# EXHIBIT E

# PERMITS NEEDED FOR CONSTRUCTION AND OPERATION
OAR 345-021-0010(1)(e)

## TABLE OF CONTENTS

## E.1 INTRODUCTION

**OAR 345-021-0010(1)(e)** *Information about permits needed for construction and operation of the facility, including:*

Response: See sections below for information.

## E.2 IDENTIFICATION OF NECESSARY PERMITS

**OAR 345-021-0010(1)(e)(A)** *Identification of all federal, state and local government permits needed before construction and operation of the proposed facility, legal citation of the statute, rule or ordinance governing each permit, and the name, address and telephone number of the agency or office responsible for each permit.*

Response: Responses are provided in sections E.2.1 through E.2.3, below.

### E.2.1 Federal Permits

#### 1.1 Bonneville Power Administration

42 USCA 4332; 40 CFR pt 1500.

Permit: None required. NEPA compliance and EIS will be led by BPA.

Agency: Kimberly St. Hilaire, Environmental Protection Specialist
Bonneville Power Administration
905 NE 11th Avenue
Portland, OR 97208
(503) 230-5361

#### 1.2 U.S. Army Corps of Engineers

33 USCA 1344; 33 CFR parts 320, 323, 325-28, and 330.

Permit: Clean Water Act, Section 404.

Agency: Karla Ellis, Permit Evaluator
U.S. Army Corps of Engineers, Portland District
333 SW First Avenue
Portland, OR 97204
(503) 808-4380

#### 1.3 U.S. Fish and Wildlife Service

16 USCA 1536, 1539; 50 CFR 402.

Permit: Potential incidental take statement.

Agency: Nancy Gilbert, Field Supervisor
U.S. Fish and Wildlife Service – Pacific Region

Bend Field Office
20310 Empire Avenue, Suite A-100
Bend, OR 97701
(541) 383-7146

**1.4 Federal Aviation Administration**

14 CFR 77.13, 77.15, 77.17

1.4.1 Proposed Construction

14 CFR 77.13

Permit: Notice of Proposed Construction or Alteration (Form 7460.1).

Agency: Don Larsen
Northwest Mountain Regional Office
Air Traffic Division, ANM-520
1601 Lind Avenue, SW
Renton, WA 98055-4056
(425) 227-2520

1.4.2 Actual Construction

14 CFR 77.13

Permit: Notice of Actual Construction or Alteration (Form 7460.2).

Agency: Don Larsen
Northwest Mountain Regional Office
Air Traffic Division, ANM-520
1601 Lind Avenue, SW
Renton, WA 98055-4056
(425) 227-2520

## E.2.2 State Permits

**2.1 Oregon Department of Energy; Energy Facility Siting Council**

2.1.1 Energy Facility Site Certificate

ORS 469.300 *et seq.*; OAR Chapter 345, Divisions 1, 21-24.

Permit: Energy Facility Site Certificate.

Agency: John White, Energy Facility Analyst
Oregon Office of Energy
625 Marion St., NE
Salem, OR 97301
(503) 378-3194

2.1.2 Land Use

ORS 215.275 (Utility Facility Necessary for Public Service); ORS 215.296 (standards for approval of certain uses in Exclusive Farm Use zones); ORS 469.504(2) (Council Standard for Exception to Statewide Planning Goal 3); OAR 660-033-0130(22) (Power Generation Facility on Non-high Value Farm Soil); OAR 660-012-0065 (Transportation Improvements on Rural Lands)

Permit: Conditional Use Permit. No separate state permit; these statutes and rules are relevant to the issuance of a conditional use permit, as set forth below, regarding local approvals.

## 2.2 Oregon Department of Environmental Quality

2.2.1 Water Quality

ORS 468 and 468B; OAR Chapter 340, Divisions 14, 41, 45, 52, and 55

Permit: Construction Storm Water Permit 1200-C

Agency: Walt West
Oregon Department of Environmental Quality, Eastern Region
2146 NE 4th
Bend, OR 97701
(541) 388-6146 x232

2.2.2 Noise

ORS 467; OAR Chapter 340, Division 35.

Permit: None required, but facility must meet state noise standards.

2.2.3 On-Site Sewage Disposal

ORS 454 and 468B; OAR Chapter 340, Divisions 71 and 73.

Permit: Onsite sewage disposal will require two permits: a soil evaluation permit and a construction permit from the Wasco-Sherman Public Health Department.

Agency: Glen Pierce, John Zalzanik, or Karl Smit
Wasco-Sherman Public Health Department
419 E 7th Street
The Dalles, OR 97058
(541) 506-2600

2.2.4 Water Quality Certification

33 USCA 1341 , Section 401; OAR Chapter 340, Division 48.

Permit: Water Quality Certification.

Agency: Christine Svetkovich
Oregon Department of Environmental Quality
811 SW 6th Avenue
Portland, OR 97204
(503) 229-5046

### 2.3 Oregon Department of State Lands

ORS 196; OAR Chapter 141, Division 85.

Permit: Removal-Fill.

Agency: Kevin Herkamp, Resource Coordinator
Oregon Department of State Lands
20300 Empire Avenue, Suite 1
Bend, OR 97701
(541) 388-6345

### 2.4 Oregon Department of Fish and Wildlife – Habitat Conservation Division

ORS 496, 506, and 509; OAR Chapter 635, Divisions 100, 415, and 425.

Permit: None required.

Agency: Rose Owens, Habitat Special Projects Coordinator
Oregon Department of Fish and Wildlife – Wildlife Division
3406 Cherry Avenue, NE
Salem, OR 97303
(503) 947-6085

### 2.5 Oregon Department of Geology and Mineral Industries

OAR 345-021-0010(1)(h).

Permit: None required.

Agency: Yumei Wang, Geotechnical Engineer, Geohazards Team Leader
Oregon Department of Geology and Mineral Industries
800 NE Oregon St., Suite 965
Portland, OR 97232
(503) 731-4100

### 2.6 Oregon Department of Land Conservation and Development

ORS 197, 215, and 283; OAR Chapter 660.

Permit: None required. Agency provides technical review and recommendations on compliance with Council rule OAR 345-022-0030.

Agency: Oregon Department of Land Conservation and Development
635 Capitol St., NE, Suite 150
Salem, OR 97301-2540
(503) 373-0050

## 2.7 Oregon Parks and Recreation Department

### 2.7.1 Historic Preservation Section

ORS 97, 358, and 390; OAR Chapter 736, Division 51.

Permit: Archaeological permit

Agency: Dr. Dennis Griffin, Lead Archaeologist
Oregon Department of Parks and Recreation, SHPO
725 Summer St., NE, Suite C
Salem, OR 97301
(503) 986-0674

### 2.7.2 Other Parks Programs

OAR 345-022-0040.

Permit: None required.

## 2.8 Oregon Department of Agriculture – Plant Conservation Biology Program

ORS 564; OAR Chapter 603, Division 73.

Permit: None required.

Agency: Bob Meinke, Program Leader
Oregon Department of Agriculture – Plant Division
635 Capitol St., NE
Salem, OR 97301
(541) 737-2317

## 2.9 Oregon Water Resources Department – Water Rights Division

ORS 537 and 540; OAR Chapter 690.

Permit: None required. Groundwater well producing less than 5000 gallons per day does not require a permit.

Agency: Oregon Water Resources Department – Water Rights Division

725 Summer St., NE, Suite A
Salem, OR 97301-1271
(503) 986-0900

### E.2.3 Local Permits

#### 3.1 Sherman County Zoning Ordinance (SCZO)

SCZO § 11.8—Design & Improvement Standards and Requirements, Streets and Other Public Facilities

Permit: Conditional Use Permit (Building Permit). Approval of the project will be sought through the Council.

Agency: Georgia Macnab, Planner
Planning Department & Planning Commission
Sherman County
110 Main St., Unit 2
Moro, OR 97039
(541) 565-3601

## E.3 DESCRIPTION OF NECESSARY PERMITS

**OAR 345-021-0010(1)(e)(B)** *A description of each permit and the reasons the permit is needed for construction or operation of the facility.*

Response: Responses are provided in sections E.3.1 through E.3.3, below.

### E.3.1 Federal Permits

#### 1.1 Bonneville Power Administration

42 USCA 4332; 40 CFR pt 1500.

Permit: None required for the Project. BPA's actions with respect to the Project (i.e., BPA's decision to construct a new transmission line and interconnect/buy electricity), will be subject to review under the National Environmental Policy Act (NEPA) as part of BPA's decision-making process. The NEPA review—in this case an Environmental Impact Statement—will include review under the Endangered Species Act, the National Historic Preservation Act, and related cultural resources protection statutes. Any other federal permitting actions referenced below also would be subject to some form of NEPA review.

#### 1.2 U.S. Army Corps of Engineers

33 USCA 1344; 33 CFR parts 320, 323, 325-28, and 330.

Permit: A Clean Water Act Section 404 permit will not be required because there will be no fill in the waters of the US including wetlands.

**1.3 U.S. Fish and Wildlife Service**

16 USCA 1536, 1539; 50 CFR 402.

Permit: Consultation with the U.S. Fish and Wildlife Service under the Endangered Species Act will not be required, because no federal license, permit, or authorization is required to build the facility.

**1.4 Federal Aviation Administration**

14 CFR 77.13, 77.15, 77.17.

1.4.1 Proposed Construction

14 CFR 77.13

Permit: None required; however, the FAA requires notice of any and all proposed construction of more than 200 feet in height above the ground level (FAA Form 7460-1).

1.4.2 Actual Construction

14 CFR 77.13.

Permit: None required; however, the FAA requires notice of any and all actual construction of more than 200 feet in height above the ground level (FAA Form 7460-2).

## E.3.2 State Permits

**2.1 Oregon Department of Energy; Energy Facility Siting Council**

2.1.1 Energy Facility Site Certificate

ORS 469.300 *et seq.*; OAR Chapter 345, Divisions 1, 21-24.

Permit: Energy Facility Site Certificate required before construction or operation.

2.1.2 Land Use

ORS 215.275 (Utility Facility Necessary for Public Service); ORS 215.296 (standards for approval of certain uses in Exclusive Farm Use zones); ORS 469.504(2) (Council Standard for Exception to Statewide Planning Goal 3); OAR 660-033-0130(22) (Power Generation Facility on Non-high Value Farm Soil); OAR 660-012-0065 (Transportation Improvements on Rural Lands)

Permit: No separate state permit; these statutes and rules are relevant to the issuance of the site certificate, through which the Applicant proposes to gain land use approval.

## 2.2 Oregon Department of Environmental Quality

### 2.2.1 Water Quality

ORS 468 and 468B; OAR Chapter 340, Divisions 14, 41, 45, 52, and 55.

Permit: Construction storm water permit 1200-C for ground disturbance of more than one acre.

### 2.2.2 Noise

ORS 467; OAR Chapter 340, Division 35.

Permit: None required, but facility must meet state noise standards.

### 2.2.3 On-Site Sewage Disposal

ORS 454 and 468B; OAR Chapter 340, Divisions 71 and 73.

Permit: The new O&M facility will require an onsite sewage permit from the Wasco-Sherman Public Health Department. The process for siting a septic system requires a soil evaluation permit and a construction permit.

### 2.2.4 Water Quality Certification

33 USCA 1341 , Section 401; OAR Chapter 340, Division 48.

Permit: Water Quality Certification will not be required, because no federal license or permit is required to build the facility.

## 2.3 Oregon Department of State Lands

ORS 196; OAR Chapter 141, Division 85.

Permit: A removal-fill permit will not be required because no removal or fill will occur within waters of the state, including wetlands.

## 2.4 Oregon Department of Fish and Wildlife – Habitat Conservation Division

ORS 496, 506, and 509; OAR Chapter 635, Divisions 100, 415, and 425.

Permit: None required. Agency provides technical review and recommendations on compliance with Council rules OAR 345-022-0040, 0060, and 0070.

### 2.5 Oregon Department of Geology and Mineral Industries

OAR 345-021-0010(1)(h).

Permit: None required. Agency provides technical review and recommendations on compliance with Council rule OAR 345-022-0020.

### 2.6 Oregon Department of Land Conservation Development

ORS 197, 215, and 283; OAR Chapter 660.

Permit: None required. Agency provides technical review and recommendations on compliance with Council rule OAR 345-022-0030.

### 2.7 Oregon Parks and Recreation Department

#### 2.7.1 Historic Preservation Section

ORS 97, 358, and 390; OAR Chapter 736, Division 51.

Permit: An archaeological permit may be required to conduct archaeological investigations of the Project site. The Permit is issued by the State Historical Preservation Office.

Note: Agency and Tribes provide technical review and recommendations on compliance with Council rule OAR 345-022-0090.

#### 2.7.2 Other Parks Programs

OAR 345-022-0040.

Permit: None required. Agency provides technical review and recommendations on compliance with Council rules OAR 345-022-0040, 0080, and 0100 concerning impacts to state park lands.

### 2.8 Oregon Department of Agriculture – Plant Conservation Biology Program

ORS 564; OAR Chapter 603, Division 73.

Permit: None required. Agency provides technical review and recommendations on compliance with Council rule OAR 345-022-0070(1).

### 2.9 Oregon Water Resources Department – Water Rights Division

ORS 537 and 540; OAR Chapter 690.

Permit: The new O&M facility will be served by a new well. No permit is required. Commercial uses of up to 5000 gallons per day from groundwater wells are exempt from permitting requirements.

### E.3.3 Local Permits

#### 3.1 Sherman County Zoning Ordinance (SCZO)

SCZO § 11.8—Design & Improvement Standards and Requirements, Streets and Other Public Facilities

Permit: Land use building permit approval will be sought through the Council.

## E.4 NON-FEDERALLY-DELEGATED PERMIT APPLICATION

**OAR 345-021-0010(1)(e)(C)** *For state or local government permits or approvals for which the Council must determine compliance with applicable standards, evidence to support findings by the Council that construction and operation of the proposed facility will comply with all statutes, rules and standards applicable to the permit. The applicant may show this evidence:*

*(i) In Exhibit J for permits related to wetlands;*

Response: See Exhibit J. No state Removal Fill Permit will be required to construct the facility.

*(ii) In Exhibit O for permits related to water rights.*

Response: See Exhibit O. Commercial and industrial water uses of less than 5000 gallons per day from a ground water well are exempt from having to obtain a permit.

## E.5 FEDERALLY-DELEGATED PERMIT APPLICATION

**OAR 345-021-0010(1)(e)(D)** *For federally-delegated permit applications, evidence that the responsible agency has received a permit application and the estimated date when the responsible agency will complete its review and issue a permit decision.*

Response: A 1200-C permit application has been prepared and is incorporated as an appendix to Exhibit I.

## E.6 THIRD-PARTY PERMITS

**OAR 345-021-0010(1)(e)(E)** *If the applicant will not itself obtain a state or local government permit or approval for which the Council would ordinarily determine compliance but instead relies on a permit issued to a third party, identification of any such third-party permit and for each:*

(i) *Evidence that the applicant has, or has a reasonable likelihood of entering into, a contract or other agreement with the third party for access to the resource or service to be secured by that permit;*

Response: It is not anticipated that any third party permits will be required to construct the facility. Adequate quarries exist in the area to provide the needed materials for construction. However, if new or expanded quarry facilities are deemed to be necessary by the contractor, the contractor will be responsible for acquiring state or local permits.

(ii) *Evidence that the third party has, or has a reasonable likelihood of obtaining, the necessary permit; and*

Response: Not applicable.

(iii) *An assessment of the impact of the proposed facility on any permits that a third party has obtained and on which the applicant relies to comply with any applicable Council standard.*

Response: Not applicable.

## E.7 FEDERALLY DELEGATED PERMIT ISSUED TO A THIRD PARTY

**OAR 345-021-0010(1)(e)(F)** *If the applicant relies on a federally-delegated permit issued to a third party, identification of any such third-party permit for each:*

(i) *Evidence that the applicant has, or has a reasonable likelihood of entering into, a contract or other agreement with the third party for access to the resource or service to be secured by that permit;*

Response: No federally delegated permits will be needed by a third party in order to construct the facility.

(ii) *Evidence that the responsible agency has received a permit application; and*

Response: Not applicable.

(iii) *The estimated date when the responsible agency will complete its review and issue a permit decision.*

Response: Not applicable.

## E.8 MONITORING PROGRAM

**OAR 345-021-0010(1)(e)(G)** *The applicant's proposed monitoring program, if any, for compliance with permit conditions.*

Response: Monitoring requirements, if any, will be determined by the Council and federal agencies responsible for issuing permits or approvals for the project. The Applicant's proposed monitoring for compliance with permit conditions are described within this application, e.g. 1200-C permit requirements for erosion control monitoring and reporting.

# EXHIBIT F

## PROPERTY OWNERSHIP
OAR 345-021-0010(1)(f)

## TABLE OF CONTENTS



## TABLES

## F.1 INTRODUCTION

**OAR 345-021-0010(1)(f)** *A list of the names and mailing addresses of all owners of record, as shown on the most recent property tax assessment roll, of property located within or adjacent to the corridor(s) the applicant has selected for analysis as described in subsection (b) and property located within or adjacent to the site of the proposed facility. The applicant shall submit an updated list of property owners as requested by the Office of Energy before the Office issues notice of any public hearing on the application for a site certificate as described in OAR 345-015-0220. In addition to incorporating the list in the application for a site certificate, the applicant shall submit the list to the Office in electronic format suitable to the Office for the production of mailing labels. Property adjacent to the proposed site of the facility or corridor means property that is:*

**OAR 345-021-0010(1)(f)(A)** *Within 100 feet of the site or corridor, where the site or corridor is within an urban growth boundary;*

**OAR 345-021-0010(1)(f)(B)** *Within 250 feet of the site or corridor, where the site or corridor is outside an urban growth boundary and not within a farm or forest zone;*

**OAR 345-021-0010(1)(f)(C)** *Within 500 feet of the site or corridor, where the site or corridor is within a farm or forest zone.*

Response: The site, including the overhead collector line, is within a farm or forest zone; see Section F-2 and corresponding Table F-1.

## F.2 SUMMARY

The site is within a farm or forest zone. Table F-1 of this Exhibit provides the required list of property owners within 500 feet of the site boundary. In preparing the table, the Applicant assembled the relevant sections of the current Sherman County tax maps and reviewed the tax maps to identify tax lots wholly or partially within the areas required by OAR 345-021-00010(1)(f). The Applicant used these names and addresses to prepare Table F-1.

