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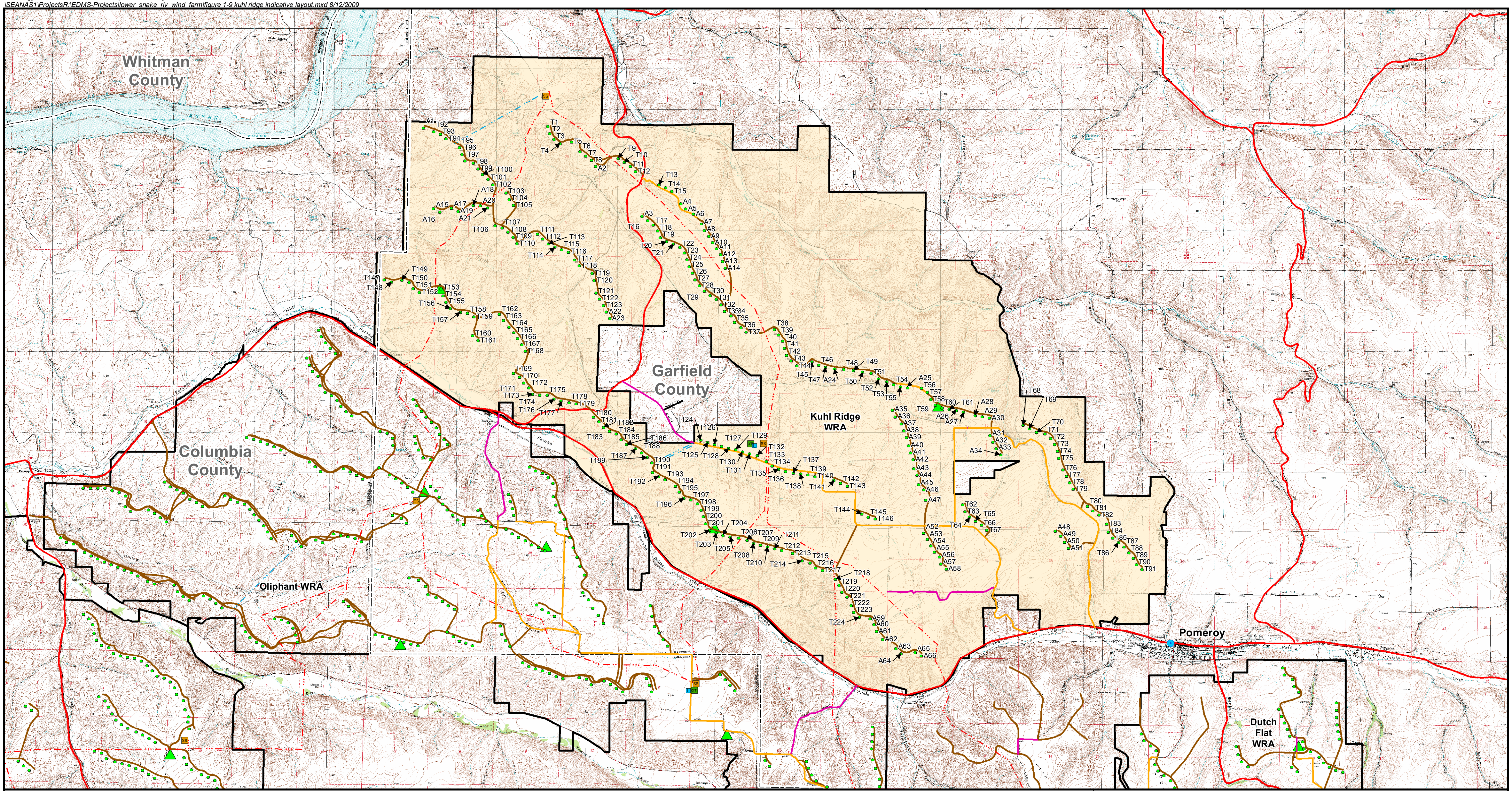

Legend

- Turbine Location
- City
- Laydown
- Operations & Maintenance
- Substation
- Met Towners
- County Lines
- 35 kV Transmission Line
- 230 kV Transmission Line
- Existing Roads
- New Roads
- Existing Roads to be Upgraded
- Project Area

Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

Figure 1-9
Kuhl Ridge WRA Indicative Layout

0 0.5 1 2 3 4 5
Scale 1:94,000 Miles

Source Information:

