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RFP APPENDIX A.X (HV)
WORK SPECIFICATIONS (BTA)

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WORK SPECIFICATIONS (BTA)

1.0 EXHIBIT INFORMATION

1.1 Purpose

1.1.1 Without limiting the information summarized herein, the purpose of this document is to summarize the *minimum* performance specifications, quality standards, and other criteria required for the engineering, procurement, and construction of the High Voltage Systems for the Project.

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1.2 Project Description

1.2.1 PacifiCorp (Owner) is soliciting proposals from qualified bidders (Sellers) for cost-effective renewable resources that are located in or can be delivered to PacifiCorp's west balancing authority area ("**PACW**"). Any High Voltage Systems for wind, solar or battery energy storage system projects to be owned and operated by Owner shall meet the Owner requirements set forth herein. The performance requirement is that the Project must be capable of producing safely, reliably and continuously at all ranges of rated power output and ambient conditions.

1.3 References

1.3.1 This exhibit shall be used in conjunction with RFP Appendixes related to Wind, Solar and Battery Energy Storage System Specifications which more fully describes the *minimum* scope of work and technical requirements for Seller.

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1.3.2 In addition to anything summarized herein, Appendix "A-7" contains the following Owner standards that apply to this Technical Specification:

- RFP Appendix A-7.01: Attachment 1A Project Document Formatting and Requirements.
- RFP Appendix A-7.02: Attachment 1B – Project Document Deliverables
- RFP Appendix A-7.03: Computer Aided Design (PacifiCorp Energy) General AutoCAD/Drafting Standards (Specification DCAP876).
- RFP Appendix A-7.04.1: EBU PX-S01/S01A Substation Equipment—Power Transformer, All Ratings and Substation Equipment—Transformer-Specific Requirements
- RFP Appendix A-7.04.2: EBU PX-S02 Substation Equipment—Collector Substation Main Power Transformer

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- RFP Appendix A-7.04.3: ZS-102 Two-Winding Distribution Transformer Inverter Step-Up Liquid-Immersed (Pad Mounted, Compartmental Type)
- RFP Appendix A-7.05: EBU SI-S04 Electrical Equipment—Insulating Oil
- RFP Appendix A-7.06: EBU SI-S02 Wind, Ice, and Seismic Withstand
- RFP Appendix A-7.07: EBU SI-S03 Contaminated Environment Protection
- RFP Appendix A-7.08: SP-TRF-INST Transformer, Oil-Filled Reactor and 3phase Regulator Installation Procedure
- RFP Appendix A-7.09: TD 051 Sign, Danger
- RFP Appendix A-7.10.1: 6B.5—Fence Application and Construction

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- RFP Appendix A-7.10.2: Section 02810 Chain Link Fencing and Gates
- RFP Appendix A-7.10.3: Section 02815 Cantilever Slide Gate
- RFP Appendix A-7.11: 6B.6—Substation Grounding
- RFP Appendix A-7.12: GEN-ENG-RELAY-0001 Protective Relaying Standard
- RFP Appendix A-7.13: GEN-ENG-RELAY-0002 Arc Flash Hazard Standard
- RFP Appendix A-7.14: GEN-ENG-RELAY-0003 Relay Current Transformer (CT) and Potential Transformer (PT) Insulation Integrity Test
- RFP Appendix A-7.15: GEN-ENG-RELAY-1003 Thermal Plant Protective Relay Maintenance and Testing – PRC-005

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- RFP Appendix A-7.16: Relay Testing and Commissioning Checklist
- RFP Appendix A-7.17: GPCP-EQPMNT-INST Generation Protection And Control Equipment Installation Procedure
- RFP Appendix A-7.18: GPCP-CT-INST Current Transformer Installation Procedure
- RFP Appendix A-7.19: PCF-CT-INST Current Transformer Installation Form
- RFP Appendix A-7.20: SG-001 Substation High-Voltage Warning Signs
- RFP Appendix A-7.21: EXHIBIT X Specification for Substation Equipment Installation, Testing and Commissioning
- RFP Appendix A-7.22.1: SV 251 Bird and Animal Protection for Miscellaneous Equipment

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- RFP Appendix A-7.22.2: SV 001 Bird and Animal Protection – General Information
- RFP Appendix A-7.22.3: SV 002 Bird and Animal Protection – General Installation Instructions
- RFP Appendix A-7.23: Volume 8 Consultant Drafting Procedures and Standards (For Engineering Drawings)

1.4 Definitions

The following words shall have the respective meanings set forth below when used in this specification:

1.4.1 "**Access Roads**" means all of the complete, fully-functional roads to be constructed by Seller under the Agreement.

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1.4.2 "**Agreement**" means the written agreement between Owner and Seller covering the furnishing of Work and other services in connection therewith. Other documents and deliverables are attached to the Agreement and made a part thereof as provided therein.

1.4.3 "**Applicable Standards**" has the meaning set forth in this specification.

1.4.4 "**As-Built Drawings**" means a complete set of drawings prepared by Seller or a SubSeller which accurately and completely represent the Work as constructed and installed.

1.4.5 "**BOP**" means balance-of-plant.

1.4.6 "**Collection System**" means the permanent electrical and communications infrastructure required to transmit energy and performance and operating data between each Wind Turbine and the Project Substation, or to the Turbine SCADA System control panel as appropriate.

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1.4.7 "**Communications System**" means the supervisory, control, and data acquisition system for the Project Substation equipment (including all breakers, switches, transformers, relays, and meters) and permanent meteorological towers; all fiber optic cabling and supporting devices within the Collection System Circuits; and the Turbine SCADA System.

1.4.8 "**Seller**" means the person, firm, or corporation with whom Owner has entered into the Agreement.

1.4.9 "**Seller Deliverables**" means all drawings, plans, studies, reports, calculations, specifications, pictures, videos, test results, manuals, completion certificates, completion procedures, checklists, documents, and other similar items necessary for the successful completion of the Work.

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1.4.10 "**Equipment**" means all of the parts, components, equipment, materials, apparatus, structures, tools, supplies, consumables, goods, and other items required or appropriate for a complete, fully-functional Project or that otherwise form or are intended to form part of the Work or the Project, including all equipment, materials, apparatus, structures, tools, supplies and other goods provided and used by Seller and the SubSellers for performance of the Work, but that are not incorporated into the Project, and excluding all Owner-Supplied Equipment.

1.4.11 "**Foundation**" means each Wind Turbine foundation.

1.4.12 "**Job Book**" means a manual to be prepared by Seller and approved by Owner, which will include all Seller engineering, design, purchasing, and other information relating to the Work.

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1.4.13 "**Interconnection Line**" means the [TBD]-kV high-voltage transmission line connecting the Project Substation with the Point of Interconnection. "TBD" is a Project-specific voltage to be specified in the Proposal, but generally expected to be 115 kV or greater.

1.4.14 "**O&M Building**" means the operations and maintenance building for the Project.

1.4.15 "**Owner**" means PacifiCorp.

1.4.16 "**Point of Interconnection**" means the point where the Interconnection Line connects to the interconnection facilities constructed and owned by the interconnecting utility to which electrical power produced by the Project will be delivered.

1.4.17 "**Project**" means the generating facility described in the Proposal.

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1.4.18 “**Project Schedule**” means the schedule of key dates, milestones, and other activities for timely completion of the Work, reflecting the project execution plan and anticipated sequence of site operations.

1.4.19 “**Project Site**” or “**Site**” means the location, or proposed location, of the Project.

1.4.20 “**Project Substation**” means the 34.5/[TBD]-kV substation to be located at the Project Site, with all necessary equipment to connect the Project to the interconnecting utility’s grid. “TBD” is a Project-specific voltage to be specified in the Proposal, but generally expected to be 115 kV or greater.

1.4.21 “**Proposal**” means the formal offer of Seller together with all information submitted that pertains to this RFP.

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1.4.22 "**Quality Plan**" means quality assurance and quality control plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.23 "**Requirements**" means the Work Specifications, Prudent Wind Industry Practices, applicable laws, applicable permits, Applicable Standards, the Project Schedule, the Project's interconnection Agreement, the Project design documents, and the other requirements of the Agreement.

1.4.24 "**RFP**" means request for proposals.

1.4.25 "**Safety Plan**" means safety plan to be prepared by Seller in compliance with the requirements in this specification.

1.4.26 "**SCADA**" means supervisory control and data acquisition.

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1.4.27 "**Security Plan**" means security plan to be prepared by Seller in compliance with the requirements in <u>this specification.</u>

1.4.28 "Seller" means qualified bidder under the PacifiCorp All Sources RFP

1.4.29 "**Work**" means all actions, capital, contracts, labor, equipment, and materials necessary to construct the proposed Project and furnish wind energy and environmental attributes (including operating the Project) to Owner at the specified delivery point.

1.4.30 "**Work Specifications**" means the minimum performance specifications, quality standards, and other criteria required for the performance of the Work by Seller, each as described in more detail in this specification.

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1.4.31 References to "**roads**" and "**roadways**" herein shall be understood to consist of all access roads, Wind Turbine Generator string and spur roads, substation roads, transmission line service roads, meteorological tower roads, maintenance building roads, and temporary construction roads to be constructed for the Project.

1.4.32 As used herein, "**raceway**" shall be understood to include conduit (rigid and flexible), underground duct, wireway, cabinets and boxes, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

1.5 Interpretation

1.5.1 References herein to requirements to perform and/or provide work, services, equipment, or other similar items shall be understood to be the responsibility of Seller, unless explicitly noted as being a responsibility of Owner.

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1.5.2 The headings of sections and subsections herein are for convenience only and shall be ignored in construing this exhibit.

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2.0 STANDARDS OF PRACTICE

2.1 General Provisions

2.1.1 Seller shall be responsible for the interpretation of the data provided herein and validation of the proposed design.

2.1.2 Any proposed materials, structures, and/or assemblies shall be maintainable in the simplest and most cost-effective manner possible.

2.1.3 All materials shall be new, unused, of the highest quality, free of defects and irregularities, and consistent for use in wind generation facilities.

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2.1.4 Equipment shall be installed, assembled, and tested in strict compliance with the manufacturer's drawings, code markings, and instructions.

2.1.5 The Seller shall ensure the final drawings, models, and associated documents meet the needs of the Project requirements and adhere to all applicable codes and standards. The Seller shall have the overall responsibility for the design and engineering provided by their Engineer of Record (EOR).

2.1.6 Physical and cyber security shall adhere to NERC Critical Infrastructure Protection (CIP) protocol. This compliance shall be demonstrated within the design and using additional reporting and documentation when necessary.

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2.2 Supervision and Engineer of Record

2.2.1 All engineering shall be performed under the supervision of and stamped by the engineer(s) of record, who shall be a registered professional engineer with a current license in the Project jurisdiction. Such professional engineer(s) shall be registered in the applicable discipline for the drawings being signed and sealed.

2.2.2 Seller shall provide all engineering, technical expertise, management, and supervision, to design, engineer, specify and complete all aspects of the Project, including but not limited to: land use, access, interconnection, equipment, structures, devices, materials, construction, testing, and commissioning, (unless otherwise noted).

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2.2.3 Seller shall be responsible for complying with all technical requirements contained in the Power Purchase Agreement and Generation Interconnection Agreement, including all Utility and ISO requirements.

2.2.4 Seller shall be aware of all local requirements and shall be incorporated into the design and construction of the Project. All Work concerning the geotechnical services shall be supervised and directed by a qualified, competent, practicing geotechnical engineer. A geotechnical engineer or engineering geologist shall observe, log borings, obtain soil samples, and record blow counts of the samples, drill rates, rock quality, depth to ground water, and other pertinent data under the direction of a licensed geotechnical engineer.

2.2.5 All Project submittals shall be subject to review and/or approval by Owner, as applicable, and shall meet the minimum requirements for submittals set forth in Section 3.1.

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2.3 Applicable Standards

2.3.1 The Applicable Standards shall include (i) the minimum standards and industry codes and any other criteria required for the performance of the Work by Seller, (ii) each of the standards and industry codes listed below, and (iii) each of the relevant standards and codes issued by the organizations listed below (collectively, the "**Applicable Standards**").

(1) Aluminum Association ("AA")

(2) American Association of State Highway and Transportation Officials ("AASHTO")

(3) American Concrete Institute ("ACI")

(4) American Institute of Steel Construction ("AISC")

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(5) Association of Iron and Steel Engineers ("AISE")

(6) American National Standards Institute ("ANSI")

(7) American Society of Civil Engineers ("ASCE")

(8) American Society of Heating, Refrigeration, and Air Conditioning Engineers ("ASHRAE")

(9) American Society of Mechanical Engineers ("ASME")

(10) American Society of Nondestructive Testing ("ASNT")

(11) American Society of Testing and Materials ("ASTM")

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(12) American Water Works Association ("AWWA")

(13) American Welding Society ("AWS")

(14) Avian Power Line Interaction Committee ("APLIC")

(15) Code of Federal Regulations ("CFR")

(16) Concrete Reinforcing Steel Institute ("CRSI")

(17) Crane Manufacturer Association of America ("CMAA")

(18) United States Environmental Protection Agency ("EPA")

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(19) Federal Aviation Agency, Department of Transportation ("FAA")

(20) Federal Energy Regulatory Commission ("FERC").

(21) Federal Highway Administration ("FHWA")

(22) IAPMO Uniform Plumbing Code

(23) Illuminating Engineering Society ("IES")

(24) Institute of Electrical and Electronic Engineers ("IEEE")

(25) Instrumentation Society of America ("ISA")

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(26) Insulated Cable Engineering Association ("ICEA")

(27) International Building Code ("IBC")

(28) International Code Council ("ICC")

(29) International Electrotechnical Commission ("IEC")

(30) Applicable state requirements, including State Department of Transportation and Environmental Protection

(31) National Electric Code ("NEC")

(32) National Electrical Contractors Association ("NECA")

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(33) National Electric Safety Code ("NESC")

(34) National Electrical Manufacturers Association ("NEMA")

(35) National Electrical Testing Association ("NETA")

(36) National Fire Protection Association ("NFPA")

(37) National Safety Council ("NSC")

(38) North American Electric Reliability Corporation (NERC)

(39) Occupational Safety and Health Administration ("OSHA")

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(40) Post-Tensioning Institute ("PTI")

(41) Scientific Apparatus Makers Association ("SAMA")

(42) Sheet Metal and Air Conditioning Contractors National Association ("SMACNA")

(43) Society for Protective Coatings ("SPC")

(44) Telecommunications Industry Association/Electronic Industries Association ("TIA/EIA")

(45) Underwriter's Laboratories ("UL")

(46) Uniform Building Code ("UBC")

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(47) DNVGL-ST-C502, Offshore Concrete Structures.

2.3.2 Unless otherwise specified, all engineering, procurement, and construction associated with the Project shall comply with the latest revision of all applicable codes and standards including, but not limited to, those listed herein. Any departure from the referenced codes and standards must be fully explained in writing and submitted for Owner's review and approval prior to implementation.

2.3.3 All specific standards applicable to pieces of equipment, structures, and/or buildings may not be listed herein. Specifications may describe the specific standards that may apply.

2.3.4 Any general standard or organization listed above shall be understood to include all relevant codes, standards, and/or guidelines under that particular standard or organization. For example, ACI shall include ACI 301, ACI 305, ACI 306, ACI 318, etc.

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2.3.5 Unless otherwise specified herein, in the case of conflict between any Applicable Standards, the more stringent requirement shall apply.

2.3.6 It is the Seller's responsibility to be knowledgeable to include designs and practices that incorporate the latest revisions of all applicable codes, standards and regulations.

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2.4 Approved Suppliers

2.4.1 This Section 2.4 contains a list of approved materials, equipment suppliers, and subcontractors. In the event that Seller is considering the selection of a material, equipment supplier, or subcontractor that is not listed herein, Seller shall request approval from Owner prior to executing any contract for the procurement of such material or with such equipment supplier or subcontractor. Equipment catalog cut sheets shall be submitted for Owner review and approval prior to procurement.

2.4.2 Project Substation:

(1) Approved substation engineering contractors:

(a) Refer to Appendix C (*Approved Subcontractors*)

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(2) Approved substation construction contractors:

(a) Refer to <u>Appendix C</u> (*Approved Subcontractors*)

(3) Approved main step-up power transformer suppliers:

(a) ABB.

(b) Delta Star.

(c) Efacec USA.

(d) GE Prolec Transformers.

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(e) HICO.

(f) Hitachi Power Systems Ltd.

(g) Hyundai Heavy Industries (HHI).

(h) JSHP Transformer Corporation.

(i) Mitsubishi Electric Power Products, Inc.

(j) Pennsylvania Transformer (PTTI).

(k) Siemens Energy.

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(l) Smit Transformers.

(m) Tebian Electric Apparatus Stock Company Ltd (TBEA).

(n) SPX Transormer Solutions (Waukesha).

(4) Approved station service transformer suppliers:

(a) ABB.

(b) General Electric.

(c) Cooper Power.

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(5) Approved high-voltage voltage transformer suppliers:

(a) ABB (U.S. or Sweden).

(b) Alstom.

(c) Trench N.A.

(6) Approved 34.5-kV voltage transformer suppliers:

(a) ABB.

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(b) Alstom.

(c) General Electric.

(d) Ritz.

(7) Approved high-voltage current transformer suppliers:

(a) ABB (U.S. or Sweden).

(b) Alstom.

(c) Trench N.A.

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(8) Approved 34.5-kV current transformer suppliers:

(a) ABB.

(b) Alstom.

(c) General Electric.

(d) Ritz.

(9) Approved high-voltage circuit breaker suppliers:

(a) ABB (with spring/hydraulic mechanism).

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(b) Siemens.

(10) Approved 34.5-kV circuit breaker suppliers:

(a) Schneider Electric.

(b) Siemens.

(11) Approved high-voltage surge arrestor suppliers:

(a) ABB.

(b) Cooper Power.

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(c) General Electric.

(d) Hubbell.

(12) Approved 34.5-kV surge arrestor suppliers:

(a) ABB.

(b) Cooper Power.

(c) General Electric.

(d) Hubbell.

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(13) Approved high voltage disconnect switch suppliers:

(a) Cleveland / Price.

(b) Pascor Atlantic.

(c) Southern States.

(14) Approved 34.5-kV disconnect switch suppliers:

(a) Cleveland / Price.

(b) Royal.

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(c) Southern States.

(d) Hubbell.

(e) USCO.

(15) Approved battery charger suppliers:

(a) Alcad / Hindle.

(b) Enersys (formerly Exide / Yuasa).

(c) LaMarche.

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(16) Approved battery suppliers:

(a) Enersys (formerly Exide / Yuasa); preferred.

(b) C&D.

(17) Approved capacitor bank suppliers:

(a) ABB.

(b) Cooper Power.

(c) General Electric.

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(18) Approved control building suppliers:

(a) Trachte.

(19) Approved panel suppliers:

(a) Gexpro.

(b) Codale.

(20) Approved relay suppliers:

(a) Schweitzer Engineering Laboratories (SEL).

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(21) Approved grounding rod suppliers:

(a) Not used.

(22) Approved compression connection suppliers:

(a) Burndy.

(b) Hubbell.

(c) Travis Pattern.

(d) Alcoa.

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2.4.3 Interconnection Line:

(1) Approved Interconnection Line engineering contractors:

(a) Refer to Appendix C (*Approved Subcontractors*)

(2) Approved Interconnection Line construction contractors:

(a) Refer to Appendix C (*Approved Subcontractors*)

(3) Approved OPGW suppliers:

(a) Corning.

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(b) Fukijikura.

(4) Approved grounding rod suppliers:

(a) Blackburn.

(b) Weaver.

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3.0 GENERAL SPECIFICATIONS

3.1 General Provisions

3.1.1 All Work, including construction, materials storage, grading, landscaping, cut/fill, erosion control, and other similar or related activities, shall not extend beyond the designated disturbance areas. Unnecessary disturbance of the existing Project Site conditions shall be minimized, and under no circumstance may Seller perform any Work or cause any disturbance beyond these corridors without explicit written confirmation from Owner.

3.1.2 Existing access to the Project Site, including along public roads, shall remain open throughout construction.

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3.1.3 All existing infrastructure, including communications towers, pipelines, telephone lines, and electrical lines, shall be maintained in their current condition throughout the construction of the Project.

3.1.4 Temporary power and utilities must be included by Seller including easements and access need for construction.

3.1.5 Seller shall maintain an office on or close to the site of the Project. These construction office trailers shall be delivered, set-up, furnished and ready to use including power, phone service, internet service, HVAC systems, sewer and restroom facilities and decking by Seller's mobilization date and shall be demobilized after substantial completion has been achieved.

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3.1.6 Seller shall provide sufficient space and electrical service in the office complex area for one office trailer for the turbine supplier. Site grading shall include parking space for turbine supplier's personnel.

3.1.7 Seller shall maintain two-way radio communication till substantial completion. Each crew shall have a radio for communications, at all times, effective communication for compliance with the Seller's emergency action plan.

3.2 Submittal Requirements

3.2.1 This Section 3.1 sets forth the *minimum* requirements for all Seller-provided submittals, including Seller Deliverables.

3.2.2 General requirements:

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(1) Seller is required to submit a Master Drawing List showing all drawings and documents estimated to be provided for the project within ten (10) Business Days after Notice to Proceed.

(2) Seller shall name and label all submittals using an Owner-approved naming convention. Such naming convention shall be used consistently for all submittals, and the only filename modification for revised submittals shall be a change in revision number. Unidentifiable submittals will be returned for proper identification.

(3) Submittals shall be accompanied by copies of native, electronic design files (e.g., AutoCAD .dwg file, PLS-CADD .bak file, etc.), including for interim design transmittals (e.g., 30%, 90%, etc. as applicable) and As-Built Drawings.

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(4) All design submittals shall be provided in a common and consistent coordinate system. Such coordinate system shall be subject to Owner approval.

(5) All drawings shall be clearly marked with: Revision numbers, dates, clouds around any change and appropriate explanations for the design changes.

(6) Seller shall maintain current set of IFC drawings on-site at all times, updated to the latest revisions.

3.2.3 Quality requirements:

(1) Scanned submittals are not acceptable. All submittal text shall be electronically recognizable and searchable.

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(2) Submittals to Owner shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings shall be useable for further reproduction to yield legible hard copies.

(3) Documents submitted to Owner that do not conform to specified requirements shall be subject to rejection by Owner, and upon request, Seller shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Seller's (or its subSeller's) failure to initially satisfy the legibility quality requirements will not relieve Seller (or its subSellers) from meeting the required schedule for submittals.

3.2.4 Quantity requirements:

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(1) Seller shall electronically transmit one (1) copy of all submittals to Owner, including modifications to submittals, except as otherwise specified elsewhere in the Agreement.

(2) Seller shall provide four (4) complete, full-size (size D), color sets *and* four (4) complete, 11-inch by 17-inch, color sets of As-Built Drawings in hard copy format, as well as one (1) complete, full-size (size D) set of As-Built Drawings in electronic format on external hard drive.

3.2.5 Languages and dimensions:

(1) All words shall be in the English language.

(2) All dimensional units shall be in English units. When both metric and English units of measurement are presented, English dimensional units shall prevail.

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(3) All drawings and dimensions shall be to scale; not-to-scale (“**NTS**”) dimensions will not be permitted on scalable drawings. A scale bar shall be included to permit use following photo-reduction.

3.2.6 Submittal completeness:

(1) Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Owner to review the information effectively.

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(2) Where standard drawings are furnished which cover a number of variations of the general class of equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations which do not apply to the submittal. The use of "highlighting markers" will not be an acceptable means of annotating submittals. Such annotation shall also include proper identification of the submittal permanently attached to the drawing.