**Table F- 1. Property Ownership Within 500 Feet of Facility Site**

| Tax Lot # | Landowner(s) | Address | Township, Range<br>W.M. Sherman County | Section |
|---|---|---|---|---|
| 600 | Nancy M. Faner, Trustee and Richard G. Harber and Gerry H. Harber, Trustee | Nancy Faner<br>23860 Long Valley Rd<br>Hidden Hills, CA 91302 | T.1N. R.18E | 2 |
| 500 | Rodney M. Welk and Lynette K. Welk, Trustees | Rodney Welk<br>31530 Sodaville Rd<br>Lebanon, OR 97355 | T.1N. R.18E | 2 |
| 800 | James Weir Memorial Fund - Bigelow District | c/o J. Thomas Coats<br>113 "A" E. Second Street<br>The Dalles, OR 97058 | T.1N. R.18E | 3 |
| 7100, 8400 | Richard E. Jones and Robert C. Jones, Jr. and Mary Alice Jones, Trustees | Robert C. Jones<br>1928 S. Century Lane<br>Spokane Valley, WA 99037-8351 | T.2N. R.18E | 28 |
| 2400 / 2500 / 2700 / 2800 | Roland and Sharon Simantel | Roland & Sharon Simantel<br>PO Box 364<br>Wasco, OR 97065 | T.1N. R.18E | 11, 12, 13, 14 |
| 3700<br>9300 / 9400<br>800 / 900 / 1000 / 1100 / 1200 / 1600 / 1900 | Stevens Family Farms | c/o Arthur Stevens<br>PO Box 257<br>Husum, WA 98623 | T.1N. R.18E<br>T.2N. R.18E<br>T.1N. R.19E | 20<br>36<br>6, 7, 8 |
| 300 | Vernon and Virginia Melzer | PO Box 41<br>Wasco, OR 97065 | T.1N. R.18E | 1 |
| 6700 / 8700 | Frank and Deanna Zaniker | 901 Richmond St<br>The Dalles, OR 97058 | T.1N. R.18E | 27, 34 |
| 3400 | Nancy Lewis | 964A Kiely Blvd<br>Santa Clara, CA 95051 | T.1N. R.18E | 19 |

| **Tax Lot #** | **Landowner(s)** | **Address** | **Township, Range**<br>W.M. Sherman County | **Section** |
|---|---|---|---|---|
| 3600 | Elizabeth Thomas | 3564 East 2nd #61<br>The Dalles, OR 97058 | T.1N. R.18E | 19 |
| 5400 / 5500 | U.S. Bank-Trustee - J.R. Morgan Trust, on behalf of Owners, and Marilyn Clark and Judy Probstfield | JR Morgan Trust (P&C)<br>US Bank c/o Scott Robar SO-WA-T7TR<br>428 Riverside Ave<br>Spokane, WA 99201 | T.1N. R.17E | 23, 24, 25, 26 |
| 2000 | Lee and Terry Kaseberg | 70031 Van Gilder Rd<br>Wasco, OR 97065 | T.1N. R.18E | 9, 10 |
| 4101 / 4200 | Lyndon P. & Symantha McClennan | P.O. Box 215<br>Wasco, OR 97065 | T.1N. R.17E | 14, 15 |
| 5300 / 5900 | Alison Yamauchi | 4900 Crestwood Dr<br>Little Rock, AR 72207 | T.1N. R.17E | 22, 29 |
| | Paula Walker Thompson | 81157 McRae Rd.<br>Helix, OR 97835 | | |
| | Judy Probsfield | | | |
| | Marilyn Clark | | | |
| 5800 / 7700 | Sylvia Irene Rogers, ET AL | 2010 SW Nancy Dr.<br>Gresham, OR 97080 | T.1N. R.17E | 27, 34 |
| 5600 / 7900 | Kenneth R. Hart, Trust | 95682 DeMoss Springs Lane<br>Moro, OR 97039 | T.1N. R.17E | 25, 35 |
| 4000 / 4100 / 4201 | Patrick A. & Kathleen A. Powell | 12520 S.W. 19th<br>Lake Oswego, OR 97034 | T.1N. R.17E | 13, 14 |
| 3900 | Ronald R. Powell, LE | c/o Patrick Powell<br>12520 S.W. 19th<br>Lake Oswego, OR 97034 | T.1N. R.17E | 13 |

| Tax Lot # | Landowner(s) | Address | Township, Range<br>W.M. Sherman County | Section |
|---|---|---|---|---|
| 3300 | Century Farm McDermid LLC | c/o Wendy Parker<br>26339 Stubbs Road<br>Brownsville, OR 97327 | T.1N. R.18E | 18 |
| 5600 | Eunice L. Henkle | c/o Carole Louise Makinster<br>P.O. Box 353<br>Moro, OR 97039 | T.1N. R.18E | 30, 31 |
| 4700 / 4900 / 6300 | James Robert Belshe LE | P.O. Box 327<br>Wasco, OR 97065 | T.1N. R.18E | 27, 28, 33 |
| | Martin James Belshe | 97200 Hwy. 206<br>Moro, OR 97039 | | |
| | Robert Boyce Belshe | | | |
| 4000 | William V. & Catherine Trimble | P.O. Box 10<br>Sandy, OR 97055 | T.1N. R.18E | 23, 26 |
| 4200 / 4100 | BLM | | T.1N. R.18E | 24, 25 |
| 1400 / 2800 / 2900 | Evelyn Smith LE AL | 1955 Dallas Hwy. NW, Apt. 207<br>Salem, OR 97304 | T.1N. R.19E | 7, 17, 19 |
| 2600 | Evelyn Smith LE AL | 1955 Dallas Hwy. NW<br>Apt. 207<br>Salem, OR 97304 | T.1N. R.18E | 13 |
| | Lawrence L. Smith | 22 Areys Lane<br>Orleans, MA 02653 | | |
| | Ray Smith | Wasco, OR 97065 | | |
| 1300 / 1500 | Bonnie Anita Baker | 1111 Wright St.<br>The Dalles, OR 97058 | T.1N. R.19E | 7, 17 |

| Tax Lot # | Landowner(s) | Address | Township, Range<br>W.M. Sherman County | Section |
|---|---|---|---|---|
| 801 / 1001/ 1700 / 1800 / 801 / 1100 | David Schlecht | 5701 N.E. 88th St.<br>Vancouver, WA 98665 | T.1N. R.19E | 5, 6, 7, 8 |
| 6000 | Mederick Liberty Trust | c/o Leslie Suske<br>7510 Ridge Drive<br>Gladstone, OR 97027 | T.2N. R.18E | 25 |
| 6300 / 6400 / 6500 / 9100 / 9200 | Dewey J. Thomas Trustee | P.O. Box 153<br>Wasco, OR 97065 | T.2N. R.18E | 26, 27, 35 |
| 9000 | James E. & Dean W. Medler<br><br>Louis Tatum - Living Trust | James E. & Dean W. Medler<br>2067 Hwy. 52<br>Payette, ID 83661<br><br>Louis Tatum Living Trust<br>c/o Louann Jones<br>P.O. Box 426<br>Irrigon, OR 97844 | T.2N. R.18E | 35 |
| 5100 / 6900 / 7200 | Dewey J. Thomas Trustee<br>Ronald K.& Melva D. Thomas | James E. & Dean W. Medler<br>2067 Hwy. 52<br>Payette, ID 83661 | T.2N. R.18E | 21, 28, 29 |
| 7400 | Delta M. Johnson, Trustee | 3325 Columbia View Dr. #8<br>The Dalles, OR 97058 | T.2N. R.18E | 29 |
| 8200 | Stuart M. Macnab | c/o Michael S. Macnab, Trustee<br>3440 N.W. Vaughn St.<br>Portland, OR 97210 | T.2N. R.18E | 32 |
| 7000 / 8500 / 8701 | James E. & Dean W. Medler<br>Marci Medler Cress Thompson | Marci Medler Cress Thompson<br>66351 Hay Canyon Road<br>Moro, OR 97039 | T.2N. R.18E | 28, 33 |
| 8600 | Nancy Lewis | 964A Kiely Blvd.<br>Santa Clara, CA 95051 | T.2N. R.18E | 33 |

| Tax Lot # | Landowner(s) | Address | Township, Range<br>W.M. Sherman County | Section |
|---|---|---|---|---|
| 2900 | Betty G. Parker | c/o Jan Parker<br>909 W. Heather Dr.<br>Mesa, AZ 85201 | T.2N. R.18E | 15 |

# EXHIBIT G

## MATERIALS ANALYSIS
OAR 345-021-0010(1)(g)

## TABLE OF CONTENTS



## TABLES

## G.1 INTRODUCTION

**OAR 345-021-0010(1)(g)** *A materials analysis, including:*

Response: The evidence below provides an inventory of industrial materials of substantial quantity moving into and out of the proposed facility and a description of the Applicant's plans to manage hazardous substances and non-hazardous waste materials during construction and operation of the project.

## G.2 INVENTORY OF INDUSTRIAL MATERIALS

**OAR 345-021-0010(1)(g)(A)** *An inventory of substantial quantities of industrial materials flowing into and out of the proposed facility during construction and operation;*

Response: Responses are provided in Sections G.2.1 and G.2.2, below.

### G.2.1 Construction

Response: Table G-1 provides an inventory of industrial materials that will be used within the site boundary in substantial quantities during project construction. The primary construction materials are rock, water, concrete, steel, and assorted electrical equipment. Construction of new and improved roads will require an estimated 50,000 cubic yards of rock/gravel, which will be brought from off-site quarry sources. An estimated 55,000 gallons of water may be applied daily to roads and construction areas during project construction for road compaction and to reduce dust. An additional 11,500 gallons of water will be combined with 45,000 cubic yards of concrete to construct up to 165 concrete turbine pads and transformer pads (one each for each proposed turbine). During construction, water will be trucked in from offsite. See Exhibit O for a more detailed discussion of water and its source. Finally, 165 turbine towers will be constructed. An estimated 4100 tons of steel will be required for each turbine tower.

A number of other materials will be brought into the site boundary to construct the turbines and electrical components. Mounted on top of each of the 165 turbine towers is a nacelle – the unit that houses the turbine itself, the rotor, blades, hub, and gearbox. An electrical transformer will be adjacent to each turbine tower. Transformers will contain non-polychlorinated biphenyl (PCB) mineral oil and will be sealed; the oil will not be changed. Underground electrical cable will be used to connect the turbines, for a total of approximately 30 miles of underground electrical cable on the project site.

As indicated in Table G-1, the materials used for construction will remain on site, with the exception of water, which will be lost through infiltration and evaporation. Handling of construction wastes is discussed below.

### G.2.2 Operations

Response: No substantial quantities of industrial materials will be brought onto or removed from the project site during operations. The only materials that will be brought onto the site will be those related to maintenance and/or replacement of project elements (*e.g.*, nacelle or turbine components, electrical equipment). The only materials that will be removed from the site will be those parts or elements replaced during maintenance activities. Those materials removed or replaced will not constitute significant amounts.

## G.3 MANAGEMENT OF HAZARDOUS SUBSTANCES

**OAR 345-021-0010(1)(g)(B)** *The applicant's plans to manage hazardous substances during construction and operation, including measures to prevent and contain spills; and*

Response: Hazardous materials that will be used on the project site include lubricating oils, cleaners, and pesticides, as shown in Table G-1. These materials will be used primarily during operations but potentially during construction as well. These hazardous materials will be stored at the O&M facility for the Klondike III project.

Hazardous materials will be used in a manner that is protective of human health and the environment and will comply with all applicable local, state, and federal environmental laws and regulations. Accidental releases of hazardous materials (*e.g.*, vehicle fuel during construction or lubricating oil for turbines) will be prevented or minimized through proper containment of these substances during use and transportation to the project site, and used primarily within the turbines themselves, where any spill would be contained. Any oily waste, rags or dirty or hazardous solid waste will be collected in sealable drums and removed for recycling or disposal by a licensed contractor.

In the unlikely event of an accidental hazardous materials release, any spill or release would be cleaned up and the contaminated soil or other materials disposed of and treated according to applicable regulations. See Exhibit CC for a listing of applicable regulations. Spill kits containing items such as absorbent pads will be located on equipment and in on-site temporary storage facilities to respond to accidental spills, if any were to occur. Employees handling hazardous materials will be instructed in the proper handling and storage of these materials as well as where spill kits are located.

## G.4 MANAGEMENT OF NON-HAZARDOUS WASTE MATERIALS

**OAR 345-021-0010(1)(g)(C)** *The applicant's plans to manage non-hazardous waste materials during construction and operation.*

Response: Solid waste materials, such as excess construction or steel, will be generated during construction. Wood (from concrete forms) and steel scraps (from turbine towers) will be separated and recycled to the extent feasible. Excess excavated material will be used to restore ground contours after construction, used as fill on site or will be removed from the site for fill use elsewhere.

Disposal of materials as fill onsite will be conducted in accordance with OAR 340-093-0080 and other applicable regulations. OAR 340-093-0080 provides a variance or permit exemption for disposal of inert wastes. The inert waste must be demonstrated to be substantially the same as "clean fill." OAR 340-093-0080(2). Clean fill is defined as material consisting of soil, rock, concrete, brick, building block, tile or asphalt paving, which do not contain contaminants which could adversely impact the waters of the State or public health. To meet the clean fill definition, the inert construction debris will be separated form other debris that is not inert. The only clean fill that has the potential to be disposed of onsite will be waste concrete generated during construction. The construction contractor may (with agreement of the landowner) bury waste concrete (excess cement mix form a construction site; batches of concrete that do not meet specifications) onsite. In such cases, the materials will be placed in an excavated hole, covered with at least 3 feet of topsoil, and regraded to match existing contours.

Any packing materials, paper, and refuse will be separated, accumulated in dumpsters, and periodically removed for recycling or disposal by a licensed waste hauler. Portable toilets will be provided for on-site sewage handling during construction and will be pumped and cleaned regularly by the construction contractor.

## Table G- 1. Inventory of Materials to be Used During Construction and Operation

| Material | Quantity/Units | Ultimate Disposition |
|---|---|---|
| ***CONSTRUCTION*** | | |
| Rock/gravel for road constrcution | 50,000 cubic yards | Will remain onsite roadbed |
| Water for dust control and road compaction | 55,000 gpd | Absorption/evaporation |
| Water for concrete mixing | 70 gallons per turbine pad | Incorporated into concrete |
| Concrete for 165 turbine pads | 275 cubic yards per turbine pad | Incorporated into turbine pads |
| Steel for 165 turbines | 25 tons per turbine | Incorporated into turbine towers |
| Nacelles (include turbine, rotor, blades, hub, and gearbox) | Up to 165 units | Mounted on turbine towers |
| Electrical transformers | Up to 165 units | Mounted on concrete pad adjacent to turbine tower |
| Electrical cable | Approximately 30 miles | Buried underground, except 3.5 miles of above ground collection system |
| ***OPERATIONS and MAINTENANCE*** | | |
| Mineral oils (turbine lubricant and transformer coolant) | 3 gallons/turbine | Stored in O&M for Klondike III; added to turbine as needed |
| Synthetic oils (turbine lubricant, gear oil) | 10 gallons/turbine | Stored in O&M for Klondike III; added to turbine as needed |
| Simple Green (general cleaner) | 3 gallons/turbine | Stored in O&M for Klondike III |
| WD-40; grease (general lubricant) | 5 gallons/turbine | Stored in O&M for Klondike III |
| Ethylene Glycol (anti-freeze) | 3 gallons/turbine | Stored in O&M for Klondike III |
| Round-up and 2,4-D (weed control) | 0 – subcontract out for weed control | |

# EXHIBIT H

# GEOLOGY AND SEISMICITY
OAR 345-021-0010(1)(h)

## TABLE OF CONTENTS



## TABLES



## APPENDICES

## H.1 INTRODUCTION

**OAR 345-021-0010(1)(h)** *Information from reasonably available sources regarding the geological and soil stability of the site and vicinity, providing evidence to support findings by the Council as required by OAR 345-022-0020, including:*

## H.2 GEOLOGICAL AND TOPOGRAPHIC FEATURES

**OAR 345-021-0010(1)(h)(A)** *A description of the geological features and topography of the site and vicinity.*

Response: The project is located in the Deschutes-Columbia Plateau physiographic province. This province is a north-sloping, volcanic plateau that measures over 60,000 square miles in Oregon, Washington, and Idaho. Volcanic rocks mapped as Columbia River Basalt Group (CRBG) underlie nearly the entire province. These rocks are middle Miocene in age (around 6 to 17 million years old) and principally consist of basalt that erupted from vents in central and northeast Oregon, southeast Washington, and Idaho, and flowed westward to the Pacific Ocean (Beeson and others, 1989). In late Pleistocene time, a surficial layer of wind-derived, fine-grained silty soils referred to as "loess" was deposited in the province along the Columbia River drainage. Geologic observations made during a site visit indicate the majority of the project site is mantled by 4 to 6 feet of loess.

On a regional scale, the project vicinity lies along the southwest boundary of the Yakima Fold Belt, a structural portion of the Deschutes-Columbia Plateau, which has been deformed by regional north-south compression into a series of shallow eastwest-trending folds. Several large segmented faults are associated with the folds, including the Oak Flat-Luna Buttes Fault Zone and Arlington-Shutler Buttes Fault Zone. The location and extent of these faults are shown on Figure 4 of Appendix H-2 (Geologic Map).

On a local scale, the project site lies between the Deschutes and John Day Rivers, between the Columbia Hills Anticline to the north (Newcomb, 1966) and the Gordon Ridge Anticline and Grass Valley Syncline to the south (Bela, 1982).

Obvious surficial evidence of large-scale, deep-seated slope instability, or evidence of faulting or ground rupture, was not observed during the reconnaissance. Review of aerial photography did not reveal evidence of slope instability, faulting, or ground rupture.

## H.3 SITE-SPECIFIC GEOLOGIC AND GEOTECHNICAL WORK

**OAR 345-021-0010(1)(h)(B)** *A description of site specific geological and geotechnical work performed or planned to be performed before construction. The application shall include:*

*(i) A proposed schedule for geotechnical work;*

Response: A geotechnical investigation will be undertaken prior to construction in spring of 2006 to investigate the subsurface and foundation support conditions at the locations of the turbine towers and other significant facility structures. The investigation may include exploration borings and test pit excavations, laboratory testing, engineering analyses, and/or the development of feasible foundation types and associated design criteria to mitigate the loess soils. Seismic design criteria will also be reviewed and modified, if appropriate, based on the subsurface conditions disclosed by the subsurface explorations.

*(ii)* *A description of the nature and extent of the work with a discussion of the methods used to assess the expected ground response, including amplification, at the site;*

Response: Existing information, including local, state, and federal government documents and maps, were reviewed and used to characterize the existing geologic conditions and potential seismic hazards in the vicinity of the project. This task included review of available aerial photographs of the project site. Representatives of the Oregon Department of Geology and Mineral Industries (ODGAMI) were then contacted for information regarding local conditions or current research that may affect the project.

A reconnaissance of readily accessible portions of the project site was performed to document surficial conditions of interest and to field-verify characterization of the soil, rock, and geologic conditions. Emphasis was placed on examination of mapped features or geologic hazards that could significantly impact design, construction, and performance of the planned facilities.

A seismic hazard assessment was conducted to characterize seismicity in the vicinity of the project and evaluate the potential seismic hazards. The work was based on the potential for regional and local seismic activity as described in the existing scientific literature, and on the subsurface conditions within the lease boundary, interpreted from geotechnical explorations made by others at and in the vicinity of the project. Specifically, the seismic hazard assessment included the following tasks:

1) A detailed review of the literature.

2) Compilation, examination, and evaluation of existing subsurface data gathered at and in the vicinity of the site. This information was used to prepare a generalized subsurface profile for the site.

3) Identification of the potential seismic events appropriate for the site and characterization of those events in terms of a series of generalized design events.

4) Office studies, based on the generalized subsurface profile and the generalized design earthquakes, resulting in conclusions and recommendations concerning:

a) specific seismic events that might have a significant effect on the site;

b) the potential for seismic energy amplification at the site;

c) a site-specific acceleration response spectrum for the site; and

d) the potential for earthquake-induced fault displacement, landslides, liquefaction, settlement, subsidence, and damage by tsunamis and/or seiches at the site.

*(iii) A list of professional literature relied on in characterizing the site; and*

Response: Refer to references in Section X of Appendix H-2 for a list of the professional literature that was used in characterizing the site.

*(iv) The names of the personnel responsible for the work and a description of their relevant experience.*

Response: Geotechnical work was conducted by the following:

**Dwight J. Hardin, PE,** has 33 years of geotechnical engineering experience and has directed the geotechnical services for numerous tower structures, including wind turbine towers, and over 1,500 miles of high-voltage transmission lines.

**George A. Freitag, PG, CEG,** is a senior engineering geologist. He has 18 years of experience and has evaluated geologic and seismic hazards for numerous projects in the Pacific Northwest.

**Tova R. Peltz** is a geologist and staff engineer, who has completed the seismic hazard and site response analysis for over 25 projects in Oregon.

## H.4 TRANSMISSION LINES

**OAR 345-021-0010(1)(h)(C)** *For all transmission lines, 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, corners, and portions of the proposed route where geological reconnaissance and other site-specific studies provide evidence of existing landslides or marginally stable slopes that could be made unstable by the planned construction.*

Response: A 3.5-mile portion of the 230 kV collector system will be above ground on poles. It is anticipated that geotechnical borings would be conducted at each end of the line and at least two other locations along the alignment. Geotechnical information developed for the Klondike I and II projects may also be used to supplement this information.

## H.5 PIPELINES

**OAR 345-021-0010(1)(h)(D)** *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, and portions of the proposed* *alignment where geologic reconnaissance and other site specific studies provide evidence of existing landslides or marginally stable slopes that could be made unstable by the planned construction;*

Response: There are no pipelines associated with the project.

