EXHIBIT I
SOILS

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Introduction

OAR 345-021-0010(1)(i) *Information from reasonably available sources regarding soil conditions and uses in the analysis area, providing evidence to support findings by the Council as required by OAR 345-022-0022, including:*

RESPONSE

This exhibit provides information required by OAR 345-021-0010(1)(i) to demonstrate that the soil protection standard in OAR 345-022-0022 can be satisfied. OAR 345-022-0022 requires the following:

> "the Council must find that the design, construction and operation of the Facility, taking into account mitigation, are not likely to result in a significant adverse impact to soils including, but not limited to, erosion and chemical factors such as salt deposition from cooling towers, land application of liquid effluent, and chemical spills."

For this Exhibit the analysis area described in OAR 345-001-0010(2) and the study area described in OAR 345-01-0010(57) refer to the same areas and are defined as the area within the Facility site boundary. The following information is provided by the Applicant to establish that the Facility will not cause significant adverse impact to soils within the Facility's site boundary. See OAR 345-001-0010(2) and (57).

I.1 Identification and Description of Soil Types

OAR 345-021-0010(1)(i)(A) *Identification and description of the major soil types in the analysis area.*

RESPONSE

Surface soils within the Facility site boundary were identified using the NRCS SSURGO for Gilliam County, Oregon (NRCS, 2009). Soil conditions are described from ground surface down to 60 inches or less depending on subsurface conditions (bedrock, boulders, etc.). NRCS data was derived from soil sampling that was conducted by NRCS scientists via discrete sampling methods within the upper 60 inches of soil, with the intention of categorizing average soil conditions within an area. During the field reconnaissance specific to the development of this application, soil types were confirmed in readily accessible areas like road cuts and quarries.

The soil survey map for the Facility and general area is provided in Figure I1. Detailed maps are provided in Figures I1a-I1g. Most of the Facility infrastructure is expected to be constructed on the following five soil units (listed from highest to lowest in terms of site percent coverage): the Ritzville Unit (58 percent); the Mikkalo Unit (9.6 percent); the Olex Unit (8.4 percent); the Willis Unit (8.2 percent); and the Warden Unit (5.8 percent). Soils are typically well-drained, moderately permeable, fertile silt loams formed in loess deposits. Annual precipitation ranges between 9 and 14 inches in the area and falls primarily between October 1 and March 31. Soil descriptions are detailed below based on NRCS Official Soil Series Descriptions (NRCS, 2008). Proposed wind turbine locations will be located on the five major soil units listed above and described in Section I.1.1. Section I.1.2 provides descriptions of the other general soil units within the Facility area. In addition to

Figure I1, which shows the general soil units within the area, Figures I1a-I1g provide detailed maps showing individual soils that make up each unit.

I.1.1 Dominant Soil Units within the Facility Site Boundary

Within the Facility site boundary, 17 major soil units were mapped by the Soil Conservation Service, now NRCS (Hostler, 1984). Of those, the 5 units listed above make up 90 percent of the soils. These soil types will be the most affected during construction. These are described in this section and the other 12 are described in Section I.1.2. Each major soil unit contains several subseries. The units typically share similar engineering properties across subseries.

The **Ritzville Unit (Map Units 32A, B, C and D)** covers approximately 58 percent of the Facility site. Formed in loess and ash deposits, it is typically deep and well-drained. These soils formed on ridge tops/plateaus and side slopes. The surface layer and subsoil are dark brown silt loam, about 12 and 19 inches thick, respectively. The substratum is calcareous, brown silt loam. Bedrock is at a depth of more than 60 inches. Permeability of the Ritzville soil is moderate. Available water capacity is about 10 to 12.5 inches. Effective rooting depth is 60 inches or more. Over 75 percent of the unit is on slopes less than 7 percent and runoff is expected to be slow. About 22 percent of the unit is on slopes between 7 and 20 percent where runoff is moderate. Runoff is rapid on the steeper slopes within the units between 20 and 40 percent. The hazard of water erosion is high in steeper areas of the site. Naturally, the steeper the slope, the greater the potential for soil loss. The hazard of wind erosion is low to moderate.