3.2.7 Transmittal of submittals:

(1) Submittals and Project documents shall be transmitted in (i) nonproprietary, native electronic format, incorporating any necessary reference files; and/or (ii) Adobe (*.pdf) files created directly from native electronic format.

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(2) All electronic submittals shall be uploaded to Owner's web-based document management site. Selected submittals may also be required to be provided on CD, DVD, or flash drive.

(3) All electronic submittals shall be clearly named and versioned (e.g., revision number, date appended to file name).

(4) Each submittal shall be accompanied by a completed transmittal letter. Submittals that are not accompanied by a completed transmittal letter will not be accepted and will be returned to Seller. All Seller transmittal letters submitted to Owner shall contain the following information, at a minimum:

(a) Transmittal number.

(b) Date of transmittal.

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(c) Seller's name.

(d) Project name.

(e) Owner's project number.

(f) Filename and revision number.

(g) Description of the information contained in the specific transmittal.

(h) Purpose of transmitting to Owner (i.e., issued for information, issued for review, etc.), including applicable Agreement references.

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(5) Seller shall check and approve submittals of subSellers and manufacturers prior to transmitting them to Owner. Seller's submission shall constitute a representation to Owner that Seller approves such submittal(s) and has determined and verified all information contained therein, and Seller assumes full responsibility for doing so; and Seller has coordinated each submittal with requirements of the Work and the Agreement.

(6) Seller shall, at the time of each submission, call to the attention of Owner in the letter of transmittal any and all deviations from the Requirements.

3.2.8 Owner's review:

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(1) Owner's review and approval of submittals will not relieve Seller of responsibility for any deviation from the Requirements unless Seller has in writing called Owner's attention to such deviation at the time of submission, and Owner has given written concurrence in and approval of the specific deviation. Approval by Owner shall not relieve Seller from responsibility for errors or omissions in submittals.

(2) Seller shall make all modifications noted or indicated by Owner and return the required number of revised submittals until approved. Direct specific attention in writing, or on revised submittals, to changes other than the modifications called for by Owner on previous submittals. After submittals have been approved, submit copies thereof for final distribution. Previously approved submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the submittal and resubmit for review.

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(3) Seller shall not construct any portion of the Work until issued-for-construction drawings have been approved by Owner. Wind Turbine Generator Foundations shall not be constructed until the Wind Turbine Generator Foundation drawings and calculations have been approved by Owner, including its independent engineer.

(4) Seller shall submit equipment catalog cut sheets for Owner review and approval prior to procurement.

(5) Review of drawings by Owner does not relieve Seller of responsibility for errors, correctness of details or conformance with these specifications.

3.2.9 Design Submittals

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(1) The Project Substation design documents shall include a general arrangement plan; physical layout diagrams; civil works drawings, including subgrade preparation, grading, drainage, and erosion control; protection and control system designs and philosophies; one-line diagrams; three-line diagrams; wiring diagrams, including A/C and D/C schematics; cable specifications and arrangements; conduit and cable schedules; panel scheduled; loop drawings; elevation drawings; connector and fitting details; foundation plans and details, including all structural calculations; ground grid plans; metering diagrams; conduit and trough plans; fencing details; control building drawings; the Project Electrical Studies, as defined in <u>this specification;</u> drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

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(2) The Interconnection Line design documents shall include plan and profile drawings; structure details and drawings, including elevations, spacing, and hardware; civil works drawings, including subgrade preparation, grading, drainage, and erosion control; foundation design and embedment drawings; anchoring and guying details; structural calculations; PLS-CADD design files; grounding details; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum. Interconnection Line electrical phasing shall be placed on the plan and profile drawings. Phasing should match the phasing at the Project Substation terminations with minimal rolls and phase swapping.

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(3) The Communications System design documents shall include a plan view of the fiber optic cable layout; fiber optic loop diagram, including communication loop and connection details for all Wind Turbine Generators, permanent meteorological towers, and the O&M Building; communications block diagram, including all Communications System equipment, WTG/PV/BESS SCADA and utility equipment; logic descriptions; points lists; rack layout diagrams; HMI screen development; fiber termination diagrams; drawing index; bill of materials; construction sequencing; and inspection, testing, and quality control requirements, at a minimum.

(4) Issued-for-construction drawings shall not be changed or substantially deviated from without Owner approval.

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(5) As-Built Drawings: As-Built Drawings shall be issued as the next sequential revision from previous releases. The revision block shall state "As Built". All clouds, revision diamonds, and other interim control markings shall be removed, and all information listed as "later" or "hold" shall be completed. The As-Built Drawings shall include a final bill of materials. As-Built Drawings shall be created in the latest version of AutoCAD, or in the version of AutoCAD utilized by Owner, as applicable.

(6) All design submittals shall bear the Project name and the status of the submittal (e.g., Preliminary, Issued for Bid, Issued for Construction, As Built).

(7) Each drawing and submittal shall be sequentially numbered with a unique identifier.

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(8) All materials shall be fully identified by Seller, and each engineering package shall include a bill of materials, including all equipment and materials to be procured. Every item in the bill of materials shall have a unique identifier (typically numerical). Each bill of materials shall list product name, manufacturer, unique product / part number, and quantity.

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3.3 Project Schedule Requirements

3.3.1 This Section 3.3 provides an outline for the *minimum* contents and requirements of the Project Schedule to be prepared by Seller. Seller shall provide Initial Level 3 Schedule, twenty-one (21) days after Notice to Proceed and at a level of engineering deliverable that supports construction detailed activity breakdowns for task duration and estimates of the work to be detailed/performed for the schedule. Final Level 3 Baseline Project Schedule to be provided within 1 week after approval of Initial Level 3 Schedule.

3.3.2 For purposes of only this Section 3.3, the following words shall have the respective meanings set forth below.

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(1) "**Activity**" means a discrete part of a contract that can be identified for planning, scheduling, monitoring, and controlling the construction Work. Activities included in a construction schedule consume time and resources but shall not include planned work stoppages. Activities shall not normally reflect the Work of more than one trade.

(2) "**Baseline**" schedule means the initial Project Schedule, as approved by Owner.

(3) "**Critical path**" means the longest sequence of activities in a project plan which must be completed on time for that project to complete by the stated due date.

(4) "**Critical path method**" or "**CPM**" means a method of planning and scheduling a construction contract where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Agreement.

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(5) “**Float**” means the measure of leeway in starting and completing an activity. Float time (including total float) is not for the exclusive use or benefit of either Owner or Seller, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Agreement completion date.

(6) “**Predecessor activity**” means an activity that precedes another activity in the network.

(7) “**Resource loading**” means the allocation of manpower, equipment, or material necessary for the completion of an activity as scheduled.

(8) “**Successor activity**” means an activity that follows another activity in the network.

(9) “**Total float**” is the measure of leeway in starting or completing an activity without adversely affecting an intermediate deadline or the planned Agreement completion date.

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3.3.3 General requirements:

(1) Seller's accepted Baseline schedule will be set forth in Appendix B (*Critical Path Schedule Requirements*).

(2) Seller shall utilize Primavera Professional Project Management Software from Oracle for preparation of the Project Schedule. At a minimum, this shall be version Primavera P6.7 or newer.

(3) Activities in the Project Schedule shall be defined so that no single construction activity is longer than 20 calendar days and no single other activity is longer than 30 calendar days, respectively, unless specifically allowed by Owner.

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(4) Each activity shall be assigned a number. Numbering shall be such that predecessor activity numbers are smaller numerically than successor activity numbers in the Baseline Project Schedule. Seller shall use even-numbered activities for base Agreement Work, and odd-numbered activities for change order work. No activity number shall change after approval of the Baseline Project Schedule.

(5) The Project Schedule shall include a clear and logical work breakdown structure, wherein all items are assigned a sensible activity number based upon the type of work being performed. Such work breakdown structure shall be subject to approval by Owner.

(6) Procurement process activities shall be included for all long-lead and major items (as defined by Owner) as separate activities in the Project Schedule. Procurement cycle activities shall include, but not be limited to, submittals, approvals, purchasing, fabrication, and delivery.

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(7) The Project Schedule shall indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

(a) Preparation and processing of submittals.

(b) Mobilization and demobilization.

(c) Acquisition of key permits.

(d) Completion of interconnection studies and interconnection agreement, respectively.

(e) Purchase of major equipment.

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(f) Delivery.

(g) Fabrication.

(h) Utility interruptions.

(i) Installation.

(j) Work by Owner that may affect or be affected by Seller's activities.

(k) Startup and initial operations.

(l) Tests and inspections.

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(m) Training.

(8) The Project Schedule shall include Milestones indicated in the Agreement, including, but not limited to, guaranteed Milestone completion dates and any critical milestones in Appendix M (*Critical Milestones*). All major milestones shall be presented at the top of the Project Schedule.

(9) The Project Schedule shall show the Work in Gantt chart format, on a sheet size of 11-inch by 17-inch, the scale and spacing shall allow room for notation and revisions, and the font shall be sized such that it is easily legible when printed.

(10) Each revised or updated Project Schedule shall show actual progress compared to the originally accepted Baseline schedule and any proposed changes in the schedule of remaining Work.

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(11) The Project Schedule shall clearly identify all critical path activities. Scheduled start and completion dates shall be consistent with Agreement milestone dates.

(12) Seller shall not use artificial activity durations, preferential logic, or other devices for sequestering Float. Owner retains the right to reject any schedule submittal in which Seller has sequestered Float. Any activity with lag greater than two (2) days shall be identified in the activity description.

(13) Constraint dates shall be kept to a minimum, and all constraints shall be identified with descriptive text in the activity description.

(14) All activities shall have a predecessor activity and successor activity except for the first and last activities in the Project Schedule.

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(15) Each Project Schedule shall meet the minimum requirements for submittals set forth in Section 3.1 (*General Provisions*

3.3.4 All Work, including construction, materials storage, grading, landscaping, cut/fill, erosion control, and other similar or related activities, shall not extend beyond the designated disturbance areas. Unnecessary disturbance of the existing Project Site conditions shall be minimized, and under no circumstance may Seller perform any Work or cause any disturbance beyond these corridors without explicit written confirmation from Owner.

3.3.5 Existing access to the Project Site, including along public roads, shall remain open throughout construction.

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3.3.6 All existing infrastructure, including communications towers, pipelines, telephone lines, and electrical lines, shall be maintained in their current condition throughout the construction of the Project.

3.3.7 Temporary power and utilities must be included by Seller including easements and access need for construction.

3.3.8 Seller shall maintain an office on or close to the site of the Project. These construction office trailers shall be delivered, set-up, furnished and ready to use including power, phone service, internet service, HVAC systems, sewer and restroom facilities and decking by Seller’s mobilization date and shall be demobilized after substantial completion has been achieved.

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3.3.9 Seller shall provide sufficient space and electrical service in the office complex area for one office trailer for the turbine supplier. Site grading shall include parking space for turbine supplier's personnel.

3.3.10 Seller shall maintain two-way radio communication till substantial completion. Each crew shall have a radio for communications, at all times, effective communication for compliance with the Seller's emergency action plan.

(1) Submittal Requirements) herein.

(2) The Project Schedule shall include allowances for delays that may be encountered for reasonably expected weather conditions, non-working holidays, and other similar items.

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(3) Recovery Schedule - A detailed breakdown of the detailed schedule may be requested by Owner as a mitigation plan for a Critical Milestone activity that becomes delayed.

3.3.11 Concurrent with each Project Schedule submittal, Seller shall submit the following reports:

(1) General: electronic copies of the complete Project Schedule file in P6 executable (*.xer) format (including the Project-specific *.plf layout filters) and Adobe (*.pdf) format, respectively.

(2) Critical path report: list of all activities on critical path, sorted in ascending order by activity number.

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(3) Activity report: list of all activities sorted by activity number and then start date, or actual start date if known. Within each activity, Seller shall indicate estimated completion percentage in no greater than 10 percent (10%) increments.

(4) Logic report: list of preceding and succeeding activities for all activities, sorted in ascending order by activity number.

(5) Total float report: list of all activities sorted in ascending order by activity number and showing total float by activity.

(6) Three-week look ahead: list of all planned Work activities during the current week and the subsequent two-week interval, sorted in ascending order by activity number.

(7) Tabulated reports and/or schedule layouts showing the following:

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(a) Identification of activities that have been added, deleted, or changed.

(b) Changes in activity durations in workdays.

(c) Changes in total float.

(d) Detailed schedule layout showing start and finish date variances.

(e) Critical path and near critical path (1 to 15 days float) layout with variances.

(f) Major milestone report with variances.

(g) Activity constraints, including type.

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(8) Format for each activity in all reports described above shall contain, at a minimum, activity number, activity description, resource loading, original duration, remaining duration, early finish date, late start date, late finish date (or actual start date and/or actual finish date, as applicable), and total float in calendar days.

3.4 Job Book Requirements

3.4.1 This Section **Error! Reference source not found.** sets forth an outline for the *minimum* contents of the Job Books to be prepared by Seller.

3.4.2 Job Book outline:

(1) **General:**

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(a) Index:

1. Job Book index
2. Project Directory
3. Drawing index, including all categories listed under Section 3.4.2(2)(b) below

(b) Schedule:

1. Final Project Schedule
2. Actual delivery schedule of Owner-Supplied Equipment

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(c) Seller plans:

1. Safety Plan
2. Security Plan
3. Environmental Plan
4. Project execution plan

(d) Health and safety statistics:

1. Project construction Work hours and statistical information

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2. Incident reports, including accidents, thefts, injuries, and near misses

(e) Changes:

1. Project Change Orders
2. Seller correspondence concerning Change Orders

(f) Permits:

1. Owner permits
2. Seller permits

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3. Certification of compliance to permit requirements

(g) Training:

1. Project construction training records
2. Copies of training manuals

(h) Reporting:

1. Plan of the day reports
2. Weekly progress reports

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3. Monthly progress reports

(i) Contracting:

1. List of Subcontractors used on the Project
2. Summary of all work performed by Subcontractors
3. Copies of all subcontracts for construction services (non-priced)
4. Copies of purchase orders for major equipment

(2) **Drawings and manuals:**

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(a) Design documentation:

1. Project Site plan
2. As-built Wind Turbine Generator coordinates
3. Design basis and Project Site data
4. Engineering calculations and design studies
5. Final geotechnical engineering report

(b) Issued for construction drawings:

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1. Project Substation (including civil, structural, and electrical)

2. Interconnection Line

3. SCADA System

4. As-Built Drawings, including all items listed under Section 3.4.2(b) above

5. Project bill of materials

6. Correspondence between Owner and Seller, including RFIs

(c) Manuals and data sheets for all major equipment within or a part of the following:

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1. Project Substation
2. Interconnection Line
3. SCADA System

(d) Other equipment documentation:

1. Instruction manuals where appropriate for building systems
2. Equipment factory acceptance test reports
3. Spare parts list

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4. Warranty agreements (including contact information) for all Equipment

(e) Material safety data sheets

(3) **Quality assurance documentation:**

(a) Construction photographs:

1. Photographs of construction activities

2. Photographs of Project Site restoration

(b) Civil / structural works:

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1. Road base aggregate proctor testing results
2. Road base density testing results
3. Access Road inspection documentation
4. Drainage structure inspection documentation
5. Soil testing results
6. Compaction testing results road subgrade and aggregate base
7. Moisture and density analysis

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8. Drainage works (including culverts) inspection reports

9. Concrete mix design(s) and placement procedures

10. Grout mix design(s) and placement procedures, including specification sheets

11. Concrete and grout testing results / reports

12. Concrete batch tickets

13. Trial Batch Testing Report

14. Site Water Analysis Report

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15. Batch Plant Scale Certification

16. Crane Pad compaction test results

17. Non-conformance and corrective action reports

(c) <u>Project Substation:</u>

1. Construction inspection documentation

2. Control building/switchgear inspection

3. Main Power transformer factory acceptance test

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4. Control Building factory acceptance test

5. Main power transformer foundation installation inspection

6. Equipment foundation excavation, reinforcement, concrete placement, earthing installation, foundation backfilling inspection

7. Concrete cable trenches installation inspection

8. Fences and gates installation inspection

9. Substation yard earthing system installation inspection

10. Final grade level and backfilling inspection of substation yard

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11. Relay functionality check

12. Energization and testing procedures

13. Electrical testing and commissioning results, including commissioning checklists

14. Communications validation and IT integration

15. Non-conformance and corrective action reports

16. Switching Procedures

(d) Interconnection Line:

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1. Check of the delivered material
2. Check of pole coordinates and orientation
3. Pole drilling, reinforcement placement, concrete placement inspection
4. Pole, insulators and conductor's installation inspection
5. Construction inspection documentation
6. Energization and testing procedures
7. Electrical testing and commissioning results, including commissioning checklists

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8. Non-conformance and corrective action reports

(e) Agreement certificates (e.g., Certificate of Access Road Completion).

(f) Other certifications:

1. Reinforcing steel mill certificates
2. Flange bolt certifications
3. Tooling calibration records and testing certificates
4. Rigging inspection reports

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5. Welding certifications

6. Equipment receipt, inspection, and inventory reports

(4) **Handover Documents:**

(a) Substation Completion Certificate

(b) Interconnection Line Completion Certificate

(c) Project Substantial Completion Certificate

(d) Project Final Completion Certificate

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(e) All the associated punch lists

(f) All certificates of insurance

(g) Any third-party inspection reports

(h) All approved permits and utility permissions

(i) Partial and Final Lien Release Certificates

(j) Set of Project Record drawings

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3.5 Quality Plan Requirements

3.5.1 This <u>Section 3.5</u> sets forth an outline for the *minimum* contents and requirements of the Quality Plan to be prepared by Seller.

3.5.2 Quality Plan outline:

(1) **Overview:**

(a) Purpose and scope of quality assurance program

(b) Description of quality system procedures

(2) **Personnel:**

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(a) Roles and responsibilities:

1. Project director(s)
2. Project manager
3. Quality manager
4. Construction manager / site manager
5. Project engineer(s)
6. Superintendents and foremen

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7. Testers / inspectors (including third parties)

(b) Organization chart (including all personnel listed in Section 3.5.2(2)(a) above)

(c) Reporting responsibilities:

1. Lines of authority

2. Communication procedures

3. Authority to stop work

(3) **Administration:**

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(a) Document control:

1. Document control plan / procedure
2. Transmittal process, including naming convention
3. Document revision process / change management
4. Redlines and as-built documents

(b) Routine documentation procedures:

1. Daily, weekly, and monthly reporting

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2. Incident reporting
3. Non-conformance reports
4. Technical clarifications / requests for information
5. Notice of design change process
6. Field design change process
7. Request for Information (RFI)

(c) Personnel training:

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1. Requirements (competency / certification)

2. Records

(d) Quality meetings

(4) **Inspections, testing, and non-conformance:**

(a) Audits:

1. Schedule of audits

2. Audit personnel

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3. Non-conformance reports

(b) <u>Inspections (including frequency, duration, procedures, and documentation for each):</u>

1. Tools and equipment

2. Materials

3. Field work (e.g., civil works, electrical works, structural works)

4. Field tests and laboratory qualifications

5. Checklists and installation procedures

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(c) Non-conformance reporting

(d) Issues / conflict resolution process

(5) **Sample forms:**

(a) Non-conformance report

(b) Request for information

(c) Transmittal

(d) Inspections

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3.5.3 Other Quality Plan requirements:

(1) The Quality Plan shall be specific to the Project and the Project Site.

(2) The Quality Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(3) The Quality Plan shall clearly communicate the anticipated actions of Seller in the event of defects or non-conformance of the Work, including corrective action.

3.6 Safety Plan Requirements

3.6.1 This Section **Error! Reference source not found.** sets forth an outline for the *minimum* contents and requirements of the Safety Plan to be prepared by Seller.

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3.6.2 Safety Plan outline:

(1) **General:**

(a) Purpose and scope of safety program

(b) Project Site description

(c) Project Site map

(d) Roles and responsibilities / key personnel / contact information

(2) **Project Site rules:**

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(a) Project Site / employee orientation

(b) Project Site- and task-specific training

(c) Stretching program

(d) Firearms / weapons

(e) Motor vehicle operation qualifications and requirements

(f) Heavy equipment operation qualifications and requirements

(g) Substance abuse program

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(h) Removal of employees

(i) Subcontractor management

(j) Badging requirements

(k) Tours / third-party visits

(l) Disruption avoidance plan

(m) Incident notification procedures

(3) **Emergency procedures:**

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(a) Safety stand-down procedures

(b) Explosion procedures

(c) Severe weather procedures

(d) Bomb threat procedures

(e) Utility emergency procedures

(f) Civil disturbance procedures

(g) Tower rescue procedures

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(h) Snake / insect bite and dangerous animals

(i) Spill control and prevention plan

(j) Evacuation procedures

(k) Emergency route map

(l) Emergency contacts and first responder list

(4) **Health and safety programs:**

(a) Job safety and environmental analysis (“**JSEA**”) program / pre-task planning

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(b) Toolbox talks

(c) Personal protective equipment ("**PPE**") requirements

(d) Fire prevention and suppress procedures

(e) Fall protection program

(f) Material Handling and Storage

(g) Welding and Cutting

(h) Walking / working surfaces

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(i) Stairways and Ladders

(j) Scaffold standards

(k) Tower climbing program

(l) Crane and erection safety program

(m) Crane walking procedures

(n) Excavation and trenching program

(o) Hazard communication / hazardous materials program

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(p) Electrical safety

(q) Lockout / tagout ("**LOTO**") program

(r) Motor vehicle and traffic safety program

(s) Respiratory protection program

(t) Concrete safety program

(u) Confined space entry program

(v) Inspection / audit program

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(w) Incident / injury reporting and investigation program

(x) Hand and power tool safety program

(y) First aid / CPR / medical response program

(z) Bloodborne pathogens

(aa) Permitted work requirements

(bb) Blasting requirements

(cc) Competency requirements

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(dd) Hunting safety

(ee) Environmental program

(ff) Working on or near exposed energized parts

(gg) Deenergizing lines and equipment for employee protection

(5) **Required checklists and forms:**

(a) Accident / injury / incident report forms

(b) Site orientation training verification form – employee

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(c) Site orientation training verification form – visitor

(d) Stretch and bend sign-in form

(e) Safety audit checklist

(f) Site inspection forms

(g) Critical lift planning forms and checklists

(h) Excavation inspection form

(i) Competency evaluation forms

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(j) JSEA form

(k) Toolbox talk form

(l) Rigging inspection forms

(m) Hazardous materials inventory form

(n) Heavy equipment inspection forms (daily, monthly)

(o) Heavy equipment operator certification form

(p) Respirator compliance checklist

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(q) Respirator fit test certification form

(r) Form of LOTO permit and extraction form

(s) Form of hot work permit

(t) Form of dig permit

(u) Form of blasting permit

(v) Form of confined space entry permit

3.6.3 Other Safety Plan requirements:

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(1) The Safety Plan shall be specific to the Project and the Project Site.

(2) Seller is responsible for creating an energization and de-energization plan for safe operation. The Seller shall coordinate with all applicable parties to coordinate the energization plan. Site safety plans shall detail the process, roles, and responsibilities related to the energization procedure.

(3) Energization and de-energization plans shall be submitted to the Owner for review no less than 30 Business Days before the energization date. The Seller shall hold a meeting with all applicable parties before energization to walk through the energization/de-energization plans.

(4) The Safety Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

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(5) Seller shall be responsible to establish coordination with locally available hospitals and medical facilities to ensure that they will be supporting the project site for nay emergency needs. These details should be part of the site safety plan.

(6) All rigging shall be rated; inspected daily and monthly; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the Safety Plan. The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner. Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

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(7) Seller shall conduct daily job hazard analysis meetings for each task to be performed in order to identify and mitigate potential hazards prior to beginning Work. Each such meeting shall be specific to the task and shall be conducted at the respective work area. A job hazard analysis form shall be completed daily for each such meeting.

