**1412203478 (RFP-CCNA) Geotechnical Services for Transmission and Substation Projects**
**Appendix A – Scope of Work**

## SECTION 1: OBJECTIVES AND DESCRIPTION OF PROJECTS

### 1.1 General

JEA is soliciting qualifications from Geotech firms to perform geotechnical investigation services needed for Transmission and Substations facilities. JEA will require a successful bidder to perform all geotechnical investigation including drill rigs, SPT, CPT, sampling, soil testing, ground water level and thermal resistivity for use of transmission & Substation projects.

## SECTION 2: SCOPE OF SERVICES

### 1.0 Field Investigation Requirements

#### 1.1. Locations

Perform indicated investigation techniques and/or field-testing techniques at indicated investigation locations. If coordinates are provided, utilize GPS equipment that provides accuracy of less than 10 feet for establishing investigation locations. If dimensions are provided, establish investigation locations using methods that provide accuracy of less than 0.5 feet. Stake final placement of investigation locations.

Investigation locations may be adjusted in the field to avoid utilities, overhead obstructions, or to permit easier access, provided the final locations (latitude and longitude coordinates) are noted on the respective logs and plans and adjustment is discussed in final report. Offsets shall not exceed 10 feet from the original location unless approved in advance. In addition, the final latitude and longitude coordinates of all investigation locations shall be summarized as a table in the report and on the boring logs and shall have an accuracy of five (5) decimal places.

If indicated, survey the elevation of each final investigation location, and note the elevation on each boring log. Be responsible for using an established plant benchmark for elevation information or establishing a temporary benchmark.

#### 1.2. Site Access

Coordinate with the JEA for access to the site and determine requirements to access the test locations and site restoration requirements.

#### 1.3. Utilities

Locate all underground utilities, obstructions, objects and subsurface structures in vicinity of investigation prior to commencement of any intrusive operations. This includes making appropriate One-Call utility locate, reviewing private utility information made available and meeting with on-site personnel familiar with locations of private utilities as needed. Be responsible for protection of all utilities, obstructions, objects and subsurface structures once identified and be responsible for all damage to such utilities, obstructions, objects and subsurface structures caused by operations.

If indicated, perform soft dig techniques in the indicated upper footage at the indicated investigation locations. Soft dig techniques may include hydro-vac excavation or other techniques accepted during the proposal phase to verify clearances from subsurface utilities and structures. Soft dig techniques shall be performed in an “L” shape or in a perimeter around the investigation locations such that undisturbed samples in the indicated upper footage can be obtained. Backfill with material that

prevents subsidence at surface. Note backfill material and method in report.

If indicated, subcontract a private utility locate service to locate utilities at the indicated investigation locations. Use of ground penetration radar or other techniques accepted during the proposal phase shall be used. Provide results of private utility locate service including any plan drawings of the site with located utilities noted.

## 1.4. Contamination

*No Known Contamination*

No contamination is known at the site. If contamination is encountered, cease work and contact contracting party for further direction.

*Possible Contamination in Soils*

Previous construction in the vicinity of the proposed project encountered indicated contamination in the subsurface soils. Due to the potential for encountering additional amounts of the indicated contamination at the proposed subsurface investigation areas, take appropriate measures to detect the presence of contaminants and properly handle any contaminated materials encountered during the proposed subsurface investigation. If contaminated materials are encountered during the investigation, immediately notify the contracting party. Be responsible for the safety and protection of its persons and property at the project site and shall comply with all applicable federal, state, and local safety laws and regulations.

If indicated, contaminated soil cuttings and drilling fluids shall be containerized and removed from the investigation area and disposed of at an off-site location at the direction of the contracting party.

If indicated, contaminated soil cuttings and fluids shall be containerized as required to meet federal, state, and/or local regulations, and moved to an off-site location at the direction of the JEA. JEA will be responsible for treatment and/or disposal of the contaminated materials.

*Known Contamination in Soils*

Known contamination is expected to be encountered during the investigation. Investigation shall be performed in accordance with the Contamination Work Plan provided.

## 1.5. Borings

Advance borings to the indicated minimum depths with drilling methods that minimize the potential for disturbance, sloughing, or mixing of materials within soil samples. When water is encountered within a hole in cohesionless material, rotary wash drilling methods with bentonite or polymer slurry shall be used, in which positive head is maintained within the hole. Water levels encountered as well as the method used in advancing drilling shall be indicated on the respective boring logs.