The **Mikkalo Unit (Map Units 17B, C, D and E)** covers approximately 9.6 percent of the Facility site. It formed in loess deposits overlying basalt, on ridge tops and south facing exposures. The surface layer is very dark grayish brown and dark brown silt loam. The subsoil is dark brown silt loam and the substratum is calcareous, brown silt loam. Basalt is at a depth of 20 to 40 inches. The surface layer is very dark grayish brown and dark brown silt loam. The subsoil is dark brown, silt loam, and the substratum is calcareous, brown silt loam. Permeability of the Mikkalo soil is moderate. Available water capacity is about 3.5 to 8 inches. Effective rooting depth is 20 to 40 inches or more. About 55 percent of the unit is on slopes less than 7 percent and runoff is expected to be slow. About 44 percent of the unit is on slopes between 7 and 20 percent where runoff is moderate. Runoff is rapid on the steeper slopes (20 to 40 percent). The hazard of water erosion in steeper areas is high. The hazard of wind erosion is low to moderate.

The **Olex Silt Loam and Gravelly Silt Loam (Map Units 23B and C and 24D and E)** cover approximately 8.4 percent of the Facility site. These soils formed in loess and very gravelly alluvial deposits. Slopes are 0 to 40 percent. This soil unit consists of very deep, well-drained soils, located on high terraces and uplands north of Rock Creek within the Facility area. The surface layer is dark brown silt loam about 12 inches thick. The subsoil is dark brown gravelly silt loam about 12 inches thick. The stratum extends to a depth of 60 inches or more. Permeability is moderate. Available water capacity is about 4 to 6.5 inches. Effective rooting depth is 20 to 40 inches. About 38 percent of the unit is on slopes less that 5 percent and runoff is expected to be slow. About 29 percent of the unit is on slopes between 7 and 20 percent where runoff is moderate. About 33 percent of the slopes are between 20 and 40 percent and runoff is rapid. The hazard of water erosion is high in steeper areas of the site. The hazard of wind erosion is low to moderate.

The **Willis Silt Loam (Map Units 56B, C, D and E)** covers 8.2 percent of the Facility site. The soil formed on terraces within the site area. This is a moderately well-drained soil. Typically, the surface layer is dark brown silt loam. The subsoil is dark brown silt loam about 17 inches thick. The substratum is brown silt loam about 7 inches thick. It is underlain by calcareous hardpan, which occurs at depths between 26 and 60 inches below ground surface. Permeability of the Willis soil is moderate. Available water capacity is about 4 to 8.5 inches. Effective rooting depth is 20 to 40 inches. Slopes are 2 to 30 percent in the Facility area, and runoff is moderate. The hazard of water erosion is high in steeper areas of the site. The hazard of wind erosion is low to moderate.

The **Warden Silt Loam (Map Units 55B, C, D and E)** covers 5.8 percent of the Facility site and is found on uplands. The soil formed in loess over calcareous, silty lacustrine deposits. It is a very deep, well-drained soil. The surface layer is dark brown and brown silt loam. The upper part of the substratum is brown silt loam and the lower part of the substratum is calcareous, grayish brown silt loam. Basalt is at a depth of 60 inches or more. Permeability is moderate. Available water capacity is about 11.5 to 12.5 inches. Effective rooting depth is 60 inches or more. About 62 percent of the unit is on slopes less that 5 percent and runoff is expected to be slow. About 16 percent of the unit is on slopes between 5 and 12 percent where runoff is slow to moderate. About 17 percent of the unit is on slopes between 12 and 20 percent where runoff is moderate. About 16 percent of the unit is on slopes between 20 and 40 and runoff is rapid. The hazard of water erosion is high in steeper areas of the site . The hazard of wind erosion is low to moderate.

I.1.2 Other Soil Units within the Facility Site Boundary

The following units make up the remaining 10 percent of the soils within Facility site boundary.

The **Bakeoven Very Cobbly Loam (Map Unit 1D)** was formed in loess mixed with colluvium over basalt. Bedrock is at 4 to 12 inches. This soil has a surface layer of dark brown very cobbly loam. The subsoil is dark brown very cobbly loam and very cobbly clay loam. Permeability is moderately slow. Effective rooting depth is 5 to 12 inches. Available water capacity is 0.5 to 1.5 inches. Runoff is slow to moderate, and the hazard of erosion is moderate.

