Middle Tennessee Electric

Veterans Substation Bank 2 Addition
Engineering, Procurement, and Construction Specifications RFP

November 2024

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Request for Proposal Letter

Middle Tennessee Electric
555 New Salem Highway, Murfreesboro, TN 37129
1.877.777.9020 / www.MTE.com

November 14, 2024

Dear Bidder:

This letter is a request for a proposal to engineer, procure, and construct an additional transformer bay at the Veterans Substation for Middle Tennessee Electric (MTE) in accordance with the attached specifications and drawings. The proposal will be evaluated by MTE.

The proposal is to include any necessary drawings required to support your proposed design to MTE for our evaluation. Also required is a list of the major suppliers of materials and proposed subcontractors. At a minimum, this list of suppliers and subcontractors shall include **all** consulting engineers including geotechnical engineers, excavation Contractors, concrete Contractors, steel suppliers, and steel/bus erectors. MTE reserves the right to request the Contractor to change subcontractors or suppliers before the contract is signed. Refusal to change subcontractors or suppliers may cause the proposal to be rejected. In addition, the proposal is to include a schedule including starting date, design target dates, approval drawing dates, excavation start dates, steel erection start date, completion dates of each stage of construction, etc. **Failure to provide any of the above design details, schedules, and lists with your proposal may result in a rejection of your proposal during evaluation.**

The proposal is to build the substation transformer bay addition to MTE design specifications, applicable industry standard codes, and use the manufacturers and subcontractors specified and any specific material detailed in the specifications. There is to be one section of the proposal that is labeled "Exceptions". The "Exceptions" section of the proposal is to include any items that the bidder is proposing not to follow in the specifications. MTE will evaluate each "Exception" on its own merit. If the "Exception" is not specifically approved in writing, then the Contractor **must** follow the MTE specification at no additional cost to MTE.

The enclosed design drawings and geotechnical study were prepared by qualified parties and believed by MTE to be valid. MTE assumes no liability with initial site conditions submitted or design drawings provided for bidding purposes. MTE's intent is to provide a design guideline. MTE recommends that the bidder procure the services of a Licensed Surveyor, Civil Engineer, Excavator, and Geotechnical Engineer to evaluate the site and site conditions in preparing a proposal for the construction of the substation.

MTE expects firm price proposals for the construction of the substation transformer bay addition. Change orders due to the Contractor’s failure to understand the scope of work and standard MTE practices will not be approved. Contractor, at their expense, must provide work and material according to applicable codes and MTE standards. However, given the volatile nature of the industry, change orders deemed by MTE to be appropriate will be accepted. Proposals and

designs with adders, loopholes, exceptions, limitations, clauses, or other such criteria will be subject to rejection at MTE's sole discretion without explanation.

The Contractor will be responsible for designing and building the additional substation transformer bay. The Contractor will be financially responsible for any defects in material and workmanship (reference Guarantee and Warranty section of Engineering Specification for details). The Contractor will design and build the steel structures, bus work, foundations, and concrete. The Contractor will be responsible for designing and installing oil containment for the transformers, providing SPCC plan. MTE will design the protective relaying and control scheme, conduit system, cable schedule, and field connections. The Contractor will be responsible for the installation of the conduit system, field cabling, and terminations for the protective relaying and controls including fiber optic cables. The existing control house is already complete with the protective relaying and controls and auxiliary equipment. MTE will provide the power transformer and dress-out of the transformer. The Contractor will connect the transformer to the bus.

The Contractor completion date for this substation is **June 2026**. There will be a $1,000 per day-liquidated damages from that date. There will not be any extensions on the deadline date unless the holdup is due to the fault of MTE or extreme acts of nature such as a tornado touching down on the site, extensive flooding or other extreme unforeseen site conditions as determined by MTE. Maximum liquidated damages will be five (5) percent of the project cost.

The site shall be ready for the delivery of the power transformer in **March 2025**. It is the responsibility of the Contractor to have the site ready to accept delivery. Failure of the Contractor to meet this date will cause any delay or storage fees charged by the transformer manufacturer to be passed on to the Contractor.

The Contractor shall be responsible for the removal of all existing debris from the substation site.

The Contractor will be responsible for posting a performance bond equal to the contract amount within 10 days of the awarding of the contract by MTE.

Proposal Information

By submitting a proposal, the bidder acknowledges that he/she has made a careful examination of the site of the Project and of the Plans, Specifications and Construction Drawings, and has become informed as to the location and nature of the proposed construction, the transportation facilities, the kind and character of soil and terrain to be encountered, the kind of equipment, tools, and other facilities required before and during the construction of the Project and has become acquainted with the availability status of materials to be furnished and with the labor conditions which would affect work on the Project. The bidder also acknowledges that details provided in this RFP document are for general bidding purposes only and the bidder takes full responsibility for verifying the validity of such information before submitting a proposal. In

addition, the bidder accepts full liability for any failure in evaluating the scope of work required. If any conflict or problem exists, the bidder shall notify MTE for resolution before submitting a proposal.

MTE substation construction projects require Construction Site Managers. The proposals are to include the proposed Construction Site Manager and their experience resume. MTE reserves the right to request the Contractor to change their proposed Construction Site Manager before the contract is signed. Refusal to change the proposed Construction Site Manager might cause the proposal to be rejected (see Construction Site Manager Section of Engineering Specification for details).

The site is at 4132 Windrow Road, Rockvale, TN 37153.

This request for proposal is made with the specific understanding that MTE reserves the right to reject any and all proposals without explanation. This will be a private bid opening. The bids will need to be submitted to MTE no later than **1:30pm on January 14, 2025**.

Also note, there will be a pre-bid meeting at **9:30am on November 19, 2024,** at MTE. The address is 1010 Haley Rd, Murfreesboro, TN 37129. The meeting will conclude with a site visit.

Included in this proposal package are the following documents and drawings:

- Approved Contractors List
- Contract
- Engineering and Construction Specifications
- Circuit Switcher Specification
- Substation Nuts, Bolts, and Washer Standards
- One-line Diagram
- General Arrangement and Details
- Typical Cable/Conduit Details and Conduit Layout
- Geotechnical Investigation Report

Note: Record Drawings are provided for informational purposes to aid with proposals. MTE recommends attaining the services of a licensed professional engineer in the state of TN to complete the necessary design.

If you have any questions, don't hesitate to get in touch with me at (615) 580-9133 or autumnferree@mte.com .

Sincerely,

Autumn Ferree
Electrical Engineer
Middle Tennessee Electric
1010 Haley Rd,
Murfreesboro, TN 37129

Initial_____No Bid

Section 200

Approved Bidders and Contractors

Veterans Substation Approved Bidders/Contractors List

Approved Substation Packagers

Dis-Tran Packaged Substations, LLC
4725 Hwy 28 East
Pineville, LA 71360

MD Henry Company, Inc.
120 Clark Street
Pelham, AL 35124

Approved Site-work Contractors

Thorne's Excavating Co.
624 Old Horn Springs Road
Lebanon, TN 37087

Baker Construction
3895 Betty Ford Road
Murfreesboro, TN 37130

Approved Geotechnical Engineers

Geosciences Design Group, LLC
2212B Dunn Ave.
Nashville, TN 37211

Geo Services, LLC
163 Business Park Dr. #15
Lebanon, TN 37090

Geotek Engineering Co., Inc.
2909 Elizabeth Street
Nashville, TN 37211

TTL, Inc.
5010 Linbar Drive, Ste. 153
Nashville, TN 3721

If you wish to use someone not on the approved list, please submit the following for the new company to Autumn Ferree for approval five (5) working days prior to the proposal due date: five (5) references, a list of similar projects completed, and contact information.

Section 300

Contract and Forms

SUBSTATION PROJECT CONSTRUCTION CONTRACT

NOTICE AND INSTRUCTIONS TO BIDDER

1. **Owner Furnished Materials.** The lump sum price(s) submitted in the Bidder's Proposal shall not include provisions for the materials that shall be furnished by the Owner (or "Owner Furnished Materials"). The Owner Furnished Materials shall be specified in the Plans, Specifications and Construction Drawings (collectively, the "Plans").

2. **Obtaining Documents.** The Plans, together with all necessary forms and other documents for bidders shall be obtained from the Owner in PDF format.

3. **Due Diligence.** Prior to the submission of the Proposal, the Bidder shall make and shall be deemed to have made a careful examination of the site of the project and of the Plans, and forms of Contractor's Proposal and Contractor's Bond, and shall review the location and nature of the proposed construction, the transportation facilities, the kind and character of soil and terrain to be encountered, the kind of facilities required before and during the construction of the project, general local conditions, environmental and historic preservation considerations, and all other matters that may affect the cost and time of completion of the project. Bidder will be required to comply with all federal, state, and local laws, rules, and regulations applicable to its performance, including those pertaining to the licensing of contractors, and the Anti Kick-Back Act of 1986 (41 U.S.C. 51 et seq).

4. **The Time for Completion of Construction** of the project is of the essence of the Contract and shall be as specified by the Owner in the Plans.

5. **Contractor's Bond.** For a Contract in excess of $500,000, the Bidder agrees to furnish a Contractor's Bond with sureties listed by the United States Treasury Department as Acceptable Sureties, in a penal sum not less than the contract price.

6. **Debarment Certification.** The Bidder must provide to the Owner a suspension and debarment certificate in the form attached hereto.

7. **Contract is Entire Agreement.** The Contract to be effected by the acceptance of the Proposal shall be deemed to include the entire agreement between the parties thereto, and the Bidder shall not claim any modifications thereof resulting from any representation or promise made at any time by any officer, agent or employee of the Owner or by any other person.

8. **Minor Irregularities.** The Owner reserves the right to waive minor irregularities or minor errors in any Proposal, if it appears to the Owner that such irregularities or errors were made through inadvertence. Any such irregularities or errors so waived must be corrected on the Proposal in which they occur prior to the acceptance thereof by the Owner.

9. **The Owner Represents:**

   a. Owner Furnished Materials will be provided on hand at locations specified per the Plans, or if such materials are not on hand, they will be made available by the Owner to the successful Bidder at the locations specified before the time such materials are required for construction.

b. All titles, easements and rights-of-way, except as shown on maps included in the Plans, have been obtained from the owners of the properties on which the project is to be constructed (including tenants who may reasonably be expected to object to such construction). The remaining easements and rights-of-way, if any, will be obtained as required to avoid delay in construction.

c. Contractor shall be responsible for the staking and layout of project per the Plans, except for those areas indicated in the Plans to be completed by Owner.

d. Where underground distribution construction is required, permission has been obtained from state and local highway and road authorities to install underground distribution power facilities and set pedestals, if any, on the highway and road right-of-way in the project area. Notwithstanding such permission granted to the Owner, each Bidder is responsible for ascertaining that the equipment, methods of construction, and repair proposed to be used on the project will meet all requirements of public authorities having jurisdiction over highway and road right-of-way. The successful Bidder will be required to furnish proof satisfactory to the Owner of compliance with this requirement. If required by highway or road authorities, the successful Bidder will furnish to such authorities a bond or meet other guaranty requirements to assure the prompt repair of all damages to highways and roads and their associated rights-of-way caused by the Bidder during construction of the project. This requirement is in addition to and independent of the Contractor's Bond required under this Contract. The acceptance of a bid from any Bidder is not to be construed as approval of the Bidder's equipment or proposed construction methods by or on behalf of the highway and road authorities. Bidders may obtain information concerning the requirements of highway and road authorities by communicating with the following:

_____

e. All funds necessary for prompt payment for the construction of the project will be available.

If the Owner shall fail to comply with any of the undertakings contained in the foregoing representation or if any of such representations shall be incorrect, the Bidder will be entitled to an extension of time of completion for a period equal to the delay, if any, caused by the failure of the Owner to comply with such undertakings or by any such incorrect representation; provided the Bidder shall have promptly notified the Owner in writing of its desire to extend the time of completion in accordance with the foregoing; provided, however, that such extension, if any, of the time of completion shall be the sole remedy of the Bidder for the Owner's failure, because of conditions beyond the control and without the fault of the Owner, to furnish materials in accordance with subparagraph a. above.

THE MIDDLE TENNESSE
ELECTRIC MEMBERSHIP CORPORATION
Owner

*By*_____

_____
Title

_____, *20*___
Date

PROPOSAL

(hereinafter referred to as “Proposal” or “Contract”)

TO:

THE MIDDLE TENNESSEE ELECTRIC MEMBERSHIP CORPORATION (MTEMC), 555 New Salem Road, Murfreesboro, TN 37129 (hereinafter called the "Owner").

ARTICLE I--
GENERAL

Section 1. Offer to Construct. The undersigned (hereinafter called the "Bidder') hereby proposes to receive and install such materials and equipment as may hereinafter be specified to be furnished by the Owner, and to furnish all other materials and equipment, all machinery, tools, labor, transportation and other means required to construct the project in strict accordance with the Plans, Specifications and Construction Drawings (collectively, the “Plans”), which are incorporated by reference as if fully set forth herein, for the lump sum price hereinafter stated.

Section 2. Materials and Equipment. The Bidder agrees to furnish and use in the construction of the project under this Proposal, in the event the Proposal is accepted, only such approved material in the Plans. The use of non-listed materials requires prior consent by the Owner.

The Bidder will purchase all materials and equipment (other than Owner Furnished Materials) outright and not subject to any conditional sales agreements, bailment, lease or other agreement reserving unto the seller any right, title or interest therein. All such materials and equipment shall be new and shall become the property of the Owner when erected in place.

Section 3. Owner Furnished Materials. The Bidder understands and agrees that, if this Proposal is accepted, the Owner will furnish to the Bidder the material set forth in the attached Plans as Owner Furnished Materials. For those items not yet delivered, the Bidder will, on behalf of the Owner, accept delivery of such of the materials as may be subsequently delivered and will promptly forward to the Owner for payment the supplier's invoice. The Bidder will acknowledge in writing the receipt of all materials received as indicated in the Plans. The materials referred to are on hand at, or will be delivered to, the substation site and the Bidder will use such materials in constructing the project.

Materials, if any, not required for the project, which have been furnished to the Bidder by the Owner or delivery of which has been accepted by the Bidder on behalf of the Owner, shall be returned to the Owner by the Bidder upon completion of construction of the project. The value of all materials not installed in the project nor returned to the Owner shall be deducted from the final payment to the Bidder.

The Owner shall not be obligated to furnish materials in excess of the quantities, size, kind and type set forth in the Plans. If the Owner furnishes, and the Bidder accepts, materials in excess thereof the values of such excess materials shall be their actual cost as stated by the Owner.

Information on the shipping schedules of materials in the Plans will be furnished to the Bidder as necessary during progress of the work.

Upon delivery, the Bidder shall promptly receive, unload, transport and handle all materials and equipment in the Plans at its expense and shall be responsible for demurrage, if any.

Section 5. Description of Contract. The Notice and Instructions to Bidders, Plans, Specifications, and Construction Drawings, which by this reference are incorporated herein, together with the Proposal and Acceptance constitute the Contract. The Plans, Specifications, and Construction Drawings, including maps, special drawings, and approved modifications in standard specifications are attached
hereto and identified as follows:

Section 6. Due Diligence. The Bidder has made a careful examination of the site of the project to be constructed and of the Plans, Specifications, Construction Drawings, and form of Contractor's Bond attached hereto, and has become informed as to the location and nature of the proposed construction, the transportation facilities, the kind and character of soil and terrain to be encountered, and the kind of facilities required before and during the construction of the project, and has become acquainted with the labor conditions, federal, state, and local laws, rules, and regulations applicable to its performance.

Section 7. License. The Bidder warrants that a Contractor's License is required and it possesses Contractor's License No. _____ for the State of Tennessee and said license expires on _____, 20____.

Section 8. Warranty of Good Faith. The Bidder warrants that this Proposal is made in good faith and without collusion or connection with any person or persons bidding or the same work.

Section 9. Financial Resources.

a. The Bidder warrants that it has or will obtain the financial resources necessary to ensure completion of the project.

b. The Bidder agrees that in the event this Proposal is accepted and a Contractor's Bond is required, it will furnish a Contractor's Bond in the form attached hereto, in a penal sum not less than the maximum Contract price, with a surety or sureties listed by the United States Department of Treasury as Acceptable Sureties.

Section 10. Taxes. The lump sum price in this Proposal includes provisions for the payment of all monies which will be payable by the Bidder or the Owner in connection with the construction of the project on account of taxes imposed by any taxing authority upon the sale, purchase or use of materials, supplies and equipment, or services or labor of installation thereof to be incorporated in the project as part this project. The Bidder agrees to pay all such taxes, except taxes upon the sale, purchase or use of Owner Furnished Materials. The Bidder will furnish to the appropriate taxing authorities all required information and reports pertaining to the project, except as to the Owner Furnished Materials.

Section 11. Changes in Quantities. The Bidder understands and agrees that the quantities, as specified in the Plans and called for in this Proposal are approximate. If the Owner changes the quantity of any material specified in this Proposal by more than fifteen percent (15%), the change shall be regarded as a change in the construction within the meaning of Article II, Section 1(d) of this proposal.

ARTICLE II-CONSTRUCTION

Section 1. Time and Manner of Construction.

a. The Bidder agrees to commence construction of the project on a date (hereinafter called the "Commencement Date") which shall be determined by the agreement of the Bidder and Owner after the proposed Bidder's schedule is approved by the Owner. In no event will the Commencement Date be later than ____ calendar days after date of approved by the Owner. The Bidder further agrees to prosecute diligently and to complete construction in strict accordance with the Plans no later than _____, 20____ . Since time is of the essence for the substation project, Liquidated Damages may be required to be paid by the Bidder if the Bidder does not complete the substation project by the above completion date. Liquidated Damages will be defined in the Plans.

b. The time for Completion of Construction shall be extended for the period of any reasonable delay which is due exclusively to causes beyond the control and without the fault of the Bidder, including Acts of God, fires, floods, inability to obtain materials and acts or omissions of the Owner with respect to matters for which the Owner is solely responsible: Provided, however that no such extension of time for completion shall be granted the Bidder unless within ten (10) days after the happening of any event relied upon by the Bidder for such an extension of time the Bidder shall have made a request therefore in writing to the Owner, and provided further that no delay in such time of completion or in the progress of the work which results from any of the above causes, except acts or omissions of the Owner, shall result in any liability on the part of the Owner.

c. The sequence of construction shall be as set forth in the Plans. Or if no sequences are set forth, the sequence of construction shall be as determined by the Bidder, subject to the approval of the Owner.

d. The Owner may from time to time during the progress of the construction of the project may make such changes, additions, or subtractions from the Plans, List of Materials and sequence of construction provided for in the previous paragraphs which are part of the Contractor's Proposal as conditions may warrant. Provided, however, that if any change in the construction to be done shall require an extension of time, a reasonable extension will be granted if the Bidder shall make a written request therefore to the Owner within ten (10) days after any such change is made. And provided further, that if the cost to the Bidder of construction of the project shall be materially increased by any such change or addition, the Owner shall pay the Bidder for the reasonable cost thereof in accordance with a Construction Contract Amendment signed by the Owner and the Bidder, but no claim for additional compensation for any such change or addition will be considered unless the Bidder shall have made a written request therefore to the Owner prior to the commencement of work in connection with such change or addition.

Section 2. Environmental Protection. The Bidder shall perform the work in compliance with all applicable Federal, State, and local Environmental Laws. For purposes of this Agreement, the term "Environmental Laws" shall mean all Federal, state, and local laws including statutes, regulations ordinances, codes, rules, and other governmental restriction and requirements relating to the environment or solid waste, hazardous substances, hazardous waste, toxic or hazardous material, pollutants or contaminants including, but not limited to the Comprehensive Environmental Response, Compensation, and Liability Act, as amended, 42 U.S.C. §§ 9601, et seq., the

Federal Water Pollution Control Act, as amended, 33 U.S.C. §§ 1251, et seq., and the Solid Waste Disposal Act, as amended, 42 U.S.C. §§ 6901, et seq., now or at any time hereafter in effect.

Section 3. Tools, Equipment, and Qualified Personnel. The Bidder agrees that in the event this Proposal is accepted it will make available for use in connection with the proposed construction all necessary tools and equipment and qualified supervisors and workers.

Section 4. Changes in Construction. The Bidder agrees to make such changes in construction previously installed in the project by the Bidder as required by the Owner for prices arrived at as follows:

a. For substations where only a portion of the substation is affected by the change, the compensation for such change shall be as agreed upon in writing by the Bidder and the Owner prior to the commencement of work in connection with such change.

b. For all other changes, the compensation for such change shall be the reasonable cost thereof as agreed upon by the Bidder and the Owner.

No payment shall be made to the Bidder for materials or labor involved in correcting errors or omissions on the part of the Bidder which result in construction not in accordance with the Plans.

Section 5. Construction Not in Proposal. The Bidder also agrees that when it is necessary to construct items not shown in the Proposal, in absence of other mutual agreement, it will construct such items for a price arrived at as follows:

a. The cost of materials shall be determined by the invoices.

b. The cost of labor shall be the reasonable cost thereof, but in no event shall it exceed an amount determined by calculating the ratio of the total labor costs to the total material costs in the section of the Proposal involved, and multiplying the cost of materials for the items in question by this ratio.

Section 6. Supervision and Inspection.

a. The Bidder shall give sufficient supervision to the work, using its best skill and attention. The Bidder will carefully study and compare all drawings, specifications and other instructions and will at once report to the Owner any error, inconsistency or omission which it may discover. The Bidder shall cause the construction work on the project to receive constant supervision by a competent superintendent (hereinafter called the "Superintendent") who shall be present at all times during working hours where construction is being carried on. The Bidder shall also employ, in connection with the construction of the project, capable, experienced and reliable supervisors and such skilled workers as may be required for the various classes of work to be performed. The Bidder shall be solely responsible for the means and methods of construction and for the supervision of the Bidder's employees.

b. The Owner reserves the right to require the removal from the project of any employee of the Bidder if in the judgment of the Owner such removal shall be necessary in order to protect the interest of the Owner. The Owner shall have the right to require the Bidder to increase the number of its employees and to increase or change the amount or kind of tools and equipment if at any time the progress of the work shall be unsatisfactory to the Owner; but the failure of the Owner to give any such directions shall not relieve the Bidder of its obligations to complete the work within the time and in the manner specified in this Proposal.

c. The construction of the project and all materials and equipment used therein, shall be subject to the inspection, tests, and acceptance by the Owner and the Bidder shall furnish all information required by the Owner concerning the nature or source of any materials incorporated or to be incorporated in the project. All Bidder procedures and records pertaining to the work shall be made available to the Owner-for review prior to such inspections and tests. The Bidder shall provide all reasonable facilities necessary for such inspection and tests and shall maintain an office at the site of the project, with telephone service where obtainable and at least one office employee to whom communications from the Owner may be delivered. Delivery of such communications in writing to the employee of the Bidder at such office shall constitute delivery to the Bidder. The Bidder shall have an authorized agent accompany the Owner when final inspection is made and, if requested by the Owner, when any other inspection is made. The performance of such inspections or tests by the Owner shall not relieve the Bidder of its obligations to perform the work in accordance with the requirements of this Contract.

d. In the event that the Owner shall determine that the construction contains or may contain numerous defects, it shall be the duty of the Bidder and the Bidder's Surety or Sureties, if any, to have an inspection made by an engineer approved by the Owner for the purpose of determining the exact nature, extent and location of such defects.

e. The Owner may require that the Bidder suspend the work wholly or in part for such period or periods as the Owner may deem necessary due to unsuitable weather or such other conditions as are considered unfavorable for satisfactory prosecution of the work or because of the failure of the Bidder to comply with any of the provisions of the Contract: Provided, however, that the Bidder shall not suspend work pursuant to this provision without written authority from the Owner so to do. The time of completion hereinabove set forth shall be increased by the number of days of any such suspension, except when such suspension is due to the failure of the Bidder to comply with any of the provisions of this Contract. In the event that work is suspended by the Bidder with the consent of the Owner, the Bidder before resuming work shall give the Owner at least twenty-four (24) hours' notice thereof in writing.

Section 7. Defective Materials and Workmanship.

a. The acceptance of any materials, equipment (except Owner Furnished Materials) or any workmanship by the Owner shall not preclude the subsequent rejection thereof if such materials, equipment, or workmanship shall be found to be defective after delivery or installation, and any such materials, equipment or workmanship found defective before final acceptance of the construction shall be replaced or remedied, as the case may be, by and at the expense of the Bidder. Any such condemned material or equipment shall be immediately removed from the site of the project by the Bidder at the Bidder's expense. The Bidder shall not be entitled to any payment hereunder so long as any defective materials, equipment or workmanship in respect to the project, of which the Bidder shall have had notice, shall not have been replaced or remedied, as the case may be.

b. Notwithstanding any certificate which may have been given by the Owner, if any materials, equipment (except Owner Furnished Materials) or any workmanship which does not comply with the requirements of this Contract shall be discovered within one (1) year after Completion of Construction of the project, the Bidder shall replace such defective materials or equipment or remedy any such defective workmanship within thirty (30) days after notice in writing of the existence thereof shall have been given by the Owner. If any such defective materials, equipment, or workmanship so replaced or repaired is found to be defective within one year after the completion of the replacement or repair, the Bidder shall replace or remedy such defective materials, equipment, or workmanship. If the Bidder shall be called upon to replace any defective materials or equipment or to remedy defective workmanship as

herein provided, the Owner, if so requested by the Bidder shall de-energize that section of the project involved in such work. In the event of failure by the Bidder so to do, the Owner may replace such defective materials or equipment or remedy such defective workmanship, as the case may be, and in such event the Bidder shall pay to the Owner the cost and expense thereof.

ARTICLE III--PAYMENTS AND RELEASE OF LIENS

Section 1. Payments to Bidder.

a. On or before the fifth (5) day of each calendar month, the Bidder will make application for payment, and the Owner, on or before the fifteenth (15) day of such month, shall make partial payment to the Bidder for construction accomplished during the preceding calendar month on the basis of completed construction furnished and certified to by the Bidder and approved by the Owner solely for the purposes of payment: Provided, however, that such approval shall not be deemed approval of the workmanship or materials. Only ninety percent (90%) of each such estimate approved during the construction of the project shall be paid by the Owner to the Bidder prior to Completion of the project. Upon completion by the Bidder of the construction of the project, the Owner will review, inspect, and test the substation for completeness, accuracy of construction with the Plans, and quality of the workmanship and materials. Upon the approval and acceptance by the Owner, the Owner shall make payment to the Bidder of all amounts to which the Bidder shall be entitled thereunder which shall not have been paid. Final payment should be made not later than ninety (90) days after the date of completion of construction of the project unless withheld because of the fault of the Bidder.

b. No payment shall be due while the Bidder is in default in respect of any of the provisions of this Contract and the Owner may withhold from the Bidder the amount of any claim by a third party against either the Bidder or the Owner based upon an alleged failure of the Bidder to perform the work hereunder in accordance with the provisions of this Contract.

c. The Owner and the Administrator shall have the right to inspect all payrolls, invoices of materials, and other data and records of the Bidder and of any subcontractor, relevant to the construction of the project.

Section 2. Release of Liens and Certificate of Contractor. Upon the completion by the Bidder of the construction of the project but prior to final payment to the Bidder, the Bidder shall deliver to the Owner releases of all liens and of rights to claim any lien, in the form attached hereto from all manufacturers, material suppliers, and subcontractors furnishing services or materials for the project and a certificate in the form attached hereto to the effect that all labor used on or for the project has been paid and that all such releases have been submitted to the Owner.

Section 3. Payments to Material Suppliers and Subcontractors. The Bidder shall pay each material supplier, if any, within five (5) days after receipt of any payment from the Owner, the amount thereof allowed the Bidder for and on account of materials furnished or construction performed by each material supplier or each subcontractor.

ARTICLE IV--PARTICULAR UNDERTAKINGS OF THE BIDDER

Section l. Protection to Persons and Property. The Bidder shall at all times take all reasonable precautions for the safety of employees on the work and of the public, and shall comply with all applicable provisions of federal, state, and local laws, rules, and regulations and building and construction codes, in addition to the safety rules and procedures of the Owner.

The following provisions shall not limit the generality of the above requirements:

a. The Bidder shall at no time and under no circumstances cause or permit any employee of the Bidder to perform any work upon energized lines, or upon structures carrying energized conductors, unless otherwise specified in the Plans.

b. The Bidder shall transport and store all material in facilities and vehicles which are designed to protect the material from damage. The Bidder shall ensure that all vehicles, trailers, and other equipment used comply with all applicable licensing, traffic, and highway requirements.

c. The Bidder shall so conduct the construction of the project as to cause the least possible obstruction of public highways.

d. The Bidder shall provide and maintain all such guard lights and other protection for the public as may be required by applicable statutes, ordinances and regulations or by local conditions.

e. The Bidder shall do all things necessary or expedient to properly protect any and all parallel, converging and intersecting lines, joint line poles, highways, and any and all property of others from damage, and in the event that any such parallel, converging and intersecting lines, joint line poles, highways or other property are damaged in the course of the construction of the project the Bidder shall at its own expense restore any or all of such damaged property immediately to as good a state as before such damage occurred.

f. Where the right-of-way of the project traverses cultivated or grazing lands, the Bidder shall limit the movement of its crews and equipment so as to cause as little damage as possible to crops, orchards or property and shall endeavor to avoid marring the lands. All fences which are necessarily opened or moved during the construction of the project shall be replaced in as good condition as they were originally found prior to construction and precautions shall be taken to prevent the escape of livestock. Except as otherwise provided in the descriptions of underground plowing and trenching assembly units, the Bidder shall not be responsible for loss of or damage to crops, orchards or property (other than livestock) on the right-of-way necessarily incident to the construction of the project and not caused by negligence or inefficient operation of the Bidder. The Bidder shall be responsible for all other loss of or damage to crops, orchards, or property, whether on or off the right-of-way, and for all loss of or damage to livestock caused by the construction of the project.

The right-of-way for purposes of this said section shall be indicated on the attached Plans.

g. The project, from the commencement of work to completion, or to such earlier date or dates when the Owner may take possession and control in whole or in part as hereinafter provided shall be under the charge and control of the Bidder and during such period of control by the Bidder all risks in connection with the construction of the project and the materials to be used therein shall be borne by the Bidder. The Bidder shall make good and fully repair all injuries and damages to the project or any portion thereof under the control of the Bidder by reason of any act of God or other casualty or cause whether or not the same shall have occurred by reason of the Bidder's negligence.

(1) To the maximum extent permitted by law, Bidder shall defend, indemnify, and hold harmless Owner and Owner's directors, officers, and employees from all claims, causes of action, losses, liabilities, and expenses (including reasonable attorney's fees) for personal loss, injury, or death to persons (including but not

limited to Bidder's employees) and loss, damage to or destruction of Owner's property or the property of any other person or entity (including but not limited to Bidder's property) in any manner arising out of or connected with the Contract, or the materials or equipment supplied or services performed by Bidder, its subcontractors and suppliers of any tier. But nothing herein shall be construed as making Bidder liable for any injury, death, loss, damage, or destruction caused by the sole negligence of Owner.

(2) To the maximum extent permitted by law, Bidder shall defend, indemnify, and hold harmless Owner and Owner's directors, officers, and employees from all liens and claims filed or asserted against Owner, its directors, officers, and employees, or Owner's property or facilities, for services performed or materials or equipment furnished by Bidder, its subcontractors and suppliers of any tier, and from all losses, demands, and causes of action arising out of any such lien or claim. Bidder shall promptly discharge or remove any such lien or claim by bonding, payment, or otherwise and shall notify Owner promptly when it has done so. If Bidder does not cause such lien or claim to be discharged or released by payment, bonding, or otherwise, Owner shall have the right (but shall not be obligated) to pay all sums necessary to obtain any such discharge or release and to deduct all amounts so paid from the amount due Bidder.

(3) Bidder shall provide to Owner's satisfaction evidence of Bidder's ability to comply with the indemnification provisions of subparagraphs i and ii above, which evidence may include but may not be limited to a bond or liability insurance policy obtained for this purpose through a licensed surety or insurance company.

h. Any and all excess earth, rock, debris, underbrush and other useless materials shall be removed by the Bidder from the site of the project as rapidly as practicable as the work progresses.

i. Upon violation by the Bidder of any of the provisions of this section, after written notice of such violation given to the Bidder by the Owner, the Bidder shall immediately correct such violation. Upon failure of the Bidder so to do the Owner may correct such violation at the Bidder's expense: Provided, however, that the Owner may, if it deems it necessary or advisable, correct such violation at the Bidder's expense without such prior notice to the Bidder.

j. The Bidder shall report any and all accidents immediately upon occurrence to the Owner, giving such data as may be prescribed by the Owner.

k. The Bidder shall not proceed with the cutting of trees or clearing of right-of-way without written notification from the Owner that proper authorization has been received from the owner of the property, and the Bidder shall promptly notify the Owner whenever any landowner objects to the trimming or felling of any trees or the performance of any other work on its land in connection with the project and shall obtain the consent in writing of the Owner before proceeding in any such case.

l. The Bidder will furnish, prior to the commencement of underground distribution construction, proof satisfactory to the Owner, of compliance with requirements of highway and road authorities having jurisdiction, including without limitation, the furnishing of a bond or other guaranty, and approval by such authorities of the equipment and methods of construction and repair to be used by the Bidder.

Section 2. Insurance. The Bidder shall take out and maintain throughout the period of this Agreement the following types and minimum amounts of insurance:

a. Workers' compensation and employers' liability insurance, as required by law, covering all its employees who perform any of the obligations of the Bidder under the contract. If any employer or employee is not subject to the workers' compensation laws of the governing state, then insurance shall be obtained voluntarily to extend to the employer and employee coverage to the same extent as though the employer or employee were subject to the workers' compensation laws.

b. Public liability insurance covering all operations under the contract shall have limits for bodily injury or death of not less than $5 million each occurrence, limits for property damage of not less than $5 million each occurrence, and $10 million aggregate for accidents during the policy period. A single limit of $5 million of bodily injury and property damage is acceptable. This required insurance may be in a policy or policies of insurance, primary and excess including the umbrella or catastrophe form.

c. Automobile liability insurance on all motor vehicles used in connection with the contract, whether owned, nonowned, or hired, shall have limits for bodily injury or death of not less than $2 million per person and $2 million each occurrence, and property damage limits of $2 million for each occurrence. A single limit of $2 million of bodily injury and property damage is acceptable. This required insurance may be in a policy or policies of insurance, primary and excess including the umbrella or catastrophe form.

The Owner shall have the right at any time to require public liability insurance and property damage liability insurance greater than those required in subsection "b" and "c" of this Section.

The Owner shall be named as Additional Insured on all policies of insurance required in subsections "b" and "c" of this Section.

The policies of insurance shall be in such form and issued by such insurer as shall be satisfactory to the Owner. The Bidder shall furnish the Owner a certificate evidencing compliance with the foregoing requirements which shall provide not less than (30) days prior written notice to the Owner of any cancellation or material change in the insurance.

Section 3. Delivery of Possession and Control to Owner.

Upon written request of the Owner the Bidder shall deliver to the Owner full possession and control of any portion of the project provided the Bidder shall have been paid at least ninety percent (90%) of the cost of construction of such portion. Upon such delivery of the possession and control of any portion of the project to the Owner, the risk and obligations of the Bidder as set forth in Article IV Section 1.g hereof with respect to such portion of the project so delivered to the Owner shall be terminated; Provided, however, that nothing herein contained shall relieve the Bidder of any liability with respect to defective materials and workmanship as contained in Article II, Section 7 hereof.

Section 4. Energizing the Project.

a. Prior to Completion of the project the Owner, upon written notice to the Bidder, may test the construction thereof by temporarily energizing any portion or portions thereof. During the period of such test the portion or portions of the project so energized shall be considered as within the possession and control of the Owner and governed by the provisions of Section 3 of this Article. Upon written notice to the Bidder by the Owner of the completion of such test and upon de-

energizing the lines involved therein said portion or portions of the project shall be considered as returned to the possession and control of the Bidder unless the Owner shall elect to continue possession and control in the manner provided in Section 3 of this Article.

b. The Owner shall have the right to energize permanently any portion or portions of the project delivered to its possession and control pursuant to the provisions of Section 3 of this Article.

Section 5. Assignment of Guarantees. All guarantees of materials and workmanship running in favor of the Bidder shall be transferred and assigned to the Owner prior to the time the Bidder receives final payment.

ARTICLE V--REMEDIES

Section 1. Completion on Bidder's Default. If default shall be made by the Bidder or by any subcontractor in the performance of any of the terms of this Proposal, the Owner, without in any manner limiting its legal and equitable remedies in the circumstances, may serve upon the Bidder and the Surety or Sureties, if any, upon the Contractor's Bond or Bonds a written notice requiring the Bidder to cause such default to be corrected forthwith. Unless within twenty (20) days after the service of such notice upon the Bidder such default shall be corrected or arrangements for the correction thereof satisfactory to both the Owner shall be made by the Bidder or its Surety or Sureties, if any, the Owner may take over the construction of the project and prosecute the same to completion by Contract or otherwise for the account and at the expense of the Bidder, and the Bidder and its Surety or Sureties, if any, shall be liable to the Owner for any cost or expense in excess of the Contract price occasioned thereby. In such event the Owner may take possession of and utilize, in completing the construction of the project, any materials, tools, supplies, equipment, appliances, and plant belonging to the Bidder or any of its subcontractors, which may be situated at the site of the project. The Owner in such contingency may exercise any rights, claims or demands which the Bidder may have against third persons in connection with this Contract and for such purpose the Bidder does hereby assign, transfer and set over unto the Owner all such rights, claims and demands.

Section 2. Liquidated Damages. The time of the Completion of Construction of the project is of the essence of the Contract. Should the Bidder neglect, refuse or fail to complete the construction within the time herein agreed upon, after giving effect to extensions of time, if any, herein provided, then, in that event and in view of the difficulty of estimating with exactness damages caused by such delay, the Owner shall have the right to deduct from and retain out of such moneys which may be then due, or which may become due and payable to the Bidder, amounts as specified in the Plans as liquidated damages and not as a penalty. If the amount due and to become due from the Owner to the Bidder is insufficient to pay in full any such liquidated damages, the Bidder shall pay to the Owner the amount necessary to effect such payment in full: Provided, however, that the Owner shall promptly notify the Bidder in writing of the manner in which the amount retained, deducted or claimed as liquidated damages was computed.

Section 3. Cumulative Remedies. Every right or remedy herein conferred upon or reserved to the Owner shall he cumulative, shall be in addition to every right and remedy now or hereafter existing at law or in equity or by statute and the pursuit of any right or remedy shall not be construed as an election: Provided, however, that the provisions of Section 2 of this Article shall be the exclusive measure of damages for failure by the Bidder to complete the construction of the Project within the time herein agreed upon.

ARTICLE VI-MISCELLANEOUS

Section 1. Patent Infringement. The Bidder shall hold harmless and indemnify the Owner from any and all claims, suits and proceedings for the infringement of any patent or patents covering any materials or

equipment used in construction of the project.

Section 2. Permits for Explosives. All permits necessary for the handling or use of dynamite or other explosives in connection with the construction of the project shall be obtained by and at the expense of the Bidder.

Section 3. Compliance with Laws. The Bidder shall comply with all federal, state, and local laws, rules, and regulations applicable to its performance under the contract and the construction of the project.

Section 6. Equal Opportunity Provisions.

a. Bidder's Representations.

The Bidder represents that:

It has____, does not have____,100 or more employees, and if it has, that it has____, has not_____, furnished the Equal Employment Opportunity-Employers Information Report EEO-1, Standard Form 100, required of employers with 100 or more employees pursuant to Executive Order 11246 of September 24, 1965, and Title VII of the Civil Rights Act of 1964.

The Bidder agrees that it will obtain, prior to the award of any subcontract for more than $10,000 hereunder to a subcontractor with 100 or more employees, a statement, signed by the proposed subcontractor, that the proposed subcontractor has filed a current report on Standard Form 100.

The Bidder agrees that if it has 100 or more employees and has not submitted a report on Standard Form 100 for the current reporting year and that if this Contract will amount to more than $10,000, the Bidder will file such report, as required by law, and notify the owner in writing of such filing prior to the Owner's acceptance of this Proposal.

b. Equal Opportunity Clause. During the performance of this Contract, the Bidder agrees as follows:

(1) The Bidder will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. The Bidder will take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotions or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection of training, including apprenticeship. The Bidder agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this Equal Opportunity Clause.

(2) The Bidder will, in all solicitations or advertisements for employees placed by or on behalf of the Bidder, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

(3) The Bidder will send to each labor union or representative of workers, with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representative of the Bidder's commitments under this section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Bidder will comply with all provisions of Executive Order 11246 of September 24, 1965, and the rules, regulations and relevant orders of the Secretary of Labor.

(5) The Bidder will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the administering agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Bidder's noncompliance with the Equal Opportunity Clause of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part, and the Bidder may be declared ineligible for further Government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as provided by law.

(7) The Bidder will include this Equal Opportunity Clause in every subcontractor purchase order unless exempted by the rules, regulations, or order of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each subcontractor or vendor. The Bidder will take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; Provided, however, that in the event Bidder becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, the Bidder may request the United States to enter into such litigation to protect the interests of the United States.

c. Certificate of Nonsegregated Facilities. The Bidder certifies that it does not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Bidder certifies further that it will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it will not permit its employees to perform their services at any location, under its control, where segregated facilities are maintained. The Bidder agrees that a breach of this certification is a violation of the Equal Opportunity Clause in this Contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and washrooms, restaurants and other eating areas, timeclocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin, because of habit, local custom, or otherwise. The Bidder agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) it will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding $10,000 which are not exempt from the provisions of the Equal Opportunity Clause, and that it will retain such certifications in its files.

Section 7. Franchises and Rights-of-Way. The Bidder shall be under no obligation to obtain or assist in obtaining: Any franchises, authorizations, permits or approvals required to be obtained by the Owner from Federal, State, County, Municipal or other authorities; any rights-of-way over private lands; or any agreements between the Owner and third parties with respect to the joint use of poles, crossings, or other matter incident to the construction and operation of the project.

Section 8. Nonassignment of Contract. The Bidder shall perform directly and without subcontracting not less than twenty-five percent (25%) of the construction of the project, to be calculated on the basis of the total Contract price. The Bidder shall not assign the Contract effected by an acceptance of this Proposal or any interest in any funds that may be due or become due hereunder or enter into any contract with any person, firm or corporation for the performance of the Bidder's obligations hereunder or any part thereof without the approval in writing of the Owner and of the Surety or Sureties, if any, on any bond furnished by the Bidder for the faithful performance of the Bidder's obligations hereunder. If the Bidder, with the consent of the Owner and any Surety or Sureties on the Contractor's Bond or Bonds, shall enter into a subcontract with any subcontractor for the performance of any part of this Contract, the Bidder shall be as fully responsible to the Owner for the acts and omissions of such subcontractor and of persons employed by such subcontractor as the Bidder would be for its own acts and omissions and those of persons directly employed by it.

Section 9. Successors and Assigns. Each and all of the covenants and agreements herein contained shall extend to and be binding upon the successors and assigns of the parties hereto.

Section 10. Independent Contractor. The Bidder shall perform the work as an independent contractor, not as a subcontractor, agent, or employee of the Owner. Upon acceptance of this Proposal, the successful Bidder shall be the Contractor and all references in the Proposal to the Bidder shall apply to the Contractor.

Section 11. Counterparts. This Contract may be executed in multiple counterparts, each of which shall be deemed an original and all of which shall constitute one and the same instrument.

ATTEST

_____
Witness

Dated _____

_____
Bidder

_____
Title

_____
Address

The Proposal must be signed with the full name of the Bidder. If the Bidder is a partnership, the Proposal must be signed in the partnership name by a partner. If the Bidder is a corporation, the Proposal must be signed in the corporate name by a duly authorized officer and the corporate seal affixed and attested by the Secretary of the Corporation.

ACCEPTANCE

The Owner hereby accepts the fore going Proposal of the Bidder, _____

_____, *for the construction of the following:*

_____

_____

_____

_____

_____

_____

_____

*for a total contract price of $*_____*(*_____*dollars.)*

The Middle Tennessee Electric
Membership Corporation
Owner

By _____
COO

_____
Witness

_____, *20* _____
Date of Contract

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY AND VOLUNTARY EXCLUSION – LOWER TIER COVERED TRANSACTIONS

INSTRUCTIONS FOR CERTIFICATION

1. By signing and submitting this proposal, the prospective lower tier participant is providing the certification set out below.

2. The certification in this clause is a material representation of fact upon which reliance was placed when this transaction was entered into. If it is later determined that the prospective lower tier participant knowingly rendered an erroneous certification, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

3. The prospective lower tier participant shall provide immediate written notice to the person to which this proposal is submitted if at any time the prospective lower tier participant learns that its certification was erroneous when submitted or had become erroneous by reason of changed circumstances.

4. The terms *covered transaction, debarred, suspended, ineligible, lower tier covered transaction, participant, person, primary covered transaction, principal, proposal, and voluntarily excluded*, as used in this clause, have the meaning set out in the Definitions and Coverage sections of the rules implementing Executive Order 12549. You may contact the person to which this proposal is submitted for assistance in obtaining a copy of those regulations.

5. The prospective lower tier participant agrees by submitting this proposal that, should the proposed covered transaction be entered into, it shall not knowingly enter into any lower tier covered transactions with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, declared ineligible, or voluntarily excluded from participation in this covered transaction, unless authorized by the department or agency with which this transaction originated.

6. The prospective lower tier participant further agrees by submitting this proposal that it will include the clause titled "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions.

7. A participant in a covered transaction may rely upon a certification of a prospective participant in a lower tier covered transaction that it is not proposed for debarment under 48 CFR part 9, subpart 9.4, debarred, suspended, ineligible, or voluntarily excluded from the covered transaction, unless it knows that the certification is erroneous. A participant may decide the method and frequency by which it determines the eligibility of its principals. Each participant may, but is not required to, check the List of Parties Excluded from Federal Procurement and Nonprocurement Programs.

8. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render in good faith the certification required by this clause. The knowledge and information of a participant is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

9. Except for transactions authorized under paragraph 5 of these instructions, if a participant in a covered transaction knowingly enters into a lower tier covered transaction with a person who is proposed for debarment under 48 CFR part 9, subpart 9.4, suspended, debarred, ineligible, or

voluntarily excluded from participation in this transaction, in addition to other remedies available to the Federal Government, the department or agency with which this transaction originated may pursue available remedies, including suspension and/or debarment.

CERTIFICATION

(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

Organization Name PR/Award or Project Name

Name and Title

Signature Date

U.S. Department of Agriculture
Rural Utilities Service

WAIVER AND RELEASE OF LIEN

WHEREAS the undersigned, _____
NAME OF MANUFACTURER, MATERIAL SUPPLIER OR SUBCONTRACTOR

has furnished to _____ *the following:*
NAME OF CONTRACTOR

_____ *for*
KIND OF MATERIAL AND SERVICES FURNISHED

use in the construction of a project belonging to _____
NAME OF BORROWER

and designated the Rural Utilities Service as _____
RUS DESIGNATION

NOW, THEREFORE, the undersigned, _____
NAME OF MANUFACTURER, MATERIAL SUPPLIER, OR SUBCONTRACTOR

for and in consideration of $ _____ *and other good and valuable consideration, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all liens, or right to or claim of lien, on the above described project and premises, under any law, common or statutory, on account of labor or materials, or both, heretofore or hereafter furnished by the undersigned to or for the account of*

said _____ *for said project .*
NAME OF CONTRACTOR

Given under my (our) hand(s) and seal(s) this _____ *day of* _____ *,20* _____ .

_____
Name of Manufacturer, Material Supplier, or Subcontractor

By _____
President

This Waiver and Release of Lien must be signed with the full name of the Manufacturer, Material Supplier, or Subcontractor. If the Manufacturer, Material Supplier, or Subcontractor is a partnership, this Waiver and Release of Lien must be signed in the partnership name by a partner. If the Manufacturer, Material Supplier, or Subcontractor is a corporation, this Waiver and Release of Lien must be signed in the corporate name by a duly authorized officer and the corporate seal affixed and attested by the Secretary of the Corporation.

Section 400

Engineering and Construction Specification

Veterans Substation
Engineering and Construction Specifications
MIDDLE TENNESSEE ELECTRIC MEMBERSHIP CORPORATION

GENERAL INFORMATION

The following specifications are submitted in addition to the drawings and reports in order to provide the information necessary to build the substation to MTE standards.

The drawings contain notes and directions that are not included in this narrative.

Job site **safety** is the responsibility of the Contractor.

All design work shall be done under appropriate Tennessee licensed Professional Engineers. All drawings and calculations submitted to MTE shall bear their Tennessee engineering seals and signatures. The engineering company shall also be authorized to practice engineering in the State of Tennessee, in accordance with Tennessee Code Annotated Sections 62-2-601 and 62-2-602.

All Contractors shall be licensed in the state of Tennessee. The Contractor's license should have a total limit of no less than the bid amount. Failure to meet these criteria will result in a rejection of the bid due to Rules for Tennessee Board for License Contractors 0680-1-.18.

In the event that a conflict arises between the site construction drawings, the specifications, or the site conditions, the Contractor shall immediately cease work and contact MTE personnel and the design engineer.

All work shown shall be performed in accordance with the plans and site work specifications for this project and shall conform to all codes, ordinances, restrictions, and standards for all governing agencies having jurisdiction over the site. The Contractor will only perform construction activities based on plans and specifications that have been issued for construction purposes.