## H.6 SOIL STABILITY MAP

**OAR 345-021-0010(1)(h)(E)** *A map showing the location of existing and significant potential geological and soil stability hazards and problems, if any, on the site and in its vicinity that could adversely affect, or be aggravated by, the construction and operation of the proposed facility;*

Response: No significant potential geological or soil stability hazards were identified. Potential mapped hazards are shown in Figure 4 of Appendix H-2.

## H.7 SEISMIC HAZARD ASSESSMENT

**OAR 345-021-0010(1)(h)(F)** *An assessment of seismic hazards. For the purposes of this assessment, the maximum probable earthquake (MPE) is the maximum earthquake that could occur under the known tectonic framework with a 10 percent chance of being exceeded in a 50-year period. If seismic sources are not mapped sufficiently to identify the ground motions above, the applicant shall provide a probabilistic seismic hazard analysis to identify the peak ground accelerations expected at the site for a 500 year recurrence interval and a 5000 year recurrence interval. In the assessment, the applicant shall include:*

*(i) Identification of the Oregon Building Code Seismic Zone designation for the site;*

Response: With adoption of the 2003 International Building Code, Oregon no longer identifies a seismic zone designation.

*(ii) Identification and characterization of all earthquake sources capable of generating median peak ground accelerations greater than 0.05g on rock at the site. For each earthquake source, the applicant shall assess the magnitude and minimum epicentral distance of the maximum credible earthquake (MCE) and the MPE;*

Response: The geologic and seismologic information available for identifying the potential seismicity at the project site is incomplete, and uncertainties are associated with any estimates of the probable magnitude, location, and frequency of occurrence of earthquakes that might affect the project. The information that is available indicates the potential seismic sources that may affect the project vicinity or site can be grouped into three independent categories: *subduction zone events*, *subcrustal events*, and *local crustal events* (Table H-1), as described below.

**Subduction Zone Event.** Since subduction zone events have not occurred in the Pacific Northwest in historic times, estimates of their probable size, location, and frequency are generally based on comparisons of the Cascadia Subduction Zone with active convergent plate margins in other parts of the world and on evidence that suggests these seismic events have likely occurred in the Pacific Northwest in the geologic past. For the purpose of this analysis, based on the location of the project and available published information, a subduction zone event was evaluated with an earthquake of MW = 8.8 at a focal distance of 150 miles. This corresponds to a sudden rupture of half of the length of the Juan de Fuca-North American plate interface, placed at the closest approach of the interface, due west of Portland. It should be noted that this choice of a design earthquake is based primarily on an estimate of the capability of the subduction zone to produce a large earthquake, not on a probabilistic analysis of a demonstrated seismic history. Based on the attenuation relationship published by Youngs, et al. (1997), a subduction zone event of this size and location would result in a peak horizontal bedrock acceleration of approximately 0.08 g at the site.

**Subcrustal Event.** Estimates of the probable size, location, and frequency of subcrustal events in the Pacific Northwest are generally based on comparisons of the Cascadia Subduction Zone with active convergent plate margins in other parts of the world and on the historical seismic record for the region surrounding Puget Sound. For the purpose of this study, the potential subcrustal event with an earthquake of magnitude MW = 7.0 at an epicentral distance of about 100 miles was evaluated. As with the subduction zone event, this choice is based on an estimate of the capability of the source region rather than on a probabilistic analysis of an historical record of events of this type. A subcrustal event of this size would result in a peak horizontal bedrock acceleration of approximately 0.04 g at the site.

**Local Crustal Event.** Sudden crustal movements along relatively shallow, local faults in the Columbia-Deschutes Plateau area, though rare, have been responsible for local crustal earthquakes. The precise relationship between specific earthquakes and individual faults is not well understood, since few of the faults in the area are expressed at the ground surface, and the foci of the observed earthquakes have not been located with precision.

The history of local seismic activity is commonly used as a basis for determining the size and frequency to be expected of local crustal events.

**Table H-1. Deterministic Seismic Hazard Assessment Peak Bedrock Acceleration**

| Earthquake source | Attenuation relationships for target spectra | Magnitude (Mw) | Epicentral distance (miles) | Focal depth (miles) | Peak bedrock acceleration (g) | Assumed peak bedrock acceleration (g) |
|---|---|---|---|---|---|---|
| Subduction Zone | Youngs, et al., 1997 | 8.8 | 150 | 15 | 0.05 | 0.05 |
| Subcrustal | Youngs, et al., 1997 | 7 | 100 | 30 | 0.04 | .02 |
| | Atkinson and Boore, 1997 | 7 | 100 | NA | 0.007 | |
| Local Crustal | Sadigh, et. al., 1997 | 6.5 | 10 | NA | 0.21 | 0.12 |
| | Boore, et al., 1997 | 6.5 | 10 | NA | 0.19 | |
| | Abrahamson and Silva 1997 | 6.5 | 10 | NA | 0.20 | |

*(iii) A description of any recorded earthquake within 50 miles of the site and of recorded earthquakes greater than 50 miles from the site that caused ground shaking at the site more intense than the Modified Mercalli III intensity. The applicant shall include the date of occurrence and a description of the earthquake that includes its magnitude and highest intensity and its epicenter location or region of highest intensity;*

Response: See Tables H-2 and H-3, below.

**Table H-2. Local Earthquakes of Northern Hood River, Wasco, and Sherman Counties, Oregon (Beaulieu, 1977)**

| Date | Intensity | Magnitude (Richter) $M_R$ | Location |
|---|---|---|---|
| November 24, 1866 | IV | 3.7 | The Dalles |
| December 1866 | III | 3.0 | The Dalles |
| February 29, 1892 | IV | 3.7 | The Dalles |
| November 28,1920 | IV | 3.7 | Hood River |
| April 12, 1976 | IV-V | 4.8 | Maupin, Tygh Valley |

**Table H-3. Large Earthquakes Greater than 50 Miles from the Project Site (Niewendorp and Neuhaus, 2003)**

| Date | Intensity | Magnitude (Richter), MR | Location | Comments |
|---|---|---|---|---|
| January 26, 1700 | NA | 9.0 | Offshore, Cascadia Subduction Zone | |
| December 15, 1872 | IV-IX | 5.7 | Southwest British Columbia | Intensity of I-II in Gilliam County |
| October 12, 1877 | VII | NA | Troutdale-Corbett area, OR | Not felt at The Dalles |
| March 7, 1893 | VIII | 5.7 | Umatilla, OR | |
| September 14, 1921 | VI | 5.0 | Walla Walla, WA | Intensity of IV in Gilliam County |
| July 15, 1936 | VII+ | 5.8 | Milton-Freewater, OR | IV at The Dalles, V at Rufus |
| April 13, 1949 | VIII | 7.1 | Olympia, WA | V at The Dalles |
| January 7, 1951 | V | 4.3 | McNary, OR | Maupin, Tygh Valley |
| 1959 | VIII | 6.3 | Hebgen Lake, MT | I - II in Gilliam County |
| November 5, 1962 | NA | 5.5 | Portland, OR<br>Vancouver, WA | |
| 1968 | NA | 5.1 | Adel, OR | |
| April 25, 1992 | NA | 7.1 | Cape Mendocino, CA | |
| March 25, 1993 | NA | 5.6 | Scotts Mill, OR | |
| September 20, 1993 | NA | 5.9 and 6.0 | Klamath Falls, OR | |
| February 28, 2001 | | 6.8 | Near Olympia, WA | |

NA = Not Available

*(iv) Assessment of the median ground response spectrum from the MCE and the MPE and identification of the spectral accelerations greater than the design spectrum provided in the Oregon Building Code. The applicant shall include a description of the probable behavior of the subsurface materials and amplification by subsurface materials and any topographic or subsurface conditions that could result in expected ground motions greater than those characteristics of the Oregon Building Code Seismic Zone identified above; and*

Response: The probability of an earthquake of a specific magnitude occurring at a given location is commonly expressed by its return period, i.e., the average length of time between successive occurrences of an earthquake of that size or larger at that location. The return period of a design earthquake can be calculated once a project design life and some measure of the acceptable risk that the design earthquake might occur or be exceeded are specified. These expected earthquake recurrences are expressed as a probability of exceedance during a given time period or design life. The recently adopted International Building Code (IBC, 2003) develops a design spectrum by using two-thirds of the Maximum Considered Earthquake (MCE) ground motion. The MCE earthquake combines probabilistic earthquakes with a 2% probability of exceedance in 50 years (return period of about 2,500 years) with modifications for deterministic ground motions, where necessary (Leyendecker, et al., 2000). The change to a MCE was an effort to reduce the risk of building collapse in portions of the country where the earthquake with a 2,500-year recurrence interval is significantly larger than the standard code recurrence interval of 475 years.

It is important to recognize that the origin of the two-thirds reduction factor incorporated in the IBC code is a function of the "seismic margin" identified in the 1997 National Earthquake Hazards Reduction Program (NEHRP) commentary. The seismic margin of 1.5 is recognized as the inherent factor of safety in the code. In this regard, if a structure is subjected to a ground motion of 1.5 times the design level, the structure should still have a low likelihood of collapse.

A series of acceleration-time histories (commonly referred to as "accelerograms") of well-studied earthquakes have been selected to represent each of the seismic events described above. These events were selected from the current inventory of the National Geophysical Data Center (NGDC) in Boulder, Colorado, and from the records available from the California Division of Mines and Geology in Sacramento, California. From the available records, corrected free-field and basement/ground floor accelerograms were chosen to match the spectral shape of the aforementioned attenuation relationships or probabilistic spectra. Wherever possible, earthquakes of similar magnitude and duration were chosen to match the target spectra for each respective earthquake type. These records were checked for obvious errors, missing data points, and other anomalies and were transformed into a uniform data format.

The effect of a specific seismic event on the site is related to the type and thickness of soil overlying the bedrock and to the type and quantity of seismic energy delivered to the bedrock beneath the site by the earthquake. A generalized model of the subsurface profile beneath the site was developed by GGRI based on subsurface explorations in the project area by Barr (2004), available water well logs provided by the Oregon Water Resources Department, and shear wave velocities measured at the site by NORCAL Geophysical Consultants for Barr's investigation. The generalized soil profile developed by GRI is summarized below.

**Table H-4. General Soil Profile**

| Soil type | Thickness (feet) | Unit Weight (pcf) | Shear Wave Velocity (feet/second) |
|---|---|---|---|
| Silt | 10 | 100 | 825 |
| Weathered basalt | 20 | 135 to 140 | 825 to 2,115 |
| Basalt | undefined | 160 | 4,000 |

Based on the generalized subsurface profile described above, the peak bedrock accelerations estimated for the design events, and the strong-motion records listed in the preceding tables, pseudoacceleration response spectra have been prepared using PROSHAKE. The spectra were produced for a ground surface elevation corresponding to the proposed building foundations, damped at 5% of critical damping, from the larger horizontal component of each of the strong-motion records, and scaled to match the estimated peak horizontal bedrock accelerations of the earthquake events.

*(v) An assessment of seismic hazards expected to result from reasonably probable seismic events. As used in this rule "seismic hazard" includes ground shaking, landslide, lateral spreading, liquefaction, tsunami inundation, fault displacement, and subsidence;*

Response: Based on review of local geology, there are no mapped faults on the project site, and the risk of ground rupture due to fault displacement in the project vicinity is low. The proposed Klondike III project is located on relatively flat or gradually sloped terrain. In addition, rock is present at shallow depths, and the groundwater table is deep. Considering these site conditions, the potential for earthquake-induced landslides, lateral spreading, liquefaction and settlement/subsidence at the site are low.

The project is not located near any large water bodies and is over 1000 feet above the Columbia River. The risk of damage by tsunamis and/or seiches at the site is absent.

The risk of seismic hazards, such as slope instability, ground rupture, liquefaction, and settlement or subsidence, is low. As a result, mitigation measures to address these hazards in the siting, design, and construction of the project are not necessary. The input of seismic energy into the bedrock beneath the silt will result in some amplification of the energy at the ground surface. The resulting estimated peak ground acceleration (PGA) is about 0.16 g and can be readily accommodated in the design of the turbine tower structures. Transient wind loading on turbine towers will be the more severe loading conditions that will govern the design of the tower structure.

## H.8 NON-SEISMIC GEOLOGIC HAZARDS

**OAR 345-021-0010(1)(h)(G)** *An assessment of soil-related hazards such as landslides, flooding and erosion which could, in the absence of a seismic event, adversely affect or be aggravated by the construction or operation of the facility;*

Response: The planned Klondike III turbine towers, as shown on Figure 2 of Appendix H-2, have been sited on relatively flat to very gradually sloping terrain. In addition, the regional groundwater table is located several tens of feet below the ground surface, and basalt bedrock occurs at shallow depths. Considering these conditions, slope instability and landslides are not geologic hazards that will impact the wind project and associated infrastructure.

The project site is mantled with wind-deposited silt soil known as loess. The silt particles are of relatively uniform size and the silt usually has sufficient cohesion, or undrained shear strength, so that excavations made in the material can stand on near-vertical slopes. True loess soils have never been submerged. When loaded by conventional spread footings and subsequently saturated, the bond between the soil particles becomes weakened and the soil structure altered which can result in large settlements at the ground surface.

## H.9 SEISMIC HAZARD MITIGATION

**OAR 345-021-0010(1)(h)(H)** *An explanation of how the applicant will design, engineer and construct the facility to avoid dangers to human safety from the seismic hazards identified in paragraph (F). The applicant shall include proposed design and engineering features, applicable construction codes, and any monitoring for seismic hazards; and*

Response: As discussed above, the risk of seismic hazards, such as ground rupture, liquefaction, settlement, or subsidence, is low. As a result, mitigation measures to address these hazards in the siting, design, and construction of the project are not necessary.

## H.10 NON-SEISMIC HAZARD MITIGATION

**OAR 345-021-0010(1)(h)(I)** *An explanation of how the applicant will design, engineer and construct the facility to adequately avoid dangers to human safety presented by the hazards identified in paragraph (G).*

Response: No non-seismic geologic hazards that will require special consideration in the siting, design, and construction of the Klondike III project were identified. The presence of loess soils can be accommodated by conventional foundation designs methods including: (1) spread foundations below the loess, (2) drilled shaft foundations that support in the materials below the loess; (3) removal of the loess and replacement with compacted fill, and/or (4) in situ improvements of the loess soils. One or more of these approaches have been used in the design and construction of the foundations for Klondike II and will be used to design the foundations for Klondike III turbine towers.

## H.11 CONCLUSION

Based on above information, the Applicant has satisfied the required OAR 345-021-0010(1)(h), and the Council may find that the standard contained in OAR 345-022-0020 is satisfied.

## H.12 REFERENCES

Barr Engineering Company, 2004, Geotechnical Engineering Report, Klondike Wind Power II Project, Wasco, Oregon: prepared for PPM Energy, Portland, Oregon.

Beaulieu, J.D., 1977, Geologic Hazards of Parts of Northern Hood River, Wasco, and Sherman Counties, Oregon: Oregon Department of Geology and Mineral Resources Bulletin B-91.

Beeson, M.H., Tolan, T. L., and Anderson, J. L., 1989, The Columbia River Basalt Group in western Oregon; geologic structures and other factors that controlled flow emplacement patterns, in Reidel, S. P., and Hooper, P. R., eds., Volcanism and tectonism in the Columbia River flood-basalt province. Geological Society of America Special Paper 239.

Bela, J.L., 1982, Geologic Compilation Map of The Dalles 1° by 2° Quadrangle, Oregon and Washington: Oregon Department of Geology and Mineral Resources Geologic Map Series GMS-27.

International Code Council, 2003, International building code: Building Officials and Code Administrators International, Inc., International Conference of Building Officials, Southern Building Code Congress International.

Newcomb, R.C., 1966, Lithology and Eastward Extension of The Dalles Formation, Oregon and Washington: USGS Professional Paper, 550-D, p. 59-63.

Niewendorp, C.A. and Neuhaus, M.E., 2003, Map of Selected Earthquakes for Oregon, 1841-2002: Oregon Department of Geology and Mineral Resources Open-File Report OFR-03-02.

Youngs, R.R., Chiou, S.J., Silva, W.J. and Humphrey, J.R., 1997, Strong ground motion attenuation relationships for subduction zone earthquakes: Seismological Research Letters, vol 68, no 1.

# APPENDIX H-1

## Recorded Earthquakes within 50 Miles

## Recorded Earthquakes Within 50 Miles

## Local Earthquakes of Northern Hood River, Wasco, and Sherman Counties, Oregon

(Beaulieu, 1977)

| Date | Intensity | Magnitude (Richter) $M_R$ | Location |
|---|---|---|---|
| November 24, 1866 | IV | 3.7 | The Dalles |
| December 1866 | III | 3.0 | The Dalles |
| February 29, 1892 | IV | 3.7 | The Dalles |
| July 1893 | II | 2.3 | Pleasant Ridge |
| December 5, 1902 | II | 2.3 | Hood River |
| November 28,1920 | IV | 3.7 | Hood River |
| April 12, 1976 | IV-V | 4.8 | Maupin, Tygh Valley |

# APPENDIX H-2

## Preliminary Geotechnical Site Investigations

**Geologic and Seismic Evaluation for**
**Klondike III Wind Project**
*(3/30/2005)*

## I. INTRODUCTION

At the request of David Evans and Associates, Inc. (DEA), GRI Geotechnical & Environmental Consultants (GRI) has completed an assessment of the geologic and seismic conditions at the location of the proposed Klondike III wind project. The purpose of the study was to characterize, on a preliminary basis, the geology and seismicity of the project area and immediate vicinity, identify associated potential hazards that could impact the project, and identify potential mitigation measures.

GRI's scope of work included review of relevant available information and publications regarding geologic and seismic conditions; examination of aerial photographs; a limited ground-level reconnaissance; geologic, seismic, and geotechnical analysis; and preparation of this report. The scope of work did not include a detailed geologic reconnaissance and mapping of the project area or site-specific subsurface or geophysical investigations. In this regard, the level of effort and scope of work were appropriate to evaluate the geology, seismicity, and associated hazards of the project area; however, supplemental site-specific investigations will be necessary for final design of the project.

### Project Description

The Klondike III Wind Project is located on approximately 14,500 leased acres in Sherman County, as shown on the Vicinity Map, Figure 1. The Project will generate up to 273 MW of power and will include up to 165 wind turbines. As shown on Figure 2, the turbine towers are configured in several north-south alignments. As also shown on Figure 2, Klondike Wind Projects I and II exist or are under construction near the site. The tower alignments will be accessed by new and existing 16-ft-wide, gravel-surfaced roads; the underground collector system will be largely within road prisms. Project elements also include a 4-acre O&M facility, 19 laydown areas throughout the site, 3.5-mile 230-kV overhead collector line, and two substation collectors.

The Klondike III project will transmit power via a proposed new BPA transmission line that will extend approximately 11 miles from the new BPA Klondike Schoolhouse substation to a new BPA John Day Substation. The alignment of this transmission line has not been determined.

## II. BACKGROUND

The purpose of this report is to provide a technical basis to fulfill the requirements for the completion of Appendix H, Geology and Seismicity, as outlined in OAR 345-021-0010(1)(h) for provision of evidence to support the findings by the State of Oregon, Energy Facility Siting Council.

A previous geotechnical investigation for the Klondike I project was completed by Barr (2004). A copy of the Barr report was provided to GRI for use in completing this report. GRI also obtained, reviewed, and relied upon published reports addressing local and regional geology and seismicity, as discussed in subsequent sections of this report.

## III. EXISTING CONDITIONS

### General

The site is roughly 1 mile west of the John Day River, at its closest, approximately 5 miles south of the Columbia River, and 12 miles east of the Deschutes River. Grass Valley, which contains an intermittent tributary to the John Day River, extends along the southern edge of the project site. The project site is located approximately 7 miles east of Wasco, Oregon. Agriculture, particularly dry-land wheat, is the predominant land use, and there are very few residential dwellings and agriculture-related structures within the project area.

### Topography

Topography within the project area is typified by gently rolling to level ground located along the high plateau south of the Columbia River. Areas of steep slopes are confined to portions of the northeast and southern margins of the study area. These areas drop rapidly from the high and relatively level plateau down to the Grass Valley and several unnamed intermittent tributaries of the John Day River. Elevations along the plateau, within the project area, range between approximately 1,250 to 1,500 ft.

