Exhibit H

Geologic and Soil Stability

West End Solar Project
September 2022

Prepared for
EE West End Solar LLC

Prepared by

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Table of Contents

List of Tables

List of Figures

List of Attachments

Acronyms and Abbreviations

Applicant	EE West End Solar LLC
BMP	best management practices
DOGAMI	Oregon Department of Geology and Mineral Industries
ESCP	Erosion and Sediment Control Plan
FEMA	Federal Emergency Management Agency
IBC	International Building Code
NRCS	Natural Resources Conservation Service
OAR	Oregon Administrative Rules
OSSC	Oregon Structural Specialty Code
Project	West End Solar Project
USGS	U.S. Geological Survey

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1.0 Introduction

EE West End Solar LLC (Applicant), a subsidiary of Eurus Energy America Corporation, proposes to construct the West End Solar Project (Project), a solar generation facility and related or supporting facilities in Umatilla County, Oregon. Exhibit H was prepared to meet the submittal requirements in Oregon Administrative Rules (OAR) 345-021-0010(1)(h).

2.0 Geologic Report and Evidence of Consultation with DOGAMI – OAR 345-021-0010(1)(h)(A) and (B)

> *OAR 345-021-0010(1)(h) Information from reasonably available sources regarding the geological and soil stability within the analysis area, providing evidence to support findings by the Council as required by OAR 345-022-0020, including:*
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> > *OAR 345-021-0010(1)(h)(A) A geologic report meeting the Oregon State Board of Geologist Examiners geologic report guidelines. Current guidelines must be determined based on consultation with the Oregon Department of Geology and Mineral Industries, as described in paragraph (B) of this subsection.*
> >
> > *OAR 345-021-0010(1)(h)(B) A summary of consultation with the Oregon Department of Geology and Mineral Industries regarding the appropriate methodology and scope of the seismic hazards and geology and soil-related hazards assessments, and the appropriate site-specific geotechnical work that must be performed before submitting the application for the Department to determine that the application is complete.*

The Applicant consulted with the Oregon Department of Geology and Mineral Industries (DOGAMI) on June 10, 2021. The general details of the Project and the analysis area terrain and geology were discussed. Discussion focused on geological features within the provided figures and identification of other data sources that DOGAMI would like the Applicant to discuss in Exhibit H and display on the figures. The meeting notes of the consultation discussion were used to support development of this exhibit and are included as Attachment H-1.

Exhibit H provides an analysis of geologic hazards and soil stability for the Project as required to meet the structural standard in OAR 345-022-0020 and the submittal requirements in OAR 345-021-0010(1)(h) paragraphs (A) through (I). To prepare this exhibit, existing published information was reviewed and used to characterize the current geologic conditions and potential seismic hazards in the vicinity of the Project site. These materials included local, state, and federal government aerial photography, site photographs, published geologic maps, and geotechnical data reports. The findings are described in the following sections.

Subsurface explorations, testing, and engineering analysis will be conducted prior to design and construction as described in Section 3.0. When site-specific geotechnical exploration is complete, a report meeting the current Oregon State Board of Engineering Geology Reports guidelines will be submitted to DOGAMI and the Oregon Department of Energy.

The Analysis Area for geologic and soil stability is the area within the proposed Site Boundary (see Figure H-1). The Analysis Area for historical seismic and potentially active faults included a 50-mile buffer around the proposed Site Boundary (see Figure H-2). The Site Boundary is defined in detail in Exhibits B and C and is shown on Figure H-1.

2.1 Topographic Setting

The Project is located in north-central Oregon, an area of rolling hills covered in grasslands and desert vegetation. The Site Boundary is located entirely within Umatilla County, approximately 2 miles southeast of the city of Hermiston and 2 miles north of the city of Stanfield. Umatilla County spans a total area of 3,213 square miles with a total of 16 square miles covered by water. The major topographic features in the area are controlled by the underlying structure of the Columbia River Basalt (USGS 1964).

The Site Boundary occupies slopes ranging from approximately zero to 15 percent, with an average slope of less than 2 percent. Elevations within the Site Boundary range from approximately 665 feet to 732 feet above mean sea level (Google Earth 2021).