The **Blalock Loam (Map Unit 4C)** consists of shallow, well-drained soils formed in loess, on uplands. Typically, the surface layer is very dark grayish brown to brown loam about 7 inches thick. The subsoil is brown loam to gravelly loam, about 11 inches thick. The subsoil overlies approximately 4 inches of light brownish gray, very gravelly, indurated hardpan. The substratum is calcareous, brown gravelly loam, about 19 inches thick, and is underlain by partially decomposed shale. Permeability of the Blalock soil is moderate. Effective rooting depth is 10 to 20 inches. Runoff is slow, and the hazard of water erosion is slight. Slopes are 2 to 12 percent.

The **Kimberly Fine Sandy Loam (Map Unit 13)** is a very deep, well-drained soil on alluvial bottom lands along Rock Creek and Willow Creek. It formed in mixed alluvium and has an average slope of 1 percent. The surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil and substratum are similar dark brown fine sandy loam to a depth of 60 inches or more. Permeability is moderately rapid. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The average slope of the alluvial drainage where this soil is found is about 1 percent.

The **Krebs Silt Loam (Map Units 14B, D and E)** consists of deep, well-drained loess soil formed on uplands in the site area. The surface layer is very dark grayish brown silt loam and silty clay loam, about 10 inches thick. The subsoil is pale brown to dark brown silty clay loam and silty clay about 26 inches thick. The substratum is silty clay loam about 12 inches thick, and underlain by partially decomposed diatomite. Permeability is slow. Effective rooting depth is 20 to 40 inches. Runoff is slow to rapid, and the hazard of water erosion is slight to high. Slopes are 2 to 40 percent.

The **Lickskillet Very Stony Loam (Map Unit 15E)** consists of shallow, well-drained soils formed in loess and basalt colluvium, on south and west-facing slopes. Typically, the surface layer is dark brown very stony loam about 3 inches thick. The subsoil is dark brown very gravelly loam to clay loam, about 12 inches thick. This soil is underlain by basalt. Permeability is moderate. Effective rooting depth is 12 to 20 inches. Runoff is rapid, and the hazard of water erosion is high. Slopes are 7 to 40 percent.

The **Nansene Silt Loam (Map Unit 22F)** consists of very deep, well-drained soils on north-facing exposures mainly along Rock Creek. It formed in loess. The average slope is 50 percent. Typically, the surface layer is very dark brown and dark brown silt loam about 21 inches thick. The subsoil is dark brown and brown silt loam about 24 inches thick. The substratum is brown silt loam to a depth of 60 inches or more. Permeability is moderate. Effective rooting depth is more than 60 inches. Available water capacity is 6.5 to 12 inches. Runoff is rapid and the erosion hazard is high.

The **Olex Gravelly Silt Loam (23 B, C, D and E)** consists of very deep, well-drained soils formed in loess and very gravelly alluvium, on the uplands north of Rock Creek. Typically, the surface layer is very dark grayish brown and dark brown silt loam about 12 inches thick. The subsoil is brown gravelly to very gravelly silt loam about 12 inches thick. The substratum is brown silt loam with increasing gravel content to a depth of 60 inches or more. Permeability is moderate. Effective rooting depth is 20 to 40 inches. Runoff is moderate to rapid, and the erosion hazard is moderate to high. Slopes are 0 to 40 percent.

The **Rock Outcrop-Rubble Land Complex, Very Steep (Map Unit 36F)** is a complex on uplands. It consists of bare basalt outcrop or cobbly and stony rubble of various thicknesses. Slope ranges from 5 to more than 100 percent, although it is dominantly more than 40 percent. However, because these areas are primarily rock erosion potential is very low.

The **Roloff Silt Loam (Map Unit 38C)** consists of moderately deep, well-drained soils formed in loess, located on bedrock terraces. Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsoil is dark brown silt loam about 16 inches thick, and the soil overlies fractured basalt. Permeability is moderate. Effective rooting depth is 20 to 40 inches. Runoff is moderate, and the erosion hazard is moderate. Slopes are 7 to 12 percent.