All applicable codes and standards shall be followed in the design and building of this substation including but not limited to the following:

Rural Electric Service (RUS)
Institute of Electrical and Electronic Engineers (IEEE)
National Electric Safety Code (NESC)
Nation Electrical Manufacturers Association (NEMA)
American National Standards Institute (ANSI)
American Concrete Institute (ACI)
American Society of Testing Materials (ASTM)
American Institute of Steel Construction (AISC)
American Society of Civil Engineers (ASCE)

In the event the Contractor feels that conflict exists between documents containing specifications for this substation, the Contractor shall immediately bring it to the attention of MTE so that the conflict may be resolved before it causes problems with the project. If the Contractor finds that it is not possible to meet the specifications in this document, then work is to be stopped and MTE is to be notified immediately so that the problem may be resolved.

If the Contractor finds that something is extraordinary and/or unconventional in these specifications, notify MTE so the issue can be resolved.

APPROVAL DRAWINGS and APPROVAL LIST

Approval drawings are to be submitted for the site work plan, site drainage plan, general arrangement, steel design, foundation layouts and design details, ground grid design details, oil containment, lightning study, all bills of material, and any other pertinent design details. Two (2) copies of these drawings and lists are to be submitted. MTE will return one set with corrections or approve them as submitted. Approval by MTE shall not relieve the Contractor of the responsibility for the correctness of the drawings furnished by the Contractor nor the compliance with the specifications or any applicable codes, ordinances, restrictions, and standards for all governing agencies having jurisdiction over the site.

DRAWINGS

The Contractor shall supply MTE copies of construction drawings. Copies of the electronic versions of the final drawings in the latest AutoCAD format are required. Electronic files may be provided on a CD-R with a professional label detailing the Project Name, EPC, and Date of As-builts at a minimum. These drawings shall include, but are not limited to, site work plan, site drainage plan, the general arrangement, structure erection diagrams, steel details, foundation layouts, foundation construction details, oil containment details, lightning study, grounding layout, apparatuses furnished by the Contractor, and the bill of materials. The bill of materials electronic format shall be in an Excel or Word format.

TENNESSEE ONE CALL

It is the Contractor’s responsibility to have all underground utilities located.

PERMITS

MTE will obtain any local building permits and attend any planning committee should it be required. Additionally, any other permits such as burn permit, blasting permits, TDOT driveway permit, communications tower permits, etc. will be the sole responsibility of the Contractor.

The Contractor shall be required to post a 4’ x 6’ sign near the construction entrance. The sign shall bear the Contractor’s name, “MTE”, and the site address. The right of way setback and sign dimensions shall follow local requirements for temporary signs.

CONSTRUCTION MEETINGS

There will be a regular weekly meeting during the construction phase that will be attended by a minimum of one of the following: Project Manager, Project Engineer, or senior level management from MTE. The Contractor shall also have appropriately responsible personnel at the meetings.

The meeting is to be scheduled at the same time and day for each week. If conflicts occur, the meeting can be rescheduled or skipped by agreement of both the Contractor and MTE. This is not to be a normal occurrence. There should be a minimum of one-day notice for meetings to be changed. Failure to attend a scheduled meeting will result in a $100 fine for the Contractor.

CONSTRUCTION SITE MANAGER

A full-time Construction Site Manager, (aka “CSM”) is required. It is required that the same CSM remain with the substation construction project from start to finish.

The CSM shall be a direct employee of the EPC Contractor and shall be at the site anytime work is being performed. The CSM shall be easily accessible and available at all times (i.e. not in a bucket truck or running a stinger truck). This person shall also be at the regular weekly construction meetings and provide the interface between MTE, construction personnel, and the Contractor. The CSM shall be aware of all construction tasks taking place at all times and shall be responsible for keeping the project on schedule and resolving any construction issues as they arise. Substation Construction Foremen shall report directly to the CSM. The CSM shall consult with MTE Substation Electrical Engineer on any construction issues or conflicts as they arise and report them during the weekly construction meeting. (Note: The CSM is not a Substation Construction Foreman. See Construction Site Foreman Section for details.)

It is required that the CSM have a minimum of fifteen (15) years experience with substation construction and a minimum of four (4) years experience with substation construction management. It is strongly recommended, but not required, that the CSM be an Engineer. The Contractor shall submit an experience resume for the proposed CSM for MTE approval during the bid process. MTE reserves the right to reject the Contractors proposed CSM for any reason.

CONSTRUCTION SITE FOREMAN

There shall be a separate Construction Site Foreman (aka “CSF”) for each major discipline of work that will be performed (i.e. earthwork, concrete placement, steel and bus erection, etc…) on site. Resumes of all proposed CSF shall be submitted and are subject to approval by MTE.

It is required that the same CSF remains with the substation construction project from start to finish for their portion of the project.

The CSF shall be a direct employee of the sub-Contractor or Contractor performing the work and shall be at the site anytime work is being performed for their portion of the project. The CSF shall be easily accessible and available at all times. This person shall also be at the regular weekly construction meetings and report their progress and any construction issues encountered. The CSF shall be aware of all construction tasks taking place for their portion of the work. The CSF shall report directly to the CSM. (Note: The Construction Site Foremen are not the Substation Construction Site Manager. See Construction Site Manager Section for details.)

It is required that the CSF has a minimum of four (4) years experience in their chosen discipline. The Contractor shall submit an experience resume for each proposed CSF for MTE approval during the bid process. MTE reserves the right to reject the Contractors proposed CSF for any reason.

SITE WORK

Clearing and grubbing limits shall include all areas disturbed by grading operations.

All structures inside the fence shall be located a minimum of 12’ from the fence.

The site is an existing substation, and therefore, the site design is already complete. However, the Contractor shall obtain a civil engineering firm to evaluate this site for the final design and layout for the addition. MTE is agreeable to the Contractor using the civil engineering firm that provided the original design. The final site design shall be a collaborative effort between the Contractor, Civil Engineering firm, Geotechnical Engineering firm, and MTE. The Contractor shall follow recommendations of the civil engineering firm and geotechnical engineering firm for the required site drainage, elevations, earthwork, and site design details. The Contractor shall adhere to all Federal, State, and Local codes and regulations in the design and construction of the site. All design and construction modifications that deviate from the original design shall be approved by MTE.

MTE has provided a geotechnical engineering report for this site but assumes no liability for the information contained therein. The Contractor shall obtain the services of a geotechnical engineer and shall confirm the correctness of the geotechnical engineering report provided by MTE for this site before construction begins. The Contractor shall follow the recommendations of the geotechnical engineer for the earthwork activities including, but not limited to: excavation, fill placement, fill compaction, and temporary and permanent slope excavations. All earthwork is to be monitored by a qualified geotechnical engineer provided by the Contractor. Copies of all reports are to be sent directly from the geotechnical engineer to MTE. See the Geotechnical Engineering section of this specification.

The Contractor shall coordinate the installation of all underground utilities. All underground utilities (storm sewer, electrical conduit, irrigation sleeves, ground grid, and any other miscellaneous items) shall be placed before the placement of base course of gravel. Any

ditches or trenches opened up for placement of underground utilities shall be placed back with proper compaction.

Property pins are marked. The Contractor will be responsible for locating and maintaining the baselines. The Contractor is also responsible for protection of all property corners and benchmarks. All property corners and benchmarks eliminated or damaged during construction shall be replaced by the Contractor. The Contractor is also responsible for silt fence removal.

Before placing engineered fill material, the Contractor is responsible for providing samples of the material to be used to the geotechnical engineering firm to ensure that it is suitable material. An approval report for this material is to be sent directly from the geotechnical engineer to MTE before proceeding. MTE must approve the site fill. MTE retains the right to reject the proposed site fill.

Any ditches dug, areas around foundations, or other disturbance to the substation pad shall be back filled and compacted a minimum of 95% compaction or greater if required by the Geotechnical engineer.

All areas inside the fence that are not part of the mobile drive are to have 6" of compacted crusher run gravel with 2" of clean rock chips (1/4”) top dressing. The gravel portion of the mobile drive is to have 1' of surge rock as a base, and then have 6" of compacted crusher run gravel with 2" of rock chips (1/4") top dressing. A detail drawing is shown on the site specifications drawing. The concrete area of the mobile drive is to have 10" of surge rock, 2" of compacted crusher run, and 8" of 4,000-pound concrete with 1.5 pounds of polypropylene fiber reinforcement per cubic yard. A detail drawing is shown on the site specifications drawing.

Below the gravel of the substation pad is a required 36” of dirt. There is 18” of dirt required above and below the ground grid. Under no circumstances shall these requirements not be met, including after the final grading of the site. If dirt removal is expected during final grading, then include this amount in addition to the requirements. If the geotechnical test shows rock in the 36” space, then the rock must be removed before the pad is built. **Include this 36” of dirt in your bid**.

GEOTECHNICAL ENGINEERING

The Contractor shall obtain a geotechnical engineering firm. The firm will need to be approved by MTE before submitting a proposal. The geotechnical firm shall provide the Contractor and MTE a report or confirm the report provided by MTE to aid the Contractor in the design and construction of the site and foundations. The Contractor is to follow the geotechnical engineer’s recommendations during construction of the substation.

Once stripping activities have been completed, and before fill placement, a representative of the geotechnical engineering firm should be present to observe proof-rolling activities and locate any unstable zones. Once unstable areas have been undercut to a stable sub grade, fill should be placed to attain construction grades. All lifts should be placed and compacted in accordance with the geotechnical report. A qualified technician from the geotechnical firm, on a full time basis, shall observe all shot rock fill placement. Each lift of soil fill should be tested

(density and moisture) for compliance with project specifications. Field reports detailing daily observations and field tests shall be prepared and submitted to MTE.

Concrete shall be sampled in accordance with ASTM C-172 and C-31. Each batch of concrete shall be tested. Each sample shall consist of at least 6- 6" X 12" cylindrical specimens to be tested in compression at the following interval: 7-day break - 1; 14-day break – 2, 28-day break - 2; spare - 1. Two samples should be from before pouring, two samples from mid-pour, and two samples from the end of pour. Any foundations or concrete work formed with a concrete batch that did not meet the minimum design requirements shall be removed and re-formed at the Contractor's expense.

Any footing excavations in question by MTE, Geotechnical Engineer, or Contractor should be observed by qualified field personnel from the geotechnical firm before concrete placement. All footing excavations for the 161 kV dead-end structure, the 25 kV pull off bays, static poles, and the transformer pads shall be observed by qualified field personnel from the geotechnical firm and reports filed with MTE.

OIL CONTAINMENT SYSTEM

The oil containment system for this substation will consist of a pit encompassing each transformer foundation. These pits shall be shall able to hold a minimum of 14,000 gallons of oil or water total after any rock fill has been placed. The new pit shall match existing pits at substation. The Contractor shall be responsible for the design of the pits and this design shall meet the EPA's requirements for a SPCC plan. The Contractor shall submit the plans for the oil containment as approval drawings and provide the appropriate SPCC plan.

ROCK & SITE

It is recommended that the Contractor procure the services of a Licensed Surveyor, Civil Engineer, and Geotechnical Engineer to evaluate the site and site conditions in preparing a proposal for the construction of the substation. MTE assumes no liability with initial site conditions submitted or design drawings provided for bidding purposes, as it is not our intent to provide such information. MTE's intent is to provide property lines, and MTE design guidelines only.

MTE expects rock to be encountered in this project. MTE will not accept any rock clause or site fill clause associated with this project. The Contractor is responsible for any rock removal and site fill needed. Site fill must be approved by Geotechnical Engineer and MTE before use. If site fill is rejected by Geotechnical Engineer or MTE, then Contractor must locate and provide an approved site fill at their expense.

Any damage resulting from rock removal activities will be the responsibility of the Contractor.

CONDUIT AND CABLING

MTE will design the conduit system for the substation. The Contractor will provide and install the conduit systems and junction boxes. The Contractor will provide and install the pull strings in the relaying and protection conduit.

The below grade duct system is to be schedule 40 PVC conduit with long hubs. See the conduit schedule for details. The above grade conduit and turn up elbows shall be schedule 80 PVC. The radius shall be 24” for turn up elbows and 36” elbows for turns in the ground. There should be no more than three sweeps per conduit run. Cable trench is acceptable, but shall be drive rated.

The Contractor shall furnish and install all junction boxes required by MTE. MTE has approved Hoffman, and Wiegman. The boxes are to have continuous swing hinges with a ¼ turn semi-flush oil-tight padlockable latch. NO SCREW LATCHING BOXES. Contractor shall submit proposed box for use and MTE must approve the boxes before purchase.

There will be one metering cabinet and one junction box furnished by TVA and installed by the Contractor. The Contractor will furnish and install conduit between these boxes and between the CT’s and PT’s. The Contractor will also pull the TVA furnished wires between the metering cabinet and the junction boxes and the CT’s and PT’s.

MTE will design and specify the cabling system. The Contractor will provide and install the field cables per the MTE cable schedule and field connection drawings. This includes the termination of the field cables in the appropriate equipment. Note, fiber optic cabling is included in this requirement. Since the cabling system for the protection scheme is not complete at this time, a "typical cable schedule design" has been provided in the RFP for bidding purposes. **Also, bid as an option, a discount if MTE provides the cabling and performs the installation.**

INSTRUMENT TRANSFORMERS

TVA will furnish and the Contractor will install a set of current transformers and a set of potential transformers. The Contractor will install all associated conduit, wiring, and junction boxes/metering cabinets as specified in the Conduit section. The TVA metering potential transformers shall be installed on the side of the TVA metering current transformers closest to the power transformer.

POWER TRANSFORMERS

MTE will provide one (1) power transformer. MTE will purchase a new 161/13 kV transformer for the Bank No. 2 transformer pad. Typically, MTE’s transformers weigh ~100 tons. The transformer foundations shall be adequately designed to handle 150 tons.

The Contractor will connect the transformer(s) to the substation bus and ground grid. MTE will supply NEMA 4 hole spades on the bushings of the transformers. See the Grounding Section for details about the grounding. The Contractor will connect the conduit to the transformers and pull the cables and terminate the control, fiber, and CT wiring.

CIRCUIT SWITCHER

The Contractor shall supply and install the circuit switchers as described in the attached specifications. The circuit switchers are numbered 924A and 924B. The Contractor is responsible for making the circuit switchers ready for testing and service. Damage resulting from improper installation or not making ready shall be the responsibility of the Contractor.

STATION GROUNDING

The buried ground grid shall be a minimum of 18" below the earth, 26" below final grade. The buried ground conductor shall be per design drawing. All below grade connections are to be made using DMC Power compression grounding connectors. MTE personnel will randomly test the DMC Power connections during installation.

All above grade conductor shall be per design drawing. The conductor is to be supported with bronze clamps at a maximum distance of every 8 feet when the conductor goes up a structure. The conductor is to be connected to the equipment and/or structures with a tin-plated bronze connector. The connectors are to be Burndy # YA-28 for one hole applications and Burndy #YA-28-2 for two hole applications.

Columns, stands, and towers must have a minimum of one ground grid connection. If the base exceeds 10 square feet, a minimum of two ground grid connections must be placed on diagonally opposite corners.

The neutral bushing of the power transformers shall be connected to the ground grid by a minimum of two separate grounding conductors that follow a different path from the bushing to the ground grid. All three grounding pads on the transformer shall be connected to the ground grid.

Circuit breakers, fault initiating switches, and circuit switchers shall have at least two connections placed on diagonally opposite corners. The bolted frame extensions shall be grounded.

The ground terminal of the lightning arresters shall have a single connection to a common ground bus having a minimum of two connections to the ground grid.

Cabinets and junction boxes shall have a minimum of one #2 AWG BCu connection to the ground grid.

CONCRETE / FOUNDATIONS

The foundations and the anchor bolts are to be designed such that the bottoms of the steel base plate sit on leveling nuts. The bottom of the base plate should be a consistent distance above the finished concrete and that distance should be about 2 inches. A grout cap will not be

required. The top of the concrete shall be poured such that water will not sit on top of the foundation. The concrete is to be smooth and consistent in appearance above grade.

All foundations shall have an ultimate strength of 4,000 PSI and consist of air-entrained concrete and reinforcing steel in accordance with ASTM A615-Grade 60. All foundations on top of concrete shall be at least 3 inches above grade and no more than 18 inches above grade. The foundations may be spread type footings and/or augured-type foundations. The distribution breakers shall be installed on slab foundations. The concrete is to be tested as indicated in the Geotechnical Engineering section.

In the concrete pouring, the following precautions should be noted:

1) No concrete should be poured if the atmospheric temperature is below 35 degrees Fahrenheit or over 90 degrees Fahrenheit without taking special heating or cooling precautions as recommended.

2) The concrete shall be allowed to cure a minimum of five days before the equipment base is installed and leveled. At this time, the leveling nuts shall be torqued no more than 10 pounds so that the anchor bolt bonding will remain undisturbed.

3) In the event of over-excavation of any footing, the void shall be filled with soil free of rocks and whose plasticity index is no greater than 20. The fill material shall be placed in 6 to 9 inch layers and each lift shall be compacted to 98% or better of the standard maximum density in accordance with ASTM-01618 (or AASHOT-99). The geotechnical engineering firm must test this and provide copies of the test reports to MTE. As an alternative, the voids may be filled with concrete.

4) Special moist-curing procedures should be used when necessary. The sealing of concrete shall be performed when necessary for proper curing.

5) Excessive spading and internal vibration of the concrete mixture should be avoided.

The Contractor is responsible for selecting the concrete supplier and if concrete is found to be bad at any time, the Contractor will be responsible to MTE for the bad concrete.

If a foundation is poured with the anchor bolt pattern incorrect, epoxy anchors may be used for correction. MTE should be contacted after the epoxy anchors are installed, then an independent licensed structural engineer will be hired by the Contractor to perform "pull tests" to determine that the anchors are fully bonded in the foundation. The Engineer's signed and sealed report will be required by MTE. Note: Epoxy anchors shall not be used on foundations that support tension bearing structures such as feeder bays or transmission line structures.

The Contractor is responsible for pouring one transformer foundation. See transformer pad design drawing for dimensions. Transformer foundations shall be designed and constructed to support a minimum transformer weight of 150 tons.

The following concrete compression strength requirements must be met before material installation and/or placement on foundations, slabs, or piers:

1) Equipment foundations shall be cured a minimum of 14 days and shall have a minimum concrete compression strength of 85% of the specified minimum 28 day strength.

2) Structure foundations shall be cured a minimum of 7 days and shall have a minimum concrete compression strength of 70% of the specified minimum 28 day strength. Before attaching wires, structure foundations shall be cured a minimum of 28 days and shall have a minimum concrete compression strength of 100% of the specified minimum 28 day strength.

STRUCTURES

Structural steel shall conform to all the latest ASTM standards. The structural steel shall be fabricated and erected in accordance with the latest recommendations of the AISC specifications for the design, fabrication, and erection of structural steel for buildings. Care is to be taken in shipping, on and off loading, storage, and erection not to damage the galvanizing or to not lay the steel directly on the ground. Any damage to the galvanizing shall be repaired as soon as possible. All steel structures on bolts are to be hot dipped galvanized. **Steel is to remain clean and free of dirt or mud. Contractor will be required to clean the steel if it is dirty.**

BUSWORK

The 13 kV bus shall be constructed from 4” and 5” IPS aluminum. See design drawing for details.

The transformer bus shall have a minimum 3,000 Amp capacity at 30 degrees Centigrade rise rating.

See design drawing for wire bus sizing for jumpers for both 161 kV and 13 kV bus.

Tube bus shall be provided with vibration-damping cable and end caps. The bus and bus support supplied shall have a short-time current capability of 40,000 Amps fault current. The bus and bus support system shall be designed such that the bus system suffers no mechanical or electrical damage at this fault current level. The bus level shall be designed to allow for expansion and contraction by providing for both slip and fixed supports. All switches shall have less than 120 pounds longitudinally, 40 pounds transversely, and 110 pounds vertical load at the terminal or as per the latest version of the ANSI standards.

The bottom of any insulator or surge arrester shall maintain a minimum height of 8’-6” from the top of the concrete foundation. The following minimum height clearances from the top of the concrete foundations or foot holds on steel structures such as base plates to the lowest live part of any bus or equipment shall be meet:

1) 13kV equipment shall maintain a minimum top of foundation clearance of 10’-0”.

2) 161kV equipment shall maintain a minimum top of foundation clearance of 14’-0”.

INSULATORS

The low side of the station shall be 13 kV, TR-227,150 kV BIL, gray, post type, porcelain. The only approved manufacturers of acceptable insulators are Locke, Lapp, or Newell.

SWITCH, BREAKER, AND PHASE DESIGNATIONS

Phase Markings (A, B, C) shall be installed to match the other banks. One (1) set will be required for the 13 kV bus. Phase markers are to be 4" X 4", porcelain-enameled: red with white letter "A", white with blue letter "B", blue with white letter "C". They are to have mounting holes in each corner.

Switch numbers, phasing tags, and holders may be obtained from Cherokee Porcelain Enamel Company, 2717 Independence Lane, Knoxville, TN 37914, 423-637-7833, fax 423-637-0019.

TESTING

A walk-through of the station will be conducted by MTE personal before energizing the station. This will include torque testing of at least 20 randomly selected bolted bus connections. If any fail the test, the Contractor will be required to go back and re-torque all of the bolted bus connections in the station. MTE will then repeat the tests. Some structural bolted connections will also be checked.

The testing of all relays, circuit breakers, circuit switchers, transformers switchboards, metering and control wiring terminals will be done by MTE or other Contractors. The substation Contractor will not be responsible for this type of testing, however, will be responsible for correcting any Contractor errors found during testing.

CLEAN UP

The Contractor will be responsible for disposing of all rubbish resulting from the construction of this substation. The Contractor will be responsible for any damage done to adjacent property during this construction project.

All completed steel and buswork should be free of dirt, mud, and debris.

GUARANTEE AND WARRANTY

Contractor shall warranty their work against all defects in material and workmanship for a period of two years after station is put in service or 2.5 years after the project is completed by the Contractor, whichever expires first.

After the station has been in service for 90 days, MTE will contact the equipment manufacturer if the problem is with a device that carries a warranty independent of the Contractor's warranty. If MTE and the manufacturer cannot resolve the problem, then MTE will request assistance from the Contractor for the period of the Contractor's warranty.

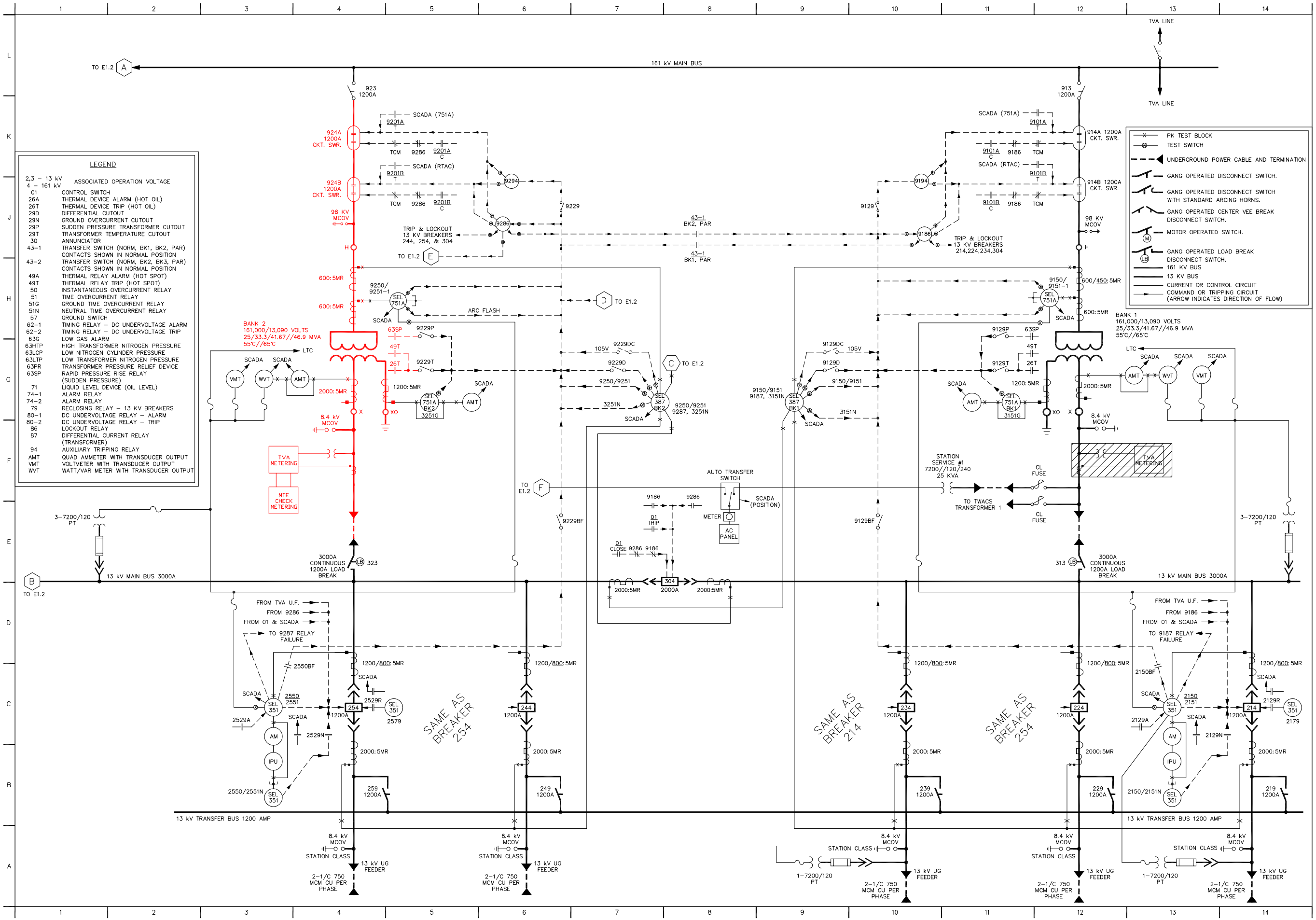
Written application for final payment of the 10% withholding may be made 60 days after the energization of the substation and MTE's receipt of final drawings.

PROJECT COORDINATION

The Contractor **MUST** provide MTE with site elevations, substation baselines, dead-end detail drawings and location by ASAP. The transformer is scheduled to be delivered 3/26/2025.

SITE FACILITIES

Contractor shall provide a mobile office on the site upon work beginning. Mobile office shall be climate controlled, provide adequate meeting space, and provide phone and fax machine access, and adequate seating. Contractor shall connect all required service connections to mobile office, maintain the mobile office, and follow all requirements for bracing. Contractor shall provide and maintain restroom facilities on the site during the construction process.



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VETERANS PARKWAY 161/13kV SUBSTATION

MURFRESSBORO TENNESSEE
MURFREESBORO ELECTRIC DEPARTMENT
MURFREESBORO, TENNESSEE

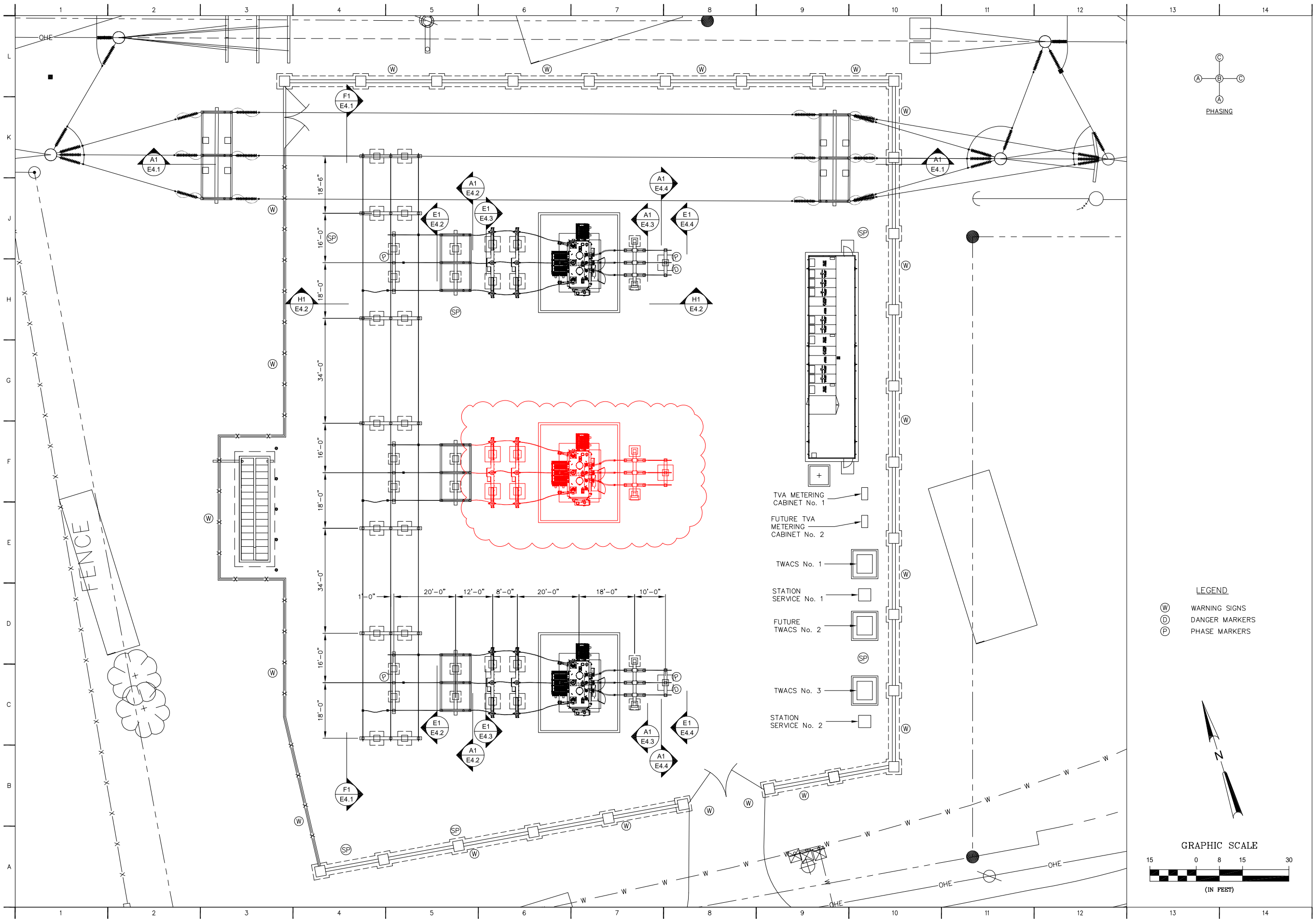
No.	Revision	Date

SINGLE LINE DIAGRAM

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E1.1 R1

RECORD DRAWINGS 1/30/19

E1.1 R1
BID DOCUMENTS



PHASING

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MURFREESBORO
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DEPARTMENT
MURFREESBORO, TENNESSEE

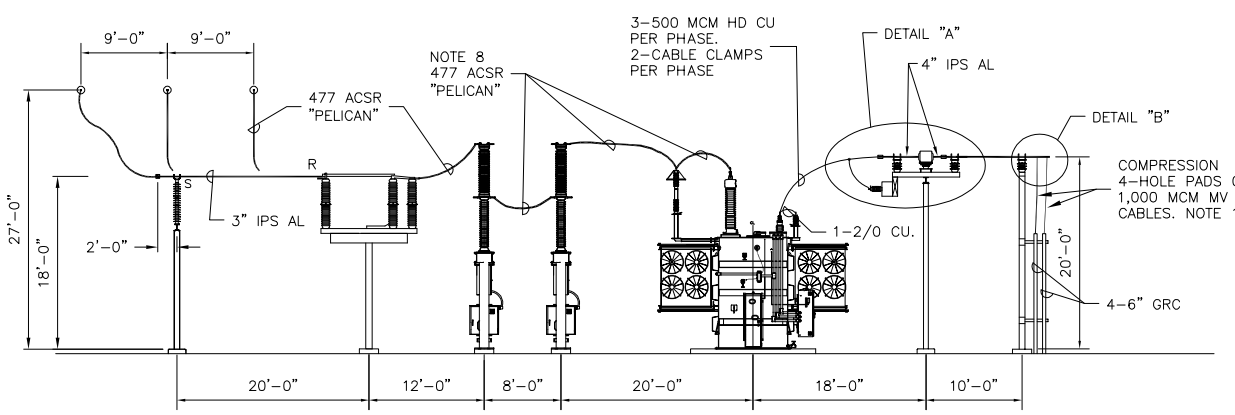
No.	Revision	Date

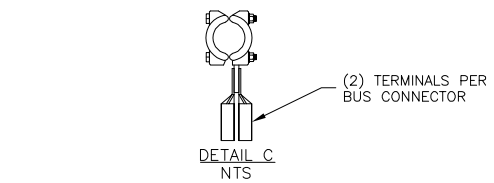
PLAN
VIEW

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E3.1 R1

RECORD
DRAWINGS
1/30/19

E3.1 R1
BID
DOCUMENTS





DETAIL C
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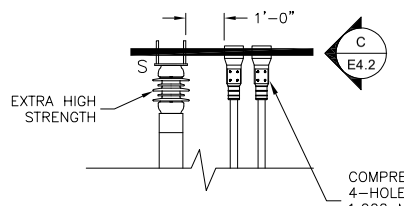
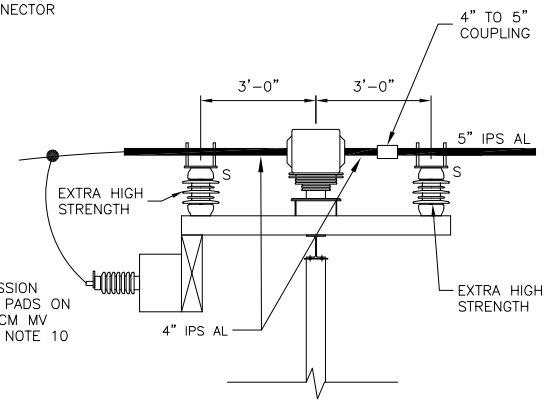


DETAIL B
5 SCALE
WHEN PRINTED ON 11X17



DETAIL A
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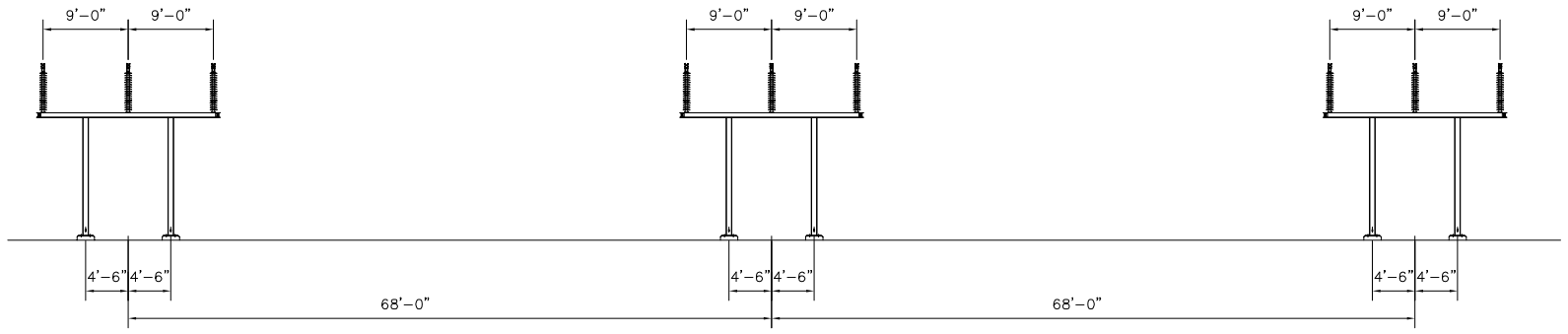
WHEN PRINTED ON 11X17

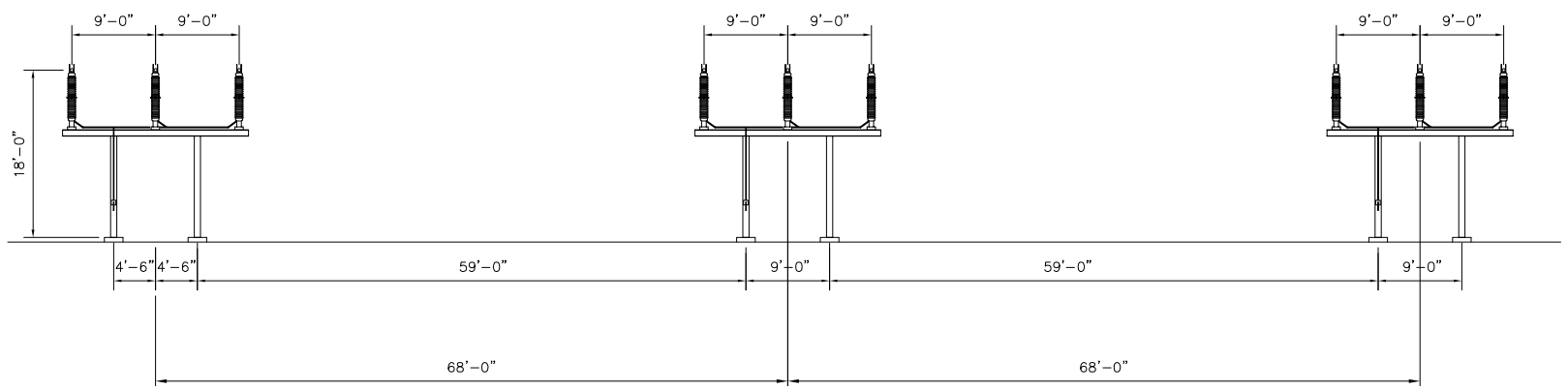
NOTES: (REFER TO SPECIFIC NOTE ID)

1. BUS SUPPORT INSULATORS:
   161 kV TR-291, 750 kV BIL
   13 kV TR-227, 150 kV BIL
   EXCEPT AS SHOWN ON DRAWINGS
2. METERING TEST BOXES, AND METER CABINET BY TVA AND INSTALLED UNDER THIS CONTRACT.
3. 161 kV TRANSMISSION LINE CONDUCTOR, SWITCH AND STRUCTURE FOUNDATION PROVIDED BY TVA. JUMPERS AND CONNECTORS TO BE PROVIDED UNDER THIS CONTRACT.
4. ALL 477 ACSR, "PELICAN".
5. SEE VENDOR DRAWING FOR DIMENSION.
6. PIPE BUS DAMPING CABLE:
   3" - 477 ACSR
   5" - 477 ACSR
7. ALL ACSR/AAC CONNECTORS SHALL BE COMPRESSION TO 4-HOLE PAD.
8. JUMPER LENGTH EQUAL TO STRAIGHT LINE DISTANCE PLUS 8 INCHES.
9. MACLEAN PART NO. G3MA024813ADB
10. SOUTHEASTERN MANUFACTURING INC. TERMINALS.

H1	ELEVATION
SCALE BAR	E3.1



E1	ELEVATION
SCALE BAR	E3.1



A1	ELEVATION
SCALE BAR	E3.1

LEGEND
S - SLIDE BUS CONNECTOR
R - RIGID BUS CONNECTOR
E - EXPANSION BUS CONNECTOR

GRAPHIC SCALE
10 0 5 10 20
(IN FEET)

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DATE	REVISION	BY
11/12/24	REMOVED TWACS FROM ORIGINAL DRAWINGS	A.PERREE

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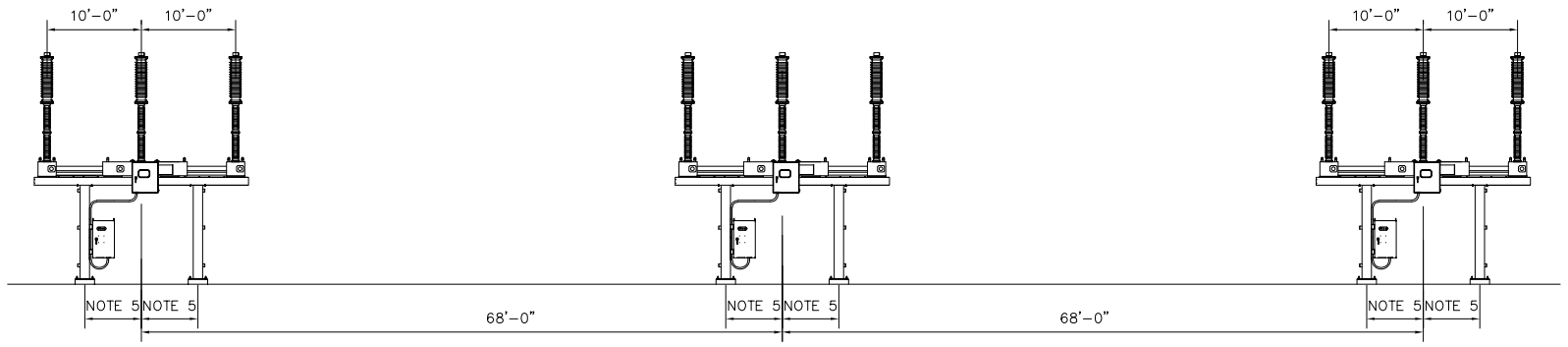
No.	Revision	Date

BANK 3
ELEVATIONS

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E4.2 R1

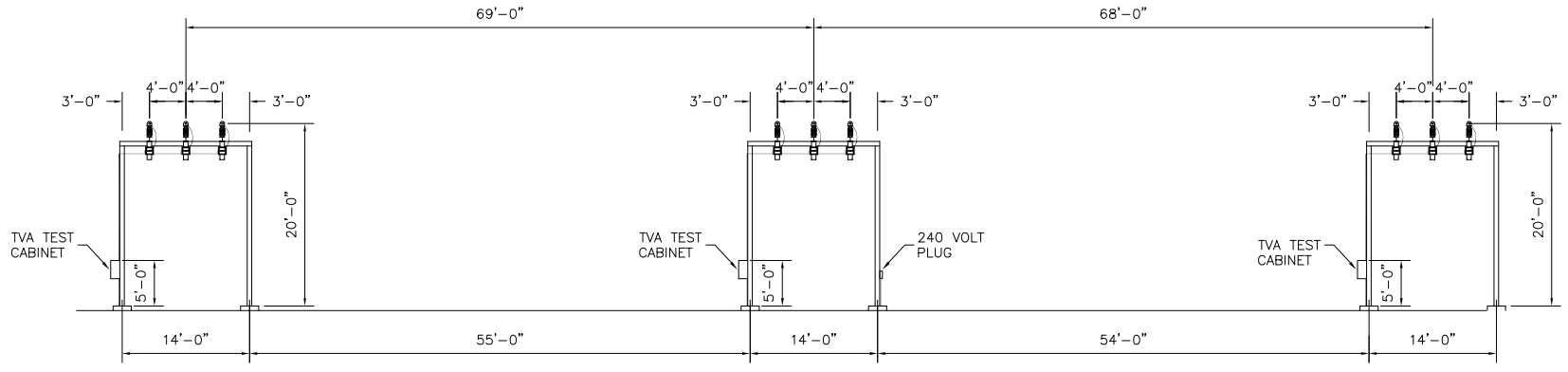
RECORD
DRAWINGS
1/30/19

E4.2 R1
BID
DOCUMENTS



E1 ELEVATION

SCALEBAR E3.1



A1 ELEVATION

SCALEBAR E3.1

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LEGEND
S – SLIDE BUS CONNECTOR
R – RIGID BUS CONNECTOR
E – EXPANSION BUS CONNECTOR

GRAPHIC SCALE
5 0 2.5 5 10
(IN FEET)

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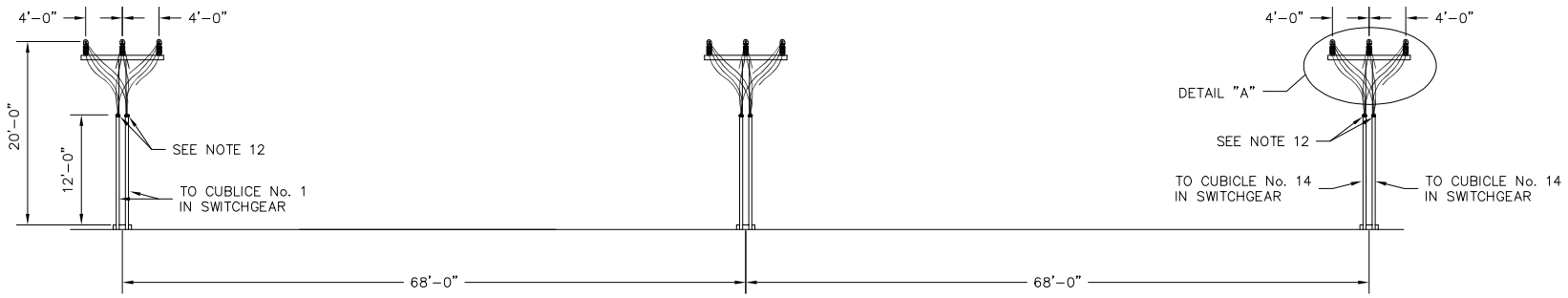
No.	Revision	Date

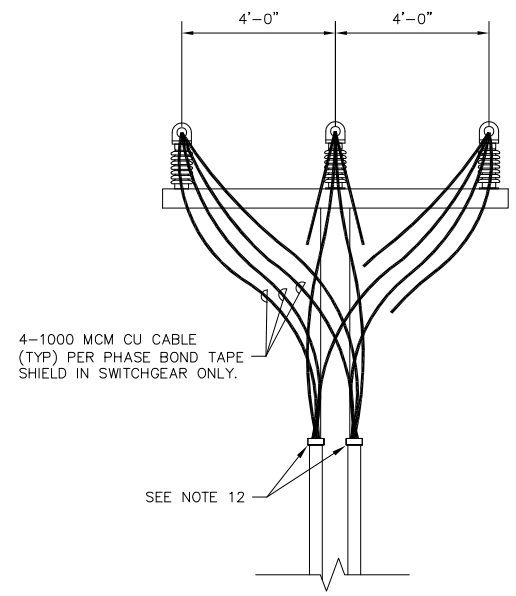
ELEVATIONS

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E4.3

RECORD DRAWINGS 1/30/19

E4.3
BID DOCUMENTS





DETAIL "A"
5 SCALE
WHEN PRINTED ON 11X17

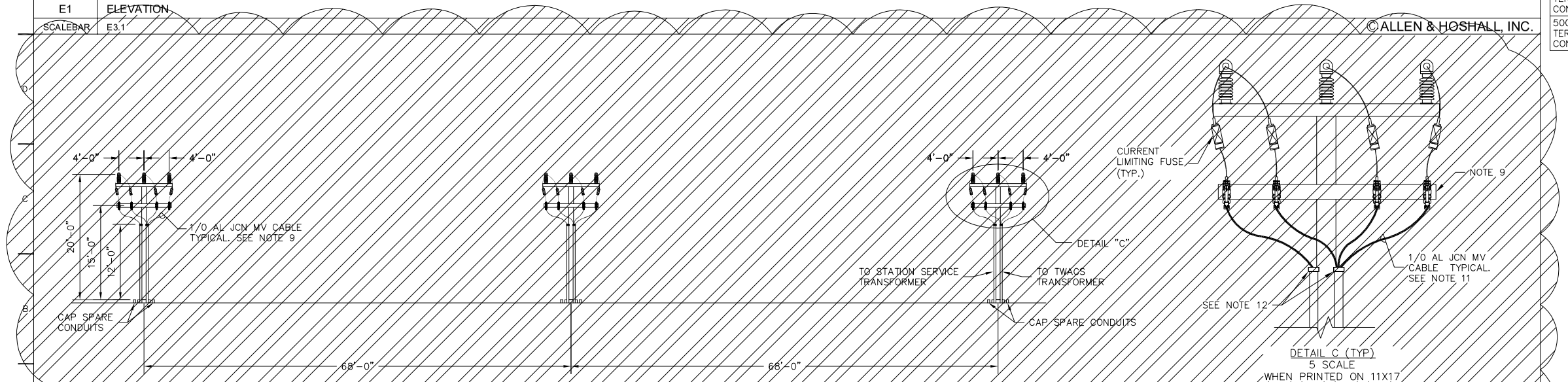
NOTES: (REFER TO SPECIFIC NOTE ID)

1. BUS SUPPORT INSULATORS:
   161 kV TR-291, 750 kV BIL
   13 kV TR-227, 150 kV BIL
   EXCEPT AS SHOWN ON DRAWINGS
2. METERING TEST BOXES, AND METER CABINET BY TVA AND INSTALLED UNDER THIS CONTRACT.
3. 161 kV TRANSMISSION LINE CONDUCTOR, SWITCH AND STRUCTURE FOUNDATION PROVIDED BY TVA. JUMPERS AND CONNECTORS TO BE PROVIDED UNDER THIS CONTRACT.
4. ALL 477 ACSR, "PELICAN".
5. SEE VENDOR DRAWING FOR DIMENSION.
6. PIPE BUS DAMPING CABLE:
   3" - 477 ACSR
   5" - 477 ACSR
7. ALL ACSR/AAC CONNECTORS SHALL BE COMPRESSION TO 4-HOLE PAD.
8. JUMPER LENGTH EQUAL TO STRAIGHT LINE DISTANCE PLUS 8 INCHES.
9. MACLEAN PART NO. G3MA024813ADB
10. SOUTHEASTERN MANUFACTURING INC. TERMINALS.
11. TWACS AND STATION SERVICE TRANSFORMER MATERIAL INSTALLATION RESPONSIBILITY.
12. CONDUIT SEALING BUSHING SHALL BE PLM TYPE CU.