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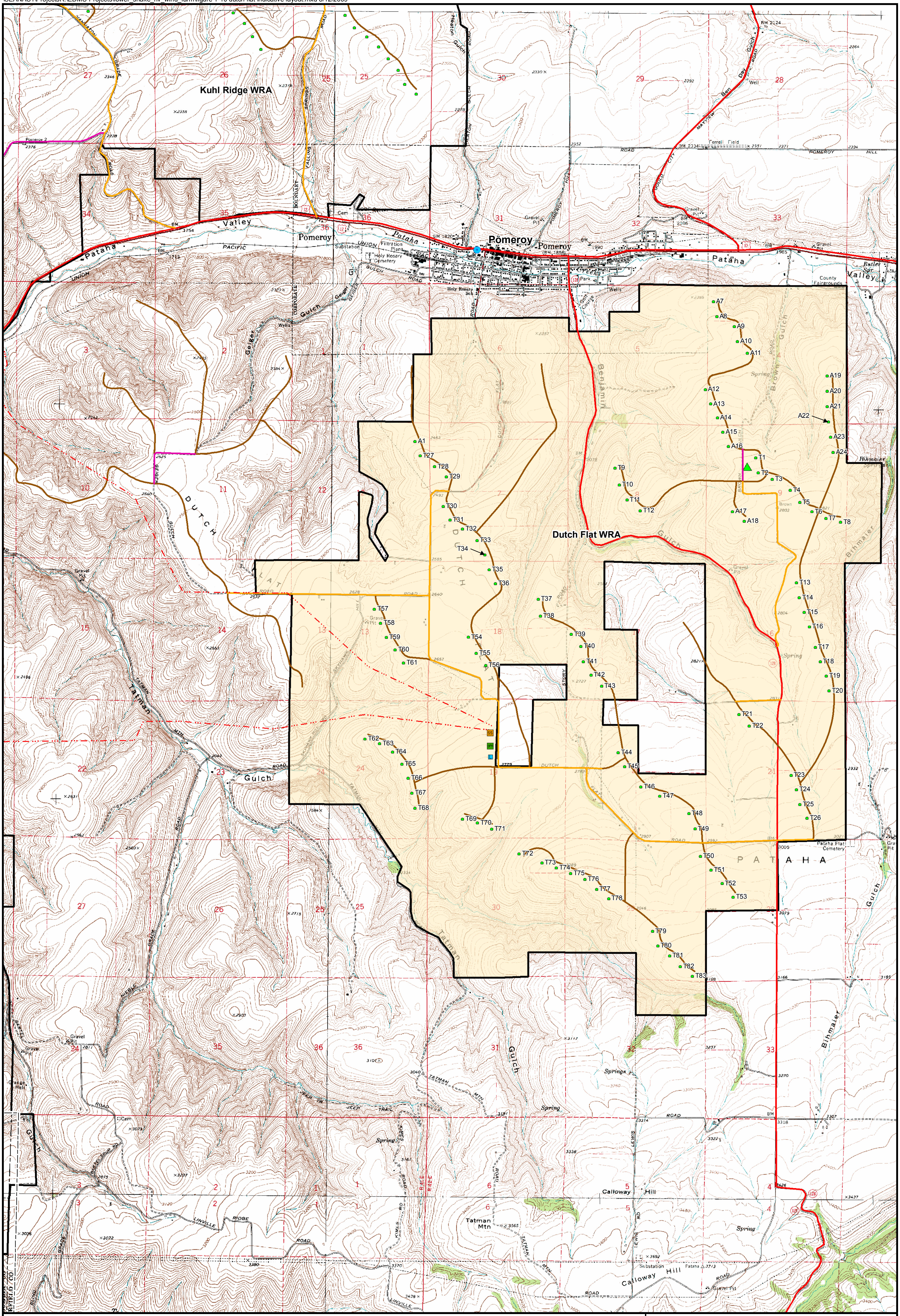

Legend

- Turbine Location
- City
- Laydown
- Operations & Maintenance
- Substation
- Met Towners
- County Lines
- 35 kV Transmission Line
- 230 kV Transmission Line
- Existing Roads
- New Roads
- Existing Roads to be Upgraded
- Project Area

Lower Snake River Wind Energy Project

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Figure 1-10
Dutch Flat WRA Indicative Layout