Do not terminate borings in soils that do not provide adequate resistance for the structure types, foundations, loads, earthwork or other project aspects that affect geotechnical performance. At a minimum, medium stiff cohesive soils or medium dense sands are required for boring termination.

Spoils and drilling fluids are to be disposed of properly based on site conditions and as directed. For undeveloped sites, spoils and drilling fluids can be spread along the surrounding ground surface with acceptance by JEA. For developed sites, spread soils and drilling fluids in nearby open area with acceptance by JEA or dispose of spoils and drilling fluids off-site. If specified, containerize all spoils and drilling fluids in 55-gallon metal drums and manage as directed by JEA. If specified, dispose of drums and contents at an off-site location per local, state, and federal regulations.

If specified, coring of pavement is required to perform investigation. Provide required equipment for coring.

If bedrock is encountered and no rock coring is indicated, borings can be terminated upon auger refusal on bedrock and a confirmatory sample taken. Auger refusal is defined as less than 3-inches of drill advancement over a one-minute interval with full drilling effort.

If unanticipated bedrock is encountered, boring may be terminated upon achieving 10 feet of rock core or the minimum boring depth. Under no circumstances shall the total boring depth be less than 50 percent of the indicated minimum boring depth. Notify the JEA within 24 hours of encountering unanticipated bedrock.

If coring is required, drill boring to refusal on bedrock and then core to minimum core length and/or boring depth as indicated.

Where rock core samples are obtained, the boring logs shall include detailed information regarding the rock types, rock formations, degree of hardness, cementation, extent of weathering, percentage of recovery, and Rock Quality Designation (RQD) values.

## 1.6. Sampling

Obtain indicated samples every 2.5 feet in the upper 15 feet and every 5 feet below 15 feet unless otherwise indicated by the following methods:

a. Split-Barrel Sampler (SPT) or Ring-Lined Barrel Sampling in cohesionless soils (sands, gravels, non-plastic silts), and cohesive soils (clays and plastic silts) where a disturbed sample is appropriate or a Shelby tube cannot be obtained (hard soils); ASTM D1586 or D3550.

b. Thin-Walled Tube (Shelby) in cohesive soils (clays, plastic silts and materials with cohesive binder); ASTM D1587.

c. Obtain bulk samples of materials from near-surface and/or cut areas for compaction testing.

d. If applicable, perform rock coring continuously to obtain rock core samples and store in core boxes in accordance with ASTM D2113. Take color photographs of each complete core box for inclusion in the Report.

If Field Directed Sampling is indicated, obtain Thin-Walled Tube and bulk samples at indicated points and depths as directed in the field.

Practical refusal of the sampler shall be defined as a minimum of 50 blows for one inch when within the first six inches of the sampler penetration, and 50 blows for six inches or less when the sampler penetration exceeds six inches.

Provide hammer calibration, and blow count correction to obtain standard N60 value, if an automatic hammer is utilized. Note on the logs what type of hammer is utilized (rope and cathead, or auto hammer and relative energy).

Obtain calibrated hand-held pocket penetrometer and/or torvane readings on all cohesive samples in the field. Seal samples to prevent disturbance and moisture changes and transport them to the laboratory for testing. Field extrusion of thin-walled tube (Shelby) samples shall not be performed. Maintain samples for six months after the final Report is provided.

### 1.7. Rock Probes
Perform rock probe borings at the indicated locations. Drill rock probes until termination criteria is met. Obtain SPT samples every 5 feet for depth of rock probe unless otherwise indicated. An SPT sample shall be obtained at the termination depth of the rock probe. No laboratory testing on SPT samples from rock probes will be performed.

### 1.8. Cone Penetrometer (CPT) Soundings
Perform CPT soundings at the indicated locations. Complete the CPT soundings to the previously defined depth or refusal criteria utilizing a minimum 10-ton CPT rig that is specifically outfitted to perform only CPT soundings. Other equipment may be considered at discretion of JEA. Utilize seismic CPT as required for indicated work.