MATERIAL	SUPPLY	INSTALL
CONDUITS	C	C
CUTOUTS & BRACKETS MACLEAN PART NO. G3MA024813ADB	C	C
CURRENT LIMITING FUSE	C	C
1/0 AL UG CABLE TERMINATION & ELBOWS	M	C
TWACS SIGNAL CABLE	M	M
1,000 MCM CU CABLE TERMINATION & CONNECTIONS	C	C
500 MCM CU CABLE TERMINATION & CONNECTIONS	C	C

C = CONTRACTOR
M = MED

E1 ELEVATION
SCALEBAR E3.1



DETAIL C (TYP)
5 SCALE
WHEN PRINTED ON 11X17

LEGEND
S - SLIDE BUS CONNECTOR
R - RIGID BUS CONNECTOR
E - EXPANSION BUS CONNECTOR

GRAPHIC SCALE
10 0 5 10 20
(IN FEET)

A1 ELEVATION
SCALEBAR E3.1

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11/12/24	REMOVED TWACS FROM ORIGINAL DRAWINGS	A.PERREE
DATE	REVISION	BY

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No.	Revision	Date

BANK 3
ELEVATIONS

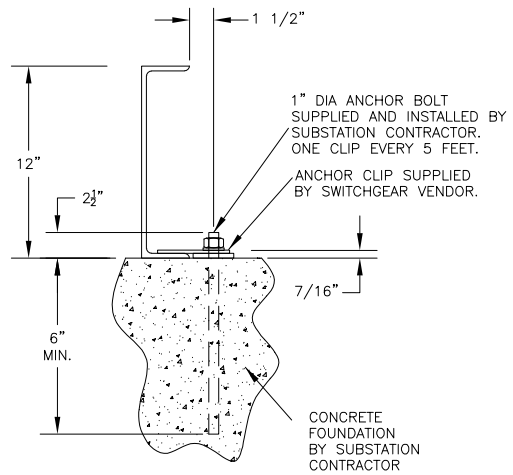
JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E4.4 R1

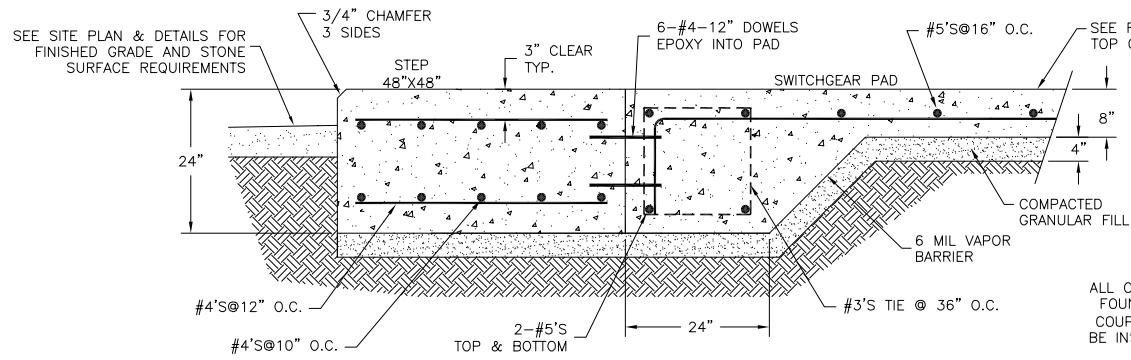
RECORD
DRAWINGS
1/30/19

E4.4 R1
BID
DOCUMENTS

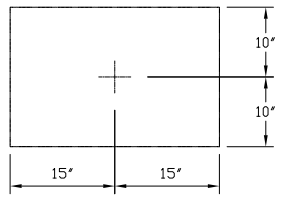
ANCHOR BOLT–EPOXY	
DIAMETER	1"
PROJECTION	2½"
EMBEDDED	6"

HILTI RE500 EPOXY SYSTEM

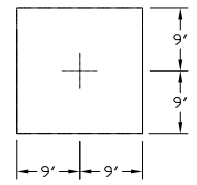




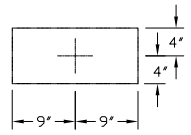
DETAIL "A–A"



DETAIL "A"
SWITCHGEAR DUCT ENTRANCE WINDOWS

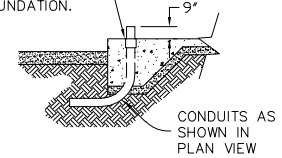


DETAIL "B"
SWITCHGEAR DUCT ENTRANCE WINDOWS



DETAIL "C"
SWITCHGEAR DUCT ENTRANCE WINDOWS

ALL CONDUITS TO BE FLUSH WITH FOUNDATION. TOP SHOULD BE A COUPLING SO 9" EXTENSION CAN BE INSTALLED AFTER SWITCHGEAR IS ON FOUNDATION.



NOTES:

1) SEE APPROPRIATE DRAWINGS FOR HANDHOLE DETAILS.

2) CENTER ALL DUCT BANKS IN THE RESPECTIVE SWITCHGEAR FLOOR OPENING.

3) SPACE CONDUITS SO ALL CABLES COME STRAIGHT OUT OF THE CONDUIT INTO THE SWITCHGEAR.

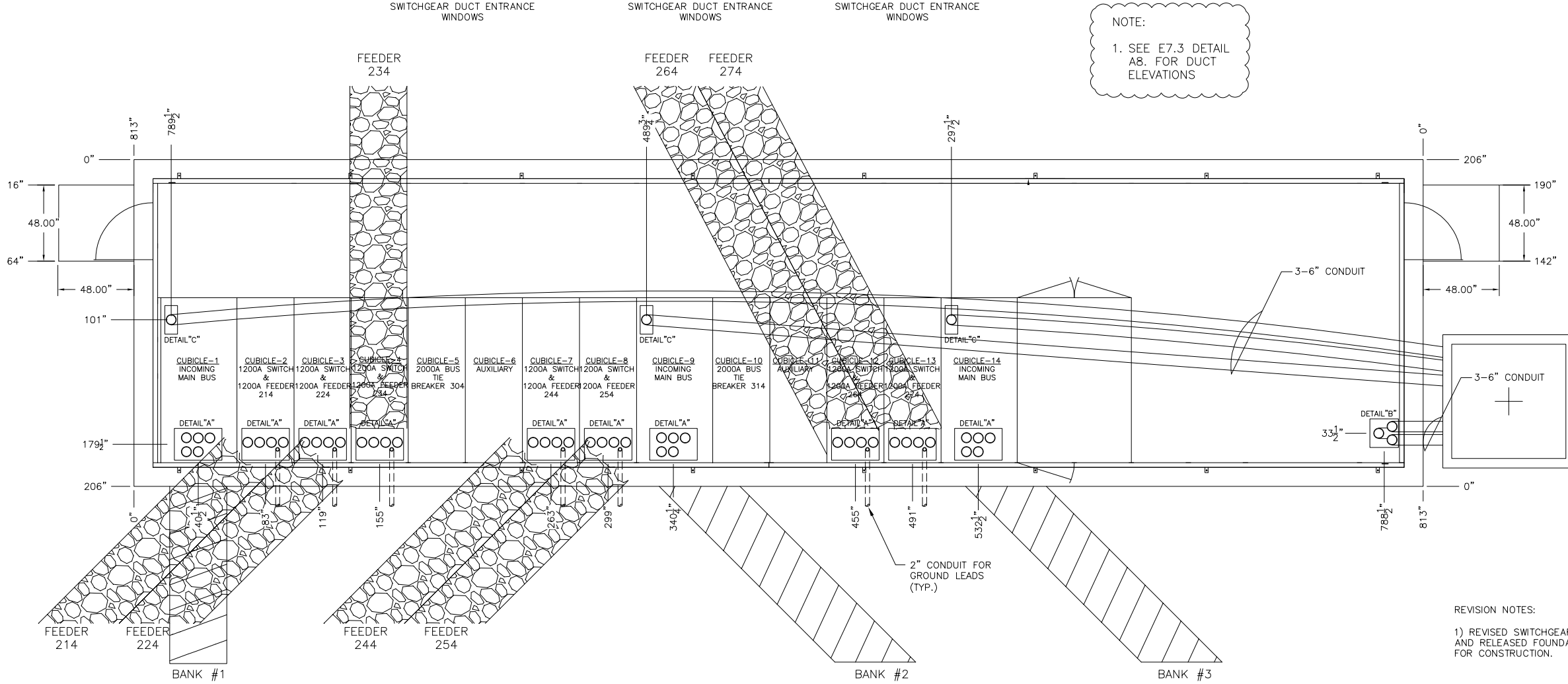
4) SUPPORT CONDUITS SO THEY REMAIN PLUMB.

5) SEE CONDUIT AND CABLE PLAN / SCHEDULE FOR MORE INFORMATION.

6) DUCTS SHALL BE PLACED TO FIT WITHIN SWITCHGEAR DUCT ENTRANCE WINDOW.

7) CONCRETE TO BE POURED AROUND CONDUITS – NOT BOXED OUT.

NOTE:
1. SEE E7.3 DETAIL A8. FOR DUCT ELEVATIONS



REVISION NOTES:

1) REVISED SWITCHGEAR FOUNDATION SIZE. AND RELEASED FOUNDATION P1 AND P2 FOR CONSTRUCTION.

A1	PAD, P2 SWITCHGEAR FOUNDATION PAD		
NO SCALE		03300-60 R091010	© ALLEN & HOSHALL, INC.

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No.	Revision	Date
1.	SEE REVISION NOTE 1	12/21/15

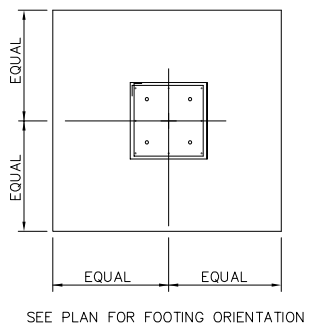
FOUNDATION DETAILS

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: S1.5

RECORD DRAWINGS 1/30/19

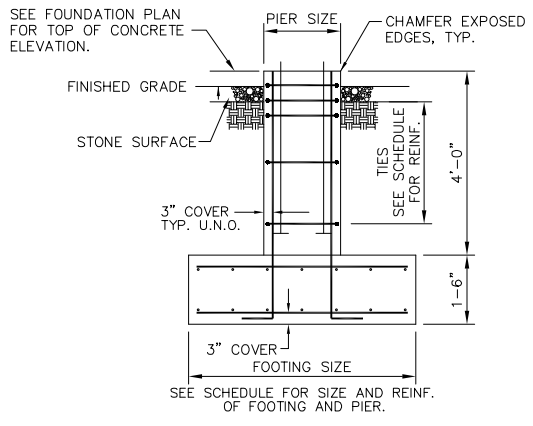
S1.5
BID DOCUMENTS

SPREAD FOOTER SCHEDULE						
MARK	FOOTING SIZE	FOOTING REINFORCEMENT	PIER SIZE	PIER REINFORCEMENT	ANCHOR ROD PLAN	VENDOR
SF1	3'-6" x 3'-6" x 18"	(4)#6 EACH WAY TOP AND BOTTOM	24" x 24"	(8)#6 W/ #3 TIES @ 6" O.C.	SEE VENDOR DWG.	
SF2	4'-6" x 4'-6" x 18"	(5)#6 EACH WAY TOP AND BOTTOM	24" x 24"	(8)#6 W/ #3 TIES @ 6" O.C.	SEE VENDOR DWG.	
SF3	5'-0" x 5-0" x 18"	(5)#6 EACH WAY TOP AND BOTTOM	32" x 32"	(12)#6 W/ #3 TIES @ 6" O.C.	SEE VENDOR DWG.	
SF4	NOT USED					
SF5	NOT USED					
SF6	5'-0" x 5-0" x 24"	(6)#6 EACH WAY TOP AND BOTTOM	24" x 24"	(8)#6 W/ #3 TIES @ 6" O.C.	SEE VENDOR DWG.	



SEE PLAN FOR FOOTING ORIENTATION

PLAN

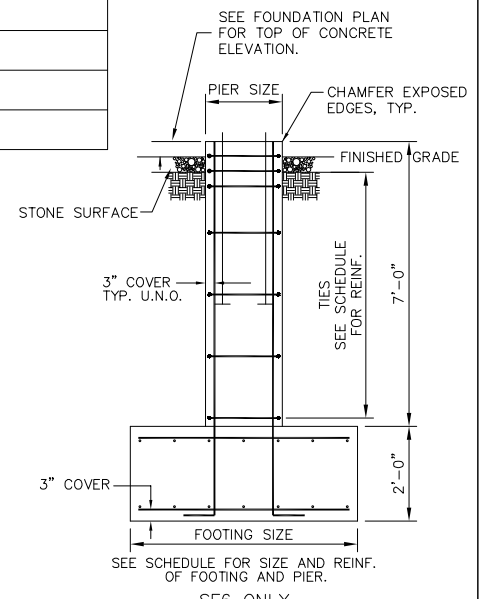


SEE SCHEDULE FOR SIZE AND REINF. OF FOOTING AND PIER.

ELEVATION

NOTES:

1. SEE STEEL VENDOR DRAWINGS FOR BASE PLATE AND ANCHOR ROD LAYOUT.



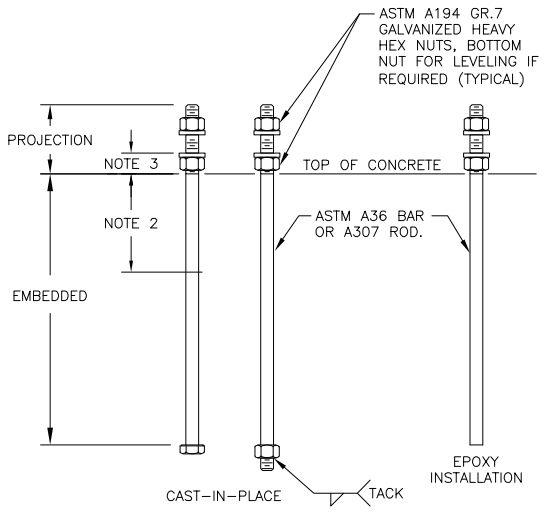
SEE SCHEDULE FOR SIZE AND REINF. OF FOOTING AND PIER.

SF6 ONLY

A1	SPREAD FOOTER & PIER DETAIL		
NO SCALE		03300-20 R121510	© ALLEN & HOSHALL, INC.

NOTES:

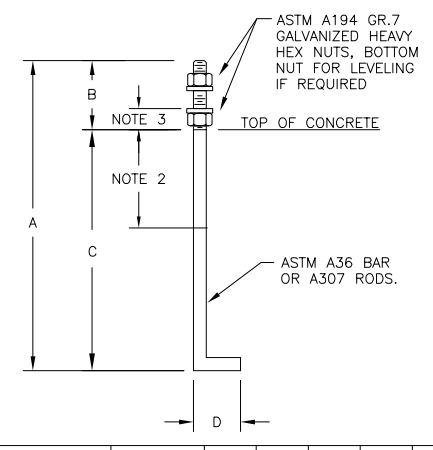
1. ANCHOR ROD SHALL BE THREADED THE FULL LENGTH OF THE PROJECTION.
2. HOT DIPPED GALVANIZED TO MINIMUM OF 4" BELOW CONCRETE SURFACE.
3. MAXIMUM OF 2X ANCHOR ROD DIAMETER.



A9	ANCHOR ROD		
NO SCALE		03300-01 R012012	© ALLEN & HOSHALL, INC.

NOTES:

1. ANCHOR ROD SHALL BE THREADED THE FULL LENGTH OF THE PROJECTION
2. HOT DIPPED GALVANIZED TO MINIMUM OF 4" BELOW CONCRETE SURFACE.
3. MAXIMUM OF 2X ANCHOR ROD DIAMETER
4. SEE FOUNDATION DETAIL FOR ROD PATTERN.



MANUFACTURER	MODEL	A	B	C	D	DIA.
SIEMENS		30"	4"	26"	4"	1"
SOUTHERN STATES	CSV	33"	5¼"	27¾"	3"	1"
SOUTHERN STATES	CSH	44"	4"	40"	4"	1¼"

A12	161 kV CIRCUIT SWITCHER ANCHOR ROD		
NO SCALE		03300-02 R121510	© ALLEN & HOSHALL, INC.

REVISION NOTES:

1) RELEASED SPREAD FOOTERS FOR CONSTRUCTION.

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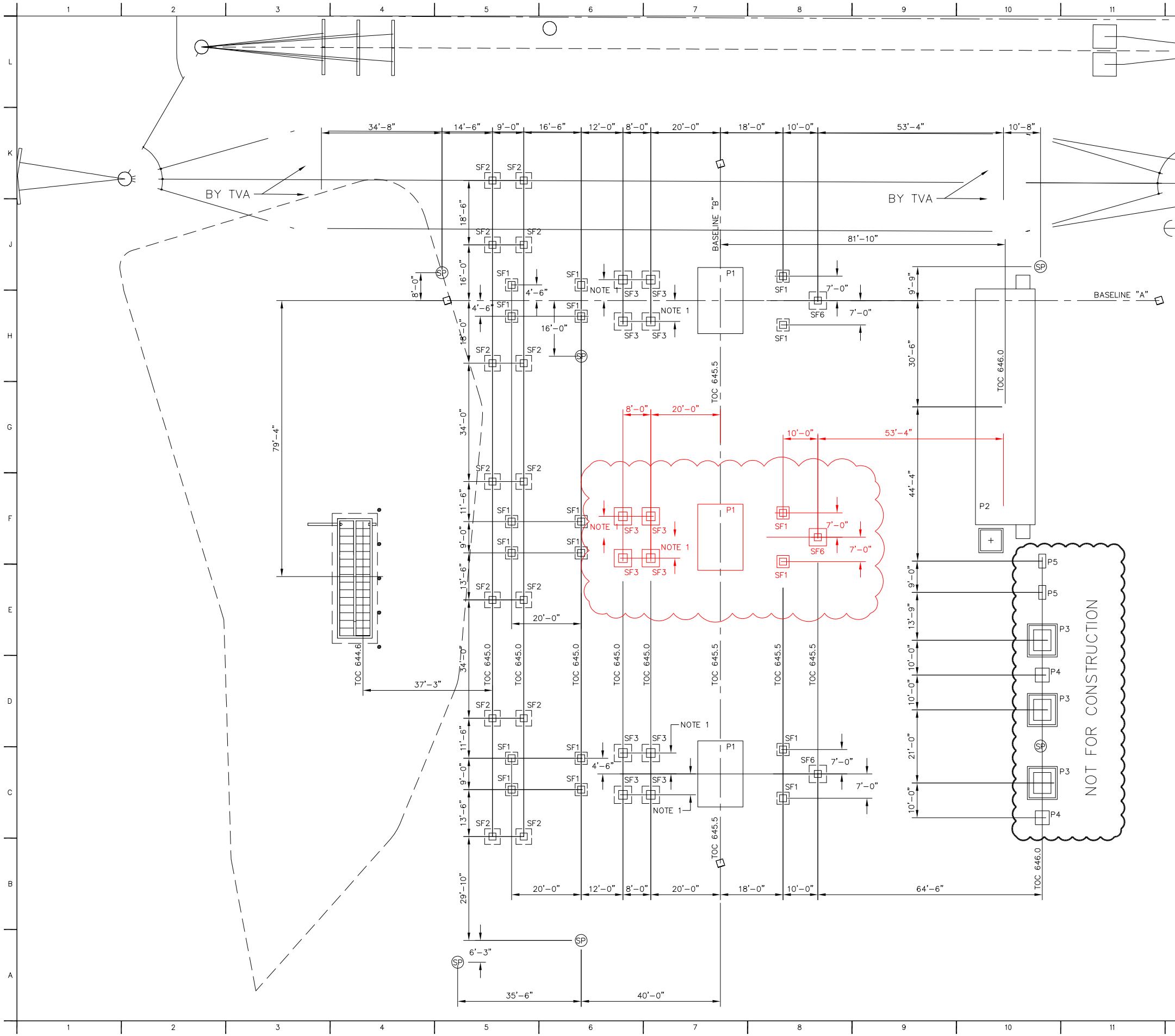
No.	Revision	Date
1.	SEE REVISION NOTE 1	1-21-16

FOUNDATION
DETAILS

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: S1.2

RECORD
DRAWINGS
1/30/19

S1.2
BID
DOCUMENTS



NOTES:

1. SEE VENDOR DRAWING FOR DIMENSION.

REVISION NOTES:

1) REVISED SWITCHGEAR FOUNDATION SIZE AND OIL CONTAINMENT AND RELEASED FOUNDATION P1, P2, AND OIL CONTAINMENT TANK FOR CONSTRUCTION.

2) RELEASED SPREAD FOOTERS FOR CONSTRUCTION.

GRAPHIC SCALE

15 0 8 15 30

(IN FEET)

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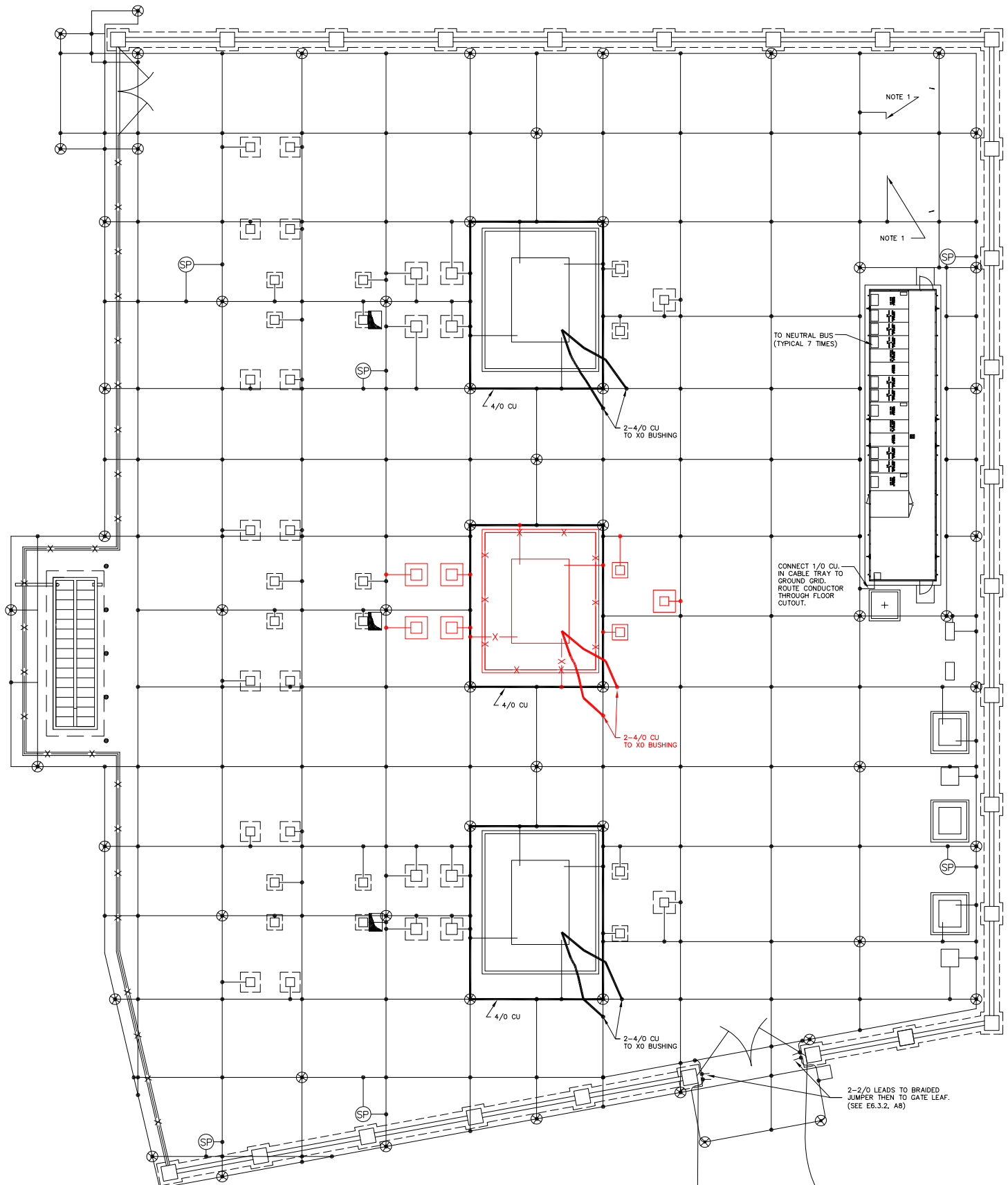
No.	Revision	Date
2.	SEE REVISION NOTE 2	1-21-16
1.	SEE REVISON NOTE 1	12/21/15

FOUNDATION PLAN

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: S1.1

RECORD DRAWINGS 1/30/19

S1.1
BID
DOCUMENTS



LEGEND

- GROUND GRID
- 3/4" X 10'-0" GROUND ROD
- 3'-0" x 4'-0" GROUND MAT
- STATIC POLE
- LOOP OUTSIDE FENCE

1/0 Cu. GROUND GRID LOOP OUTSIDE FENCE

2/0 Cu. GROUND GRID

2/0 Cu. GRID TO STRUCTURES

2/0 Cu. SWITCH OPERATOR MATS

2/0 Cu. GRID TO EQUIPMENT

2/0 Cu. GRID TO OHSW STRUCTURES

2/0 Cu. GRID TO SURGE ARRESTERS

2/0 Cu. GRID TO POWER TRANSFORMER TANK

2/0 Cu. GRID TO NEUTRAL BUS

2-4/0 Cu. GRID TO POWER TRANSFORMER XO BUSHING.

4/0 Cu. GRID AROUND POWER TRANSFORMER

NOTES:

1.) PROVIDE BURNDY YGHA-262N CONNECTOR FOR TVA SWITCH STRUCTURE.

GRAPHIC SCALE

15 0 8 15 30

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No.	Revision	Date

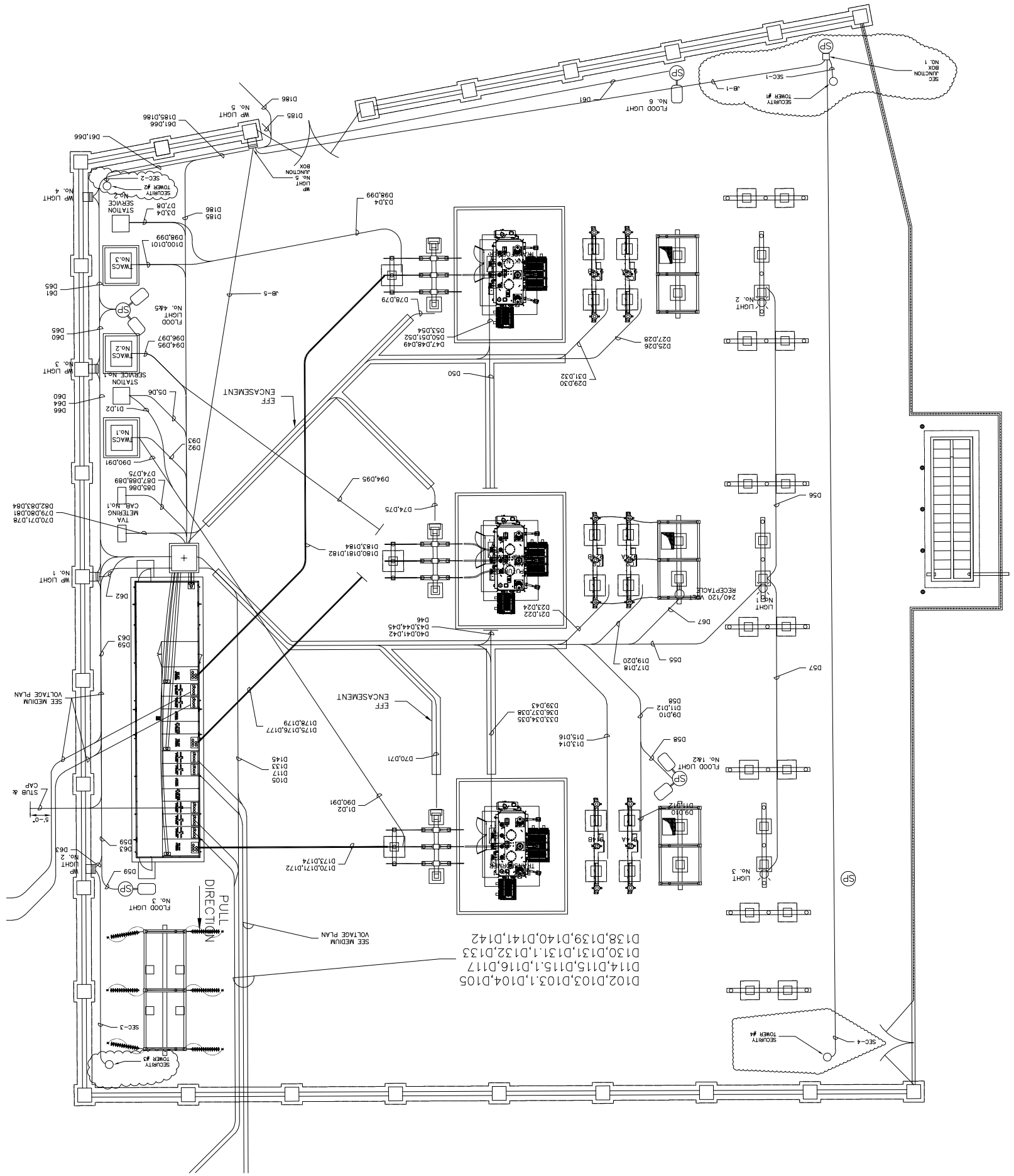
GROUNDING PLAN

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E6.1 R1

RECORD DRAWINGS 1/30/19

E6.1 R1
BID DOCUMENTS

*CONDUIT FOR SECURITY TOWERS BURIED 4" BELOW SUBSTATION GRADE



*BASE DRAWING BY A&H

DATE	REVISION	BY
–	–	–

MTEMC

VETERANS SUBSTATION
CONDUIT DIAGRAM

SCALE: NTS	APPROVED	DATE
PREPARED BY: AKP	DRAWING NO. VET–070	JUNE 17, 2021
DRAWN BY: A FRASER		SHEET 2
CHECKED BY:		OF 2 SHEETS

CONDUIT MARK	CABLE MARK	CIRCUIT VOLTAGE	FROM	TO	REMARKS	CABLE OR WIRE			CONDUIT SIZE
						CONDUCTOR	SIZE	TYPE	
D1	SS2	7.2 kV	BANK 1 RISER STR.	STATION SERVICE No. 1	NOTE 4	1–1/C	1/0	MV	3"
D2	SPARE				SPARE CONDUIT				3"
D3	SS3	7.2 kV	BANK 3 RISER STR.	STATION SERVICE No. 2	NOTE 4	1–1/C	1/0	MV	3"
D4	SPARE				SPARE CONDUIT				3"
D5	SS4	240 AC	STATION SERVICE XFMR No. 1	ATS		3–1/C	3/0	RHW	2"
D6	SPARE				SPARE CONDUIT				2"
D7	SS5	240 AC	STATION SERVICE XFMR No. 2	ATS		3–1/C	3/0	RHW	2"
D8	SPARE				SPARE CONDUIT				2"
CIRCUIT SWITCHER 914A									
D9	AC914A.1	240 AC	AC PANEL	CIRCUIT SWITCHER 914A	30 AMP	1–4/C	10	TC	2"
D10	CC914A.1		CUBICLE No. 1	CIRCUIT SWITCHER 914A	CONTROL	1–7/C	10	TC	2"
	CC914A.2		CUBICLE No. 1	CIRCUIT SWITCHER 914A	CONTROL	1–7/C	10	TC	
	CC914A.3		CUBICLE No. 1	CIRCUIT SWITCHER 914A	CONTROL	1–7/C	10	TC	
D11	DC914A.1	125 DC	DC PANEL	CIRCUIT SWITCHER 914A	30 AMP	1–2/C	10	TC	2"
D12	SPARE		HANDHOLE No. 1	CIRCUIT SWITCHER 914A	SPARE CONDUIT				2"
CIRCUIT SWITCHER 914B									
D13	AC914B.1	240 AC	AC PANEL	CIRCUIT SWITCHER 914B	30 AMP	1–4/C	10	TC	2"
D14	CC914B.1		CUBICLE No. 1	CIRCUIT SWITCHER 914B	CONTROL	1–7/C	10	TC	2"
	CC914B.2		CUBICLE No. 1	CIRCUIT SWITCHER 914B	CONTROL	1–7/C	10	TC	
	CC914B.3		CUBICLE No. 1	CIRCUIT SWITCHER 914B	CONTROL	1–7/C	10	TC	
D15	DC914B.1	125 DC	DC PANEL	CIRCUIT SWITCHER 914B	30 AMP	1–2/C	10	TC	2"
D16	SPARE		HANDHOLE No. 1	CIRCUIT SWITCHER 914B	SPARE CONDUIT				2"
CIRCUIT SWITCHER 924A									
D17	AC924A.1	240 AC	AC PANEL	CIRCUIT SWITCHER 924A		1–4/C	10	TC	2"
D18	CC924A.1	125 DC	CUBICLE No. 9	CIRCUIT SWITCHER 924A		1–9/C	10	TC	2"
	CC924A.2	125 DC	CUBICLE No. 9	CIRCUIT SWITCHER 924A		1–9/C	10	TC	
	CC924A.3	125 DC	CUBICLE No. 9	CIRCUIT SWITCHER 924A		1–9/C	10	TC	
D19	DC924A.1	125 DC	DC PANEL	CIRCUIT SWITCHER 924A		1–5/C	10	TC	2"
D20	SPARE		HANDHOLE No. 1	CIRCUIT SWITCHER 924A	SPARE CONDUIT				2"
CIRCUIT SWITCHER 924B									
D21	AC924B.1	240 AC	AC PANEL	CIRCUIT SWITCHER 924B		1–4/C	10	TC	2"
D22	CC924B.1	125 DC	CUBICLE No. 9	CIRCUIT SWITCHER 924B		1–9/C	10	TC	2"
	CC924B.2	125 DC	CUBICLE No. 9	CIRCUIT SWITCHER 924B		1–9/C	10	TC	
	CC924B.3	125 DC	CUBICLE No. 9	CIRCUIT SWITCHER 924B		1–9/C	10	TC	
D23	DC924B.1	125 DC	DC PANEL	CIRCUIT SWITCHER 924B		1–5/C	10	TC	2"
D24	SPARE		HANDHOLE No. 1	CIRCUIT SWITCHER 924B	SPARE CONDUIT				2"
CIRCUIT SWITCHER 934A									
D25	AC934A.1	240 AC	AC PANEL	CIRCUIT SWITCHER 934A	30 AMP	1–4/C	10	TC	2"
D26	CC934A.1		CUBICLE No. 14	CIRCUIT SWITCHER 934A	CONTROL	1–7/C	10	TC	2"
	CC934A.2	2	CUBICLE No. 14	CIRCUIT SWITCHER 934A	CONTROL	1–7/C	10	TC	
	CC934A.3		CUBICLE No. 14	CIRCUIT SWITCHER 934A	CONTROL	1–7/C	10	TC	
D27	DC934A.1	125 DC	DC PANEL	CIRCUIT SWITCHER 934A	30 AMP	1–2/C	10	TC	2"
D28	SPARE		HANDHOLE No. 1	CIRCUIT SWITCHER 934A	SPARE CONDUIT				2"
CIRCUIT SWITCHER 934B									
D29	AC934B.1	240 AC	AC PANEL	CIRCUIT SWITCHER 934B	30 AMP	1–4/C	10	TC	2"
D30	CC934B.1		CUBICLE No. 14	CIRCUIT SWITCHER 934B	CONTROL	1–7/C	10	TC	2"
	CC934B.2	2	CUBICLE No. 14	CIRCUIT SWITCHER 934B	CONTROL	1–7/C	10	TC	
	CC934B.3		CUBICLE No. 14	CIRCUIT SWITCHER 934B	CONTROL	1–7/C	10	TC	
D31	DC934B.1	125 DC	DC PANEL	CIRCUIT SWITCHER 934B	30 AMP	1–2/C	10	TC	2"
D32	SPARE		HANDHOLE No. 1	CIRCUIT SWITCHER 934B	SPARE CONDUIT				2"
TRANSFORMER BANK No. 1									
D33	ACTB1.1	240 AC	AC PANEL	TRANSFORMER BANK No. 1	60 AMP	4–1/C	No. 6	RHW	2"
D34	DCTB1.1	125 DC	DC PANEL	TRANSFORMER BANK No. 1	30 AMP	1–2/C	10	TC	2"
	~~FOTB1.1~~		~~19" RACK~~	~~TRANSFORMER BANK No. 1~~	~~SEE NOTE 5~~	~~2–FIBER~~		~~F.O.~~	
D35	CCTB1.1		CUBICLE No. 1	TRANSFORMER BANK No. 1	CONTROL	1–7/C	10	TC	2"
	CCTB1.2		CUBICLE No. 5	TRANSFORMER BANK No. 1	CONTROL	1–7/C	10	TC	
	CCTB1.3	2	CUBICLE No. 5	TRANSFORMER BANK No. 1	CONTROL	1–7/C	10	TC	
D36	CTTB1.1		CUBICLE No. 1	TRANSFORMER BANK No. 1	CURRENTS	1–4/C	10	TC	2"
	CTTB1.2		CUBICLE No. 1	TRANSFORMER BANK No. 1	CURRENTS	1–4/C	10	TC	
D37	CTTB1.3		CUBICLE No. 1	TRANSFORMER BANK No. 1	CURRENTS	1–4/C	10	TC	2"
	CTTB1.4		CUBICLE No. 1	TRANSFORMER BANK No. 1	CURRENTS	1–4/C	10	TC	
	LTC3		TRANSFORMER BANK No. 1	HANDHOLE	SEE NOTE 6				
D38	F–T1A		HANDHOLE No. 1	TRANSFORMER BANK No. 1		1–FIBER		F.O.	2"

CONDUIT MARK	CABLE MARK	CIRCUIT VOLTAGE	FROM	TO	REMARKS	CABLE OR WIRE			CONDUIT SIZE
						CONDUCTOR	SIZE	TYPE	
D39	SPARE		HANDHOLE No. 1	TRANSFORMER BANK No. 1	SPARE CONDUIT				2"
TRANSFORMER BANK No. 2									
D40	ACTB2.1	240 AC	AC PANEL	TRANSFORMER BANK No. 2		4–1/C	No. 6	RHW	2"
D41	DCTB2.1	125 DC	DC PANEL	TRANSFORMER BANK No. 2		1–5/C	10	TC	2"
	FOTB2.1		19" RACK	TRANSFORMER BANK No. 2		2–FIBER		F.O.	
D42	CCTB2.1	125 DC	CUBICLE No. 10	TRANSFORMER BANK No. 2	TRIP CONTROL	1–9/C	10	TC	2"
	CCTB2.2	125 DC	CUBICLE No. 5	TRANSFORMER BANK No. 2	ALARMS	1–7/C	10	TC	
	CCTB2.3	125 DC	CUBICLE No. 5	TRANSFORMER BANK No. 2	ALARMS	1–7/C	10	TC	
D43	LTC1		TRANSFORMER BANK No. 1	TRANSFORMER BANK No. 2	CIRC. CURRENT	1–7/C	10	TC	2"
D44	CTTB2.1		CUBICLE No. 10	TRANSFORMER BANK No. 2	DIFFERENTIAL	1–5/C	10	TC	2"
	CTTB2.2		CUBICLE No. 10	TRANSFORMER BANK No. 2	H.S. OVERCURRENT	1–5/C	10	TC	
D45	CTTB2.3		CUBICLE No. 10	TRANSFORMER BANK No. 2	L.S. PHASE METERING	1–5/C	10	TC	2"
	CTTB2.4		CUBICLE No. 10	TRANSFORMER BANK No. 2	N METERING	1–5/C	10	TC	
D46	SPARE		HANDHOLE	TRANSFORMER BANK No. 2	SPARE CONDUIT				2"
TRANSFORMER BANK No. 3									
D47	ACTB3.1	240 AC	AC PANEL	TRANSFORMER BANK No. 3	60 AMP	4–1/C	No. 6	RHW	2"
D48	DCTB3.1	125 DC	DC PANEL	TRANSFORMER BANK No. 3	30 AMP	1–2/C	10	TC	2"
	FOTB3.1		19" RACK	TRANSFORMER BANK No. 3	SEE NOTE 5	2–FIBER		F.O.	
D49	CCTB3.1	2	CUBICLE No. 14	TRANSFORMER BANK No. 3	CONTROL	1–7/C	10	TC	2"
	CCTB3.2		CUBICLE No. 10	TRANSFORMER BANK No. 3	CONTROL	1–7/C	10	TC	
	CCTB3.3		CUBICLE No. 10	TRANSFORMER BANK No. 3	CONTROL	1–7/C	10	TC	
D50	LTC2		TRANSFORMER BANK No. 2	TRANSFORMER BANK No. 3	CIRC. CURRENT	1–7/C	10	TC	2"
D51	CTTB2.1		CUBICLE No. 14	TRANSFORMER BANK No. 3	CURRENTS	1–4/C	10	TC	2"
	CTTB2.2	2	CUBICLE No. 14	TRANSFORMER BANK No. 3	CURRENTS	1–4/C	10	TC	
D52	CTTB2.3		CUBICLE No. 14	TRANSFORMER BANK No. 3	CURRENTS	1–4/C	10	TC	2"
	CTTB2.4		CUBICLE No. 14	TRANSFORMER BANK No. 3	CURRENTS	1–4/C	10	TC	
	LTC3		HANDHOLE	TRANSFORMER BANK No. 3	SEE NOTE 6				
D53	F–T3A		HANDHOLE	TRANSFORMER BANK No. 3		1–FIBER		F.O.	2"
D54	SPARE		HANDHOLE	TRANSFORMER BANK No. 3	SPARE CONDUIT				2"
LIGHTS									
D55	LT No. 1	120 VAC	AC PANEL	LT No. 1 JUNCTION BOX		1–3/C	10	TC	2"
D56	LT No. 2	120 VAC	LT No. 1 JUNCTION BOX	LT No. 2 JUNCTION BOX		1–3/C	10	TC	2"
D57	LT No. 3	120 VAC	LT No. 1 JUNCTION BOX	LT No. 3 JUNCTION BOX		1–3/C	10	TC	2"
D58	FL No.1&2	240 VAC	AC PANEL	FLOOD LT No. 1&2 JUNCTION BOX		1–3/C	10	TC	2"
D59	FL No. 3	240 VAC	AC PANEL	FLOOD LT No. 3 JUNCTION BOX		1–3/C	10	TC	2"
D60	FL No.4&5	240 VAC	AC PANEL	FLOOD LT No. 4&5 JUNCTION BOX		1–3/C	10	TC	2"
D61	FL No. 6	240 VAC	FLOOD LT No. 4&5 JUNCTION BOX	FLOOD LT No. 6 JUNCTION BOX		1–3/C	10	TC	2"
D62	WPLT No.1	120 VAC AND 24 VDC	AC PANEL	WP LT No. 1 JUNCTION BOX		1–3/C AND 1–5/C	10	TC	2"
D63	WPLT No.2	120 VAC AND 24 VDC	WP LT No. 1 JUNCTION BOX	WP LT No. 2 JUNCTION BOX		1–3/C AND 1–5/C	10	TC	2"
D64	WPLT No.3	120 VAC	WP LT No. 1 JUNCTION BOX	WP LT No. 3 JUNCTION BOX		1–3/C	10	TC	2"
D65	WPLT No.4	120 VAC	WP LT No. 3 JUNCTION BOX	WP LT No. 4 JUNCTION BOX	DUCT ONLY				2"
D66	WPLT No.5	120 VAC	WP LT No. 4 JUNCTION BOX	WP LT No. 5 JUNCTION BOX		1–3/C	10	TC	2"
D67		120/240	AC PANEL/HANDHOLE	RECEPTACLE	MED OIL PUMP	3–1/C 1–1/C	8 10	RHW RHW	2"

NOTES:

1. ALL CONDUIT IS SCHEDULE 40 UNLESS NOTED OTHERWISE.
2. TVA TO PROVIDE CABLE, CONTRACTOR TO INSTALL UNDER THIS CONTRACT.
3. OWNER TO PROVIDE, INSTALL, TERMINAL CONNECT ALL 500 MCM MV CABLES..
4. OWNER SUPPLY 1/0 MV CABLE CUTOUT AND LIGHTING ARRESTOR. CONTRACTOR PROVIDE REMAINING ASSOCIATED MATERIAL AND INSTALL ALL.
5. CONTRACTOR TO PROVIDE PULL STRING IN EACH EMPTY DUCT.
6. INSTALL 1–7/C SIZE No.10 TYPE TC LTC CABLE BETWEEN TRANSFORMER BANK No. 1 & No. 3.

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11-5-24	BANK 2 INSTALL	A.FERREE
6-17-21	INSTALL LTC CONTROLLER FIBER	A.FERREE
DATE	REVISION	BY

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No.	Revision	Date
2.	REVISED CUBICLE NUMBERS.	6/20/16
1.	REVISED LTC CABLES.	12/21/15

CONDUIT & CABLE SCHEDULE

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E7.2.1_R2

RECORD DRAWINGS 1/30/19

E7.2.1_R2
BID DOCUMENTS

CONDUIT MARK	CABLE MARK	CIRCUIT VOLTAGE	FROM	TO	REMARKS	CABLE OR WIRE			CONDUIT SIZE
						CONDUCTOR	SIZE	TYPE	
TVA									
D68	M1	CT	BANK 1 CT'S	TEST BOX No. 1	NOTE 2		10	TC	1"
D69	P1	PT	BANK 1 PT'S	TEST BOX No. 1	NOTE 2		10	TC	1"
D70	MP1		TVA TEST BOX No. 1	TVA METER CABINET No. 1	NOTE 2	1-12/C	10	TC	2"
D71	SPARE		TVA TEST BOX No. 1	TVA METER CABINET No. 1					2"
D72	M2	CT	BANK 2 CT'S	TEST BOX No. 2		6-1/C	10	TC	1"
D73	P2	PT	BANK 2 PT'S	TEST BOX No. 2		6-1/C	10	TC	1"
D74	MP2		TVA TEST BOX No. 2	TVA METER CABINET No. 2		1-12/C	10	TC	2"
D75	SPARE		TVA TEST BOX No. 2	TVA METER CABINET No. 2	DUCT ONLY				2"
D76	M3	CT	BANK 3 CT'S	TVA TEST BOX No. 3	NOTE 2		10	TC	1"
D77	P3	PT	BANK 3 PT'S	TVA TEST BOX No. 3	NOTE 2		10	TC	1"
D78	MP3		TVA TEST BOX No. 3	TVA METER CABINET No. 1	NOTE 2	1-12/C	10	TC	2"
D79	SPARE		TVA TEST BOX No. 3	TVA METER CABINET No. 1					2"
D80	FP1		CUBICLE No. No. 6	TVA METER CABINET No. 1	NOTE 2	1-4/C	10	TC	2"
	FP3		CUBICLE No. No. 6	TVA METER CABINET No. 1	NOTE 2	1-4/C	10	TC	
D81	CT1		CUBICLE No. No. 6	TVA METER CABINET No. 1	NOTE 2	1-4/C	10	TC	2"
	CT3		CUBICLE No. No. 6	TVA METER CABINET No. 1	NOTE 2	1-4/C	10	TC	
D82	SS1.1		AC PANEL	TVA METER CABINET No. 1		1-4/C	10	TC	2"
D83	SPARE		HANDHOLE No. 1	TVA METER CABINET No. 1	DUCT ONLY				2"
D84	SPARE		HANDHOLE No. 1	TVA METER CABINET No. 1	DUCT ONLY				2"
D85	FP2		HANDHOLE No. 1	TVA METER CABINET No. 2	DUCT ONLY				2"
D86	CT2		HANDHOLE No. 1	TVA METER CABINET No. 2	DUCT ONLY				2"
D87	SS1.2		HANDHOLE No. 1	TVA METER CABINET No. 2	DUCT ONLY				2"
D88	SPARE		HANDHOLE No. 1	TVA METER CABINET No. 2	DUCT ONLY				2"
D89	SPARE		HANDHOLE No. 1	TVA METER CABINET No. 2	DUCT ONLY				2"
TWACS									
D90			BANK 1 RISER STR.	TWACS No. 1	DUCT ONLY				4"
D91			BANK 1 RISER STR.	TWACS No. 1	DUCT ONLY				4"
D92			TWACS No. 1	HANDHOLE	DUCT ONLY				2"
D93			TWACS No. 1	HANDHOLE	DUCT ONLY				2"
D94			FUTURE BANK 2 RISER STR.	TWACS No. 2	DUCT ONLY				4"
D95			FUTURE BANK 2 RISER STR.	TWACS No. 2	DUCT ONLY				4"
D96			TWACS No. 2	HANDHOLE	DUCT ONLY				2"
D97			TWACS No. 2	HANDHOLE	DUCT ONLY				2"
D98			BANK 3 RISER STR.	TWACS No. 3	DUCT ONLY				4"
D99			BANK 3 RISER STR.	TWACS No. 3	DUCT ONLY				4"
D100			TWACS No. 3	HANDHOLE	DUCT ONLY				2"
D101			TWACS No. 3	HANDHOLE	DUCT ONLY				2"
FEEDER CIRCUITS									
D102	214-A1	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	6"
	214-B1	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	
	214-C1	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	
D103	214-A2	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	6"
	214-B2	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	
	214-C2	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	
D103.1	214-A3	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	6"
	214-B3	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	
	214-C3	7.2 kV	CUBICLE No. 2	PULL BOX No. 1		1-1/C	500 MCM	MV	
D104			CUBICLE No. 2	PULL BOX No. 1	SPARE CONDUIT				6"
D105			HANDHOLE	PULL BOX No. 1	SPARE CONDUIT				2"
D106	214-A1	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	5"
	214-B1	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	
	214-C1	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	
D107	214-A2	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	5"
	214-B2	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	
	214-C2	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	
D107.1	214-A3	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	5"
	214-B3	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	
	214-C3	7.2 kV	PULL BOX No. 1	PULL BOX No. 2		1-1/C	500 MCM	MV	
D108			PULL BOX No. 1	PULL BOX No. 2	SPARE CONDUIT				5"
D108.1			PULL BOX No. 1	PULL BOX No. 2	SPARE CONDUIT				5"
D109			PULL BOX No. 1	PULL BOX No. 2	SPARE CONDUIT				2"

CONDUIT MARK	CABLE MARK	CIRCUIT VOLTAGE	FROM	TO	REMARKS	CABLE OR WIRE			CONDUIT SIZE
						CONDUCTOR	SIZE	TYPE	
D110	214-A1	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	5"
	214-B1	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	
	214-C1	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	
D111	214-A2	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	5"
	214-B2	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	
	214-C2	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	
D111.1	214-A3	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	5"
	214-B3	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	
	214-C3	7.2 kV	PULL BOX No. 2	RISER POLE		1-1/C	500 MCM	MV	
D112			PULL BOX No. 2	RISER POLE	SPARE CONDUIT				5"
D113			PULL BOX No. 2	RISER POLE	SPARE CONDUIT				2"
D114	224-A1	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	6"
	224-B1	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	
	224-C1	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	
D115	224-A2	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	6"
	224-B2	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	
	224-C2	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	
D115.1	224-A3	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	6"
	224-B3	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	
	224-C3	7.2 kV	CUBICLE No. 3	PULL BOX No. 3		1-1/C	500 MCM	MV	
D116			CUBICLE No. 3	PULL BOX No. 3	SPARE CONDUIT				6"
D117			HANDHOLE	PULL BOX No. 3	SPARE CONDUIT				2"
D118	224-A1	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	5"
	224-B1	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	
	224-C1	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	
D119	224-A2	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	5"
	224-B2	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	
	224-C2	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	
D119.1	224-A3	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	5"
	224-B3	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	
	224-C3	7.2 kV	PULL BOX No. 3	PULL BOX No. 4		1-1/C	500 MCM	MV	
D120			PULL BOX No. 3	PULL BOX No. 4	SPARE CONDUIT				5"
D120.1			PULL BOX No. 3	PULL BOX No. 4	SPARE CONDUIT				5"
D121			PULL BOX No. 3	PULL BOX No. 4	SPARE CONDUIT				2"
D122	224-A1	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	5"
	224-B1	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	
	224-C1	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	
D123	224-A2	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	5"
	224-B2	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	
	224-C2	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	
D123.1	224-A3	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	5"
	224-B3	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	
	224-C3	7.2 kV	PULL BOX No. 4	RISER POLE		1-1/C	500 MCM	MV	
D124			PULL BOX No. 4	RISER POLE	SPARE CONDUIT				5"
D125			PULL BOX No. 4	RISER POLE	SPARE CONDUIT				2"

NOTES:

1. ALL CONDUIT IS SCHEDULE 40 UNLESS NOTED OTHERWISE.
2. TVA TO PROVIDE CABLE, CONTRACTOR TO INSTALL UNDER THIS CONTRACT.
3. OWNER TO PROVIDE, INSTALL, TERMINAL CONNECT ALL 500 MCM MV CABLES..
4. OWNER SUPPLY 1/0 MV CABLE CUTOUT AND LIGHTING ARRESTOR. CONTRACTOR PROVIDE REMAINING ASSOCIATED MATERIAL AND INSTALL ALL.
5. CONTRACTOR TO PROVIDE PULL STRING IN EACH EMPTY DUCT.

