is recommended to improve the subgrade condition, evenly distribute the floor load, and provide a working table during construction. A modulus of subgrade reaction, *k* of 175 pci can be used for the design of the floor slab with the use of limestone base.

In areas where floor covering will be used, a polyethylene sheeting is recommended to be placed between the limestone and the floor slab to act as a vapor barrier. The floor slab should have an adequate number of joints to reduce cracking resulting from any differential movement.

Water Storage Tank

Based on the information provided to PSI, it is understood that the proposed tank will be supported on a two (2) foot thick concrete slab/mat foundation. It is also understood that the planned area of the proposed tank will receive about five (5) feet of fill. Based on our analysis, a rigid mat placed at least two (2) feet below the finished grade on properly compacted structural fill can be designed for

a maximum net allowable bearing capacity of 2,200 psf. Based on the imposed uniform bearing pressure of 2,200 psf on a mat placed on three (3) feet of properly compacted structural fill, the total settlement at the center of the mat could be on the order of four (4) inches. Differential settlement (center to edge) is typically about 50 percent of the total settlement. We anticipate about 50 percent of the total settlement to occur within the first year. For the design and construction of the proposed rigid mat foundation system, the structural engineer must take the settlements into account and should design the structural and other components accordingly.

For the foundation soils, the modulus of subgrade reaction for the mat foundation system could be taken as 50 lbs/in^3. The modulus of subgrade reaction across the mat varies based on the imposed bearing pressure concentrations on the mat. Based on the estimated bearing capacity and center and edge settlements, the modulus of subgrade reaction can vary on the order of 20 to 50 lbs/in^3.

The foundation excavation should be observed by a representative of PSI prior to steel or concrete placement to assess that the foundation materials are consistent with the materials discussed in this report. Soft or loose soil zones encountered at the bottom of the excavations should be removed and the excavation extended to stiffer soils as directed by the geotechnical engineer.

Utility Lines

Should reinforced concrete pipes (RCP) be used at the site, it is recommended that aggregate bedding material be placed beneath them to distribute the load and minimize initial subsidence. The bedding should be at least six (6) inches in thickness and should extend one-half of the pipe diameter beyond the edge of either side of the pipe or a minimum of 12 inches, whichever is greater. The RCP should be side bedded to the mid-height of the pipe or to the pipe spring line if arch pipe is used. The bedding material should consist of well-graded, free-draining stone. A geotextile fabric should be placed at the interface of the bedding material and natural subgrade to minimize migration of the bedding material into the very soft subsoils. A geotextile fabric should also be placed around the pipe at each joint to reduce potential migration of the sand fill or base into the joints of the pipe.

The trench excavation should be backfilled to the surface with granular fill. The fill should be placed in lifts not exceeding eight (8) inches and compacted to 95% of the maximum dry density, as determined by ASTM D698.

Pavement Recommendations

The performance of pavements depends upon several factors including (1) the characteristics of the supporting soils; (2) the magnitude and frequency of wheel load applications; (3) quality of construction materials; (4) the contractor's placement and workmanship abilities; and (5) the desired period of design life. PSI has evaluated both rigid and flexible pavements for this project.

Based on the information provided to us, it is understood that less than two (2) feet of fill will be required to reach the parking lot design grades. If portions of the parking area require more than two (2) feet of fill to reach parking area grades, PSI should be contacted, as this may induce additional differential settlements. Based on the information provided to us, much of the parking area will undergo typical heavy truck traffic on the order of 50 semi-trailers per day, six

(6) days a week, for a 20-year design life, resulting in an equivalent 18-kip single axle load (ESAL) of 1,300,000 for rigid pavement and 750,000 for flexible pavement. Light duty traffic is anticipated at the east end of the facility, where employee parking is located.

The recommended pavement sections presented are considered typical and minimum for the assumed parameters in the general site area and anticipated traffic conditions. We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the owner and the project designers should be aware that thinner pavement sections may result in increased maintenance costs and lower than anticipated pavement life. The pavement subgrade should be prepared as discussed in the site preparation section of this report.