The proposed tower locations are situated on a relatively flat topographic plateau in the range of elevation 1,250 to 1,500 ft. Slopes in the tower locations are typically less than 3%. The tower locations do not encroach on steeper areas to the south along Grass Valley Canyon.

## Regional Geology

The project is located in the Deschutes-Columbia Plateau physiographic province. This province is a north-sloping, volcanic plateau that measures over 60,000 sq. mi in Oregon, Washington, and Idaho. Volcanic rocks mapped as Columbia River Basalt Group (CRBG) underlie nearly all of the province. These rocks are middle Miocene in age (around 6 to 17 million years old) and principally consist of basalt that erupted from vents in central and northeast Oregon, southeast Washington, and Idaho and flowed westward to the Pacific Ocean (Beeson and others, 1989). In late Pleistocene time, a surficial layer of wind-derived, fine-grained sediment referred to as "loess" was deposited in the province along the Columbia River drainage. Arid-land processes have also locally formed light-colored layers of calcium carbonate, known as "caliche," in the near-surface loess soils.

## IV. METHODS

GRI completed a scope of work to evaluate the geology and seismicity of the project, which is outlined below.

## Geological Assessment Methodology

GRI reviewed existing information, including local, state, and federal government documents and maps, to characterize the existing geologic conditions and potential seismic hazards related with the project area. This task included review of available aerial photographs of the project area and transmission line corridor.

GRI contacted representatives of the Oregon Department of Geology and Mineral Industries for information regarding local conditions or current research that may affect the project. GRI did not contact Federal or Local regulatory agencies.

On January 19 and 20, 2005, a geotechnical engineer and engineering geologist from GRI completed a geologic reconnaissance of readily accessible portions of the project area to document surficial conditions of interest and to field-verify characterization of the soil, rock, and geologic conditions. Emphasis was placed on examination of mapped features or geologic hazards that could significantly impact design, construction, and performance of the planned facilities. The approximate route is provided on the Reconnaissance Map, Figure 3. Using the information developed in the previous tasks, GRI completed data analyses and studies to evaluate the geologic hazards that could impact the project area.

## Seismic Hazard Assessment Methodology

The purpose of the seismic hazard assessment was to characterize the seismicity of the project area and evaluate the potential seismic hazards associated with regional and local seismicity, and estimate the effect those hazards might have on the site. Project. The work was based on the potential for regional and local seismic activity as described in the existing scientific literature, and on the subsurface conditions within the lease boundary, interpreted from geotechnical explorations made by others at and in the vicinity of the project. Specifically, the seismic hazard assessment included the following tasks:

1) A detailed review of the literature, including published papers, maps, open-file reports, seismic histories and catalogs, works in progress, and other sources of information regarding the tectonic setting, regional and local geology, and historical seismic activity that might have a significant effect on the site.

2) Compilation, examination, and evaluation of existing subsurface data gathered at and in the vicinity of the site, including classification and laboratory analyses of soil samples. This information was used to prepare a generalized subsurface profile for the site.

3) Identification of the potential seismic events appropriate for the site and characterization of those events in terms of a series of generalized design events.

4) Office studies, based on the generalized subsurface profile and the generalized design earthquakes, resulting in conclusions and recommendations concerning:

    a) specific seismic events that might have a significant effect on the site;

    b) the potential for seismic energy amplification at the site;

    c) a site-specific acceleration response spectrum for the site; and

    d) the potential for earthquake-induced fault displacement, landslides, liquefaction, settlement, subsidence, and damage by tsunamis and/or seiches at the site.

## V. RESULTS

### Site Geologic Conditions

#### Klondike III Project Area Geology

Geologic observations made during the site visit indicate the majority of the project area is mantled by brown, fine-grained, silty soils, referred to as loess. The thickness of loess observed in road cuts was typically on the order of 4 to 6 ft. Local areas of gray to white caliche were observed in several road cuts. The rock units beneath the site are mapped as the Frenchman Springs Member of the Wanapum Basalt (part of the middle portion of the CRBG; Bela, 1982). This unit is approximately 15 million years old, and is typically on the order of 300 to 500 ft thick. The unit generally consists of fine- to medium-grained basalt.

Exposures of this unit were found in a rock quarry ('gravel pit' on Figure 3 located just west of the project boundary between "not yet constructed" towers T-20 and T-19. The quarry exposures revealed an upper 5-ft thickness of fine-grained silt soil (loess) underlain by about 20 to 25 ft of hard, brown basalt. The contact between the silt and basalt appeared distinct. The basalt in the quarry was observed to have closely spaced joints and appeared slightly weathered.

Landslide deposits are not mapped within the lease boundary (Bela, 1982; scale 1:250,000). A geologic map of the project area is provided on Figure 4.

Obvious surficial evidence of large-scale, deep-seated slope instability, or evidence of faulting or ground rupture, was not observed during the reconnaissance. Review of aerial photography did not reveal evidence of slope instability, faulting, or ground rupture.

Barr (2004) completed a geotechnical investigation for the Klondike Wind II project, which is adjacent to the Klondike III project area. In general, their investigation disclosed the project area is underlain by a surface layer of silt (loess) overlying basalt. The silt was on the order of 3 to 20 ft thick. Basalt was encountered to the maximum depth of their explorations (47 ft). Groundwater was not encountered in the explorations.

#### Structural Geology Setting

On a regional scale, the project area lies along the southwest boundary of the Yakima Fold Belt, a structural portion of the Deschutes-Columbia Plateau which has been deformed by regional north-south compression into a series of shallow east-west-trending folds. Several large segmented faults are associated with the folds, including the Oak Flat-Luna Buttes Fault Zone and Arlington-Shutler Buttes Fault Zone. The location and extent of these faults are shown on Figure 4. These faults have been mapped on the basis of geomorphology, stratigraphic offsets, and geophysical evidence, and they are reasonably well-defined and generally considered seismogenic (Geomatrix/ODOT, 1995). On a local scale, the project area lies between the Deschutes and John Day Rivers, between the Columbia Hills Anticline to the north (Newcomb, 1966) and the Gordon Ridge Anticline and Grass Valley Syncline to the south (Bela, 1982). At present, no findings or effort is underway to re-evaluate the geology or seismic setting of the project area (DOGAMI, Personal Communication, 2005)

The project area lies approximately 180 miles inland from the surface expression of the Cascadia Subduction Zone, an active plate boundary along which remnants of the Farallon Plate (the Gorda, Juan de Fuca, and Explorer plates) are being subducted beneath the western edge of the North American continent. The subduction zone is a broad, eastward-dipping zone of contact between the upper portion of the subducting slabs of the Gorda, Juan de Fuca, and Explorer plates and the over-riding North America Plate.

**Historic Seismicity**

Precise, quantitative information regarding historic seismic activity in the Pacific Northwest and in central Oregon is sparse. Events that may have occurred in the region prior to settlement of the Oregon Territory in the mid-nineteenth century are speculative and have not been clearly identified in terms of location, magnitude, or frequency. From the mid-nineteenth century to the time of the installation of the first dependable seismometers in the area (about 1940), reliable information regarding location and magnitude is not available, although rough estimates of these parameters have been based on records of eyewitness accounts. Since about 1940, seismographic records of increasing sophistication and accuracy are available for local events larger than about 3.5 ($M_L$). In this study, size is expressed in Richter (local) magnitude ($M_L$), surface wave magnitude ($M_S$), Japanese Meteorological Association magnitude ($M_{JMA}$), or moment magnitude ($M_W$); location is expressed as epicentral or focal distance, measured radially from the subject site in kilometers; and peak horizontal bedrock accelerations are expressed in gravities (1 g = 32.2 ft/sec/sec = 980.6 cm/sec/sec). The term "intensity" as used in Tables 1 and 2 refers to the Modified Mercalli Intensity Scale, which is a measure of an earthquake's effects on humans and surface features. The scale ranges from I to XII, where I is a measurement of an earthquake that is not felt by humans, and XII is an earthquake that causes near total damage to structures in the area of observation. Local seismic events that may have generated measurable accelerations in the vicinity of the project site are shown in Table 1. Historic earthquakes that may have affected the site, occurring at a distance greater than 50 miles, are shown in Table 2.

**Table 1**
**Local Earthquakes of Northern Hood River, Wasco, and Sherman Counties, Oregon**
(Beaulieu, 1977)

| Date | Intensity | Magnitude (Richter) $M_R$ | Location |
|---|---|---|---|
| November 24, 1866 | IV | 3.7 | The Dalles |
| December 1866 | III | 3.0 | The Dalles |
| February 29, 1892 | IV | 3.7 | The Dalles |
| July 1893 | II | 2.3 | Pleasant Ridge |
| December 5, 1902 | II | 2.3 | Hood River |
| November 28,1920 | IV | 3.7 | Hood River |
| April 12, 1976 | IV-V | 4.8 | Maupin, Tygh Valley |

**Table 2**
**Historic Earthquakes Greater Than 50 mi From The Project Site**
(Niewendorp and Neuhaus, 2003)

| Date | Intensity | Magnitude (Richter), $M_R$ | Location | Comments |
|---|---|---|---|---|
| January 26, 1700 | NA | 9.0 | Offshore, Cascadia Subduction Zone | |
| December 15, 1872 | IV-IX | 5.7 | Southwest British Columbia | Intensity of I-II in Gilliam County |
| October 12, 1877 | VII | NA | Troutdale-Corbett area | Not felt at The Dalles |
| March 7, 1893 | VIII | 5.7 | Umatilla, OR | |
| September 14, 1921 | VI | 5.0 | Walla Walla, WA | Intensity of IV in Gilliam County |
| July 15, 1936 | VII+ | 5.8 | Milton-Freewater | IV at The Dalles, V at Rufus |
| April 13, 1949 | VIII | 7.1 | Olympia, WA | V at The Dalles |
| January 7, 1951 | V | 4.3 | McNary, OR | Maupin, Tygh Valley |
| 1959 | VIII | 6.3 | Hebgen Lake, MT | I - II in Gilliam County |
| November 5, 1962 | NA | 5.5 | Portland, OR Vancouver, WA | |
| 1968 | NA | 5.1 | Adel, OR | |
| April 25, 1992 | NA | 7.1 | Cape Mendocino, CA | |
| March 25, 1993 | NA | 5.6 | Scotts Mill, OR | |
| September 20, 1993 | NA | 5.9 and 6.0 | Klamath Falls, OR | |
| February 28, 2001 | NA | 6.8 | Near Olympia, WA | |

NA = Not Available

**Seismicity**

The geologic and seismologic information available for identifying the potential seismicity at the project area is incomplete, and large uncertainties are associated with any estimates of the probable magnitude, location, and frequency of occurrence of earthquakes that might affect the project. The information that is available indicates the potential seismic sources that may affect the project area can be grouped into three independent categories: *subduction zone events* related to sudden slip between the upper surface of the Juan de Fuca plate and the lower surface of the North American plate, *subcrustal events* related to deformation and volume changes within the subducted mass of the Juan de Fuca plate, and *local crustal events* associated with movement on shallow, local faults within and adjacent to the Portland Basin. Based on our review of currently available information, we have developed generalized design earthquakes for each of these categories. The design earthquakes are characterized by three important properties: size, location relative to the subject site, and the peak horizontal bedrock accelerations produced by the event.

**Subduction Zone Event.** Since subduction zone events have not occurred in the Pacific Northwest in historic times, estimates of their probable size, location, and frequency are generally based on comparisons of the Cascadia Subduction Zone with active convergent plate margins in other parts of the world and on geologic evidence that suggests seismic events of this type have likely occurred in the Pacific Northwest in the geologic past. Published estimates of the probable maximum size of subduction zone events range from moment magnitude $M_W = 8.3$ to $> 9.0$. Published information regarding the location and geometry of the subduction zone indicates that minimum focal distances (measured from the Klondike site) of approximately 150 miles are probable (Weaver and Shedlock, 1989). Published recurrence intervals, plus and minus one standard deviation, for these events range from 260 to 1,490 years (Adams, 1984 and 1990; Atwater, 1987 and 1988; Peterson and Darienzo, 1989 and 1991) with mean recurrence intervals of 500 to 600 years (Goldfinger, 2003). Tsunami data from Japan indicates the last Cascadia Subduction Zone event may have occurred in January 1700 (Satake, et al., 1996). Tsunami inundation in buried marshes along the Washington and Oregon coast and stratigraphic evidence from the Cascadia margin support these recurrence intervals (Goldfinger, 2003). For the purpose of this study, based on the location of the project and available published information, we have evaluated a subduction zone event with an earthquake of $M_W = 8.8$ at a focal distance of 150 miles. This corresponds to a sudden rupture of half of the length of the Juan de Fuca-North American plate interface, placed at the closest approach of the interface, due west of Portland. It should be noted that this choice of a design earthquake is based primarily on an estimate of the capability of the subduction zone to produce a large earthquake, not on a probabilistic analysis of a demonstrated seismic history. Based on the attenuation relationship published by Youngs, et al. (1997), a subduction zone event of this size and location would result in a peak horizontal bedrock acceleration of approximately 0.08 g at the site.

**Subcrustal Event.** Estimates of the probable size, location, and frequency of subcrustal events in the Pacific Northwest are generally based on comparisons of the Cascadia Subduction Zone with active convergent plate margins in other parts of the world and on the historical seismic record for the region surrounding Puget Sound, where significant events known to have occurred within the subducting Juan de Fuca plate have been recorded. Published estimates of the probable maximum size of these events range from moment magnitude $M_W$ = 7.0 to 7.5. The 1949, 1965, and 2001 documented subcrustal earthquakes in the Puget Sound area correspond to $M_W$ = 7.1, 6.5, and 6.8, respectively. Published information regarding the location and geometry of the subducting zone indicates that a focal depth of 30 miles and an epicentral distance of 100 miles from the project are probable (Weaver and Shedlock, 1989). For the purpose of this study, based on the location of the site and available published information, we have evaluated the subcrustal event with an earthquake of magnitude $M_W$ = 7.0 at an epicentral distance of about 100 miles. As with the subduction zone event, this choice is based on an estimate of the capability of the source region rather than on a probabilistic analysis of a historical record of events of this type. Based on an average of attenuation relationships published by Youngs, et al. (1997), and Atkinson and Boore (1997), a subcrustal event of this size would result in a peak horizontal bedrock acceleration of approximately 0.04 g at the site.

**Local Crustal Event.** Sudden crustal movements along relatively shallow, local faults in the Columbia-Deschutes Plateau area, though rare, have been responsible for local crustal earthquakes. The precise relationship between specific earthquakes and individual faults is not well understood, since few of the faults in the area are expressed at the ground surface, and the foci of the observed earthquakes have not been located with precision. The history of local seismic activity is commonly used as a basis for determining the size and frequency to be expected of local crustal events. Although the historical record of local earthquakes is relatively short (the earliest reported seismic event in the area occurred in 1866), it can serve as a guide for estimating the potential for seismic activity in the area.

Another method of estimating the magnitude to be expected of local crustal events involves an analysis of the lengths of local faults. The empirical relationship between fault rupture length and the magnitude of the resulting earthquake has been studied extensively (Matthiesen, 1984; Wells and Coppersmith, 1994). Based on the fault mapping of Quaternary faults conducted by Geomatrix for the Oregon Department of Transportation (1995) the closest mapped faults to the project (see Figure 4) are the following:

| Fault | Distance From, Project, miles | Mapped Length, miles | Characteristic Earthquake Magnitude, $M_w$ |
|---|---|---|---|
| Oak Flat-Luna Buttes Fault Zone | 7 | 24 | 6.5 |
| Arlington-Shutler Buttes Fault Zone | 12 | 42 | 6.5 |

The range of characteristic earthquake magnitudes depends on the geometry of the faults at depth and the degree to which the faults are segmented, neither of which is well understood. Based on the attenuation relationships of Boore, et al. (1997), Sadigh, et al. (1997), and Abrahamson and Silva (1997) for a magnitude 6.5 earthquake at a distance of 7 miles, the estimated peak horizontal bedrock accelerations at the site would be approximately 0.20 g. The latter relationships both include site effects and are typically biased toward larger magnitude earthquakes. For this study, in keeping with the intent of the 2003 International Building Code (IBC), we have used an assumed peak horizontal bedrock acceleration of 0.12 g, which is obtained by using two-thirds of the Maximum Considered Earthquake (MCE) based on the 1996 U.S. Geological Survey (USGS) probabilistic mapping effort.

### Summary of Deterministic Earthquake Parameters

In summary, we conclude that earthquakes of three different types, subduction zone, subcrustal and local crustal, affect the seismicity of the project area. Due to a lack of reliable historic record of local earthquakes, the seismic capability of the earthquake sources was used rather than a probabilistic evaluation of the individual faults. Published attenuation relationships were used to estimate the peak bedrock accelerations at the site. The basic parameters of the selected earthquakes are as follows:

| Earthquake Source | Attenuation Relationships for Target Spectra | Magnitude, $M_w$ | Epicentral Distance, miles | Focal Depth, miles | Peak Bedrock Acceleration, g | Assumed Peak Bedrock Acceleration, g |
|---|---|---|---|---|---|---|
| Subduction Zone | Youngs, et al., 1997 | 8.8 | 150 | 15 | 0.05 | 0.05 |
| Subcrustal | Youngs, et al., 1997 | 7 | 100 | 30 | 0.04 | 0.02 |
| | Atkinson and Boore, 1997 | 7 | 100 | NA | 0.007 | |
| Local Crustal | Sadigh, et. al., 1997 | 6.5 | 10 | NA | 0.21 | 0.12 |
| | Boore, et al., 1997 | 6.5 | 10 | NA | 0.19 | |
| | Abrahamson and Silva 1997 | 6.5 | 10 | NA | 0.20 | |

**Probabilistic Considerations**

The probability of an earthquake of a specific magnitude occurring at a given location is commonly expressed by its return period, i.e., the average length of time between successive occurrences of an earthquake of that size or larger at that location. The return period of a design earthquake can be calculated once a project design life and some measure of the acceptable risk that the design earthquake might occur or be exceeded are specified. These expected earthquake recurrences are expressed as a probability of exceedance during a given time period or design life. Historically, building codes have adopted an acceptable risk level by identifying ground acceleration values that meet or exceed a 10% probability of exceedance in 50 years, which corresponds to an earthquake with an expected recurrence interval of 475 years. The recently adopted International Building Code (IBC, 2003) develops a design spectrum by using two-thirds of the Maximum Considered Earthquake (MCE) ground motion. The MCE earthquake combines probabilistic earthquakes with a 2% probability of exceedance in 50 years (return period of about 2,500 years) with modifications for deterministic ground motions, where necessary (Leyendecker, et al., 2000). The change to a MCE was an effort to reduce the risk of building collapse in portions of the country where the earthquake with a 2,500-year recurrence interval is significantly larger than the standard code recurrence interval of 475 years.

It is important to recognize the origin of the two-thirds reduction factor incorporated in the IBC code is a function of the "seismic margin" identified in the 1997 National Earthquake Hazards Reduction Program (NEHRP) commentary. The seismic margin of 1.5 is recognized as the inherent factor of safety in the code. In this regard, if a structure is subjected to a ground motion of 1.5 times the design level, the structure should still have a low likelihood of collapse.

The ground motion parameters for the IBC were adopted from the 1997 NEHRP regulations, which were based on the 1996 U.S. Geological Survey (USGS) probabilistic mapping effort. The USGS mapping proportions the likelihood of movement for all identified seismic sources (i.e., local crustal, subcrustal, and subduction zone earthquakes) and probabilistically averages the results into a single acceleration response spectrum curve. The USGS seismic work provides response spectra for both the 2% and 10% in 50-year earthquakes. The peak bedrock accelerations at the site are 0.19 g and 0.09 g for the 2% and 10% in 50-year earthquakes, respectively. As described below, earthquake motions were also chosen to match the spectral shapes from this probabilistic work for a comparison to the deterministic shapes developed from the chosen attenuation relationships.