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No.	Revision	Date

CONDUIT & CABLE SCHEDULE

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E7.2.2 R1

RECORD DRAWINGS 1/30/19

E7.2.2 R1
BID DOCUMENTS

CONDUIT MARK	CABLE MARK	CIRCUIT VOLTAGE	FROM	TO	REMARKS	CABLE OR WIRE			CONDUIT SIZE
						CONDUCTOR	SIZE	TYPE	
BANK 1 MAIN FEEDER									
D170	B1–A1	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	6"
	B1–B1	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
	B1–C1	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
D171	B1–A2	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	6"
	B1–B2	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
	B1–C2	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
D172	B1–A3	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	6"
	B1–B3	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
	B1–C3	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
D173	B1–A4	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	6"
	B1–B4	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
	B1–C4	7.2 kV	BANK 1 RISER	CUBICLE No. 1		1–1/C	1000 MCM	MV	
D174			BANK 1 RISER	CUBICLE No. 1	DUCT ONLY				6"
			BANK 1 RISER	CUBICLE No. 1	DUCT ONLY				
			BANK 1 RISER	CUBICLE No. 1	DUCT ONLY				
BANK 2 MAIN FEEDER									
D175	B2–A1	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	6"
	B2–B1	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
	B2–C1	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
D176	B2–A2	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	6"
	B2–B2	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
	B2–C2	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
D177	B2–A3	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	6"
	B2–B3	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
	B2–C3	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
D178	B2–A4	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	6"
	B2–B4	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
	B2–C4	7.2 kV	BANK 2 RISER	CUBICLE No. 10		1–1/C	1000 MCM	MV	
D179			BANK 2 RISER	CUBICLE No. 10	SPARE CONDUIT				6"
			BANK 2 RISER	CUBICLE No. 10	SPARE CONDUIT				
			BANK 2 RISER	CUBICLE No. 10	SPARE CONDUIT				
BANK 3 MAIN FEEDER									
D180	B3–A1	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	6"
	B3–B1	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
	B3–C1	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
D181	B3–A2	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	6"
	B3–B2	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
	B3–C2	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
D182	B3–A3	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	6"
	B3–B3	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
	B3–C3	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
D183	B3–A4	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	6"
	B3–B4	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
	B3–C4	7.2 kV	BANK 3 RISER	CUBICLE 14		1–1/C	1000 MCM	MV	
D184			BANK 3 RISER	CUBICLE 14	SPARE CONDUIT				6"
			BANK 3 RISER	CUBICLE 14	SPARE CONDUIT				
			BANK 3 RISER	CUBICLE 14	SPARE CONDUIT				
MISCELLANEOUS									
D185			HANDHOLE	GATE PILASTER	DUCT ONLY				2"
D186			HANDHOLE	BACKFLOW PERVENTER BOX	DUCT ONLY				2"

CONDUIT MARK	CABLE MARK	CIRCUIT VOLTAGE	FROM	TO	REMARKS	CABLE OR WIRE			CONDUIT SIZE
						CONDUCTOR	SIZE	TYPE	
SECURITY									
SEC–1	ZONE 1	24 VDC	HAND HOLE	SECURITY TOWER #1		1–5/C	10	TC	1.25"
SEC–2	ZONE 2	24 VDC	WP LIGHT No. 5 JUNCTION BOX	SECURITY TOWER #2		1–5/C	10	TC	1.25"
SEC–3	ZONE 3	24 VDC	HAND HOLE	SECURITY TOWER #3		1–5/C	10	TC	1.25"
SEC–4	ZONE 4	24 VDC	SEC JUNCTION BOX No. 1	SECURITY TOWER #4		1–5/C	10	TC	1.25"
JB–5		24 VDC	HANDHOLE	WP LIGHT No. 5 JUNCTION BOX		3–5/C	10	TC	2"
JB–1		24 VDC	WP LIGHT No. 5 JUNCTION BOX	SEC JUNCTION BOX No. 1		2–5/C	10	TC	2"

NOTES:

1. ALL CONDUIT IS SCHEDULE 40 UNLESS NOTED OTHERWISE.
2. TVA TO PROVIDE CABLE, CONTRACTOR TO INSTALL UNDER THIS CONTRACT.
3. OWNER TO PROVIDE, INSTALL, TERMINAL CONNECT ALL 500 MCM MV CABLES..
4. OWNER SUPPLY 1/0 MV CABLE CUTOUT AND LIGHTING ARRESTOR. CONTRACTOR PROVIDE REMAINING ASSOCIATED MATERIAL AND INSTALL ALL.
5. CONTRACTOR TO PROVIDE PULL STRING IN EACH EMPTY DUCT.

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11–13–24	INSTALL BANK 3	A.FERREE
6–17–21	INSTALL SECURITY TOWERS	A.FERREE
DATE	REVISION	BY

MTEMC

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MURFREESBORO, TENNESSEE

No.	Revision	Date

CONDUIT & CABLE SCHEDULE

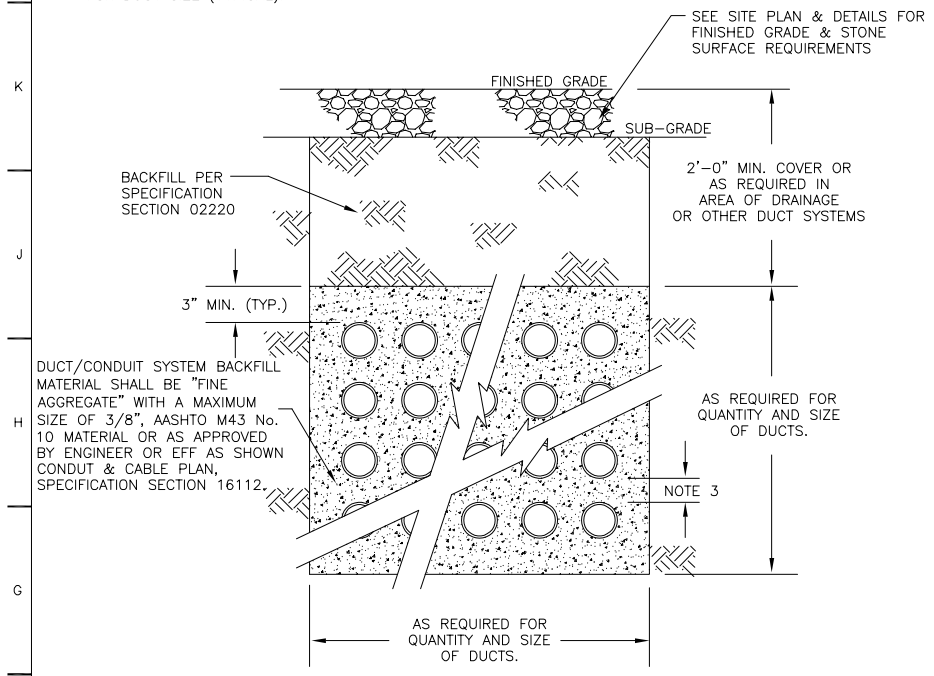
JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E7.2.4_R2

RECORD DRAWINGS 1/30/19

E7.2.4_R2
BID DOCUMENTS

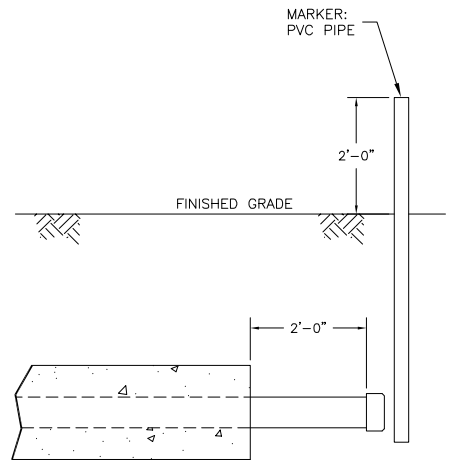
NOTES:

1. SCHEDULE 40 PVC.
2. DUCT SIZE AND QUANTITY PER CONDUIT AND CABLE PLAN AND SCHEDULE.
3. STANDARD SEPARATION (DUCT SPACERS) FOR DUCT SIZE (TYPICAL).



F1 CONTROL AND LOW VOLTAGE POWER CONDUIT SYSTEM DETAIL

NO SCALE | 16112-01 R110707 | © ALLEN & HOSHALL, INC.



NOTES:

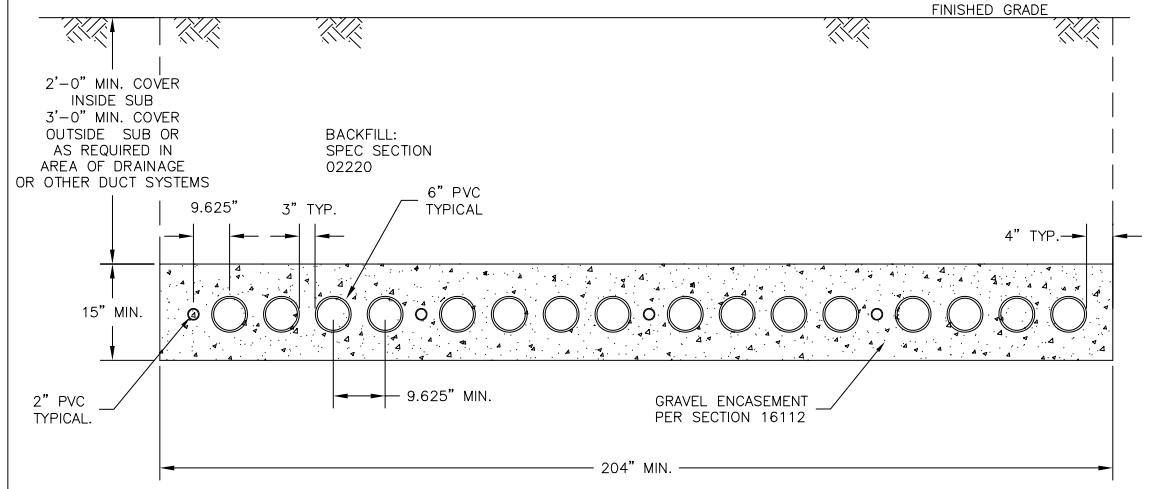
1. STOP EFF TWO FEET BERORE END OF DUCTS
2. CAP DUCTS
3. INSTALL MARKER SO END OF CONDUIT CAN BE FOUND

F6 DUCT LOCATION MARKER

NO SCALE | 16112-82 R041715 | © ALLEN & HOSHALL, INC.

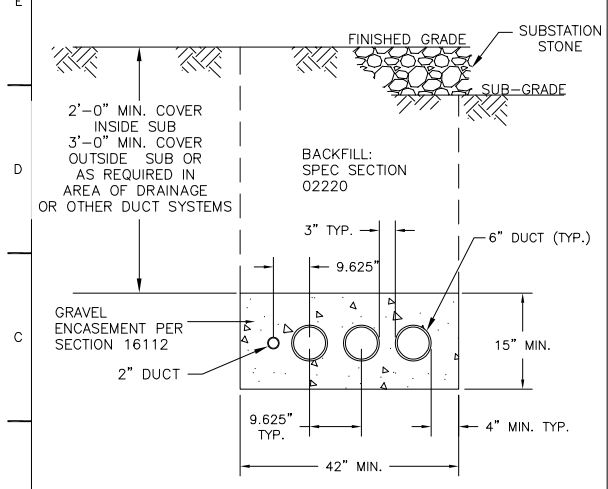
NOTES:

1. SCH-40 PVC.
2. STANDARD DUCT SEPARATORS FOR 9.625" CENTER TO CENTER AND 3" BETWEEN DUCTS.



F9 UNDERGROUND FEEDER DETAIL

NO SCALE | © ALLEN & HOSHALL, INC.

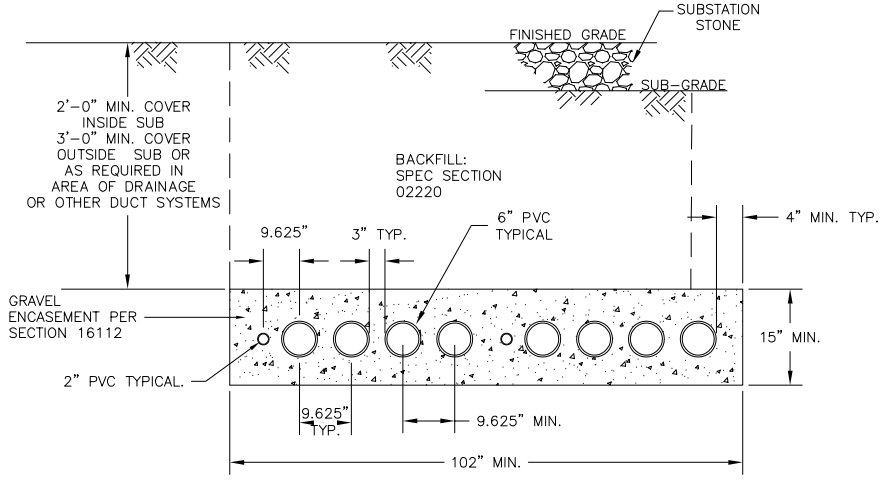


NOTES:

1. DUCT TYPE: SEE SECTION 16112.
2. STANDARD DUCT SEPARATORS FOR 9.625" CENTER TO CENTER AND 3" BETWEEN DUCTS.

A1 UNDERGROUND FEEDER DETAIL

NO SCALE | 16112-62 R050611

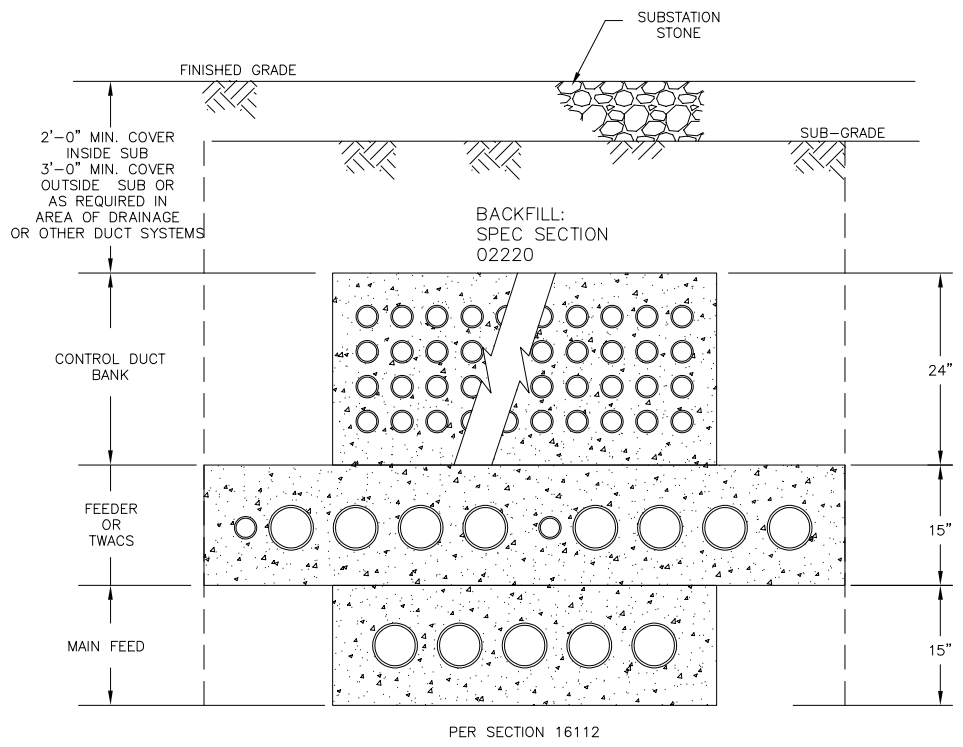


NOTES:

1. SCH-40 PVC.
2. STANDARD DUCT SEPARATORS FOR 9.625" CENTER TO CENTER AND 3" BETWEEN DUCTS.

A4 UNDERGROUND FEEDER DETAIL

NO SCALE | DETAIL No: 16112-63-MED R120107 | © ALLEN & HOSHALL, INC.



A8 UNDERGROUND FEEDER DETAIL

NO SCALE | DETAIL No: 16112-6X-MED R120107 | © ALLEN & HOSHALL, INC.

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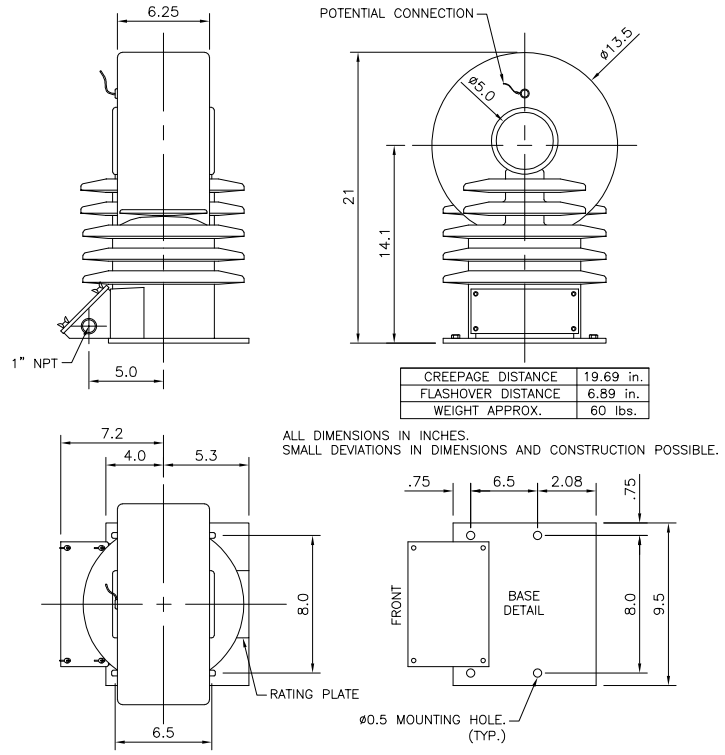
No.	Revision	Date

CONDUIT SYSTEM DETAILS

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E7.3

RECORD DRAWINGS 1/30/19

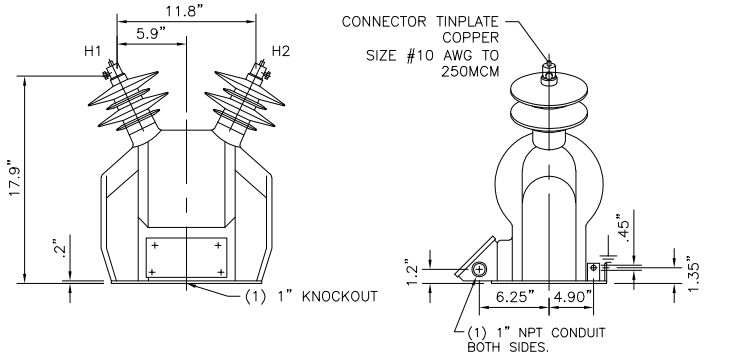
E7.3
BID DOCUMENTS

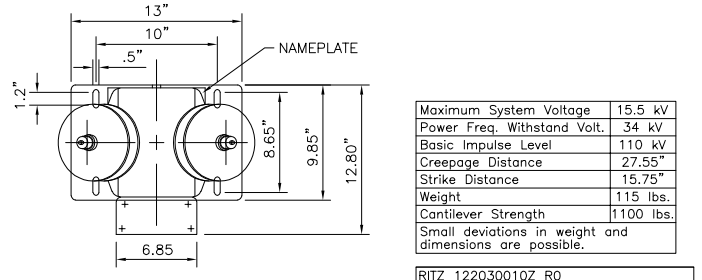


ALL DIMENSIONS IN INCHES.
SMALL DEVIATIONS IN DIMENSIONS AND CONSTRUCTION POSSIBLE.

CREEPAGE DISTANCE	19.69 in.
FLASHOVER DISTANCE	6.89 in.
WEIGHT APPROX.	60 lbs.

G1	CURRENT TRANSFORMER, RITZ GIFD 25-03 (PROVIDED BY TVA)		
NO SCALE		DETAIL NO: 16310-82 R122210	© ALLEN & HOSHALL, INC.

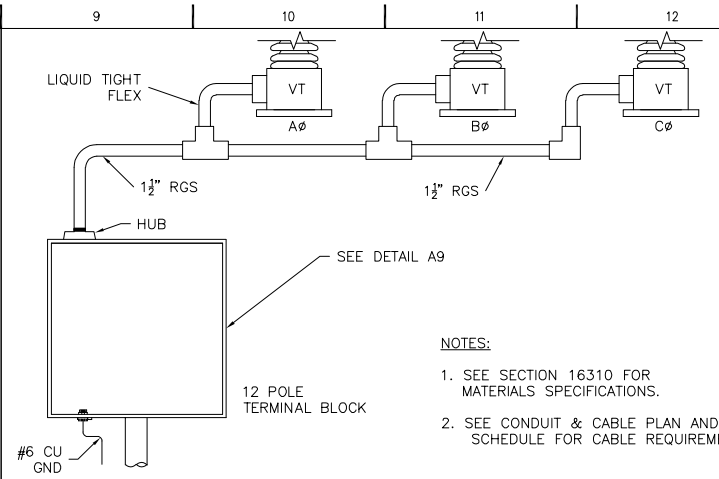




Maximum System Voltage	15.5 kV
Power Freq. Withstand Volt.	34 kV
Basic Impulse Level	110 kV
Creepage Distance	27.55"
Strike Distance	15.75"
Weight	115 lbs.
Cantilever Strength	1100 lbs.
Small deviations in weight and dimensions are possible.	

RITZ 122030010Z R0
TVA TIIC CGL910E, CDL909L, CDL908N

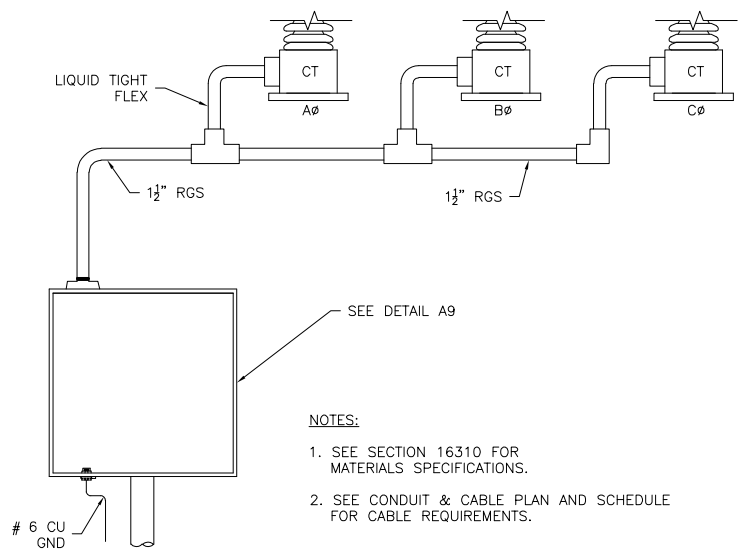
G5	VOLTAGE TRANSFORMER, RITZ, VZF 15-20 (PROVIDED BY TVA)		
NO SCALE		16310-83 R110507	© ALLEN & HOSHALL, INC.



NOTES:

1. SEE SECTION 16310 FOR MATERIALS SPECIFICATIONS.
2. SEE CONDUIT & CABLE PLAN AND SCHEDULE FOR CABLE REQUIREMENTS.

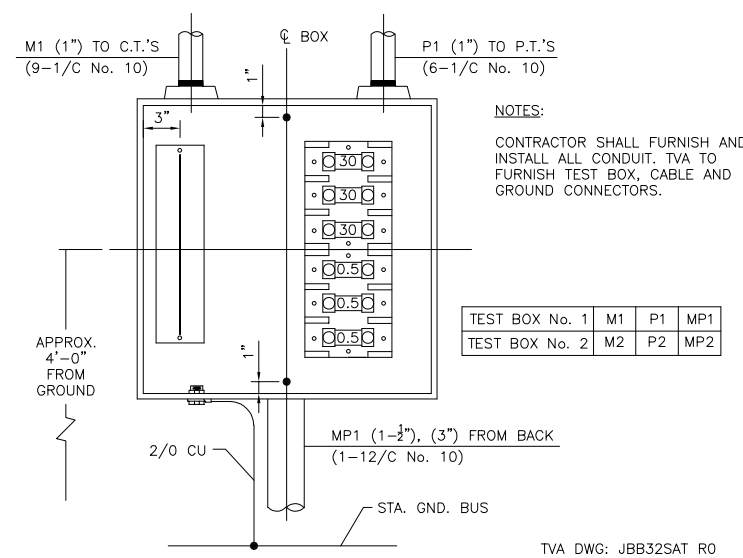
J9	VOLTAGE TRANSFORMER		
NO SCALE		16314-92 R051011	© ALLEN & HOSHALL, INC.



NOTES:

1. SEE SECTION 16310 FOR MATERIALS SPECIFICATIONS.
2. SEE CONDUIT & CABLE PLAN AND SCHEDULE FOR CABLE REQUIREMENTS.

E9	CURRENT TRANSFORMER		
NO SCALE		16314-90 R051011	© ALLEN & HOSHALL, INC.

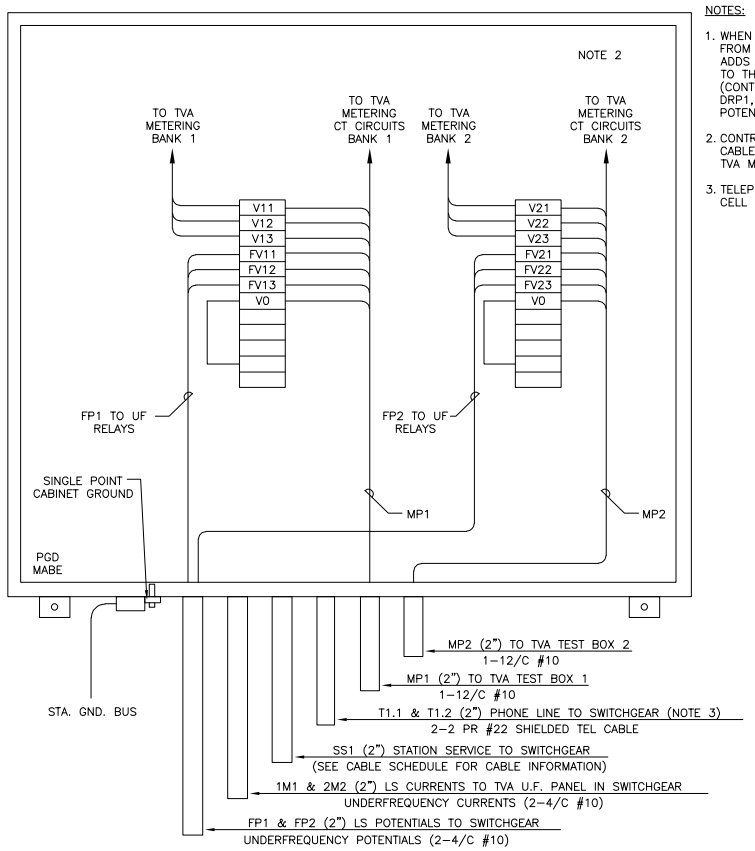


NOTES:

CONTRACTOR SHALL FURNISH AND INSTALL ALL CONDUIT. TVA TO FURNISH TEST BOX, CABLE AND GROUND CONNECTORS.

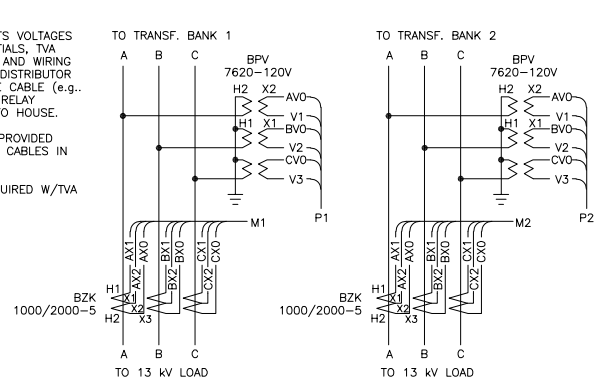
TEST BOX No. 1	M1	P1	MP1
TEST BOX No. 2	M2	P2	MP2

TVA DWG: JBB32SAT R0



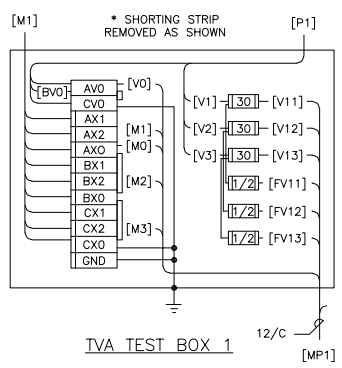
NOTES:

1. WHEN DISTRIBUTOR REQUESTS VOLTAGES FROM TVA METERING POTENTIALS, TVA ADDS THE 1/2 AMP FUSES AND WIRING TO THE TERMINAL BLOCK. DISTRIBUTOR (CONTRACTOR) INSTALLS THE CABLE (e.g., DRP1, DRP2) (DISTRIBUTOR RELAY POTENTIAL) FROM CABINET TO HOUSE.
2. CONTRACTOR INSTALLS TVA PROVIDED CABLE. TVA TERMINATES ALL CABLES IN TVA METER AND TEST BOX.
3. TELEPHONE CABLE NOT REQUIRED W/TVA CELL PHONE PACKAGE

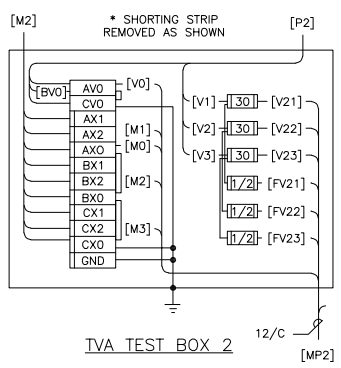


THREE LINE DIAGRAM

THREE LINE DIAGRAM



TVA TEST BOX 1



TVA TEST BOX 2

A1	TVA METERING CABINET (W/2 REVENUE METERS)		
NO SCALE		DETAIL No: 16310-86 R100209	© ALLEN & HOSHALL, INC.

A9	TVA METERING TEST BOX (PROVIDED BY TV A)		
NO SCALE		DETAIL No: 16310-88 R110507	© ALLEN & HOSHALL, INC.

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No.	Revision	Date

SUBSTATION
DETAILS

JOB NO: 81513
DATE: 10/04/14
DRAWN: TDT
CHECKED: VTV
CAD FILE: E5.2

RECORD
DRAWINGS
1/30/19

E5.2
BID
DOCUMENTS

SPECIFICATIONS

SUBSTATION CIRCUIT SWITCHER SPECIFICATION

This specification gives the general requirements for a substation circuit switcher that will be used for transformer protection. All ratings specified shall be considered minimum. The bidders shall list all exceptions to this specification or specify that no exceptions exist.

The device shall be an outdoor substation type Southern States CSV circuit switcher, three pole single throw, rated 161 kV, 750 kV BIL, 1200 Amp, with a SF6 interrupter contact environment. The circuit switcher shall be capable of interrupting a minimum 20,000 amps symmetrical by ANSI standards.

The circuit switcher shall be equipped to group operate three phase candlestick interrupters electrically by remote or local control. Electric operation shall be arranged for control trip from 125 volts DC and control closing from 125 volts DC. Low SF6 gas alarm shall be provided for scada indication. Trip coil monitoring shall be provided with the circuit switcher.

The interrupter units shall be activated through a stored energy device.

The circuit switcher shall be provided with all standard accessories including, without limitation, the following:

1. Four(4) hole NEMA terminal pads suitable for either copper or aluminum connections.

2. Weatherproof mechanism housings containing the following:
   - 2.1. Motor operating mechanism
   - 2.2. Necessary auxiliary and cut-off switches
   - 2.3. Mechanically operated non-resettable operation counter
   - 2.4. Necessary wiring and terminal blocks
   - 2.5. Necessary heaters and thermostatic controls:
     The thermostatically controlled space heater shall be rated for single-phase 240 volts. It shall be sized so that it may function properly to prevent condensation when connected at 120 volts alternating current.

3. Low profile, two column galvanized steel mounting frame, 12 feet high for 120 inch phase spacing. Anchor bolt setting plan shall be three(3) legs spaced 120 inches apart with the anchor bolts placed in a twenty(20) inch square pattern for each leg. Other leg designs must be included in the bid package.

4. NEMA standard copper faced frame grounding pad.

5. Standard assembly will be performed by the contractor.

6. A duplex receptacle with ground-fault circuit interrupter and convenience-light lampholder with switch located inside the operator enclosure is to be provided.

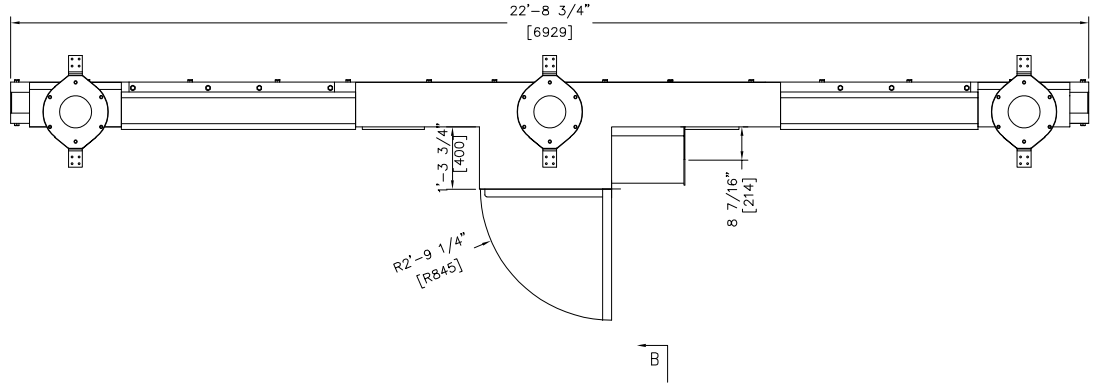
7. Complete sets of all drawings, wiring diagrams, descriptive data, and installation/maintenance instruction sheets pertaining to the circuit switcher and all associated equipment shall be mailed to the MTE Corporate Office with the shipment of the circuit switchers. There is also to be a complete set of drawings, wiring diagrams, descriptive data, and installation/maintenance instruction sheets in each circuit switcher. (Assuming they are identical circuit switchers, that means 4 total extra copies). A CD with a professional looking label is to be furnished containing all drawings, data, etc.

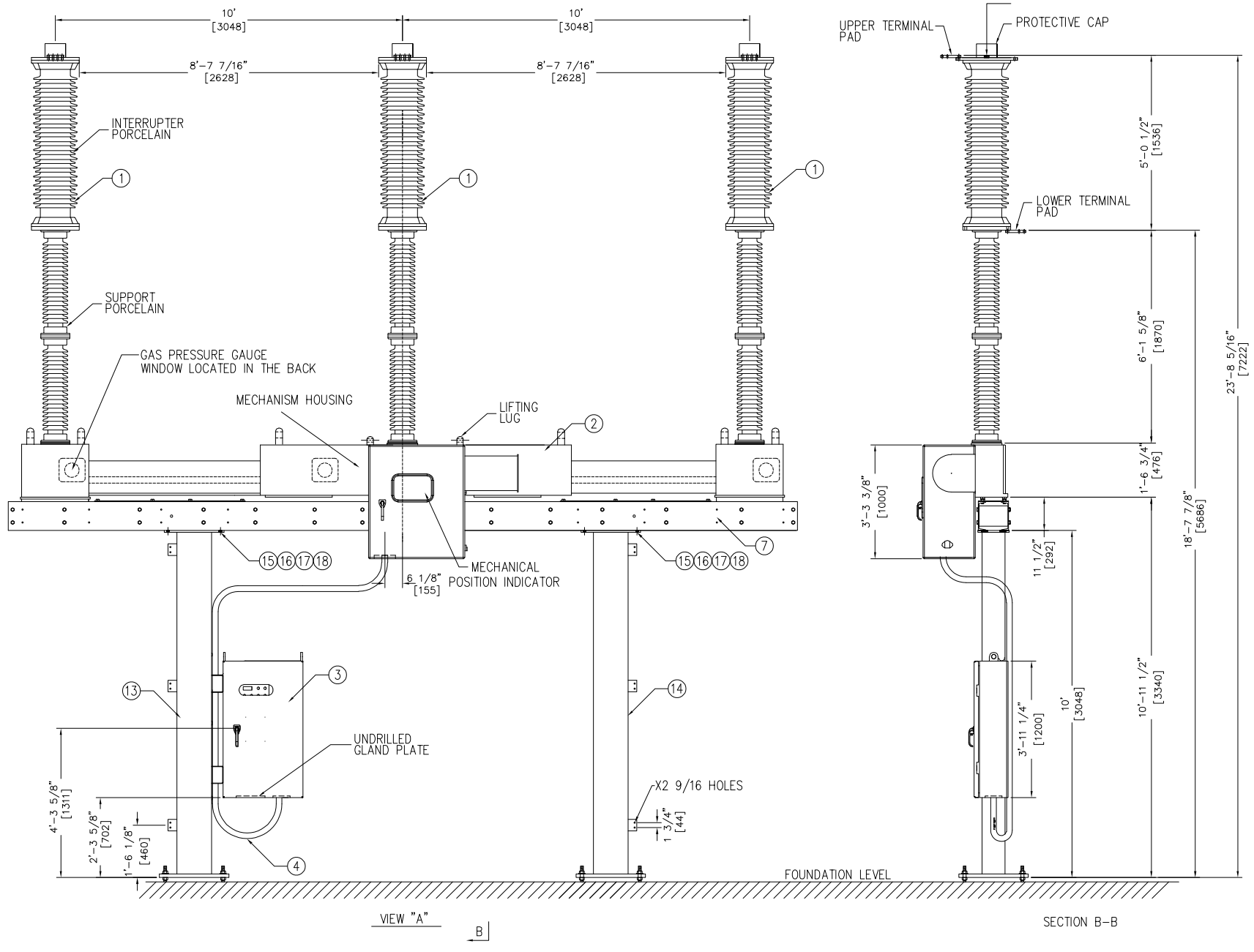
8. Approval Drawings shall be provided to MTE before the manufacture of the breaker. One set will be returned to the contractor/packager. Approval by MTE shall not relieve the contractor of the responsibility for the correctness of the drawings furnished by the contractor nor the compliance with the specifications, unless so stated by MTE at the time of approval.

9. Accepted manufacturer is Southern States. No other manufacturer will be accepted.

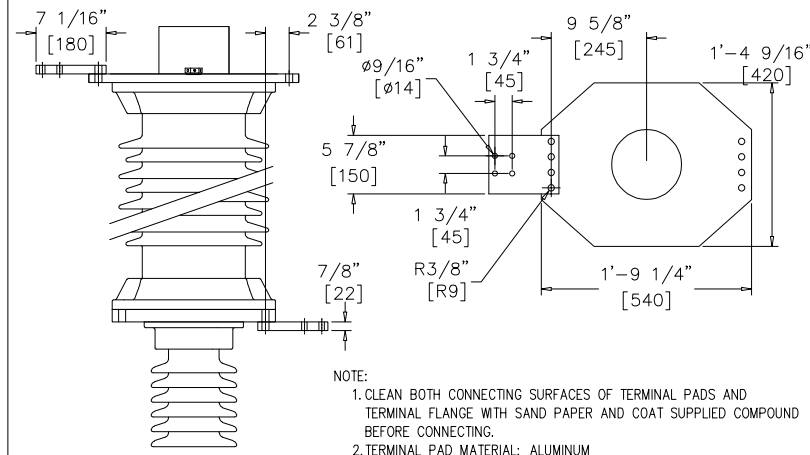
All apparatus included under these specifications and supplied by the switch manufacturer shall be in accordance with the latest NEMA, ANSI, and IEEE standards.

This Specification is for 2 circuit switchers for MTE's Veterans Substation located near Murfreesboro, Tennessee. One circuit switcher is for primary protection and one is for backup protection.



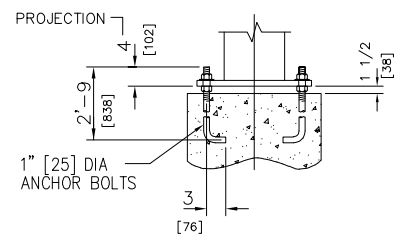


DETAIL OF UPPER AND LOWER TERMINAL PADS



NOTE:
1. CLEAN BOTH CONNECTING SURFACES OF TERMINAL PADS AND TERMINAL FLANGE WITH SAND PAPER AND COAT SUPPLIED COMPOUND BEFORE CONNECTING.
2. TERMINAL PAD MATERIAL: ALUMINUM
3. PAD LOCATIONS ARE REVERSIBLE BY REMOVING BOLTS & RELOCATING AT NEW POSITION.

ANCHOR BOLT DETAIL



WEIGHTS (APPROX)	lbs.	kg.
a. POLE UNIT ASSY.	3x772=2316 lbs.	3x350=700 kg.
b. HOR FRAME ASSY WITH MECH HSG.	1764 lbs.	800 kg.
c. CONTROL CABINET.	331 lbs.	150 kg.
d. SF6 GAS.	16.7 lbs.	7.6 kg.
e. SUPPORT COLUMN.	2x571=1142lbs.	2x259=518kg.
f. SUB-BASE ASSEMBLY	930 lbs.	421kg.

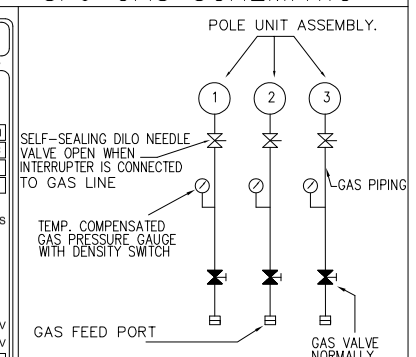
NAMEPLATE

Southern States
The Quality Name in High Voltage Switching
CircuitSwitcher®

TYPE DESIGNATION	CSV	SERIAL NO.	SEE TABLE 1
JOB ORDER NO.	SEE TABLE 1	AMBIENT TEMP. RANGE	-40°C to +50°C
DRAWING NO.	83080073	REFERENCE DRAWING NO.	N/A
MFR DATE: MM/YY		WARRANTY EXP. MM/YY	
RATED MAX VOLT.	170 kV	POWER FREQUENCY	60 Hz.
CONTINUOUS CURRENT	1200 A	INTERRUPTING TIME	3 CYCLES
RATED PRIMARY-BUS FAULT BREAKING CURRENT		40 kA	
TRANSFORMER-LIMITED FAULT BREAKING CURRENT		4.2 kA	
SHORT TIME WITHSTAND CURRENT (RMS)	63 kA. FOR 1 SEC.		
SHORT-CIRCUIT MAKING CURRENT (RMS)	63 kA		
PEAK WITHSTAND CURRENT	164 kA		
LIGHTNING IMPULSE WITHSTAND VOLTAGE INTERRUPTER (BIL)		750 kV	
LIGHTNING IMPULSE WITHSTAND VOLTAGE DISCONNECT BLADE (BIL)		N/A kV	
COIL VOLTAGE:CLOSING	125 VDC	TRIPPING	125 VDC
MOTOR VOLTAGE	240 VAC	AUX. CKT.	120 VAC
OPERATING SEQUENCE	O-0.3 SEC - CO - 15 SEC - CO	HEATER CKT.	240 VAC

INSTRUCTION BOOK NO. SEE TABLE 1
GAS WEIGHT 16.7 lbs. @ 76 PSIG AT 20° C NOMINAL 76 MINIMUM 52
SEE TABLE 1
SEE TABLE 1 TOTAL WT.
Southern States LLC, 30 Georgia Ave, Hampton, Georgia, USA

SF6 GAS SCHEMATIC



PSI VALUES
RATED: 76
ALARM: 60
LOCKOUT: 52

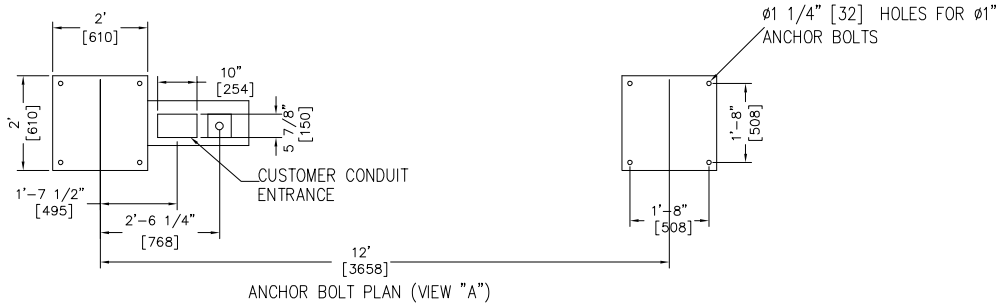


TABLE 1

603501	81513.7	CV 12069	VETERANS PARKWAY	IB-806-CSV170	1
603501	81513.7	CV 12068	VETERANS PARKWAY	IB-806-CSV170	1
603501	81513.7	CV 12067	VETERANS PARKWAY	IB-806-CSV170	1
603501	81513.7	CV 12066	VETERANS PARKWAY	IB-806-CSV170	1
601538	17568	CV 11650	SOUTHEAST	IB-806-CSV170-R11	1
601538	17568	CV 11649	SOUTHEAST	IB-806-CSV170-R11	1
601538	17568	CV 11648	SOUTHEAST	IB-806-CSV170-R11	1
601538	17568	CV 11647	SOUTHEAST	IB-806-CSV170-R11	1
J.O.#	P.O. #	SERIAL NO.	SUBSTATION	INSTRUCTION BOOK	REV

D-83080073 | BILL OF MATERIAL

CSV 170 kV 40 kA

ITEM	DESCRIPTION	DWG SIZE	PART NO.	QUANTITY
1	POLE UNIT ASSEMBLY	C	08240388	3
2	BASE FRAME/MECHANISM HOUSING	C	08240400	1
3	CONTROL CABINET	D	08240510	1
4	CONDUIT ASSEMBLY - 15'	D	08127649	1
5	CSV HARDWARE ASSEMBLY	B	08129208	1
6	SHIP LOOSE PARTS		08244002	1
7	SUB-BASE ASSEMBLY		15262015	1
8	CONTROL PANEL ASSEMBLY		08243499	1
9	240 VAC MOTOR		01470096	1
10				
11				
12				
	DO NOT REQUISITION BELOW THIS LINE			
13	SUPPORT COLUMN	D	27801363	1
14	SUPPORT COLUMN	D	27802064	1
15	3/4" GALV. ST. BEVELED WASHER		01187420	8
16	3/4" GALV. LOCKWASHER		01187280	8
17	3/4" GALV. HEX. NUT		01177080	8
18	3/4" X 2 1/2" GALV H.H. BOLT		01057040	8

NOTE :-
1. MAXIMUM IMPACT LOAD DURING OPERATION :-4410 LBS. [2000 KG.] UPWARD & DOWNWARD.
2. FINISH :- ALL EXPOSED FERROUS PARTS ARE PAINTED WITH SHADE ANSI 70 GRAY.
3. CREEPAGE DISTANCE SUPPORT INSULATOR: 176 15/16" [4495 mm].
4. CREEPAGE DISTANCE INTERRUPTER INSULATOR: 142 11/16" [3625 mm].
5. HARDWARE EXPOSED TO ATMOSPHERE ARE EITHER HOT DIPPED GALVANIZED OR STAINLESS STEEL.
6. DIMENSIONS SHOWN IN "[ ]" ARE IN MILLIMETERS. OTHER DIMENSIONS ARE IN FEET AND INCHES.
7. EACH CSV CIRCUIT SWITCHER CONSISTS OF THE FOLLOWNG:
   CONTROL CABINET - QTY 1
   BASE FRAME WITH MECHANISM HOUSING ATTACHED - QTY 1
   INTERRUPTER POLES BOLTED WITH SUPPORT INSULATOR - QTY 3
   GALVANIZED MOUNTING PEDESTALS - QTY 2

TERMINAL PAD LOADING

DIRECTION OF LOAD	LOADING, LBS	LOADING, KG
IN-LINE WITH TERMINAL PADS	225	102
PERPENDICULAR TO TERMINAL PADS	169	77
VERTICAL TO TERMINAL PADS	169	77

FOUNDATION LOADINGS

LOADING PER COLUMN	
COMPRESSION	7200 lbs
TENSION	0 lbs
OVERTURNING MOMENT	26299 ft-lbs.
SHEAR	1779 lbs
LOADING PER BOLT	
COMPRESSION	8860 lbs
TENSION	6919 lbs
SHEAR	445 lbs
FOUNDATION LOADS BASED ON g=0.2, WIND=90 mph, ICE=3/4"	

Southern States
30 GEORGIA AVENUE
HAMPTON, GEORGIA 30228-2199
TELEPHONE: (770) 946-4562
FAX: (770) 946-8106

OUTLINE
CSV 170 kV 1200 AMP, 40kA CIRCUIT SWITCHER

NO.	DATE	BY	REVISION
1	4/10/13	FTA	INITIAL RELEASE ECN 23622

DRAWN	4/10/13	FTA	APPROVED CHIEF ENG.
TRACED			SHEET 1 OF 5
CHECKED	4/10/13	PVP	D-83080073 REV. 1
SCALE : 1/25	P.O.		