2.2 Geologic Setting

The Site Boundary is located on the Columbia Plateau physiographic province, which consists of a large plateau formed by a series of basalt flows. The top of the plateau tends to be relatively flat but has been dissected by ephemeral streams into steep-sided canyons. The Applicant has selected this location for solar development due to its flat topography and southern exposure to the sun. The site is surrounded by farmland; S Edwards Road is located to the east and Canal Road is to the west.

The geologic setting of the Project generally consists of loess and other unconsolidated sediments overlying basalt bedrock. Figure H-1 provides a geologic map of the Project's vicinity, adapted using U.S. Geological Survey (USGS) Geographic Information System data and DOGAMI resources (Madin and Geitgey 2007). In some valley locations within the Site Boundary, catastrophic flood deposits (gravel and cobble bars overlain by silt) have been deposited by ancient floods. The surficial geologic units are shown on Figure H-1 and include quaternary surficial deposits Qe Eolian sand and ash (Holocene age) and Qmf Missoula flood deposits (Pleistocene age). Eolian sand and ash is described as eolian deposits, primarily unconsolidated wind-blown sand and silt reworked from older Missoula Flood deposits, and airfall volcanic ash deposits (Madin and Geitgey 2007). Qmf Missoula flood deposits are described as boulder to pebble gravel, sandy gravel, sand, and silt deposited during catastrophic floods caused by the repeated failures of the glacial ice dam that impounded glacial Lake Missoula (Madin and Geitgey 2007). The Missoula flood deposits can reach 150 feet in thickness and the thickness of the Eolian sand and ash is generally less than 4 feet. Beneath the sedimentary deposits at varying depths is the middle Miocene age Wanapum Basalt. The Wanapum Basalt formation consists of four similar members: Priest Rapids, Powatka, Frenchman Springs, and Lookingglass. The Wanapum Basalts are compositionally similar but can be distinguished by lithology and geochemistry. In general the Wanapum is thickest along the Columbia river, approximately 100 meters thick, thinning down to 0 meters the further south. The Wanapum Basalt flows are generally flow on flow with little or no sediments (Madin and Geitgey 2007).. In the vicinity of the Site Boundary, this formation is overlaid by much younger alluvium and Missoula flood deposits. To the north of the Site Boundary are the upper/middle Miocene age Saddle Mountains Basalts. The Saddle Mountains Basalts range from 120 to 240 meters in thickness and is interspersed by sedimentary layers of the Ellensburg Formation. These geologic descriptions are summarized from Madin and Geitgey 2007 and DOGAMIs online geological map (Franczyk et al 2020).

Groundwater in the Project Site Boundary is estimated to range from 78 to 400 feet below ground surface based on data from wells located approximately 1,500 feet north of the Site Boundary (Well Log UMAT 2867 and 2866) and approximately 1,500 feet south of the Site Boundary (Well Log UMAT 2881)(OWRD 2021).

Exhibit I describes properties of the site surficial soils based on Natural Resources Conservation Service (NRCS) data within the Project Site Boundary, as well as the approximate thickness, formation setting, permeability, runoff potential, and potential hazard for erosion.

3.0 Site-Specific Geotechnical Investigation – OAR 345-021-0010(1)(h)(C)

> *OAR 345-021-0010(1)(h)(C) A description and schedule of site-specific geotechnical work that will be performed before construction for inclusion in the site certificate as conditions.*

At an appropriate stage in the development, additional subsurface explorations will be completed to confirm the anticipated soil conditions and provide final design recommendations. The site-specific geological and geotechnical investigation will address subsurface exploration plans and testing plans. The geotechnical investigation will consist primarily of the following tasks:

- Reviewing available data from previous geotechnical explorations near the Site Boundary;
- Reviewing available geologic information from published sources;
- Reviewing data for evidence of active faults and landslides;
- Conducting a geotechnical field exploration, such as soil borings, test pits, and possibly geophysical testing; and
- Collecting additional soil samples for classification and laboratory testing, if necessary.

Geotechnical analyses will be used to calculate bearing capacity of the soils, conduct stability analyses, and provide engineering recommendations for construction of the Project’s structures.