**Estimated Site Response**

A series of acceleration-time histories (commonly referred to as "accelerograms") of well-studied earthquakes have been selected to represent each of the seismic events described above. These events were selected from the current inventory of the National Geophysical Data Center (NGDC) in Boulder, Colorado, and from the records available from the California Division of Mines and Geology in Sacramento, California. From the available records, corrected free-field and basement/ground floor accelerograms were chosen to match the spectral shape of the aforementioned attenuation relationships or probabilistic spectra. Wherever possible, earthquakes of similar magnitude and duration were chosen to match the target spectra for each respective earthquake type. These records were checked for obvious errors, missing data points, and other anomalies and were transformed into a uniform data format. The selected strong-motion records are as follows:

***SUBDUCTION ZONE EVENT***

| Earthquake | Recording Station | Magnitude | Focal Distance, mi | Peak Bedrock Acceleration, g |
|---|---|---|---|---|
| El Salvador | San Miguel | 7.6 ($M_S$) | 55 | 0.12 |
| Michoacan | La Union | 8.1 ($M_S$) | 50 | 0.17 |
| Nihonkai | Frofushi | 7.7 ($M_{JMA}$) | 44 | 0.23 |
| Santiago | Univ of Chile | 7.9 ($M_S$) | 80 | 0.16 |
| Valparaiso | Llolleo | 7.8 ($M_S$) | 44 | 0.45 |

***SUBCRUSTAL EVENT***

| Earthquake | Recording Station | Magnitude | Focal Distance, mi | Peak Bedrock Acceleration, g |
|---|---|---|---|---|
| Lima, Peru | Arequipa | 7.6 ($M_S$) | 50 | 0.20 |
| Nihonkai-Chuba | Frofushi | 7.7 ($M_{JMA}$) | 44 | 0.15 |
| Northridge | Santa Monica | 6.7 ($M_S$) | 13 | 0.37 |
| Puget Sound | Olympia | 6.7 ($M_S$) | 53 | 0.20 |
| Santiago, Chile | Univ. of Chile | 7.9 ($M_S$) | 80 | 0.16 |
| San Fernando | Lankershim Blvd. | 6.6 ($M_L$) | 17 | 0.17 |

***LOCAL CRUSTAL EVENT***

| Earthquake | Recording Station | Magnitude | Focal Distance, mi | Peak Bedrock Acceleration, g |
|---|---|---|---|---|
| Imperial Valley | El Centro | 5.2 ($M_W$) | 17 | 0.15 |
| Lima, Peru | Arequipa | 7.6 ($M_W$) | 50 | 0.18 |
| Morgan Hill | Mission Trails | 6.2 ($M_L$) | 24 | 0.21 |
| Whittier Narrows | 4407 Jasper St. | 6.1 ($M_L$) | 7 | 0.22 |

The effect of a specific seismic event on the site is related to the type and thickness of soil overlying the bedrock and to the type and quantity of seismic energy delivered to the bedrock beneath the site by the earthquake. A generalized model of the subsurface profile beneath the site was developed by GRI based on subsurface explorations in the project area by Barr (2004), available water well logs provided by the Oregon Water Resources Department, and shear wave velocities measured at the site by NORCAL Geophysical Consultants for Barr's investigation. The generalized soil profile developed by GRI is summarized below.

| Soil Type | Thickness, ft | Unit Weight, pcf | Shear Wave Velocity, ft/sec |
|---|---|---|---|
| Silt | 10 | 100 | 825 |
| Weathered Basalt | 20 | 135 to 140 | 825 to 2,115 |
| Basalt | undefined | 160 | 4,000 |

Based on the generalized subsurface profile described above, the peak bedrock accelerations estimated for the design events, and the strong-motion records listed in the preceding tables, pseudoacceleration response spectra have been prepared using PROSHAKE. The spectra were produced for a ground surface elevation corresponding to the proposed building foundations, damped at 5% of critical damping, from the larger horizontal component of each of the strong-motion records, and scaled to match the estimated peak horizontal bedrock accelerations of the earthquake events.

## Seismic Hazard Conclusions

The results of our site-specific seismic study indicate that for the varied conditions existing at this site, the peak horizontal ground accelerations are generated by the local crustal model. This condition resulted in a mean peak horizontal ground acceleration of 0.16 g, which exceeds the IBC design spectrum for site class B at the 0.0-second period. The IBC site class B spectrum appears appropriate for all other periods.

Based on our review of local geology, there are no mapped faults on the site, and in our opinion, the risk of ground rupture due to fault displacement in the project area is low.

The proposed wind farm is located on relatively flat or gradually sloped terrain. In addition, rock is present at shallow depths, and the groundwater table is deep. Considering these site conditions, it is our opinion that the potential for earthquake-induced landslides, lateral spreading, liquefaction and settlement/subsidence at the site are low.

The project area is not located near any large water bodies and is over 1,000 feet above the Columbia River. The risk of damage by tsunamis and/or seiches at the site is absent.

As discussed in the previous section, it is our opinion that the risk of seismic hazards, such as slope instability, ground rupture, liquefaction, and settlement or subsidence, is low. As a result, mitigation measures to address these hazards in the siting, design, and construction of the project are not necessary.

GRI's site response studies indicate that the input of seismic energy into the bedrock beneath the silt will result in some amplification of the energy at the ground surface. The resulting estimated peak ground acceleration (PGA) is about 0.16 g. Based on our past experience, ground accelerations of this magnitude can be readily accommodated in the design of the turbine tower structures. It has also been our experience that transient wind loading on turbine towers and wind and ice loading on transmission line towers will be the more severe loading conditions that will govern the design of the tower structures.

## Non-Seismic Geologic Hazards

The planned Klondike III turbine towers, as shown on Figure 2, have been sited on relatively flat to very gradually sloping terrain. In addition, the regional groundwater table is located several tens of feet below the ground surface, and basalt bedrock occurs at shallow depths. Considering these conditions, it is our opinion that slope instability and landsliding are not geologic hazards that will impact the wind project and associated infrastructure.

The project area is mantled with wind-deposited silt soil known as loess. The silt particles are of relatively uniform size and the silt usually has sufficient cohesion, or undrained shear strength, so that excavations made in the material can stand on near-vertical slopes. True loess soils have never been submerged. When loaded by conventional spread footings and subsequently saturated, the bond between the soil particles becomes weakened and the soil structure altered which can result in large settlements at the ground surface.

## Mitigation of Non-Seismic Geologic Hazards

With the possible exception of the presence of loess soils, the work completed by GRI has not identified non-seismic geologic hazards that will require special consideration in the siting, design, and construction of the Klondike III Wind Project.

The presence of loess soils can be readily accommodated during foundation design by several conventional methods that include: (1) establishing spread foundations below the loess, (2) drilled shaft foundations that develop support in the materials below the loess; (3) removal of the loess and replacement with compacted fill; and/or (4) in situ improvements of the loess soils. It is understood that one or more of these approaches have been used in the design and construction of the foundations for the existing turbine towers at the project.

## VI. FUTURE INVESTIGATIONS

GRI has completed an evaluation of the geologic conditions and seismicity of the planned Klondike III Wind Project area. As discussed previously, the scope of work was completed to characterize the general geologic conditions of the site and vicinity, and the associated seismicity for the purpose of identifying potential geologic and seismic hazards that could affect siting and design of project elements. As such, the findings in this report are somewhat preliminary in nature. For this reason, additional site-specific investigations should be completed for the final design of the project. The additional work will likely include the following investigations.

### Wind Farm Area

A geotechnical investigation will be undertaken to investigate the subsurface and foundation support conditions at the locations of the turbine towers and other significant structures. The investigation will likely include exploration borings and/or test pit excavations, laboratory testing, engineering analyses, and the development of feasible foundation types and associated design criteria to mitigate the loess soils. Seismic design criteria should also be reviewed and modified, if appropriate, based on the subsurface conditions disclosed by the subsurface explorations.

## VII. LIMITATIONS

This report has been prepared to aid in the preliminary assessment of this project. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects of the project relevant to the feasibility of constructing the proposed wind farm.

With respect to the work performed by others, GRI did not participate in the implementation of the work and did not independently verify the accuracy or completeness of the information provided. GRI makes no representations or warranty regarding instruments of service completed by others.

The information provided herein is for preliminary assessment only and is not intended for design or construction of the project. Additional geotechnical investigations will be necessary to develop guidelines for final design of this project.

## VIII. LIST OF PREPARERS

This report was prepared by the following GRI personnel.

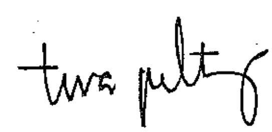
**Dwight J. Hardin, PE,** served as principal-in-charge and principal geotechnical engineer. He has 33 years of geotechnical engineering experience and has directed the geotechnical services for numerous tower structures, including wind turbine towers, and over 1,500 miles of high-voltage transmission lines.

**George A. Freitag, PG, CEG,** served as project manager and senior engineering geologist. He has 18 years of experience and has evaluated geologic and seismic hazards for numerous projects in the Pacific Northwest.

**Tova R. Peltz** served as staff geologist and staff engineer. She has completed the seismic hazard and site response analysis for at least 25 projects in Oregon.

## IX. SIGNATURES





Dwight J. Hardin, PE
Principal

George A. Freitag, PG, CEG
Associate

Tova R. Peltz
Staff Engineer

## X. REFERENCES


Abrahamson, N.A., and Silva, W.L., 1997, Empirical response spectral attenuation relations for shallow crustal earthquakes: Seismological Research Letters, v. 68, no. 1, pp. 94-127.

Adams, J., 1984, Active deformation of the Pacific Northwest continental margin: Tectonics, v. 3, p. 449-472.

__________, 1990, Paleoseismicity of the Cascadia subduction zone: Evidence from turbidites off the Oregon-Washington margin: Tectonics, v. 9, no. 4, p. 569-583.

Atkinson, G.M., and Boore, D.M., 1997, Stochastic point-source modeling of ground motions in the Cascadia region: Seismological Research Letters, v. 68, no. 1, pp. 74-85.

Atwater, B.F., 1987, Evidence for great Holocene earthquakes along the outer coast of Washington State: Science, v. 236, p. 942-944.

_________, 1988, Geologic studies for seismic zonation of the Puget Lowland: U.S. Geological Survey Open-File Report, v. 25, p. 120-133.

Barr Engineering Company, 2004, Geotechnical Engineering Report, Klondike Wind Power II Project, Wasco, Oregon: prepared for PPM Energy, Portland, Oregon.

Bela, J.L., 1982, Geologic Compilation Map of The Dalles 1° by 2° Quadrangle, Oregon and Washington: Oregon Department of Geology and Mineral Resources Geologic Map Series GMS-27.

Beaulieu, J.D., 1977, Geologic Hazards of Parts of Northern Hood River, Wasco, and Sherman Counties, Oregon: Oregon Department of Geology and Mineral Resources Bulletin B-91.

Beeson, M.H., Tolan, T. L., and Anderson, J. L., 1989, The Columbia River Basalt Group in western Oregon; geologic structures and other factors that controlled flow emplacement patterns, in Reidel, S. P., and Hooper, P. R., eds., Volcanism and tectonism in the Columbia River flood-basalt province. Geological Society of America Special Paper 239.

Boore, D.M., Joyner, W.B., and Fumal, T.E., 1997, Equations for estimating horizontal response spectra and peak acceleration from western North American earthquakes: a summary of recent work: Seismological Research Letters, v. 68, no. 1, p. 128-153.

Couch, R.W., Johnson, S., and Gallagher, J., 1968, The Portland earthquake of May 13, 1968, and earthquake energy release in the Portland area: The Ore Bin (Oregon Department of Geology and Mineral Industries), v. 30, no. 10, p. 185-190.

Dragert, H., Hyndman, R.D., Rogers, G.C., and Wang, K., 1994, Current deformations and the width of the seismogenic zone of the northern Cascade subduction thrust: Journal of Geophysical Research, vol. 99, pp. 653-668.

Earthquake Engineering Research Institute (EERI), 1993, The Klamath Falls, Oregon Earthquake of September 20, 1993: EERI Special Earthquake Report.

Geomatrix Consultants/Oregon Department of Transportation, 1995, Seismic Design Mapping for the State of Oregon: Geomatrix Consultants.

Goldfinger, C., 2003, Presentation at 2003 EERI National Conference, Portland, Oregon: Great Earthquakes in Cascadia, a Who Dunnit Success Story.

Haines, Don, Technical Representative, Oregon Department of Geology and Mineral Industries. February 7, 2005. Telephone Interview.

International Code Council, 2003, International building code: Building Officials and Code Administrators International, Inc., International Conference of Building Officials, Southern Building Code Congress International.

Jenks, Margi, Librarian, Oregon Department of Geology and Mineral Industries. February 11, 2005. Meeting.

Johnson, A.G., Scofield, D.H. and Madin, I.P., 1994, Earthquake database for Oregon, 1883-October 25, 1994: Oregon Department of Geology and Mineral Industries Open-File Report 0-94-04.

Matthiesen, R.B., 1984, Recommendations concerning seismic design and zonation, in Critical Aspects of Earthquake Ground Motion and Building Damage Potential, ATC-10, pp. 213-246.

Newcomb, R.C., 1966, Lithology and Eastward Extension of The Dalles Formation, Oregon and Washington: USGS Professional Paper, 550-D, p. 59-63.

Niewendorp, C.A. and Neuhaus, M.E., 2003, Map of Selected Earthquakes for Oregon, 1841-2002: Oregon Department of Geology and Mineral Resources Open-File Report OFR-03-02.

Peterson, C.D., and Darienzo, M.E., 1989, Discrimination of flood, storm and tectonic forcing of marsh burial events from Alsea Bay, Oregon: Final (unpublished) Report to the National Earthquake Hazards Reduction Program, p. 1-33.

_________, 1991, Episodic tectonic subsidence of late Holocene salt marshes, northern Oregon coast, central Cascadia margin, USA: Tectonics, v. 8.

Sadigh, K., Chang, C.Y., Egan, J.A., and Makdisi, F.I., and Youngs, R.R., 1997, Attenuation relationships for shallow crustal earthquakes based on California strong motion data: Seismological Research Letters, v. 68, no. 1, pp. 180-189, January/February.

Satake, K., Shimazaki, K., Tsuji, Y., and Ueda, K., January 18, 1996, Time and size of a giant earthquake in Cascadia inferred from Japanese tsunami records of January 1700: Nature, V.379, pp. 246-249.

USGS, 1996, Probabilistic hazard lookup by zip code: U.S. Geological Survey, http://eqhazmaps.usgs.gov/html/zipcode.html.

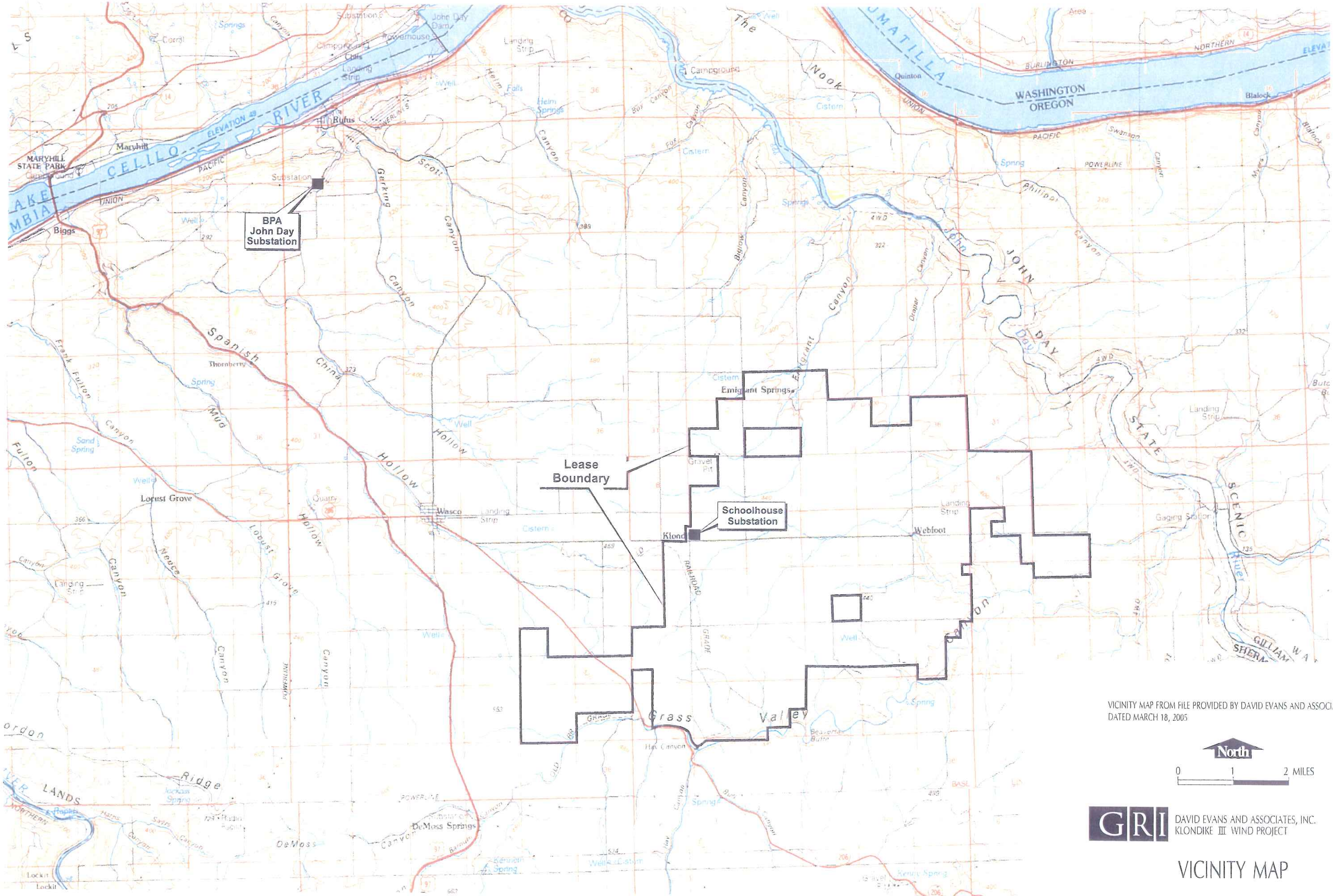
Walker, G.W., and MacLeod, N.S., 1991, Geologic map of Oregon: U.S. Geological Survey, scale 1:500,000.

Walsh, T.J., Korosec, M.A., Phillips, W.M., Logan, R.L., and Schasse, H.W., 1987, Geologic Map of Washington – Southwest Quadrant: Washington Division of Geology and Earth Resources Geologic Map GM-34.

Weaver, C.S., and Shedlock, K.M., 1989, Potential subduction, probable intraplate and known crustal earthquake source areas in the Cascadia subduction zone: U.S. Geological Survey Open File Report 89-465, pp. 11-26

Wells, D.L., and Coppersmith, K.J., 1994, New empirical relationships among magnitude, rupture length, rupture width, rupture area, and surface displacement: Bulletin of the Seismological Society of America, v. 84, no. 4, p. 974-1002.

Youngs, R.R., Chiou, S.J., Silva, W.J. and Humphrey, J.R., 1997, Strong ground motion attenuation relationships for subduction zone earthquakes: Seismological Research Letters, vol 68, no 1.