Raw cone penetrometer data shall include direct measurements of the cone depth, tip resistance, sleeve friction, and pore pressure for maximum intervals of 2 inches over the full sounding depth. Graphical presentation of the CPT data shall include the above direct measurements, plus additional graphics for the friction ratio, soil classification and shear strength parameters, as applicable. Provide raw data including cone depth, tip resistance, sleeve friction and pore pressure in .XLS format. Provide probe radius, cone area ratio and location of pore pressure measurements on cone.

### 1.9. Backfill
If indicated, backfill all borings and CPT soundings, after water level measurements, with cement- bentonite grout (or in general accordance with the specific requirements of applicable federal, state, and/or local agencies). The backfill material and technique shall be noted on the boring logs and in Report.

If indicated, backfill all borings and CPT soundings, after water level measurements, with bentonite chips or pellets (or in general accordance with the specific requirements of applicable federal, state, and/or local agencies). The backfill material and technique shall be noted on the boring logs and in Report.

If a particular backfill method is not indicated, backfill all borings and CPT soundings in general accordance with the specific requirements of applicable federal, state, and/or local agencies.

For existing pavements, patch in kind with existing materials by using concrete or cold patch asphalt.

### 1.10. Groundwater Measurements
In all borings, measure groundwater when first encountered during drilling and at completion of drilling. Perform additional measurements of groundwater depth as indicated.

### 1.11. Piezometers
Install piezometers as indicated for use in monitoring piezometric levels and obtaining water samples. Install piezometers in augered borings only. Install each piezometer in accordance with the applicable federal, state, or local regulations. Obtain all necessary piezometer installation permits.

Minimum requirements for piezometer installation and finishing shall be as noted in attached scope.

## 2.0 Field Testing

### 2.1 Field Electrical Resistivity Survey
Perform a field resistivity survey at the locations indicated. The survey shall be completed in an area

that is not influenced by the presence of overhead EHV transmission lines, underlying storage facilities, underground utilities or other obstructions that would impact the results of the survey.

## 2.2 Field Crosshole Seismic Testing

Perform field crosshole seismic testing at the locations indicated. The field crosshole seismic testing shall be performed in accordance with ASTM D4428, Standard Test Methods for Crosshole Seismic Testing.

Provide a summary of the field crosshole seismic testing, including a design soil profile with soil unit weight, shear wave velocity, shear modulus, and Poisson's ratio values as a function of depth for the site in final report.

## 2.3 Field Downhole Seismic Testing

Perform field downhole seismic testing, including seismic CPT soundings, at the locations indicated. The field downhole seismic testing shall be performed in accordance with ASTM D7400, Standard Test Methods for Downhole Seismic Testing. Provide a summary of the field downhole seismic testing, including a design soil profile with soil unit weight, shear wave velocity, shear modulus, and Poisson's ratio values as a function of depth for the site in final report.

## 2.4 Field MASW Survey

Perform a field MASW (Multichannel Analysis of Surface Waves) survey at the indicated locations. Complete each survey in an area that is not influenced by the presence of underlying utilities or other obstructions that would impact the results of the survey. Obtain approval in advance of adjustments of a survey location as needed to avoid utilities or other obstructions if approved in advance. Provide a summary of the field MASW testing, including a design soil profile with soil unit weight, shear wave velocity, shear modulus and Poisson's ratio values as a function of depth for the site and final survey location in final report.

## 2.5 CPT Dissipation Testing

Perform dissipation tests at indicated CPT sounding locations in accordance with ASTM D5778, Standard Test Method for Electronic Friction Cone and Piezocone Penetration Testing of Soils. Dissipation tests shall be performed at intervals indicated within the CPT sounding depth below groundwater. Each dissipation test shall be held until all excess pore pressures dissipate. If time to fully dissipate excess pore pressures is greater than 600 seconds, dissipation test shall be held until 50% of excess pore pressures dissipate. Provide dissipation test result data in XLS format.

If depth interval is not indicated, a minimum of one dissipation test shall be performed at the termination depth or refusal of the CPT sounding.

## 2.6 Field Hydraulic Conductivity Testing

If indicated, perform field hydraulic conductivity testing at indicated piezometers and/or borings.

## 2.7 Pressure meter Testing

Perform pressure meter testing at locations indicated.