4.0 Transmission Lines and Pipelines – OAR 345-021-0010(1)(h)(D)

OAR 345-021-0010(1)(h)(D) For all transmission lines, and for all pipelines that would carry explosive, flammable or hazardous materials, a description of locations along the proposed route where the applicant proposes to perform site specific geotechnical work, including but not limited to railroad crossings, major road crossings, river crossings, dead ends (for transmission lines), corners (for transmission lines), and portions of the proposed route where geologic reconnaissance and other site specific studies provide evidence of existing landslides, marginally stable slopes or potentially liquefiable soils that could be made unstable by the planned construction or experience impacts during the facility's operation.

The proposed Project does not involve construction of a new transmission line, as it will interconnect with an existing transmission line that runs parallel to or through the Site Boundary. Additionally, the Project does not have a pipeline. Therefore, this provision is not applicable.

5.0 Seismic Hazard Assessment – OAR 345-021-0010(1)(h)(E)

OAR 345-021-0010(1)(h)(E) An assessment of seismic hazards, in accordance with standard-of-practice methods and best practices, that addresses all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection, and an explanation of how the applicant will design, engineer, construct, and operate the facility to avoid dangers to human safety and the environment from these seismic hazards. Furthermore, an explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters. The applicant must include proposed design and engineering features, applicable construction codes, and any monitoring and emergency measures for seismic hazards, including tsunami safety measures if the site is located in the DOGAMI-defined tsunami evacuation zone.

5.1 Methods

Topographic and geologic conditions and hazards within the Site Boundary were evaluated by reviewing available reference materials such as topographic and geologic maps, aerial photographs, existing geologic reports; and data provided by DOGAMI, the Oregon Water Resources Department, USGS, and the NRCS (see Exhibit I).

This work was based on the potential for regional and local seismic activity as described in the existing scientific literature, and on subsurface soil and groundwater conditions within the Site

Boundary based on desktop evaluations. The seismic hazard analysis consisted of the following tasks:

1. Detailed review of the USGS National Geophysical Data Center (USGS 2020a, USGS 2020b, USGS 2020c) and DOGAMI literature and databases (DOGAMI 2021a);
2. Identification of potential seismic events for their site characterization in terms of a series of design events;
3. Evaluation of seismic hazards, including potential for fault rupture, earthquake-induced landslides, liquefaction and lateral spread, settlement, and subsidence; and
4. Mitigation recommendations based on the characteristics of the subsurface soils and design earthquakes, including specific seismic events that might have a significant effect on the site, potential for seismic energy amplification at the site, and the site-specific acceleration response spectrum for the site (ICC 2019).

5.2 Maximum Considered Earthquake Ground Motion under IBC 2015

The ground motions were developed using a probabilistic seismic hazard analysis from the USGS (2020a) that covered the Project Site Boundary. Though these motions are not considered site-specific, they provide a reasonable estimate of the ground motions within the Site Boundary. For new construction, the site should be designed for the maximum considered earthquake, according to the most recently updated International Building Code (IBC; ICC 2017) as supplemented by the Oregon Structural Specialty Code (OSSC; ICC 2019). The USGS Unified Hazard Tool (USGS 2020a) was run for the Site Boundary and the design event has a 2 percent probability of exceedance in 50 years (or a 2,475-year return period). Probabilistic seismic hazard deaggregation at 475-year intervals are shown in Attachment H-2, and at 2,475-year intervals in Attachment H-3. This event has a peak ground acceleration of 0.198 acceleration from gravity at the bedrock surface, at the center of the site. The values of peak ground acceleration on rock are an average representation of the acceleration most likely to occur at the site for all seismic events (crustal, intraplate, or subduction; ATC 2020).

These desktop seismic design parameters were developed in accordance with the 2015 IBC (ICC 2014). Using the subsurface information currently available, the Project would be designed for Site Class D, according to IBC requirements (Table H-1).

Table H-1. Seismic Design Parameters—Maximum Considered Earthquake

Site Class	Peak Horizontal Ground Acceleration on Bedrock	Soil Amplification Factor, F_a	Peak Horizontal Ground Acceleration at Ground Surface
S_D	0.198g	1.499	0.236g

g = acceleration from gravity.