VICINITY MAP FROM FILE PROVIDED BY DAVID EVANS AND ASSOCIATES, INC., DATED MARCH 18, 2005

North

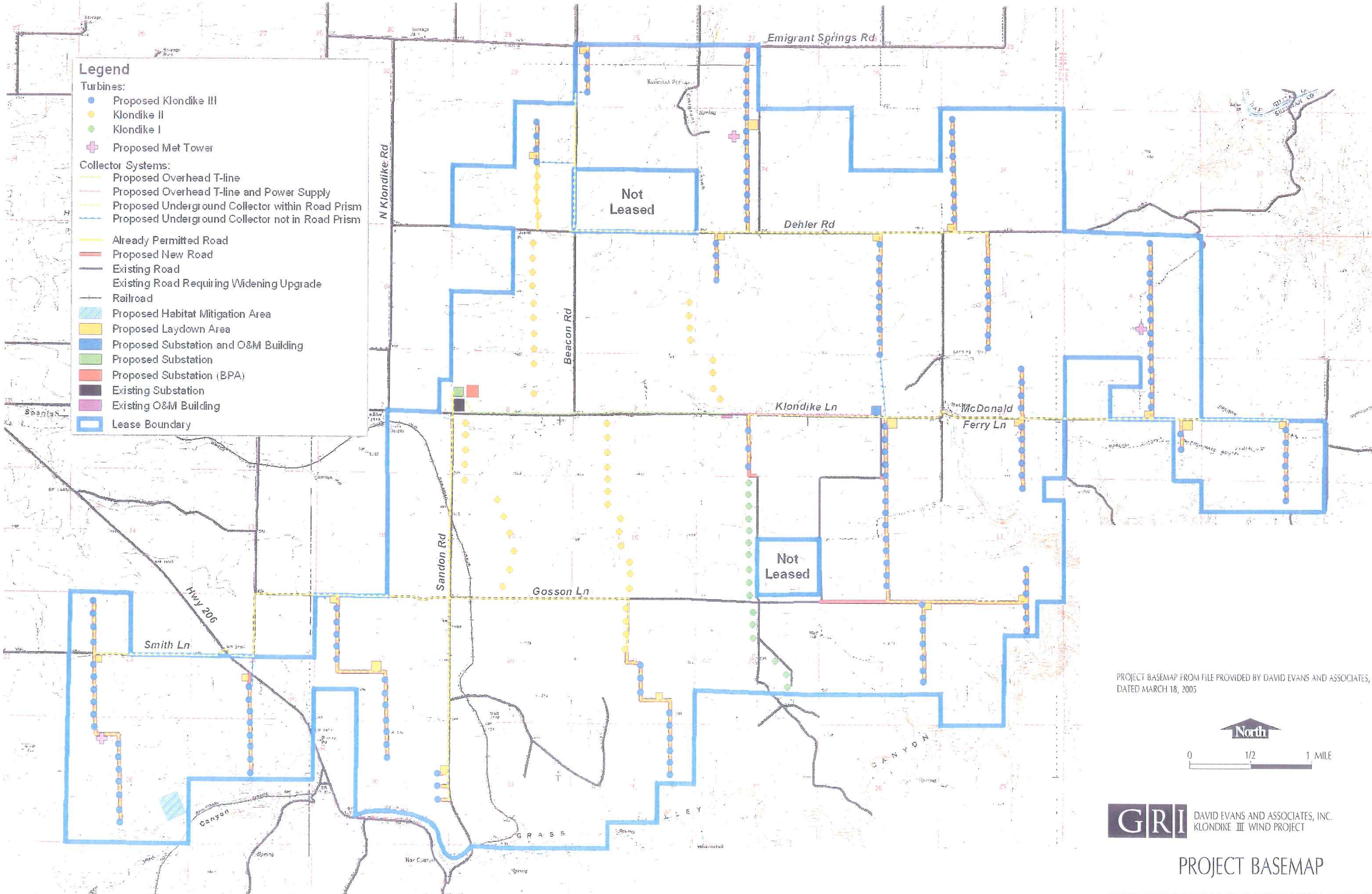
0 1 2 MILES

GRI

DAVID EVANS AND ASSOCIATES, INC.
KLONDIKE III WIND PROJECT

# VICINITY MAP

MAR. 2005 | JOB NO. 4207 | FIG. 1

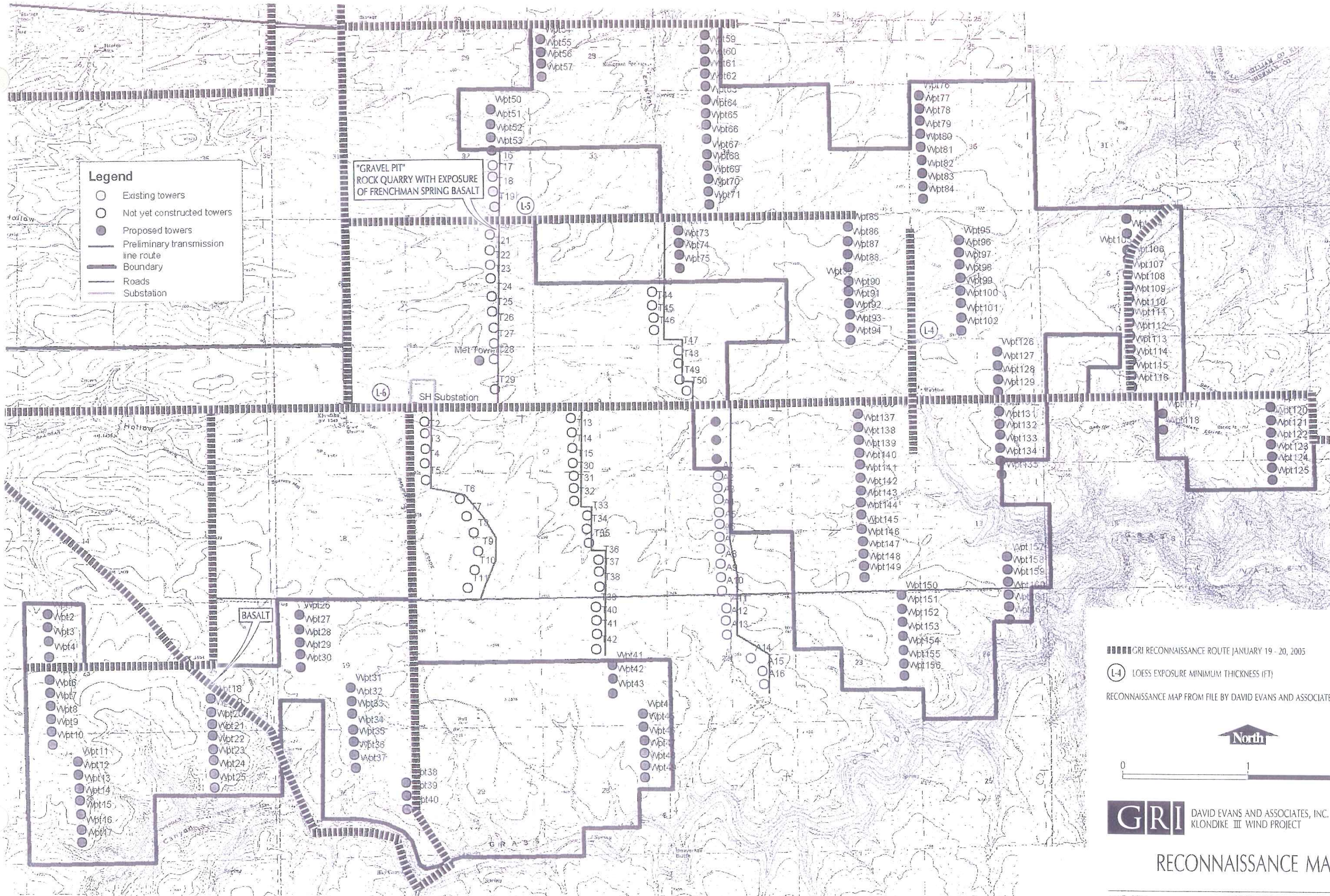



PROJECT BASEMAP FROM FILE PROVIDED BY DAVID EVANS AND ASSOCIATES, INC., DATED MARCH 18, 2005

GRI DAVID EVANS AND ASSOCIATES, INC.
KLONDIKE III WIND PROJECT

PROJECT BASEMAP

MAR. 2005 JOB NO. 4207 FIG. 2




GRI DAVID EVANS AND ASSOCIATES, INC.
KLONDIKE III WIND PROJECT

# RECONNAISSANCE MAP

MAR. 2005 | JOB NO. 4207 | FIG. 3


Qs — Sedimentary deposits (Quaternary)
Qls — Landslide Debris
Qfg — Catastrophic flood deposits
Qtb — Olivine basalt and andesite (upper Miocene-Quaternary)

Tda — Dalles Group, Alkali Canyon Formation – Poorly sorted, basaltic cobble gravel and minor interbedded tuffaceous sand and silt; commonly carbonate cemented.

Tdc — Dalles Group, Chenoweth Formation – Volcaniclastic and sedimentary rock consistng primarily of laharic deposits.

Tp — Columbia River Basalt Group, Pomona Member
Tpr — Columbia River Basalt Group, Priest Rapids Member
Tr — Columbia River Basalt Group, Roza Member
Tf — Columbia River Basalt Group, Frenchman Springs Member
Tg — Columbia River Basalt Group, Grande Ronde Member

Geologic Compilation Map of The Dalles 1° and 2° Quadrangle, Oregon and Washington
J.L. Bela, 1982 DOGAMI GMS-27

North

0 — 5 — 10 MILES

0 — 5 — 10 KILOMETERS

GRI
DAVID EVANS AND ASSOCIATES, INC.
KLONDIKE III WIND PROJECT

# GEOLOGIC MAP

MAR. 2005 | JOB NO. 4207 | FIG. 4

# EXHIBIT I

## SOILS
OAR 345-021-0010(1)(i)

## TABLE OF CONTENTS

## I.1 INTRODUCTION

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

Response: The evidence below demonstrates that facility construction and operation will not result in significant adverse impacts to soils. The potential for erosion during facility construction will be minimized by adhering to an erosion control plan and NPDES 1200-C construction permit. Further, all areas of temporary soil disturbance and vegetation removal will be reclaimed through reseeding of native vegetation or crops to protect against loss of soil to erosion.

## I.2 IDENTIFICATION AND DESCRIPTION OF SOIL TYPES

**OAR-345-021-0010(1)(i)(A)** *Identification and description of the major soil types at the site and its vicinity;*

Response: The near surface soils at the project site and in its vicinity were identified using the U.S. Soil Conservation Service (SCS) Soil Survey of Sherman County, Oregon. The soils in the project area are grouped into four General Soil Units – Walla Walla-Anderly, Wrentham-Lickskillet-Rock Outcrop, Lickskillet-Nansene, and Mikkalo-Ritzville. Each of these general soil units is comprised of several soil series units, which are mapped at a greater level of detail but share relatively similar spatial coverage and engineering properties as the more General Soil Unit. Figure I-1 shows the soil series map and Table I-1 provides a list of soil series within the project site and vicinity.

The Walla Walla-Anderly series soils are extensive on mesas in the north-central part of Sherman County in mostly flat and gently sloping areas. They have formed from loess over basalt in a 12- to 13-inch precipitation zone. This General Soil Unit is approximately 73 percent Walla Walla soils and 22 percent Anderly soils. The rest is soils of minor extent. Walla Walla soils are very deep or deep and are well drained. The surface layer is very dark brown silt loam. The subsoil is dark brown silt loam. Anderly soils are moderately deep and well drained. The surface layer is very dark grayish brown silt loam. The subsoil is dark brown silt loam. Of minor extent in this unit are very deep Endersby soils on terraces, very deep Hermiston soils on flood plains, and shallow Kuhl soils on north-facing canyonsides. The soils in this unit are used mainly for wheat, barley, alfalfa hay, and as pasture. Areas too steep for cultivation are used for livestock grazing and as wildlife habitat.

Wrentham-Lickskillet-Rock Outcrop series soils are moderately deep to shallow, well drained silt loam and very stony loam that formed over basalt and in residuum derived from basalt in an 11- to 12-inch precipitation zone. They occur mainly in canyons. This map unit is adjacent to the Deschutes and John Day Rivers, in the southern part of the county. This map unit consists of about 30 percent Wrentham soils, 30 percent Lickskillet soils, and 26 percent Rock outcrop. Wrentham soils are moderately deep and well drained. The surface layer is very dark brown silt loam. The subsoil is dark brown extremely cobbly silt loam. Lickskillet soils are shallow and well drained. The surface layer is very dark grayish brown very stony loam. The upper part of the subsoil is dark brown very gravelly loam, and the lower part is dark brown very gravelly clay loam, very gravelly loam, or very cobbly loam. Rock outcrop consists of areas of exposed bedrock on the shoulders and convex side slopes of very steep canyons. The soils in this unit are used mainly for livestock grazing and as wildlife habitat.

Lickskillet-Nansene series soils are composed of shallow to deep, well drained, very stony loam and silt loam that have formed in residuum derived from basalt and in loess over basalt in a 12- to 13-inch precipitation zone. This map unit is located in the northern part of Sherman County. It is about 45 percent Lickskillet soils and 12 percent Nansene soils. The rest consists of soils of minor extent. Lickskillet soils are shallow and well drained. The surface layer is very dark grayish brown very stony loam. The upper part of the subsoil is dark brown very gravelly loam, and the lower part is dark brown very gravelly clay loam, very gravelly loam, or very cobbly loam. Nansene soils are deep and well drained. The surface layer and subsoil are very dark brown silt loam. The substratum is dark brown silt loam. Of minor extent in this unit are very shallow Bakeoven soils on ridgetops and benches of canyons, very deep Sagemoor soils on dissected terraces, and moderately deep Wrentham soils on north-facing canyonsides. The soils in this unit are used mainly for livestock grazing and as wildlife habitat.

The Mikkalo-Ritzville General Soil Unit consists of moderately deep and deep, well-drained silt loam that has formed in loess over basalt in a 9- to 11-inch precipitation zone, typically on mesas. This map unit is in the northeastern corner of the survey area. It is about 56 percent Mikkalo soils and 38 percent Ritzville soils. The rest is soils of minor extent. Mikkalo soils are moderately deep and well drained. The surface layer is very dark grayish brown silt loam. The subsoil is dark brown, calcareous silt loam. Ritzville soils are deep and well drained. The surface layer is dark brown silt loam. The subsoil is dark yellowish brown, calcareous silt loam. Of minor extent in this unit are shallow Lickskillet Soils. The soils in this unit are used mainly for wheat and barley grown in a grain-summer fallow system. Areas too steep for cultivation are used for livestock grazing and as wildlife habitat.

## I.3 IDENTIFICATION AND DESCRIPTION OF LAND USES

**OAR-345-021-0010(1)(i)(B)** *Identification and description of any land uses on the proposed site and its vicinity, such as growing crops, that require or depend on productive soils;*

Response: The project site and vicinity consist of private agricultural land generally used for dryland wheat production. Portions of the land have also been enrolled in the Conservation Reserve Program (CRP). Over 14,500 acres are currently being leased by Klondike III, but permanent facilities, in the aggregate, will occupy approximately 70 acres of the property. Facility construction will temporarily disturb an additional 46 acres.

## I.4 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: Unavoidable impacts to soils will result from placement of permanent project facilities on approximately 70 acres of soil. Additionally, facility construction will temporarily disturb 55 acres (including soil disturbing activities that may be needed for 2 acres of habitat enhancement mitigation). These soil impacts will be limited, however, according to the methods discussed below.

The majority of the project site consists of agricultural fields where bare soils are often exposed to wind and water. This project will not significantly increase the amount of exposed soils. Based on the soil types present, soil erosion potential at the facility site varies, being high in some areas and not high in others (USDA 1964; Table I-1). Currently, the land at the project site consists primarily of plowed cropland and to a lesser extent, other vegetation.

Soil disturbance resulting from the project will be either permanent or temporary. Permanent impacts include activities such as road construction (with associated underground collector system) and turbine pad construction, which may require the removal of surface vegetation, and thus expose soils. Turbine pad areas will be covered with non-erosive material, such as gravel or concrete, immediately following exposure, thereby limiting the time for wind or water erosion to soils stockpiled from turbine pad excavation.

Temporary impacts are associated with creation of staging areas and excavation for underground collector cables not associated with roads. To minimize exposure of soils to the elements during installation of the collector system, the Applicant will endeavor to open only as much trench in a day as can be excavated and backfilled; in no case will a trench remain open for more than the 7 days allowed by the general NPDES permit 1200-C. Establishing staging areas will involve stripping and temporarily stockpiling the topsoil before placing gravel on the laydown areas. Because stockpiling will occur during the time of year when rainfall is lowest, very little erosion will result from precipitation. Best management practices will be used to minimize the impacts of wind erosion. In actively cropped areas, the wheat crop will protect the stockpiles from wind erosion. In other areas, haybales or others similar containment will be provided. As needed, water trucks will be used to keep wind borne erosion losses to a minimum. After the need for the staging area is over, the site will be brought back to its original contours, topsoil will be spread on the site, and normal cropping or revegetation will occur. Any disturbed Conservation Reserve Program (CRP) areas and other non-cropped vegetated areas will be revegetated with the appropriate species.

Construction will require the use of heavy equipment and haul trucks to deliver aggregate, concrete, water, and similar materials. The repeated traffic of heavy machinery could cause localized soil compaction. To minimize compaction, truck traffic will be limited to designated existing and improved road surfaces, whenever feasible. Any compacted soils outside of the permanent project footprint will be restored.

In the event of decommissioning, potential erosion hazards would be similar to those occurring during its construction. As turbine towers and supporting facilities are removed, soil would be exposed to wind and water erosion due to lack of vegetation. Decommissioning requirements would include strict implementation of erosion control measures when soil is exposed to prevent this occurrence. In addition to revegetation requirements, the measures are likely to include the use of silt fences, straw bales, watering, check dams, and other similar erosion control methods.

Because no cooling towers are needed and no wastewater will be generated, no soil impacts are expected from chemical factors during construction, operation, or retirement. There will be minimal amounts of chemicals used at the facility site such as lubricating oils and cleaners for the turbines and pesticides for weed control. These materials are discussed further in Exhibit G. Chemicals will be stored on site according to all applicable requirements and regulations to limit the risk of adverse effects due to chemical factors. The risk of a chemical spill is negligible and the impacts of any such spill would be limited due to the small amounts of chemicals that will be transported to the facility site. In accordance with NPDES 1200-C, any use of toxic or other hazardous materials will include proper storage, application, and disposal. See Exhibit G for a discussion of precautions that will be taken in handling hazardous materials such as lubricating oils and the equipment that will be on site in the unlikely event of a chemical spill.

## I.5 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; and*

Response: Direct permanent impacts to soil due to turbine footprints will be unavoidable. Construction of all features of the project will be in compliance with an erosion control plan and NPDES 1200-C construction permit (See Exhibit I-2) that will require best management practices to minimize possible impacts from erosion.

Impacts from roads will be minimized by using existing roads wherever possible. Work on the access roads will include grading and regraveling existing roads and construction of new roads. Erosion control measures to be installed during the work on the access roads include:

- Not removing vegetation unless absolutely necessary and not removing existing vegetation any sooner than is absolutely necessary.
- Maintaining vegetative buffer strips between the areas impacted by construction activities and any receiving waters.
- Installing sediment fence/straw bale barriers to filter sediments prior to reaching waters of the U.S. and/or the State where necessary.

- Surfacing the areas with gravel or other non-erodible surface as quickly as possible.
- Planting designated seed mixes at impacted areas adjacent to the roads.
- Watering roads and exposed soils in dry weather when wind exposure may cause erosion.

All non-agricultural areas that are impacted by the construction will be seeded when there is adequate soil moisture. Sediment fences, straw bale barriers, and other erosion control measures will remain in place until the impacted areas are vegetated and the risk of erosion has been eliminated.

To the extent possible, haul truck traffic will be limited to improved road surfaces, limiting soil compaction and disturbances. Proper erosion control methods will be employed to limit soil loss due to water and wind action, and all areas of temporary disturbance will be reclaimed at the end of construction activities.

Should the facility be retired, the turbines will be removed and soil surfaces will be restored to their condition prior to construction, with the exception of the improved farm roads. The retirement plan is described in Exhibit W. The decision whether to reclaim new or expanded access roads will be left to the individual landowners.

## I.6 MONITORING PROGRAM

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

Response: The majority of the project site consists of agricultural fields where bare soils are often exposed to wind and water. This project will not significantly increase the amount of exposed soils within the 14,500-acre leased area. Impacts to soils due to facility construction and operation will be limited through the mitigation efforts required by an erosion control plan and NPDES 1200-C construction permit (see Appendix I-2 for permit application). The 1200-C permit will require monitoring through observation of erosion control methods periodically and after significant precipitation events. When visual observations reveal the need, maintenance or repair of erosion control measures during construction and operation of the facilities will be undertaken. When construction is complete, all temporarily disturbed areas will be re-seeded. If problem areas are observed, mitigation and reclamation measures will be implemented and a formal monitoring program will be established in the problem areas.

## I.7 CONCLUSION

The information provided in this exhibit describe soils on the site and potential impacts in detail. The Applicant will prevent impacts on soil by using existing roads and restoring temporarily disturbed areas. These preventive measures and erosion control measures described in the 1200-C permit application will ensure the impacts on soils are insignificant. Therefore the Applicant has met this standard, the Council may find that the standard contained in OAR 345-022-0022 is satisfied.

## I.8 REFERENCES

U.S. Department of Agriculture (USDA). 1964. *Soil Survey of Sherman County, Oregon.* Soil Conservation Service.