(8) Seller shall conduct site safety orientation (approximately 2-3 hours) for all personnel working on the Project Site, including, but not limited to, Owner, Turbine Supplier, subcontractors, office personnel, and visitors, prior to their being released to work on the Project Site. In addition, there shall be a delivery driver orientation given to all delivery drivers that will visit the site. Personnel who have not attended the site safety orientation and environmental awareness training shall have escorted access around the project site.

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(9) Seller shall provide two (2) full-time safety representatives at all times till the final completion of the project. In periods of low activity, these two HSE representatives will be on site on a standby basis. Seller will provide additional safety staff based on the number of employees on site. Seller shall, in all cases where the Seller, or Subcontractor(s) perform any Work during extended or weekend hours, have an HSE representative on-Site till such Work is completed.

(10) HSE representative should have a degree in Health and Safety or equivalent safety experience. Shall be fully dedicated to health and safety with at least half of their time being in the field to ensure adherence with the site safety plan is maintained. Shall have working knowledge of OSHA regulations as well as other applicable agencies related to safe work practices.

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(11) Seller shall provide the Owner the weekly hours, number of orientations and incidents for the week on a weekly reporting schedule.

(12) Seller shall conduct daily safety plan of the day meeting at the beginning of each shift including a stretch program, which will occur at the office compound prior to dispatching to site work locations. This meeting can be completed in break-out groups by trade at the respective hob sites. Seller shall conduct a weekly all hands site safety meeting that includes all employees of each Seller for the entire site.

(13) Seller shall document weekly site health and safety inspections with all the corrective actions. Seller shall implement a documented audit program per quarter.

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(14) Seller shall establish a Health and Safety Committee consisting of the EPC/BOP Seller and Subcontractor's employees other than management personnel. The committee shall meet at least once per week and document meeting minutes and actions.

(15) Seller shall establish a weekly Site Safety Managers Meeting with published meeting minutes and actions. This meeting shall include the health and safety representatives from each Seller on site.

(16) Seller shall report incidents to Owner's Site Safety Representative as soon as practically possible either verbally or electronically. Seller shall perform follow-up written incident investigations that will include recommended corrective actions within forty-eight (48) hours from incident occurrence and submit the investigation report to the Owner. Final reports are due to the Owner no later than ten (10) days after the incident.

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(17) Seller shall liaise and coordinate with local emergency services, including coordination with local "life flight" to identify landing sites available for helicopter emergency evacuation of personnel. Seller will develop a written Emergency Management Plan (EMP) which shall include at a minimum injury response, environmental and weather risks. Two safety evacuation drills shall be conducted, one during early works and another prior to the completion of five (5) wind turbines. A report of these drills shall be submitted to Owner which shall include, at a minimum, a timeline of events and any areas that may need improvement.

(18) Seller shall perform all necessary emergency response drills, to be performed at least quarterly, including coordination with local emergency response officials and hospitals and incorporating the dispatch of ambulance and life flight to the Project Site.

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(19) Seller shall immediately report all near misses, accidents, thefts, injuries (including first aid), and safety incidents to Owner's site manager and health and safety representative(s). A written incident report shall be submitted to Owner within 48 hours of each incident.

(20) Seller shall provide all necessary safeguards to ensure safety and security of, at a minimum, the Project Site, equipment, and personnel at the Project Site.

(21) Seller shall ensure medical and first aid. Review all Federal and State regulations for first aid kit and AED inspection and/or registrations. All sites shall have AEDs and personnel trained in their operation.

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(22) Seller shall provide drug and alcohol testing for all injuries requiring more than first aid; if drug or alcohol use is reasonably suspected; in the event of equipment damage that causes a loss of more than 10 hours of operable work; or in the event of equipment damage that exceeds $5,000 in estimated damage to the equipment or related work. Drug and alcohol testing shall be performed as soon after the event as reasonably possible.

(23) Training records shall be retained by the Seller for the duration of construction.

(24) Seller shall provide training for the following but not limited to, site evacuation and emergency awareness training, fall prevention awareness training, mobile equipment training, energy isolation training, confined space training, forklift training and reporting requirements.

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(25) Seller shall conduct environmental Orientation shall be of an appropriate length (approximately 1 hour). This orientation shall include at the minimum, overview of the environmental regulatory obligations, including relevant site permits, review of the flora, fauna and archaeological restrictions and housekeeping and recycling requirements.

3.7 Security Plan Requirements

3.7.1 This <u>Section 3.7</u> sets forth an outline for the *minimum* contents and requirements of the Security Plan to be prepared by Seller.

3.7.2 Security Plan outline:

(1) General:

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(a) Purpose and scope of security program

(b) Project Site description

(c) Project Site map

(d) Roles and responsibilities / key personnel / contact information

(2) Project Site security procedures:

(a) Controlled entry procedures

(b) Badging requirements

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(c) Site / employee orientation

(d) Suspicious activity and unauthorized visitor procedures

(e) Security threats / emergency procedures

(f) Firearms / weapons

(g) Site security procedures

(h) Equipment security procedures

(i) Security guards and patrols

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(j) Incident notification procedures

3.7.3 Other Security Plan requirements:

(1) The Security Plan shall be specific to the Project and the Project Site.

(2) The Security Plan shall be sufficient in scope and detail to convey the means and methods that will be employed by Seller to perform all aspects of the Work.

(3) Seller shall provide site passports to all project personnel for identification and daily site population tracking purposes. Site personnel shall keep their passports on their person at all times while onsite.

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(4) All visitors shall check in with and receive a visitor pass from Security prior to entering the compound area. All visitor passes shall be returned to Security at the end of each day.

(5) A security office shall be located at the compound entrance and supplied with electricity and appropriate toilet facilities as required. The location of the security office shall allow for the security officer to view all persons entering and exiting vehicles without impeding traffic flow. Seller shall ensure that the Security Officer shall be provided a radio, cell phone and a vehicle.

(6) Seller, and Subcontractors shall ensure that their vehicles except for rentals on site temporarily, have placards or company insignias.

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3.8 Foundation Inspection Reports

3.8.1 A Foundation Inspection Report shall be provided for each excavation and every drilled pier constructed (if any). Each report shall include the following minimum information:

(1) Information on the foundation excavation, including, but not limited to, date, ambient air temperature, line name, structure number, location, structure type, foundation type, size and condition (e.g., dry excavation, casing, slurry) of excavation, soil conditions, depth to rock, depth to water, and method of disposal of excavated/displaced material.

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(2) Concrete and concrete placement information, including, but not limited to, concrete supplier, concrete mix number, batch tickets (including batch time), number of cubic meters placed (including time of placement for each truck), concrete temperature, results of concrete testing, name of person performing concrete testing, number of test cylinders cast, placement and compaction method (e.g., free fall, tremie, slurry displacement, pumped), curing measures, and protection against freezing or heat.

(3) A delivery ticket shall be prepared for each load of concrete delivered, including, but not limited to, the number of cubic meters delivered, the quantities of each material in the batch, the ambient temperature at the time of delivery, the time at which the cement was added, the amount of water able to be added at the pour site, and the numerical sequence of the delivery. The delivery ticket shall be handed to the authorized representative of Seller by the truck operator at the time of delivery, and a copy of each delivery ticket shall be included in the Foundation Inspection Report.

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3.9 Rigging and Tooling

3.9.1 All rigging shall be rated; inspected daily and monthly; and load tested in accordance with the Applicable Standards or other more rigorous requirements set forth in the HSSE Plan (as defined in this specification). The manufacturer-rated capacities shall be legible and permanently affixed. Inspection reports shall be maintained at the Project Site and available for review by Owner.

3.9.2 Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

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3.10 Fencing, Walls, and Gates

3.10.1 All permanent fencing and gate materials shall be galvanized in accordance with ASTM A392.

3.10.2 Unless stated otherwise, fencing shall be 8-foot-high (7-foot fence plus 1-foot barbed wire), anti-climb, chain link, perimeter fencing. Fencing fabric shall be woven into a 2-inch diamond mesh.

3.10.3 Barbed wire shall be a minimum of 2-strand, #12-1/2 steel wire gauge with 4 half-round barbs of #14 steel wire gauge at 5-inch spacing. After weaving, the wire shall be galvanized per ASTM A121. Barbed wire fencing posts shall be galvanized, standard-weight steel pipe. At least three (3) lines of barbed wire shall be provided when used.

3.10.4 Unless stated otherwise, or as necessary to complete the Work, gate widths shall be consistent with road widths, wherein all gate posts shall be set outside of the road width area.

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3.10.5 Sufficient space and graded area shall be provided near each gate to allow truck turning.

3.10.6 All corner posts and gate posts shall be set (embedded) in concrete.

3.10.7 All gates shall be designed to adequately contain livestock without being pushed open, bending, or otherwise failing. Further, all gates shall be designed to adequately prevent opening due to wind conditions expected at the Project Site.

3.10.8 A gate shall be installed at every location where a roadway penetrates an existing fence line at the Project Site. Each such gate shall be a double-hung, prefabricated, finished metal gate. Each such gate shall be a minimum 40-feet-wide manual swing gate with a pipe frame and manufacturer's standard coating finish; complete with hinges and latching hardware; complete with a metal hinge post and removable center post; lockable; and each gate post shall be set in concrete.

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3.10.9 Cattle guards shall cover the full road width and be installed level and provided with a stable base capable of sustaining heavy loads without shifting or settling.

3.11 Signage

3.11.1 The Seller shall erect directional and access signage on each access road intersection in accordance with the Seller's traffic management plan

3.11.2 Temporary signage shall be legible and of sufficient durability to last the duration of construction activities.

3.11.3 Temporary signage shall be approved by Owner prior to installation.

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3.11.4 All signage and equipment marking (including numbering and labeling) are subject to approval by Owner.

3.12 Dust Control

3.12.1 Water used for dust control shall be treated to ensure no negative impacts to human health and ecology, including downstream environments.

4.0 GEOTECHNICAL WORK SPECIFICATIONS

4.1 General Provisions

4.1.1 All geotechnical, geophysical, and other similar subsurface investigations and testing described herein shall be completed before commencing the applicable Work.

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4.1.2 The geotechnical engineering report shall be utilized for the design and construction of all Project structures. All foundations shall be designed with consultation of a licensed geotechnical engineer.

4.1.3 The maximum loads (including load factors) applied to the foundations and used for design shall be determined from the structure design of the supported structure considering load cases and Applicable Standards associated with the particular structure type.

4.1.4 Foundation designs shall neglect or degrade soil strength properties at the top of the foundation as a result of frost or disturbance during drilling per recommendations of the geotechnical engineer.

4.1.5 The Project Site premises shall at all times remain free from accumulations of waste materials or rubbish resulting from the subsurface investigations.

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4.1.6 All field investigations and all laboratory testing shall comply with the Applicable Standards, including the most current, applicable ASTM standards.

4.2 Field Investigations

4.2.1 Geotechnical borings and material sampling shall be provided at the following minimum frequencies:

(1) Coordinated with the Project Site requirements for Wind, Solar and BESS.

(2) Project Substation: minimum of five (5) locations at the Project Substation.

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(3) Interconnection Line: each angled and dead-end structure, respectively, as well as any additional borings and samplings necessary to ensure that adjacent borings are no more than one (1) mile apart.

4.2.2 Geotechnical borings and material sampling shall be provided at the following minimum depths:

(1) All borings: minimum depth of 35 feet below base of foundation, or greater if specified below.

(2) Project Substation: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

(3) Interconnection Line: to a minimum depth necessary to provide sufficient information for the data and recommendations required in the geotechnical engineering report.

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4.2.3 Sufficient rock core samples shall be obtained from each boring to adequately characterize and test the material, including coring from the point at which competent rock is encountered and until the appropriate boring depth is achieved (at a minimum). All core samples shall be delineated and digitally photographed in color. Unaltered rock core samples shall be placed in a core box and taken to a laboratory for analysis.

4.2.4 Additional geotechnical and geophysical investigations shall be performed as necessary to adequately describe and characterize the Project Site materials and provide the data and recommendations required in the geotechnical engineering report. These shall include, but not be limited to, standard penetration tests, and Shelby tube samples, additional borings, test pits, seismic refractions, cone penetrometer soundings, *in situ* testing, and other similar or related methods.

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4.2.5 If using rock anchor foundations, a rock analysis shall be performed to identify the presence of fissures, rock joints, or other discontinuities that will control the overall strength of the rock mass, including, but not limited to, rock mass rating, rock classifications, depth of overburden, rock quality designation, joint spacing and orientation, stratifications, rock material strength, and water pressure in joints.

4.2.6 Soil resistivity testing shall be completed using the Wenner Four-Electrode method.

4.2.7 Existing utilities in the vicinity of borings or other subsurface test locations shall be identified and protected.

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4.2.8 Borings shall be backfilled with cement-bentonite grout and in a manner and with materials required under the applicable laws of the location of the Project Site. Excess cuttings shall be disposed of by Seller in accordance with the applicable Requirements and subject to Owner approval.

4.2.9 Borings shall be drilled using methods that minimize the potential for disturbance, sloughing or mixing of materials within samples. When water is encountered in a hole in cohesionless materials, rotary wash drilling methods with bentonite or polymer slurry shall be used, maintaining a positive head in the borehole at all times.

4.2.10 Unless explicitly stated otherwise, all rock core sampling shall be complete, full-boring-length samples. Such coring shall span from the point at which competent rock is encountered and until the appropriate boring depth is achieved (at a minimum).

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4.2.11 All core samples shall be delineated and digitally photographed in color. Unaltered rock core samples shall be placed in a core box and taken to a laboratory for analysis.

4.2.12 Seller shall obtain 24-hour water level readings in boreholes or install piezometers for long-term water level readings as required to determine prevailing groundwater levels.

4.2.13 A geologic review should consist of a review of the geologic data along the Project alignment. This review should identify and document areas of landslides, potential landslides, potential geologic hazards, past (historical) earth movements, and transitions between geologic units. Special consideration should be given to identify active and potential landslide zones.

4.3 Lab Testing

4.3.1 All testing described herein shall be performed by an independent, experienced third party.

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4.3.2 Laboratory testing shall be sufficient to provide the data and recommendations required in the geotechnical engineering report, at a minimum. Laboratory testing shall include chemical testing to evaluate corrosion potential and to determine the required cement type for concrete.

4.3.3 At a minimum, laboratory testing shall include the following:

(1) Moisture content (ASTM D2216).

(2) Grain size analysis (per ASTM D422).

(3) Atterberg limits (per ASTM D4318).

(4) Maximum soil density (per ASTM D4253).

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(5) Specific gravity (per ASTM D854).

(6) Compaction characteristics of the soil (per ASTM D698 or ASTM D1557 A).

(7) Unit weight determination (per ASTM D653).

(8) Core recovery percentage and rock quality designation when rock is encountered.

(9) Perform multi-channel analysis of surface wave tests.

(10) Soil resistivity testing (per ASTM-G57-95a). Results to be submitted in Ω-cm.

(11) Direct shear angle.

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(12) Cohesion constant.

(13) Unconfined compressive strength (per ASTM D2166).

(14) Unconsolidated undrained (UU) triaxial compression (per ASTM D2850).

(15) Consolidation test parameters (per ASTM D2435).

(16) Soil corrosiveness (chloride, sulfate, and pH).

(17) California bearing ratio.

(18) Dry and wet densities.

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4.4 Submittals

4.4.1 The geotechnical engineering report shall contain the following, at a minimum:

(1) Boring location drawings and coordinates.

(2) Field photographs.

(3) Description of the drilling and sampling program.

(4) Final boring logs.

(5) Description of the geology.

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(6) Subsurface and groundwater conditions encountered.

(7) Summary of results of field and laboratory tests performed.

(8) Foundation recommendations (as further described in Section 4.4.2 below).

(9) Specific design criteria for the Project (as further described in Section 4.4.2 below).

4.4.2 Seller's design criteria shall address the following items, as a minimum:

(1) Impacts of new construction on existing facilities.

(2) Factors of safety used in determining allowable foundation loads.

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(3) Recommended foundation types for all structures.

(4) Discussion of the dynamic soil properties at the Project Site, including dynamic shear modulus, Poisson's ratio, Young’s Modulus, and shear wave velocity.

(5) Recommendations for designing for seismic issues, including liquefaction potential. Identify the building code site coefficient/site classification for seismic design.

(6) Recommendations for site dewatering and construction practices, including design water level.

(7) For shallow foundations:

(a) Allowable soil bearing values and minimum bearing depths.

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(b) Anticipated total and differential settlements.

(c) Uplift resistance.

(d) Lateral resistance.

(e) Subgrade modulus.

(f) Dynamic spring constants for foundations supporting vibrating machines, if applicable.

(8) For deep foundations:

(a) Type of deep foundation (e.g., drilled shaft, rock anchor).

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(b) Diameter (or dimensions) and depth of foundation members.

(c) Minimum spacing and group reduction factors.

(d) Allowable compressive, uplift, and lateral capacities, including allowable skin friction and end bearing capacities.

(e) Anticipated settlements and lateral deflections.

(f) Static and dynamic spring constants.

(9) For retaining structures:

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(a) Active, passive and at-rest earth pressures for both drained and undrained conditions and requirements for type of backfill.

(b) Required rotation or translation to mobilize active and passive pressures.

(c) Recommendations of methods to insure drained conditions.

(10) Recommendations for slopes:

(a) Temporary excavation slopes and OSHA soil types.

(b) Permanent slopes.

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(11) Temporary and permanent excavation support requirements.

(12) Corrosion potential and chemical attack to construction materials.

(13) Recommended cement type in concrete and corrosion protection for buried steel, based on chemical test results. Recommended cement type shall be based on soluble sulfate content in the soil and ACI recommendations.

(14) An evaluation of the expansive, dispersive, and collapsing nature of the on-Site soil materials and discussion of design features to resist these tendencies.

(15) Recommendations for earthwork requirements including acceptable fill materials, moisture contents, compactive effort, lift thickness, proofrolling, equipment, and compaction testing.

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(16) Recommended aggregate gradations for general fill, load bearing fill, granular road base, and granular surfacing.

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5.0 CIVIL WORKS SPECIFICATIONS

5.1 General Provisions

5.1.1 Seller is responsible for all surveying, layout and control work, including establishing and maintaining survey control points for the duration of the Work and conforming to the Seller provided ALTA survey.

5.1.2 Seller shall be using the excavated topsoil and excavated material for final dressing of the site. Any additional topsoil, vegetation, organic material, rock, earth, sand and debris shall be removed and disposed by the Seller as per approved procedures and permit requirements. Soils shall not be relocated throughout the project site, unless approved by Owner.

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5.1.3 Seller is responsible for restoring all temporarily disturbed areas prior to the completion of the Work. This shall include all crane paths, crane pads, lay down areas, storage areas, road shoulders, collection system trenches, temporary access roads, etc. which should be fully remediated including decompaction as necessary.

5.1.4 Seller is responsible for ensuring, in agricultural areas (wheat, hay, and other actively farmed fields), that all backfill areas impacted by the Work are free of rock to a minimum depth per landowner and environmental agreements.

5.2 Design Working Life

5.2.1 The design working life of the civil works shall be a minimum of 30 years.

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5.2.2 The design of the civil works shall be consistent with the following storm events:

(1) Roadways (including all drainage facilities, such as swales and culverts) shall be designed for a 25-year, 24 hours storm event, while being able to safely convey a 100-year, 24 hours storm event.

5.3 Project Site Preparation

5.3.1 Project design shall consider existing Project Site conditions with respect to, at a minimum, soil characteristics, permit conditions, site clearing, grading, and drainage including existing floodplains and floodways.

5.3.2 Clearing and grubbing requirements:

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(1) Clearing, grubbing, removing and disposing of all vegetation and debris shall be understood to include felling and disposal of trees, brush, and other vegetation within the project limits as shown on the design drawings or as designated by the Owner

(2) Verify limits of clearing and features designated to remain, are clearly labeled and tagged prior to start of work; resolve any areas of confusion prior to start of work.

(3) Stripping shall be understood to consist of excavation and removal of all topsoil and organic matter.

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(4) Topsoil shall be stockpiled for later use during landscape reclamation activities. Topsoil shall be stockpiled only in areas designated where it will not interfere with construction operations or existing facilities. Stockpiled topsoil shall be reasonably free of subsoil, stumps, roots, debris, and stones larger than two (2) inches in diameter. Topsoil shall not be used as structural fill. Appropriate erosion control measures shall be utilized on stockpiled topsoil. If the topsoil strata are such that there are more than 2 distinct layers impacted, then each layer shall be stockpiled separately and returned in reverse order, unless agreed upon in writing with Owner.

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(5) Debris, rubbish, shrubs, organic matter, and vegetation from developed areas shall be grubbed and removed from the Project Site in accordance with applicable permit instructions and other pertinent Requirements. Burning or burying of materials on site shall not be permitted unless otherwise specified. No fill shall be placed in wetlands, environmentally or culturally sensitive areas unless a permit/approval has been received to do so.

(6) Root mats and stumps shall be completely removed from the Project Site construction areas, holes refilled with select material and compacted adequately for the ultimate expected loading for the material used and graded to drain. Any pockets of organic laden soils, and/or deleterious materials should be excavated to competent soils before proof rolling and placing structural fill.

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(7) Except in areas to be excavated, backfill stump holes and other holes from which obstructions are removed, with suitable materials, and compact in accordance with contract documents.

5.3.3 Removal of or damage to trees without written approval of Owner is prohibited outside the designated disturbance areas. Trees shall be adequately protected, including protecting tops, trunks, and roots of existing trees at the Project Site which are to remain, as follows:

(1) Box, fence around, or otherwise protect trees before any construction Work is started.

(2) Do not permit heavy equipment or stockpiles within branch spread (dripline) of trees.

(3) Trim or prune to obtain working space in lieu of complete removal when possible. Conduct operation as follows:

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(a) With experienced personnel.

(b) Conform to good horticultural practice.

(c) Preserve natural shape and character.

(d) Protect cuts with Owner-approved tree paint.

(4) Grade around trees as follows:

(a) Trenching: where trenching is required around trees which are to remain, avoid cutting the tree roots by careful hand tunneling under or around the roots. Avoid injury to or prolonged exposure of roots.

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(b) Raising grades: where existing grade at a tree is below the new finished grade and fill not exceeding 15 inches is required, place 1 to 2 inches of clean, washed gravel directly around the tree trunk. Extend gravel out from trunk on all sides at least 20 inches and finish 2 inches above finished grade at tree. Install gravel before earth fill is placed. Do not leave new earth fill in contact with any tree trunks.

(c) Lowering grades: re-grade by hand to elevation required around existing trees in areas where new finished grade is to be lower. As required, cut the roots cleanly 3 inches below finished grade, and cover scars with tree paint.

(5) Remove when damage occurs and survival is doubtful, following approval by Owner.

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(6) Replace with similar item when damaged through carelessness and so requested by Owner.

5.3.4 All underground utilities, pipelines, and other buried facilities shall be located and marked before construction activities, and such items shall be appropriately considered in the Project design.

5.4 Blasting

5.4.1 Blasted material shall be crushed and screened for use as fill on access roads and in other areas of the Project Site assuming the aggregate meets the appropriate geotechnical specifications for this application. Seller shall be responsible for verifying that the quantity and quality of such rock is suitable for use as aggregate at the Project Site.

5.4.2 Controlled blasting will be used to create a precise rock profile without significant final surface irregularities.

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5.4.3 Owner shall be notified prior to the use of explosives at the Project Site, and such blasting shall be completed, at a minimum, in accordance with the applicable permits and Seller-furnished blasting plan.

5.4.4 Seller shall prepare blasting plans and procedures for all blasting work to be performed at the Project Site, as required. Such plans and procedures shall include, at a minimum, a description of safety buffer zones, parameters for blasting times during the day and approved certification as required from the authority having jurisdiction, technical report to define detailed parameters, define blast hole alignment, locations, diameters, quantity required, drilling slope and depth, type of explosive, quantity of explosive, blasting sequence, features of fuses, detonators, delayers, triggers and any other special devices.