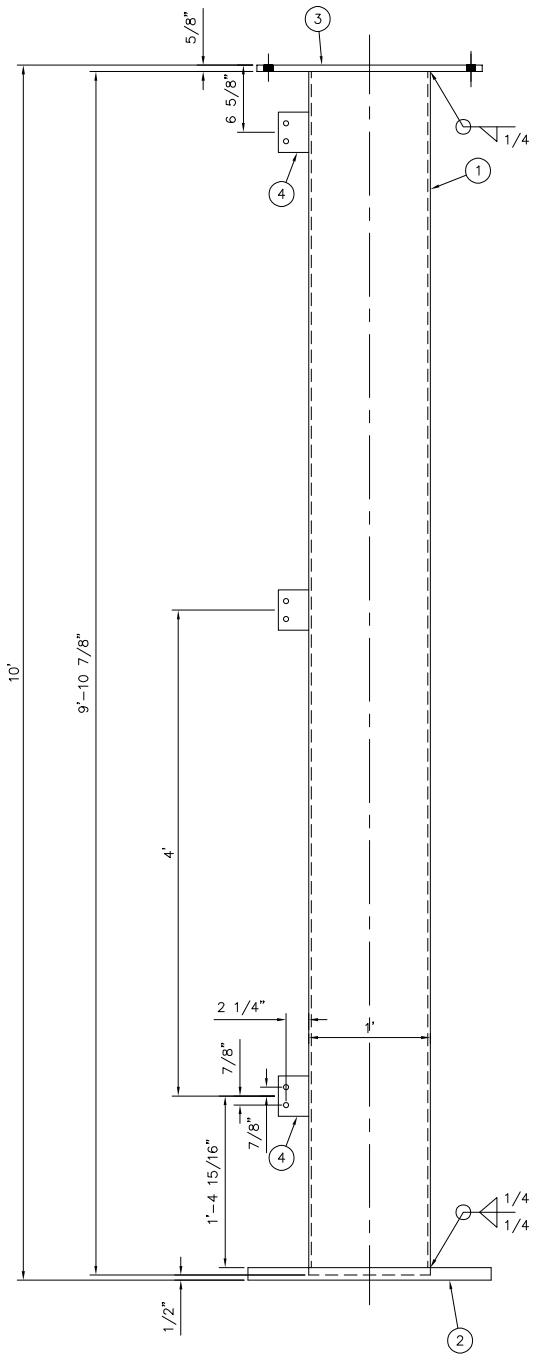
SHOP NOTES:
1. STAMP PART NO. INTO METAL PRIOR TO GALVANIZING, MINIMUM 3/8" HIGH.
2. HOLES ARE 13/16 ø UNLESS OTHERWISE NOTED.
3. SAW CUT ENDS SQUARE ±1/32".
4. REMOVE ALL BURRS AND SHARP EDGES.

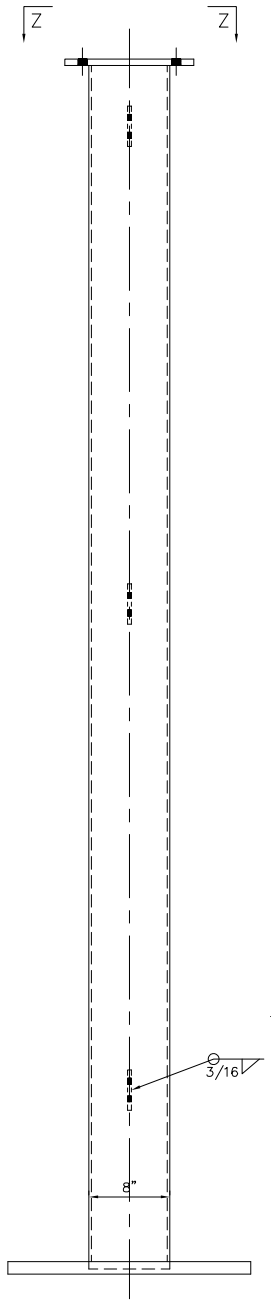
D | PRODUCT NUMBER ✓ | 27802064

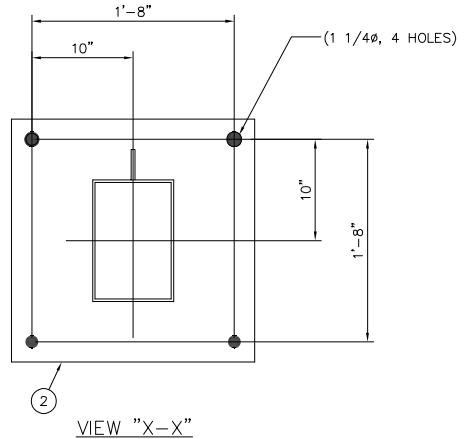
J.O. NUMBER
J.O. ITEM
SUB ITEM

BILL OF MATERIAL

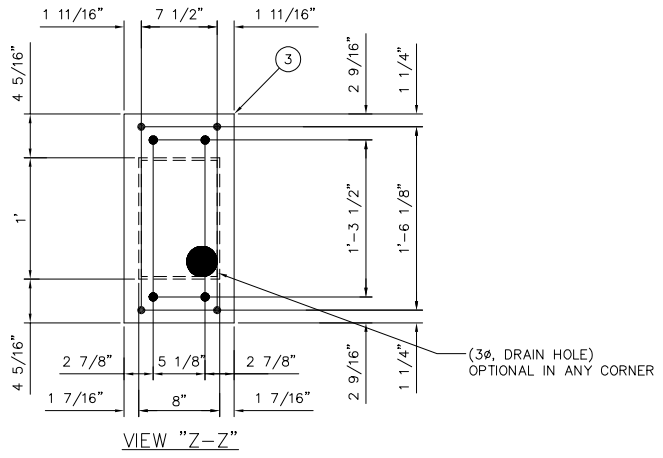
ITEM	DESCRIPTION	PCS	SWG SIZE	PART NO.	QUAN.
1	TS– 12 X 8 X 1/4 X 9'–10f	1		16369870	9.91
2	PL– 24 X 1 1/4 X 2'–0		A	01761151	1
3	PL– 10 7/8 X 5/8 X 1'–8 5/8	1		16160895	1.72
4	PL– 3 X 3/8 X 0'–4	3		16160448	1.00



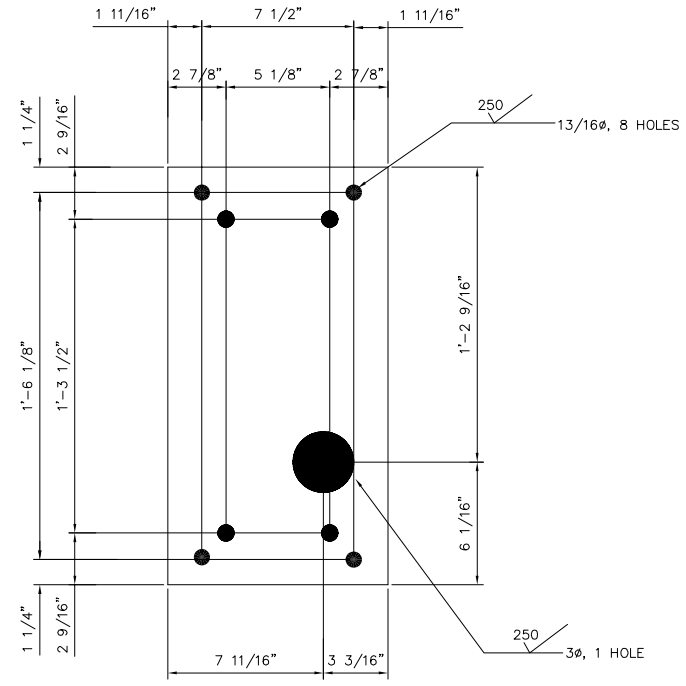




VIEW "X–X"

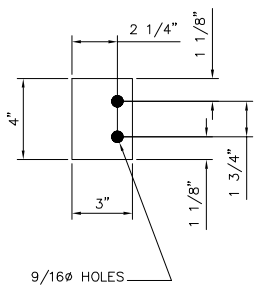


VIEW "Z–Z"



NOTE: CUT 13" SIDE OF PLATE (IT. 3) TO LENGTH OF 12 3/4".

(3)
SCALE: 1/5



(4)
SCALE: 1/5

571#

NO.	DATE	BY	REVISION
1	1/19/12	CAB	INITIAL RELEASE. ECN 23230

Southern States, LLC
30 GEORGIA AVENUE
HAMPTON, GEORGIA 30228–2199
TELEPHONE: (770) 946–4562
FAX: (770) 946–8106

COLUMN ASSY

DRAWN	1/19/12	CAB	APPROVED CHIEF ENG.
TRACED			SHEET NO. 1 OF 1 SHEETS
CHECKED			D–27802064 REV. 1
J.O.		P.O.	

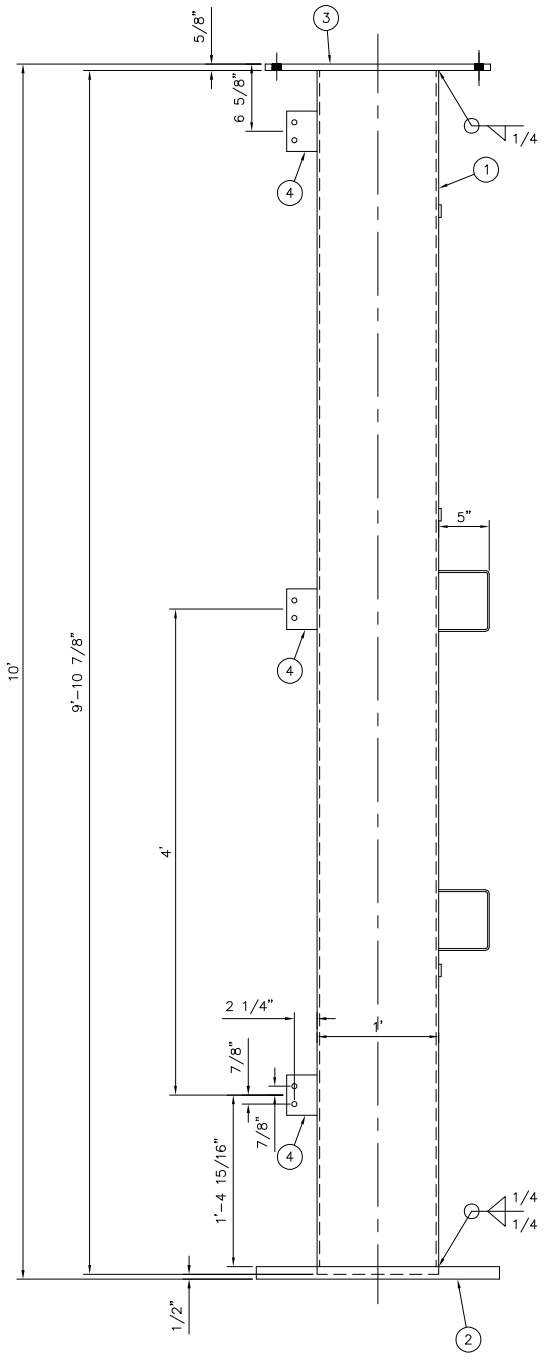
D	PRODUCT NUMBER	✓
	27801363	A

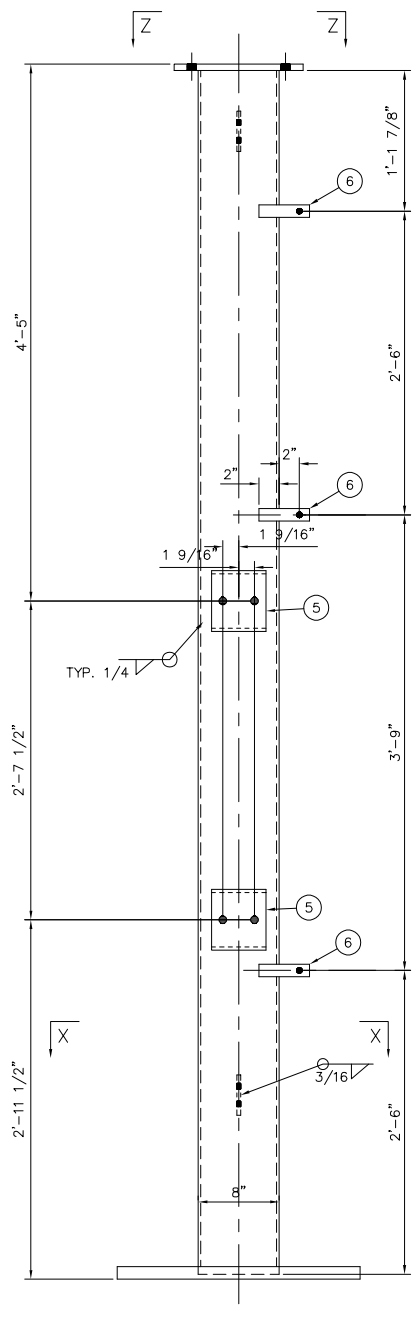
J.O. NUMBER
J.O. ITEM
SUB ITEM

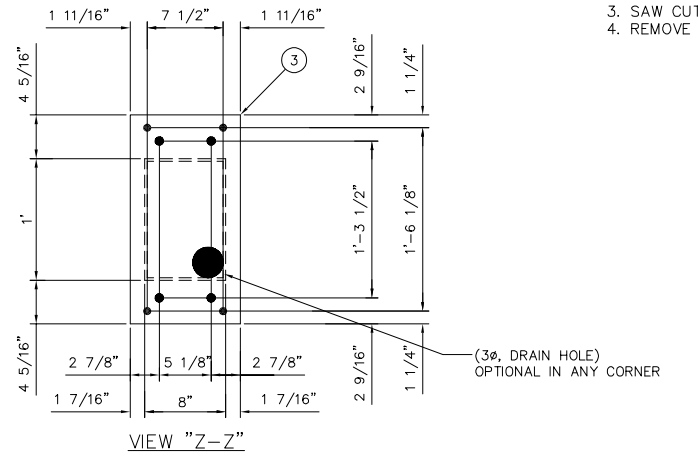
BILL OF MATERIAL

ITEM	DESCRIPTION	PCS	SWG SIZE	PART NO.	QUAN.
1	HSS– 12 X 8 X 1/4 X 9'–10f	1		16369870	9.91
2	PL– 24 X 1 1/4 X 2'–0		A	01761151	1
3	PL– 10 7/8 X 5/8 X 1'–8 5/8	1		16160895	1.72
4	PL– 3 X 3/8 X 0'–4	3		16160448	1.00
5	TS– 10 X 6 X 1/4 X 0'–5 3/8 (1 CUT MAKES 2)	1		16369881	0.45
6	PL– 1 1/4 X 1/2 X 0'–5	3		16160630	1.25

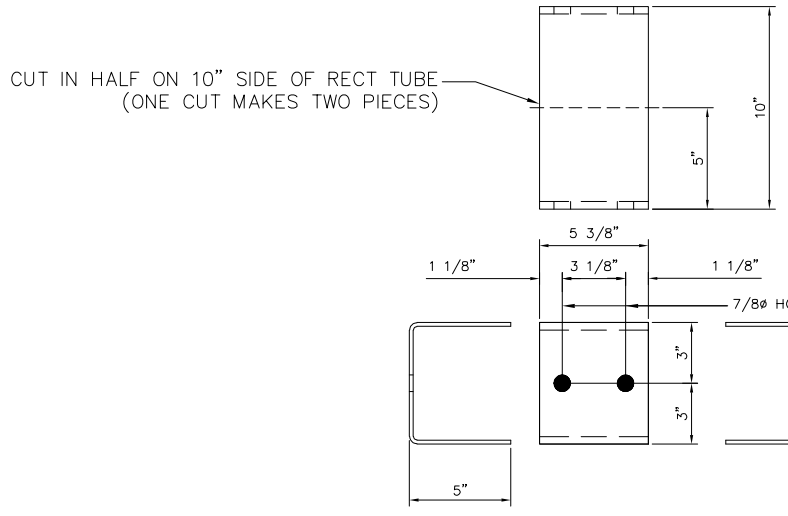
SHOP NOTES:
1. STAMP PART NO. INTO METAL PRIOR TO GALVANIZING, MINIMUM 3/8" HIGH.
2. HOLES ARE 13/16 ø UNLESS OTHERWISE NOTED.
3. SAW CUT ENDS SQUARE ±1/32".
4. REMOVE ALL BURRS AND SHARP EDGES.



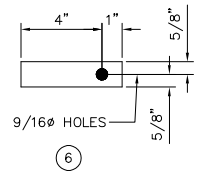




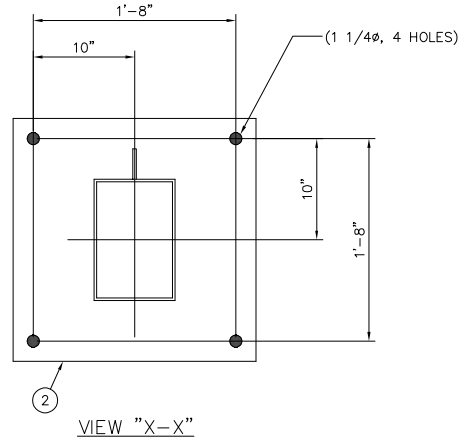
VIEW "Z–Z"



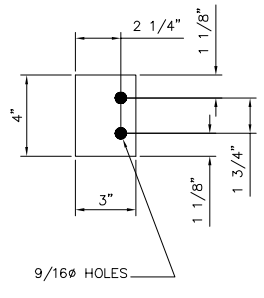
⑤
SCALE: 1/5



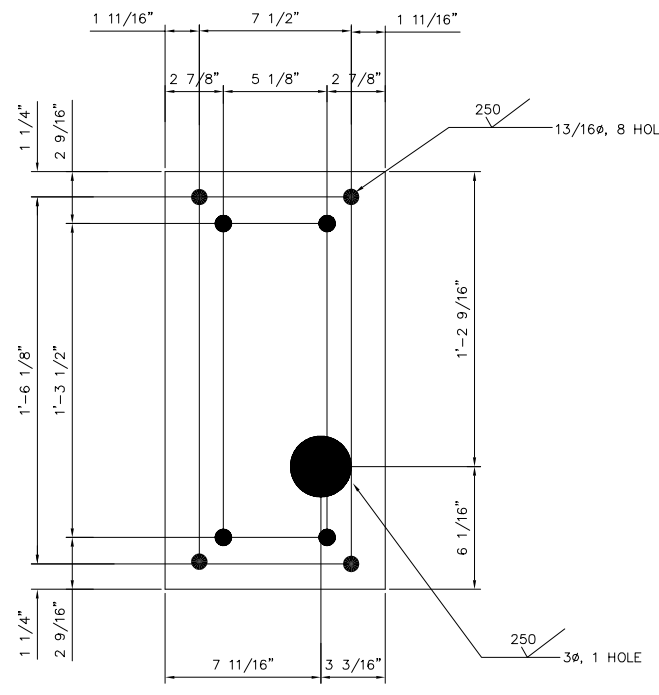
⑥
SCALE: 1/5



VIEW "X–X"



④
SCALE: 1/5



NOTE: CUT 13" SIDE OF PLATE (IT. 3) TO LENGTH OF 12 3/4".

③
SCALE: 1/5

571#

NO.	DATE	BY	REVISION
6	7/30/12	CAB	IT. 1 DESCRIPTION WAS "TS..." ECN #24348
5	8/19/11	CAB	CORRECTED QUAN. OF PCS IN IT. 4 AND ADDED IT. 6 TO ASSY.
4	12/17/09	RCL	ADDED MIDDLE GROUND PAD, ECN 19837
3	11/20/09	RCL	REVISED ITEMS, ECN 19845
2	8/25/08	RCL	REVISED LOWER GROUND PAD LOCATION AND ADDED UPPER GROUND PAD ITEM 4, REVISED ITEM 1 AND ADDED ONE REVISED LOCATIONS AND ADDED ONE ITEM 4 AS SHOWN.
1	12/28/04	CAB	INITIAL RELEASE: ECN 13207

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HAMPTON, GEORGIA 30228–2199
TELEPHONE: (770) 946–4562
FAX: (770) 946–8106

COLUMN WELDMENT

DRAWN	12/28/04	CAB	APPROVED CHIEF ENG. Neil McCord
TRACED			SHEET NO. 1 OF 1 SHEETS
CHECKED	12/28/04	CAB	REV. 6
J.O.	P.O.		D–27801363

CONTROL CABINET

DEVICE	DESCRIPTION	QTY	SOUTHERN STATES PART NO.	MANUFACTURER PART NO.
11–52	TRIP–NEUTRAL–CLOSE SWITCH	1	01491013 – 250 VDC, 16A, 3 POSITION, 45 DEG. ANGLE, 2T+2C, SPRING RETURN	SEE SOUTHERN STATES PART NO.
23SH–M	THERMOSTAT FOR CONTROL CABINET	1	01490955 – 120/240 VAC, SET AT 90°F(32°C)	STEGO CAT. NO 01140.9–00
43	LOCAL–REMOTE SWITCH	1	01490959 – 250 VDC 2 POSITION, 3L+3R	SEE SOUTHERN STATES PART NO.
52Y	ANTIPUMP CONTACTOR	1	01491133 – 125 VDC , Ith 10 A	TELEMECANIQUE CATALOG NO. CAD32GD
63GLX	CONTACTOR FOR 63GL	1	01491133 – 125 VDC , Ith 10 A	TELEMECANIQUE CATALOG NO. CAD32GD
88M	CONTACTOR FOR MOTOR	1	01491132 – 125 VDC	TELEMECANIQUE CATALOG NO. LC1D09GD
8D1	CIRCUIT BREAKER FOR TRIP CIRCUIT	1	01490960 – ~415 VAC, 16 A, 15 kA	MERLIN GERIN 24987,16A,2 POLE, C CURVE
8D2	CIRCUIT BREAKER FOR MOTOR CIRCUIT	1	01490960 – ~415 VAC, 16 A, 15 kA	MERLIN GERIN 24987,16A,2 POLE, C CURVE
8D3	CIRCUIT BREAKER FOR CLOSE CIRCUIT	1	01490960 – ~415 VAC, 16 A, 15 kA	MERLIN GERIN 24987,16A,2 POLE, C CURVE
8SH1	CIRCUIT BREAKER FOR UTILITY CIRCUIT	1	01490960 – ~415 VAC, 16 A, 15 kA	MERLIN GERIN 24987,16A,2 POLE, C CURVE
8SH2	CIRCUIT BREAKER FOR HEATER CIRCUIT	1	01490960 – ~415 VAC, 16 A, 15 kA	MERLIN GERIN 24987,16A,2 POLE, C CURVE
DOS–M	SWITCH FOR CONTROL CABINET LIGHT	1	01490173 – 120 VAC	EATON/CUTLER–HAMMER CAT. NO. 8434K2
EC	OPERATIONS COUNTER	1	01491026 – 90–270 VAC, 6 DIGITS, DIGITAL DISPLAY	SEE SOUTHERN STATES PART NO.
GFCI	DUPLEX RECEPTACLE	1	01491090 – 120 VAC, 20 A MAX	HUBBELL CAT. NO. GFR53521
GL	GREEN (OPEN) INDICATING LIGHT	1	01491113 – 48–240 VOLTS DC OR AC	SEE SOUTHERN STATES PART NO.
IL–M	CONTROL CABINET LIGHT	1	01490965 – 120 VAC, 100 W	PHILIPS CAT. NO.100A21/35
RL	RED (CLOSED) INDICATING LIGHT	1	01491112 – 48–240 VOLTS DC OR AC	SEE SOUTHERN STATES PART NO.
SH–M	SPACE HEATER FOR CONTROL CABINET	1	01491086 – 240 VAC, 160 W	CHROMALOX CAT. NO. 393–303585–018
TR2	TIMER DELAY RELAY – 1 MIN. ON DELAY	1	01491066 – 20–240 VAC/VDC	SELEC CAT. NO 800XA
TB	TERMINAL BLOCKS	10	01490507 – 600 VAC, 30 A	MARATHON CAT. NO. 1512STD
27M	LOSS OF VOLTAGE RELAYS	1	01491097 – 24–240 VAC/VDC TIMING RELAY, ON DELAY .5–10 SECONDS	SPRECHER & SCHUH CAT NO. RZ7–FSA3CU18
74A, 74B	TRIP COIL MONITOR RELAYS	2	01491073 – 24–240 VAC/VDC TIMING RELAY, OFF DELAY .15 SECONDS – 10 MINUTES	SPRECHER & SCHUH CAT NO. RZ7–FSQ3QU18

MECHANISM CABINET

DEVICE	DESCRIPTION	QTY	SOUTHERN STATES PART NO.	MANUFACTURER PART NO.
23SH–B	THERMOSTAT FOR BASE FRAME	1	01490955 – 120/240 VAC, SET AT 90°F(32°C)	STEGO CAT. NO 01140.9–00
23SH–B2	THERMOSTAT FOR DASHPOT	1	01490955 – 120/240 VAC, SET AT 32°F(0°C)	STEGO CAT. NO 01140.9–00
23SH–H	THERMOSTAT FOR MECHANISM HOUSING	1	01490955 – 120/240 VAC, SET AT 90°F(32°C)	STEGO CAT. NO 01140.9–00
52a/52b	AUXILIARY SWITCH(5NO+5NC =1STACK)	3	01491024 – 125 VDC, 15A–CONTINUOUS CURRENT, 25A–MOMENTARY CURRENT	SEE SOUTHERN STATES PART NO.
52C	CLOSE COIL ASSEMBLY	1	01491052 – 125 VDC, 24.22 OHMS, 5.2 A	SEE SOUTHERN STATES PART NO.
52T1/T2	TRIP COIL ASSEMBLY	1	01491048 – 125 VDC, 24.22 OHMS, 5.2 A	SEE SOUTHERN STATES PART NO.
63GA 63GL	LOW GAS PRESSURE ALARM LOW GAS PRESSURE LOCKOUT	3	01490957 – CONTACT RATING 30W/50 VA. MAX. 1 A FILL PRESSURE 76 PSI	SEE SOUTHERN STATES PART NO.
DOS–H	SWITCH FOR MECHANISM CABINET	1	01490173 – 120 VAC	EATON/CUTLER–HAMMER CAT. NO. 8434K2
IL–H	MECHANISM HOUSING LIGHT	1	01490965 – 120 VAC, 100 W	PHILIPS CAT. NO.100A21/35
LS	LIMIT SWITCH FOR 88M	1	01491215 – 125 VDC, 1 NO + 1NC	SEE SOUTHERN STATES PART NO.
M	MOTOR	1	01470096 – 240 VAC, 3 A , RUNNING CURRENT 3~5 AMPS	SEE SOUTHERN STATES PART NO.
SH–B1	SPACE HEATER FOR BASE FRAME	1	01491086 – 240 VAC, 160 W	CHROMALOX CAT. NO. 393–303585–018
SH–B2	SPACE HEATER FOR BASE FRAME	1	01491086 – 240 VAC, 160 W	CHROMALOX CAT. NO. 393–303585–018
SH–B3	SPACE HEATER FOR BASE FRAME	1	01491085 – 240 VAC, 80 W	CHROMALOX CAT. NO. 393–303585–017
SH–B4	SPACE HEATER FOR DASHPOT	1	01491086 – 240 VAC, 160 W	CHROMALOX CAT. NO. 393–303585–018
SH–H	SPACE HEATER FOR MECHANISM HOUSING	1	01491085 – 240 VAC, 80 W	CHROMALOX CAT. NO. 393–303585–017
TB	TERMINAL BLOCKS	6	01490507 – 600 VAC, 30 A	MARATHON CAT. NO. 1512STD

NOTES: –

1) AUXILIARY SWITCHES ARE SHOWN FOR OPEN CSV.
2) AUXILIARY CONTACTORS CONTACTS ARE SHOWN IN DE–ENERGIZED POSITION.
3) GAS PRESSURE SWITCH IS SHOWN FOR NO GAS PRESSURE.
5) ⊣⊢ ARE OPEN CONTACTS.
   ⊣/⊢ ARE CLOSED CONTACTS.
6) SIZE OF WIRE = 14 GAUGE SIS
7) COLOR OF WIRE FOR AC CIRCUIT – BLACK.
   DC CIRCUIT – GRAY.
   GROUND – GREEN.
8) STUD TYPE TERMINAL BLOCKS ARE PROVIDED.
9) CONTINUOUS CURRENT CARRYING CAPACITY OF TRIP COIL IS 50mA TO PERMIT FOR TRIP COIL MONITORING.
10) 52a CONTACTS ARE OPEN WHEN CSV IS OPEN.
11) 52b CONTACTS ARE CLOSED WHEN CSV IS OPEN.
12) "ø" TERMINAL ARE WIRED UP TO TERMINAL BLOCKS FOR REMOTE CONTROL OF CIRCUIT SWITCHER.
13) SCHEMATIC DIAGRAM ON SHEET 2.

Southern States, LLC
30 Georgia Avenue
Hampton, Georgia 30228–2199
Telephone: 770–946–4562
FAX 770–946–8106

CSV
LEGEND
125 VDC TRIP & CLOSE
240 VAC MOTOR
120 VAC UTILITY
240 VAC HEATERS

DRAWN	4/10/13	FTA	APPROVED CHIEF ENG.
TRACED			SHEET NO. 5 OF 5 SHEETS
		PVP	D–83080073
J.O.	P.O.		REV. 1

DEVICES ON CONTROL PNL

TB
TERMINAL BLOCK ROW

TB-A(1)	J3	1	
63GL-B(1)	J3	2	
TB-C(1)	J3	3	
52T1(-)	J4	4	
52a(13)	J7	5	
52C(-)	J8	6	
52a(1)	K3	7	
52b(3)	K15	8	
52a(2)	K17	9	
52a(5)	K27	10	
52a(6)	K29	11	
52a(9)	K57	12	
52a(10)	K59	13	
LS(2)	K71	14	
52a(14)	K73	15	
52b(16)	K75	16	
TB-A(2)	K77	17	
63GL-B(4)	K77	18	
TB-C(2)	K77	19	
DDS-H(1)	H3	20	
IL-H(N)	H4	21	
23SH-H(1)	H23	22	
23SH-B2(1)			
SH-H(2)	H24	23	
MOTOR(2)	M2	24	

L.H. FRONT SIDE

MOTOR(1)	M5	25	
TB-A(3)	L1	26	
63GA-B(3)	L1	27	
TB-C(3)	L1	28	
TB-A(4)	L2	29	
63GA-B(5)	L2	30	
TB-C(4)	L2	31	
52a(17)	11	32	
52a(18)	12	33	
52a(21)	13	34	
52a(22)	14	35	
52a(25)	15	36	

L.H. BACK SIDE

52a(26)	16	37
52a(29)	17	38
52a(30)	18	39
52a(33)	19	40
52a(34)	20	41
52a(37)	21	42
52a(38)	22	43
52a(41)	23	44
52a(42)	24	45
52b(19)	31	46
52b(20)	32	47
52b(23)	33	48

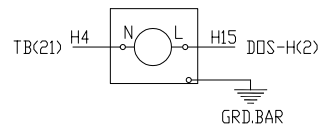
R.H. FRONT SIDE

52b(24)	34	49	52a(50)	28	61
52b(27)	35	50	52b(43)	43	62
52b(28)	36	51	52b(44)	44	63
52b(31)	37	52	52b(47)	45	64
52b(32)	38	53	52b(48)	46	65
52b(35)	39	54	SPARE		66
52b(36)	40	55	SPARE		67
52b(39)	41	56	SPARE		68
52b(40)	42	57	SPARE		69
52a(45)	25	58	SPARE		70
52a(46)	26	59	SPARE		71
52a(49)	27	60	SPARE		72

TO CONTROL CABINET

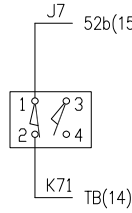
DEVICES ON MECH. HSG.

IL-H
ILLUMINATION LAMP

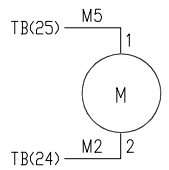


DEVICES ON MECH. FRAME

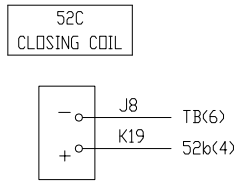
L.S.
LIMIT SW.



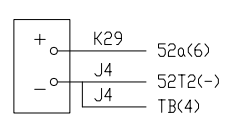
MOTOR



52C
CLOSING COIL



52T1
TRIP COIL-1



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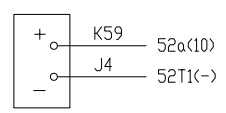
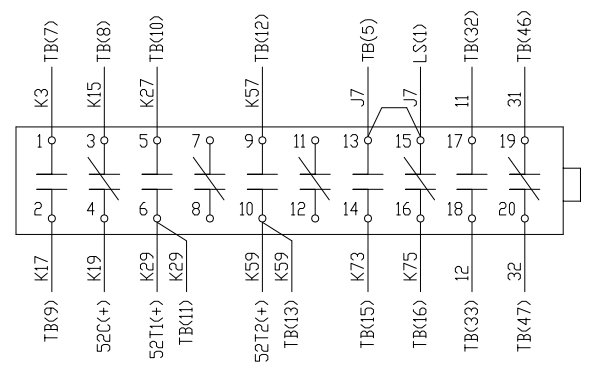
TRIP COIL-2



AUXILIARY SWITCHES

52a-52b
AUX. SWITCHES



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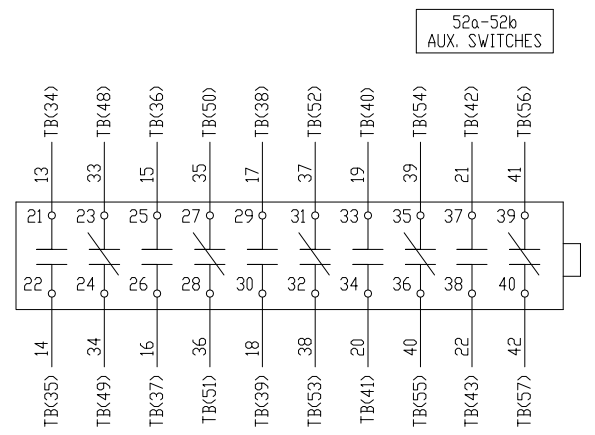
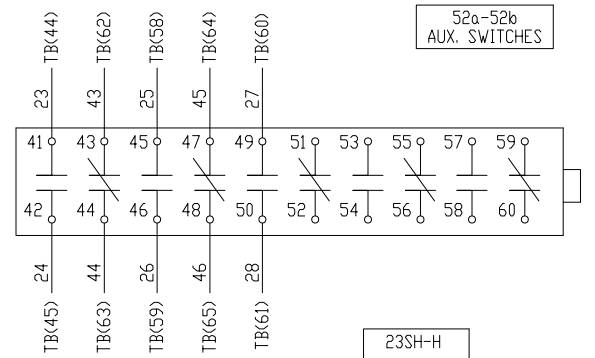
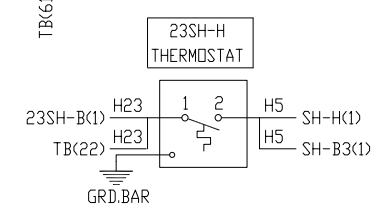
AUX. SWITCHES



52a-52b
AUX. SWITCHES

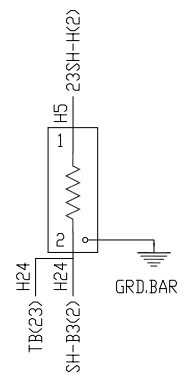


23SH-H
THERMOSTAT

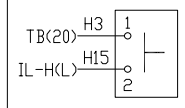


DEVICES ON MECH. HSG.

SH-H
SPACE HEATER

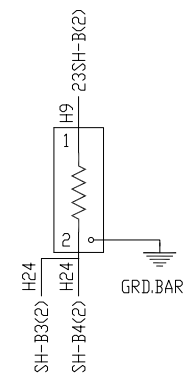


DDS-H
DOOR OP. SW.

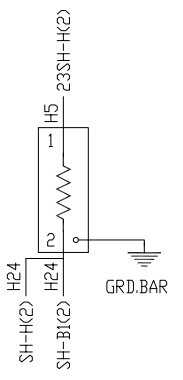


DEVICES TO BE MOUNTED IN THE BASE FRAME

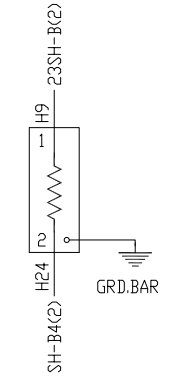
SH-B1
SPACE HEATER



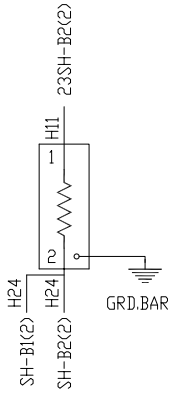
SH-B3
SPACE HEATER



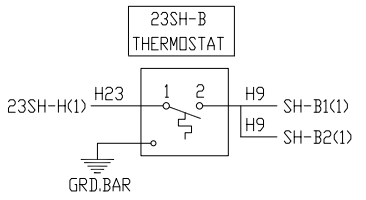
SH-B2
SPACE HEATER



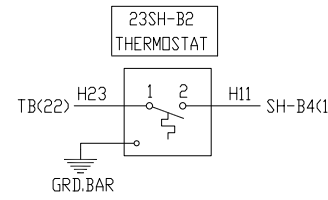
SH-B4
SPACE HEATER



23SH-B
THERMOSTAT

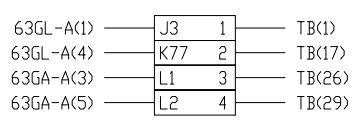


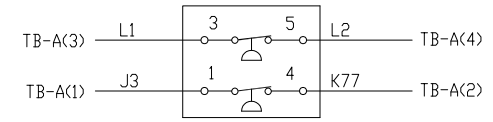
23SH-B2
THERMOSTAT



63GA/63GL - A
LOW GAS PR. ALARM/
LOW GAS PR. LOCKOUT

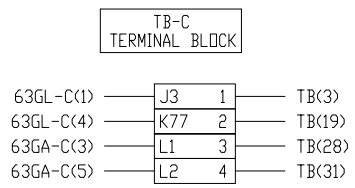
TB-A
TERMINAL BLOCK

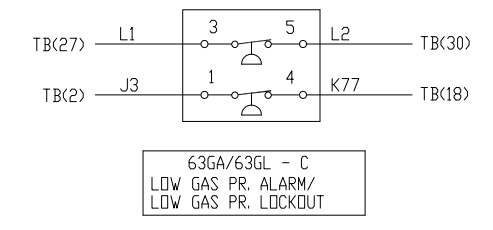




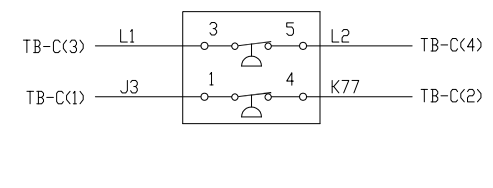
63GA/63GL - B
LOW GAS PR. ALARM/
LOW GAS PR. LOCKOUT

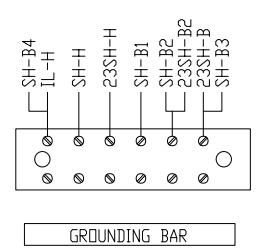
TB-C
TERMINAL BLOCK



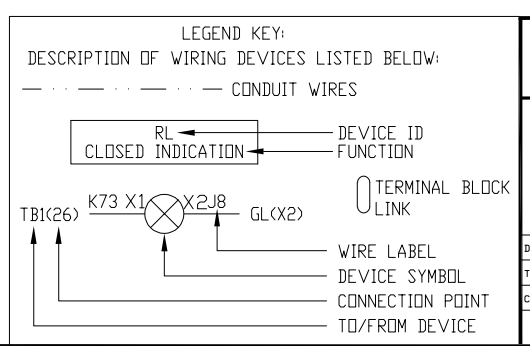


63GA/63GL - C
LOW GAS PR. ALARM/
LOW GAS PR. LOCKOUT





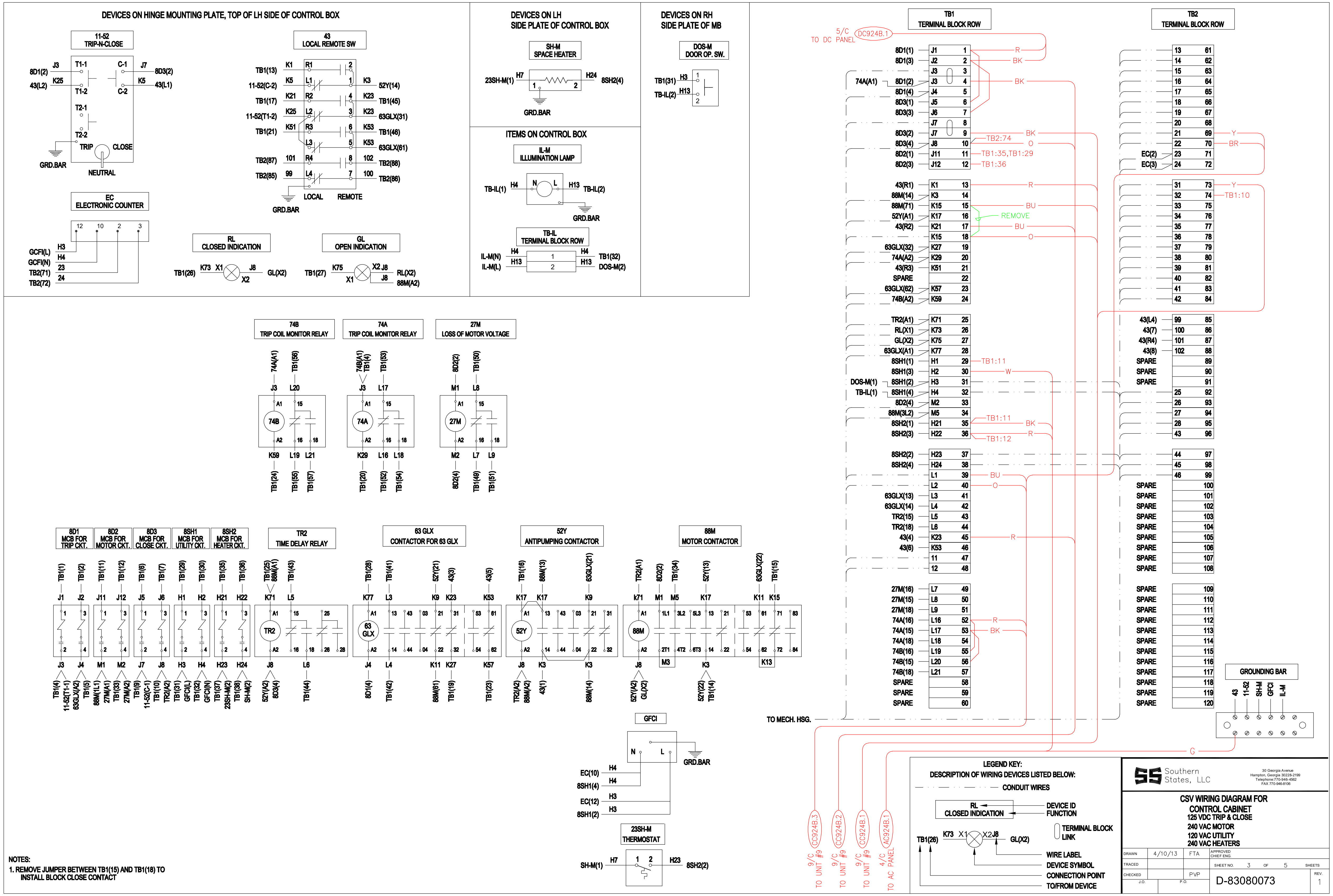
LEGEND KEY:
DESCRIPTION OF WIRING DEVICES LISTED BELOW:



Southern States, LLC
30 Georgia Avenue
Hampton, Georgia 30228-2199
Telephone:770-946-4562
FAX 770-946-8106

CSV WIRING DIAGRAM FOR
MECHANISM CABINET
125 VDC TRIP & CLOSE
240 VAC MOTOR
120 VAC UTILITY
240 VAC HEATERS

DRAWN	4/10/13	FTA	APPROVED CHIEF ENG.		
TRACED			SHEET NO. 4	OF 5	SHEETS
CHECKED		PVP	D-83080073		REV. 1
J.O.		P.O.			