**Table I-1. Detailed soil map units present on project site and their properties**

| Soil Series | Drainage Class | Erosion Potential |
|---|---|---|
| Anderly silt loam, 1 to 7 percent slopes | Well drained | Highly |
| Anderly silt loam, 7 to 15 percent slopes | Well drained | Highly |
| Anderly silt loam, 15 to 35 percent south slopes | Well drained | Highly |
| Endersby fine sandy loam, 0 to 3 percent slopes | Somewhat excessively drained | Not highly |
| Endersby-Hermiston complex, 0 to 3 percent slopes | Well drained | Not highly |
| Kuhl very stony very fine sandy loam, 3 to 20 percent slopes | Well drained | Highly |
| Lickskillet-Rock outcrop complex, 40 to 70 percent south slopes | Well drained | Not highly |
| Lickskillet very stony loam, 7 to 40 percent south slopes | Well drained | Not highly |
| Lickskillet-Bakeoven complex, 2 to 20 percent slopes | Well drained | Not highly |
| Mikkalo silt loam, 2 to 7 percent slopes | Well drained | Highly |
| Mikkalo silt loam, 7 to 15 percent slopes | Well drained | Highly |
| Nansene-Rock outcrop complex, 35 to 70 percent north slopes | Well drained | Not highly |
| Ritzville silt loam, 2 to 7 percent slopes | Well drained | Not highly |
| Ritzville silt loam, 7 to 15 percent slopes | Well drained | Not highly |
| Rock outcrop-Rubble land-Lickskillet complex, 50 to 80 percent south slopes | Well drained | Not highly |
| Walla Walla silt loam, 1 to 7 percent slopes | Well drained | Not highly |
| Walla Walla silt loam, 7 to 15 percent slopes | Well drained | Not highly |
| Walla Walla silt loam, 15 to 35 percent north slopes | Well drained | Not highly |
| Wato very fine sandy loam, 3 to 7 percent slopes | Well drained | Not highly |
| Wato very fine sandy loam, 7 to 15 percent slopes | Well drained | Not highly |

# Appendix I-1

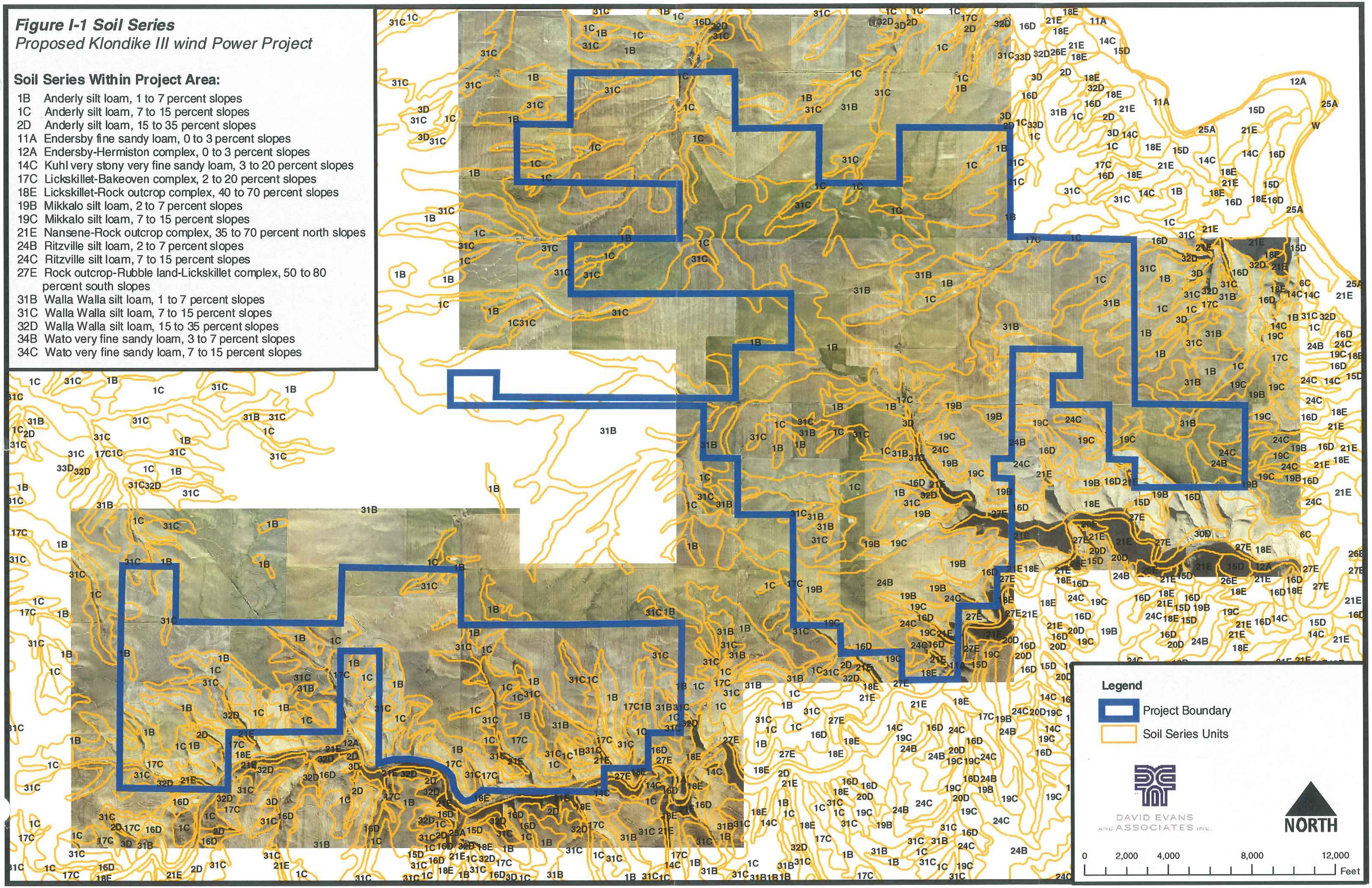
## Soil Map

## *Figure I-1 Soil Series*

*Proposed Klondike III wind Power Project*

**Soil Series Within Project Area:**

- 1B Anderly silt loam, 1 to 7 percent slopes
- 1C Anderly silt loam, 7 to 15 percent slopes
- 2D Anderly silt loam, 15 to 35 percent slopes
- 11A Endersby fine sandy loam, 0 to 3 percent slopes
- 12A Endersby-Hermiston complex, 0 to 3 percent slopes
- 14C Kuhl very stony very fine sandy loam, 3 to 20 percent slopes
- 17C Lickskillet-Bakeoven complex, 2 to 20 percent slopes
- 18E Lickskillet-Rock outcrop complex, 40 to 70 percent slopes
- 19B Mikkalo silt loam, 2 to 7 percent slopes
- 19C Mikkalo silt loam, 7 to 15 percent slopes
- 21E Nansene-Rock outcrop complex, 35 to 70 percent north slopes
- 24B Ritzville silt loam, 2 to 7 percent slopes
- 24C Ritzville silt loam, 7 to 15 percent slopes
- 27E Rock outcrop-Rubble land-Lickskillet complex, 50 to 80 percent south slopes
- 31B Walla Walla silt loam, 1 to 7 percent slopes
- 31C Walla Walla silt loam, 7 to 15 percent slopes
- 32D Walla Walla silt loam, 15 to 35 percent slopes
- 34B Wato very fine sandy loam, 3 to 7 percent slopes
- 34C Wato very fine sandy loam, 7 to 15 percent slopes



# Appendix I-2

## 1200-C Permit Application

# Erosion and Sediment Control Plan Worksheet

Project Name: **Klondike III Wind Energy Project**

Prepared By: **Sean P. Sullivan, L.A. (Oregon No. 412)**

Company Name: **David Evans and Associates, Inc.**

Telephone: **503-223-6663**

Please answer the following questions as indicated. If needed, additional space is provided for you at the end of this form. You may also attach any information you feel is pertinent to the project.

1. Is your Erosion and Sediment Control Plan for an activity that covers 20 acres or more of disturbed land?
   ☒ YES ☐ NO

   If yes, the plan must be prepared by an Oregon Registered Professional Engineer, Oregon Registered Landscape Architect, or Certified Professional in Erosion and Sediment Control (Soil and Water Conservation Society). Please complete question #4.

2. Does your Erosion and Sediment Control Plan require engineered facilities such as settling basins and/or diversion structures?
   ☐ YES ☒ NO

   If yes, the plan must be prepared by an Oregon Registered Professional Engineer.

3. If you answered "YES" to question #1 or 2, please provide the following information and use the space provided to imprint your seal.

   Name: Sean P. Sullivan, L.A. (Oregon No. 412)

   Address: David Evans and Associates, Inc.

   2100 SW River Parkway

   Portland, OR 97201

   Telephone: 503.223.6663

   REGISTERED
   412
   Sean P. Sullivan
   OREGON
   11/13/98
   LANDSCAPE ARCHITECT

   *Imprint Seal Above*

4. Describe the nature of the construction activity: The applicant proposes to construct a wind generation project in Sherman County, Oregon. The proposed project is an expansion of Klondike I (25 MW) and II (74 MW) wind generating projects located on adjacent lands. The project is expected to provide about 250 MW of capacity and approximately 85 average megawatts (aMW) of energy.

5. Describe in detail the phases of construction and the erosion control measures to be implemented during each phase. Also complete the table on the next page to assist with the narrative description.

See Attached. ____________________________________________

____________________________________________

Fill in the year(s) and the month(s) at the top of the chart during which the project will occur, and check the appropriate boxes to indicate when the items in the left column will be performed and/or installed. You may photocopy the chart if your project will last longer than 12 months.

| YEAR: 2006 – 2007 | 2006 | | | | | | | | | | 2007 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH: | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| **CLEARING** | x | x | x | x | x | x | x | | | | | | | |
| **EXCAVATION** | x | x | x | x | x | x | x | x | | | | | | |
| **GRADING** | x | x | x | x | x | x | x | x | x | x | | | | |
| **CONSTRUCTION** | x | x | x | x | x | x | x | x | x | x | | | | |
| **EROSION CONTROLS:** | | | | | | | | | | | | | | |
| Vegetative Buffer Strips | x | x | x | x | x | x | x | x | x | x | | | | |
| Mulching | x | x | x | x | x | x | x | x | x | x | | | | |
| Netting/Mats/Blankets | | | | | | | | | | | | | | |
| Temporary Seeding | | | | | | | | | | | | | | |
| Permanent Seeding | | | | | | | | | | | x | x | x | |
| Sod Stabilization | | | | | | | | | | | | | | |
| Other: | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| **SEDIMENT CONTROLS:** | | | | | | | | | | | | | | |
| Silt Fencing | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| Straw Bales | x | x | x | x | x | x | x | x | x | x | | | | |
| Sediment Traps | | x | x | x | x | x | x | x | x | x | | | | |
| Sediment Basins | | | | | | | | | | | | | | |
| Storm Inlet Protection | | | | | | | | | | | | | | |
| Drainage Swales | | | | | | | | | | | | | | |
| Check Dams | | | | | | | | | | | | | | |
| Contour Furrows | | | | | | | | | | | | | | |
| Terracing | | | | | | | | | | | | | | |
| Pipe Slope Drains | | | | | | | | | | | | | | |
| Rock Outlet Protection | | | | | | | | | | | | | | |
| Other: Sediment moat | x | x | x | x | x | x | x | x | x | x | | | | |
| | | | | | | | | | | | | | | |

6. Describe the origin and nature of fill material to be used: Native soils will be excavated for placement of the concrete turbine pads and temporary staging areas. These soils will be stockpiled until after construction when they will be redistributed over the temporarily disturbed areas.

7. Describe the soils present on the site and erosion potential of the soils.

a) Soil type(s): The near surface soils at the project area were identified using the U.S. Soil Conservation Service (SCS) Soil Survey of Sherman County, Oregon. The near surface soils in the project area are grouped into four General Soil Units: Walla Walla-Anderly, Wrentham-Lickskillet-Rock Outcrop, Lickskillet-Nansene, and Mikkalo-Ritzville.

The Walla Walla-Anderly series soils are extensive on mesas in the north-central part of Sherman County in mostly smooth and gently sloping areas. They have formed from loess over basalt in a 12- to 13-inch precipitation zone. This General Soil Unit is approximately 73 percent Walla Walla soils and 22 percent Anderly soils. The rest is soils of minor extent. Walla Walla soils are very deep or deep and are well drained. The surface layer is very dark brown silt loam. The subsoil is dark brown silt loam. Anderly soils are moderately deep and well drained. The surface layer is very dark grayish brown silt loam. The subsoil is dark brown silt loam. Of minor extent in this unit are very deep Endersby soils on terraces, very deep Hermiston soils on flood plains, and shallow Kuhl soils on north-facing canyonsides. The soils in this unit are used mainly for wheat and barley grown in a grain-summer fallow system, for alfalfa hay, and as pasture. Areas too steep for cultivation are used for livestock grazing and as wildlife habitat.

Wrentham-Lickskillet-Rock Outcrop series soils are moderately deep and shallow, well drained silt loam and very stony loam that formed in loess over basalt and in residuum derived from basalt in an 11- to 12-inch precipitation zone. They occur mainly in canyons. This map unit is adjacent to the Deschutes and John Day Rivers, in the southern part of the county. This map unit consists of about 30 percent Wrentham soils, 30 percent Lickskillet soils, and 26 percent Rock outcrop. Wrentham soils are moderately deep and well drained. The surface layer is very dark brown silt loam. The subsoil is dark brown extremely cobbly silt loam. Lickskillet soils are shallow and well drained. The surface layer is very dark grayish brown very stony loam. The upper part of the subsoil is dark brown very gravelly loam, and the lower part is dark brown very gravelly clay loam, very gravelly loam, or very cobbly loam. Rock outcrop consists of areas of exposed bedrock on the shoulders and convex side slopes of very steep canyons. The soils in this unit are used mainly for livestock grazing and as wildlife habitat.

Lickskillet-Nansene series soils are composed of shallow and deep, well drained very stony loam and silt loam that have formed in residuum derived from basalt and in loess over basalt in a 12- to 13-inch precipitation zone. This map unit is located in the northern part of Sherman County. It is about 45 percent Lickskillet soils and 12 percent Nansene soils. The rest consists of soils of minor extent. Lickskillet soils are shallow and well drained. The surface layer is very dark grayish brown very stony loam. The upper part of the subsoil is dark brown very gravelly loam, and the lower part is dark brown very gravelly clay loam, very gravelly loam, or very cobbly loam. Nansene soils are deep and well drained. The surface layer and subsoil are very dark brown silt loam. The substratum is dark brown silt loam. Of minor extent in this unit are very shallow Bakeoven soils on ridgetops and benches of canyons, very deep Sagemoor soils on dissected terraces, and moderately deep Wrentham soils on north-facing canyonsides. This soil unit is used mainly for livestock grazing and as wildlife habitat.

The Mikkalo-Ritzville General Soil Unit consists of moderately deep and deep, well drained silt loam that has formed in loess over basalt in a 9- to 11-inch precipitation zone, typically on mesas. This map unit is in the northeastern corner of the survey area. It is about 56 percent Mikkalo soils and 38 percent Ritzville soils. The rest is soils of minor extent. Mikkalo soils are moderately deep and well drained. The surface layer is very dark grayish brown silt loam. The subsoil is dark brown, calcareous silt loam. Ritzville soils are deep and well drained. The surface layer is dark brown silt loam. The subsoil is dark yellowish brown, calcareous silt loam. Of minor extent in this unit are shallow Lickskillet Soils. The soils in this unit are used mainly for wheat and barley grown in a grain-summer fallow system. Areas too steep for cultivation are used for livestock grazing and as wildlife habitat.

b) Erosion Potential: Based on the soil types present, soil erosion potential at the facility site varies, being high in some areas and not high in others (USDA 1964; Table 2).

**Table 2. Detailed soil map units present on project site and their properties.**

| Soil Series | Drainage Class | Erosion Potential |
|---|---|---|
| Anderly silt loam, 1 to 7 percent slopes | Well drained | Highly |
| Anderly silt loam, 7 to 15 percent slopes | Well drained | Highly |
| Anderly silt loam, 15 to 35 percent south slopes | Well drained | Highly |
| Endersby fine sandy loam, 0 to 3 percent slopes | Somewhat excessively drained | Not highly |
| Endersby-Hermiston complex, 0 to 3 percent slopes | Well drained | Not highly |
| Kuhl very stony very fine sandy loam, 3 to 20 percent slopes | Well drained | Highly |
| Lickskillet-Rock outcrop complex, 40 to 70 percent south slopes | Well drained | Not highly |
| Lickskillet very stony loam, 7 to 40 percent south slopes | Well drained | Not highly |
| Lickskillet-Bakeoven complex, 2 to 20 percent slopes | Well drained | Not highly |
| Mikkalo silt loam, 2 to 7 percent slopes | Well drained | Highly |
| Mikkalo silt loam, 7 to 15 percent slopes | Well drained | Highly |
| Nansene-Rock outcrop complex, 35 to 70 percent north slopes | Well drained | Not highly |
| Ritzville silt loam, 2 to 7 percent slopes | Well drained | Not highly |
| Ritzville silt loam, 7 to 15 percent slopes | Well drained | Not highly |
| Rock outcrop-Rubble land-Lickskillet complex, 50 to 80 percent south slopes | Well drained | Not highly |
| Walla Walla silt loam, 1 to 7 percent slopes | Well drained | Not highly |
| Walla Walla silt loam, 7 to 15 percent slopes | Well drained | Not highly |
| Walla Walla silt loam, 15 to 35 percent north slopes | Well drained | Not highly |
| Wato very fine sandy loam, 3 to 7 percent slopes | Well drained | Not highly |
| Wato very fine sandy loam, 7 to 15 percent slopes | Well drained | Not highly |

8. Submit two copies of site maps and constructions plans. The following checklist is provided for your convenience:

| IS THE FOLLOWING INFORMATION PROVIDED AND DETAILED ON THE MAPS SUBMITTED TO THE DEQ? | YES | NO | NOT APP. | EXHIBIT |
|---|---|---|---|---|
| .. The complete development, including any phases. | x | | | B, C |
| b. The areas of soil disturbance on the site, including areas that will be cleared, graded or excavated. | x | | | App B-2 |
| c. The areas of cut and fill. | x | | | App B-2 |
| d. The drainage patterns and slopes of the land both before and after major grading activities. | x | | | App C-2 |
| e. The location of existing and proposed storm drains and outfalls. | | | x | |
| f. The receiving waterbody for drainage from the site. | x | | | App C-2 |
| g. The areas used for storage of soils or wastes. (laydown areas) | x | | | App C-2 |
| h. The location of all erosion and sediment control facilities and/or structures. | | | x | |
| i. The areas on the site where vegetative practices will be used. | | | x | |
| j. The location of existing and future impervious structures and areas. | x | | | App C-2 |
| k. The location and name of all springs, wetlands, and surface waterbodies near the project. | x | | | App C-2 |
| l. The boundaries of the 100 year flood plain if known. | | | x | |
| m. The location of graveled access entrance and exit drives and graveled parking areas to be used by construction vehicles. (at each turbine string entrance) | x | | | App C-2 |
| n. The locations of graveled roads traveled by more than 25 vehicles per day. | x | | | App C-2 |
| o. Installation details of vegetative and other erosion control practices (vegetative buffer strips, seeding, mulching, erosion blankets, etc.). | | | x | |
| Installation details of sediment control practices (silt fences, straw bale dikes, storm drain inlet protection, etc.). (per DEQ BMP for Stormwater Discharges Associated with Construction Activities guide) | x | | | |
| q. List the temporary and permanent vegetative seed in the seed mix. * | x | | | |
| r. If concrete work is done on site, then note the concrete truck washout procedure used and locate any sump, if used, on the drawing. | | | x | |

* No temporary seeding is proposed because of arid conditions during construction period. Mulch will be used instead. Permanent seeding will be completed in Spring 2007.