0 0.25 0.5 1 1.5
Miles
Scale 1:43,000

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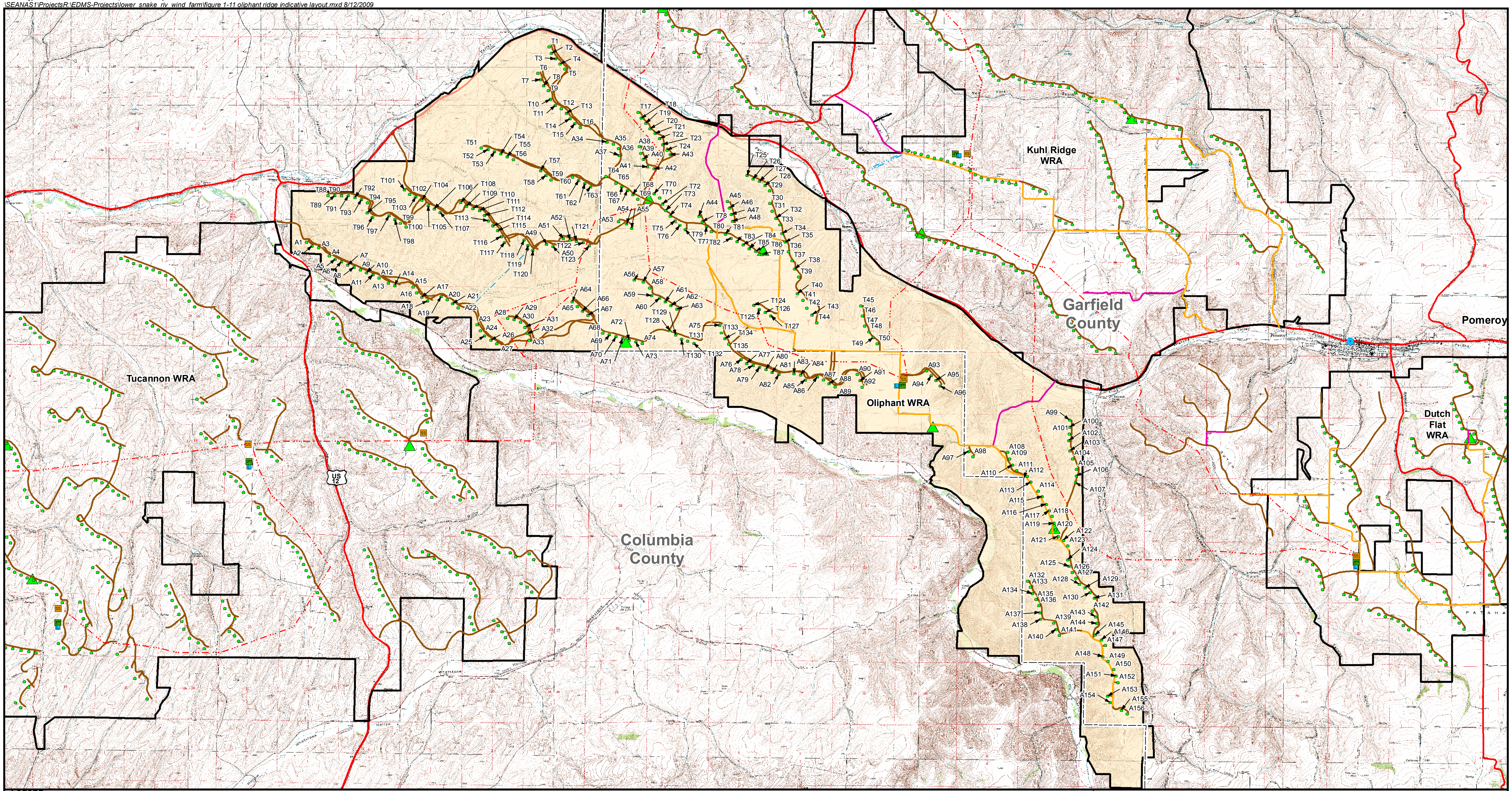
\SEANAS1\ProjectsR-\EDMS-Projects\lower_snake_riv_wind_farm\figure 1-11 oliphant ridge indicative layout.mxd 8/12/2009



Legend

- Turbine Location
- City
- Met Towners
- Streams
- County Lines
- 35 kV Transmission Line
- 230 kV Transmission Line
- Existing Roads
- New Roads
- Existing Roads to be Upgraded
- Project Area

Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

Figure 1-11
Oliphant Ridge WRA Indicative Layout

0 0.5 1 2 3 4 5 6
Miles
Scale 1:100,000

Source Information:

1.5.3 Project Facilities

The Project will include the facilities listed below. Depending on the phased construction sequence, facilities may be shared among WRAs.