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5.4.5 When the use of explosives is necessary for the Work, Seller shall use the utmost care not to endanger life or property and shall comply with all applicable laws and other Requirements and conduct the necessary advance notifications.

5.4.6 Under no circumstance shall caps or other exploders or fuses be stored, transported, or kept together with powder.

5.4.7 All explosives shall be handled in a secure manner, and all such storage places (if permitted) shall be marked clearly "DANGER - EXPLOSIVES" or as otherwise required by law.

5.4.8 All permits and licenses required for blasting shall be obtained, paid for, and maintained by Seller.

5.4.9 Blasting shall be performed only by persons who are qualified, competent, and thoroughly experienced in the use of explosives for rock excavation.

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5.4.10 Charge holes shall be located properly and drilled to correct depths for charges used.

5.4.11 Charges shall be limited in size to the minimum required for reasonable removal of material by excavating equipment.

5.4.12 Excessive overbreak or damage to adjacent structures, exposed cut slopes, equipment, utilities, or buried pipeline and conduit shall be avoided as follows:

(1) With properly designed pattern.

(2) By use of Owner-approved explosion mats.

5.4.13 Blasting near utilities, pipelines, or facilities (buried or above-ground) shall be subject to approval of owning agency and Owner.

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5.4.14 Before delivery of any explosives to the Project Site, Seller shall have obtained a blasting endorsement on their public liability and property damage insurance policy.

5.4.15 Seller shall control debris resulting from blasting, including minimizing, to the extent practicable, the size of said debris. Seller shall use the utmost care not to endanger life or property, and to comply with all applicable laws and conduct the necessary advanced notifications.

5.4.16 Blast mats shall be utilized as required in sensitive areas, including, but not limited to, archeologically sensitive areas, environmentally sensitive areas, existing Project Site facilities, and other Project infrastructure.

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5.5 Excavation, Filling, and Backfilling

5.5.1 Different types of excavations based on the type and consistency of soil and rock are provided by the design and/or as requested by Owner. The Seller shall provide his own excavation plan for any excavation activity and shall submit it to Owner for approval before commencing any work. The excavation plan shall contain all the relevant information detailing the means, procedures and scheduling to implement the excavation activities, any environmental conditions and geotechnical characteristics. The Seller shall update the excavation plan as the work progresses.

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5.5.2 The excavation plan for all working locations shall include the excavation procedure, type and transport of all the earthmoving equipment, any type of shoring or reinforcement that may be needed for supporting the excavation walls, drainage measures and procedures, blasting procedures, stockpiling and storage procedures for reusable excavated material, detailed work schedule.

5.5.3 Stability of excavation sides shall comply with local codes, ordinances and requirements of agencies having jurisdiction. Shore and bracing are permitted in case of space restrictions or depending on stability of the excavated material. Remove shoring carefully to prevent caving or collapse of excavation. The sides and slopes of the excavation shall be maintained in safe condition until backfilling is complete.

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5.5.4 Materials suitable for use as fill at the Project Site shall include only materials that are free of debris, roots, organic matter, frozen matter, coal, ashes or cinders, and as recommended by the geotechnical engineering report.

5.5.5 All excavations shall be maintained in a safe, clean, and sound condition up to the time of concrete placement. The stability of all excavations shall be maintained by providing adequate sheeting, shoring, and bracing to support any lateral earth pressure. Stability considerations shall include the surrounding land surfaces that may impact the Project or nearby improvements. Sheeting, shoring, and bracing shall be removed as backfilling proceeds.

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5.5.6 Permanent slope and rock stability measures shall be part of the Project design and shall incorporate the recommendations and requirements set forth in the geotechnical engineering report. Safe stabilization for all slopes, regardless of the type of rock or soil conditions, shall be guaranteed including protection of all personnel and structures against any damage from cave-ins, heaving, or other earth movements.

5.5.7 All structure foundations shall be surveyed and staked prior to excavation. The methods of staking and final alignment of the concrete caisson, anchor bolts, reinforcing steel, stub angles, and embedment sections shall be designed such that the finished condition of the Work meets the requirements for alignment, position, elevation, and rotation.

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5.5.8 Seller shall be responsible for locating buried utilities and other underground obstructions prior to any excavation. For underground gas and oil pipelines, it may be required, that the pipeline owner be on site always while the work is occurring within the pipeline easement. Seller shall coordinate such activities with pipeline owners prior to starting work so that the project schedule is not impacted. Excavation by hand tools without any mechanical means shall occur when it is not possible to proceed with earthmoving machines, or a special precision and/or care is needed to avoid any damage to existent underground cables, pipes, sewers, equipment's, objects and manufactured items in general, or other special situations. The Seller shall bear the full cost associated with repairing any damage done to underground utility lines caused by work performed by the Seller. Should uncharted, or incorrectly charted, utilities be encountered during excavation, stop work and contact the Owner immediately.

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5.5.9 When excavation reaches the required subgrade elevations, notify the Owner and geotechnical engineer and they will make the inspection of conditions. If the project geotechnical engineer determines that the bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are reached. This shall be after approval from the Owner and geotechnical engineer is received.

5.5.10 Correct unauthorized excavation, including areas over excavated by error, at Sellers' expense.

5.5.11 Stockpile of excavated materials shall be protected from erosion. Do not permit topsoil to be mixed with subsoil. As a guideline, topsoil (from topsoil excavation) shall be deposited, loosely, in heaps with a maximum height of 15 feet and excavated soil (excluding the topsoil from excavation) shall be deposited in subsequent layers, with a slope angle equal to the natural friction angle of the soil. If stockpiles left undisturbed for more than 30 days, then they need to be stabilized. Direct surface water away from the stockpile to prevent erosion, runoff and deterioration of materials.

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5.5.12 Prevent surface water and groundwater from flowing into excavations and accumulate. Remove water to prevent softening of foundation bottoms, undercutting foundations which may cause the soil changes that that can impact the structural stability of the foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines and other dewatering systems necessary to convey the water away from excavations. Establish temporary drainage ditches or other diversions outside the excavation limits to convey rainwater or water removed from excavations. Do not use any trenches or other excavations for permanent structures as temporary drainage ditches.

5.5.13 Dispose water from the work in a suitable manner that causes no damage to adjacent property and does not interfere with the traffic flow or other construction activities. Water shall be disposed of in such a manner as not to be a menace to public health and in accordance with Environmental Protection Agency, Corps of Engineers, state water quality control division standards and permits and project storm water pollution prevention plan or environmental plan.

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5.5.14 Seller shall be responsible for maintaining a temporary, highly visible fencing around excavations that exceed 4 feet in depth . Such temporary fencing will be used for protecting against fall hazards for site personnel, other people on site, ranch livestock etc. Setback for any temporary fencing shall be a minimum of 6 feet from the edge of the excavation. Carry out daily checks on the conditions and completeness of temporary fencing and carry out repairs if necessary.

5.5.15 All excavations shall have at least two (2) means of ingress and egress.

5.5.16 All foundations shall bear on undisturbed soils or structural fill. Conform to all design elevations and dimensions within acceptable tolerances for placing and removing of concrete formwork, conducting inspections and other construction activities.

5.5.17 Protect excavation bottoms against freezing when atmospheric temperature is less than 35°F or as per design requirements.

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5.5.18 Proof roll subgrade with loaded rubber-tired equipment for a total equipment weight greater than 25 tons to determine soft areas or as per design requirements. After passing proof roll test, road base material, foundation mud mat will be placed on the subgrade. Additional tests for subgrade compaction shall be completed as per design requirements, which may include but not limited to checking the moisture content, in-situ density and degree of compaction. The Seller may be asked by the Owner to implement remedial measures and repeat these tests if the compaction requirements are not met.

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5.5.19 Structural fill lifts shall not exceed a thickness of 8 inches. Other fill lifts shall not exceed a thickness of 12 inches.

5.5.20 Embankments (fill and cut) shall have a slope of 3H:1V or flatter. All embankment fill material shall comply with the design requirements. The material shall be uniformly spread in layers and the required degree of compaction should be achieved. The compaction is 95% of standard proctor density or as per the design documents. The embankment construction shall be done with minimal slope to avoid rainwater stagnation and soil softening and to prevent soil washout.

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5.5.21 Earthwork activities shall be sub-divided in smaller sections/areas to reduce the time lapse between completion of the layers and placement of new layers above. The Seller shall follow the design guidelines for new embankment constructed on an existing embankment. Embankments to support roads and service yards shall have slopes as per the design/project documents. Areas no longer being actively grades shall be temporarily or permanently stabilized per permit conditions.

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5.5.22 The excavated materials may require crushing and screening prior to backfilling of foundations if they do not meet the design specifications of backfill material. The tests that need to be performed as per a minimum shall be particle size distribution, Atterberg limits and abrasion resistance. This is applicable to the material available for backfilling after blasting activities. The Seller shall provide crushing and screening plant in compliance with applicable standards/codes and shall obtain the required approvals from the local authorities. Seller shall submit the crushing and screening plant report to the Owner for review and approval prior to commencing work. The report shall include, but not limited to size of the plant, location of the plant, schedule of crushing activities, permits, compliance with emission standards including pollution, dust and noise.

5.5.23 The material produced from crushing and screening shall be tested as per the frequency mentioned in the design documents. The crushing and screening plant shall be capable of supplying high quality materials in the quantity required. The crushed material should be capable of being handled by earthmoving machines.

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5.5.24 The backfill material shall meet the design requirements as this will be spreading the structural loads to the subgrade. To check the material properties, the Seller shall perform tests as per the frequency mentioned in the design documents. For special situations, as per the Owner's request or as per the design, the Seller may be asked to perform these tests with greater frequency under additional compensation or to perform additional test.

5.5.25 Fill activity includes filling soils with compaction into road excavations, trenches, general grading applications and backfilling for foundation excavations. The material for backfilling can be the same as the material excavated if it meets the design requirements as per the design/project documentation.

5.5.26 Soil proposed for fill and backfill shall be approved by geotechnical engineer prior to use. The backfill or fill layers shall be tested during placement and compaction operations. The number of tests shall be made in a quantity to ensure that uniform compaction for each lift is suitably achieved.

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5.5.27 Ensure areas to be backfilled are free of debris, snow, ice and water and that ground surface es are not in frozen conditions. Do not use muddy or frozen fill materials. Moisture condition of the fill material shall be as required to achieve design compaction. Compact backfill material in layers not exceeding a thickness of 8”.

5.5.28 Use hand tampers or vibrating compactors at foundations or similar locations inaccessible to large equipment and rollers. Rolling equipment shall not be used immediately to the foundations.

5.6 Laydown Yard

5.6.1 The laydown yard shall be sufficient in size to allow for simultaneous (i) storage of equipment, including any Owner-Supplied Equipment, that will not be stored at the Wind Turbine Generator Pads; (ii) storage of office trailers and other temporary facilities; (iii) parking for approximately 20 Owner vehicles; and (iv) regular construction traffic.

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5.6.2 The laydown yard shall be covered throughout with crushed rock surfacing. All crushed rock surfacing at the laydown yard shall conform, at a minimum, to the specifications prescribed in Section 5.8 (*Crushed Rock Surfacing*) herein.

5.6.3 The laydown area shall remain suitable for use in all weather conditions.

5.6.4 The laydown yard shall have a two percent (2%) grade, or less if required, for the safe storage of equipment, or to meet manufacturer's requirements for storage of equipment. The surface of the yard shall be free from potholes and ruts and shall allow for free drainage of surface water.

5.6.5 The laydown yard shall comply with the Turbine Supplier Project Site Requirements.

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5.6.6 Fencing shall be installed around the perimeter of the laydown yard, and vehicle gates shall be installed at all entrances to the laydown yard. All fencing and gates shall comply with the minimum specifications in Section 3.10 (*Fencing, Walls, and Gates*) herein.

5.6.7 The laydown yard shall have at a minimum two points of ingress/egress which shall be accessible at all times.

5.7 Roads

5.7.1 Seller is responsible for Construction of the project access roads in accordance with the IFC drawings and specifications, including the ability to withstand both the individual and sustained loading requirements of construction traffic associated with the foundation material deliveries, component deliveries, and erection crane travel.

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5.7.2 Seller is responsible for conducting a survey to document the existing conditions of the roads to be utilized, prior to the start of and after the completion of the construction activities. This survey shall include video of the roads and Seller will be submitted to the Owner.

5.7.3 All roads shall be constructed within the permitted corridors.

5.7.4 Roads shall be designed, constructed, and maintained adequately to support all anticipated construction loads, equipment delivery (including Owner-Supplied Equipment), mobile cranes, construction traffic usage, and weather conditions to be expected.

5.7.5 Roads shall comply with the Turbine Supplier Project Site Requirements.

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5.7.6 Road entries, intersections, and turns that will be used by heavy equipment shall be designed to accommodate the longest vehicle anticipated to utilize the road so that it will be able to maneuver through the entire Project Site without leaving the graveled road area.

5.7.7 Roads shall be designed with turnarounds to assist in truck and trailer flow throughout the Project Site. Backup motions for tractor trailers shall be kept to a minimum and are subject to Owner approval.

5.7.8 Dead-end roads shall be designed with adequate turnaround space for a tractor/trailer to turn around without leaving the graveled road area. If backup motions for tractor trailers are necessary, the backup path shall be as straight and short as possible. All turnarounds shall be constructed using the same gravel design as the roads.

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5.7.9 Roads shall be designed to have a graveled roadway surface with sub-grade cleared and compacted to at least ninety-five percent (95%) of the maximum density within the moisture content of two percent (2%) below optimum to two percent (2%) above optimum, as determined by ASTM Standard D698, unless a higher level of compaction is required by the geotechnical engineering report.

5.7.10 Roads shall be rocked with crushed rock material over a stabilized subgrade. All such crushed rock surfacing shall conform, at a minimum, to the specifications prescribed in Section 5.8 (*Crushed Rock Surfacing*) herein.

5.7.11 Roads shall be constructed within permitted boundaries and shall be subject to grading permit review and approval, if required, from the agency(ies) having jurisdiction.

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5.7.12 Roads shall be cleared of overhead obstructions (e.g., power lines). Mark all overhead obstructions with signs and goal posts.

5.7.13 Roads shall be able to accommodate two-way traffic during normal conditions but may be converted to one-way traffic when wide vehicles are entering the Project Site and delivering equipment and/or materials.

5.7.14 Seller is responsible for ongoing regular maintenance of all project and public roads as needed throughout the Work, to include grading, dust control, and snow removal as needed.

5.7.15 Seller is responsible for all surveying and staking out needed to construct the roads in accordance with design plans. The levels and control points and final grade of the roads shall follow the design drawings.

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5.7.16 Seller shall be responsible for locating buried utilities and other underground obstructions prior to any excavation. For underground gas and oil pipelines, it may be required, that the pipeline owner be on site always while the work is occurring within the pipeline easement. Seller shall coordinate such activities with pipeline owners prior to starting work so that the project schedule is not impacted. Excavation by hand tools without any mechanical means shall occur when it is not possible to proceed with earthmoving machines, or a special precision and/or care is needed to avoid any damage to existent underground cables, pipes, sewers, equipment's, objects and manufactured items in general, or other special situations. The Seller shall bear the full cost associated with repairing any damage done to underground utility lines caused by work performed by the Seller. Should uncharted, or incorrectly charted, utilities are encountered during excavation, stop work and contact the Owner immediately.

5.7.17 Roads shall be a *minimum* of 20 feet wide.

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5.7.18 Roads shall be widened through turns and curves, as necessary. Seller shall provide documentation for required widenings to demonstrate the ability for required vehicles to accommodate turns safely.

5.7.19 Roads shall be designed and constructed with a maximum grade of ten percent (10%) grade. Approaches to pads from access roads shall be designed and constructed sufficiently level so as to allow transport and construction vehicles to work and park on a flat surface.

5.7.20 Roads shall have no more than two percent (2%) crown, unless such roads will be utilized as crane paths, in which case the maximum crown shall be one percent (1%). All roadways, including shoulders, shall be graded so as to self-drain, and must not allow water to puddle.

5.7.21 Maximum allowable rutting is two (2) inches.

5.7.22 Roads shall meet all required design elements at substantial completion.

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5.7.23 Maximum vertical crest and dip on roads is six (6) inches vertical to 50 feet horizontal, or less if required by the Turbine Supplier Project Site Requirements.

5.7.24 The longitudinal radii (convex or concave) of roads shall not be less than 750 feet.

5.7.25 The surface of the road shall be free from potholes and ruts and shall allow for free drainage of surface water.

5.7.26 All roadways shall be able to accommodate traffic consisting of general-purpose pickup trucks, SUVs, and bucket trucks, or as required during construction to perform the Work. During construction, equipment delivery trucks shall also be able to safely travel these roadways.

5.7.27 All site entrances/exits shall have a system in place to prevent tracking of mud and other debris onto the public way.

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5.7.28 Seller shall procure and install cattle guards, when required. Cattle guards shall be installed level and provided with a stable base capable of sustaining heavy loads without shifting or settling.

5.7.29 Seller shall inventory, analyze and verify all existing bridges and culvert crossings on the Project Site are sufficient for the intended Project use. If any improvements are needed to existing culverts and bridges, Seller shall make these improvements as per planned schedule to not delay any major component deliveries or construction traffic.

5.7.30 The Seller shall modify existing public roads, as required, at the access road intersections and other locations as needed to allow the delivery of the turbine components to the respective foundation locations. Modifications to the existing public road should meet all applicable State DOT and local jurisdictional requirements and follow any road use agreements.

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5.7.31 Construction and maintenance of project site roads shall follow all storm water pollution prevention and spill prevention plans.

5.7.32 During winter conditions, carry out snow plowing to provide vehicle access to all turbine locations throughout the construction life of the project. This shall be completed by the Seller as soon as safely practical after a storm event. Seller is responsible for applying sand/salt mixture or all sand mixture in the event of icy conditions on access roads and construction areas.

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5.7.33 Seller shall prepare, implement, and manage a detailed traffic management plan that is specific to the Project. The traffic management plan shall clearly identify all haul routes from the nearest highway; proposed traffic flow within the Project Site, including public roads; plans for managing construction, delivery, public, and other traffic at the Project Site during construction; daily concrete truck delivery flow plans; and mitigation measures to reduce risk and impact to non-construction vehicles due to construction activities. The Seller is responsible for all signage, spotters or other requirements to meet state traffic requirements. The Seller is responsible for any agency approval needed prior to any road work.

5.7.34 Seller shall provide temporary signs at public and site access road intersections to provide direction to turbine locations; and at the appropriate locations on public roads to indicate that no wind project traffic is allowed along these roads. These signs shall remain in place throughout the construction period.

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5.7.35 Lime treatment of road subgrade to modify the physical and mechanical properties of the soil through chemical reactions is acceptable for road subgrade improvement. Seller shall be responsible for submitting to the Owner the procedure for lime stabilization for review and approval before lime application. The lime treatment procedure shall include but not limited to the following: suitable climatic condition for lime treatment, suitable subgrade soil conditions, measures to mitigate frost conditions and dewatering methods, types of lime, storage and delivery of lime material, material dosage requirements, lime application methods and testing methods. The procedure shall follow the latest editions of all applicable standards. Lime stabilization is preferred for cohesive soils.

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5.7.36 For granular soils, cement stabilization methods can be used for road subgrade improvement. It is important to remember that in situations where there is time constraint due to fast pace of construction activity, cement stabilization can be considered as an alternative as the cement treated soils can gain strength much quickly compared to lime treated soils. Seller shall be responsible for submitting to the Owner the procedure for lime stabilization for review and approval before cement application. The cement stabilization procedure shall include but not limited to the following: suitable climatic condition for lime treatment, suitable subgrade soil conditions, measures to mitigate frost conditions and dewatering methods, types of lime, storage and delivery of material, optimum dosage of cement, cement application methods and testing methods, placement and compaction methods. The procedure shall follow the latest editions of all applicable standards. For cement stabilization, Type I Portland Cement conforming to ASTM C150 shall be used. Other equivalent products shall be submitted for review and approval.

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5.7.37 Geosynthetics may be required as per design requirements to filter, drain, separate, protect and reinforce the ground during and after construction. Materials must be delivered to the construction site in their original packaging with labels along with the manufacturer's technical sheets indicating the main specifications and instructions for proper installation. The Owner may request certificates issued by authorized testing laboratories to confirm the physical, mechanical, hydraulic and durability properties stated in the technical sheets. Materials must be stored on the construction site in their original packaging and be protected from weather and exposure to direct sunlight must be avoided.

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5.7.38 Joint types between geotextile sheets can be overlapping, sewn or, with adhesive strips, staples, adhesives (gluing) or hot melt and tying. Geotextiles for filtering can be installed outdoors or underground on horizontal, sloped and vertical surfaces. They can be used around perforated pipes or in trenches. Geotextiles must be installed in a stable position during construction of drains and during burial. If installed in drainage trenches to be filled by gravel, geotextile tarps must be positioned and adhered to the trench bottom and to the walls to avoid tension stress when the drain is filled. The Seller shall ensure that the geotextile material shall not be in contact with rock or any sharp objects.

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5.7.39 Geogrid is a geosynthetic formed by a network of integrally connected elements to allow interlocking with surrounding soil, rock, earth and other surrounding materials to function primarily as reinforcement. Geogrids shall not decompose and must be non-toxic, rodent and micro-organism proof, chemically inert and ultraviolet (UV) ray stable. Geogrids must be installed as per the design requirements and manufacture's specifications. Construction site equipment (such as excavators and cranes) should not be allowed to travel directly on geogrids.

5.8 Crushed Rock Surfacing

5.8.1 Verify gradients and elevation of the subgrade are correct as per design drawings. Proof roll road subgrade using loaded rubber-tired equipment weighing more than 25 tons to detect soft areas prior to any aggregate placement. If unsuitable/soft subgrade is encountered, Seller shall undercut unstable material and stabilize subgrade using structural fill prior to aggregate placement.

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5.8.2 The maximum aggregate size for surface fill (i.e., crushed rock surfacing) shall not exceed three (3) inches, including, but not limited to, that used for roadways, Wind Turbine Generator Pads, Project Substation, laydown yard, and the O&M Building.

5.8.3 Spread and compact aggregate base material in lifts of thickness no greater than 6 inches.

5.8.4 Unless explicitly stated otherwise, all crushed rock surfacing shall be of thickness required by Project Site loading requirements, including those set forth in (i) the Turbine Supplier Project Site Requirements and (ii) the geotechnical engineering report.

5.8.5 Unless explicitly stated otherwise, all aggregate shall conform to local department of transportation requirements.

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5.8.6 An aggregate job mix formula shall be established prior to the start of fill operation based on recommendations from the final geotechnical engineering report. This mix shall not be changed without prior approval of Owner. Testing data, including sieve analysis, shall be submitted for all aggregate sources.

5.8.7 Road aggregate characteristics shall be tested as per frequency of testing mentioned in the design requirements. For construction of crane pads/roads, the material must be placed in lifts not exceeding 6 inches or as per the design and should be properly compacted while providing adequate drainage of runoff water away from the pavement surface. The characteristics of the material shall be tested for of grain size analysis, compaction, Atterberg limits, soundness of aggregate, LA abrasion and CBR tests.

5.8.8 Restore all the permanent access roads to meet the road surfacing design conditions at the end of the project.

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5.8.9 Finish surfaces by rolling with smooth steel wheel roller. Repair soft and yielding areas that develop in the final rolling.

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5.9 Drainage and Erosion Control

5.9.1 The working areas of the Project Site shall be well drained during and after construction, respectively. All drainage shall be away from buildings and foundations.