Note: An earthquake magnitude of 6.0 in this table is a mean representation of all known seismic sources for the Site Boundary.

The following additional parameters for the maximum considered earthquake may be used for structural design:

- Short period (0.2-second) spectral response acceleration, S_{MS} = 0.563g for Site Class S_D
- 1-second period spectral response acceleration, S_{M1} = 0.323g for Site Class S_D

The design spectral response acceleration parameters, SDS and SD1, for both short period and 1-second period are determined by multiplying the maximum considered earthquake spectral response accelerations (SMS and SM1) by a factor of 2/3.

5.2.1 Earthquake Sources

Seismicity in northern Oregon is generated from the convergence of the Juan de Fuca plate and the North American plate at the Cascadia Subduction Zone. These plates converge at a rate between 1 and 2 inches per year and accumulate large amounts of stress that are released abruptly in earthquake events. The four sources of earthquakes and seismic activity in this region are crustal, intraplate, volcanic, and the Cascadia Subduction Zone (DOGAMI 2010).

Regionally, seismicity has been attributed to shallow source crustal deformation (10-20 km) associated with wrench faults in the Yakima Fold Belt.. Faults are considered active if there has been displacement in the last 10,000 years, and potentially active if there has been movement over the Quaternary period (last 1.6 million years). Overall, earthquakes in Oregon are associated with active faults in four regional zones of seismicity: the Cascade Seismic Zone, Portland Hills (Portland, Oregon-Vancouver, Washington metropolitan area) Zone, South-Central (Klamath Falls) Zone, and Northeastern Oregon Zone (Niewendorp and Neuhaus 2003). There are no known or active faults mapped within the Site Boundary, as indicated on Figure H-2. Figure H-2 was created using the DOGAMI Oregon HazVu Statewide Geohazards Viewer earthquake hazard layer (DOGAMI 2021a) and the USGS Geologic Hazards Science Center (USGS 2020b). The site-specific geotechnical investigation will include information on any potentially active faults within the Site Boundary. The investigation will include a description of the potentially active faults, their potential risk to the Project, and any additional mitigation that will be undertaken by the certificate holder to ensure safe design, construction, and operation of the Project.

5.2.2 Recorded Earthquakes

Figure H-2 displays the location and approximate magnitude of all recorded earthquakes within 50 miles of the Site Boundary. The historical seismic events are grouped by magnitude and are displayed using different-sized icons based on the strength of the event. Because of the high number of events in the 50-mile analysis area of the Project site, several of the icons overlap in the figure. The National Earthquake Information Center data show no earthquakes within the Site Boundary (Figure H-2). A table listing the recorded historical earthquakes mapped on Figure H-2 and the year they occurred within 50 miles of the Project is provided in Attachment H-4 (Rukstales 2012).

Attachment H-4 and Figure H-2 (DOGAMI 2021a, USGS 2020c) provide a summary of all recorded earthquakes known to have caused Modified Mercalli Intensity (MMI) III shaking intensity or greater within the Project Site Boundary, regardless of epicentral origin. For reference, an intensity of MMI III is associated with shaking that is "noticeable indoors but may not be recognized as an earthquake." An intensity of MMI V is "felt by nearly everyone; many awakened" (USGS 2020d).

The Ground Response Spectra Assessment in Attachment H-5 lists the design response spectrum based on the 2015 IBC for the maximum considered earthquake at the location of the Project. Separate response spectra modified by the amplification factors for Site Class D are provided. It is possible that areas of shallow bedrock (Wanapum Basalt) may exist in areas of the Site Boundary, where the Site Class B response spectra would apply. The site-specific geotechnical investigation will determine the final Site Class for the Site Boundary area which will be applied to final design.

5.2.3 Hazards Resulting from Seismic Events

Potential seismic hazards associated with a design seismic event for this Project include seismic shaking or ground motion, and fault displacement. These hazard risks are anticipated to be low, as discussed below.