## 2.8 Thermal Resistivity

Obtain samples for laboratory thermal resistivity testing or perform in-situ thermal resistivity testing at locations indicated.

## 2.9 Infiltration Testing

Perform infiltration testing at locations indicated.

### 2.10 Geophysical Testing

Perform geophysical testing at locations indicated.

## 3.0 Laboratory Testing

### 3.1. Specified Testing Program

For specified testing program, perform test types and quantities as specified during the investigation. Provide any necessary information including draft/field logs, CPT sounding data, soil sample type and recoveries or other pertinent information to aid in laboratory testing assignments.

### 3.2. Non-specified Testing Program

Perform laboratory test types and quantities to classify soils and obtain geotechnical physical characteristics for soils and rock such as strength, compressibility, and compaction characteristics. Perform laboratory testing consistent in quantity and quality with local geotechnical engineering practice to provide the information for the required recommendations. The quantity of tests to be performed shall be dependent upon type of soil and/or rock encountered during drilling and sampling and in consideration of recommendations required for the structures. Laboratory tests may include, but are not limited by, the tests listed below:

a. Moisture Content
b. Dry Unit Weight
c. Sieve Analyses
d. Percent Finer than No. 200 Sieve
e. Atterberg Limits
f. Unconfined Compression – Soil (Although pocket penetrometer test results can be used to support unconfined compression strength results, they shall not be used exclusively to establish design recommendations for cohesive soils.)
g. Unconfined Compression - Rock
h. One-Point Triaxial Compression (Unconsolidated Undrained)
i. Three-Point Triaxial Compression (Consolidated Undrained with Pore Pressure Measurements)
j. Direct Shear (Consolidated Drained) (to be used in soils not conducive to Unconfined or Triaxial Tests) (Note: soil samples which exhibit a tendency to premature failure due to low cohesion should be tested with a confining pressure equal to the overburden pressure at the depth which the sample was located.)
k. Swell Pressure
l. Consolidation
m. Compaction Characteristics (Standard or Modified Proctor Test, as indicated)
n. Chemical Analyses
    (1) pH
    (2) Soluble Sulfates
    (3) Chloride Ion
    (4) Electrical Resistivity
    (5) Redox Potential
    (6) Sulfides

## 4.0 Reporting

### 4.1. Data Only Report

Provide report prepared under the direction of a Registered Professional Engineer in Florida and signed and sealed in accordance with florida state regulations. Draft version shall be submitted for review and comment. Following receipt and incorporation of draft comments provide an electronic copy (pdf format) of the final report.

Provide all data and information related to the work performed and applicable to the project. Data includes final boring logs, computer generated CPT sounding logs as well as raw CPT data files, boring location plan, laboratory testing program results, results of the field resistivity survey, results of the field crosshole seismic testing, results of field downhole seismic testing, results of MASW survey testing, results of thermal resistivity testing, CPT dissipation testing results, groundwater depths, results of pressuremeter testing, results of field hydraulic conductivity testing and/or results of infiltration testing.

Provide all laboratory testing result data sheets in report including in addition to results noted on boring logs. Summarize all laboratory testing results in a table attached to report as required by Contracting Party.

### 4.2. Interpretative Report

*General*

Provide report prepared under the direction of a Registered Professional Engineer in Florida and signed and sealed in accordance with florida state regulations. Draft version (pdf format) shall be submitted for review and comment. Following receipt and incorporation of draft comments, provide a final report (pdf format). If required, provide all documented calculations for review.

Prepare geotechnical analysis and recommendations in accordance with applicable provisions of the International Building Code (IBC), ASCE7, and any applicable local or state codes as indicated.

*Data*

Provide all data and information related to the work performed and applicable to the project. Data includes investigation location plan, final boring logs, computer generated CPT sounding logs as well as raw CPT data files, laboratory testing program results, results of the field resistivity survey, results of the field crosshole seismic testing, results of field downhole seismic testing, results of MASW survey testing, results of thermal resistivity testing, CPT dissipation testing results, groundwater depths, results of pressuremeter testing, results of field hydraulic conductivity testing, and/or results of infiltration testing.

Provide all laboratory testing result data sheets in report including in addition to results noted on boring logs. Summarize all laboratory testing results in a table attached to report as required by JEA.