5.9.2 Seller shall be responsible for submitting Stormwater Pollution Prevention Plan to Pacific Corp for review and approval prior to any site disturbance. Implementing and maintaining a comprehensive storm water pollution prevention plan (SWPPP) during the course of construction. This shall include all required permit submittals. The SWPPP shall be a live document, subject to review and adaptation throughout construction – a final SWPPP will be provided as part of the turnover documentation robustly capturing any residual maintenance requirements.

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5.9.3 Roadway cross sections shall be shaped to move water away from the road, such as crowning or cross-slopes, and roads shall be designed and constructed to prevent water ponding. Storm water shall not channel flow across constructed roads.

5.9.4 Controls shall be provided to protect the water quality and shall be in accordance with all Requirements, including applicable laws, applicable permits, and the Seller-provided SWPPP.

5.9.5 Seller shall provide all excavation, embankment preparation, drainage contours and culverts necessary to prevent excessive erosion and degradation of site due to water runoff.

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5.9.6 Culvert pipe ends, swales, and ditches shall be designed to control concentrated flow velocities and minimize erosion and siltation. Corrugated metal pipes are most widely used for drainage applications including storm sewers, culverts, and storm water detention and infiltration systems in the wind projects. These pipes can be made of steel or aluminum. Corrugated coupling bands, galvanized steel or aluminum to match pipe, minimum 10-inches (250-mm) wide; connected with two neoprene O-ring gaskets per and two galvanized steel bolts.

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5.9.7 Verify is trench cut to the dimensions, and elevations are as indicated on the Construction Drawings. Remove large stones which could damage piping or impede backfilling or compaction. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation. Place bedding material at trench bottom, level continuous layer not exceeding 8-inch compacted depth; compact to 95 percent of the modified proctor maximum dry density. Install pipe as per manufacturer's instructions. Seal joints watertight. Keep pipe and fittings clean until work is completed. Lay pipe to alignment and slope gradient noted on the design. Protect pipe and bedding from damage or displacement until backfill operation is in progress.

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5.9.8 Riprap shall be placed primarily for culvert outlet protection and embankment slope protection. Riprap shall be tested as per frequency of testing mentioned in design documents. LA abrasion test and soundness test shall be completed for testing the riprap. Riprap shall be irregular shaped rock; 2-inch minimum size, 12-inch maximum size; solid and non-friable. Do not place riprap over frozen subgrade surfaces. Installation thickness of riprap shall be of minimum 6 inches.

5.9.9 Wetlands impacts shall be avoided to the maximum extent practicable and are subject to regulatory approval or other applicable Requirements.

5.9.10 All storm water flows shall be returned to their original drainage patterns and the Project shall not increase flow rates from their historic levels.

5.9.11 Sheet flows shall be collected in roadside drainage swales and conveyed to culverts or channels to safely pass storm water flows.

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5.9.12 Culverts or low-water crossings shall be placed under roads where required to pass existing storm water concentrated flows.

5.9.13 Erosion and sediment control, both during and after construction, shall be provided as required by the Requirements to retain sediment onsite and to control the erosion of embankments, temporary and final exposed slopes, and temporary stockpile(s).

5.9.14 All practicable erosion control devices shall be installed and maintained in good working order throughout construction to prevent the unauthorized discharge of material into a wetland or tributary. These controls shall be maintained until permanent erosion controls are in place.

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5.9.15 Silt fences, check dams, drainage ditches or swales, straw mulch, and pre-manufactured geotextiles, geotubes, geogrids, cellular geoweb, and other similar items (collectively, the "**Best Management Practices**") shall be utilized as appropriate. Use impervious materials to cover stockpiles when unattended or during rain event. Erosion control measures shall be inspected and maintained daily to ensure their continued effectiveness. No heavy machinery in a wetland or other waterway. Seller shall prepare maps showing location and type of BMPs installed and used for Project Site.

5.9.16 Synthetic, toxic, or otherwise harmful erosion-control materials shall be made inaccessible to livestock on or adjacent to the Project Site during the construction period.

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5.9.17 Construction operations shall be continuously monitored by Seller to avoid creating conditions that could lead to excessive erosion of soil with surface runoff from Work areas. Site drainage shall be provided to ensure that water does not "pond" on or near the project facilities constructed by the Seller. Special attention shall be paid to wind turbine foundation areas, substation areas, O&M facilities, and access roads.

5.9.18 Run off from all site roads, parking areas and any areas liable to be contaminated by oil shall be managed in accordance with the Spill Prevention Control and Countermeasure Plan or Storm Water Pollution Prevention Plan.

5.9.19 Seller shall provide construction dust control at the project throughout the duration of the Work, including furnishing of all labor, equipment, and materials, including water and/or equivalent duct control products, necessary for dust control and as necessary to reduce the risk of dust becoming a nuisance. Dust control methods to be reviewed by the Owner prior to implementation.

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5.9.20 Local agencies may enforce requirements that limit certain construction activities during a portion of the year (e.g., due to storm events). These requirements shall be incorporated into the proposed SWPPP, erosion control plan, and Project Schedule.

5.9.21 Seller is responsible for maintaining a log of all storm events, the impacts and corrections as required under the SWPPP.

5.9.22 Seller shall document, record and maintain all documentation relating to SWPPP. The SWPPP package shall be submitted to the Owner upon final completion of the project.

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5.9.23 Seller shall be responsible for repairing drainage tile systems damaged during the installation of the foundations, collection system, crane walks, or any other activity with the potential to damage drain tiles. Seller shall recognize locations of drain tile by GPS and flagging/staking. All repair made to drain tiles shall fully comply with local Codes and standards and Landowner requirements. Seller shall include the GPS coordinates, photo documentation and field report and submit to the Owner as per the quality job book.

5.10 Site Restoration

5.10.1 Seeding shall occur during a time / season when the probability of successful seed germination is maximized. Hydro-seeding is acceptable for slopes.

5.10.2 Prior to re-seeding, Seller to obtain approval from Owner and landowners on reseeding and the desired seed mix. Active agricultural fields should not be reseeded.

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5.10.3 Seller shall restore the erection areas to pre-construction conditions at the completion of the project.

5.10.4 All temporary structures, buildings, temporary concrete footings and slabs, and scaffolding furnished by the Seller during the construction shall be removed, and the involved areas shall be left in their intended or original condition.

5.11 Testing and Quality Control

5.11.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

5.11.2 All roadways and compacted areas shall be tested to demonstrate they meet stated design criteria and are fit for purpose.

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5.11.3 Roadway testing shall include the following, at a minimum:

(1) Maximum dry density and optimum moisture content: per ASTM D698 or ASTM D1557

(2) In-place density by nuclear methods (shallow): per ASTM D2922

(3) Aggregate sampling: per ASTM D75

(4) Sieve analysis of fine and coarse aggregates: per ASTM C136

(5) California Bearing Ratio of laboratory-compacted soils: per ASTM D1883

(6) Sand equivalent value: per ASTM D2419

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(7) Liquid limit, plastic limit, and plasticity index: per ASTM D4318

(8) Roadway subgrade and surfacing compaction shall be verified at a minimum of every 1,000 feet. Roadway subgrades shall be proof-rolled over the entire length.

(9) Aggregate base shall be analyzed with a sieve at a minimum of every 2,500 cubic yards.

5.11.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

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6.0 STRUCTURAL WORKS SPECIFICATIONS

6.1 General Provisions

6.1.1 All buildings, support structures, foundations (including Turbine Foundations), and equipment pads shall be constructed on competent material. All loose materials shall be removed from excavation bottoms. Unsatisfactory foundation subgrade material shall be removed and replaced with compacted structural fill material or with suitable concrete.

6.1.2 All buildings, foundations, meteorological towers, equipment supports, and other structures shall be designed in accordance with the latest edition of the Applicable Standards.

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6.1.3 As further described in Section 3.0 (*Geotechnical Specifications*), the geotechnical engineering report shall be utilized for the design and construction of all Project structures. All foundations shall be designed with consultation of a licensed geotechnical engineer.

6.1.4 The foundation designer shall perform and detail all appropriate design verifications in a calculation report. The following information shall be included at a minimum:

a. List of all design standards utilized with revisions/edition.

a. List of design load cases based on loading information

b. List of all safety factors, load factors, materials factors, etc. and correlation to the design standard they are taken from.

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c. Justification for foundation type and shape based on the Geotechnical Assessment and site conditions.

d. Coordination with Civil Engineer to ensure alignment of final proposed grades with civil site plans.

e. Intended soil improvement justification, improvement type, and locations, as needed.

f. Concrete Exposure Class.

g. Environmental Analysis (seismic)

h. Stability Checks:

    i. Differential Settlement

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ii. Foundation Stiffness

iii. Soil Bearing Capacity

iv. Gapping Requirements

v. Overturning & Sliding

i. Structural Analysis Checks:

i. Concrete Design (Raft, Pedestal, etc.)

ii. Anchorage Design (Bolt length, embedment plates, etc.)

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iii. Fatigue Assessment.

6.1.5 Foundation designer may specify ground improvements as needed if the soil below the foundation does not comply with required strength and compressibility properties.

a. Soil Substitution

i. Existing soil below the foundation shall be removed and replaced with more suitable soils. Foundation designer shall ensure that backfill has sufficient bearing capacity and soil compressibility to dissipate pressure to deeper native soils. Soil substitution area shall be wider than the foundation footprint.

b. Stone Column & Rigid Inclusion

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i. Foundation designer shall be permitted to utilize stone column techniques as needed to supplement existing soils. If used, the design should following international design guidelines and recommendations as provided by DNV or IEC to determine adequacy of design. Owner may request the use of a finite element analysis model to conform design approach.

c. Foundation Subsurface Void Grouting

i. If other techniques are not found suitable for the project, foundation designer may recommend void grout filling within the foundation influence zone to supplement soil strength.

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6.1.6 The maximum loads (including load factors) applied to the foundations and used for design shall be determined from the structure design of the supported structure considering load cases and Applicable Standards associated with the particular structure type.

6.1.7 All relevant site parameters shall be identified to ensure that load effects transmitted from wind turbine are sufficiently captured in foundation design. The primary contributor is typically the wind load, however consideration shall be given, where necessary, to other factors such as snow loads, seismic loads, ground water buoyancy, etc.

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6.2 Project Substation Foundations

6.2.1 All Project Substation buildings, support structures, foundations, and equipment pads shall be designed in accordance with the Applicable Standards and other applicable Requirements, and the type of foundations required and allowable bearing values for soil and rock shall be as recommended by the geotechnical engineer based on the subsurface conditions found in the geotechnical engineering report. All loose materials shall be removed from excavation bottoms. Unsatisfactory foundation subgrade material shall be removed and replaced with compacted structural fill material or with 2000-psi concrete. Total foundation settlements will be limited to one (1) inch or as required by applicable building or industry codes, and equipment supplier's recommendations.

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6.2.2 Equipment foundations shall be of reinforced concrete including all formwork, rebar, waterstop, and other similar items.

6.2.3 Main step-up transformer foundation and containment shall be provided with secondary oil containment equal to at least 110% of the volume of oil present in the transformer in addition to the volume of rain water for a 100-year storm event over the area of the containment; a calculation shall be provided by Seller to demonstrate compliance with this requirement. Oil containment shall be a concrete containment with a sump placed within the containment area.

6.2.4 Equipment support structures shall be low profile (non-lattice) framing consisting of galvanized structural steel tubing and rolled shapes as the basic structural element. Steel support structures shall be designed, fabricated, and erected in accordance with the provisions of the AISC.

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6.2.5 Reinforced concrete support structure foundations and equipment pads shall be designed and constructed in accordance with the provisions of ACI 318, ASTM A615, and allowable soil bearing pressures resulting from site soil sampling, laboratory testing, and geotechnical analysis and recommendations set forth in the geotechnical engineering report.

6.2.6 Reinforced concrete, cast-in-place drilled piers utilizing stub angles (lattice tower structures) or anchor bolts (tubular steel pole structures) to attach the structure to the foundation are the preferred foundation types.

6.2.7 Requirements and restrictions for access, site disturbances, conduits for power and communications, and other similar items shall be incorporated into the foundation design as appropriate.

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6.2.8 For stub angle type foundations, a minimum of four (4) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

6.2.9 For anchor bolt type foundations, a minimum of six (6) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

6.2.10 The anchor bolt embedment length shall be not less than the development length for the strength of concrete specified.

6.2.11 Compression/uplift type foundations shall be straight piers and shall not be belled on the bottom. The parameters shown in Table 1 (*Stub Angle Type Foundation Parameters*) shall be used to design stub angle (compression/uplift loaded pier) type foundations:

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Table 1: Stub Angle Type Foundation Parameters

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Description	Load Factor*	Criteria
Settlement, individual pier	1.1	0.50 inch
Differential settlement measured against other piers in the same structure	1.1	0.25 inch
Predicted ultimate capacity, compression (bearing)	Safety factor of 2.0 over maximum factored loads	
Predicted ultimate capacity, uplift	Safety factor of 2.0 over maximum factored loads	
* Note: Load Factors for the NESC Combined Ice and Wind District Loading (e.g., NESC Heavy) shall be applied in lieu of the Load Factors in this table.		

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6.3 Overhead Power Line Structure Foundation Design

6.3.1 Information presented in this Section 6.3 shall apply to both Interconnection Line structure foundations and Collection System Circuit overhead structure foundations, as applicable, and unless explicitly stated otherwise.

6.3.2 Structure foundations shall be surveyed and staked prior to excavation.

6.3.3 Reinforced concrete support structure foundations and equipment pads shall be designed and constructed in accordance with the provisions of ACI 318, ASTM A615, and allowable soil bearing pressures resulting from site soil sampling, laboratory testing, and geotechnical analysis and recommendations.

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6.3.4 Reinforced concrete, cast-in-place drilled piers utilizing stub angles (lattice tower structures) or anchor bolts (tubular steel pole structures) to attach the structure to the foundation are the preferred foundation types.

6.3.5 Compression/uplift type foundations shall be straight piers and shall not be belled on the bottom. The parameters shown in Table 1 shall be used to design stub angle (compression/uplift loaded pier) type foundations.

6.3.6 For stub angle type foundations, a minimum of four (4) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

6.3.7 For anchor bolt type foundations, a minimum of six (6) inches of clear space is required from the outermost reinforcing steel to the side of the excavation.

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6.3.8 The anchor bolt embedment length shall be not less than the development length for the strength of concrete specified.

6.4 Overhead Power Line Structure Design

6.4.1 Information presented in this Section 6.4 shall apply to both Interconnection Line structures and Collection System Circuit overhead structures, as applicable, and unless explicitly stated otherwise.

6.4.2 Appropriate construction grades set forth in the current version of NESC C2 shall be utilized.

6.4.3 Material used on overhead power line structures, cross arms, etc. shall consist of treated wood, fiberglass composite, tubular steel, steel lattice, or a combination thereof.

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6.4.4 Structural design of all overhead power line structures, including, but not limited to, the tower, conductor cable, OPGW, shield wire, and insulator hardware, shall be in accordance with all applicable loading conditions and sagging/tension limits set forth in the Applicable Standards.

6.4.5 Structure configurations shall be designed in a way that all required electrical clearances are met as set forth in the Applicable Standards.

6.4.6 Vertical clearances of conductors above ground, all obstacles, and overhead power line components shall be maintained as defined in the Applicable Standards with clearances maintained assuming the maximum final sag (after creep) and including consideration of expected snow and drifting.

6.4.7 All clearances shall be maintained assuming the worst case (smallest clearance) wire condition, either initial tension/sag conditions or final tension/sag (after creep) conditions.

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6.4.8 Sag and tension limits shall conform to the requirements set forth in the Applicable Standards, including, but not limited to, the latest version of NESC C2.

6.4.9 Deflection line angle ranges per structure configuration shall meet design requirements.

6.4.10 Structure configurations shall be designed for a maximum shield angle of 30° measured from the shield wire outward to the phase position.

6.4.11 Guys and guy anchors (if required) shall be sited within existing easements.

6.4.12 Structures shall be guyed as required using Class A, zinc-coated, high-strength, stranded steel (ASTM A475), guy material.

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6.4.13 Any outer guy wire that is near a road or could present a safety hazard shall have a yellow safety shied to enhance visibility.

6.4.14 All angle and dead-end structures shall be of a self-supporting design.

6.4.15 All structures shall be designed to withstand, without failure or permanent deformation, the applicable loadings set forth in the Applicable Standards, including, but not limited to, the latest version of NESC C2

6.4.16 Stability shall be provided for the structure as a whole and for each structural element.

6.4.17 The non-linear behavior of the structure, under load, shall be incorporated into the design of the structure.

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6.4.18 The structure design calculations, fabrication details, and fabrication drawings shall be supplied to Owner for review prior to fabrication.

6.4.19 Loading combinations for both “all wires intact” and “all wires removed from one side” conditions must be considered for terminal dead-end structures.

6.4.20 Suspension attachments for conductor and shield wire shall not be in uplift at a temperature of 0°F.

6.4.21 All wire systems (OPGW and conductor) shall be designed to prevent wire damage due to Aeolian vibration.

6.4.22 The design shall incorporate manufacturer (wire and damper manufacturers) recommendations for vibration protection of conductors and OPGW/shield wires.

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6.5 Overhead Power Line Assemblies and Component Design

6.5.1 Information presented in this Section 6.5 shall apply to both Interconnection Line structures and Collection System Circuit overhead structures, as applicable, and unless explicitly stated otherwise.

6.5.2 All assemblies, hardware, and components of assemblies shall be designed to meet the strength requirements set forth in the Applicable Standards, including, but not limited to, the latest version of NESC C2, and shall be verified that all standard or non-standard material, assemblies, hardware, and components of assemblies meet the strength requirements for the application and intended use.

6.5.3 All non-standard material shall be approved by Owner prior to implementing its use in design.

6.5.4 Any piece of hardware in an insulator assembly must, at a minimum, match the ultimate strength of the insulator.

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6.5.5 All hardware shall be selected such that the hardware supports the defined loads without exceeding the factored strengths as specified by the hardware manufacturer.

6.5.6 The parts of each assembly, including insulators, shall be verified that they can be assembled properly.

6.5.7 Assemblies shall be articulating so that undue binding or overstressing will not occur during wire movements.

7.0 COMMUNICATIONS SYSTEM SPECIFICATIONS

7.1 General Provisions

7.1.1 The Communications System shall be designed with data continuity and reliability as priority.

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7.1.2 All monitoring and control devices and systems shall be suitably zone protected against lightning electromagnetic impulses in accordance with IEEE C37.90.1.

7.1.3 The Communications System shall be compliant with all Applicable Standards, including NERC Functional Model Registered Entity function, NERC Reliability Standards, Regional Entity Standards, approved regional variances, and/or FERC Orders as defined by NERC/FERC orders and Owner interpretation. Further, the Communications System shall comply and be designed to work in accordance with applicable system operator approved protocols, operating guides, standards, business practice manuals, and/or approved rules. In so far as either a state utility commission or provincial authority has instituted additional regulations, the communications system should be designed to accommodate where no conflict exists with NERC or FERC. Design should include parameters for operating under conditions specified by rules stated hereto as well as capability to function on an evidentiary basis.

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7.1.4 The design deliverables shall include but not limited to, integrated control and monitoring systems and communication networks schedule, description and technical specifications of monitoring and control systems, SCADA architecture, fiber optic design, SCADA points list, SCADA RTU program, HMI interface screens, data and telephone specifications, bill of materials, fiber patch panel drawings, logic diagrams and functional control diagrams.

7.1.5 All Communications System design and construction shall conform to the Wind Turbine, Solar PV, or Battery Energy Storage System Supplier's requirements.

7.2 Design Working Life

7.2.1 The design working life of the Communications System equipment shall be a minimum of 30 years.

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7.3 Civil Works Requirements

7.3.1 All civil works for the Communications System shall comply with the applicable specifications in Section 5.0 *(Civil Works Specifications)*.

7.3.2 Excavation by blasting for the Communications System is prohibited.

7.3.3 Trench widths shall be kept to a minimum to allow sufficient space for equipment installation.

7.3.4 The trench bottom shall be firm for the entire length and width.

7.3.5 Trenches shall be kept free from water.

7.3.6 Conduit and cable shall not be placed on frozen ground.

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7.3.7 All splice pits (if used) and backfill shall be compacted to a minimum of 85 percent (85%) of standard proctor density, unless otherwise noted on the design drawings.

7.3.8 Backfill shall be free of debris and sharp objects.

7.4 System Functionality

7.4.1 The Control and Monitoring systems shall be designed to meet the Wind Turbine, Solar PV, or Battery Energy Storage System drawings and specifications, Interconnection Agreement requirements, PPA requirements and Owner's design guidelines and standards.

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7.4.2 The Communications System shall be capable of centrally and remotely monitoring, controlling, and recording the performance of the Project Substation equipment, permanent meteorological towers or weather stations, Wind/Solar/Battery Systems, wind turbine supplier wind farm SCADA and other critical sensors.

7.4.3 The Communications System design shall include configuration files and a comprehensive data points list and protocol specification for communications between all Project components requiring communications, data transfer, and control monitoring using the fiber network integrated into the Communications System. Such configuration files shall have the ability to be configured by Owner, and Seller shall furnish development application software for each configurable device.

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7.4.4 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with Project Substation equipment to support grid monitoring. Seller is responsible to provide design and drawings, supply, install and test all necessary Ethernet and fiber optic cable networks to maintain all communications.

7.4.5 The Redundant Real Time Automation Controllers (RTACs) must share the signals and measurements from the switchgear and switchyard protection relays, network switches, check meter, WTG/PV/BESS SCADA, PPA and GIA utilities, MET towers, FAA lights and any other devices as required. The Substation SCADA will also make data available to the local HMI, WTG/PV/BESS SCADA, Off-takers, and to the Plant SCADA.

7.4.6 The RTACs will be provided with industrial standard protocols mainly DNP3, MODBUS, serial and TCP-IP versions, master, and slave. The RTACs shall have the ability to post the event reports from the relays to the web interface.

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7.4.7 The HMI will be connected to the automation controllers, to protection relays switches, and the substation LAN network for remote access. The HMI screens shall follow the one-line electrical drawing and substation equipment layouts.

7.4.8 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with the permanent meteorological towers to support data monitoring.

7.4.9 The Communications System shall include the necessary equipment (hardware and software) for the exchange of signals and integration of any required reactive compensation devices (e.g., capacitor banks, reactors).

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7.4.10 Remote monitoring, control, and reporting of the Communications System equipment shall be available through a web-based configuration accessible from a standard internet browser. The system shall be connected to the internet at all times and shall remain behind an Owner-managed firewall.

(1) Owner shall have unlimited access to Project data through the web-based system.

(2) Owner shall have no limitation on number of users through web-based system.

(3) Varying levels of access to the web-based system shall be permitted through secure login and user permissions.

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7.4.11 Upon loss of utility power interconnection or failure of utility power, restart of the instrumentation and control system to a fully functioning condition should require no local manual operations. Synchronization shall be performed automatically.

7.4.12 The equipment IP addresses networking security shall be aligned to Owner standards and recommendations

7.5 Fiber Network

7.5.1 Fiber optic cable shall be installed in the same trench as the Collection System Circuit power cabling.

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7.5.2 When fiber cables are installed in a trench, the fiber cable shall be placed in conduit or continuous innerduct; the fiber cable shall be rated for underground use; and there shall be a suitable locating cable installed in the innerduct/conduit. Innerduct shall have a minimum diameter of 1.25 inches.

7.5.3 Fiber optic shall be separated from any power cables when co-located in a trench.

7.5.4 All fiber cables shall consist of a minimum of 12-strand multi/single mode fiber. All fiber runs greater than one (1) mile in length shall be single-mode fiber, or as otherwise required to maintain a minimum of at least one (1) gigabyte bandwidth throughout the backbone of the system.