5.2.4 Seismic Shaking or Ground Motion

The design seismic event will have a 2,475-year recurrence interval. The Project structures will be designed for this unlikely event so that no permanent structural damage will occur. The Project's structures will be designed to withstand the maximum risk-based design earthquake ground motions developed for the Project site. The State of Oregon has adopted the IBC 2018 code for structural design. Specifically, this is Section 1613 (Earthquake Loads) of the 2019 OSSC, which is in Chapter 16. It should be noted that building codes are frequently updated; the IBC specifically is updated every 3 years. The Applicant will design, engineer, and construct the Project in accordance with the current version of the latest IBC, OSSC, and building codes adopted by the State of Oregon at the time of construction. Therefore, it is incumbent on the design engineers to ensure that the designs are in accordance with the current versions of the latest codes as adopted by the State of Oregon at the time of construction.

Based on desktop geotechnical and geological information, a Site Class D (stiff soils) for the soil/bedrock at the site is appropriate for the Project. As stated earlier, the final Site Class assigned to the site will be determined based on results of the site-specific geotechnical investigation and will be applied to final design.

Based on site-specific geotechnical analyses, the original equipment manufacturer will provide the structural engineer with site specific foundation loads and requirements. The structural engineer will then complete the foundation analyses based on the design site-specific parameters. Generally, these include the following loads for solar foundation design: extreme loads, load cases for up-lift, shear failure, tension loads (for pile foundations), earthquake loads, fatigue loads, subsoil properties, spring constants, verification procedures, and maximum allowable inclination.

The geotechnical studies and analyses provide site-specific parameters including, but not necessarily limited to, moisture content and density, soil/bedrock bearing capacity, bedrock depth, settlement characteristics, structural backfill characteristics, soil improvement (if required), and dynamic soil/bedrock properties including shear modulus and Poisson's Ratio of the subgrade. The foundation design engineer will use these parameters to design a foundation suitable for the Project and will verify that the foundation/soil interaction meets or exceeds the minimum requirements stated by the original equipment manufacturer for the Project.

5.2.5 Fault Rupture

The probability of a fault displacement within the Site Boundary is considered low because of the distance (more than 15 miles away) of known or mapped potentially active faults from the Site Boundary and the absence of faults within the Site Boundary (Figure H-2). Unknown faults could exist, or new fault ruptures could form during a significant seismic event, but the likelihood of either occurrence is low based on the lack of active faults identified during previous geologic investigations.

5.2.6 Liquefaction

Liquefaction is a phenomenon in which saturated, cohesionless soils temporarily lose their strength and liquefy when subjected to dynamic forces such as intense and prolonged ground shaking and seismic activity. The soils in the Site Boundary are not saturated and are generally cohesive in nature. Along with the relatively low seismic event potential, this indicates that the liquefaction of soils within the Site Boundary is considered extremely unlikely. The site-specific geotechnical investigation will determine the soil characteristics to be applied to final design of the Project.

5.2.7 Seismically Induced Landslides

Seismicity in the region has the potential to trigger landslides and mass wasting processes within the Site Boundary; however, the potential is considered low due to the relative flat topographic setting of the site. According to DOGAMI's HazVu Statewide Geohazards Viewer, there are no historic landslides in or near the Site Boundary and the landslide hazard rating is "Low-Landsliding Unlikely" (DOGAMI 2021a).

5.2.8 Subsidence

Subsidence is the sudden sinking or the gradual downward settling of the land surface, and is often related to groundwater drawdown, compaction, tectonic movements, mining, or explosive activity. Subsidence due to a seismic event is highly unlikely. In most areas, the bedrock is relatively shallow, and the overlying soils are not saturated.

5.2.9 Seismic Hazard Mitigation

The State of Oregon uses the 2018 IBC, with current amendments by the OSSC (ICC 2019). Pertinent design codes as they relate to geology, seismicity, and near-surface soil are contained in the IBC Chapter 16, Section 1613, with slight modifications by the current amendments of the State of Oregon. The Project will be designed to meet or exceed the minimum standards required by these design codes.

A site-specific geotechnical exploration will be conducted to collect pertinent data for the design of the Project to mitigate potential hazards that could be created during a seismic event. The hazard of a surficial rupture along a fault trace is anticipated to be low, given the low probability that a fault rupture would actually displace the ground surface at the location of any of the solar panel arrays or transmission structures. No mitigation for potential fault rupture is anticipated; the risk to human safety and the environment will be minimal, as the Project will be located in a sparsely populated area. No structures will be built on steep slopes that could be prone to instability, thus avoiding potential impacts.