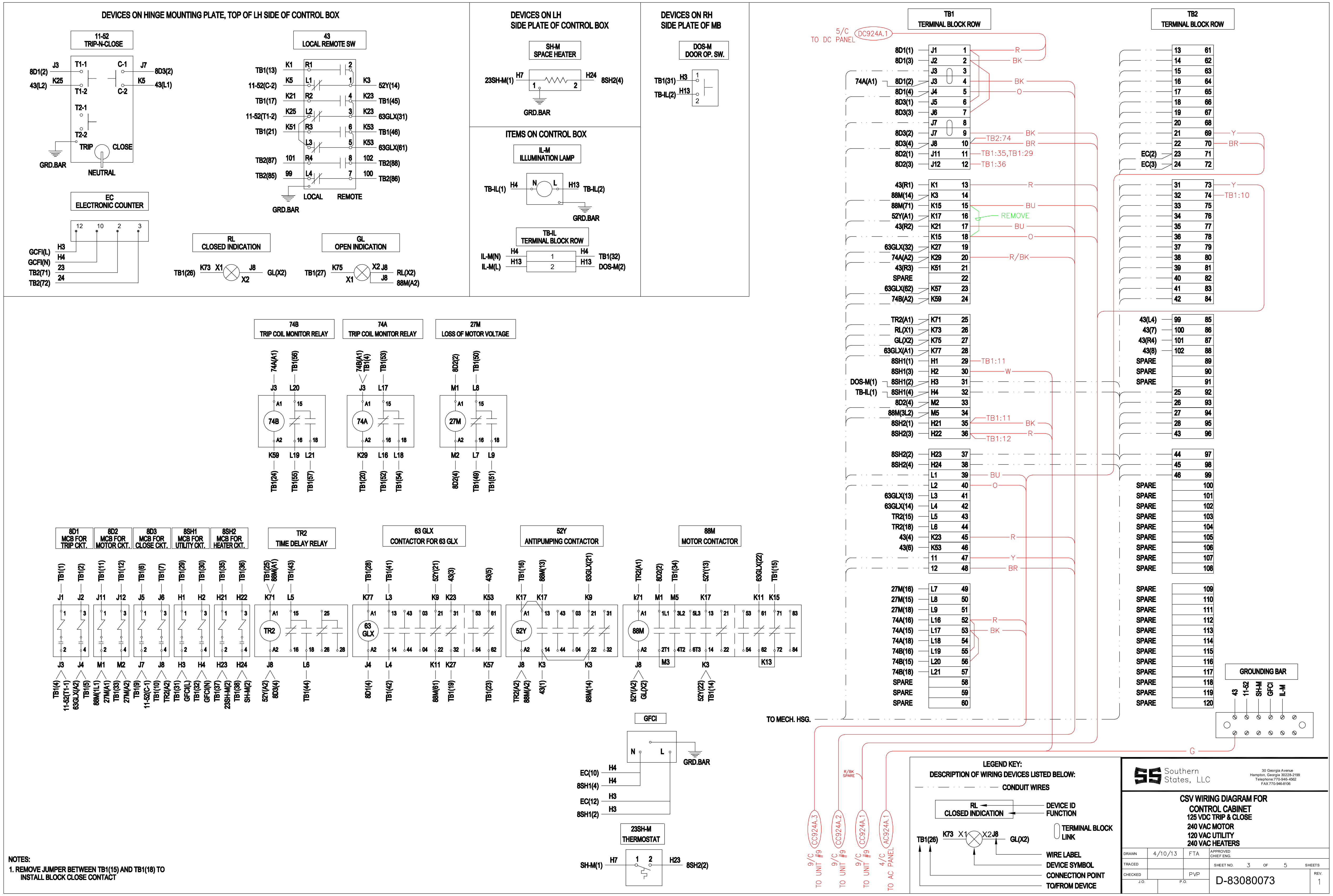


DATE	REVISION	BY
–	–	–

MTEMC

VETERANS SUBSTATION
CKT SWR 924A WIRING DIAGRAM

SCALE: NTS
PREPARED BY: AKP
DRAWN BY: A. FERREE
CHECKED BY:
APPROVED
DRAWING NO. VET-144
DATE NOV 5, 2024
SHEET 2 OF 2 SHEETS



DATE	REVISION	BY
–	–	–

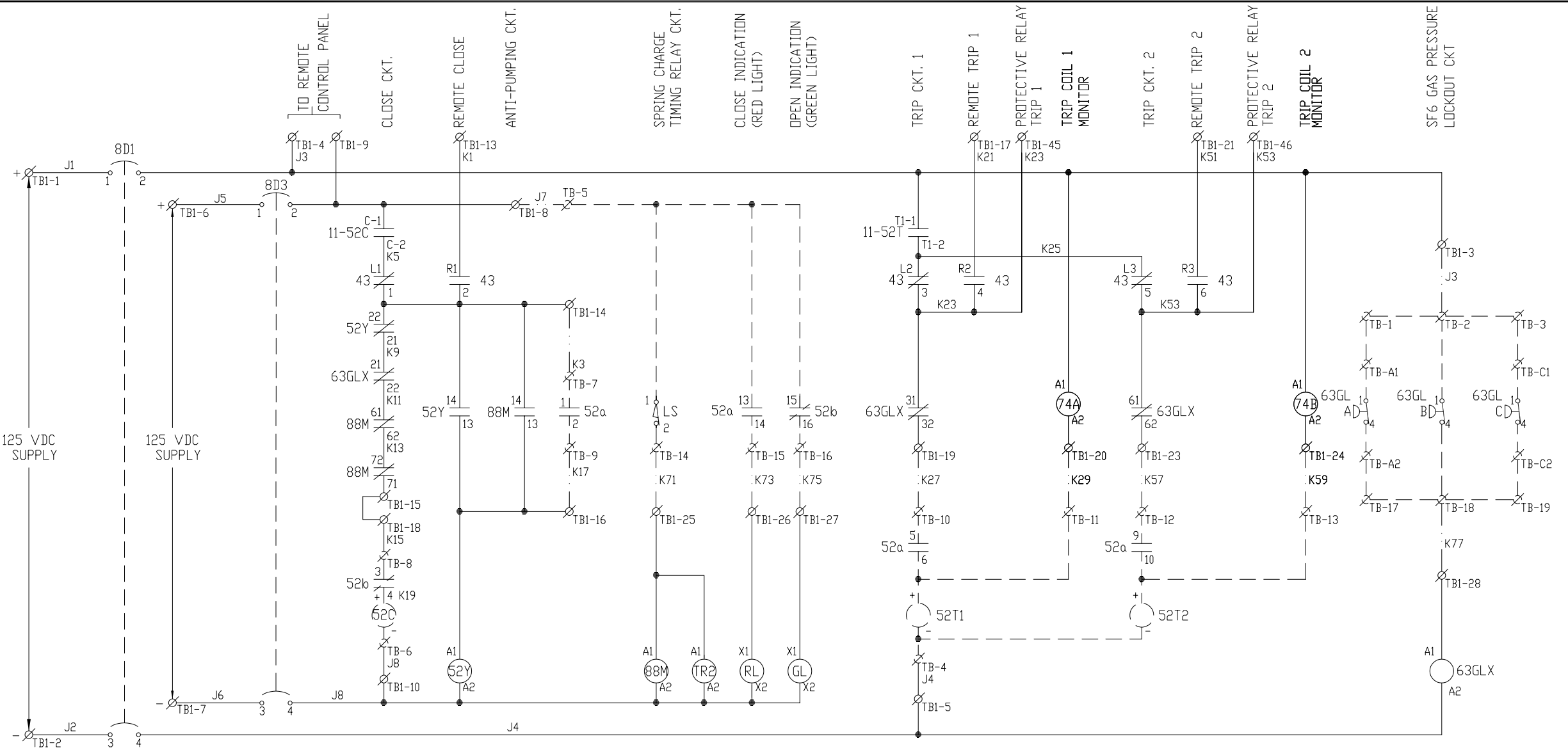
MTEMC

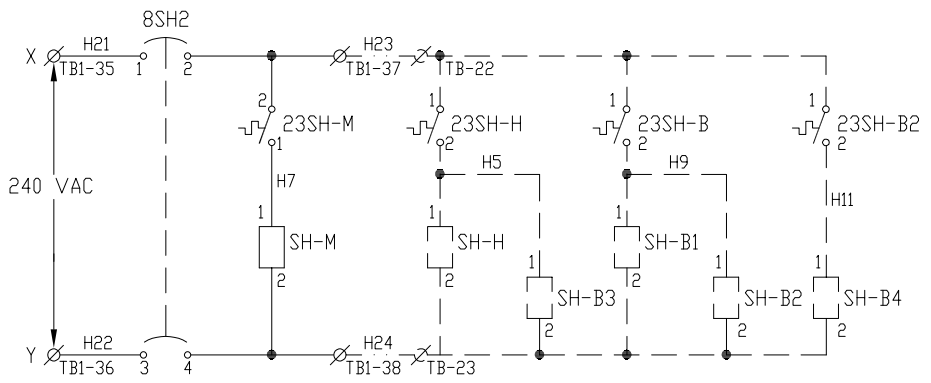
VETERANS SUBSTATION
CKT SWR 924A WIRING DIAGRAM

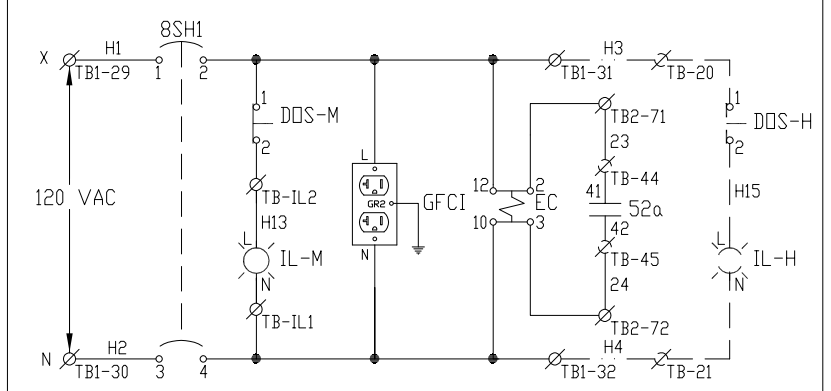
SCALE: NTS
PREPARED BY: AKF
DRAWN BY: A. FERREE
CHECKED BY:

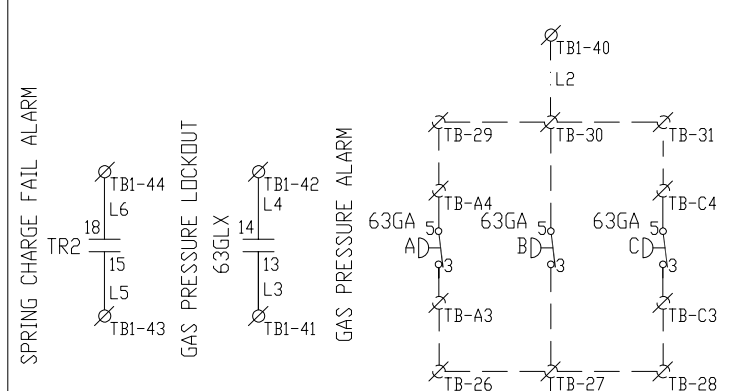
APPROVED
DRAWING NO.
VET-144

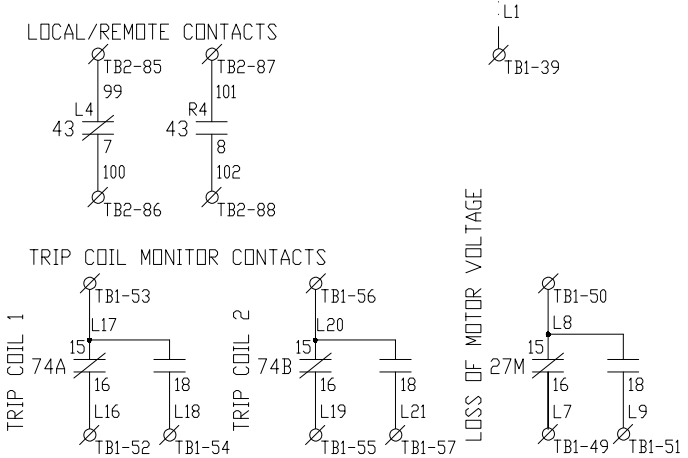
DATE NOV 5, 2024
SHEET 1 OF 2 SHEETS

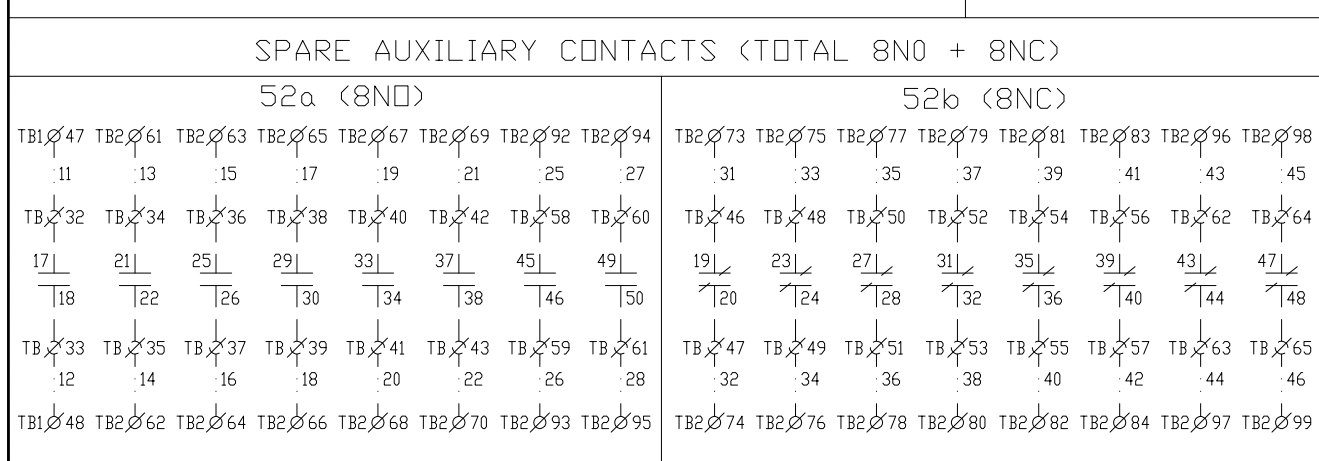


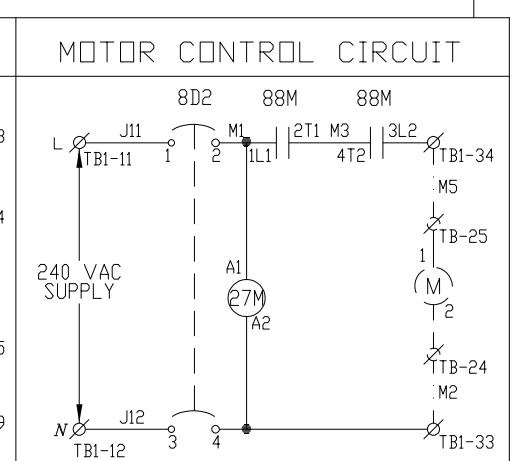












CSV LEGEND	
CONTROL CABINET COMPONENTS:	
MARK	DESCRIPTION
11-52	TRIP-NEUTRAL-CLOSE SWITCH
23SH-M	THERMOSTAT FOR CONTROL CABINET
43	LOCAL-REMOTE SWITCH
52Y	ANTIPUMP CONTACTOR
63GLX	CONTACTOR FOR 63GL
88M	CONTACTOR FOR MOTOR
8D1	CIRCUIT BREAKER FOR TRIP CIRCUIT
8D2	CIRCUIT BREAKER FOR MOTOR CIRCUIT
8D3	CIRCUIT BREAKER FOR CLOSE CIRCUIT
8SH1	CIRCUIT BREAKER FOR LIGHT & DUPLEX RECEPTACLE
8SH2	CIRCUIT BREAKER FOR HEATER
DDS-M	DOOR OPERATED SWITCH FOR CONTROL CABINET LIGHT
EC	OPERATIONS COUNTER
GFCI	DUPLEX RECEPTACLE
GL	GREEN (OPEN) INDICATING LIGHT
IL-M	CONTROL CABINET LIGHT
RL	RED (CLOSED) INDICATING LIGHT
SH-M	SPACE HEATER FOR CONTROL CABINET
TB1,TB2	TERMINAL BLOCKS
TR2	TIME DELAY RELAY - 1 MIN. ON DELAY
27M	LOSS OF MOTOR VOLTAGE MONITORING RELAY
74A	TRIP COIL 1 MONITORING RELAY
74B	TRIP COIL 2 MONITORING RELAY
MECHANISM HOUSING COMPONENTS:	
MARK	DESCRIPTION
23SH-B	THERMOSTAT FOR BASE FRAME
23SH-B2	THERMOSTAT FOR DASHPOT
23SH-H	THERMOSTAT FOR MECHANISM HOUSING
52a/52b	AUX. SWITCH (8 N.O. & 8 N.C.)
52C	CLOSE COIL
52T1/52T2	TRIP COIL 1 & 2
63GA	LOW GAS PRESSURE ALARM SWITCH
63GL	LOW GAS PRESSURE LOCKOUT SWITCH
DDS-H	DOOR OPERATED SWITCH FOR MECH. HOUSING LIGHT
IL-H	LIGHT FOR MECHANISM HOUSING
LS	LIMIT SWITCH FOR 88M
M	MOTOR
SH-B1	SPACE HEATER FOR BASE FRAME
SH-B2	SPACE HEATER FOR BASE FRAME
SH-B3	SPACE HEATER FOR BASE FRAME
SH-B4	SPACE HEATER FOR DASHPOT
SH-H	SPACE HEATER FOR MECHANISM HOUSING
TB	TERMINAL BLOCK

NOTES:
1. THIS DIAGRAM IS SHOWN IN THE FOLLOWING CONDITIONS.
   a) CSV OPEN
   b) SF6 GAS PRESSURE IS SLIGHTLY ABOVE ZERO
   c) 43 SWITCH IS IN LOCAL POSITION.
   d) CONTROL & AUXILIARY SUPPLY IS NOT APPLIED
   e) CLOSING SPRING IS DISCHARGED
2. CONTROL WIRING: 14 GA SIS
3. CIRCUIT DRAWN IN DOTTED LINE (— — —) IS IN MECHANISM HOUSING.
4. CIRCUIT DRAWN IN DOTTED LINE (— · · —) ARE CONDUIT WIRES.
5. REMOVE JUMPER BETWEEN TB1(15) AND TB1(18) TO INSTALL BLOCK CLOSE CONTACT

Southern States, LLC
30 Georgia Avenue
Hampton, Georgia 30228-2199
Telephone:770-946-4562
FAX 770-946-8106

CSV
SCHEMATIC DIAGRAM
125 VDC TRIP & CLOSE
240 VAC MOTOR
120 VAC UTILITY
240 VAC HEATERS

DRAWN	4/10/13	FTA	APPROVED CHIEF ENG.	
TRACED			SHEET NO. 2 OF 5	SHEETS
CHECKED		PVP	D-83080073	REV. 1
J.D.	P.D.			

Substation Nuts, Bolts and Washer Standards For Bolted Bus Connections

Stainless Steel

Bolts

½ “ x “length” – 13 Stainless Steel hex bolts, class 2A, ASTM 304, Alloy (18-8)

Washers

½” Stainless Steal lock washer, ASTM 304

½” Stainless Steel Belleville washer, preset, 17-7 PH alloy, 1.063 outside diameter, 0.531” inside diameter, 0.109 thickness, 0.017 internal height, 3000 pounds load/flat (Key Belleville catalogue number K1063-E-10907)

Nuts

½” x 13 UNC Class 2B hex nut, silicon bronze, full hard (in accordance with ANSI/ASME B18.2.2 as last revised)

GEOTEK

Geotek Engineering Company, Inc. • 2909 Elizabeth Street • Nashville, Tennessee 37211-2302
(615) 833-3800 • Fax (615) 833-4097

GEOTECHNICAL INVESTIGATION

Veterans Parkway Substation
Murfreesboro, Tennessee

for

Allen & Hoshall
Nashville, Tennessee

GPN: 15-6968-A
August 11, 2015

GEOTEK

Geotek Engineering Company, Inc. • 2909 Elizabeth Street • Nashville, Tennessee 37211-2302
(615) 833-3800 • Fax (615) 833-4097

August 11, 2015

Allen & Hoshall, Inc.
420 BNA Drive, Bldg. 100, Suite 208
Nashville, Tennessee 37217

ATTN: Jody Cathey

SUBJ: Geotechnical Investigation
Veterans Parkway 161-13kV Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

Dear Mr. Cathey:

Geotek Engineering Company, Inc. (Geotek) is pleased to submit the attached report documenting the geotechnical investigation for the above-referenced project. Should you have any questions or need additional information, feel free to call.

Sincerely,

GEOTEK ENGINEERING COMPANY, INC.

Kenneth L. McCurdy, P.E.
Senior Engineer

KENNETH L. McCURDY, P.E. REGISTERED ENGINEER AGRICULTURE COMMERCE NO. 20225 STATE OF TENNESSEE 8/11/15

John Rami Mishu, P.E., P.G.
Principal Engineer

KLM/ds*15-6968-A Veterans Pkwy Substation

TABLE OF CONTENTS

GEOTECHNICAL INVESTIGATION
Veterans Parkway 161-13kV Substation
Murfreesboro, Tennessee

1.0 INTRODUCTION

1.1 General

This report presents the results of our geotechnical investigation for a proposed electrical substation in Murfreesboro, Tennessee. This project site consists of approximately 1.5 acres of land located on the west side of Veterans Parkway about 150 feet north of the intersection of Veterans Parkway and Windrow Road as shown on the Site Location Map in Figure 1. The site's location on the USGS topographic map is shown in Figure 2. The proposed substation boundary is shown on an aerial photograph of the site in Figure 3. The proposed site layout is shown in Figure 4. Several photographs of the site are shown in Figures 5 and 6.

This study was authorized by Mr. Jody Cathey of Allen & Hoshall and was carried out in general accordance with our proposal letter dated June 4, 2015.

1.2 Scope of Services

The purpose of this investigation was to obtain site-specific subsurface data and to provide certain geotechnical recommendations for the proposed project. The complete scope of geotechnical services provided is comprised of the following:

- A field investigation of the subsurface soil including 21 borings and 4 test-pits.
- A field resistivity survey of the site using the Wenner 4-Probe Electrode Method.
- A reconnaissance of the site and immediate area including an evaluation of rock outcrops and topographic features.
- A review of readily available maps and other publications of the regional geology.
- Laboratory testing of samples obtained from the site.
- Recommendations for shallow and deep "drilled-shaft" foundations, including bearing and lateral capacities, and anticipated lateral deflections and settlements.
- Seismic site classification per ASCE-7 (2005), Table 20.3-1.
- Geotechnical recommendations regarding site preparation and the use of engineered fills.

2.0 METHODS OF INVESTIGATION

2.1 Field Exploration

General - The field phase of work was conducted from July 9 to 12, 2015. The field study at the site included 21 borings, 4 test-pits, and field resistivity testing. The approximate boring and test-pit locations are shown in Figure 4. The borings are numbered B-1 to B-12, with 3 offset borings numbe B-2a, B-8a, and B-12a, and P-1 to P-6. The test-pits are numbered TP-1 to TP-4.

Boring and Test-Pit Locations - The field boring and test-pit locations were staked by Geotek field personnel who measured distances and visually estimated angles from recognizable property lines and other evident landmarks. The boring and test-pit elevations were not surveyed but, for purposes of this report, were estimated from site topographic contours delineated on drawings provided by Allen & Hoshall. The boring and test-pit locations and elevations noted in this report should be considered approximate in view of the methods used.

Drill Methods - Drilling, sampling, and testing were conducted in general accordance with methods of the American Society for Testing and Materials (ASTM) or other widely accepted geotechnical engineering standards. A description of the procedures used during this exploration is provided in the following paragraphs.

The borings were drilled into the soil with a truck-mounted drill rig using 3¼-in. ID continuous-flight hollow-stem power augers in accordance with ASTM D1452.

The relative density and consistency of the *in-situ* soils were measured at discrete depth intervals in the borings by penetration tests (ASTM D1586). Standard penetration tests were performed by driving a 1.4-in. I.D., 2-in. O.D. split-barrel sampler into the undisturbed soil by means of a 140-lb weight falling 30 in. The penetration resistance (N-value) in terms of blows per foot of penetration was logged. Samples of soil recovered in the penetration spoon were placed in air-tight containers and transported to our laboratory for evaluation and testing.

After auger refusal was encountered at depths of 9.8, 1.0, and 4.2 feet in Borings B-2, B-8, and B-12, the borings were offset and Borings B-2a, B-8a, and B-12a were advanced to auger-refusal depths of 11.8, 11.3, and 13.0 feet, respectively. After auger refusal was encountered at depths of 9.9, 17.4, 7.9, and 5.5 feet in Borings B-1, B-4, B-5, and B-7, the underlying rock formation at the boring locations was then penetrated by use of NQ (nominal 1.875-in. diameter) diamond core drilling (ASTM D2113) using swivel-mounted, double-tube core barrels. Observations of drilling conditions were noted and the resulting cores were measured for length, placed in boxes, and shipped to our laboratory for logging. Logging included evaluation of rock soundness and continuity by (1) determination of percent recovery (ratio of sample length recovered to the length drilled) and (2) determination of the Rock Quality Designation (RQD), which is the ratio of sample length recovered as intact pieces, 4 in. or greater length, to the total length drilled.

The borings were backfilled with auger cuttings shortly after drilling for safety purposes. The upper 3 ft of auger cuttings were compacted, and the final ground surface was slightly mounded. Please be advised that, even with this backfill technique, there is the possibility of future borehole subsidence depending on actual subsurface conditions, surface drainage, etc. The property owner should monitor the boring locations over time to check for any subsidence and make the necessary repairs.

Test-Pits - In selected areas near borings where auger deflections indicated a sloping rock surface, four test-pits were opened using a backhoe to excavate a narrow trench approximately 2-ft wide by 32-ft long and to the required depths to observe the variation in rock depth. These open excavations were then examined by a member of our professional staff who logged the observed stratigraphy, photographed the trench, and obtained bag samples of the excavated soils. These samples were transported to our laboratory for evaluation and testing. The test-pits were subsequently backfilled in semi-compacted layers to the original surface to the extent possible. If this test-pit backfill material is exposed during construction, it might not be as stable as needed, and might require some minor stabilization.

Water-Levels - Water-level readings were taken in the borings and test-pits at the time of drilling and trenching. Groundwater levels may fluctuate due to recent rainfall, seasonal conditions, construction activity, and other site-specific factors. Since these conditions may change with time, the water-level information presented on the boring and test-pit logs represents the conditions only at the time each measurement was taken.

Boring and Test-Pit Logs - Final boring and test-pit logs are included in Appendix A of this report. Field logs, laboratory data, and visual examination of samples in our lab were used in preparation of these final logs. These logs represent only those interpretations and descriptions that can be made of the conditions encountered in the specific locations investigated at that time.

In borings which were augered to refusal but not cored, the refusal depth may indicate the presence of boulders or very cherty zones, or may demarcate the top of non-rippable weathered rock or unweathered rock. Additionally, auger-flight drilling techniques do not necessarily transmit all subsurface materials to the surface for observation. Depths to interfaces between strata that can be distinguished by auger drilling are often approximate, particularly if changes in soil horizons are gradual transitions.

Field Resistivity - Field resistivity measurements were taken along 2 traverses at the locations shown in Figure 4. The resistivity of the subsurface soils was measured at the site using the Wenner 4-Probe Electrode Method (ASTM G57). With this method, potential electrodes are centered on a traverse line between current electrodes, and an equal spacing between electrodes is maintained. For each traverse line, tests are performed with multiple electrode spacing's. The test results are included in Appendix A, Table A-2.

2.2 Laboratory Testing

General - Laboratory tests were performed on selected soil samples estimated to be representative of *in-situ* conditions. Test procedures used were in general accordance with specifications of the American Society of Testing and Materials (ASTM) and are described briefly herein. All test data are included in Tables B-1 and B-2 found in Appendix B of this report.

Classification Testing - Natural moisture content tests (ASTM D2216) were performed on most samples. The results of these tests are listed in Tables B-1 and B-2 along with descriptions of the samples.

Atterberg limits tests were performed to determine the plasticity characteristics of the soil (ASTM D4318). The soil's Plasticity Index (PI) is representative of this characteristic, and is bracketed by the Liquid Limit (LL) and the Plastic Limit (PL). Results of these tests are shown in Tables B-1 and B-2. The Atterberg Limits are primarily classification tools, but when considered in conjunction with natural moisture content, provide an indirect evaluation of soil consistency and volume-change potential.

In conjunction with the classification testing program, all soil samples were examined in our laboratory and described per ASTM D2488. If Atterberg Limits test data are available, the samples are also classified on the basis of their grain-size, texture, and plasticity in accordance with the Unified Soil Classification System (USCS). The soil descriptions are in conformance with this methodology, and the estimated group symbols (according to the USCS) are included in parentheses following the soil descriptions.

Strength Testing - Hand penetrometer tests were performed on representative portions of the cohesive soil samples. In this test, the unconfined compressive strength is estimated, to a maximum value of 4.5 tons per square foot (tsf), by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. These test results are listed in Tables B-1 and B-2.

3.0 SUBSURFACE CONDITIONS

3.1 General Geology

The site lies in the Central Basin Physiographic Province of Middle Tennessee. The Central (or Nashville) Basin is an oval-shaped topographic depression approximately located in the geographic center of the state. The terrain is gently rolling to hilly with some nearly level areas. Elevations range from 500 to 700 feet above sea level, but many isolated "knobs" rise 200 to 400 ft above the general level of the basin, most commonly along the outer part of the basin. The Central Basin was formed as a result of erosion of the gently-arched Nashville Dome and is underlain by essentially flat-lying limestones and shales. This erosion has been facilitated by the solutional removal of the calcium carbonate rock, which occurs most rapidly along rock joints. These joints also appear to have controlled the pattern of many stream segments in the Central Basin. Many areas of the Central Basin are also characterized by a lack of surface drainage and by Karst features such as caves and sinkholes. The bedrock typically weathers in-place into a cohesive "residual" soil, which caps the bedrock.

Based on the Tennessee Division of Geology's Geologic Map of the Murfreesboro Quadrangl (dated 1964), the site is mapped as being directly underlain by bedrock of the Ridley Limestone (see Figure 7). This unit consists of a medium-gray, brownish-gray, to yellowish-gray, cryptocrystalline to fine-grained-grained limestone that is medium- to thick-bedded. This formation also contains minor amounts of magnesian limestone as small irregular mottlings and thin bands and lenses of chert. The Ridley Limestone is also highly karstic with sinkholes, springs, and small caves being common. The bedrock typically weathers in-place into a clayey cohesive "residual" soil.

The soil residuum in the area typically varies from 5 to 15 ft thick. Limestone outcrops are also common in some areas. The soil overburden is largely derived from the physical and chemical weathering of the "parent" limestone bedrock. As a result of this weathering, the soil has retained some of the original structure and sub-structure of the bedrock. Typically, this consists of a very fine-grained soil matrix (clay or silt) having a complex sub-structure of boulders, chert fragments, chert beds, and occasional sand lenses.

The Rutherford County, Tennessee Soil Survey completed by the (NRCS) indicates that the site is generally underlain by soils of the Tupelo silt loam (Tu), Capshaw silt loam (CpA), and Dowellton silt loam (Do) series as shown in Figure 8. The Tupelo silt loam and Dowellton silt loam are described as being somewhat poorly drained and poorly drained, having a parent material of clayey alluvium deriv from limestone, and being located on stream terraces with an inclination from 0 to 2 percent. The Capshaw silt loam is described as being moderately-well drained, having a parent material of loess and/or clayey alluvium over clayey residuum weathered from limestone and being located on stream terraces with an inclination from 0 to 2 percent. The Tupelo silt loam is mapped over most of the site as shown in Figure 6, with the Dowellton silt loam mapped in a small area in the southwest corner of the site and the Capshaw silt loam mapped in the northeastern portion of the site.

3.2 Site Conditions

The site is shown on an aerial photograph in Figure 3. The site is bounded to the south by Windrow Road. The northern portion of the site is bounded to the east by Veterans Parkway and the southern portion is bounded to the east by an undeveloped property that extends to the northwest corner of the intersection of Veterans Parkway and Windrow Road. The site is bounded to the west by a small commercial building, and to the north by a TVA easement.

The site is gently sloping with only about 1 to 2 feet of relief, generally from east to west across the site. The ground-surface elevations in this area range from about El. 642 to 644 ft (see Figure 9).

The site currently contains a ground cover of mostly tall grasses and weeds (see Photos 1 and 2 in Figure 5). But a low area that is covered by dense woods lies just south of the TVA easement a the northwest corner of the site (see Photo 3 in Figure 6). A few bedrock outcrops were seen. A tower that supports overhead electric transmission lines is located in the TVA easement in the northern

portion of the site. These transmission lines can be seen where they cross Veterans Parkway at the northeast corner of the site in Photo 4 in Figure 6.

3.3 Subsurface Stratigraphy

General - The subsurface profile described herein is based primarily on the field and laboratory test data found in this report. Appendix A contains the individual boring and test-pit logs. Table A-1 in Appendix A lists selected data for the boring and test-pits (including depth to refusal, groundwater level, and other brief comments). Appendix B includes the laboratory test data.

The surficial soil stratum encountered in the borings and test-pits is generally a 6- to 12-in. thick topsoil layer. But note that bedrock outcrops were observed at isolated locations across the site. Thicker layers of topsoil might exist in some other areas. Borings P-1 and P-2 were drilled through asphalt pavement.

Below the topsoil, the subsurface soils encountered in the borings and test-pits are generally moderately-soft to stiff silty clays and clays with varying amounts of sand and chert, extending to widely-varying refusal-depths of 1.0 to 17.4 feet. Refusal probably occurred on bedrock, which consisted of a moderately-weathered limestone.

Soil Properties - Atterberg Limits testing yielded Liquid Limits of 28 to 62 percent and Plasticity Indices of 12 to 30 percent, indicating that the soils are clays and silty clays of moderate to high plasticity. Based on these test results, the soil can be classified to fall primarily in the following USCS groups: CL, CH, and MH. Detailed soil descriptions are provided in Tables B-1 and B-2 and the boring and test-pit logs.

The Standard Penetration Test N-values ranged from 2 to 50+ blows per foot (bpf) but more typically between 6 and 22 blows per foot, suggesting that the soil is generally to stiff in consistency. The lower N-values suggest that softer soil pockets also exist at this site. The higher N-values may be distortions of the "true" soil penetration resistance caused by chert fragments or bedrock refusal. Compressive strength values from the Index-Penetration tests ranged between 0.25 and 4.5+ tsf, indicating a soft to very-stiff consistency soil. Apparent strength values from the relationship between the Plasticity-Index and Moisture-Content reflect a moderately-soft to stiff consistency.

Refusal - Refusal was encountered in all but one of the borings and test-pits as shown in the logs and summarized in Table A-1. The refusal depths ranged from 1.0 to 17.4 feet. As illustrated in the test-pit logs, rapid changes in the depth to refusal were observed over very short distances. Similarly, the augers in several of the borings were observed to deflect out-of-plumb as noted on the boring logs and in Table A-1, presumably as the result of encountering a steeply-sloping rock surface. Based upon this subsurface information, a highly irregular, pinnacled bedrock surface containing pinnacles/mounds and crevices/lows underlies this site. Refer to the test-pit logs and photos in Appendix A for illustrations of this highly irregular bedrock surface.

The soil-bedrock interface zone might contain some occasional floaters (i.e., detached bedroc slabs and boulders) and a transitional zone of highly-weathered bedrock with soil seams. In most cases, however, the soil-bedrock contact is sharp, but the actual bedrock surface is irregular.

Auger refusal is defined as the depth below the ground surface at which a boring can no longer be advanced using the soil drilling technique because of an obstruction such as bedrock. Backhoe refusal is defined as the depth at which the backhoe can no longer deepen a narrow test-pit because of a similar obstruction. In an area of soluble bedrock (e.g., limestone), refusal can result (a) on slabs of unweathered bedrock suspended in the residual soil matrix (i.e., "floaters"), (b) on rock pinnacles rising above the surrounding bedrock surface, (c) in widened joints that may extend well below the surrounding bedrock surface, or (d) on the upper surface of continuous bedrock. Rock coring procedures are generally required to determine the character and continuity of the refusal material; and these factors must be considered when evaluating the depth to refusal.

Bedrock - The rock core samples obtained from Borings B-1, B-4, B-5, and B-7 consist of medium-gray, very fine-grained crystalline to cryptocrystalline limestone, with a few medium-coarse grained zones. The limestone contains shaley partings and irregular parting lines and is thin- to medium-bedded. The rock is generally moderately- to slightly-weathered. But an approximately 3-ft thick highly-weathered zone was encountered below the bedrock surface in one of the borings (B-4). Rock recovery ranged between 94 and 100 percent and the RQD ranged between 50 and 86 percen.. Bedding appears to be nearly horizontal.

3.4 Groundwater

Groundwater was encountered in 5 of the 25 borings and test-pits at the time of drilling/trenching, as shown in the boring and test-pit logs and summarized in Table A-1. The static groundwater level at this site, at time studied, appears to have been below the depths investigated, although perched conditions existed as evidenced by the groundwater encountered at about 20 percent of the exploration locations. The shallow perched groundwater table is probably semi-seasonal and lies at variable depths in the bedrock lows and crevices. For example, a couple of borings encountered groundwater at a 3-ft depth. Based upon our area experience, we believe that shallow groundwater activity will exist in the more porous zones within the overburden, a variable height over the soil/bedrock interface, and the rock crevices and fractures.

We emphasize that (a) cohesive soils such as found at this site are of low permeability and require a long time to yield water and (b) groundwater levels will vary depending on seasonal and climatic conditions, on construction activities, and on other site-specific factors.

3.5 Soil Resistivity

The resistivity of the subsurface soils was measured at the site using the Wenner Vertical Profiling Method (ASTM G57). Field resistivity measurements were taken along 2 traverses at the locations shown in Figure 4. Along each traverse, field resistivity measurements were taken with electrode spacings of 10, 20, 40, 60, and 80 feet. The test results are listed below and in Table A-2 of Appendix A.

Table 1 - Field Resistivity Test Results

Traverse Line	Probe Depth (inches)	Spacing, a		Reading	Multiplier	Resistance, R (ohm)	Resistivity, ρ (ohm-meters)
		(feet)	(meters)				
A	8	10	3.05	2.40	1	2.40	46.0
	8	20	6.10	2.00	1	2.00	76.6
	8	40	12.20	2.10	1	2.10	160.9
	8	60	18.29	3.25	1	3.25	373.4
	8	80	24.39	2.20	1	2.20	337.0
B	8	10	3.05	2.20	1	2.20	42.1
	8	20	6.10	1.90	1	1.90	72.8
	8	40	12.20	1.85	1	1.85	141.7
	8	60	18.29	1.90	1	1.90	218.3
	8	80	24.39	1.90	1	1.90	291.1

Please bear in mind that the field resistivity test was performed on June 19, 2015, prior to site grading. Actual resistivity at final grade might vary.

4.0 COMMENTS AND RECOMMENDATIONS

4.1 Project Information

The geotechnical comments and recommendations presented in this report are based on (a) the results of the subsurface investigation and laboratory testing program presented herein and (b) the preliminary design information provided to us by Allen & Hoshall.

An electrical substation is proposed for this site. We were provided with a preliminary general arrangement plan for the substation, prepared by Allen & Hoshall, dated May 27, 2015. This plan is shown in Figure 4. We were also provided with a preliminary grading and drainage plan dated May 26, 2015 showing the original and proposed ground-surface elevation contours (see Figure 9). Specifications for the Subsurface Investigation for the Veterans 161-13 kV Substation, also prepared by Allen & Hoshall, dated May 2015.

We understand that the planned construction will include transformers, capacitors, bus bars, switchgears, oil-containment vessels, line-support towers, etc. We also understand that a relatively low retaining wall is planned for the northwest area of the site. The project will also include a crossing of Veterans Parkway by electric transmission lines at the northeast corner of the site. This crossing might consist of underground lines constructed using some form of trenchless technology below the road.

Based on the Specifications for the Subsurface Investigation, we understand that foundations for a majority of the structures in the substation will consist of "augered pier foundations" with vertical loads ranging from 0.5 to 6 kips and moments ranging from 3 to 300 kip-ft. Some pieces of electrical equipment are planned to have shallow spread footings and "flat pad foundations" with distributed loads of 300 to 2,500 psf.

Based on our understanding of the planned substation, grading for the site development will require fill thicknesses of about 1 to 4 feet. We understand that the grading plans will require the use of a "soil" fill, as opposed to a shot-rock fill.

Our geotechnical recommendations are highly sensitive to changes in proposed structural loads, foundation location, and subgrade elevations. These assumptions should be verified and reviewed prior to the final design, and appropriate changes made in the recommendations.

4.2 Foundations

4.2.1 General

Bearing capacities and settlements have been calculated by accepted procedures assuming foundations will be designed, constructed, and monitored in accordance with the recommendations presented herein. Recommendations for both shallow-foundation and drilled-shaft foundation systems are provided.

For seismic design purposes, we recommend a "Site Class" of C be used for the structures constructed at this site. This "Site Class" is defined in ASCE-7 (2005).

The "primary" geotechnical concern related to the proposed development of the substation at this site is the highly-variable, pinnacled bedrock surface across the site. This concern is addressed in the following paragraphs.

4.2.2 Shallow Foundations

Differential-Settlement Concerns - We expect that some of the footing excavations that extend below the existing ground-surface levels are likely to expose a footing subgrade that consists of a combination of soil and bedrock. Please refer to Photo 2 in Figure 5 and the logs of Borings B-8, P-5, TP-1, TP-2, TP-3, and TP-4 for instances of borings and test-pits encountering shallow bedrock. Similar conditions could also be encountered most anywhere on the site. These conditions can result in excessive differential (or rotational) settlement where a portion of the footing would bear on soil and a

portion would bear directly on bedrock, even at relatively light loads. Consequently, we recommend that (a) footing subgrade testing during construction include probing and/or augering to a depth of 12 inches below the planned bottom-of-footing and (b) some "subgrade modification" be made where rock is encountered to reduce this differential settlement potential. One of the more practical modifications would involve undercutting the soil to expose bedrock beneath the entire footing and then backfilling the undercut zone with concrete fill (min. f'_c=1,200 psi). Other options where the bedrock is deep include dowelling the concrete fill into the bedrock, installing micropiles, or widening the footing considerably to span over a larger area. The actual recommendation should be made in the field by the geotechnical engineer depending on actual conditions encountered. We recommend that provisions be made in the plans and specifications to allow for such modifications.

Design Parameters - For the proposed substation's structures and equipment, shallow foundation systems consisting of (a) conventional spread and/or continuous footings and (b) mat foundations are suitable. These shallow foundations should be designed using a maximum allowable bearing pressure of 1,500 psf. A safety factor of 3.0 has been used in this allowable bearing value. This relatively low bearing capacity is the result of the potentially non-uniform bearing material of soil and bedrock.

We recommend that all footings and mat-foundations be founded on stiff natural soils and/or stiff well-compacted soil fill, as described in this report. Mat foundations should be designed using a Modulus of Subgrade Reaction (k_s) of 50 pci. The maximum anticipated total settlement for the shallow spread-footings and mat-foundations is 1 inch.

Shear loads should be resisted by sliding friction on the between the bottom of the footing and underlying soil. A coefficient of friction of 0.35 is recommended for evaluating ultimate sliding resistance. We then recommend that a factor of safety of 2 be applied to the ultimate value to determine the allowable sliding resistance. If additional resistance is required, we recommend using a maximum ultimate passive resistance of 2,000 psf for that portion of the footing face that extends deeper than 2 ft below the adjacent grade. We recommend that any lateral resistance provided by the upper 2 feet of the surrounding earth be ignored in computing passive resistance for the foundation. We recommend that a minimum factor of safety of 2 also be applied to the lateral resistance computed in this manner.

Uplift loads should be resisted by the weight of the foundation and any overlying backfill above the foundation. For soil fill used above the foundation, we recommend using a maximum unit weight of 120 pcf. The unit weight of the backfill material to be used over the foundation must be greater than or equal to the unit weight assumed for design, if needed to resist uplift. We recommend that a factor of safety of at least 1.5 be applied to the resistance provided by the weight of the foundation and fill directly above the foundation.

Foundation Subgrade - Prior to placement of concrete, all foundation subgrade bearing area should be clean and free of loose soil, debris, and ponded water. The foundation excavations should be observed by the geotechnical engineer responsible for design to confirm that conditions appear to reasonably comply with assumed design parameters. Monitoring should include hand-probing or augering, density tests, hand-operated static or dynamic cone penetrometer tests, or other methods as deemed appropriate by the geotechnical engineer. Any rock encountered within 12 inches of the planned bottom-of-footing should be addressed as recommended above. Any soft zones encountered should be undercut and replaced with select fill materials as directed.

Exposure of the foundation subgrade to ponded water for even short periods can weaken the soils and measurably increase settlements. We therefore recommend that concrete be placed immediately after footing excavation where practical. Otherwise, some undercutting or mud-matting with lean concrete (min. 800 psi) may be needed to protect or repair the subgrade prior to footing construction.

Any significant crevices exposed at the rock surface in the foundation excavations should be sealed with concrete prior to placing fill. Hoe-ramming or minor blasting may be required to remove bedrock, loose boulders, and weathered rock slabs.

Sinkholes - If sinkholes are encountered during foundation construction, repairs will have to b made, the specifics of which should be determined on a case-by-case basis by the geotechnical engineer. In general, we expect that sinkhole repair will involve machine-excavation of any soft soil to expose bedrock around the opening and then backfilling the excavation with concrete and/or large boulders to form a "plug" above the solution feature.

Footing Dimensions - To reduce the potential for local shear failure and to help bridge any local, unrecognized soft zones, minimum width of continuous footings should be 36 inches and minimum plan dimension of isolated footings should be 48 inches. Minimum depth of exterior footings should be 24 inches to provide bearing below the zone of most active frost heave and seasonal soil volume-change. Interior footings seated on subgrade not subject to freezing or severe drying during construction can be founded at nominal depths.

4.2.3 Drilled-Shaft Foundations

If deep foundations are preferred for some structures or equipment, they should consist of drilled shafts that bear on either stiff native soils or bedrock, but not a combination of the two. Because of the steeply-sloping pinnacled bedrock surface, some shafts that encounter bedrock might have to be continued deeper than where the bedrock surface is first encountered (at rock-drilling prices) in order to exposed bedrock across the entire bottom of the shaft. Furthermore, maintaining a plumb shaft duri drilling could be difficult to achieve because of the sloping rock surface as experienced in a number of

our borings (see Borings B-2, B-3, B-11, B-12, P-2, and P-5). Similar sloping rock surface could be encountered at many random locations across the site. If used, the drilled shafts can be designed using the geotechnical parameters listed in below in Table 1.

Table 1 - Recommended Geotechnical Parameters for Drilled-Shaft Foundations

Layer	Total Unit Wt (pcf)	Undrained Shear-Strength (psf)	Horizontal Subgrade Modulus (pci)	Allowable Tip End-Bearing Capacity (psf)
Soil (0 to 3 ft)	120	0	0	0
Soil & New Fill (3 ft to bedrock)	120	1,500	500	4,000 (below 8-ft depth)
Competent Bedrock	150	6,000	1,500	40,000 (w/ socket and probe) 8,000 (w/o socket and probe)

Notes: 1. Soil layer includes stiff natural soil, new soil fill, and highly-weathered bedrock.
2. Bedrock implies "competent" limestone without highly-weathered zones, seams, or voids.

The minimum drilled-shaft depth is 8 feet, even if competent shallower bedrock exists. This recommendation will have implications across this site because the depth to bedrock is shallower than 8 feet at many locations, requiring removal of bedrock to construct the drilled-shaft. And in some areas, the bedrock might also be highly irregular, have a steeply-sloping surface, contain deeper crevices, or have a thick highly-weathered zone.

Some additional geotechnical design recommendations for the drilled-shaft foundation option are listed below:

1. Minimum drilled-shaft diameter is 30 inches.
2. Minimum spacing between drilled shafts is twice their diameter.
3. Minimum rock-socket embedment to use the "competent bedrock" design parameters is 2 feet, to be determined via test probes.
4. Upper 3 feet of drilled shaft, whether in soil or bedrock, will provide no lateral strength resistance.
5. Predicted vertical settlement in soil (as defined above) is less than 1 inch, and in competent bedrock is negligible.
6. Lateral deflection should be based on the horizontal Modulus-of-Subgrade Reaction.

The drilling operations should be continuously monitored by the geotechnical engineer in order to (1) assist in the evaluation of any unusually subsurface conditions encountered that could affect the integrity of any completed drilled-shaft, (2) provide data for specifying any special treatment that might be needed during concreting operations, and (3) provide logs to be used for pay quantity determinations and as-built documentation.

The shafts may need to be cased through the soil prior to drilling into bedrock. Proper placem may occasionally require that some casings be left in the ground permanently.

The bottom of each drilled shaft should be cleared and then observed by the geotechnical engineer to help select the bearing elevation. For drilled shafts designed for the higher "competent bedrock" capacities, the rock socket should be checked for its soundness by direct inspection and by testing of a 6-ft deep, 2-in. dia. test-hole drilled through the bottom surface of the drilled shaft. Any soft soil seams or other highly-weathered zones might require the drilled pier be deepened. Judgment must be made individually as to the acceptability of such unsuitable features depending on their characteristics and depending on the depth already drilled at a specific pier location. Given the possible presence of soft soil zones near the bedrock surface, deep weathered zones in the bedrock, and a soluble bedrock that can produce voids and soil seams, a portion of the drilled shafts should be expected to require deepening below their planned bottom (tip) elevations.

The placement of steel reinforcing and concrete should also be continuously monitored. Water inflow into the drilled shaft is not acceptable during concrete placement, and concrete should never be dropped through more than one or two inches of standing water. If there is any evidence of soil or water intrusion during drilled shaft construction, the contaminated portion should be removed before concrete placement. The completed drilled shaft may then need to be approved by core drilling throu-h any questionable intervals of concrete.

4.3 Retaining Walls and Below-Grade Walls

Design Parameters - We understand that a retaining wall is proposed in the northwest portion of the site, near the location of Boring P-4. This wall and any other walls which will be required to function as earthen retaining structures (including any below-grade pit/containment walls) should be designed to resist lateral earth pressures. An equivalent fluid load of 40 pcf should be used in the calculation of lateral pressures for unrestrained walls and 50 pcf for restrained walls. These loads correspond with a horizontal back-slope and the use of approved granular backfill materials in accordance with the configuration shown in Figure 7 and the construction procedures described herein.

The wall foundation at the location of P-4 should be designed for an allowable bearing pressure (at the toe) of 2,000 psf. The factor of safety against overturning and sliding should be a minimum of 2.0. Resistance to shear loads should be evaluated as recommended for shallow foundations in Section 4.2.2. And the wall foundation subgrade should also be prepared, monitored, and modified, if needed, as described in Section 4.2.2.

Surcharge conditions from vehicles, material storage, etc. may vary with time and may be greatest during construction operations. Inclined back-slopes will impose additional lateral pressure on the walls, which should also be considered by the designer.