*Subsurface Conditions*

Provide discussion of subsurface conditions encountered based upon stratigraphic sequence observed and local geology. Provide figures displaying soil borings, CPT soundings and generalized cross sections.
Provide a general description of the engineering properties or parameters developed from the

investigation and applied to foundation recommendations. Provide prevailing groundwater elevations observed and those recommended for design.

*Geologic Hazards*

Perform a review of geologic information and provide a discussion of site geologic-seismic conditions that may impact the proposed development, considering the geologic setting, geologic materials, groundwater conditions and faults. Provide a discussion of the potential geologic hazards in the vicinity of the site which may impact the project; including but not limited to fault rupture, landslides, dispersive or collapsible soils, flooding, tsunamis, seiches, inundation, scour and subsidence, as applicable to the site. Provide an evaluation of the applicable geologic hazards and special design features required to resist or reduce these tendencies.

Provide an evaluation of the potential of subgrade materials to develop karst features, solution channels or sinkhole formations and special design features required to resist or reduce these tendencies. Provide definition and discussion of the relative risk for sinkhole development and/or the presence of voids within the subsurface materials encountered.

Provide an evaluation of the expansive (swelling) nature of subgrade materials and special design features required to resist or reduce these tendencies shall be discussed. If soils present at the site are suspected of exhibiting expansive characteristics, perform a sufficient number of swell/collapse potential tests to adequately characterize the site's active zone.

*Seismic Hazards*

Perform a review of seismic hazards which may include slope instability, liquefaction, total and differential settlement (seismic induced), surface displacement due to faulting or seismically induced lateral spreading or lateral flow. Provide recommendations to address the following seismic design parameters in accordance with applicable provisions of IBC and ASCE7.

- Provide a determination of the Site Class in accordance with Chapter 20 of ASCE7.
- Provide a determination of mapped acceleration parameters $S_s$, $S_1$, $F_a$, $F_v$, $S_{DS}$, and $S_{D1}$ in accordance with ASCE7.
- Provide a determination of the Seismic Design Category per Section 11.6 of ASCE7, based upon the site-specific information and Risk Category classification.
- When structures are noted as Seismic Design Categories, the geotechnical investigation shall include an evaluation of all the following potential geologic and seismic hazards in accordance with Sections 11.8.2 and 11.8.3 of ASCE7: slope instability, liquefaction, total and differential settlement (seismic induced), surface displacement due to faulting or seismically induced lateral spreading or lateral flow. Provide recommendations for foundation designs or other measures to mitigate the effects of the above hazards.

*Previous Construction Activity*

Provide a discussion of previous construction activity which addresses any existing fills or subsurface openings (including surface or underground mining), if applicable. Outline the engineering properties of any existing fills in regard to foundation design.

*Earthwork*

Provide grading recommendations taking into consideration conceptual grading plan for the site. Provide recommended slope percent and associated distance from structures to maintain proper drainage away from foundations.

Provide general criteria and recommendations for acceptable fill and backfill materials (general and structural fill). If over excavation of unsuitable materials and structural backfill appear warranted, provide vertical and horizontal extent of the over excavation and structural backfill. Fill and/or backfill material shall provide a stable, well-drained site to minimize the potential for excessive settlement and/or shrink/swell related movements of the foundations and structures.

Where applicable, address whether the available borrow material on site is suitable for general and/or structural fill. Provide recommendations for recommended treatment to available borrow material, if applicable. Compaction criteria, including acceptable gradations, moisture control, compactive effort, and need for proof rolling shall be discussed, including criteria for both granular and cohesive fill, as applicable to material type.

*Shallow Foundation Design*

Provide the following recommendations for shallow foundations:

- Net allowable bearing pressure. The possibility of allowing for overstressing to foundations under short sustained seismic or wind live loads shall be discussed. All factors of safety utilized in developing the allowable load capacities shall be outlined in detail or provide minimum recommended factors of safety if ultimate values provided.
- Minimum foundation width.
- Minimum cover for frost depth.
- Recommendations for resistance to lateral loads, such as passive earth pressures or sliding friction and recommended factor of safety.
- Design groundwater level for evaluation of buoyancy and means to resist buoyancy and other uplift forces.
- Modulus of subgrade reaction for soils supporting mat foundations and the appropriate formula(s) for adjusting this value for varying mat sizes.
- Total and differential settlement estimates for each foundation type.
- Requirements for mitigation of poor materials if loose random fills, soft subgrade soils, collapsible and/or expansive clay soils are encountered. Provide distances, extent of limits, and depths to which mitigation are required. Provide figures for clarity of proposed dimensions.