7.5.5 If metallic armored fiber optic cable is used, protection from induced voltage shall be installed.

7.5.6 All fiber cables shall be designed with a minimum of fifty percent (50%) spare fiber, and at least an additional six (6) feet of fiber cable supplied at each end.

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7.5.7 All communications cables, including fiber cables, shall be appropriately labeled with a permanently attached label at both ends. Labels shall be sequentially numbered.

7.5.8 The fiber system shall be designed for a minimum of five (5) dB system margin.

7.5.9 The fiber system design shall be a fiber ring topology or a "daisy-chained" system.

7.5.10 Conduits for fiber entry into the WTG/PV/BESS areas shall include a pull string for pulling the cable.

7.5.11 Fiber cables may be routed through Project Substation control cable trenches with other control wiring provided that a high-visibility color innerduct is used for identification and protection of the fiber cables.

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7.5.12 All splices shall be fusion splices.

7.5.13 Maximum attenuation:

(1) 0.36 dB/km at 1310 nm.

(2) 0.22 dB/km at 1550 nm.

7.5.14 Terminations shall be completed with either an approved fiber optic pigtail kit or with approved mechanical connectors and an approved fanout kit.

7.5.15 Data collection loops shall be designed so that a loss of a power circuit does not cause a loss of data collection from the Turbines during the power outage.

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7.6 Monitoring and Control Requirements

7.6.1 Design and installation of the Communications System shall be provided with all hardware, telemetry, communication and other requirements as required by the interconnection utility.

7.6.2 The Communications System shall be provided with the following supervisory screens, at a minimum.

(1) Project Substation one-line diagram, including all breakers, switches and transformers and the real-time status of each (current, power, voltage, power factor, and reactive power, as applicable).

(2) Project Substation alarms and notifications:

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(a) Status of all relays.

(b) Status of all alarms and notifications.

(3) Main power transformer status, including the following for each main power transformer:

(a) Operation and fault status, including alarms.

(b) Relay statuses.

(c) Temperatures (winding, oil).

(d) Tap changer position.

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(4) Breaker status, including the following for each medium- and high-voltage breaker:

(a) Operation and fault status, including alarms.

(b) Relay statuses.

(c) Breaker readings (current, power, voltage), including per Collection System Circuit.

(5) Control building status, including the following:

(a) Operation and fault status, including alarms.

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(b) Enclosure alarms (fire/smoke alarm status, enclosure temperature, intrusion, etc.)

(c) Battery charger voltage and status.

(d) Intrusion detection.

(e) HVAC status.

(6) WTG/PV/BESS status, including the following:

(a) WTG/PV/BESS status (e.g., online, offline for maintenance, curtailed) for each unit.

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(b) WTG/PV/BESS generation level for each unit.

(c) Total Project power.

(d) Atmospheric conditions.

(7) Other supervisory screen requirements:

(a) All major components (e.g., breakers, transformers, meteorological towers) shall be listed separately.

(b) Alarms and faults shall be color-coded where applicable (e.g., green, yellow, red).

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7.6.3 The Communications System shall include control functionality for the following, at a minimum:

(1) Active power.

(2) Reactive power.

(3) Frequency.

(4) Voltage.

(5) Power factor.

(6) Noise-related operations.

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7.6.4 Fault notification shall be provided through real-time text messaging or e-mail alerts, as determined by Owner. Fault notification messages and recipients shall be specified by Owner.

7.7 Reporting and Storage Requirements

7.7.1 All reporting shall be in Generation Availability Data System ("**GADS**"), wind format.

7.7.2 SCADA system reporting shall include, at a minimum, the following for the Project Substation, permanent meteorological towers/weather stations, and WTGs/PV Inverters/BESS PCS:

(1) Performance parameters, availability, operation counters, faults, and alarms.

(2) Browsing and filtering of historical data.

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(3) Creation of pre-defined and custom reports.

(4) Interface and operational procedure for interaction with existing Owner assets as defined by Owner

7.7.3 All stored data and generated reports shall be exportable as ASCII and Microsoft Excel formats.

7.7.4 The system shall not permit unwarranted tampering with or changing of raw data or functionality.

7.7.5 Seller shall design and provide connectivity and data sharing form/to the Interconnection utility.

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7.8 Data Storage Requirements

7.8.1 All data monitored by the Communications System shall be recorded and stored. Local controllers shall have sufficient buffer for at least 30 days of data storage in the event of power loss.

7.8.2 Historical data shall be stored in an SQL database or Owner-approved equivalent for the life of the Project. Data shall be stored in the database as no higher than 1-minute averages, with accompanying statistical values including, but not limited to, minima, maxima, and standard deviation. All data shall be retrievable.

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7.9 Data Integration

7.9.1 Seller shall include the design with the standardization and synchronization required by the Owner's control center or Plant SCADA to integrate the new wind site including naming convention, alarms configuration, point definitions, HMI screens, ISO, PPA requirements, WTG/PV/BESS model, Substation details, etc.

7.9.2 Provide all hardware and software necessary to interface and transmit all required monitoring and control data from/to substation Owner's SCADA system (RTAC), WTG/PV/BESS SCADA and the other communication devices of Owner's Control Center.

7.9.3 Testing and commissioning of the integration shall be included as a milestone on the plan schedule.

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7.10 Testing and Quality Control

7.10.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

7.10.2 All communications system equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

7.10.3 Communications system testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

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(3) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.

(5) Verify all communication channels (intra- and inter-Project Substation), including Project Substation LAN, operate as expected.

(6) Verify fiber optic system performance (power losses, splice or connector losses, etc.) using optical domain reflectometer ("**OTDR**"). All such testing shall be done with an OTDR in both directions of the strands. For single-mode fiber, test both directions at 1310 nm and 1550 nm.

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(7) All fiber optic cable shall be visually inspected and OTDR-tested prior to installation.

(8) Provide system functionality and compatibility at the control room / O&M Building.

(9) Test each cable and strand on every fiber run from termination to termination.

(10) Provide entire Project Site testing to ensure proper operation of all data points into the component gateways and testing of all data points provided to third parties with that party.

7.10.4 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

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8.0 PROJECT SUBSTATION SPECIFICATIONS

8.1 General Provisions

8.1.1 The Project Substation shall be designed and constructed to a high level of reliability and shall meet or exceed the requirements set forth by the interconnection utility.

8.1.2 The Project Substation shall be designed and constructed in accordance with the Project Electrical Studies, as defined below:

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(1) Short Circuit Study: short circuit analysis of collection system circuits, Substation, and transmission interconnection line, including secondary values on WTGs. The short circuit analysis and study shall be utilized in Seller's electrical designs to support relay coordination study and equipment specification.

(2) Reactive Compensation Study: reactive power flow report, including power factor study at Point of Interconnection. The study shall identify reactive compensation required to meet the Technical Specifications, including the requirements of interconnection for power factor and voltage regulation, and including any capacitor bank and/or reactor requirements. The study shall include varying combinations of active power (no load, partial load, full load) and voltage (min. 0.95 to 1.05 pu) at the Point of Interconnection.

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(3) Harmonic Analysis Report: power quality analysis or harmonic monitoring at the Point of Interconnection and Substation shall be used to determine the harmonic resonance and flicker conditions within the Project, and demonstration that the Project design meets the harmonics distortion requirements in the Technical Specifications (including IEEE 519), including any necessary filtering or mitigation to be provided by Seller. If the Transmission system is found to be source of the harmonics, the Transmission Operator shall be responsible for the required mitigating actions.

(4) Insulation Coordination Report: study to ensure the insulation coordination requirements of IEEE C62.22-2009 have been satisfied within the Project electrical design, including proper application of surge arresters to safeguard electric power equipment within the collection system circuits, Substation, and transmission interconnection line against hazards of abnormally-high voltage surges of various origins.

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(5) Transient Overvoltage Report: study to confirm any system modifications required to adequately limit transient overvoltage on the collection system circuits, including determination of the transient overvoltage levels on the collection system circuits after feeders have been isolated from the Substation due to a line-to-ground fault, and determination of the maximum energy required to be absorbed by each surge arrester on the collection system circuit feeders.

(6) Substation Grounding Report: grounding system study of ground grid conductors and interconnection (if any) with the ground grid. The study shall confirm that the grounding system maintains touch and step voltages within tolerable limits, and shall be prepared in accordance with the procedures, data, and recommendations given in IEEE 80. The study shall determine the ground potential rise with respect to remote earth.

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(7) Effectively Grounded Report: study to confirm the Project is considered effectively grounded, as defined in IEEE C62.92.1-2000.

(8) Substation AC System Study: calculation of the capacity of the low-voltage AC systems in the Substation to determine size of station service.

(9) Substation DC System Study: calculation of the capacity of the batteries and chargers within the Substation with the DC service required for the equipment at the substation, as determined from a load profile developed for all DC loads. The study shall determine if the minimum voltages are maintained as specified and required by equipment vendors. The DC system shall be sized to accommodate future loads for ultimate switchyard configuration.

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(10) Substation Bus Ampacity Study: calculation of bus ampacity in the Substation based upon continuous current rating as given on the one-line diagram and Project Site-specific conditions.

(11) Substation Bus Structural Analysis Study: analysis of bus structural design in the Substation including bus, insulators, bus structures, and foundations, and based upon the most stringent combination of wind, fault current, and ice load factors, as defined in the Technical Specifications.

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(12) Substation Bus Design Study: analysis of the performance of the buses, disconnect switches, and separately-mounted current transformers within the Substation to confirm that the ampacity, structural integrity, vibration, and required mechanical and electrical ratings are in accordance with the methods and recommendations of IEEE 605. Bus design, including gust factor, exposure height factor, importance factor, and corona considerations, shall be in accordance with the procedures and data given in IEEE 605.

(13) Substation Lighting Study: lighting illumination calculations for the Substation to determine the illumination levels within the new substations that will be achieved with added luminaries.

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(14) Substation Lightning Study: direct stroke protection analysis for lightning at the Substation based upon Project Site-specific determinations for thunderstorm days, thunderstorm duration, isokeraunic levels, exposure, and other similar factors. The direct stroke protection system design shall include analysis using the rolling sphere method of the electrogeometric model given in IEEE 998. The direct stroke protection system design shall be in accordance with the procedures, data, and methods given in IEEE 998.

(15) Arc Flash Study: arc flash hazard analysis of the Equipment, including all energized equipment in the WTGs, collection system circuits, Substation, transmission interconnection line, and O&M Building. This analysis shall be performed in accordance with the latest version of NFPA-70E and IEEE 1584. Study shall inform incident energies for labels and PPE requirements. Arc flash stickers shall be prepared by Seller based on these results. Seller shall provide the stickers an detailed location guidance on where stickers are to be applied.

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(16) Protection Coordination Study: relay and protection equipment coordination study, including detailed calculations, one-line and three-line diagrams, fuse curves, coordination curves, protected equipment data, and relay set points. This study shall include the WTG equipment (including switchgear), collection system circuits, Substation, and transmission interconnection line. A narrative philosophy statement shall be submitted for comment before completing the coordination study. The relay settings shall be coordinated with that of the WTG's switchgear. The applicable trip curves and settings will be sent to the Turbine Vendor for review.

8.1.3 Project Substation basic impulse level shall be at least 200 kV for the 34.5-kV system and subject to Owner approval on the high-voltage system (to be determined based on the Project voltage level). Design of the high-voltage and 34.5-kV systems shall be for a short circuit rating calculated based on the results of a Seller-furnished short circuit study.

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8.1.4 Minimum conductor clearance criteria shall be per the NESC. Clearances shall be increased at locations where required for equipment and personnel access.

8.1.5 No splices shall be made within the Project Substation, including both power and instrument and control conductors. Shields may be spliced where necessary to permit connection to the Project Substation ground system.

8.1.6 Conductors shall be terminated, labeled, tied, and bundled at each end.

8.1.7 Project Substation equipment paint shall be ultraviolet resistant. The coating shall consist of rust-inhibiting epoxy primer, standard intermediate coating, and two (2) finish coats of paint. The total coating shall be a minimum of five (5) mils dry. The paint color shall be an ANSI 70 sky grey color, unless otherwise approved by Owner.

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8.1.8 All manufacturer installation instructions for all components shall be obtained and followed.

8.1.9 Backup power at the Project Substation shall be provided from two (2) sources. The interconnection line and local distribution system may each be utilized as a source, although the battery system may not be utilized as one of these sources. A standby generator, conforming with the requirements set forth in <u>RFP Appendix A-7.25</u> (*ZS-020 Substation Equipment AC Standby Generator System*), shall be installed if two sources of backup power are not available.

8.2 Design Working Life

8.2.1 The design working life of the Project Substation equipment shall be a minimum of 30 years.

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8.3 Civil Works Requirements

8.3.1 All civil works for the Project Substation shall comply with the applicable specifications in Section 5.0 *(Civil Works Specifications)*.

8.3.2 Excavation by blasting for the Project Substation is prohibited.

8.3.3 Trench widths shall be kept to a minimum to allow sufficient space for equipment installation.

8.3.4 The trench bottom shall be firm for the entire length and width.

8.3.5 Trenches shall be kept free from water.

8.3.6 Conduit and cable shall not be placed on frozen ground.

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8.3.7 Project Substation equipment shall have wind and seismic withstand capability in accordance with the Applicable Standards, including IEEE 693 and AISC's "*Manual of Steel Construction*".

8.4 Conductors

8.4.1 All cable furnished shall conform, at a minimum, to the requirements included in Table 2 (*Summary of Cable Requirements*):

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Table 2: Summary of Cable Requirements

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Cable Type	Description
Low-voltage power	600 volts, single-conductor, Class B stranded copper; EPR or XLP insulated; CSP or CPE jacketed.
Low-voltage power	600 volts, three-conductor; concentric lay, stranded copper with a ground wire in the interstices; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall.
Control	Control cable, 600 volt, multiple-conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple-conductor, XLP insulation; CSP, or CPE jacketed overall.

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Cable Type	Description
Instrumentation	Instrumentation cable, 600 V, flame retardant single-and multiple-twisted pairs and triads, shielded instrument cable with individually shielded pairs, overall shield, and overall jacket; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall. (Single pair or triad 16 AWG, multi-pair or triad 18 AWG).
Lighting and receptacles	Lighting circuit runs totally enclosed in conduit, NEC Type RHH-RHW-USE with XLPE insulation for use in outdoor or unheated areas.
Shielded control	Control cable, shielded, 600-volt, multiple conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple conductor, XLP insulation; CSP, FRPVC or CPE jacketed overall

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8.4.2 Power conductor size and ampacity shall be coordinated with circuit protection devices.

(1) Conductor size shall be determined for 125% of connected load at the design basis maximum outdoor ambient temperature.

(2) Below-grade power cable conductor size shall be determined in accordance with the methods in IEEE 835.

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8.4.3 Installation of conductors shall be understood to include placement, splicing, and terminating conductors; coiling and taping of spare conductors; identification, testing, and verification of each circuit, cable, and conductor.

(1) Manufacturer's pulling or side wall tension shall never be exceeded.

(2) Recorded cable tension reports shall be provided to Owner.

8.4.4 Insulated cable, conductors, and conductor accessories shall be furnished and installed in accordance with the requirements of these Specifications and the recommendations given in IEEE 525. Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated in these Specifications.

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8.4.5 All Project Substation cables shall have wire end connectors.

(1) Connectors, sizes 12 - 2 AWG, shall be vinyl or nylon pre-insulated ring-tongue type

(2) Connectors, sizes 1 AWG – 750 kcmil, shall be uninsulated two-hole rectangular tongue.

8.4.6 The cable furnished shall be flame retardant construction in accordance with the applicable ICEA standards and suitable for wet or dry locations.

8.4.7 All cable shall have surface printing showing manufacture's name, insulation type, jacket type, conductor size, conductor type, voltage rating, and numbered footage markers.

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8.5 Voltage Transformers

8.5.1 All voltage transformers shall be connected through indoor, panel mounted, voltage injection test switches. Each voltage transformer neutral shall be brought through into the control building for termination and single point grounding within the associated protection relay panel.

8.5.2 All voltage transformers shall be a 2 winding, 0.3 class unit, suitable for outdoor installation. Turn ratios shall be determined by Seller.

8.5.3 Capacitive Coupled Voltage Transformers ("**CCVT**") shall have the facility for grounding through an external grounding switch.

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8.6 Current Transformers

8.6.1 All current transformers shall be connected through indoor, panel mounted, current injection test switches. Each current transformer neutral shall be brought through into the control building for termination and single point grounding within the associated protection relay panel.

8.6.2 The facility for short circuiting the secondary tails of all current transformers, with removable links, must be provided. All current transformers are to be connected through indoor, panel mounted current injection test switches.

8.7 Main Step-Up Transformers

8.7.1 The main step-up transformer(s) shall be sufficiently sized to allow the full Project capacity to be delivered to the point of interconnection.

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8.7.2 The main step-up transformer(s) shall be in accordance with IEEE standards and the requirements set forth in Table 3 (*Summary of General Requirements for Main Step-Up Transformers*) herein, at a minimum.

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Table 3: Summary of General Requirements for Main Step-Up Transformers

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Description	Value
Quantity	See Section 8.7.5
Type	Oil filled, hermetically sealed, outdoor installation
Voltage ratio	TBD* / 34,500 / 13,200 Volts (*: varies by Project)
Phases	3
Windings	3 (HV, MV, Tertiary)
Steady state temperature rise	65°C above ambient
Frequency	60 Hz
Impulse levels	TBD kV (HV), 200 kV (MV), 110 kV (Tertiary)

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Description	Value
Vector group	YNynd11
Cooling	ONAN / ONAF / ONAF
Tapping range	±5%, 2.5% steps, manual control (DETC)
Paint finish	ANSI 70 sky grey color
Guaranteed losses	Not used
Temperature gauge	Required
Pressure level indicator	Required
Pressure relief device	Required

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Description	Value
Oil sampling valve	Required
Filling orifice	Required
Tank ground tag	Required
Oil level indicator	Required
Grounding	Solid (primary and secondary windings) Buried delta (tertiary winding)

8.7.3 Applicable standards include, but not limited to:

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(1) Berkshire Hathaway Energy EBU PX-S02 Substation Equipment – Collector Substation Main Power Transformer

(2) C57.12.00, General Requirements for Liquid-Immersed Distribution, Power and Regulating Transformers.

(3) C57.12.10, American National Standard for Transformers 230 kV and Below 833/958 Through 8333/10 417 kVA, Single-Phase, and 750/862 Through 60 000/80 000/100 000 kVA, Three-Phase without Load Tap Changing: and 3750/4687 through 60 000/80 000/100 000 kVA with Load Tap Changing—Safety Requirements.

(4) C57.12.70, Standard for Terminal Markings and Connections for Distribution and Power Transformers

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(5) C57.12.80, Terminology for Power and Distribution Transformers.

(6) C57.12.90, Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and Guide for Short-Circuit Testing of Distribution and Power Transformers

(7) C57.13 Standard Requirements for Instruments Transformers.

(8) C57.19.00, General Requirements and Test Procedure for Outdoor Power Apparatus Bushings.

(9) C57.19.01, Performance Characteristics and Dimensions for Outdoor Apparatus Bushings.

(10) C57.91, Guide for Loading Mineral-Oil-Immersed Transformers.

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(11) C57.92, Guide for Loading Transformers.

(12) C57.93, Guide for Installation of Liquid-Immersed Power Transformers.

(13) C57.98, Guide for Transformer Impulse Tests.

(14) C57.109, Guide for Liquid-Immersed Transformer Through-Fault Current Duration.

(15) C57.116, Guide for Transformers Directly Connected to Generators.

(16) C57.120, Loss Evaluation Guide for Power Transformers and Reactors

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8.7.4 An electronic impact recorder with GPS capability shall be installed by the manufacturer; if rail shipment is specified, an additional impact recorder shall be mounted on the railcar. The impact recorder shall be furnished with a sealed protective cover. Immediately prior to scheduled pickup of the transformer, the supplier shall start the recorder and verify it is operating properly.

8.7.5 Each main step-up transformer shall have a 150-MVA rating (ONAN, 65°C). The Project shall incorporate parallel main step-up transformers in 150 MVA increments, where each such transformer is identical and interchangeable (mechanically and electrically). Load from each Collection System Circuit shall be split evenly across each transformer. Example: a 250-MW project shall incorporate two (2) 150-MVA main step-up transformers with approximately 125 MW on each unit. If a project intends to use a transformer larger than 150-MVA, the proposal must include complete specifications for the proposed transformer. The proposed transformer will be subject to Owner approval.

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8.8 Station Service Transformer

8.8.1 The station service transformer shall be sized according to the Seller-provided AC system study.

8.8.2 The station service transformer shall be in accordance with the minimum requirements set forth in Table 4 (Summary of General Requirements for Station Service Transformers).

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Table 4: Summary of General Requirements for Station Service Transformers

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Description	Value
Quantity	1
Type	Oil filled, pole-mounted, outdoor installation
Voltage ratio	34,500 / 120 / 240 Volts
Phases	1 or 3 (depending on Project electrical design)
Windings	2 (MV, LV) Copper
Steady state temperature rise	65°C above ambient
Frequency	60 Hz
Impulse levels	200 kV

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Description	Value
Vector group	Dyn1
Cooling	ONAN
Tapping range	±5%, 2.5% steps, manual control
Paint finish	ANSI 70 sky grey color
Guaranteed losses	Not used
Temperature gauge	Required
Pressure level indicator	Required
Pressure relief device	Required

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Description	Value
Oil sampling valve	Required
Filling orifice	Required
Tank ground tag	Required
Oil level indicator	Required
Grounding	Solid (LV winding) Un-grounded delta (MV winding)

8.9 Circuit Breakers

8.9.1 Applicable IEEE Standards include, but not limited to:

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(1) C37.09 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

(2) C37.04 IEEE Standard for Rating Structure for AC High-Voltage Circuit Breakers

(3) C37.12 IEEE Guide for Specifications of High-Voltage Circuit Breakers (over 1000 Volts)

(4) C37.11 IEEE Standard Requirements for Electrical Control for AC High-Voltage (>1000 V) Circuit Breakers

(5) C37.06.1 American National Standard Guide for High-Voltage Circuit Breakers Rated on Symmetrical Current Basis Designated

(6) C57.13 IEEE Standard Requirements for Instrument Transformers

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(7) C37.09 IEEE Standard Test Procedure for AC High-Voltage Circuit Breakers with Rated Maximum Voltage Above 1000 V

(8) High-side circuit breakers shall be in accordance with the minimum requirements set forth in Table 5: Summary of General Requirement for High-Side Circuit Breakers

8.9.2 High-side circuit breakers shall be outdoor, air insulated, three-pole, single-throw, 60 Hertz, dead-tank design with dual trip coils, alarms, interlocks and contacts necessary to meet the Project design and PacifiCorp High Voltage Circuit Breaker spec. Such circuit breakers shall utilize SF6 gas as the interrupting medium. Such breakers shall consist of three sections: high-voltage compartment, mounting provisions, and low-voltage compartment.

Table 5: Summary of General Requirement for High-Side Circuit Breakers

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Description	Value
Quantity	TBD* (*: Varies by Project)
Nominal Line-to-Line System Voltage (kV)	TBD* (*: Varies by Project)
Maximum Operating Voltage (kV)	TBD* (*: Varies by Project)
Rated Power Frequency	60 Hz
Rated Current (Amps)	TBD* (*: Varies by Project)
Power Frequency Withstand Voltage	TBD* (*: Varies by Project)
Withstand Full wave Lightning Impulse Voltage (BIL – kV Peak	200 kV

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Short Circuit Breaking and Short Time Withstand Current	40 kA
Peak Withstand Current	170 kA
Short Circuit Making Current	170 kA
Interrupting Time	3 cycles
Closing and Latching Current (kA, Peak)	40 kA
Transient Recovery Voltage (Peak Value)	70 kV
Temperature Rating Range (Min/Max)	-50°C/+50°C

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8.9.3 34.5kV circuit breakers shall be installed for protection of the Collection System Circuits, capacitor banks, and reactors. Such circuit breakers shall be outdoor, distribution, 60 Hertz, vacuum or SF6 circuit breakers consisting of three sections: high-voltage compartment, mounting provisions, and low-voltage compartment unless alternative design is approved by Owner.