The **Sagehill Complex (Map Units 40B and C)** consists of very deep, well-drained soils formed in loess and in lacustrine sediments, on terraces. Typically, the surface layer is dark brown fine sandy loam about 8 inches thick. The subsoil is dark brown fine sandy loam and very fine sandy loam about 17 inches thick. The substratum is compact, grayish brown silt loam to a depth of 60 inches or more. Permeability is moderate. Effective rooting depth is 20 to 40 inches, though it is restricted by the stratified, waterlaid silt. Runoff is slow to moderate, and the erosion hazard is moderate. Wind erosion hazard is high. Slopes are 2 to 12 percent.

The **Wrentham-Rock Outcrop Complex (Map Unit 57F)** consists of approximately 20 percent rock outcrop, mixed with soil on north-facing upland exposures. Typically, the surface layer is very dark brown silt loam about 18 inches thick. The subsoil is dark brown very gravelly silt loam about 15 inches thick, and the soil overlies basalt. Permeability is moderately slow. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is high. Slopes are 35 to 70 percent.

The **Xeric Torrifluvents (Map Unit 58)** consists of very deep, somewhat excessively-drained soils formed in stream bottoms. Typically, the surface layer is dark brown fine sandy loam about 6 inches thick. The substratum consists of fine sandy loam, loamy fine sand, and gravelly loamy sand to a depth of 80 inches or more. Permeability of the Xeric Torrifluvents is rapid. Effective rooting depth is 60 inches or more. Runoff is slow, and the erosion hazard ranges from slight to high. The wind erosion hazard of this soil is moderate to high. The soils unit is nearly level to a 1 percent slope.

I.1.3 Corrosivity of Site Soils

The NRCS has provided general corrosion values for the soil units in the Facility site boundary. The risk of corrosion for cement is reported as low for the soils in the Facility site boundary. The risk of corrosion for steel varies from moderate to high. Site specific values will be gathered during the geotechnical exploratory field study.

I.2 Identification and Description of Land Uses

OAR 345-021-0010(1)(i)(B) *Identification and description of current land uses in the analysis area, such as growing crops, that require or depend on productive soils.*

RESPONSE

Currently, land uses within the Facility site boundary include private agricultural land generally used for dryland wheat production and rangeland. Where irrigation water is available, many soils in the area have high potential for irrigated crops such as potatoes, corn, wheat, and alfalfa hay. As discussed in Exhibit K, accepted farm practices include soil preparation, sowing, fertilizing, pest and weed management, and harvesting. Land use within the Facility site boundary is zoned EFU under the Gilliam County Zoning and Land Development Ordinance (see Exhibit K). Some agricultural lands within the Facility site boundary have also been enrolled in the Conservation Reserve Program (CRP).

The Ritzville, Mikkalo, Lickskillet, Nansene and Bakeoven units are used for grain fallow rotation and as range land. The Olex, Warden, Willis, Sagehill, Blalock and Krebs Units are mainly used for range and wildlife habitat (mule deer, birds, and small mammals).

The current land uses depend on the type of soils and percent of slope within the Facility site boundary. However, given the soil conditions within the region, these uses can be achieved in many other places.

I.3 Identification and Assessment of Impacts to Soils

OAR 345-021-0010(1)(i)(C) *Identification and assessment of significant potential adverse impact to soils from construction, operation and retirement of the Facility, including, but not limited to, erosion and chemical factors such as salt deposition from cooling towers, land application of liquid effluent, and chemical spills.*

RESPONSE

Up to 2,183.0 acres will be temporarily impacted during the construction of the Facility. Up to 188.9 acres will be permanently impacted by Facility infrastructure as discussed in Exhibit C. Impacts to the site soils from construction, operation and site retirement activities will be limited. The Facility's NPDES 1200-C construction permit, which the Applicant will provide, will address erosion control measures to minimize impacts to soils, vegetation and waters. Soil erosion potential at the Facility is low to moderate primarily because most of the proposed towers and associated components will be constructed on level to gently sloping ground.