Wall Backfill - As illustrated in Figure 10, the retaining wall and any other below-grade walls should include a perimeter drainage system that freely drains all infiltrating groundwater from behind the wall. Otherwise groundwater forces, hydraulic uplift, and seepage into subgrade spaces should be taken into consideration. The perimeter drainage system may consist of a 4-in. perforated pipe located around the perimeter (at the bottom of the wall) and below any below-grade slab level. The granular bedding beneath the below-grade slab should also be provided with suitable drainage outlets. The space behind the wall should be backfilled with an approved granular fill up to a level approximately 2 ft below the final outside grade. The backfill should be a clean, uniform gravel having a gradation compatible with the size of openings used in the drain lines and surrounding soils. The remaining 2 ft should consist of a low permeability "clayey" soil to reduce the amount of surface water handled by the drainage system. The gravel/soil interface should be protected by placement of a layer of filter fabric. The ground surface should also be back-sloped away from the wall area to further minimize ponding and infiltration of water.

Care should be taken not to overcompact the backfill immediately adjacent to the walls. No heavy equipment should be operated within 5 ft of a completed wall. Hand-tampers should be used to compact soil in this zone. Clean uniform gravel requires less compactive effort as compared to soil or densely-graded aggregate.

The design and construction of the below-grade drainage system are critical. Failure of this system during a temporary rise in the water table could result in seepage into the below-grade area, excess lateral loads on walls, and uplift pressures on slabs.

4.4 Earthwork

General - We recommend that all construction operations dealing with earthwork and foundations be observed by experienced geotechnical engineering personnel from our office to verify that the design requirements are fulfilled in the actual construction and to make on-site recommendations to minimize delays. Please also read "Field Observation - A Message to Clients" found in Appendix C of this report.

Site Preparation - Positive site drainage should be established as the first order of work and should be maintained at all times during and after construction to minimize accumulations of water, particularly within footing excavations.

Any existing uncontrolled fill, topsoil, and other soft or otherwise unsuitable materials should be removed from areas within construction limits. All organic matter, roots, stumps, and other remnants of the vegetation should be removed. Areas disturbed by tree- and stump-removal should be undercut to suitable undisturbed soils and backfilled with properly compacted fill.

The stripped areas should be proof-rolled under the direct observation of our geotechnical engineering personnel during construction in order to aid in locating objectionable materials. Proof-rolling is best achieved during reasonably dry weather using a loaded rubber-tire dump truck or similar approved vehicle traversing the site in two perpendicular directions. The unsuitable zones should then be replaced with approved fill materials as described in this report.

Near-surface soft soil will be encountered in some portions of the site, especially in low-lying or poorly-drained areas. Deeper pockets of soft soil might also be encountered in some portions of the site, especially near the soil-bedrock contact where higher moisture contents often exist. Undercuts to remove these pockets of soft soil should be anticipated at this site.

Soil Fill - Where new soil fill is required to reach the design subgrade elevations, we recommend the use of an approved soil with acceptable plasticity (USCS = CL), and free of organics and debris. This material should be placed in 7- to 8-in. thick loose lifts and then compacted to a maximum 6-in. thickness with a minimum of 95 percent of the Standard Proctor maximum dry density (ASTM D698) and to within ±3 percent of optimum moisture.

Reduced lift thicknesses may be required for compaction using hand-operated tampers or for "crusher run" stone fills. These compaction recommendations should apply to all miscellaneous backfill (e.g., in utility trenches, overlying footings, etc.). Fill pads should be constructed so that the compac surface extends horizontally beyond the footings' outer edges at least 10 feet and beyond pavement and walks at least 5 feet.

At least one density test should be performed per 10,000 sq ft of soil fill placed and per 6-in. compacted lift. More frequent test intervals should be used in smaller areas including wall backfill areas and in trench backfill areas beneath structures and pavements.

We advise against performing soil compaction in the wet-weather seasons of winter and spring. Earthwork is usually very difficult to perform in this area during these seasons.

Soil Cuts - Where soil cuts are made to grade, the exposed cut surfaces should be scarified as needed to control moisture, and the upper 6 in. of soil compacted to the same specifications as the fill. Moisture control may require drying by disking or wetting with sprinklers. Where the finished subgrade in cut and/or fill areas has been exposed to weather and traffic for any significant period of time, the soil surface should be retested and, where needed, should be recompacted before proceeding with construction.

Subgrade Stabilization - Some isolated areas of soft soil could be encountered. These soils should be removed and replaced with compacted fill. Should suitable soil strata not be encountered to reasonable excavation depths, or should excavation or backfilling difficulties ensue, we typically recommend that large-diameter crushed stone materials (e.g., shot-rock fill) be used to stabilize the

ground and improve subgrade conditions. Actual conditions encountered will dictate the recommendations made in the field by our on-site geotechnical engineering representative.

Miscellaneous - Foundation and utility-line installation, weather, and other construction activities can disturb the subgrade between the time of completion of grading and the beginning of slab (or pavement) construction. For this reason, our geotechnical engineer should re-evaluate the subgrade immediately prior to placing the base material.

Borrow Soils - Most of the *in-situ* soils are suitable for selective use as borrow in construction of engineered fill. The natural moisture contents of most of the residual soil horizons are generally above optimum moisture. Hence, these soils may be difficult to use during "wet weather" periods. Drying of these soils will be required in order to meet compaction recommendations. Additionally, the use of imported fill, such as crushed stone, should be considered during inclement weather conditions depending on construction plans. Under wet conditions, the materials may become badly disturbed by the action of the construction equipment and could require undercutting and replacement with select fill.

High-Plasticity Soil Treatment - Soils of high plasticity (i.e., Liquid Limit > 50) should not be allowed to exist (un-treated) directly below foundations and slabs in either fill or cut areas. Acceptable subgrade improvement techniques can include, for example excavation to a 12-in. depth and replacement with suitable fill.

Sinkholes - The probability of sinkholes forming at this site is "low", as opposed to "remote" or "high". The site is underlain by soluble bedrock that can, in theory, produce sinkhole-related ground subsidence. The possibility of property damage due to sinkholes is an unquantifiable risk that the owner must assume. Based on our local experience and the available subsurface data, it is our opinion that the risk of sinkhole development at this site is no greater than the low risk at other similar sites in the area.

If sinkholes are encountered during site grading or foundation construction, repairs will have to be made, the specifics of which should be determined on a case-by-case basis by the geotechnical engineer. In general, we expect that sinkhole repair will involve machine-excavation of any soft soil to expose bedrock around the opening and then backfilling the excavation with concrete and/or large boulders to form a "plug" above the solution feature.

Drainage - We reiterate that proper drainage should be provided on the site at all times. Soil softened by perched water must be undercut and replaced with compacted fill materials. Increased water activity should be anticipated during rainy seasons, and some groundwater infiltration into excavations should therefore be expected. In wet-weather periods, groundwater is also likely to perch over the bedrock surface. Foundation construction and excavations at (or near) the bedrock surface are more likely to encounter this perched groundwater table. The water can probably be removed

using gravity drainage or sump-pump techniques. We recommend that groundwater levels be verified just prior to construction.

Excavations and Temporary Slopes - 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 regulations. Specifically, the current OSHA Health and Safety Standards for Excavations (29 CFR Part 1926) should be followed. It is our understanding that these regulations are being strictly enforced.

The temporary stability of all earthen (soil and rock) sideslopes and trenches should be the responsibility of the contractor. For example, temporary slopes in soil may require inclinations of 1(H):1(V) or flatter. Bracing and shoring systems may also be necessary. We would be happy to assist with the design of such earth retention systems or to evaluate temporary slope stability.

Slope Stability - For compacted soil fill, a maximum slope inclination of 3.0(H):1.0(V) is recommended. Stiff natural soils (i.e., cut slopes) should be no steeper than 3.0(H):1.0(V). Some regular slope maintenance should be anticipated. Erosion can be reduced by diverting surface runoff from the slopes and by providing an adequate vegetative cover (for soil slopes) as soon as possible.

Earthwork for construction of the slopes (including fill compaction) should follow all of the same recommendations described elsewhere in this report. This includes (but is not limited to) our recommendation that fill placement begin at the deepest level, and proceed up in horizontal lifts. The outer wedge of all fill slopes should be constructed of high-quality fill that is compacted as well as (or better than) the other fill.

4.5 Veterans Parkway Crossing

We understand that the planned crossing of Veterans Parkway by electric transmission lines will be in the vicinity of Borings P-1, P-2, and P-3 at the northeast corner of the site. Although the auger-refusal depths in these 3 borings ranged from 8.8 to 13.0 ft, Boring P-2 encountered rock (possibly a bedrock pinnacle) between the depths of 5.5 and 7 ft that caused the boring to deflect out-of-plumb. Furthermore, we anticipate that the extreme variability in the bedrock surface over short distances seen at other locations in the site are equally likely to occur along the line of this crossing. For this reason, we anticipate that constructing this crossing using some form of trenchless technology would likely experience significant difficulties associated with encountering steeply-sloping bedrock pinnacles and a variable bedrock-surface depth.

5.0 GENERAL QUALIFICATIONS

General - This report has been prepared to aid in the evaluation of this property and to assist the owner and engineers with the evaluation of the site and design of this project. The investigation and recommendations were made in accordance with generally accepted standards and practices of the geotechnical engineering profession (see ASFE publication in Appendix C of this report). The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to geotechnical engineering considerations.

Construction Monitoring - The recommendations contained in this report were made under the assumption that we will be retained to provide the necessary monitoring of earthwork and foundation construction. If not, whoever assumes these responsibilities should understand the philosophy of our recommendations, thoroughly review all of our reports, and accept the responsibility of being the Geotechnical Engineer-of-Record. Please also read the "ASFE Publication" and "Field-Observation Memorandum" in Appendix C.

Subsurface Variations - The analysis and recommendations submitted in this report are based upon (a) the data obtained from the borings and test-pits performed at the locations indicated on the location diagram and (b) the other information discussed in this report. In the performance of subsurface explorations, specific information is obtained at specific locations of specific times. It is a well-known fact, however, that variations in subsurface conditions exist on most sites between boring and test-pit locations and with time, particularly with respect to groundwater and with respect to sites that contain a highly-irregular bedrock surface. The nature and extent of most variations may not become evident until revealed in the course of construction. If these variations then appear, a re-evaluation of the recommendations of this report may be necessary after performing on-site observations during construction and noting the characteristics of any variations. Other subsurface conditions affecting project performance may not appear until their effect is noticed after construction is completed (see ASFE publication).

Because unanticipated subsurface conditions may occur, the designers should consider including a "changed condition" clause in their contracts both with the general contractor and with sub-contractors involved in earthwork and foundation construction. In some cases, we believe that the inclusion of this clause will permit contractors to give lower prices because they will not need to provide as much in contingencies as they normally would. Equitable adjustment of changed conditions can minimize conflicts and litigation, with the attendant delays and costs. Furthermore, by immediately recognizing and adjusting the contract price at the time the changed conditions are encountered, the problem of trying to recreate facts (should litigation develop later) is eliminated. A suggested wording for a changed conditions clause is given in Appendix C of this report.

Safety - The owner and the contractor should make themselves aware of, and become familiar with, applicable local, state, and federal safety regulations, including the current OSHA excavation safety standards. Construction site safety is generally the sole responsibility of the contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. No information provided in this report should be interpreted to mean that we are assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Environmental Issues - The scope of our services did not include any environmental assessment or investigation for the presence (or absence) of wetlands or hazardous/toxic materials in the soil, surface water, groundwater or air, either on, below, or around this site. Any statements in this report or on the boring and test-pit logs regarding odors noted or unusual or suspicious items or conditions observed are strictly for the information of our client.

Design Review - Finally, we recommend that we be authorized to review the project plans and specifications to confirm that the recommendations contained in this report have been interpreted in accordance with our intent. Without this review, we cannot be responsible for misinterpretation of our data, our analysis, and our recommendations, or how these are incorporated into the final design.

FIGURES

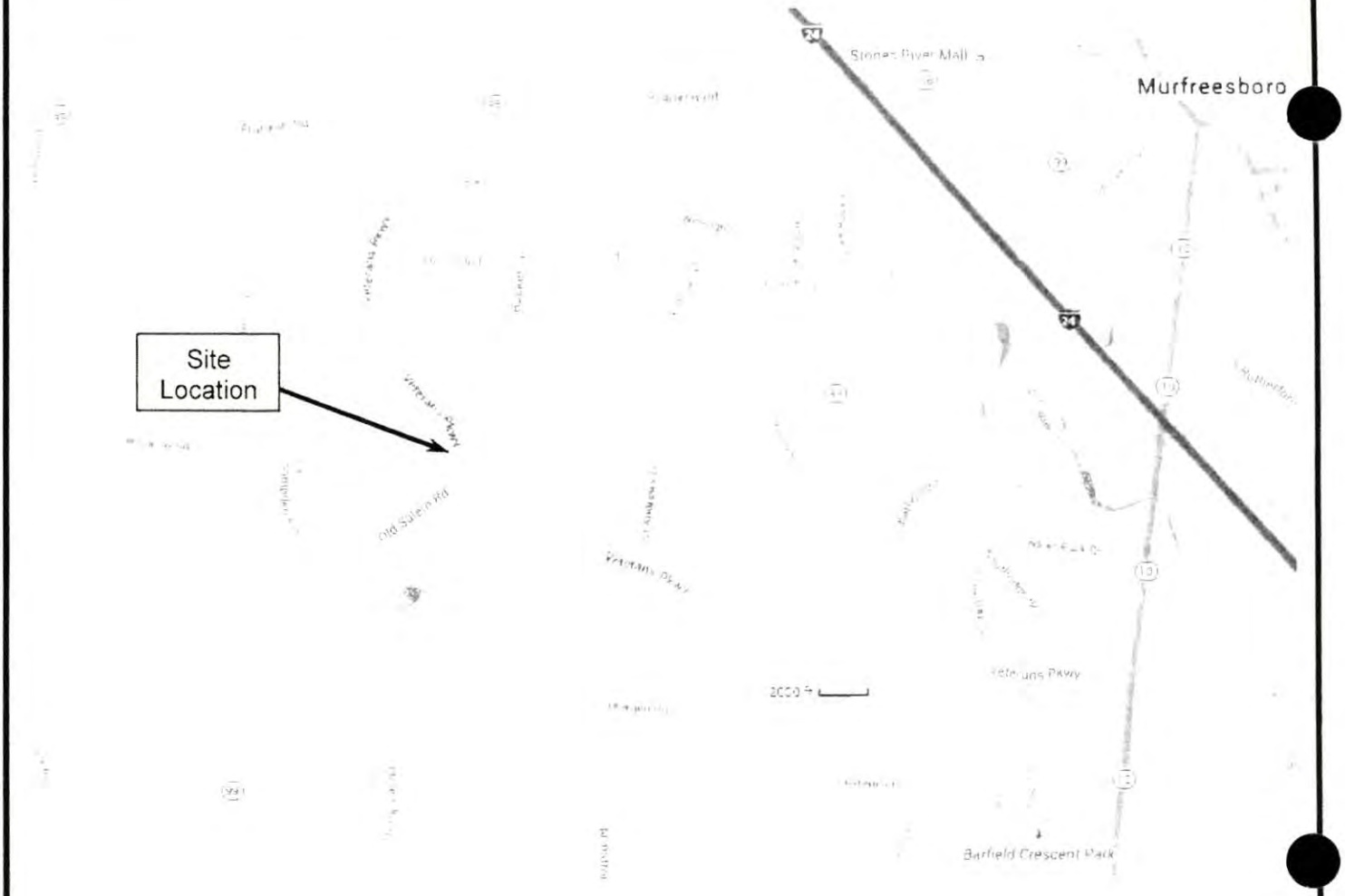


Figure 1: Site Location Map

Murfreesboro Veterans Parkway Substation
Murfreesboro, Tennessee

GPN: 15-6968-A

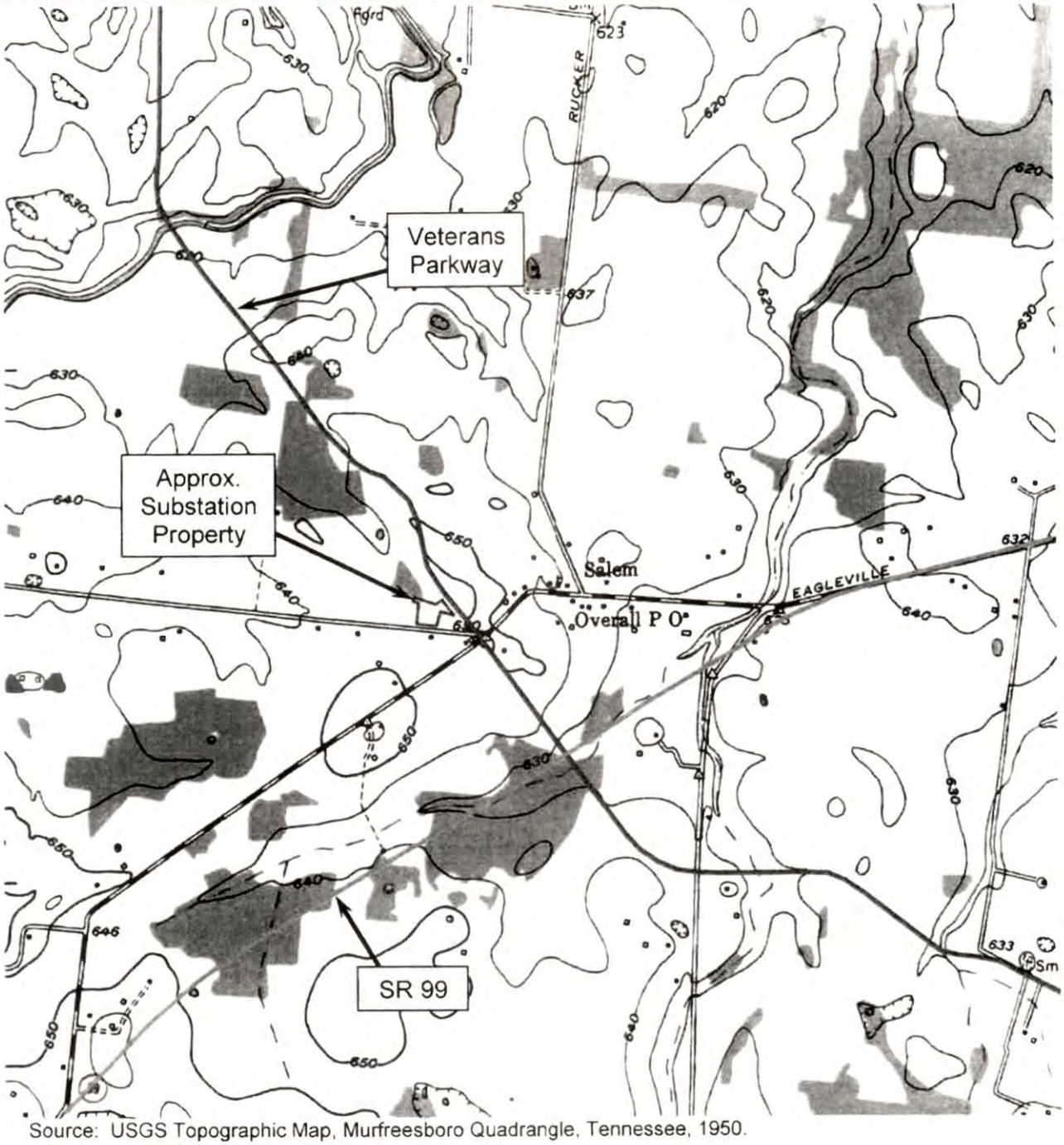
N

0 4000

Approx. Scale (ft)

Figure 1

GEOTEK



Source: USGS Topographic Map, Murfreesboro Quadrangle, Tennessee, 1950.

Figure 2: USGS Topographic Map
Murfreesboro Veterans Parkway Substation
Murfreesboro, Tennessee

GPN: 15-6968-A

N

0 2000
Approx. Scale (ft)

Figure 2

GEOTEK

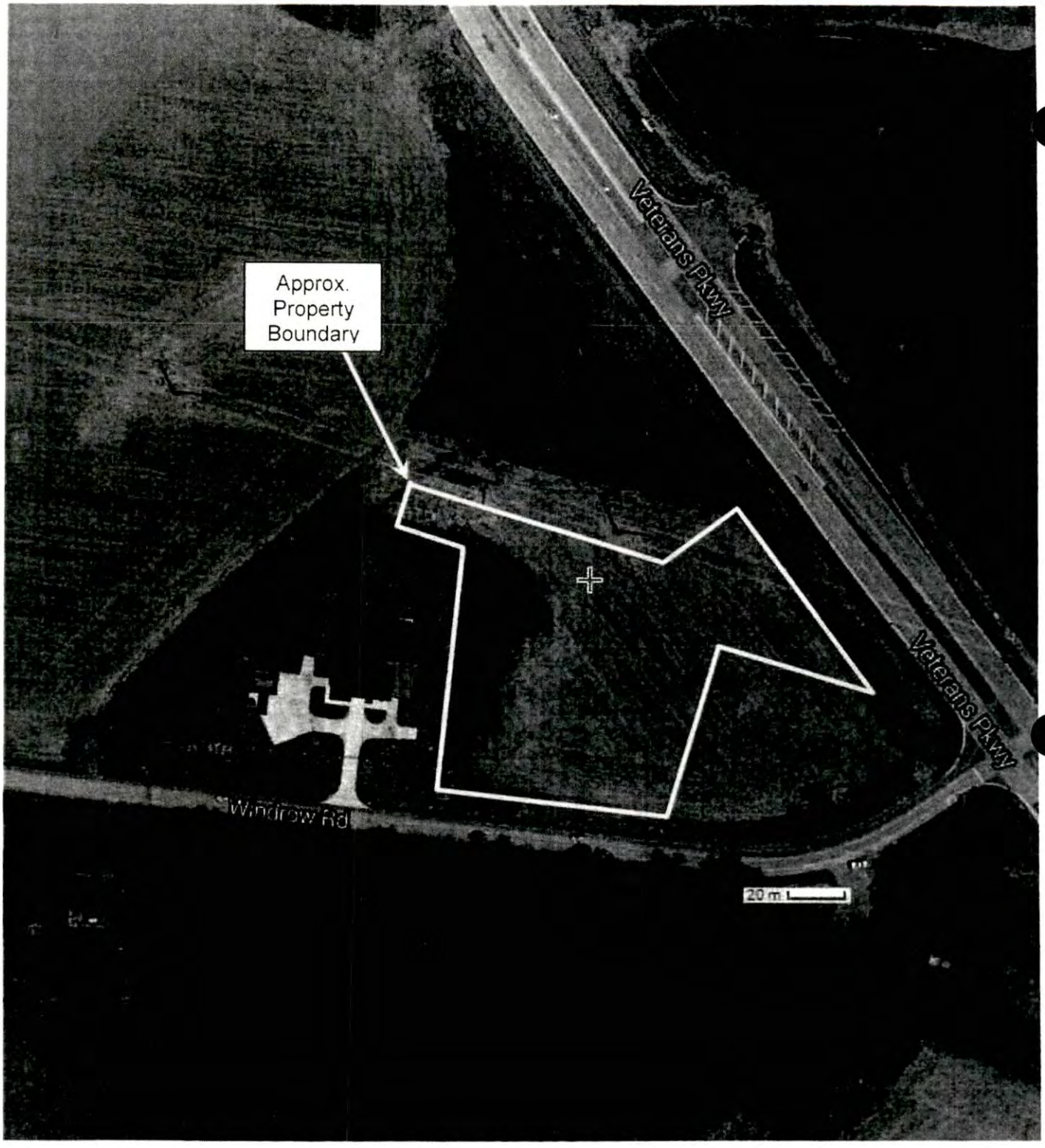


Figure 3: Aerial Photograph

Murfreesboro Veterans Parkway Substation
Murfreesboro, Tennessee

GPN: 15-6968-A

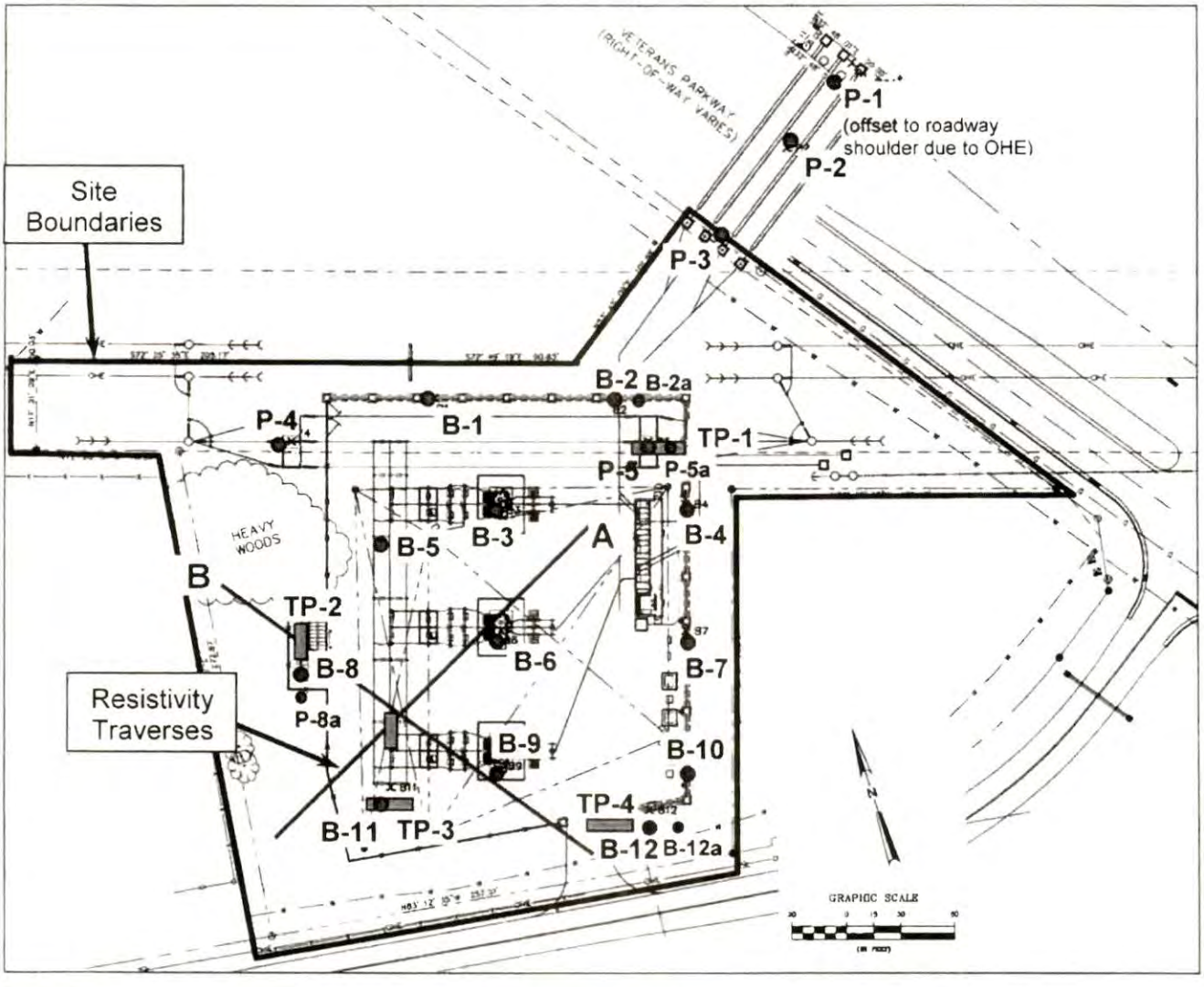
N

0 100

Approx. Scale (ft)

Figure 3

GEOTEK



Note: Borings and test-pit locations were not surveyed but scaled off site features shown on the general arrangement plan drawing by Allen & Hoshall, dwg E 2.1, 5/27/15.

Figure 4: Boring and Test-Pit Locations on Proposed Site Plan
Murfreesboro Veterans Parkway Substation
Murfreesboro, Tennessee

GPN: 15-6968-A

Photo 1: The site is a nearly level open field.

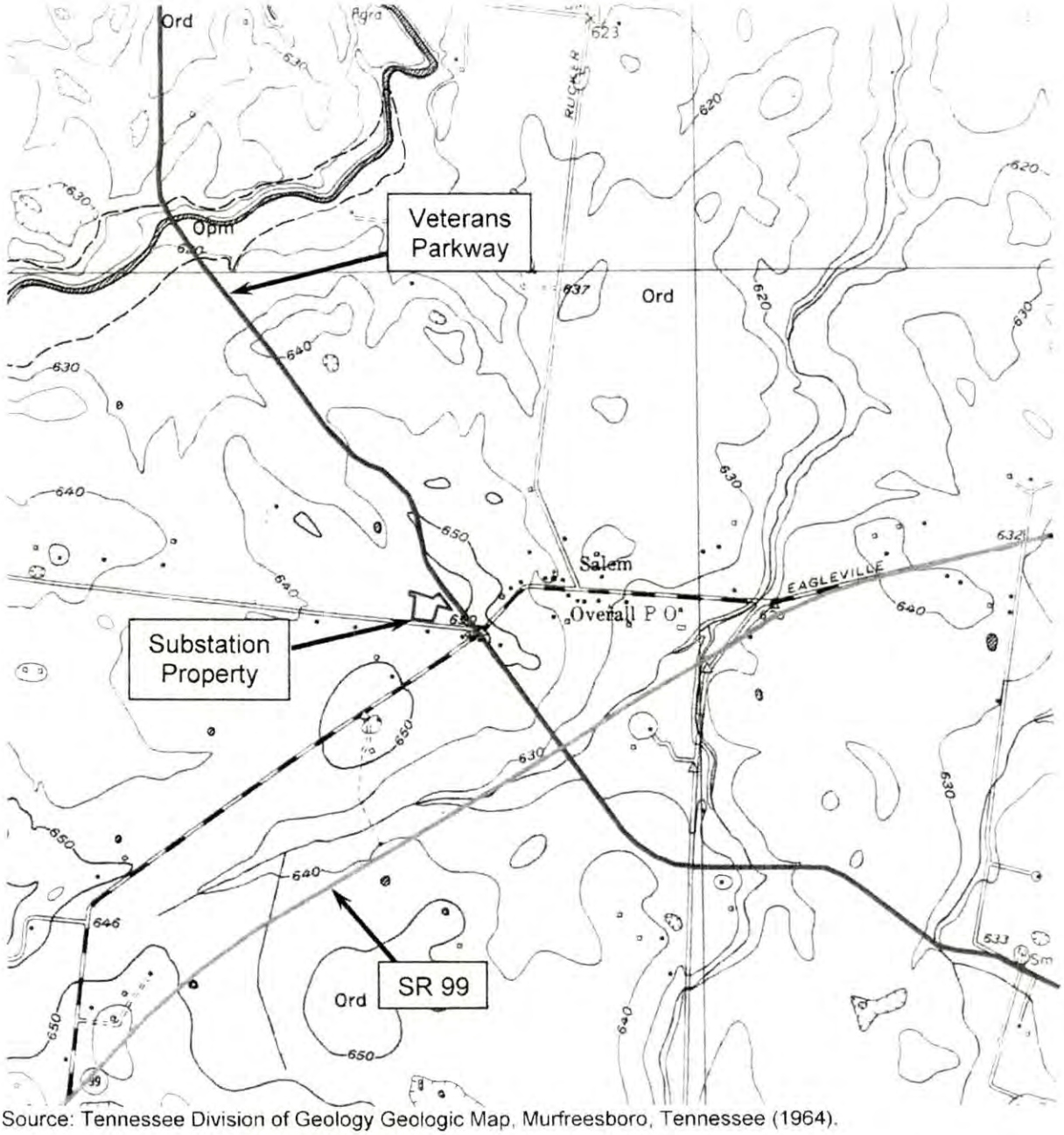
Photo 2: The site was bush-hogged after our initial site visit. This clearing made the numerous rock out crops more visible.

Figure 5: Site Photographs
Murfreesboro Veterans Parkway Substation

Photo 3: A small wet land is located on the western side of the substation area. During our site work the area contained standing water.

Photo 4: Boring P-2 was located in the center of Veterans Blvd.

Figure 6: Site Photographs
Murfreesboro Veterans Parkway Substation



Source: Tennessee Division of Geology Geologic Map, Murfreesboro, Tennessee (1964).

Legend
Ord = Ridley Limestone
Opm = Pierce Limestone
(both units are Ordovician Age)

Figure 7: Geology Map

Murfreesboro Veterans Parkway Substation
Murfreesboro, Tennessee

GPN: 15-6968-A

N

0 2000
Approx. Scale (ft)

Figure 7

GEOTEK

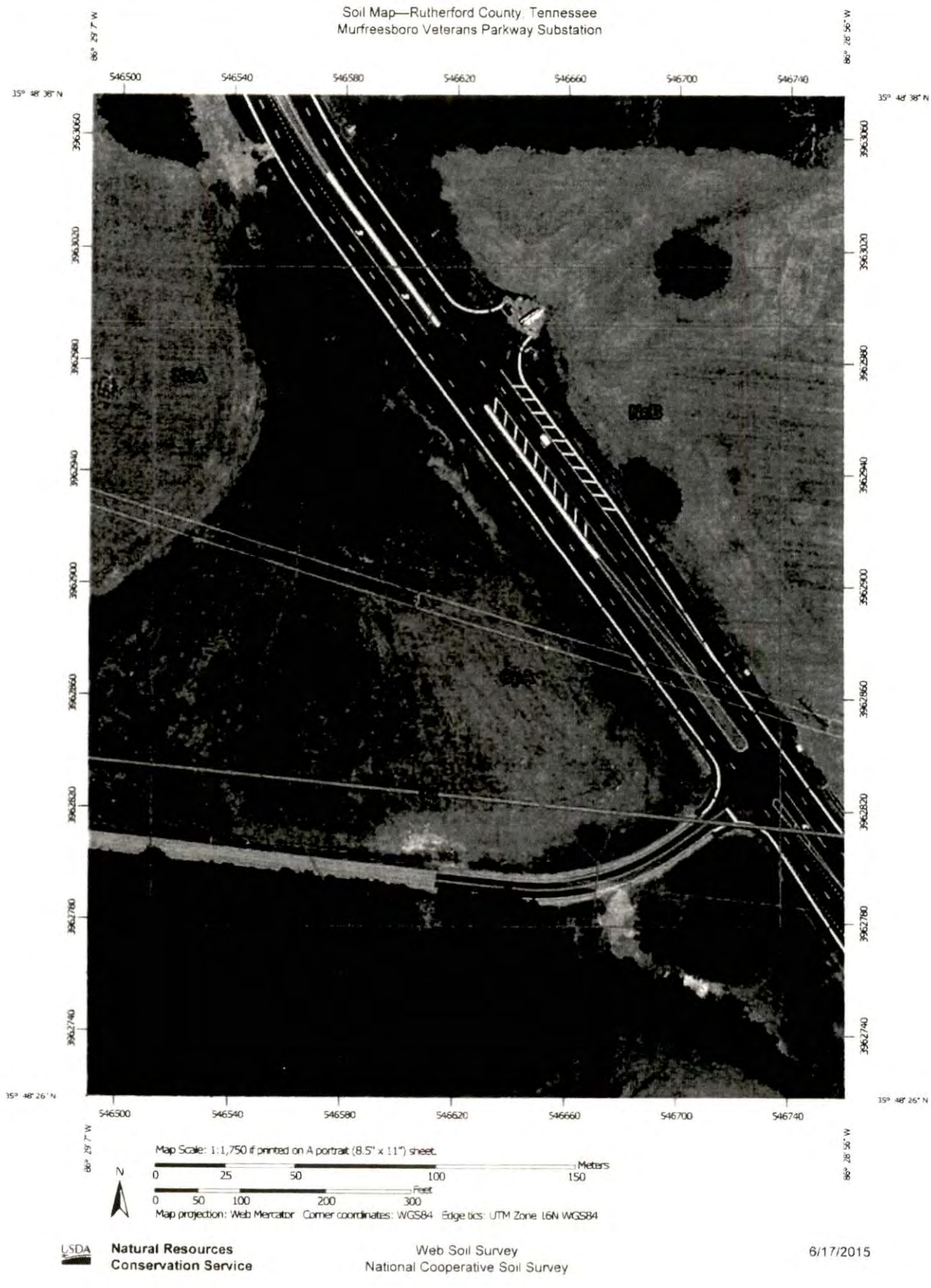


Figure 8: USDA Soil Survey
Murfreesboro Veterans Parkway Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

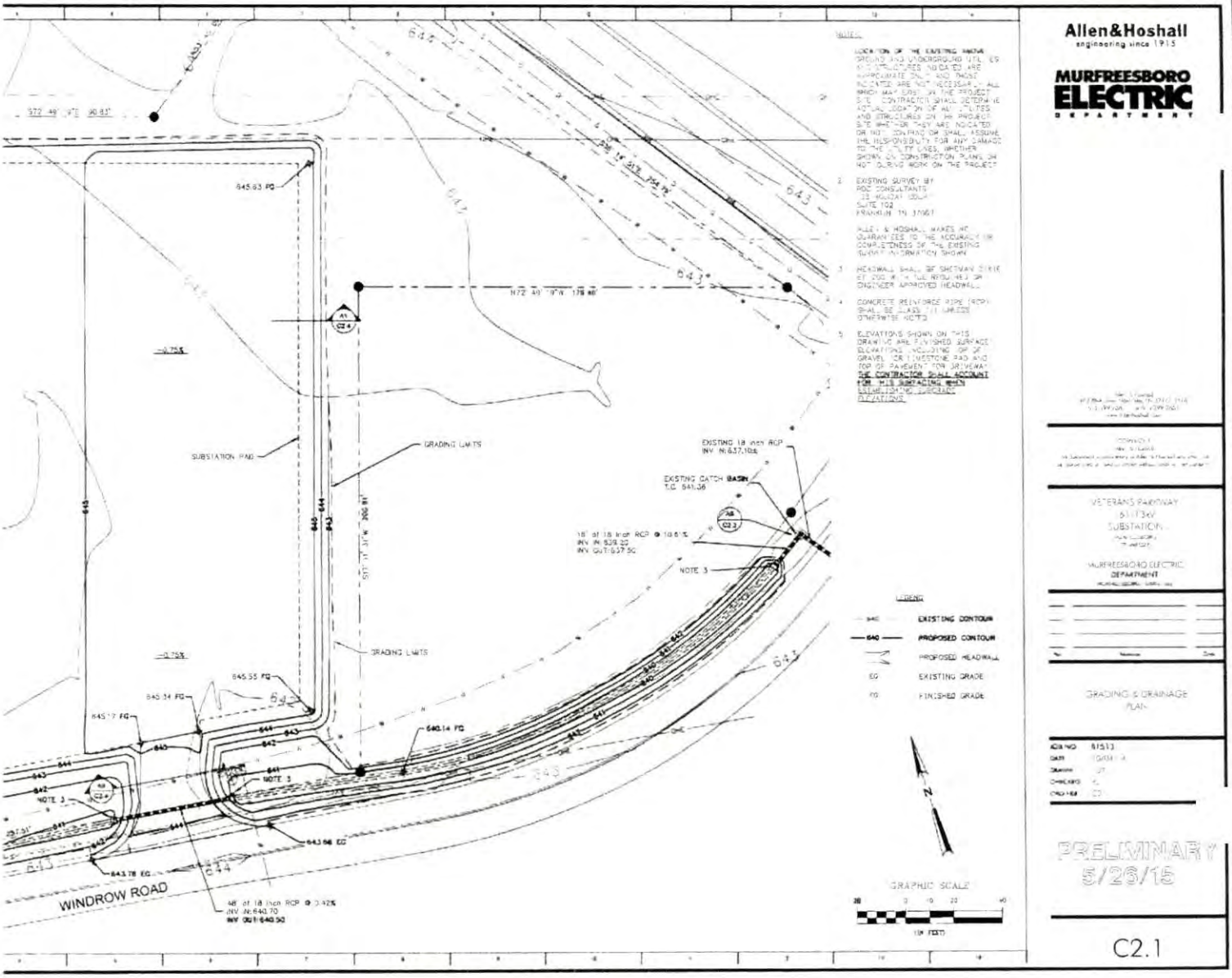
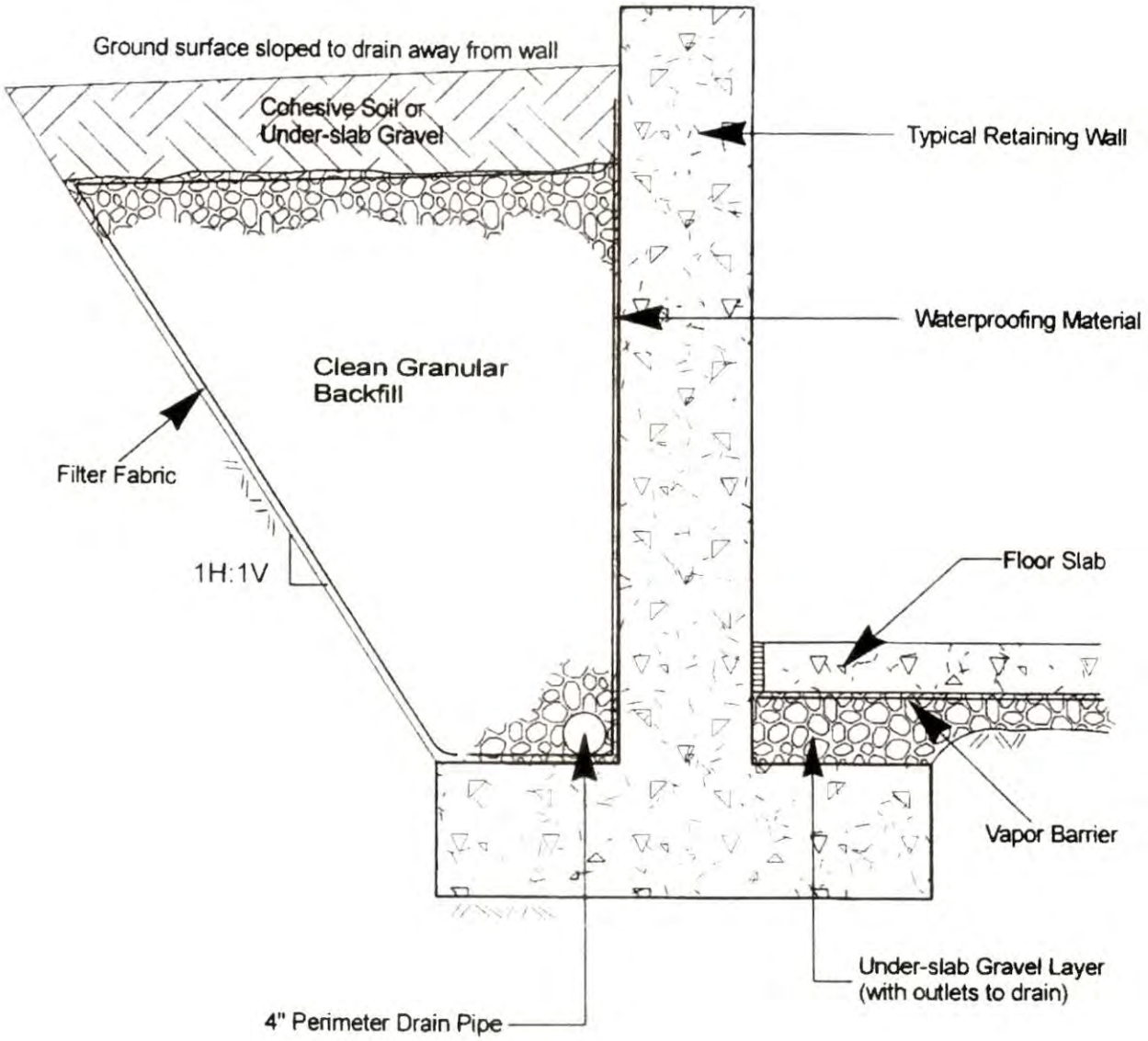


Figure 9: Proposed Grading Plan

Murfreesboro Veterans Parkway Substation
Murfreesboro, Tennessee

GPN: 15-6968-A



NTS

Retaining Wall Schematic (Typ.)

Veterans Parkway Substation
Murfreesboro, Tennessee

Geotek Proj. No. 15-6968-A

Figure 10

APPENDIX A

TABLE A-1: Summary of Selected Boring and Test-Pit Data

TABLE A-2: Field Resistivity Test Data

BORING LOGS

TEST-PIT LOGS w/ PHOTOS

LOG CLASSIFICATION SYSTEM

TABLE A-1: SUMMARY OF SELECTED BORING AND TEST-PIT DATA

Boring/Pit No.	Refusal Depth (ft)	Depth to Water (ft)	General Comments
B-1	9.9	> 9.9	
B-2	9.8	9.6	Encountered boulder at 3 to 5 ft which caused the augers to deflect out-of-plumb.
B-2a	11.8	> 11.8	
B-3	10.5	> 10.5	Augered alongside a pinnacle from 7 to 10.5 ft which caused the augers to deflect out-of-plumb.
B-4	17.4	> 17.4	
B-5	7.9	> 7.9	
B-6	12.5	6.1	
B-7	5.5	> 5.5	
B-8	1.0	> 1.0	
B-8a	11.3	> 11.3	
B-9	14.7	3.5	
B-10	15.5	> 15.5	
B-11	7.6	> 7.6	Auger refusal on sloping rock.
B-12	4.2	> 4.2	Auger refusal on sloping rock.
B-12a	13.0	> 13.0	
P-1	13.8	> 13.8	Gravel and soil fill to 5.5 ft.
P-2	10.0+	> 10.0	Encountered rock at 5.5 to 7 ft, then auger deflected and continued alongside pinnacle to 10 ft.
P-3	8.8	> 8.8	
P-4	12.7	> 12.7 3.2 @ 24 hrs.	
P-5	1.4	> 1.4	Auger refusal on sloping rock.
P-5a	12.5	> 12.5	
TP-1	1.0 - 11.0+	> 11.0	
TP-2	1.0 - 8.5	8.5	Seepage from 1.5 to 5 ft with little accumulation at 8.5 ft at completion of trenching.
TP-3	1.0 - 12.0+	> 12.0	Seepage from 7 to 9 ft with little accumulation at completion of trenching.
TP-4	0 - 11.0	> 11.0	

Notes: 1. Boring refusal is by auger drilling. Test-pit refusal is as occurred with the backhoe bucket.
2. Water level is depth measured immediately after drilling/trenching, except where noted.