9. Describe the truck drippage precautions you will take to prevent discharge of water from trucks hauling wet soils or stone excavated from the site: See Attached. ______

10. Describe the procedures you will use to assure prompt maintenance and repair of graded surfaces and erosion and sediment control measures: See Attached. ______

5. *Describe in detail the phases of construction and the erosion control measures to be implemented during each phase. Also complete the table on the next page to assist with the narrative description.*

Response: Construction activities for the Klondike III Wind Project are anticipated to begin in the second quarter of 2006 and conclude in the fourth quarter of 2006. Phases of construction and the erosion control measures (best management practices or "BMPs") to be implemented during each phase are generally as follows:

## Mobilization, Staging, and Laydown

It is anticipated that one or more general contractors would mobilize to the project area and would require staging areas for temporary construction offices, temporary laydown facilities, and materials staging (Appendix C-2, Project Component map). These staging areas would be used to park construction vehicles, construction employees' personal vehicles, and other construction equipment. Staging area locations will be proposed by the contractor and approved by the Applicant.

Multiple laydown areas will be required during tower construction and turbine installation. At each turbine location, an area of approximately 2,500 square feet would be required to place turbine blades and other turbine components and to station a construction crane as each tower is erected. Tower sections, nacelles, blades, and appurtenances would be temporarily stored in laydown facilities as each turbine is constructed. Fueling and chemical/solvent storage will occur at staging areas at each turbine string. At the end of the turbine string, an area approximately 300 feet in diameter (1.6 acres) would be needed to allow construction equipment to turn around.

BMPs anticipated for use during this phase include silt fences placed on the down slope side of the staging areas, gravel construction entrances, gravel laydown facilities, and container and waste storage bins/dumpsters. Additionally, the following BMPs would also be developed to prevent or minimize the mixing of runoff with pollutants such as hydraulic fluid, fuel, and lubricants: written spill prevention and response procedures, employee training on spill prevention and proper disposal, emergency spill kits, and regular maintenance schedule for vehicles and equipment.

After completion of construction, Klondike III would restore these temporary staging / laydown areas to their pre-construction conditions. Disturbed areas would be re-seeded to wheat or native grasses as appropriate to establish permanent vegetation. Silt fences and other BMPs would be removed once vegetation provides soil stabilization.

## Road Construction

To the extent possible, existing roads would be used to minimize the need to construct new roads. Existing roads would need to be improved to accommodate construction equipment. New roads would also be constructed to provide access to the turbine locations (Appendix C-2, Project Component map and Appendix C-3, Turbine Location map). Roads would be compacted to meet design specifications to support construction equipment and material deliveries. All unpaved roads used for construction purposes would be graveled or paved as appropriate, or effective BMPs would be placed on the road or down slope of the road to prevent the discharge of fugitive sediment in lieu of graveling.

A variety of BMPs would be used during road construction to control erosion and sedimentation. These BMPs may be used individually or in concert as site conditions and levels of disturbance warrant. BMPs for road construction include graveling, watering or applying other dust palliatives, preserving existing vegetation, silt fence, mulching, and reestablishing permanent vegetation.

Silt fences would be removed once vegetation stabilized soils.

## Underground Utility Construction

Underground electrical and communications cables would be placed in a trench approximately 2 feet wide and at least 3 feet deep, generally along the length of the proposed turbine access roads and County roads linking turbine strings to collector substations near Schoolhouse and Webfoot. Topsoil would be stripped and stockpiled adjacent to the work area. The remaining trench excavation would be sidecast adjacent to the trench and later used as backfill. Upon the installation of electrical cables, and communications cables, the trench would be backfilled with native material and then top-dressed with the salvaged topsoil. The trench excavation would be reseeded with wheat or native seed as appropriate.

BMPs for underground utility construction include phasing the work as practical to minimize disturbance at any given time, preserving existing vegetation, and reestablishing permanent vegetation. If construction persists in the wet season, additional BMPs such as covering the sidecast and topsoil stockpiles would be considered.

## Turbine Foundation Construction

It is anticipated that the foundations would be designed by conventional methods including: (1) spread foundations below the loess (i.e., wind-formed soils), (2) drilled shaft foundations that support in the materials below the loess, (3) removal of the loess and replacement with compacted fill, and/or (4) in situ improvements of the loess soils. One or more of these approaches have been used in the design and construction of the foundations for Klondike II and will be used to design the foundations for Klondike III turbine towers.

Construction would likely require excavation approximately nine to ten feet deep and approximately 50 feet in diameter. Excavated material would be stockpiled for use as backfill adjacent to the turbine pad for approximately 14 to 28 days while the concrete cures. Silt fences or sediment moats would be installed on the downslope side of stockpiles. Sediment moats are ditches dug around the perimeter of the stockpile with the excavation sidecast to the outboard side of the ditch to form a temporary dike. The temporary dike provides a physical barrier that traps sediment "in the moat" and prevents its discharge. Once the concrete cures, the stockpiled materials would be used for backfilling. The contractor would be responsible for locating a disposal site, which may include placing and cultivating the excess material on upland agricultural lands within the lease boundary for excess materials if saturated soils are encountered and must be hauled away from the site, loads would be drained on-site until dripping is reduced to minimize spillage on roads. Disturbed areas resulting from foundation and crane pad construction would be seeded to establish crops or native species as appropriate.

BMPs used as part of turbine foundation construction would include phasing the work as practical to minimize disturbance at any given time, preserving existing vegetation, graveled access road, draining saturated soils on site, silt fences, sediment moats, and reestablishing permanent vegetation. If construction persisted in the wet season, additional BMPs such as covering the stockpiles and heavy mulching would be considered. Silt fences would be removed once the stockpile has been removed and the disturbed areas stabilized with vegetation.

## *Tower and Rotor Assembly*

Turbine tower pieces, nacelle, hub, blades and appurtenances would be transported by trucks to each turbine location and erected using a construction crane. The base tower section would be bolted to the foundation pedestal, the middle section would then be bolted to the base section, and the top section would then be bolted to the middle section. The nacelle is then lifted to the top of the tower and bolted in place. The rotor (hub and three blades) is assembled on the ground and then the rotor assembly is hoisted and attached to the turbine nacelle.

No additional BMPs would be required for this phase of construction. BMPs previously installed as part of road construction and/or turbine foundation construction should provide adequate erosion and sedimentation control.

## *Mitigation Site*

Up to two acres of the proposed mitigation site may be plowed in preparation of habitat enhancement activities. A 100-foot wide vegetated filter strip will be left on the downslope side of the mitigation site, to prevent exposed soils from entering Grass Valley Canyon or its intermittent tributary.

## *Stormwater Management*

Stormwater management will be ongoing through the life of the project. The use of water for construction practices (*e.g.*, dust suppression, road compaction) is not anticipated to generate runoff. Wastewater would not be discharged into wetlands or other adjacent resources. The area receives approximately 12 inches of precipitation annually, most of which occurs between October 1 and March 31. Stormwater runoff resulting from precipitation is anticipated to be minimal and would infiltrate onsite.

## *Installation of Meteorological Towers*

The three proposed meteorlogical (met) towers and associated equipment would be delivered to the proposed location on existing project roads. The tower would be set on a concrete foundation. The lower section of the tower would be erected using a crane and the remaining sections would be added either using the crane or using a winch and gin pole. No guy wires would be needed. The towers for this project would be 80 to 100 meters tall. No specific erosion control measures would be required for this phase of construction.

## *Construction of Operations and Maintenance (O&M) Building*

A pre-engineered metal building including foundation, HVAC and electrical systems up to approximately 3,000 to 5,000 square feet in size would be constructed for spare parts and the balance of plant services. The building would also house all of the wind farm SCADA control systems. Water for the building would come from groundwater on the leased property and would remain below the threshold of 5,000 gallons per day.

During construction, silt fences would be placed on the down slope side of the construction areas. After construction has been completed, the areas surrounding the building would be graded and re-seeded to wheat or native grasses as necessary to restore vegetation. Silt fences would be removed once stabilization is completed.

## Other Facilities

Because the project requires concrete to construct the turbine pad foundations, it is anticipated that the contractor would be responsible for locating sources of aggregate and concrete and obtaining any related permits. The contractor may use its own portable batch plant, in which case the contractor would be responsible for any environmental permitting or land use permits required for such a facility. The contractor would also be responsible for providing adequate control to prevent the discharge of cement truck wash water and for returning the site of the batch plant to its pre-disturbance condition or better.

Constructing turbine pad foundations and roads would also require substantial amounts of sand and gravel. The contractor would be responsible for locating and providing aggregate for construction including the location of any quarry sites. The contractor would be responsible for providing appropriate erosion and sedimentation BMPs at any quarry sites and would be responsible for obtaining any environmental or land use permit required for such a facility.

## Demobilization

Demobilization would include final road grading, site cleanup, and decommissioning the erosion and sedimentation BMPs among other activities. The applicant will remove all silt fences and other BMPs as appropriate and would end 1200-C permit coverage once all soil disturbance activities have been completed and final stabilization of exposed soils has occurred.

Table 1 lists construction equipment typically used during wind project construction.

**TABLE 1.- EQUIPMENT TYPICALLY USED FOR WIND FACILITY CONSTRUCTION**

| Equipment | Use |
|---|---|
| Bulldozer | Road and pad construction |
| Grader | Road and pad construction |
| Water trucks | Compaction, erosion and dust control |
| Roller/compactor | Road and pad compaction |
| Backhoe/trenching machine | Digging trenches for underground utilities |
| Excavator | Foundation excavation |
| Heavy duty rock trencher | Underground trenching |
| Truck-mounted drilling rig | Drilling power pole holes |
| Concrete trucks/concrete pumps | Pouring tower and other structure foundations |
| Cranes | Tower/turbine erection |
| Dump trucks | Hauling road and pad material |
| Flatbed & Low-bed trucks | Hauling towers, turbines and components, and construction equipment |

**TABLE 1.- EQUIPMENT TYPICALLY USED FOR WIND FACILITY CONSTRUCTION**

| | |
|---|---|
| Pickup trucks | General use and hauling minor equipment |
| Small hydraulic cranes/forklifts | Loading and unloading equipment |
| Four-wheel-drive all-terrain vehicles | Rough grade access and underground cable installation |
| Rough-terrain cranes / forklifts | Lifting equipment and pre-erection assembly |

## *Additional Information*

A revegetation plan describing revegetation methods and seedmixes is attached. Erosion and Sediment control BMPs will be installed according to the guidance provided in NPDES Storm Water Regulations for Construction Projects, December 2002.

In addition to the NPDES guidance, practices that can be used to control erosion of loess soils include seeding early in the spring, stubble-mulch tillage, and construction of terraces, diversions, and grassed waterways. Leaving crop residue near the surface helps conserve moisture, maintain tilth, and control erosion.

# Response to Question 9 – Klondike III 1200-C Worksheet

9. *Describe the truck drippage precautions you will take to prevent discharge of water from trucks hauling wet soils or stone excavated from the site:*

   Because of the climate and soil types in the area, excessively wet soils and/or stone excavation are not anticipated. Therefore, truck drippage is not expected to be an issue. In the unlikely event of hauling wet soils or stone, trucks would be allowed to drain on-site before entering public right-of-way (i.e., county road system). If draining on-site is determined to be inadequate, the ESC Lead would coordinate additional BMPs to minimize truck drippage.

# Response to Question 10 – Klondike III 1200-C Worksheet

10. *Describe the procedures you will use to assure prompt maintenance and repair of graded surfaces and erosion and sediment control measures:*

<u>Response</u>: A copy of the Erosion and Sediment Control Plan (Plan) and all inspection reports (described below) would be retained on-site and made available to the Department of Environmental Quality, its agent, or the local municipality upon request. The contractor would designate an Erosion and Sediment Control Lead (ESC Lead) who would be responsible for implementing the Plan and following through on all maintenance requirements. The ESC Lead would be a person with knowledge and experience in construction stormwater controls and management practices. The ESC Lead's contact information, including an emergency contact number, would be provided as part of the Plan.

All roads, pads, trenched areas, stockpiles and disturbed areas resulting from facility construction would be inspected regularly and maintained to minimize erosion and sedimentation. For active sites, inspections would occur daily during stormwater runoff or snowmelt runoff and at least once every seven calendar days and within 24 hours after any storm event greater than 0.5 inches of rain in a 24-hour period. For inactive periods greater than seven days, inspections would occur once every two weeks. If a site is inaccessible due to adverse weather conditions, inspections would not occur, but the adverse weather conditions would be noted on the inspection report.

The inspections would document the following:

- Inspection date, inspector's name, weather conditions, and rainfall amount in the last 24 hours.
- List observations of all BMPs.
- At representative discharge point(s), document the quality of discharge for any turbidity, color, sheen, or floating materials.
- Recommended corrective actions required, if any.

The applicant would implement the following maintenance activities and guidelines:

- Significant amounts of sediment that leave the site would be cleaned up within 24 hours and placed back on the site or disposed of in a legal manner.
- Under no circumstances would sediment be intentionally washed into storm sewers or drainages unless it was to be captured by a BMP (e.g., basin insert) before entering receiving waters.
- For silt fences, the trapped sediment would be removed before it reaches one third of the above ground height of the fence.
- For catch basin protection, cleaning would occur when design capacity has been reduced by 50 percent.
- All erosion and sedimentation control BMPs not directly in the path of work would be installed before any land disturbance.
- All disturbed areas that would be revegetated with native species would be reseeded at appropriate intervals until a performance standard of 70 percent cover is met.
- Fertilizers would not be used when seeding native species, and would only be used in such a way to minimize nutrient-laden runoff when seeding wheat.
- If construction activities cease for 30 days or more, all disturbed areas would be stabilized using vegetation, heavy mulch, temporary seeding, or other appropriate BMPs as necessary.
- All temporary erosion and sediment control measures will be removed within 30 days after final stabilization of the site. Final stabilization is deemed to have occurred when the impacted areas demonstrate 70% cover and the risk of erosion has been minimized.
- Adequate stockpiles of silt fences, straw bales, spill kits, and other measures as appropriate will be maintained on site for emergency situations and to allow for the prompt response for repairs.

# REVEGETATION PLAN

# KLONDIKE III WIND PROJECT
# SHERMAN COUNTY, OREGON

April 1, 2005

Prepared by Sean Sullivan, Registered Landscape Architect (Oregon No. 412)

## BACKGROUND

This plan supplements the 1200-C Permit application for the Klondike III Wind Project (Project) and outlines techniques for revegetating areas temporarily disturbed as a result of Project construction. The Project occurs in Sherman County, Oregon on private agricultural lands primarily used for dry land winter wheat production. Soils are typically loess formations of well-drained, moderately permeable, fertile silt loams over basalt. Areas too steep for cultivation are suitable for livestock grazing and wildlife habitat. Depth to bedrock is generally 20 to 60 inches. The vicinity receives less than 12 inches of precipitation annually, most of which occurs October 1 to March 31.

## REVEGETATION APPROACH

Revegetation would occur by applying a variety of seed mixes to disturbed areas using common application methods such as broadcasting and drilling. Given climatic constraints and anticipated soil moisture levels, it is anticipated that mulching and other best management practices (BMPs) will be used for temporary erosion and sediment control throughout most of the construction window. Permanent seeding to establish vegetation would occur near the end of construction and when soil moisture conditions are conducive to seed germination (approximately October 1 to March 31 as conditions allow). The contractor would be allowed flexibility to apply seed in less favorable conditions with the understanding that reseeding may be required if adequate cover is not achieved. Up to four seed mixes are anticipated for this Project as described below:

### Seedmix 1 – Dry Land Wheat

Agricultural areas temporarily disturbed by construction activities would be reseeded with dry land wheat. The species composition, seed and fertilizer application rates, and application method would be coordinated with the landowner and/or farmer.

### Seedmix 2 – Conservation Reserve Program

Conservation Reserve Program (CRP) easements disturbed by construction would be reseeded with a mix compatible with the CRP goals. The species composition, application rate, use of fertilizers, and application method would be coordinated with Oregon Department of Fish and Wildlife (ODFW) and the easement holder.

### Seedmix 3 – Habitat Mitigation

As described in Exhibit P, an area in the southwest portion of the Project area would be used to mitigate unavoidable impacts to wildlife habitat. This area would be seeded with a mix whose composition, application rate, and application method will be coordinated with ODFW. It is anticipated that fertilizer would not be applied to areas receiving Seedmix 3.

**Seedmix 4 – Permanent Revegetation (Upland)**

Seedmix 4 would be applied to all remaining disturbed areas resulting from construction. Native species have been selected based on their relative availability and their compatibility with xeric site conditions. It is anticipated that fertilizer would not be applied to areas receiving Seedmix 4. The composition and application rate are as follows:

| Botanical Name | Common Name | PLS* Rate (lbs/ac) |
|---|---|---|
| *Artemisia tridentata* ssp. *tridentata* | big basin sagebrush | 0.09 |
| *Elymus lanceolatus* ssp. *lanceolatus* | thickspike wheatgrass | 8.07 |
| *Poa ampla* | big bluegrass | 1.23 |
| *Poa sandbergii* | Sandberg bluegrass | 1.18 |
| *Pseudoroegneria spicata* ssp. *inermis* | beardless wheatgrass | 6.01 |
| *Pseudoroegneria spicata* ssp. *spicata* | bluebunch wheatgrass | 6.93 |
| **Total** | | **23.51** |

*PLS = Pure Live Seed

Pure Live Seed (PLS) is the amount of living, viable seed in a larger total amount of seed. The amount of seed to be applied is obtained by using the purity and germination percentages from the label on the actual bag of seed to be used on the project.

To calculate the amount of seed to be applied:

1. Obtain the PLS factor by multiplying the seed label germination times the seed label purity percentage. (Change the percentages to decimals before multiplying.)
2. Divide the specified PLS rate by the PLS factor.
3. Round off the result as approved by the Landscape Architect.

For example, a PLS seeding rate of six pounds per acre is specified. The seed label shows a purity of 98% and germination rate of 90%. 0.98 times 0.90 equals a PLS factor of 0.88. The specified PLS rate, six pounds per acre, divided by the factor of 0.88 equals 6.82. About 6.8 pounds of total seed needs to be applied in order to meet a specified PLS seeding rate of six pounds per acre.

The final application rate should be based on the purity and germination rates shown on the seed certification tags provided by the supplier. It is assumed that all seed would be provided by a reputable supplier and would comply with the Oregon Seed Law.

## APPLICATION METHODS

This plan prescribes two methods that would be used for seeding disturbed areas: broadcasting and drilling. Hydroseeding is not recommended for this relatively arid environment. It is anticipated that the contractor would have flexibility in selecting the method most appropriate for a given site and would consider factors such as slope, access, area to be seeded, wind conditions, available soil moisture, and erosion potential when selecting a method.

### Broadcasting

Broadcast the seedmix at the specified application rate. Where feasible, apply half of the total mix in one direction and the second half of mix in direction perpendicular to first half. Apply weed free straw from a certified field or sterile straw at a rate of two tons per acre immediately after applying seed. Crimp straw into the ground to a depth of two inches using a crimping disc or similar device. As an alternative to crimping, a tackifier may be applied using hydroseed equipment at a rate of 100 pounds per acre. Prior to mixing the tackifer, visually inspect the tank for cleanliness. If remnants from previous hydroseed applications exist, wash tank to remove remnants. Include a tracking dye with the tackifier to visibly aid uniform application.

Broadcasting should not be used if winds exceed five miles per hour.

### Drilling

Using an agricultural or range seed drill, drill seed at 70 percent of the recommended application rate to a depth of ¼ inch or as recommended by the seed supplier. Where feasible, apply half of the total mix in one direction and the second half of mix in direction perpendicular to first half. If mulch has been previously applied as a temporary BMP, seed may be drilled through the mulch provided the drill is capable of penetrating the straw resulting in seed-to-soil contact conducive for germination.

## PERFORMANCE STANDARD

Revegetation will be considered successful when the disturbed area reaches 70 percent cover by desirable species. For the purposes of monitoring, desirable species include species included in the seedmix, or native or naturalized species common to similar areas.

## MONITORING AND MAINTENANCE

Disturbed, unseeded areas would be managed with chemical and/or mechanical means to prevent weed species from going to seed during the construction period. The contractor would be responsible for complying with all local, state, and federal regulations regarding the application of chemical pesticides and herbicides.

Areas failing to achieve the performance standard would be evaluated to determine potential reasons for lack of performance. Corrective action would be taken based on the evaluation that may include reseeding at appropriate intervals or reconfiguring the seedmix.