Removing vegetation increases the potential for wind and water erosion of soils until they are stabilized. Excavations for underground cables could temporarily expose the excavated soils to wind and water erosion during construction. These conditions will prevail for a relatively limited time period until the cables are laid, trenches are backfilled with the soils (within 2 weeks of trenching), and the area is stabilized and revegetated. Widening existing or building new roadways and turbine pads requires clearing, grubbing and grading, removing vegetation to do so. Permanent roads and turbine pads will be covered with gravel immediately following exposures, thereby limiting the time for wind or water erosion. Some cut-slope with exposed loess could be present after construction of the roads and turbine pads. Mitigation measures will be used in these areas to limit erosion from wind or water. These measures are discussed in Section I.4. It is anticipated that landowners will return temporarily impacted croplands back to active agriculture as soon as possible after construction is completed.

Heavy equipment and haul trucks delivering gravel, concrete, water, turbine components, cranes and other supplies will be used during construction. See Exhibit U for a discussion of projected trips during construction. Trucks and other equipment may temporarily operate in areas designated for temporary construction activities that have not been stabilized, compacting agricultural soil and causing a temporary loss of productivity. These areas will be restored by scarification and revegetation after completion of construction activities.

All of the permanent turbine sites and related infrastructure, including access roads, will be stabilized using gravel and other stabilization methods, where needed. Operations and maintenance activities will be limited to the graveled site pads and access roads and therefore will have no impact on soil erosion. No off-road travel, with the potential for ground disturbance, will be necessary.

Additionally, the graveled areas will be designed to minimize runoff and maximize infiltration per stormwater management guidelines. Permanent best management practices (BMPs) will be designed to capture site runoff should it occur. These BMPs may include the following (but not be limited to) stabilized, shallow perimeter ditches and stabilized road ditches (bioswales) designed to slow and filter stormwater using check dams, gravel and vegetation buffers. In either case, stormwater will be directed to soils with a high infiltration capacity, where feasible.

When the site is decommissioned, erosion control strategies will be similar to those during construction. Removal of turbine pads, underground cables, and access roads will leave exposed soils that will be quickly stabilized. BMPs used during construction will also be used during decommissioning.

Salt deposition or the uncontrolled release of other chemicals or effluent is not anticipated on the Facility site. There will be no cooling towers or other facilities that cause salt deposition. The Facility will not produce liquid effluent. There will be minimal amounts of lubricating oils and cleaners for the turbines, and minimal use of pesticides for weed control. Site personnel will be trained in the proper application and control of any of these substances, along with good housekeeping to safely contain and store them onsite. These materials are discussed further in Exhibit G.

A very limited amount of hazardous materials will be used on site, including vehicle fuel; hydraulic and other lubricating oils; and other chemicals used for site maintenance and operations. BMPs to be considered and used during construction and post-construction to prevent spills or clean up spills if they occur are discussed in Exhibit G. BMPs will include regular vehicle maintenance and overall good housekeeping practices.

I.4 Description of Proposed Mitigation Measures

OAR 345-021-0010(1)(i)(D) *A description of any measures the applicant proposes to avoid or mitigate adverse impact to soils.*

RESPONSE

BMPs will be used to minimize impacts to soils within the Facility site boundary. Some impacts will be unavoidable, such as turbine pads and other infrastructure sites, including new roads. However, the Applicant plans to minimize impacts by using existing roads for access and site circulation to the maximum extent possible. Disturbance of natural areas will be limited to the minimum extent possible, with all work conducted only within marked disturbance corridors. Disturbed areas will be restored following construction. Where possible, topsoil will be stockpiled to be used for reclamation. All construction operations will comply with the erosion control plan and NPDES 1200-C construction permit (the Applicant will provide).

Erosion control measures will meet local, county, and state erosion control measures (DEQ, 2005; ODOT, 2005), including procedures described in Exhibit V. In general, the following BMPs will be considered prior to commencement of construction.