- Wind turbine generators erected on tubular steel towers
- Individual turbine step-up transformers to increase the voltage of electricity to 34.5-kV
- A 34.5-kV electrical system to collect energy from the wind turbine generators. Most of the collector system will be buried underground; however, where this is not feasible, portions may be carried overhead
- Up to eight Project substations in addition to the BPA Central Ferry Substation
- Overhead transmission lines to transmit energy from the Project to the BPA substation
- Microwave transmission facilities and towers
- Up to six operations and maintenance (O&M) facilities
- Upgrades to existing county and private access roads and construction of new access roads where necessary
- Permanent meteorological towers for measuring wind speed and direction
- Temporary construction impact areas

The following sections describe in more detail the facilities mentioned above.

1.5.3.1 Turbines

The Applicant is considering several different wind turbine models for the Project. Final turbine selection may not occur until a few months prior to construction. Nevertheless, the Applicant has chosen two turbine models for use in the environmental analysis. In general, modern commercial wind energy turbines do not differ greatly in size or appearance. Turbine capacity could range from 1.8 to 2.3 MW. The indicative layouts in this document are based on the 1.8-MW machine. This allows for evaluation of environmental impacts for the greatest number of turbines. Additionally, the tallest machines being considered (2.3 MW) will be evaluated for impacts related to turbine size and blade length. Therefore, the environmental analysis will consider the largest scale turbine currently in production and appropriate for the Project as proposed. Turbine models not considered in this permit application may become available and may be considered in the future but are not expected to change the type of, nor significantly modify the impacts described in this EIS.

A typical commercial-scale wind turbine generator (as shown in Figure 1-12) consists of a tubular steel tower mounted on a reinforced concrete foundation. Atop the tubular steel tower, the nacelle houses the wind turbine, hub, and gearbox, and supports a rotor with three blades. Table 1-1 compares the primary components of typical 1.8-MW and 2.3-MW turbines.

Table 1-1 Comparison of 1.8- and 2.3-MW Turbines

Element	1.8 MW	2.3 MW
Blade length	144 ft (44 m)	161 ft (49 m)
Rotor diameter	295 ft (90 m)	331 ft (101 m)
Swept area	68,480 ft^2 ($6,362 m^2$)	86,111 ft^2 ($8,000 m^2$)
Hub height	262 ft (80 m)	262 ft (80 m)
Ground-to-tip height	406 ft (124 m)	423 ft (129 m)

Key:
ft = feet
m = meters

Source: Siemens 2008; Vestas 2008

Towers

Towers are mounted on reinforced concrete foundations (see Figure 1-12). Each tower is tapered from the base to the hub, with a base diameter of approximately 14 feet. The tower is hollow and houses a ladder to access the nacelle and electrical components. A controller box is situated at the base within the tower. Access to the tower is restricted by a locked steel door for safety and security.

The tower foundations may be either a spread footing or a pier-type footing (see Figure 1-13). Regardless of the footing type, a permanent cleared area will be maintained around each turbine, approximately 23 feet in diameter. In addition, a gravel crane pad with approximate dimensions of 60 feet by 100 feet will be constructed and maintained as a permanent feature at each turbine location.