TABLE A-2
Field Resistivity Test Data
Veterans Blvd. Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

Traverse Number	Spacing (feet)	Probe Depth (inches)	Reading (ohms)	Multiplier	Resistivity (ohm-meters)
T-A	10	6	2.40	19.15	46.0
	20	6	2.00	38.3	76.6
	40	6	2.10	76.6	160.9
	60	6	3.25	114.9	373.4
	80	6	2.20	153.2	337.0
T-B	10	6	2.20	19.15	42.1
	20	6	1.90	38.3	72.8
	40	6	1.85	76.6	141.7
	60	6	1.90	114.9	218.3
	80	6	1.90	153.2	291.1

Comments: Probe Dia.: 0.25 in.
Date of Test: 6/19/2015
Air Temperature: 85 degrees F
Surface Soil Conditions: dry
See Figure 3 for traverse locations.
Test by: Stephen Capps

LOG OF BORING

BORING NO. B-1

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT and Coring
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown	N	3 4 7	11				pp = 2.5 - 3.0 tsf
	No Recovery	N	6 10 7	17				
5	CLAY w/ silt, fine sand traces, chert, brown and red-brown	N	5 8 7	15				pp = 3.25 tsf
	CLAY w/ silt, fine sand traces, chert, brown, red-brown, and gray	N	50/4	50+				pp = 3.25 tsf No groundwater at completion of augering.
10	Auger Refusal at 9.9 ft - Begin NQ Core LIMESTONE, slightly-weathered, thin- to medium-bedded, medium-gray, very fine-grained to cryptocrystalline w/ few medium-coarse grained zones, shaley partings, irregular parting lines, fossiliferous				5	94	86	Pull #1 at 9.9 - 14.9 ft.
15	End of Coring at 14.9 ft.							100% Drill Water Return
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-2

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 0.8 ft.							
	CLAY w/ silt, fine sand traces, chert , brown	N	4 4 5	9				pp = 2.0 tsf
	CLAY w/ silt, fine sand traces, ferrous oxide nodules, chert, limestone fragments, brown and red-brown	N	4 9 12	21				pp = 2.25 tsf Augered past boulder at 3 to 5 ft, augers leading off.
5	CLAY w/ silt, fine sand traces, chert, red-yellow-brown	N	6 6 8	14				pp = 3.0 tsf
	CLAY w/ silt, fine sand traces, chert, limestone fragments, red-yellow-brown	N	4 4 50/2	50+				pp = 1.0 - 2.25 tsf
10	Auger Refusal at 9.8 ft. - End of Boring							Groundwater at 9.6 ft at completion of augering. Boring not core drilled due augers deflecting out-of-plumb due to the presence of a bedrock pinnacle or boulder. See Boring B-2a.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-2a

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
0	Auger Only to Refusal - No Sampling.							Boring 2a offset 5 ft east of B-2 and augered to refusal due to auger deflecting out-of-plumb in B-2.
5								
10								
11.8	Auger Refusal at 11.8 ft.							
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-3

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, hair-line roots, tan-brown and brown	N	4 5 8	13				pp = 2.5 - 3.25 tsf
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown-gray	N	5 5 7	12				pp = 3.0 - 3.25 tsf
5								
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-gray	N	50/4	50+				pp = 1.5 - 2.75 tsf
								Unable to sample at 8.5 to 10 ft due to deflection of augers out-of-plumb along side a probably bedrock pinnacle or boulder.
10								
	Auger Refusal at 10.5 ft - End of Boring							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-4

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT & Coring
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 0.8 ft.							
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, red-tan-brown and black	N	3 3 4	7				pp = 1.5 - 2.5 tsf
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, tan-brown and brown	N	4 5 7	12				pp = 2.5 - 3.75 tsf
5								
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, tan and red-brown	N	8 8 14	22				pp = 3.75 - 4.5+ tsf
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, orange and tan-brown	N	8 8 9	17				pp = 2.5 - 3.25 tsf
10								
	SILTY CLAY w/ fine sand traces, chert, tan-brown, orange-brown and brown	N	5 6 9	15				pp = 3.0 tsf
15								No groundwater at completion of augering.
	Auger Refusal at 17.4 ft - Begin NQ Core LIMESTONE, highly-weathered/fractured at 17.4 - 20.0 ft.				7	96	50	Pull #1 at 17.4 - 24.5 ft.
20								
	LIMESTONE, slightly-weathered, thin- to medium-bedded, medium-gray, very fine grained to crypotcrystalline w/ medium-coarse grained zones, shaley partings, irregular parting lines, fossiliferous							
25	End of Coring at 24.5 ft.							100% Drill Water Return

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-5

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT and Coring
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown, tan-brown and gray-brown	N	4 5 6	11				pp = 3.0 tsf
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, orange and tan-brown	N	5 5 10	15				pp = 4.25 tsf
5	SILTY CLAY w/ fine sand traces, chert, brown and dark-brown	N	5 9 50/3	50+				pp = 2.75 - 3.0 tsf No groundwater at completion of augering.
	Auger Refusal at 7.9 ft - Begin NQ Core				5	100	86	Pull #1 at 7.9 - 12.9 ft.
10	LIMESTONE, slightly-weathered, thin- to medium-bedded, medium-gray, very fine-grained to cryptocrystalline w/ medium-coarse grained zones, shaley partings, irregular parting lines, fossiliferous							
					5	100	86	Pull #2 at 12.9 - 17.9 ft.
15								
	End of Coring at 17.9 ft.							100% Drill Water Return
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-6

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/12/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.5 ft.							
	SILTY CLAY w/ fine sand traces, hair-line roots, ferrous oxide nodules, chert, brown	N	2 2 4	6				pp = 1.25 tsf
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-tan and gray-brown	N	4 5 6	11				pp = 3.0 tsf
5	SILTY CLAY w/ fine sand traces, chert, brown	N	4 5 7	12				pp = 3.25 tsf Groundwater at 6.1 ft after 4 hours.
	SILTY CLAY w/ fine sand traces, limestone fragments, chert, ferrous oxide nodules, brown	N	4 5 6	11				pp = 2.0 tsf
10								
	Auger Refusal at 12.5 ft - End of Boring							
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-7

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT and Coring
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, tan-brown and brown	N	4 4 4	8				pp = 2.75 - 3.0 tsf
	SILTY CLAY w/ fine sand traces, limestone fragments, chert, ferrous oxide nodules, brown and tan-brown	N	4 6 7	13				pp = 3.0 -3.25 tsf No groundwater at completion of augering.
5	Auger Refusal at 5.5 ft - Begin NQ Core				5	100	80	Pull #1 from 5.5 - 10.5 ft.
	LIMESTONE, slightly-weathered, thin- to medium-bedded, medium-gray, very fine grained to cryptocrystalline w/ medium-coarse grained zones, shaley partings, irregular parting lines, fossiliferous							
10					5	100	68	Pull #2 from 10.5 - 15.5 ft.
15	End of Coring at 15.5 ft.							100% Drill Water Return
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-8

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	Auger Refusal at 1.0 ft - End of Boring							No groundwater at completion of augering.
5								
10								
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-8a

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							Boring B-8a offset 5 ft east of Boring B-8 due to shallow refusal in B-8.
	SILTY CLAY w/ fine sand traces, hair-line roots, ferrous oxide nodules, brown and gray-brown	N	3 3 4	7				pp = 2.5 tsf
	SILTY CLAY w/ fine sand traces, chert, gray-brown	N	4 3 4	7				pp = 1.75 tsf
5								
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown and gray-brown	N	6 15 24	39				pp = 2.25 tsf
	CLAY w/ silt, fine sand traces, chert, black and brown-gray (mottled)	N	6 8 8	16				pp = 1.25 tsf
10								
	Auger Refusal at 11.3 ft - End of Boring							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-9

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, gray-brown	N	2 2 2	4				
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, gray-brown	N	2 2 2	4				pp = 0.5 tsf
5								
	SILTY CLAY w/ fine sand traces, hair-line roots, gray-tan-brown	N	3 3 4	7				pp =2.25 tsf
	SILTY CLAY w/ fine sand traces, hair-line roots, chert, gray-brown	N	3 3 4	7				pp = 1.25 tsf
10								
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, gray-brown	N	12 7 50/2	50+				pp = 0.5 tsf
15	Auger Refusal at 14.7 ft - End of Boring							No groundwater at completion of augering.
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-10

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, chert, hair-line roots, brown-tan-brown and red-brown (mottled)	N	4 3 5	8				pp = 2.25 tsf
	CLAY w/ silt, fine sand traces, tan-brown, brown and gray	N	5 5 7	12				pp = 3.5 tsf
5								
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert fragments, tan-brown, red-brown and brown	N	6 6 9	15				pp = 2.0 tsf
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, tan-brown and red-brown	N	5 5 7	12				pp = 1.75 tsf
10								
	SILTY CLAY w/ fine sand traces, brown and dark-brown	N	4 9 50/3	50+				pp = 1.0 tsf
15								
	Auger Refusal at 15.5 ft - End of Boring							No groundwater at completion of augering.
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-11

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, chert, hair-line roots, ferrous oxide nodules, brown	N	6 8 19	27				pp = 1.5 tsf
5	SILTY CLAY w/ fine sand traces, chert, hair-line roots, ferrous oxide nodules, limestone fragments, brown	N	7 6 6	12				pp = 1.75 tsf
	SILTY CLAY w/ fine sand traces, chert, limestone fragments, ferrous oxide nodules, brown and tan-brown	N	6 50/2	50+				pp = 1.5 tsf
	Auger Refusal at 7.7 ft - End of Boring							No groundwater at completion of augering. Augers deflecting out-of-plumb near refusal on side of a confirmed bedrock pinnacle. See Test-Pit TP-3 for more information.
10								
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-12

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
0	TOPSOIL at 0.0 - 1.0 ft.							Rock outcrop lies 2-ft from B-12.
	SILTY CLAY w/ fine sand traces, hair-line roots, brown-gray	N	3 5 6	11				pp = 2.25 - 4.25 tsf
	SILTY CLAY w/ fine sand traces, gray-brown	N	50/1	50+				pp = 1.25 - 2.25 tsf
	Auger Refusal at 4.2 ft - End of Boring							No groundwater at completion of augering.
5								
10								
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. B-12a

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							Boring B-12a offset 10 ft east of B-12 due to shallow refusal in B-12.
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, brown, gray-brown and red-brown	N	3 5 5	10				pp = 1.0 - 2.0 tsf
5	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, brown-gray, red-brown and brown	N	5 6 9	15				pp = 2.75 - 3.25 tsf
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, hair-line roots, tan-brown, gray-brown and brown	N	4 5 7	12				pp = 2.0 = 3.25 tsf
10	SILTY CLAY w/ fine sand traces, chert, brown, tan-brown and red-brown	N	4 6 7	13				pp = 3.0 - 3.25 tsf
	Auger Refusal at 13.0 ft - End of Boring							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. P-1

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	ASPHALT and LIMESTONE GRAVEL at 0.0 - 1.0 ft.							Fill at 0 - 5.5 ft (±). Fill at 1.0 to ~5.5 ft is backfill beside storm drain pipe.
	LIMESTONE GRAVEL and trace SILTY CLAY, brown (Fill)	N	13 20 17	37				
	LIMESTONE GRAVEL and little SILTY CLAY, brown (Fill)	N	6 6 4	10				
5	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown, gray-brown	N	4 5 8	13				pp = 2.25 - 2.75 tsf
	SILTY CLAY w/ fine sand traces, chert, brown and gray-brown	N	5 7 7	14				pp = 3.0 - 3.25 tsf
10								
	Auger Refusal at 13.8 ft.							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. P-2

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/12/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	ASPHALT (1-ft thick)							
	SILTY CLAY w/ fine sand traces, chert, limestone fragments, brown-gray	N	19 10 22	32				pp = 3.5 tsf
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, hair-line roots, gray-brown	N	4 6 5	11				pp = 2.5 - 3.0 tsf
5	Augered along side of probable bedrock pinnacle at 5.5 - 7.0 ft.							Augers deflected out-of-plumb below 5.5 ft.
								SPT attempted at 8.5 ft stopped due to sampler deflecting out-of-plumb.
10	End of Boring at 10.0 ft - No Refusal							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. P-3

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/10/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 0.5 ft.							
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, red and dark-brown	N	3 3 4	7				pp = 2.0 tsf
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-tan and gray-brown	N	4 5 9	14				pp = 2.0 - 2.75 tsf
5	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-tan and gray-brown	N	6 8 10	18				pp = 3.25 - 3.75 tsf
	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown and gray-brown	N	50/1	50+				pp = 2.5 tsf
10	Auger Refusal at 8.8 ft - End of Boring							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. P-4

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							
	SILTY CLAY w/ fine sand traces, chert, tan and red-brown	N	2 2 2	4				pp = 0.75 - 1.0 tsf
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown	N	3 4 5	9				pp = 2.0 - 2.25 tsf Soils at 3.5 - 5.0 ft had wet cleavage planes when freshly broken open.
5								
	SILTY CLAY w/ fine sand traces, tan and orange, brown-gray	N	4 5 7	12				pp = 2.5 - 3.25 tsf
	SILTY CLAY w/ fine sand traces, chert, yellow-orange-brown & dark gray-black	N	6 7 9	16				pp = 1.5 - 2.0 tsf
10								
	Auger Refusal at 12.7 ft - End of Boring							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. P-5

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 0.8 ft.							
	SILTY CLAY w/ fine sand traces, chert, red-brown	N	2	2				pp = 2.5 - 3.0 tsf
	Auger Refusal at 1.4 ft - End of Boring							No groundwater at completion of augering. Auger deflected out-of-plumb on probable bedrock pinnacle. See Test-Pit TP-1 for more details.
5								
10								
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

GEOTEK ENGINEERING COMPANY, INC.

LOG OF BORING

BORING NO. P-5a

PROJECT: Veterans Parkway Substation
Murfreesboro, TN
PROJECT NO.: 15-6968-A
CLIENT: Allen & Hoshall, Inc.
Nashville, TN

BORING TYPE: 3-1/4" HSA w/ SPT
DRILL CREW: Capps/Roberts
DATE DRILLED: 7/9/15

DEPTH (ft)	DESCRIPTION	SOIL DATA: Samples	SOIL DATA: Blow Count per 6-in. drive	SOIL DATA: N-VALUE (blows/ft)	CORE DATA: Length Cored (ft)	CORE DATA: Recovery (%)	CORE DATA: RQD	REMARKS
	TOPSOIL at 0.0 - 1.0 ft.							Boring P-5a offset 10-ft southeast of P-5 due to refusal in P-5.
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, orange-brown and brown	N	3 4 5	9				pp = 2.0 - 2.5 tsf
	SILTY CLAY w/ fine sand traces, chert, brown and tan-brown-gray	N	5 7 9	16				pp = 2.5 - 4.0 tsf
5								
	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, tan and yellow-brown	N	6 7 9	16				pp = 3.25 - 3.5 tsf
	SILTY CLAY w/ fine sand traces, chert, black-gray-tan and yellow-brown	N	5 9 10	19				pp = 3.0 - 3.25 tsf
10								
	Auger Refusal at 12.5 ft - End of Boring							No groundwater at completion of augering.
15								
20								
25								

N = Standard Penetration Test (SPT), S = Shelby Tube, A = Auger, pp = Pocket Penetrometer Reading

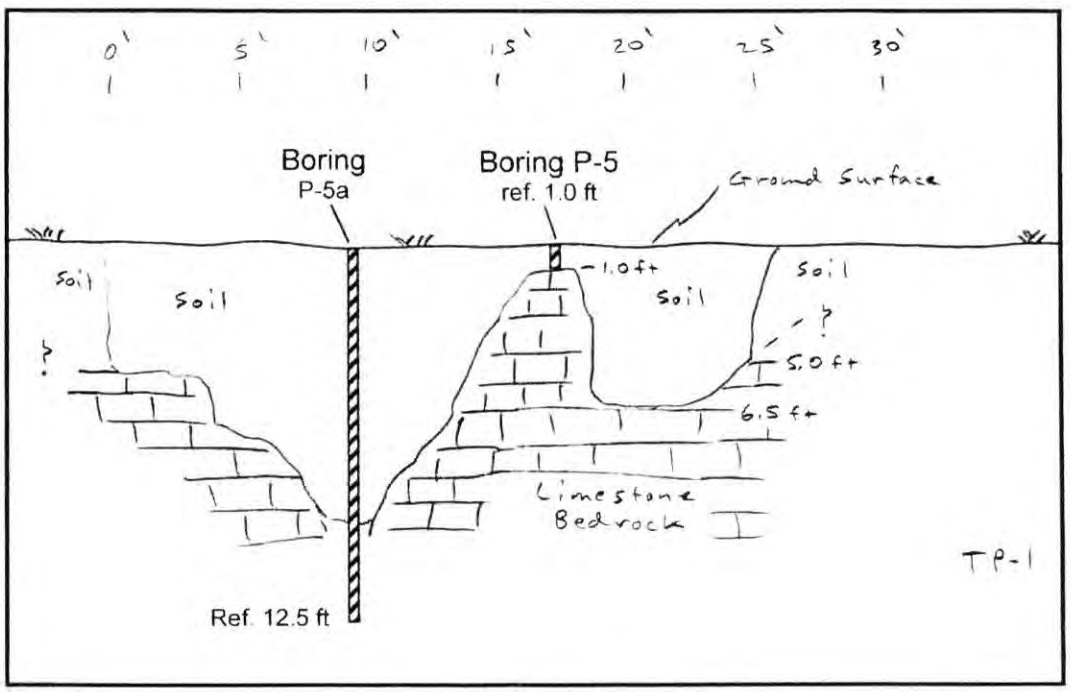
GEOTEK ENGINEERING COMPANY, INC.

LOG OF TEST-PIT

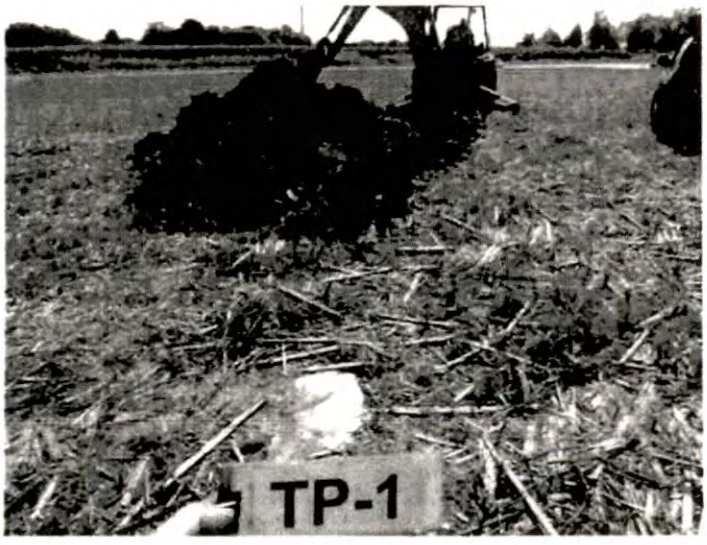
Test-Pit No: TP-1

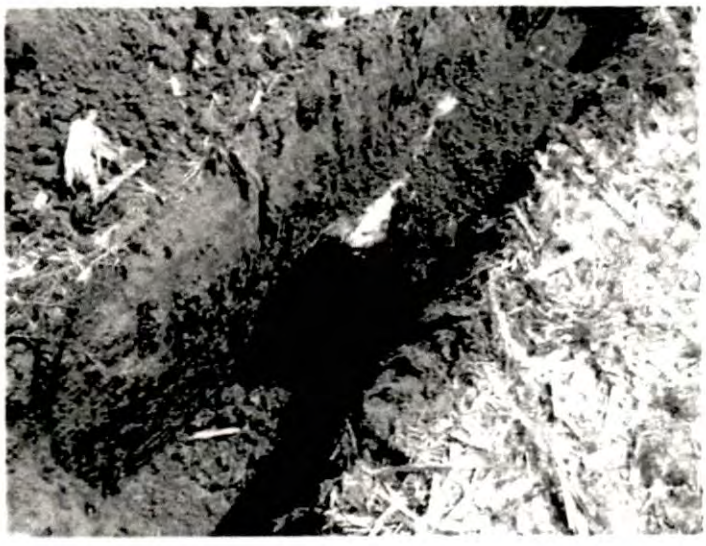
Project:	Veterans Blvd Substation		
Site Location:	Murfreesboro, Tennessee	**Logged By:**	Stephen Capps
Project No.:	15-6968-A	**Date:**	July 10, 2015
Client:	Allen & Hoshall Nashville, Tennessee	**Location:**	See Figure 4

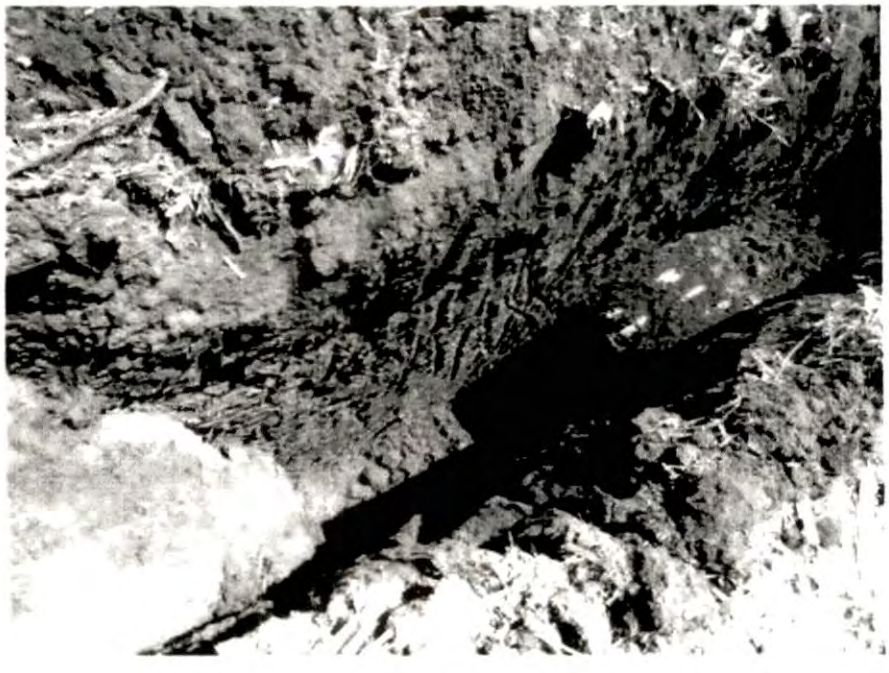
Depth (ft)	Description
0 - 0.5	TOPSOIL, SILTY CLAY w/ fine sand traces, hair-line roots, brown
0.5 - 3.0	SILTY CLAY w/ fine sand traces, red-brown (pp=0.25 tsf)
3.0 - 6.5	SILTY CLAY w/ fine sand traces, chert, brown-red-tan and yellow-brown (pp=1.75-3.5 tsf)
6.5 - 10.0	SILTY CLAY w/ fine sand traces, chert, brown and dark-brown (pp=2.0-3.5 tsf)
1.0 - 12.5	Refusal on Pinnacled Limestone Bedrock with no test-pit refusal in a narrow crevice. Boring P-5a refused at 12.5 ft (see sketch below)



Notes:
1. No groundwater encountered during the opening of the test-pit.
2. Photos of the test-pit are on the following page.
3. pp = Pocket Penetrometer reading (indicates soil consistency). This is not allowable bearing value.
4. The above sketch is at a 1:1 scale (vertical = horizontal). The test-pit measurements were made with a tape measure and are approximate.







Test-Pit TP-1

Veterans Blvd Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

GEOTEK

Test-Pit TP-1

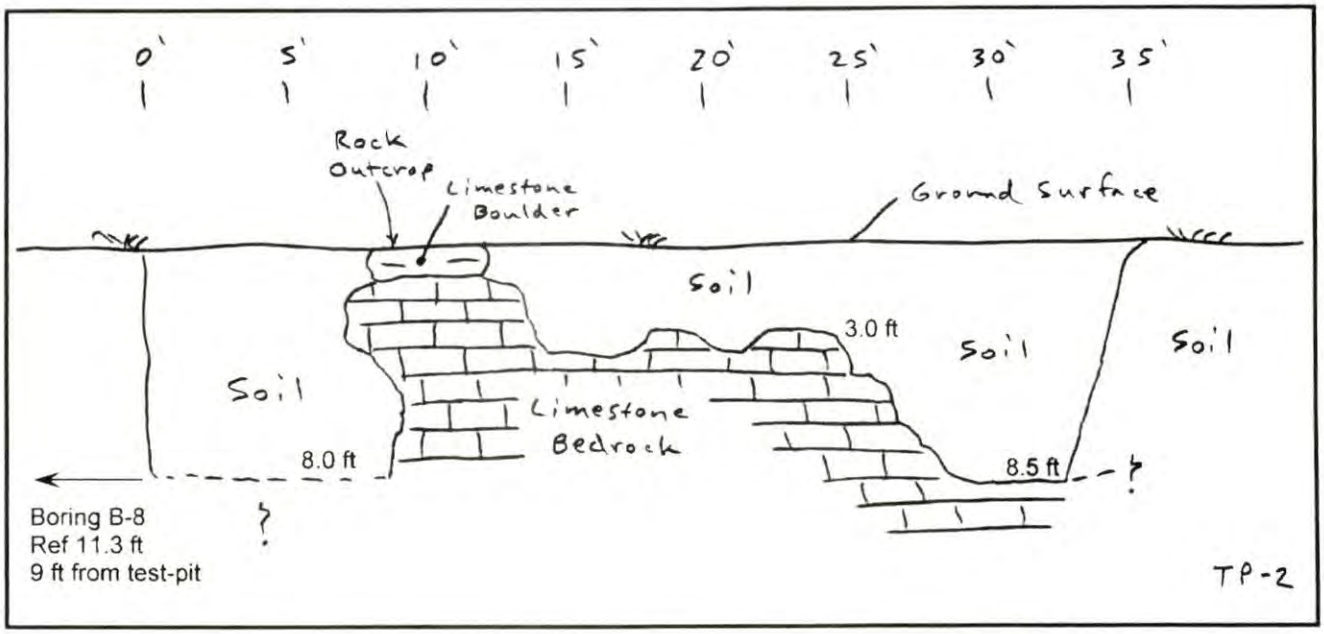
Veterans Blvd Subs
Murfreesboro, Tennessee
GPN: 15-6968-A

GEOTEK

LOG OF TEST-PIT

Test-Pit No: TP-2

Project:	Veterans Blvd Substation		
Site Location:	Murfreesboro, Tennessee	**Logged By:**	Stephen Capps
Project No.:	15-6968-A	**Date:**	July 10, 2015
Client:	Allen & Hoshall Nashville, Tennessee	**Location:**	See Figure 4



Notes:
1. No soil samples were taken from this test-pit.
2. Groundwater seepage was entered the test-pit from the 1 - 5 ft depth zone during the opening of the test-pit. A few inches of water accumulated in about one hour.
2. Photos of the test-pit are on the following page.
3. pp = Pocket Penetrometer reading (indicates soil consistency). This is not allowable bearing value.
4. The above sketch is at a 1:1 scale (vertical = horizontal). The test-pit measurements were made with a tape measure and are approximate.

Test-Pit TP-2

Veterans Blvd Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

GEOTEK

Test-Pit TP-2

Veterans Blvd Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

GEOTEK

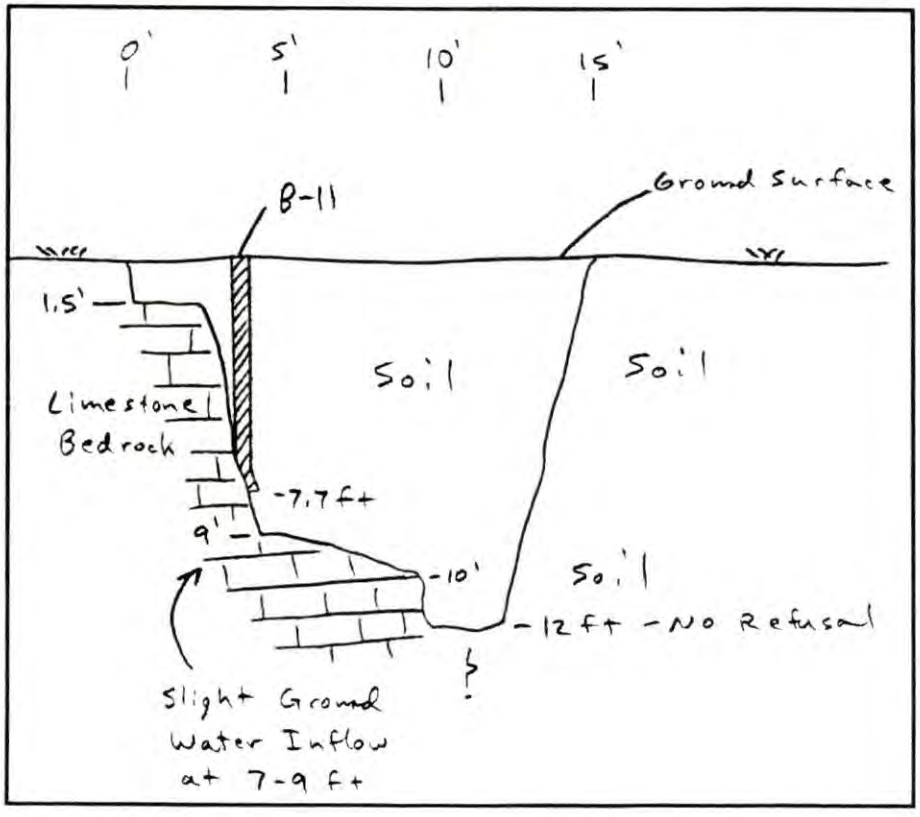
LOG OF TEST-PIT

Test-Pit No: TP-3

Project:	Veterans Blvd Substation		
Site Location:	Murfreesboro, Tennessee	**Logged By:**	Stephen Capps
Project No.:	15-6968-A	**Date:**	July 10, 2015
Client:	Allen & Hoshall Nashville, Tennessee	**Location:**	See Figure 4

Depth (ft)	Description
0 - 0.7	TOPSOIL, SILTY CLAY w/ fine sand traces, hair-line roots, brown
0.7 - 8.0	No samples taken - see Boring B-11
8.0 - 12.0	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, gray, red, tan-brown (pp=1.75 tsf)
1.5 - 12+	Refusal on Pinnacled Limestone Bedrock with no refusal at one end of test-pit (medium-stiff soil)

Notes:
1. Slight groundwater seepage encountered at 7 - 9 ft during the opening of the test-pit.
2. Photos of the test-pit are on the following page.
3. pp = Pocket Penetrometer reading (indicates soil consistency). This is not allowable bearing value.
4. The above sketch is at a 1:1 scale (vertical = horizontal). The test-pit measurements were made with a tape measure and are approximate.
5. Boring B-11 deflected off the side of a limestone bedrock pinnacle



Test-Pit TP-3

Veterans Blvd Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

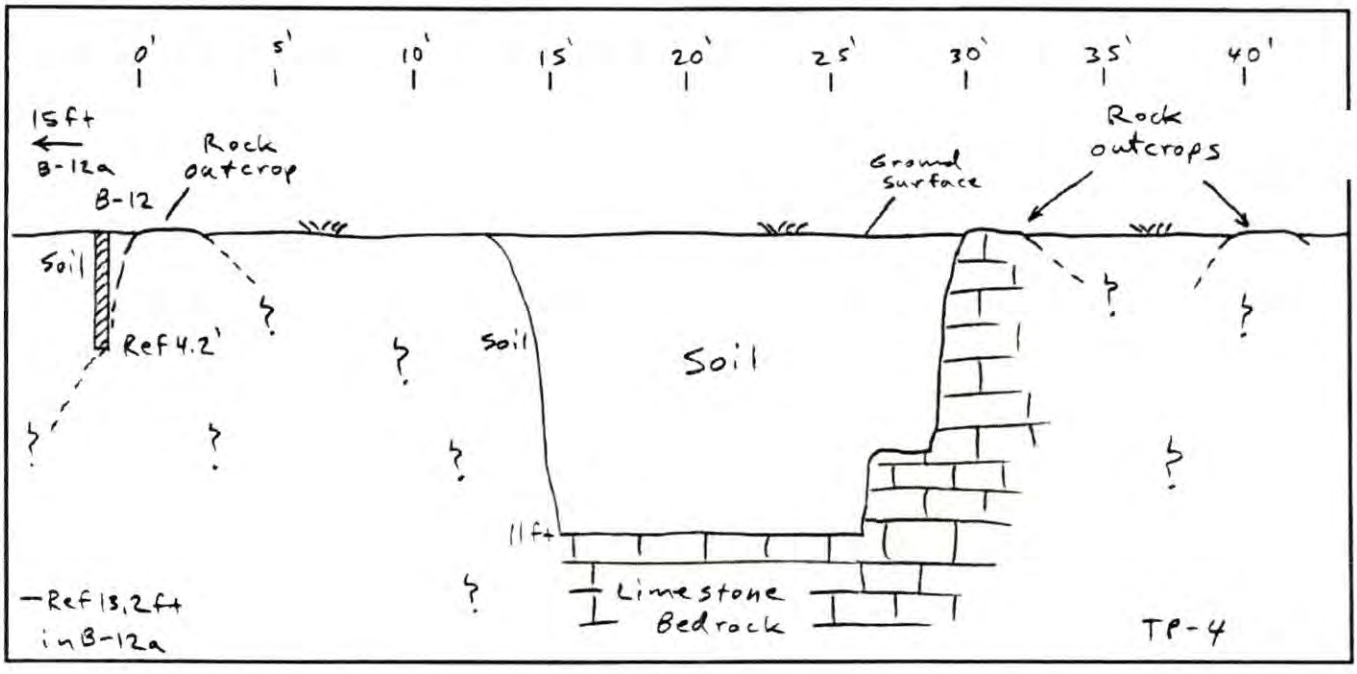
GEOTEK

LOG OF TEST-PIT

Test-Pit No: TP-4

Project:	Veterans Blvd Substation		
Site Location:	Murfreesboro, Tennessee	**Logged By:**	Stephen Capps
Project No.:	15-6968-A	**Date:**	July 10, 2015
Client:	Allen & Hoshall Nashville, Tennessee	**Location:**	See Figure 4

Depth (ft)	Description
0 - 1.0	TOPSOIL, SILTY CLAY w/ fine sand traces, hair-line roots, brown
1.0 - 3.0	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, red-brown-tan and gray-brown (pp=1.0 tsf)
3.0 - 11.0	SILTY CLAY w/ fine sand traces, chert, orange-tan-brown (pp=1.5 - 3.25 tsf)
0 - 11.0	Refusal on Pinnacled Limestone Bedrock



Notes:
1. No groundwater encountered during the opening of the test-pit.
2. Photos of the test-pit are on the following page.
3. pp = Pocket Penetrometer reading (indicates soil consistency). This is not allowable bearing value.
4. The above sketch is at a 1:1 scale (vertical = horizontal). The test-pit measurements were made with a tape measure and are approximate.

Test-Pit TP-4

Veterans Blvd Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

GEOTEK

CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

NON-COHESIVE SOILS

(Silt, Sand, Gravel, and Combinations)

DENSITY	SPT N-VALUE
Very Loose	5 blows/ft or less
Loose	6 to 10 blows/ft
Medium Dense	11 to 30 blows/ft
Dense	31 to 50 blows/ft
Very Dense	51 blows/ft or more

RELATIVE PROPORTIONS

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

PARTICLE SIZE IDENTIFICATION

Boulders	8 inch diameter or more
Cobbles	3 to 8 inch diameter
Gravel	Coarse - 1 to 3 inch
	Medium - 1/2 to 1 inch
	Fine - 1/4 to 1/2 inch
Sand	Coarse - 0.6 mm to 1/4 inch (dia. of pencil lead)
	Medium - 0.2 mm to 0.6 mm (dia. of broom straw)
	Fine - 0.05 mm to 0.2 mm (dia. of human hair)
Silt	0.06 mm to 0.002 mm (cannot see particles)

COHESIVE SOILS

(Clay, Silt, and Combinations)

CONSISTENCY	SPT N-VALUE
Very Soft	3 blows/ft or less
Soft	4 to 6 blows/ft
Medium Stiff	7 to 12 blows/ft
Stiff	13 to 20 blows/ft
Very Stiff	21 to 35 blows/ft
Hard	35 blows/ft or more

PLASTICITY

Degree of Plasticity	Plasticity Index (PI)
Low	0 - 7
Medium	8 - 22
High	over 22

Classification - On logs are made by visual inspection in general accordance with the Unified Soil Classification System.

Standard Penetration Test (SPT) - Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 1.0 foot into undisturbed soil with a 140-pound hammer free falling a distance of 30 inches. It is customary to drive the spoon 6 inches to seat the sampler into undisturbed soil, and then perform the test. The number of hammer blows for seating the spoon and making the tests are recorded for each 6 inches of penetration on the field drill log (e.g., 6/4/6). On the report log, the Standard Penetration Test result (i.e., the N value) is normally presented and consists of the sum of the 2nd and 3rd penetration counts (i.e., N=4+6=10 blows/ft).

Strata Changes - On the boring log, the horizontal lines represent strata changes. A solid line (——) represents an actually observed stratum change. A dashed line (-----) represents an estimated stratum change.

Groundwater - Observations were made at the time indicated. Porosity of soil strata, weather conditions, site topography, etc., may cause changes in water-level readings indicated on the logs.

APPENDIX B

LABORATORY TEST DATA

TABLE B-1: SOIL INDEX-CLASSIFICATION TEST DATA (from borings)

N-Value" blows/ft)	PP (tsf)	Natural Moisture Content	Soil Description
11	2.5 - 3.0	21	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown
15	3.25	33	CLAY w/ silt, fine sand traces, chert, brown and red-brown **(LL=62, PL=32, PI=30) MH**
50+	3.25	31	CLAY w/ silt, fine sand traces, chert, brown, red-brown, and gray
9	2.0	27	CLAY w/ silt, fine sand traces, chert , brown **(LL=51, PL=26, PI=25) CH**
21	2.25	28	CLAY w/ silt, fine sand traces, ferrous oxide nodules, chert, limestone fragments, brown and red-brown
14	3.0	29	CLAY w/ silt, fine sand traces, chert, red-yellow-brown
50+	1.0 - 2.25	30	CLAY w/ silt, fine sand traces, chert, limestone fragments, red-yellow-brown
13	2.5 - 3.25	22	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, hair-line roots, tan-brown and brown
12	3.0 - 3.25	22	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown-gra
50+	1.5 - 2.75	22	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-gray

tent (W) per ASTM D2216. Atterberg Limits per ASTM D4318.
ıdard Penetration Test" measuring number of hammer blows required to drive split-spoon hammer 1 foot into ground (ASTM D1586).
s/ft probably influenced by presence of bedrock at/near this depth range.
gnations:
t (i.e., moisture content where soil becomes viscous fluid)
ıit (i.e., moisture content where soil enters semi-solid stage)
ıdex (equals LL-PL and is representative of soil's plasticity)
meter reading (indicates soil consistency). This is not allowable bearing value.
sification (USCS) designation follows the description w/ Atterbergs in parenthesis.

Veterans Parkway 161-13kV Substation
Murfreesboro, Tennessee
GPN: 15-6968-A

TABLE B-1: SOIL INDEX-CLASSIFICATION TEST DATA (continued)

GPN: 15-6968-A

N-Value" blows/ft)	PP (tsf)	Natural Moisture Content	Soil Description
7	1.5 - 2.5	23	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, red-tan-brown and black **(LL=38, PL=18, PI=20) CL**
12	2.5 - 3.75	19	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, tan-brown and brown
22	3.75 - 4.5+	19	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, tan and red-brown
17	2.5 - 3.25	21	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, orange and tan-brown
15	3.0	23	SILTY CLAY w/ fine sand traces, chert, tan-brown, orange-brown and brown
11	4.25	21	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown, tan-brown and gray-brown
15	4.25	20	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, orange and tan-brown
[illegible]	2.75 - 3.0	22	SILTY CLAY w/ fine sand traces, chert, brown and dark-brown
6	1.25	18	SILTY CLAY w/ fine sand traces, hair-line roots, ferrous oxide nodules, chert, brown
11	3.0	20	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-tan and gray-brown
12	3.25	30	SILTY CLAY w/ fine sand traces, chert, brown
11	2.0	21	SILTY CLAY w/ fine sand traces, limestone fragments, chert, ferrous oxide nodules, brown

TABLE B-1: SOIL INDEX-CLASSIFICATION TEST DATA (continued)

N-Value" blows/ft)	PP (tsf)	Natural Moisture Content	Soil Description
8	2.75 - 3.0	21	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, tan-brown and brown
13	3.0 - 3.25	21	SILTY CLAY w/ fine sand traces, limestone fragments, chert, ferrous oxide nodules, brown and tan-brown **(LL=46, PL=19, PI=27) CL**
7	2.5	25	SILTY CLAY w/ fine sand traces, hair-line roots, ferrous oxide nodules, brown and gray-brown
7	1.75	24	SILTY CLAY w/ fine sand traces, chert, gray-brown
39	2.25	22	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown and gray-brown
16	1.25	33	CLAY w/ silt, fine sand traces, chert, black and brown-gray (mottled)
4	—	23	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, gray-brown
4	0.5	22	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, gray-brown **(LL=28, PL=16, PI=12) CL**
7	2.25	20	SILTY CLAY w/ fine sand traces, hair-line roots, gray-tan-brown
7	1.25	20	SILTY CLAY w/ fine sand traces, hair-line roots, chert, gray-brown
50+	0.5	29	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, gray-brown

TABLE B-1: SOIL INDEX-CLASSIFICATION TEST DATA (continued)

N-Value" blows/ft)	PP (tsf)	Natural Moisture Content	Soil Description
8	2.25	17	SILTY CLAY w/ fine sand traces, chert, hair-line roots, brown-tan-brown and red-brown (mottled)
12	3.5	19	CLAY w/ silt, fine sand traces, tan-brown, brown and gray
15	2.0	19	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert fragments, tan-brown, red-brown and brown **(LL=37, PL=17, PI=20) CL**
12	1.75	21	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, tan-brown and red-brown
50+	1.0	32	SILTY CLAY w/ fine sand traces, brown and dark-brown
27	1.5	22	SILTY CLAY w/ fine sand traces, chert, hair-line roots, ferrous oxide nodules, brown
12	1.75	22	SILTY CLAY w/ fine sand traces, chert, hair-line roots, ferrous oxide nodules, limestone fragments, brown
50+	1.5	19	SILTY CLAY w/ fine sand traces, chert, limestone fragments, ferrous oxide nodules, brown and tan-brown
	2.25 - 4.25	21	SILTY CLAY w/ fine sand traces, hair-line roots, brown-gray
50+	1.25 - 2.25	17	SILTY CLAY w/ fine sand traces, gray-brown
10	1.0 - 2.0	18	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, brown, gray-brown and red-brown
15	2.75 - 3.25	18	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, brown-gray, red-brown and brown **(LL=33, PL=16, PI=17) CL**
12	2.0 - 3.25	18	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, hair-line roots, tan-brown, gray-brown and brown
13	3.25 – 3.5	26	SILTY CLAY w/ fine sand traces, chert, brown, tan-brown and red-brown

TABLE B-1: SOIL INDEX-CLASSIFICATION TEST DATA (continued)

N-Value" blows/ft)	PP (tsf)	Natural Moisture Content	Soil Description
37	N/A	3	LIMESTONE GRAVEL and trace SILTY CLAY, brown
10	N/A	2	LIMESTONE GRAVEL and little SILTY CLAY, brown
13	2.25 - 2.75	23	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown, gray-brown
14	3.0 - 3.25	26	SILTY CLAY w/ fine sand traces, chert, brown and gray-brown
32	3.5	9	SILTY CLAY w/ fine sand traces, chert, limestone fragments, brown-gray
11	2.5 - 3.0	22	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, hair-line roots, gray-brown
7	2.0	19	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, red and dark-brown
14	2.0 - 2.75	17	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-tan and gray-brown
18	3.25 - 3.75	21	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-tan and gray-brown
50+	2.5	22	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown and gray-brown
4	0.75 - 1.0	23	SILTY CLAY w/ fine sand traces, chert, tan and red-brown
9	2.0 - 2.25	23	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, brown
12	2.5 - 3.25	26	SILTY CLAY w/ fine sand traces, tan and orange, brown-gray
16	1.5 - 2.0	24	SILTY CLAY w/ fine sand traces, chert, yellow-orange-brown & dark gray-black

TABLE B-1: SOIL INDEX-CLASSIFICATION TEST DATA (continued)

N-Value" blows/ft)	PP (tsf)	Natural Moisture Content	Soil Description
2	2.5 - 3.0	25	SILTY CLAY w/ fine sand traces, chert, red-brown
9	2.0 - 2.5	18	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, orange-brown and brown
16	2.5 - 4.0	18	SILTY CLAY w/ fine sand traces, chert, brown and tan-brown-gray
16	3.25 - 3.5	20	SILTY CLAY w/ fine sand traces, chert, ferrous oxide nodules, tan and yellow-brown
19	3.0 - 3.25	20	SILTY CLAY w/ fine sand traces, chert, black-gray-tan and yellow-brown

ent (W) per ASTM D2216. Atterberg Limits per ASTM D4318.
dard Penetration Test" measuring number of hammer blows required to drive split-spoon hammer 1 foot into ground (ASTM D1586).
s/ft probably influenced by presence of bedrock at/near this depth range
inations:
(i.e., moisture content where soil becomes viscous fluid)
it (i.e., moisture content where soil enters semi-solid stage)
dex (equals LL-PL and is representative of soil's plasticity)
neter reading (indicates soil consistency). This is not allowable bearing value
ification (USCS) designation follows the description w/ Atterbergs in parenthesis.

TABLE B-2: SOIL INDEX-CLASSIFICATION TEST DATA (from test-pits)

PP (tsf)	Natural Moisture Content	Soil Description
0.25	21	SILTY CLAY w/ fine sand traces, red-brown **(LL=34, PL=19, PI=15) CL (R = 8300)**
1.75 - 3.5	17	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, brown-red-tan and yellow-brown
2.0 - 3.5	20	SILTY CLAY w/ fine sand traces, chert, brown and dark-brown
1.75	22	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, gray-red and tan-brown **(LL=46, PL=20, PI=26) CL (R = 1400)**
1.0	19	SILTY CLAY w/ fine sand traces, ferrous oxide nodules, chert, red-brown-tan and gray-brown **(LL=30, PL=15, PI=15) CL (R = 4700)**
1.5	20	SILTY CLAY w/ fine sand traces, chert, orange-tan-brown
3.25	23	SILTY CLAY w/ fine sand traces, chert, orange and tan-brown

ımeter reading (indicates soil consistency). This is not allowable bearing value.
ıtent per ASTM D2216. Atterberg Limits per ASTM D4318.
gnations:
it (i.e., moisture content where soil becomes viscous fluid)
ıit (i.e., moisture content where soil enters semi-solid stage)
ıdex (equals LL-PL and is representative of soil's plasticity)
ation System (USCS) designation follows the Atterberg Limits values.
n) per ASTM G57.

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APPENDIX C

ASFE PUBLICATION

EXAMPLE CHANGED-CONDITION CLAUSE

FIELD-OBSERVATION MEMORANDUM

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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e-mail: info@asfe.org www.asfe.org

IGER06045.0M

EXAMPLE CLAUSE FOR UNANTICIPATED SUBSURFACE CONDITIONS

The owner has had a subsurface investigation performed by a foundation consultant, the results of which are contained in the consultant's report. The consultant's report presents his conclusions on the subsurface conditions based on his interpretation of the data obtained in the investigation. The contractor acknowledges that he has reviewed the consultant's report and any addenda thereto, and that his bid for earthwork operations is based on the subsurface conditions, as described in that report. It is recognized that a subsurface investigation may not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of a subsurface investigation and the time of earthwork operations. In recognition of these facts, this clause is entered in the contract to provide a means of equitable additional compensation for the contractor if adverse unanticipated conditions are encountered and to provide a means of rebate to the owner if the conditions are more favorable than anticipated.

"If at any time during earthwork, paving, and foundation construction operations, the contractor encounters conditions that are different than those anticipated by the foundation consultant's report, he shall immediately (within 24 hours) bring this fact to the owner's attention. Once the fact of unanticipated conditions has been brought to the attention of either the owner or the contractor, and the owner and the contractor have concurred, immediate negotiations will be undertaken between the owner and the contractor to arrive at a change in contract price for additional work or reduction in work because of the unanticipated conditions. The contractor agrees that the following unit prices would apply for additional or reduced work under the contract. For changed conditions for which unit prices are not provided, the additional work shall be paid for on a time and materials basis."

Another example of a changed conditions clause can be found in Paper No. 4035 by Robert F. Borg published in ASCE Construction Division Journal, No. C02.

FIELD OBSERVATION
A MESSAGE TO CLIENTS

Geotechnical engineering, geoenvironmental design, and other geoprofessional services are traditionally rendered through the Observational Method, the classic technique created by the father of geotechnics, Karl Terzaghi.

No matter how precise it may appear, the subsurface profile is fraught with uncertainty.

The Observational Method views a complete geoprofessional service as an indivisible two-phase process. In the first phase, the geoprofessional advises the client about project-specific risks and a subsurface exploration plan that responds to the client's risk tolerance levels, budget, schedule, and other vital concerns. The geoprofessional then supervises subsurface exploration and evaluates the samples and test data that result in order to prepare a subsurface profile that represents the geoprofessional's opinion of subsurface conditions. No matter how precise it may appear, the subsurface profile is fraught with uncertainty; it is based on a statistically tiny sample of the subsurface zone.

The subsurface profile typically is submitted as part of a report that also includes specific recommendations for construction or remediation. Even if they are not labeled as such, these recommendations are preliminary, because of the uncertainty associated with the subsurface profile on which they are based.

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Field observation comprises the second phase of a complete geoprofessional service, permitting those who developed the report to observe excavation and thereby assess the reliability of their subsurface profile and the appropriateness of their preliminary recommendations. Actual conditions often differ from those expected, and that situation can create serious problems unless a qualified individual is available to decide what to do about them, where and when they are found. Decisions such as these are "judgement calls," and the quality of judgment can have a profound impact on the client's bottom line. The geoprofessionals of record are most qualified to make effective judgment calls because they are the individuals who are most familiar with the report and its preliminary recommendations, the exploration plan, the original findings, and the client's risk tolerance levels.

Some clients eliminate the observational method by separating the two geoprofessional service phases and retaining a second firm to perform field observation. A common reason given can be stated in one word: Money. By opening field observation services to all "qualified" bidders, the owner might find a firm that is willing to perform the service for less than the original firm. As experienced owners know, however, the true cost of a professional service goes far beyond fee. Paying less by relying on another firm is hardly consolation when that firm is not in a position to recognize or respond quickly to problem conditions that lead to delays, overruns, claims, or disputes, as demonstrated by a number of case histories available from ASFE.

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Geoprofessionals have their own risks to contend with, of course, and for that reason they inquire about field observation at the outset of a project. Ordinarily, geoprofessionals work closely with project owners and their consultants in recommending the most cost-effective approach consistent with the owner's objectives, knowing that the Observational Method permits close oversight and fast reaction should unanticipated conditions be encountered. When the Observational Method will not be used, however, geoprofessionals are advised to lower their risks by relying on a far more comprehensive scope of service than otherwise would be suggested, and/or by recommending construction or remediation measures with a higher safety factor. The result in some cases can be additional project costs that exceed the total fee paid for geoprofessional service; e.g., a $1.2 million foundation or clean-up as opposed to one costing $1 million.

Responsibility is another key concern when considering the observational phase of a geoprofessional service. Geoprofessionals are advised to disavow responsibility for problems that arise when others apply - as final - recommendations that clearly are subject to field verification. In essence, these firms say, "Why should we be held accountable for problems that arise because we were prohibited from completing our service and our work was misapplied by others?" Firms retained just to perform field observation are also advised to disavow responsibility for problems. After all, their role is not to complete the original firm's service, but rather to help determine that preliminary recommendations are followed as though they are final.

When the Observational Method is not used..., full responsibility might end up in the owner's lap.

In fact, a client can obtain a complete geoprofessional service *only* by having the original firm perform field observation after it completes subsurface exploration, or by having the second firm confer with the original firm and then accept the original firm's services (and liability for them) as its own. This latter approach can be a somewhat risky proposition for the second firm and actually would be considered illegal in states that regard it as a form of unacceptable plan stamping.

In short, when the Observational Method is not used and a complete geoprofessional service therefore is not performed, full responsibility might end up in the owner's lap.

The least overall cost and risk almost invariably result from professional services performed effectively. When geotechnical and geoenvironmental consultants are not allowed to perform a complete geoprofessional service, their ability to perform effectively is seriously eroded. Speak with your geoprofessional consultant for more information about this important issue or contact ASFE.

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