(1) Collection System Circuit Breakers

(a) Collection System Circuit Breakers must be used with grounding transformers (see section 8.13).

(b) Collection system circuit breakers shall be in accordance with the minimum requirements set forth in **Table 6: Summary of General Requirements for Collection System Circuit Breakers**

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Table 6: Summary of General Requirements for Collection System Circuit Breakers

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Description	Value
Quantity	TBD* (*: Varies by Project)
Nominal Line-to-Line System Voltage (kV)	34.5kV
Maximum Operating Voltage (kV)	38kV
Rated Power Frequency	60Hz
Rated Current (Amps)	1200A
Withstand Full wave Lightning Impulse Voltage (BIL – kV Peak)	200kV
Short Circuit Breaking Current	31.5kA
Short Time Withstand Current	31.5kA

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Interrupting Time	3 cycles
Closing and Latching Current (kA, Peak)	31.5kA
Transient Recovery Voltage (Peak Value)	70kV
Bushing Current Transformers (Two Each per Pole on Both Sides of Breaker)	Relaying Accuracy Class 200
Temperature Rating Range (Min/Max in Deg C)	50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 V
Configuration (Construction for Three Poles)	Single Frame
Control Voltage (Trip and Close Schematic)	125vdc

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Charging Motor Voltage	125vdc
Lamp and Maintenance Receptacle in Control Cabinet	120vac
Tank Type	Dead Tank, Self-Supporting, Free-Standing, Weatherproof

(2) Collection System Grounding Circuit Breakers

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(a) Collection system grounding circuit breakers do not require grounding transformers (see section 8.13). The grounding-type circuit breaker will short all three phases of the load side of the collector breaker to ground when a collector breaker is opened in the system.

(b) Collection system grounding circuit breakers shall be in accordance with the minimum requirements set forth in Table 7: Summary of General Requirements for Collection System Grounding Circuit Breakers

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Table 7: Summary of General Requirements for Collection System Grounding Circuit Breakers Table 6: Summary of General Requirements for Collection System Circuit Breakers

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Description	Value
Quantity	TBD* (*: Varies by Project)
Nominal Line-to-Line System Voltage (kV)	34.5 kV
Maximum Operating Voltage (kV)	38 kV
Rated Power Frequency	60 Hz
Rated Current (Amps)	1200 A
Withstand Full wave Lightning Impulse Voltage (BIL – kV Peak)	200 kV
Dielectric Strength Withstand (60Hz, 1 minute)	80 kV
Short Circuit Breaking Current	31.5 kA
Short Time Withstand Current	31.5 kA

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Circuit Breaker Peak Making Current	85 kA
Grounding Breaker Peak Making Current	34 kA
Circuit Breaker Rated Opening Time	30 msec
Circuit Breaker Rated Closing Time	40 msec
Circuit Breaker Rated Arcing Time	4 to 11 msec
Mechanical Switching Time	12-16 msec
Maximum Electrical Switching Time	12 msec
Bushing Current Transformers (Two Each per Pole on Both Sides of Breaker)	Relaying Accuracy Class 200, Cast Resin, 600 VACc insulation level

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Temperature Rating Range (Min/Max in Deg C)	50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 VAC
Configuration (Construction for Three Poles)	Single Frame
Control Voltage (Trip and Close Schematic)	125 VDC
Charging Motor Voltage	125 VDC
Lamp and Maintenance Receptacle in Control Cabinet	120 VAC

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Tank Type	Dead Tank, Self-Supporting, Free-Standing, Weatherproof
Supporting Frame	Galvanized Steel
Interrupting Medium	Vacuum
Grounding Switch – High-Speed (make after break)	Three-Pole, Mechanically Interlocked
Initiation of Grounding Switch Operation	Automatic

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(3) Capacitor Bank Circuit Breakers

(a) Capacitor bank circuit breakers need to withstand transients which occur when connecting and disconnecting capacitor banks. These breakers require more attention to the making capacity than many other breaker types.

(b) Capacitor bank circuit breakers shall be in accordance with the minimum requirements set forth in Table 8: Summary of General Requirements for Capacitor Bank Circuit Breakers

Table 8: Summary of General Requirements for Capacitor Bank Circuit Breakers

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Description	Value
Nominal Line-to-Line System Voltage (kV)	34.5 kV
Rated Maximum Voltage	38 kV
Power Frequency Withstand Voltage	80 kV
Lightning Impulse Withstand Voltage (BIL)	200 kV
Power Frequency Rating	60 Hz
Rated Continuous Current	600 A
Short Circuit Making Current	40 kA (31.5 kA)
Peak Withstand Current	100 kA
Short-Time Symmetrical Withstand	40 kA (31.5 kA)

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Transient-Making Current (Specify HF)	18 kA Peak
Transient Inrush Frequency (Specify HF)	4630 Hz
Short Circuit Interrupting Current	TBD*
Duty Cycle Closing Time (ms at 125Vdc)	TBD*
Capacitive Switching Current/Duty	600 A
Fault Closing Withstand Capability	40 kA (31.5 kA)
Bank Breaking Current (Back-to-Back)	600 A
Pre Insertion Resistor Rating in Ohms (at 5000kVAR)	90 Ohms
Pre Insertion Resistor Withstand Rating	40 kA (31.5 kA)
Bushing Current Transformers (Relaying Accuracy)	C200

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Operating Temperature Range (Degree C)	-50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 VAC
Control Power Voltage	125 VDC
Auxiliary Power voltage	120 VAC

*: To be determined by system studies

(4) Reactor Bank Circuit Breakers

(a) Reactor bank circuit breakers require special considerations for inserting and de-energizing reactor banks.

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(b) Reactor bank circuit breakers shall be in accordance with the minimum requirements set forth in Table 9: Summary of General Requirements for Reactor Bank Circuit Breakers.

Table 9: Summary of General Requirements for Reactor Bank Circuit Breakers

Description	Value
Nominal Line-to-Line System Voltage (kV)	34.5 kV
Rated Maximum Voltage	38 kV
Power Frequency Withstand Voltage	80 kV
Lightning Impulse Withstand Voltage (BIL)	200 kV

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Power Frequency Rating	60 Hz
Rated Continuous Current	600 A
Short Circuit Making Current	40 kA (31.5 kA)
Peak Withstand Current	100 kA
Short-Time Symmetrical Withstand	40 kA (31.5 kA)
Transient-Making Current (Specify HF)	18 kA Peak
Transient Inrush Frequency (Specify HF)	4630 Hz
Mechanism	Spring Operating, Open-Close
Reactive Switching Current	350 A

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Interupter Type	Single Gap SF6
Fault Closing Withstand Capability	40 kA (31.5 kA)
Operating Temperature Range (Degree C)	-50°C to +50°C
Space Heater Voltage for Control Cabinet (operated at 120vac)	240 VAC
Control Power Voltage	125 VDC
Auxiliary Power voltage	120 VAC

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8.9.4 Circuit breakers shall contain bushing current transformers for metering and/or protective relaying applications. Current transformers utilized for metering shall be provided with accuracy levels as required by the applicable metering standards of entities which will be installing metering within the station.

8.9.5 Mounting provisions shall be formed-steel supports that mount the breaker to a foundation and provide height adjustment.

8.9.6 The low-voltage compartment of the circuit breakers shall contain the control components and operating mechanism including anti-condensation heaters.

8.9.7 The stored energy mechanism shall drive a common shaft which operates all three phases and the auxiliary switches for breaker position contacts.

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8.9.8 The control enclosure shall contain the relays, meters, and switches for the breakers.

8.9.9 The circuit breakers shall have provisions for mounting the protective relays in the control cabinet and remotely.

8.10 Shunt Capacitor Bank

8.10.1 The shunt capacitor bank shall be medium voltage, three-phase, internally-fused, single stage, open-rack, ungrounded, horizontal mounting type capacitor bank. The cap bank shall include an interlockable, gang-operated grounding switch, intended to ground the complete assembly for maintenance purposes.

8.10.2 Applicable IEEE Standards include, but not limited to:

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(1) IEEE 18 IEEE Standard for Shunt Power Capacitors

(2) IEEE 1036 IEEE Guide for Application of Shunt Power Capacitors

(3) C37.99 IEEE Guide for the Protection of Shunt Capacitor Banks

(4) IEEE 693 IEEE Recommended Practices for Seismic Design of Substations

8.10.3 Shut capacitor banks shall be in accordance with the minimum requirements set forth in Table 10: Summary of General Requirements for Shunt Capacitor Banks.

Table 10: Summary of General Requirements for Shunt Capacitor Banks

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Description	Value
MVAR Rating of Cap Bank (At Nominal Volt & Freq)	TBD*
Nominal Line-to-Line System Voltage (Kv)	34.5 kV
Maximum Operating Voltage (Kv)	38.0 kV
Temperature Rating Range (Min/Max in Deg C)	-50°C to +50°C
Fuse Technology	Internally-Fused Capacitor Design

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Rated Power Frequency	60Hz
Rated Current (Amps)	TBD*
Lightning Impulse Withstand Voltage (BIL in kV)	200 kV
Ground Switch (Three Phase Group Operated)	600A

*: to be determined based on power flow study and power factor requirements provided in interconnection agreement

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8.11 Shunt Reactor Bank

8.11.1 The shunt reactor bank shall be 34.5 kV phase to phase or 19.92 kV phase-ground designed for outdoor applications consisting of a single 3-phase step of a specified MVAR inductive reactance. The 3-phase step(s) shall consist of three (3) air-core shunt reactor coils, each rated at one-third of the full MVAR rating. The air-core shunt reactor coils are interconnected to form a wye connection with the other phases. Shunt Reactor steps shall be switched using a reactor switching device.

8.11.2 Applicable IEEE Standards include, but not limited to:

(1) IEEE C57.21 – IEEE Standard Requirements, Terminology and Test Code for Shunt Reactors Rated Over 500 kVA

(2) IEEE C37.109 – Guide for the Protection of Shunt Reactors

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(3) IEEE C37.015 – Application Guide for Shunt Reactor Switching

(4) IEEE 693 – Recommended Practice for Seismic Design of Substations

8.11.3 Shunt reactor banks shall be in accordance with the minimum requirements set forth in

Table 11: Summary of General Requirements for Shunt Reactor Banks

Description	Value
MVAR Rating of Reactor Bank (At Nominal Volt & Freq)	TBD*

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Nominal Line-to-Line System Voltage (kV)	34.5 kV
Maximum Operating Voltage (kV)	38.0 kV
Temperature Rating Range (Min/Max in Deg C)	-50°C to +50°C
Rated Power Frequency	60 Hz
Rated Current (Amps)	TBD*
Lightning Impulse Withstand Voltage (BIL in kV)	200 kV
Basic Insulation Level (BIL) phase-to-ground, kV_{peak}	250 kV
Mounting Arrangement	Trefoil

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*: to be determined based on power flow study and power factor requirements provided in interconnection agreement

8.12 Disconnect Switches

8.12.1 Applicable IEEE Standard includes, but not limited to:

(1) C37.30.3 IEEE Standard Requirements for High-Voltage Interrupter Switches, Interrupters, or Interrupting Aids Used on or Attached to Switches Rated for Alternating Currents Above 1000 V

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8.12.2 High-side, motor-operated, line disconnect switches shall be provided for isolation of the main step-up transformer and Collection System Circuits from the high-side bus system.

8.12.3 High-side breaker disconnect switches shall be outdoor, non-load break, 3-phase gang, manually operated.

8.12.4 All switches shall include contacts and interlocks wired for protection and control with provisions for padlocking for personnel safety and maintenance. All switches shall have hard-wired interlocks and shall be designed and implemented to prevent operation in an undesired state.

8.12.5 High-side, motor-operated, line disconnect switches shall be installed for isolation of the Interconnection Line.

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8.12.6 34.5-kV disconnect switches shall be outdoor, non-load break, 3-phase gang, manually operated. These switches shall provide isolation of 34.5-kV breakers, reactors, capacitor banks, and/or grounding transformers, as applicable.

8.13 Grounding Transformers

8.13.1 Grounding transformers shall be sized to effectively ground the portion of the Collection System Circuit that is disconnected from the main Project Substation 34.5-kV bus when the Project Substation feeder or collector breaker is open. Grounding transformers are not needed when grounding circuit breakers are used. See Section 8.9.3.

8.13.2 See Section 8.7.3 for applicable IEEE Standards.

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8.13.3 The duration of time that the grounding transformer shall provide effective grounding shall be determined assuming that the Collection System Circuit was at full rated generation at the time when a fault condition occurs on the Collection System Circuit, the time required for the collector breaker to trip due to the fault condition, and the additional time that the isolated Wind Turbine Generators on the Collection System Circuit continue to contribute energy to the fault after the collector breaker opens.

8.13.4 Effective grounding shall be as defined in IEEE Standard 142 and meet the following two conditions, at a minimum:

(1) The positive sequence reactance is greater than the zero sequence resistance (X1 > R0)

(2) The zero sequence reactance is less than or equal to three (3) times the positive sequence reactance (X0 <= 3X1).

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8.14 Space Heaters

8.14.1 Breakers and other outdoor equipment shall be furnished with space heaters (if not already provided by manufacturer of the equipment) that are thermostatically controlled and shall be rated single phase 240V for operation on 120V and shall include personnel protection screens.

8.15 Surge Arrestors

8.15.1 High-side voltage surge arrestors shall meet the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation. Surge arrestors shall be provided on the high-voltage bushings of the main step-up transformer.

8.15.2 34.5-kV surge arrestors shall meet the requirements of ANSI C62.11 for Station Class installation in a 60-Hertz outdoor installation. Surge arrestors shall be provided at the 34.5-kV breakers.

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8.15.3 Equipment surge arrestors shall be station class, metal-oxide type surge arrestors for outdoor use and polymer housing. Surge arrestors shall be shatterproof.

8.16 Rigid Bus

8.16.1 Design of the bus systems shall be in accordance with IEEE 605, at a minimum.

8.16.2 Loading and seismic performance shall be in accordance with the Project design and Project Site location. Such information is subject to verification by Seller.

8.16.3 Rigid bus, at a minimum, shall be seamless, Schedule 40 tube made of 6063-T6 aluminum alloy fabricated per ASTM B241.

8.16.4 A damping conductor shall be furnished in all horizontal bus.

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8.16.5 Bus shall have one-quarter inch (1/4”) drain holes in all bus/fittings that could possibly trap water.

8.16.6 Station post insulators shall be of sufficient strength to support the rigid bus and shall be ANSI 70 gray color.

8.17 Connectors and Fittings

8.17.1 Connectors and fittings shall be of the proper size and design to assure permanent, secure, and low-resistance connections.

8.17.2 Connectors and fittings shall be all welded for aluminum tubing connections and compression or puddle-welded type for aluminum cable connections.

8.17.3 Tubular aluminum welded splicing sleeves shall be used for necessary splices in aluminum tubing.

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8.17.4 For connections between aluminum tubing and cable, use a welded tubing-to-terminal pad connector and a compression-type cable-to-terminal pad connector on the end of the cable.

8.17.5 Rigid bus connections to transformers, breakers, CCVTs, or freestanding current transformers are prohibited.

8.17.6 For electrical pad connections, stainless steel hex-bolts, hex-nuts, flat washers, and Belleville washers shall be provided. Belleville washers shall have a minimum compression rating of 4,000 pounds. Bolt lengths shall be sized to provide minimal projection beyond hex nut to prevent excessive noise due to corona, but entire hex nut must be engaged.

8.17.7 For copper to aluminum connections, stainless steel bolts shall be used for copper to aluminum bar or rod connections and faced or sleeved aluminum connectors shall be used for cable connections.

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8.17.8 All connections between stranded aluminum AAC or ACSR-type conductors and equipment stud terminals shall be made with a stud-to-pad type stud connector and a compression-type cable-to-pad type conductor termination.

8.17.9 All dead-end fittings, terminals, splices, and other similar items for ACSR and other types of stranded aluminum conductor AAC shall be tubular compression type fittings. In no case shall any type of stranded aluminum conductors be used with bolted or clamp-type fittings, except for through-type connections to surge arresters on transformers. At least five percent (5%) extra dead-end body filler plugs for each type used shall be provided.

8.17.10 Stranded and tubular copper bus work, where used, shall have connectors and fittings with a minimum of four (4) bolts or two (2) "U"-bolts on each side of each joint.

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8.17.11 Fittings shall develop the full strength of the conductor and shall be capable of carrying the full current capacity of the conductor.

8.17.12 Fittings for shield wire dead ends, splices, and taps shall conform to the following:

(1) Shield wire dead-end fittings shall be compression type with bolted jumper connection. Shield wire insulators shall be located as indicated.

(2) Compression sleeves for shield wire tension splices shall be used which will develop at least ninety percent (90%) of shield wire strength.

8.17.13 "Alcoa Filler Compound" shall be furnished for application in conductor dead-end bodies and Alcoa No. 3 Electrical Joint Compound (Alnox), or approved equal for aluminum connections. At least five percent (5%) overage shall be furnished for all filler compounds furnished.

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8.17.14 Bus support clamps for rigid bus shall be fixed or slip type as required to firmly support the bus but allow for temperature expansion and contraction.

8.17.15 Bolted ground connectors and flexible type grounding jumpers shall be provided for operating handles of disconnect switches.

8.17.16 All transformer and oil circuit breaker stud connectors shall be tinned bronze material.

8.17.17 All grounding connectors in contact with galvanized structures shall be tinned bronze material.

8.17.18 All compression tees are to be open type compression run and 4-hole NEMA pad tap.

8.17.19 Bundled jumpers from power circuit breakers to disconnect switches shall be furnished.

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8.17.20 For disconnect switch connections, NEMA-type terminal pad connectors shall be provide with at least four (4) bolts.

8.17.21 All materials furnished shall have mechanical and electrical ratings, types, sizes, and other similar items coordinated with adjacent hardware and fittings.

8.17.22 All hardware furnished shall be static-free type.

8.17.23 Ground jumpers shall be provided direct from switch-operator ground pad to ground connector on operating handle or mechanism of switch. No other ground connection is to be made to pad. Ground mat(s) shall be furnished at each switch-operator.

8.17.24 Bus grounding stud, welded or swaged, shall be furnished as indicated.

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8.17.25 Wire guides and bundle conductor spacers shall be provided as required and indicated to maintain adequate clearance and support on cable jumpers, connections, and overhead lines.

8.18 Grounding System

8.18.1 The grounding system/grid shall be installed throughout the Project Substation, including beyond the substation fence line.

8.18.2 The ground grid shall be designed in accordance with IEEE 80, PacifiCorp Engineering Handbook Secton 6B.6-Substation Grounding and using SES-CDEGS software or Owner-approved equivalent.

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8.18.3 The Project Substation grounding system shall be an interconnected network of bare #4/0 AWG copper conductor and copper-clad ground rods (ground wells may be used instead of ground rods if dictated by the soil analysis). The system shall be designed such that Project Substation personnel are protected from the hazards that can occur as the Project Substation grounding system provides the earth return electrode during power system phase to ground faults.

8.18.4 Ground resistivity testing shall be performed *prior* to final design to determine ground analysis parameters. The ground resistivity shall be measured with the methods given in IEEE 81.

8.18.5 The Project Substation grounding grid shall be designed in accordance with the methods and recommendations of IEEE 80. The grounding system shall have adequate capacity to dissipate heat from ground current under the most severe conditions in areas of high ground fault current concentrations, with grid spacing such that safe voltage gradients are maintained. Ground conductors shall be sized for fault duration of 0.5 seconds.

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8.18.6 Ground conductor size shall be sized accordingly to specific ground conditions and equipment requirements.

8.18.7 Bare conductors to be installed below grade shall be spaced in a regular pattern that is consistent with the grounding analyses. Each junction of the grid shall be bonded together by an exothermal welding process. Above ground shall be NEMA two-hole connectors.

8.18.8 Grounding connections shall be made to fences and equipment. Equipment grounds shall conform to the following general guidelines:

(1) Grounds shall conform to the NESC.

(2) All equipment grounding connections shall be connected to the ground grid.

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8.18.9 All Project Substation bus and equipment support structures shall be connected to the station ground grid. Metal support structures in direct metallic contact with other metal structures do not require a separate grounding connection to the station ground grid. Fences shall be grounded in accordance with the requirements of the NESC.

8.18.10 The ground grid shall extend at least three (3) feet outside the perimeter fence of the Project Substation and shall be bonded to the fence as required to meet acceptable levels of both touch and step potential and ground potential rise per PacifiCorp Substation Grounding standards.

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8.18.11 A minimum of six (6) inches of *washed* crushed aggregate shall cover the entire Project Substation footprint, including those areas reserved for future build-out, *plus* a minimum of three (3) feet outside the perimeter fence, in order to help reduce touch and step potentials. A greater level of washed crushed aggregate shall be installed if necessary, to meet the Requirements and satisfy the recommendations set forth in the geotechnical engineering report. The minimum resistivity shall be 3,000 ohm-meters. Crushed rock shall conform to ASTM C33, gradation 1.5 to No. 8 particles.

8.18.12 All grounding materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:

(1) Rods:

(a) 5/8-inch x 10-foot (minimum) copper-clad standard type or as grounding calculations required.

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(b) The copper cladding shall be electrolytically bonded to the steel rod or bonded by a molten welding process.

(c) Cold rolled copper cladding is not acceptable.

(d) Soil conditions may require ground rods to be drilled.

(2) Cable:

(a) Bare: soft-drawn copper, Class B stranding, ASTM BB.

(b) Insulated: soft-drawn copper; Class B stranding with green-colored PVC insulation; UL 83; Type TW, THW or THHN.

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(3) Wire mesh: copper clad; 6 AWG; 6-inch x 6-inch mesh spacing; copper weld or Owner-approved equal.

(4) Bus and bars: soft copper; cross section not less than 1/8-inch thick by 1-inch wide; ASTM 8187.

(5) Exothermal welds: molds, cartridges, materials, and accessories as recommended by the manufacturer of the molds for the items to be welded. Cadweld heavy duty or Owner-approved equal. Molds and powder shall be furnished by the same manufacturer.

(6) Flush ground plates: Cadweld B-162 Series, B-164 Series, or Owner-approved equal ground plates with NEMA hole spacing.

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8.18.13 All clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be made of copper. Compression fittings above grade are prohibited.

8.19 Lightning Protection

8.19.1 Lightning protection shall be designed in accordance with IEEE 998.

8.19.2 Overhead shield wires installed on the take-off towers and lightning masts shall be provided for protection from direct lightning strikes.

8.19.3 The shield system shall be adequately tied into the Project Substation ground grid.

8.19.4 Steel masts for direct stroke protection shall be round tapered seamless extruded or spun aluminum tubes.

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(1) The overall height of the masts above grade shall be determined from the direct stroke protection study, as more particularly described in Exhibit [TBD] (*Scope of Work*).

(2) Masts shall have a single uniform taper from top to bottom.

(3) Each mast shall be capped with a suitable finial.

(4) Each mast shall be equipped with an internal vibration dampening device.

(5) The design of masts shall have a safety factor of two (2) based on the allowable yield stress for the mast material in accordance with the latest ASCE specifications governing design of structures.

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(6) The horizontal deflection at the top of each free-standing mast shall be limited to L/20 of its height above foundation.