6.0 Non-Seismic Geological Hazards – OAR 345-021-0010(1)(h)(F)

> *OAR 345-021-0010(1)(h)(F) An assessment of geology and soil-related hazards which could, in the absence of a seismic event, adversely affect or be aggravated by the construction or operation of the facility, in accordance with standard-of-practice methods and best practices, that address all issues relating to the consultation with the Oregon Department of Geology and Mineral Industries described in paragraph (B) of this subsection. An explanation of how the applicant will design, engineer, construct and operate the facility to adequately avoid dangers to human safety and the environment presented by these hazards, as well as:*
>
> > *(i) An explanation of how the applicant will design, engineer, construct and operate the facility to integrate disaster resilience design to ensure recovery of operations after major disasters.*
> >
> > *(ii) An assessment of future climate conditions for the expected life span of the proposed facility and the potential impacts of those conditions on the proposed facility.*

Nonseismic geologic hazards in the Columbia Plateau region typically include landslides, volcanic eruptions, collapsing soils, and erosion potential. The area within the Project Site Boundary consists of relatively flat-lying sedimentary surficial deposits consisting of wind-blown sand and ash and flood deposits. The solar arrays and associated equipment will be constructed on flat-lying portions of the Site Boundary and will avoid steep side slopes and drainages that could potentially be subject to landslides and soil creep. A discussion of potential geologic hazards is presented below. The site-specific geotechnical investigation will determine the soils characteristics, including the potential for collapsing soils which will be applied to final design of the Project.

6.1 Landslides

No active landslides are identified in the Statewide Landslide Information Database for Oregon within the Site Boundary (DOGAMI 2021b). The nearest mapped landslides in the Statewide Landslide Information Database for Oregon database are located approximately 20 miles to the southwest of Hermiston, Oregon.

The solar arrays and associated equipment and roads, including the access road and service roads, will be situated on flat-lying areas and avoid steep slopes. If slope stability issues are identified during the final design geotechnical investigations, either the structures will be relocated during the micrositing process or remedial measures to improve slope stability will be implemented.

6.2 Volcanic Activity

Volcanic activity in the Cascade Range is driven by the subduction of the Juan de Fuca plate beneath the North American plate. The closest volcano to the Site Boundary is Mount Adams located approximately 110 miles away to the west. Most of the potential volcanic hazard impacts would occur within a 50-mile radius of the erupting volcano. Depending on the prevailing wind direction at the time of the eruption and the source of the eruption, ash fallout in the region surrounding the Project may occur. The Project has a 0.02 percent annual probability of 10 cm or more of tephra accumulation in Oregon from major Cascade volcanoes (Scott et al 1995). Because of the distance to the nearest volcano, impacts to the Project from volcanic activity would be indirect and likely be limited to ash fallout. In addition, the Project is not located near any streams that would likely be subject to pyroclastic flows from a volcanic eruption from these close volcanoes. It is unlikely that there would be any adverse effects from volcanic activity on the construction or operation of the Project.

6.3 Erosion

Erosion can be caused by increasing exposure to wind or water. The erosion factor (K) indicates the susceptibility of a soil to sheet and rill erosion by water. The K-factor is one of six factors used in the Universal Soil Loss Equation and the Revised Universal Soil Loss Equation to predict the average annual rate of soil loss by sheet and rill erosion in tons-per-acre-per-year. The estimates are based primarily on percentage of silt, sand, and organic matter, as well as soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Data from the NRCS Web Soil Survey (NRCS 2018) indicate that the soils within the Site Boundary have a K that ranges from 0.10 to 0.32. For the range of K at the Project, the soils could be considered moderately low to moderately highly erodible, and subject to sheet erosion and rill erosion by water (NRCS 2018). Wind erosion is rated as moderate to severe for the Site Boundary. Severe wind erosion is present within 37 percent of the Site Boundary soils.