Our scope of services did not include extensive sampling for determination of Coefficient of Subgrade Reaction (*k*) and California Bearing Ratio (CBR) of existing subgrade or potential sources of imported fill for the specific purpose of a detailed pavement analysis. Instead, we have assumed pavement related design parameters that are considered to be typical for the area soil types. We have estimated the subgrade soils will be prepared to achieve a Coefficient of Subgrade Reaction (*k*) of 75 psi per inch, which could be used for rigid pavement design and a CBR of three (3) for flexible pavement design. The recommended new flexible and rigid pavement sections are as follows:

NEW FLEXIBLE PAVEMENT Minimum thickness, inches			
Pavement Materials	**Light Duty** **E_{18}: 15,000**	**Medium Duty** **E_{18}: 170,000**	**Heavy Duty** **E_{18}: 750,000**
Asphaltic Concrete Wearing Course	1 ½	2	2
Asphaltic Concrete Binder	1 ½	2	4
Compacted Crushed Limestone Base	8	10	10
Compacted Structural Fill	12	12	12

NEW RIGID PAVEMENT Minimum thickness, inches			
Pavement Materials	**Light Duty** **E_{18}: 15,000**	**Medium Duty** **E_{18}: 220,000**	**Heavy Duty** **E_{18}: 1,300,000**
Portland Cement Concrete	5	7	9
Compacted Granular Fill	12	12	12

The asphaltic concrete should meet the requirements of the latest edition of Louisiana Standard Specification for Roads and Bridges (LSSRB) and should be compacted to a minimum of 95% of the density of the laboratory molded specimen. The crushed limestone base should meet the requirements of the latest edition of LSSRB, Section 1003.03, and be compacted to at least 95% of the maximum dry density determined by ASTM D698 (Standard Proctor) within three (3)

percent of optimum moisture content. The granular fill under the rigid pavement should meet the requirements of LSSRB and should be compacted to 95% of the maximum dry density as determined by ASTM D698.

Proper finishing of concrete pavement requires the use of appropriate construction joints to reduce the potential for cracking. Construction joints should be designed in accordance with current Portland Cement Association and American Concrete Institute guidelines. Joints should be sealed to reduce the potential for water infiltration into pavement joints and subsequent infiltration into the supporting soils. Load transfer devices at the pavement joints should be designed in accordance with accepted codes. The concrete should have a minimum compressive strength of 3,500 psi at 28 days. The concrete should also be designed with 5 ± 1 percent of entrained air to improve workability and durability.

Geotextile Fabric

A woven geotextile fabric consisting of MIRAFI 600X or equivalent may be placed over the soft subgrade in the parking areas as needed to improve the subgrade condition. Placement of geotextile fabric should be performed under the direction of the geotechnical engineer. The geotextile, which is sold in rolls of various sizes, should be installed per the manufacturer's recommendations and be overlapped a minimum of two (2) feet. The geotextile fabric should meet or exceed the following properties:

Property	Test Method	Minimum Average Roll Values
Grab tensile strength, lbs.	ASTM D4632	315
Grab tensile elongation, %	ASTM D4632	15
Mullen burst strength, psi	ASTM D3786	600
Puncture resistance, lbs.	ASTM D4833	120
Trapezoid tear strength, lbs.	ASTM 4533	120
UV resistance after 500 hrs, % strength resistance	ASTM D4355	70

CONSTRUCTION CONSIDERATIONS

It is recommended that PSI be retained to provide observation and testing of construction activities involved in the foundations and pavement, earthwork, and related activities of this project. PSI cannot accept any responsibility for any conditions which deviate from those described in this report, nor for the performance of the foundations and pavement if not engaged to also provide construction observation and testing for this project to ensure that the recommendations presented herein are implemented.

Moisture Sensitive Soils / Weather Related Concerns

The upper soils encountered at this site are sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, an increase in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. Therefore adequate site drainage should be provided to prevent water from ponding on site. It will be advantageous to perform earthwork and foundation construction activities during dry weather.

Drainage and Groundwater Concerns

Water should not be allowed to collect in the foundation excavation, floor slab area, or on prepared subgrades in the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water around the perimeter of the building and beneath the floor slab.

Groundwater was generally encountered in the building borings between three (3) and seven (7) feet at the time of our field exploration. However, water was measured as shallow as one (1) foot from the surface in some poorly drained areas. Therefore, it is possible that seasonal variations will cause fluctuations of the water table. Additionally, perched water may be encountered in discontinuous zones within the overburden of silty sandy clay. Any water accumulation should be removed from excavations by pumping. Should excessive and uncontrolled amounts of seepage occur, the geotechnical engineer should be consulted.

Excavations

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA), amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P". This document was issued to better insure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations, or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary

excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety guidelines.

We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

REPORT LIMITATIONS

The recommendations submitted in this report are based on the available project information and subsurface information obtained by PSI. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not notified of such changes, PSI will not be responsible for the impact of those changes on the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Associated Wholesale Grocers, Inc. (AWG) for the specific application to the proposed AWG Distribution Center to be constructed near the intersection of Highway 1090 and Old Military Road in Pearl River, Louisiana.

APPENDIX

Site Vicinity Map
Boring Location Plan
Boring Logs
Key to Terms and Symbols Used on Boring Logs
Subsurface Soil Profiles
Consolidation Test Results