(7) Each mast shall be installed on a concrete foundation with galvanized steel anchor bolts. Foundations, bolts, and welding shall be in accordance with the Requirements, including Section 5.0 (*Structural Works Specifications*).

(8) Each mast shall be provided with two grounding pads located 12 inches above the foundation.

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8.20 Lighting

8.20.1 A lighting system shall be furnished for the Project Substation. The lighting system shall provide personnel with illumination for Project Substation operation and maintenance under normal conditions, and means of egress under emergency conditions. Dark sky lighting is recommended.

8.20.2 The power supply for the lighting system shall be from 120/208 or 277/480 volt, 3-phase, 4-wire lighting panel. Single-phase lighting is also acceptable.

8.20.3 The lighting system shall be designed in accordance with IES standards to provide acceptable illumination levels.

8.20.4 Lighting sources and fixture selections shall be based on the applicability of the luminaries for the area under consideration.

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8.20.5 Lighting levels shall meet, at a minimum, the requirements of the NESC, including Table 111-1 therein.

8.20.6 Outdoor lighting shall be LED type.

8.21 Equipment Labeling

8.21.1 All major equipment and devices shall be properly labeled with nameplates made of laminated three-ply plastic, equal to Lamicoid to meet Applicable Standards (including those for safety) and other Requirements.

8.21.2 Nameplates shall be a minimum of 1/8-inch thick, with yellow outer layers on a black core.

8.21.3 Nameplate edges shall be chamfered.

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8.21.4 Nameplates shall be fastened to the equipment by using a minimum of one (1) blank rounded screw on each end.

8.22 Substation Video Surveillance

8.22.1 For purposes of the Proposal, a CCTV system will not be installed at the Project Substation, although Seller shall install conduits and gang boxes (including covers for gang boxes) and leave appropriate space for future installation.

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8.23 Electrical Equipment Enclosures

8.23.1 Control cabinets, pull boxes, and junction boxes shall be in accordance with NEMA standards and type number and shall be suitable for the Project location conditions. Minimum design shall be:

(1) Indoor: NEMA 1

(2) Outdoor: NEMA 3, stainless or aluminum.

8.23.2 All enclosures shall be provided with pad-locking provisions.

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8.24 Battery System

8.24.1 All battery systems shall conform, at a minimum, to the Applicable Standards of IEEE, ANSI, and NEMA, as well as other applicable Requirements.

8.24.2 Batteries shall be provided with racks, connection devices, tools, instruction books, protection shield covers, rail protection system, and other standard items. They shall also include redundant fans for the required ventilation. Such fans shall be installed directly above the location where batteries are to be installed.

8.24.3 Battery charger requirements:

(1) Two (2) fully-rated, self-cooled battery chargers shall be installed. The battery chargers should be connected in parallel to charge the batteries simultaneously.

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(2) Project Substation battery chargers shall be 125VDC output, sized as required for eight (8)-hour recharge while serving continuous load.

(3) Chargers shall include an AC circuit breaker in the charger input circuit to provide a disconnect point and overcurrent protection. Chargers also shall include DC ammeters, DC voltmeters, AC power failure alarm relays, high/low DC voltage alarm relays, ground detection alarm relays, and battery temperature compensation systems which reduce the charge rate if necessary.

(4) Chargers shall maintain output voltage within plus or minus one-half percent (0.5%) from no load to full load, with an input power supply deviation in voltage level of plus or minus ten percent (10%) and an input power supply deviation in frequency of plus or minus five percent (5%).

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(5) Chargers shall automatically vary the charging rate in accordance with the requirements of the Project Substation battery.

(6) Each battery charger-eliminator furnished shall be self-regulating, natural cooled, solid-state silicon controlled full wave rectifier type designed for single and parallel operation with the batteries specified under the Specifications. Charger shall be able to provide the DC load requirements in the event that battery is disconnected.

(7) The chargers will be served from the Project Substation AC system.

(8) Solid-state electronic circuits shall have AC and DC transient voltage protection and shall be designed to recharge a totally discharged battery without overloading and without causing an interrupting operation of AC or DC circuit breakers.

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(9) Charger shall be a full capacity charger, and shall have the capacity to recharge the battery in eight (8) hours following complete discharge. Charger shall also have an equalizing charge mode. Battery charger will be self-regulating after charging levels are manually selected. Battery charger shall be manufactured in NEMA 1 enclosures suitable for placement in an indoor, environmentally controlled atmosphere. Charger shall require only front access, and will allow either top or bottom conduit/cable entry.

8.24.4 The Project Substation shall include a DC system, including, but not limited to, batteries, two (2) battery chargers, and panelboards.

(1) Battery size shall be determined using the battery load profile.

(2) Nominal voltage shall be 125VDC with 60 cells.

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(3) Batteries shall be capable of being recharged to rated capacity from a discharge down to zero (0) volts per cell, following an equalization charge.

(4) Batteries shall be capable of being recharged within eight (8) hours following a complete discharge.

(5) Design shall be based on an eight (8)-hour discharge time to 1.75 volts per cell and the voltage is to be maintained for the minimum 30-year life of the battery.

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8.24.5 Each battery cell shall be wet cell, lead-acid pasted plate-type with lead-calcium alloy plate grids or sealed type with 30-year expected life. Cell containers shall be sealed, clear, shock absorbing, heat resistant plastic, with electrolyte high and low-level markers and spray-proof vents. Batteries shall be manufactured for full float service with a high discharge rate, low deterioration rate, and low maintenance. Batteries shall be supplied complete with all accessories (e.g., battery rack, inter-cell connectors). Racks shall be a two (2)-step configuration with proper seismic design for the location.

8.24.6 The DC panel and bolted breakers shall have a main bus current rating as required to supply the connected load. The continuous current ratings and interrupting ratings of the feeder breakers shall be based on the available fault current and the characteristics of the connected loads or the battery chargers.

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8.24.7 The capacity of each battery shall be determined in accordance with IEEE 485 and the specifications herein. With the battery initially fully charged at the floating voltage specified, and with the battery chargers disconnected, the battery shall be capable of supplying the duty cycle specified. The ambient temperature during the duty cycle shall be 25°C.

8.24.8 The duty cycle for battery sizing shall include:

(1) One (1) minute at the level of current required to operate all Project Substation circuit breakers plus the continuous load.

(2) 478 minutes of continuous load (actual but not less than 15A).

(3) One (1) minute at the level of current required to operate all Project Substation circuit breakers plus the continuous load.

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8.25 Raceway

8.25.1 Raceway shall conform, at a minimum, to the recommendations included in IEEE 525.

8.25.2 Raceway that contains multiple cable circuits shall have all cables with identical insulation ratings.

8.25.3 Individual raceway systems shall be established for the following services:

(1) 600-volt control cable.

(2) Special electrical noise-sensitive circuits.

(3) Fiber optic cable.

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8.25.4 Hot-dipped, rigid galvanized conduit (after fabrication) shall be used for above-ground power and control cables.

8.25.5 Flexible conduits shall be used only at locations where vibration is required. The maximum contiguous length of flexible conduit shall be three (3) feet.

8.25.6 All raceway and conduit locations shall be coordinated with other equipment and structures. All raceway and conduit shall be installed perpendicular or parallel to the major equipment and bus structures.

8.25.7 All raceway and conduit shall be installed in a neat, rectangular form. Special attention shall be given to securing a neat appearance.

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8.25.8 All raceway materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:

(1) Duct: polyvinyl chloride, Schedule 40 PVC in accordance with NEMA TC-2.

(2) Couplings: plastic, for use with duct previously specified and “duct-to-steel” adapters as required, including joint cement.

(3) Spacers: plastic high impact, interlocking, base and intermediate type

(4) Factory bends and sweeps: Schedule 40 PVC, three (3)-foot minimum radius.

(5) End bells: plastic.

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(6) Plugs: plastic, high impact, tapered to fit end bell provided.

(7) Duct binder: hemp or sisal twine coupling.

(8) Riser termination: rigid hot-dip galvanized mild-steel coupling.

(9) Riser bends: rigid steel conduit elbows, factory or field made, three (3)-foot minimum radius, 90 degree, entirely concrete encased below grade; hot-dip galvanized rigid mild steel in accordance with ANSI C80.1 and UL 6; the conduit interior and exterior surfaces having a continuous zinc coating with an overcoat of transparent enamel or transparent lacquer.

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8.26 Protective Relaying

8.26.1 Protective relaying shall provide secure and selective isolation of equipment when necessary during faults, abnormal or hazardous operating conditions. All protective relaying equipment will meet all recommendations contained within:

(1) PacifiCorp FACILITY CONNECTION REQUIREMENTS FOR TRANSMISSION SYSTEMS

(2) , IEEE Std 666-1991 IEEE Design Guide for Electric Power Service Systems for Generating Stations

(3) IEEE Std C37.102 IEEE Guide for AC Generator Protection

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(4) IEEE Std C37.110 IEEE Guide for the Application of Current Transformers Used for Protective Relaying Purposes.

8.26.2 All relays shall be microprocessor-based and wired to a central communication processor with IRIG-B time stamping. The communication processor shall integrate all relaying.

8.26.3 Relay panels shall be located in the Project Substation control building and shall include all hard-wired and soft-wired protection and control interlocks. Relay panels shall be installed in a new control room.

8.26.4 Protective relaying design and equipment selection shall be provided in accordance with the Requirements, including, but not limited to, the Applicable Standards and prudent electrical industry practices.

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8.26.5 All protection device settings shall be provided for Owner's review no later than 60 days prior to the system energization date.

8.26.6 Programming of devices shall be provided in electronic format native to the device.

8.26.7 Owner will have the authority to review the final design prior to procurement of equipment.

8.26.8 The interconnection utility shall require review and confirm line protection and signal exchange requirements. Owner shall facilitate such reviews.

8.26.9 Protection shall be provided for all breakers, bus, transformers, 34.5-kV lines, high-side lines, capacitors, and reactors.

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8.26.10 The relaying schemes shall monitor and respond to overcurrents, phase faults, ground faults, and other system abnormalities. Protection schemes to be utilized shall include, but not be limited to, overcurrent, over/under voltage, line impedance/differential, bus differential, transformer differential, breaker failure, backup relaying, switch into fault, and sync check.

8.26.11 Annunciation and alarms shall be communicated to the Operator through an RTU that will signal loss of protection integrity including but not limited to: coil monitoring, loss of tripping power, gas pressure, relay failure, and other similar items.

8.26.12 High-side lines shall include primary and backup relaying.

8.26.13 The primary and backup systems shall use redundancy philosophies to minimize common failure modes.

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8.26.14 Main step-up transformer protection shall include primary and backup relaying and monitor for oil and winding temperature.

8.26.15 Observe IEEE 1050 for protective instrument grounding.

8.26.16 Revenue grade interchange meters shall be installed on the high-side of the main step-up transformer. Other meters shall be installed on each medium-voltage (34.5-kV) Collection System Circuit feeder and within each Wind Turbine Generator, not required if the SCADA System can register production by Wind Turbine Generator. Revenue metering shall be PacifiCorp standard metering package, a three-phase four wire 3-element grounded installation, owned and maintained by PacifiCorp.

8.26.17 All relays shall have digital read-out on the front.

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8.27 Control Building

8.27.1 The control building shall be a new, prefabricated building. All electrical equipment shall be installed in the building prior to shipment.

8.27.2 The control building shall be located within the fenced area of the Project Substation.

8.27.3 The control building shall be grounded and include HVAC.

8.27.4 The control building shall contain a data concentrator and communications processor to collect Project Substation data signals for facility use.

8.27.5 The control building shall include adequate space and clearance for all Turbine Supplier-furnished Turbine SCADA System equipment.

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8.27.6 Local user controls shall be included that are capable of overriding the controller if required for any reason. Local controls, including monitoring screens and keyboards, shall be placed in the control building.

8.28 Fencing and Gates

8.28.1 PacifiCorp chain link fencing and gate standard A-7.10.2 Section 02810 supersedes any information provided below.

8.28.2 The Project Substation perimeter shall be fenced. The fence shall be tied into the Project Substation grounding grid.

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8.28.3 At least one (1) vehicle gate shall be installed at the Project Substation. The vehicle gate shall be a double-hung, 20-foot-wide (minimum), manual, rolling gate. At least 10 remote-entry devices shall be supplied and programmed by Seller for Owner's use.

8.28.4 At least one (1) walk gate shall be installed at the Project Substation. The walk gate shall be a lockable, single-hung, 4-foot-wide, swing-gate for personnel access.

8.28.5 All fencing and gates shall comply with the minimum specifications in Section 3.10 (*Fencing, Walls, and Gates*) herein.

8.29 Testing and Quality Control

8.29.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

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8.29.2 All Project Substation equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

8.29.3 Project Substation testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

(3) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Insulation testing of all installed cables.

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(5) Point-to-point wiring checks of all installed wiring.

(6) After completion of wiring installation work, all circuits shall be tested for continuity, grounds, shorts.

(7) Breaker function testing.

(8) PT/CT turns ratio and polarity testing.

(9) Breaker contact resistance testing.

(10) Ground resistance and continuity testing.

(11) Surge arrestor testing.

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(12) Instrument transformer testing.

(13) Ground grid testing.

(14) Relay functional testing.

(15) Disconnect switch testing.

(16) Reactor / capacitor bank testing (if applicable).

(17) Control building testing.

(18) Minimum main step-up transformer testing, all on the purchased unit(s):

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(a) All tests identified as "Routine" in IEEE C57.12.00 Table 18 and performed in accordance with IEEE C57.12.90.00.

(b) Temperature rise at the maximum 65°C rating.

(c) Temperature indicator accuracy test.

(d) Induced potential test with the transformer connected at high voltage, with the transformer's own bushings in place, accompanied by partial discharge monitoring (to conform to ANSI C57.12.90).

(e) Impulse tests on all winding terminals, with the transformer's own bushings in place.

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(f) Switching surge tests on the high-voltage winding, with the transformer's own bushings in place.

(g) Test all control wiring for continuity, grounds, and correct connections; and test operation of all relays, indicators, switches, lights, and interlocks.

(h) Resistance measurements of all windings on the rated voltage connection and all load tap connections. Test results shall be reported in ohms at 85°C

(i) Double insulation power factor tests conforming to Method II in Table 4 of Article 10.10 of ANSI C57.12.90. The power factor shall be equal to or less than 0.5% at 20°C.

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(j) Perform the supplier's standard tests on each surge arrester.

(k) Zero sequence.

(l) SFRA, at factory and at Project Site.

8.29.4 All Project Substation foundations shall be tested in accordance with Section **Error! Reference source not found.** (***Error! Reference source not found.***) herein.

8.29.5 Copies of testing reports shall be submitted to Owner within 10 days of completing such test. Testing reports shall include a summary of testing procedures and acceptance criteria.

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9.0 INTERCONNECTION LINE SPECIFICATIONS

9.1 General Provisions

9.1.1 The Interconnection Line shall be designed and constructed to a high level of reliability and shall meet or exceed the requirements set forth by the interconnection line and substation shall be outfitted with PacifiCorp's standard avian safety devices.

9.1.2 The Interconnection Line shall be designed and constructed in accordance with the Project Electrical Studies, as defined in section 8.

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9.1.3 Minimum clearance for energized parts of overhead portions of the Interconnection Line shall at a minimum meet or exceed requirements specified in the applicable permits, including, but not limited to, those set forth in the current edition of the National Electric Safety Code. Electrical clearances shall be maintained in the design and construction of all jumper assemblies.

9.1.4 PLS-CADD software shall be utilized to spot and perform detailed analysis and design of the Interconnection Line. Copies of all PLS-CADD electronic design files shall be provided to Owner in final form at the conclusion of the Project. Copies of preliminary PLS-CADD electronic design files shall be provided to Owner with each preliminary design. The ellipse amplitude safety factor in PLS-CADD shall not be less than 1.0.

9.1.5 The Interconnection Line, when in operation, shall be corona free and shall not cause radio or television interference, nor excessive noise in excess of requirements set forth in the Applicable Standards, applicable permits, or other applicable Requirements.

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9.1.6 If it is determined by the meteorological report that an area is prone to icing, galloping should be considered.

9.1.7 Weather cases and loading criteria shall be developed by Seller based on requirements set forth in the Applicable Standards, including, but not limited to, NESC C2 (Current Version), as well as the Project-specific meteorological study.

9.1.8 All manufacturer installation instructions for the installation of all Interconnection Line components shall be obtained and followed.

9.2 Design Working Life

9.2.1 The design working life of the Interconnection Line equipment shall be a minimum of 30 years.

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9.3 Civil Works Requirements

9.3.1 All civil works for the Interconnection Line shall comply with the applicable specifications in Section 5.0 *(Civil Works Specifications*).

9.4 Structural Works Requirements

9.4.1 All Interconnection Line structures, foundations, assemblies, and components shall be designed and constructed in accordance with the applicable structural works specifications in Section 5.0 (*Structural Works Specifications*).

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9.5 Structure Spotting

9.5.1 Structure spotting and profile generation shall be completed with PLS-CADD. All structure spotting shall be based on profile data provided by the surveyor and aerial mapper, right-of-way, landowner input, routing constraints, permitting conditions, and field investigation.

9.5.2 All structure spotting shall be based upon the profile data provided by the design and shall consider data from routing constraints and field investigation.

9.5.3 Site specific structure locations and site specific constraints are as determined by the design data.

9.6 Conductors, Shield Wire, and OPGW

9.6.1 All conductor cables, shield wire, and OPGW shall be installed by controlled tension methods.

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9.6.2 Pre-stressing of any type of wire shall not be permitted without the prior written approval of Owner.

9.6.3 If conductors are bundled, all conductors in any one bundle shall be sagged simultaneously and all shall be clipped in on the same day.

9.6.4 Each sag span and control span shall be measured with surveyor's transits to verify exact span lengths, prior to sagging.

9.6.5 All conductor cables, shield wire and OPGW sag spans and control spans shall be measured before sagging.

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9.6.6 Conductor cables, shield wire, and OPGW shall be installed in accordance with IEEE's "*IEEE Guide to the Installation of Overhead Transmission Line Conductors*", Standard No. 524, and sagged to within a tolerance of three (3)-inch sag increase and no sag decrease. Transits shall be used for sagging and shall be maintained in good operating condition and checked for accuracy and adjusted, if necessary, a minimum of once per week during sagging operation.

9.6.7 Conductor cables, shield wire, and OPGW shall not be dead-ended and clipped sooner than two (2) hours and should be fully tensioned within 24 hours of initial stringing. In no case shall more than 72 hours elapse between the stringing of conductor/ground wires and their final tensioning.

9.6.8 No single conductor cable within a bundle shall be more than one (1) inch from its sag position relative to the other conductor cables.

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9.6.9 No more than one (1) splice or repair on anyone (1) conductor in any one (1) span shall be made. Splices shall be a minimum of 25 feet from any structure.

9.6.10 Wire tension limits shall be in accordance with the Applicable Standards, including, but not limited to, latest version of NESC C2 (Current Version).

9.6.11 The exact location where each reel of conductor was installed shall be recorded.

9.6.12 Final sag measurements, including but not limited to each sag span's record date, span number, span length, ruling span, wire temperature, ambient temperature, initial sag for the span, time in blocks, time of day and sag measurements, shall be recorded.

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9.6.13 OPGW (including a primary and secondary (redundant) OPGW) shall be installed the entire length of the overhead route and coordinated with the SCADA System/communication/protection specification.

9.6.14 OPGW shall include a minimum fiber count of 48, single mode.

9.6.15 OPGW design tension limits shall be specified in the Project-specific sections.

9.6.16 Stringing tensions for the OPGW shall not exceed twenty percent (20%) of the ultimate cable strength.

9.6.17 Splice locations shall be selected and provided with weatherproof splice boxes suitable for the selected OPGW.

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9.6.18 At each splice location, a 50-foot coil of spare wire shall be maintained.

9.6.19 Spare wire may be coiled on the pole, placed in an underground vault, or coiled in an aerial slack storage device.

9.6.20 The OPGW shall be solidly bonded to the steel pole with a braided soft drawn copper jumper and steel structures shall incorporate a welded grounding nut for that purpose.

9.6.21 Shield wire shall be minimum 3/8-inch, 7-strand EHS steel wire.

9.6.22 Shield wires and OPGW shall be bonded to the pole grounding system using a suitable ground wire.

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9.7 Insulators and Hardware

9.7.1 Non-ceramic, porcelain, or toughened glass insulators shall be used for both suspension and dead-end applications and types (non-ceramic, porcelain, or toughened glass) or manufacturer of insulators shall not be mixed.

9.7.2 Insulator length, strength, and required number shall be determined based on loading requirements, switching surge and lightning requirements, and by contamination levels.

9.7.3 All surfaces of metal parts shall be relatively smooth with no projecting points or irregularities, which may cause corona.

9.7.4 Nuts shall be hexagonal and of corona-free design.

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9.7.5 All non-ceramic insulators shall include grading rings on the energized end of assemblies 138kV and up. Extra high voltages may require additional grading.

9.7.6 All ferrous material except stainless steel shall be hot dip galvanized to conform to ASTM A153.

9.7.7 Cotter keys shall be austenitic stainless steel and each piece shall be marked for identification with the manufacturer's part or catalog number.

9.7.8 The standard porcelain insulator unit to be used is a 5.75-inch by 10-inch bell with a ball and socket coupling.

9.7.9 Insulators shall be wet-process porcelain.

9.7.10 Materials shall be packaged in weather-resistant cartons or crates suitable for outdoor storage.

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9.7.11 The insulators shall be protected with suitable material to prevent damage to the sheds, bell, connections, and/or end fittings during shipping.

9.7.12 Line guards and armor rods shall be installed in conjunction with suspension clamp assemblies.

9.7.13 The center of the armor rods shall be within one (1) inch of the suspension clamp.

9.7.14 The termination of the armor rods shall be within one-half (0.5) inch of each other.

9.7.15 In the assembly of insulators and insulator hardware, every cotter key shall be inspected to ascertain that it is in place and properly seated and spread.

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9.8 Grounding

9.8.1 All overhead poles shall be grounded locally at each pole.

9.8.2 The ground should consist of a copper ground wire connected to a 0.5-inch, coated, carbon steel ground rod.

9.8.3 Grounding systems shall be designed in accordance with all Applicable Standards and best engineering practices.

9.8.4 Maximum resistance shall be no greater than 10 ohms. If ground resistance is greater than 10 ohms, special grounding designs shall be prepared.

9.8.5 A ground resistance test shall be done at every structure.

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9.9 Lightning Protection

9.9.1 The Interconnection Line shall be protected against lightning by the use of shield wire(s).

9.9.2 The shield wires shall be located so as to intercept lightning strikes and prevent direct strikes to the conductors.

9.9.3 Position of shield wires, ground resistance, and electrical parameters of the line insulation shall be coordinated to produce a calculated performance equal or superior to the standard value.

9.9.4 The isokeraunic level of the area of the line shall be determined by Seller and shall be used in the design of the shielding/grounding system.

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9.9.5 The method of grounding and the required ground resistance to minimize the outage rate shall be calculated.

9.10 Marking and Lighting

9.10.1 All Interconnection Line structures shall be marked per FAA standards.

9.10.2 The Interconnection Line marking and lighting system shall comply with the requirements as defined in US DOT-FAA Advisory Circular No. AC 70/7460-1K: *Obstruction Marking and Lighting*.

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9.11 Testing and Quality Control

9.11.1 All testing described herein shall be performed by an independent, experienced third party. Seller shall notify Owner of all testing schedules at least 30 days in advance of testing activities.

9.11.2 All Interconnection Line equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

9.11.3 Interconnection Line testing shall include the following, at a minimum:

(1) All testing specified in the Applicable Standards, including NETA.

(2) All testing reasonably recommended or required by the applicable equipment suppliers.

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(3) All exposed conductor and OPGW sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(4) Resistance testing on grounding grid at each structure location.