To reduce the potential for soil erosion, a construction Erosion and Sediment Control Plan (ESCP) will be developed for the Project. The ESCP will include both structural and nonstructural best management practices (BMP). Examples of structural BMPs include the installation of silt fences or other physical controls to divert flows from exposed soils, or otherwise limit runoff and pollutants from exposed areas within the Project Site Boundary. Examples of nonstructural BMPs include management practices such as implementation of materials handling, disposal requirements, and spill prevention methods. Exhibit I contains a comprehensive list of mitigation measures to avoid wind and water erosion and soil impacts.

6.4 Flooding

To evaluate flood hazards, the DOGAMI Statewide Flood Hazard Database for Oregon (DOGAMI 2021c) – Federal Emergency Management Agency (FEMA), National Flood Hazard data (FEMA 2018), and Flood Insurance Study inundation zones (DOGAMI 2018) were compared to the Site Boundary. The Site Boundary is not within an identified FEMA 100-year or 500-year floodplain (Figure H-3).

Seasonal thunderstorms can result in concentrated stormwater runoff and localized flooding. The engineered access roads and drainages will direct stormwater runoff away from structures and into drainage ditches and culverts as required in the ESCP. The Project will be designed and constructed to meet the requirements of the zoning ordinances and building codes that establish flood protection standards for all construction, to avoid dangers to the infrastructure, as well as human safety and the environment, including criteria to ensure that the foundation will withstand flood forces. Therefore, the risks and potential impacts to the Project as well as human safety and the environment from flood hazards are expected to be low.

6.5 Shrinking and Swelling Soils

Changes in soil moisture cause certain clay minerals in soils to either expand or contract. The amount and type of clay minerals in the soil influence the change in volume. Structures or roads built on shrinking or swelling soils could be damaged by the change in volume of the soil. Linear extensibility (shrink-swell potential) refers to the change in length of an unconfined clod as its moisture content is decreased from a moist state to a dry state.

There are no soils identified in the Site Boundary with potential for shrinking and swelling (see Exhibit I). Prior to construction, the Applicant will include, as part of the geotechnical investigation, an investigation of the shrink/swell and collapse potential of loess soil in the Site Boundary. Based on the results of the investigation, the Applicant will include mitigation measures including, as necessary, over-excavating and replacing loess soil with structural fill; wetting and compacting; deep foundations; or avoidance of specific areas.

The solar structures will be supported by steel posts; post depth will vary depending on soil conditions but is typically 4 to 8 feet below the surface. If soil conditions require it, concrete backfill will be used.

7.0 Disaster Resilience

The State of Oregon uses the 2018 IBC, with current amendments by the OSSC (ICC 2019) and local agencies. Pertinent design codes as they relate to geology, seismicity, and near-surface soils are contained in IBC Chapter 16, Section 1613, with slight modifications by the current amendments of the State of Oregon and local agencies. The Project will be designed to meet or exceed the minimum standards required by these design codes. The Applicant acknowledges that DOGAMI encourages, but does not require, applicants to design and build for disaster resilience and future climate conditions using science, data, and community wisdom. With this in mind, the Applicant has extensive experience building energy facilities and from a structural perspective, designs projects to withstand non-seismic geologic hazards such as the potential for changes in rainfall or temperature. Additional elements such as wind speeds, snow, and dust, among others, are also considered in project designs depending on the location in the country.

A qualified engineer will assess and review the seismic, geologic, and soil hazards associated with the construction of the Project. Construction requirements will be modified, as needed, based on the site-specific characterization of seismic, geologic, and soil hazards. The Project will be designed, engineered, and constructed to meet all current standards to adequately avoid potential dangers to human safety presented by seismic hazards. Substation and operations and maintenance building structures will be designed in accordance with the current version of the OSSC. Substation equipment will be specified in accordance with the latest version of the Institute of Electrical and Electronics Engineers 693. The Project will be located in a sparsely populated area; therefore, the risks to human safety and the environment due to seismic hazards will be minimal.