*Deep Foundation Design*

Provide the following recommendations for deep foundations:

- Type(s) of foundation.
- Minimum embedment lengths.
- Ultimate skin friction and end bearing values for compression and uplift for each soil or rock stratum encountered.
- Appropriate factors of safety to utilize in design.

- Estimated settlement for deep foundations including group and individual settlement of piles.
- Generalized stratigraphic profile for the site which defines the depths and/or elevationsfor the interfaces and changes in soil and rock materials and water conditions.
- If applicable, discuss the requirements or constructability of belled drilled shafts in soil or the use of shear rings in rock to increase axial and uplift capacities.
- If the depths or elevations of stratigraphic layers vary substantially across the site, provide the extent of variability, both vertically and horizontally across the site, and provide the subsurface parameters for each respective stratigraphic profile.
- For linear projects, provide stratigraphic profiles and design parameters for each boring or CPT location.
- Direct embedded poles will utilize crushed rock or unreinforced concrete backfill.

If specified, provide the following LPILE recommendations:

- Design water level.
- Lateral design parameters for each soil layer including the recommended soil model type, effective unit weight, cohesion or friction angle.
- Lateral design parameters for each rock layer including specified rock model and required parameters as specified in LPILE technical documentation.

If specified, provide the following FAD Tools recommendations:

- Design water level.
- Lateral design parameters for each soil layer including the total unit weight, cohesion or friction angle, and deformation modulus. Standard penetration resistance should also be provided for each layer of the stratigraphic profile.
- Lateral design parameters for each rock layer including Rock Mass Rating System (RMR76), rock ϕ' (effective phi angle), rock c' (effective cohesion), rock mass modulus of deformation and rock to concrete bond strength.

*Lateral Earth Pressures*

Provide lateral earth pressures for below grade vertical walls both of the flexible and rigid type. Provide the lateral earth pressures as equivalent fluid pressure values. Provide any assumptions relating to the construction method or type of backfill in detail (i.e., granular, cohesive, drained, or undrained conditions). Active, passive, and at-rest coefficients used in calculating these pressures shall be noted.

If indicated, provide recommendations on dynamic lateral earth pressures during a seismic event. Use Mononobe-Okabe method or approved alternative method.

*Temporary Slopes and Excavations*

Provide recommendations on inclination of both temporary excavations and temporary slopes. Identify OSHA soil types and address any temporary slopes required for excavation and the need for sheeting and shoring.

*Excavation Requirements*

Address the excavatability of the soils and rock that may be exposed during foundation excavation and site grading. Provide general recommendations corresponding to the effort and type of equipment generally utilized to perform excavations of noted size and depth of the excavation and materials to be encountered.

*Trenchless Excavations*

If indicated, provide data and recommendations.

*Dewatering*

Provide discussion on conditions present at the site requiring groundwater control, dewatering, or surface drainage during excavation and construction. Anticipated types of dewatering shall be described along with extent or time of operation. Special consideration to exposed subsoils within the bottom of excavations during construction shall be addressed.

*Corrosion Potential*

Provide an evaluation of representative subsurface materials and provide laboratory test results for chemical constituents including pH, chloride ion, soluble sulfates, electrical resistivity, redox potential and sulfides. These parameters are required to evaluate the potential for corrosion of underground piping, for design of grounding, and for selection of cement type to resist potential sulfate attack. Provide recommendations on cement type for concrete in contact with soil to resist chemical attack.

*Pavement*

Provide recommendations for subgrade preparation in areas requiring paving or gravel surfacing as well as pavement design recommendations. If indicated, provide a design CBR value, the modulus of subgrade reaction, k, the resilient modulus, $M_R$, and the undrained shear strength values for the near surface soils and soils at the anticipated final grade. If indicated, provide representative concrete pavement section and asphalt pavement section based on traffic loading provided.

*Summary of Environmental Screening*

Provide a summary of the environmental screening, and the extent of environmental contamination encountered during this investigation at the Site.