- **Construction access:** Stabilize bare ground as soon as construction begins. This includes access roads and construction entrances and exits.
- **Maintain existing vegetation:** If natural vegetation is present, minimize disturbance to the extent possible.
- **Sediment control, traps/barriers:** Install barriers such as fiber rolls, silt fences, brush and rock filters, and sand bags prior to grading
- **Runoff control:** Install diversions prior to onset of grading activities.
- **Land clearing and grubbing:** Clear and grade the site after sediment and runoff control measures have been installed.
- **General site and materials BMPs:** Establish stockpile management and spill prevention and control measures; provide areas for equipment maintenance and fueling, and concrete washout.

- **Maintenance:** Conduct BMP inspections in accordance with permit requirements; repair and maintain BMPs and remove accumulated sediments from BMPs.
- **Surface stabilization:** Apply surface stabilization measures immediately to any disturbed areas to control dust and erosion such as soil binders, mulching, and use of water trucks for dust control.
- **Building construction:** Install needed erosion and sediment control devices.
- **Final stabilization:** Stabilize the areas, including reseeding/revegetation, and remove all temporary sediment control and construction wastes.

I.5 Monitoring Program

OAR 345-021-0010(1)(i)(E) *The applicant's proposed monitoring program, if any, for adverse impact to soils during construction and operation.*

RESPONSE

Adherence to the Facility site's erosion control plan and the NPDES 1200-C construction permit will limit impacts to site soils, vegetation, and potential impacts to streams. Impacts will be mitigated as defined within the plan and permit. Monitoring inspections will be conducted, recorded, and reported as required by the erosion control plan and the stormwater construction permit. Inefficient or failing temporary BMPs will be replaced or repaired per the permit schedule. Permanent BMPs installed during Facility operation will be inspected regularly and repaired as needed to ensure proper control of stormwater runoff.

A Revegetation Plan will be prepared for the Facility and implemented during and following construction.

I.6 Proposed Site Certificate Conditions

Similar to the conditions proposed by previously-approved wind energy facilities in the vicinity of the Facility, the Applicant proposes the following conditions:

Condition 42
The certificate holder shall conduct all construction work in compliance with an Erosion and Sediment Control Plan (ESCP) satisfactory to the Oregon Department of Environmental Quality and as required under the National Pollutant Discharge Elimination System (NPDES) Stormwater Discharge General Permit #1200-C. The certificate holder shall include in the ESCP any procedures necessary to meet local erosion and sediment control requirements or stormwater management requirements.

Condition 43
During construction, the certificate holder shall limit truck traffic to improved road surfaces to avoid soil compaction, to the extent practicable.

Condition 44
During construction, the certificate holder shall implement best management practices (BMPs) to control any dust generated by construction activities, such as applying water to roads and disturbed soil areas.

Condition 45

During Facility operation, the certificate holder shall routinely inspect and maintain all roads, pads and trenched areas and, as necessary, maintain or repair erosion and sediment control measures.

I.7 Conclusion

Based on the information provided in this report, Facility construction and operation will not result in significant adverse impacts to soils. Erosion will be minimized by adherence to the erosion control plan and NPDES 1200-C construction permit, as well as by the mitigation activities described above. Further, areas of vegetation removal will be reclaimed through reseeding of native vegetation or crops to protect against loss of soil to wind and water erosion. Therefore, the EFSC may find that the design, construction, and operation of the Facility, taking into account the proposed mitigation measures, are not likely to result in a significant adverse impact to soils.

I.8 References

Hosler, Richard E. 1984. *Soil Survey of Gilliam County, Oregon*. U.S. Department of Agriculture, Soil Conservation Service. May 1984.

Natural Resources Conservation Service (NRCS). 2008. United States Department of Agriculture. Official Soil Series Descriptions. USDA-NRCS, Lincoln, NE. Available URL: http://soils.usda.gov/technical/classification/osd/index.html.

Natural Resources Conservation Service (NRCS). 2009. U.S. Department of Agriculture. Soil Survey Geographic (SSURGO) for Gilliam County, Oregon.

Oregon Department of Environmental Quality (DEQ). 2005. Erosion and Sediment control Manual.

Oregon Department of Transportation (ODOT). 2005. Guidelines for Developing and Implementing Erosion and Sediment Controls.

Figures