The Project will be designed, engineered, and constructed to meet or exceed all current standards. The Applicant proposes to design, engineer, and construct the Project to avoid dangers to human safety–related and non-seismic hazards in many ways, including conducting site-specific geotechnical evaluations for the facilities. Typical mitigation measures for non-seismic hazards include avoiding potential hazards, conducting subsurface investigations to characterize the soils to adequately plan and design appropriate mitigation measures, creating detailed geologic hazard maps to aid in laying out facilities, and providing warnings in the event of hazards. Solar facilities are designed to be modular, with different circuits and disconnect switches between inverters. This allows for portions of a facility to be taken offline for repair following a disaster, while the remainder of the solar arrays can continue to operate in a reduced capacity. The Applicant plans to follow the industry practice of installing excess cabling between strings to allow for splicing and repairs in the event of a disaster. Should Project elements like the access roads or solar panels be damaged, they will be assessed, and repairs made to recover operations after a major storm event.

8.0 Climate Change

The University of Washington conducted a study to assess climate vulnerability and adaptation in the Columbia River Plateau, the region where the Project is located (Michalak et al. 2014). The study involved downscaling five climate models (CCM3, CGM3.1, GISS-ER, MIROC3.2, and Hadley). Climate projections were downscaled to approximately a 1-kilometer resolution for over 40 different direct (mean annual temperature/precipitation) and derived (number of growing-degree days, actual and potential evapotranspiration) climate variables (Michalak et al. 2014). The downscaling of the climate models for this area led to future projections of greater annual average and summer temperatures, and more severe storm events and wildfires, among other changes. These specific changes are expected to increase stress to power lines in the region.

Reinforcing the local electric grid with solar power, battery storage, and a new transmission line will provide resilience to the overall energy grid in this part of Oregon. This reinforcement will be direct, by upgrading the system, which is anticipated to experience higher loads under rising temperatures and the related increases in power demand for summer cooling. It is also indirect, by supporting the delivery of power generated through a larger variety of sources, minimizing the potential reduction in hydro power's role under future conditions. All aspects of this Project support resiliency in the face of future climate change. In addition, the Project will be designed to withstand extreme events as explained above in Section 7.0.

9.0 Conclusions

The risk of seismic hazards to human safety at the Project is considered low. The Applicant has adequately characterized the seismic hazard risk of the area within the Project Site Boundary and surrounding vicinity in accordance with OAR 345-022-0020(1)(a) and has considered seismic events and amplification for the Project's specific subsurface profile. The probability of a large seismic event occurring while operational staff are on site is very low given the low frequency of onsite operational work required. This very low probability results in minimal risk to human safety. Furthermore, in accordance with OAR 345-022-0020(1)(b), the Applicant has demonstrated that the Project can be designed, engineered, and constructed to avoid dangers to human safety and the environment from the seismic hazards discussed in this Exhibit. Site-specific geotechnical studies will be completed during Project final design which will allow the Applicant to design, engineer, and construct the Project to the most current standards at the time of construction. The Project design will adhere to recently updated IBC requirements. Given the relatively low level of seismic hazard risk for the Project, adherence to the IBC requirements will ensure that appropriate protection measures for human safety are taken.

The Applicant has provided appropriate site-specific information and demonstrated (in accordance with OAR 345-022-0020[1][c]) that the construction and operation of the Project, in the absence of a seismic event, will not adversely affect or aggravate the geological or soil conditions within the

Project Site Boundary or surrounding vicinity. The risks posed by non-seismic geologic hazards such as landslides, volcanic activity, and flooding are considered to be low because of the characteristics/location of the Project site. Non-seismic geologic hazard related to erosion and soil shrinking/swelling or collapsing can be avoided and minimized through Project design. Erosion hazards resulting from water and wind action will be minimized with the implementation of an engineered erosion control plan. Based on the results of the Project's site specific geotechnical investigation that will be completed prior to construction, the Applicant will include appropriate mitigation measures to minimize non-seismic geological hazards as needed.

Accordingly, given the relatively small risks the seismic hazard and non-seismic geological hazards pose to human safety, standard methods of practice (including implementation of the current IBC) will be adequate for the design and construction of the Project.

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Attachment H-1.
Record of Correspondence with DOGAMI

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Attachment H-2.
Probabilistic Seismic Hazard Deaggregation – 475-Year Return Time

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Attachment H-3.
Probabilistic Seismic Hazard Deaggregation – 2,475-Year Return Time

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Attachment H-4.
Historical Earthquakes within 50 Miles of the Project Site Boundary

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Attachment H-5.
Response Spectrum – Site Class D "Stiff Soil"

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