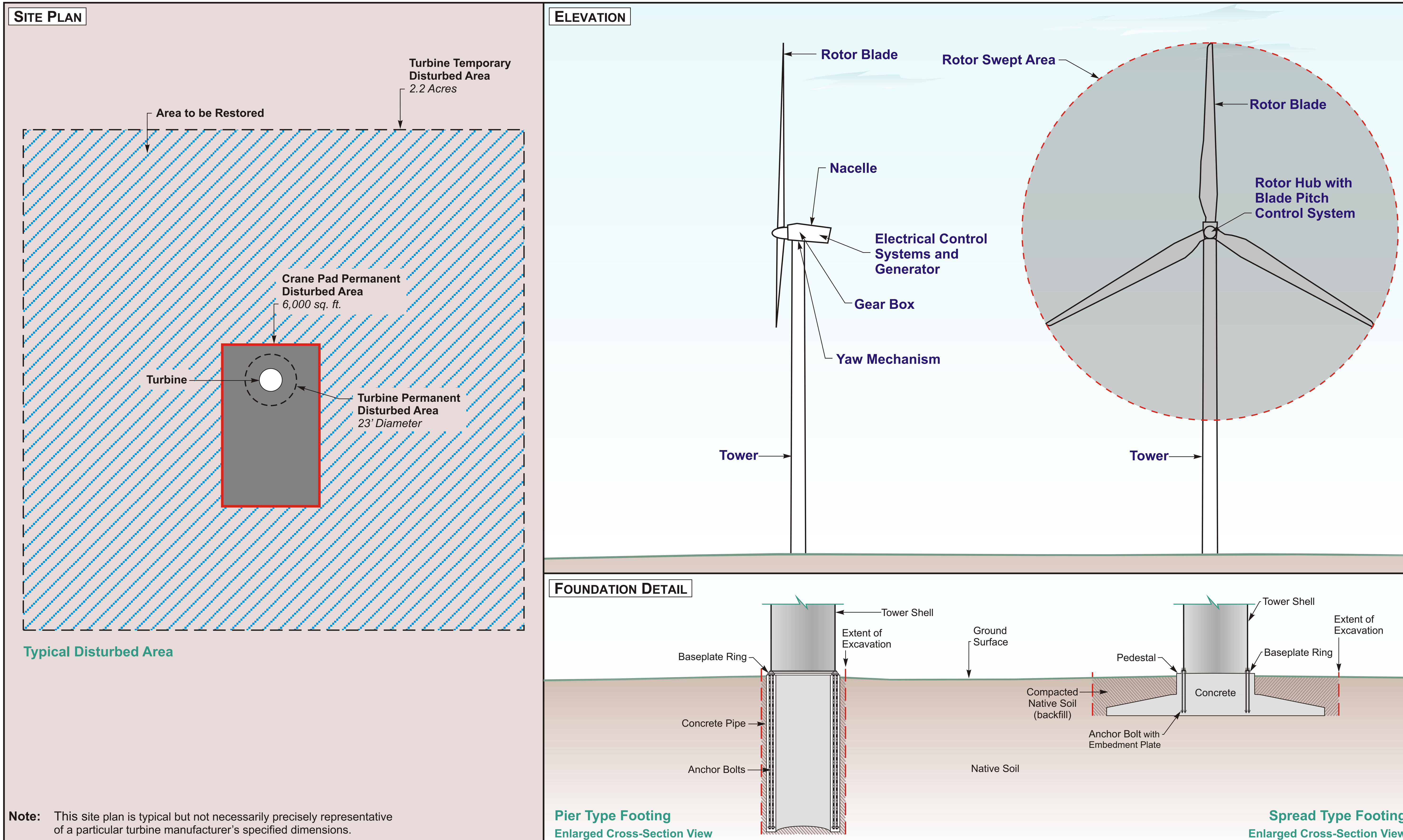
Nacelles

The nacelle houses several turbine components, including the turbine's main shaft, gearbox, brakes, bearings, cooling system, hydraulic systems, yaw gears, generator, and, in some models, the step-up transformer. Other models set the transformer at ground level adjacent to the tower.

The nacelle also has an anemometer to measure wind speeds and direction, which in turn controls the yaw mechanism to turn the nacelle and rotor to capture the wind. The FAA requires lighting on selected turbines. The lighting scheme will be determined in consultation with the FAA.

Turbine Blades and Rotor

Three turbine blades attach to the turbine's main shaft via a blade hub. Depending on the turbine model selected for the Project, the blades will be made of either carbon fiber or laminated fiberglass. For the representative 1.8-MW turbine size selected, the blades are approximately 44 meters (144 feet) long. When they spin they will cover an area approximately 90 meters (295 feet) in diameter; this is known as the rotor swept area. For the representative 2.3-MW turbine size selected, the blades are approximately 49 meters (161 feet) long, with a rotor swept area of approximately 101 meters (331 feet) in diameter.



Not to Scale - For Demonstrative Purposes Only	**Figure 1-12** **Typical Turbine with Foundations and Associated Disturbed Areas**	**Lower Snake River Wind Energy Project** **Columbia & Garfield Counties** **Washington**

Figure 1-13
Typical Turbine Foundations

Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

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The rotor's rotational speed ranges from 6 to 16 revolutions per minute (rpm). The turbines operate on a variable pitch principle, in which the rotor blades are adjusted as the wind speed changes, to maximize electrical power generation. The turbines will begin to generate electricity at wind speeds of approximately 9 miles per hour (mph) and will be shut down at speeds exceeding 56 mph. At wind speeds above approximately 27 mph, the rotor blades will adjust to limit the power generation to the turbine's rated power.

1.5.3.2 Electrical System

The generator located in each nacelle will generate electricity under 1,000 volts. Depending on the turbine selected, the electrical system will consist of five key elements:

1. Individual step-up transformers to increase the voltage of electricity generated by each turbine to 34.5 kV
2. An electrical collector system to collect energy at 34.5 kV from each wind turbine, primarily using underground cabling; overhead cabling will only be used in areas where underground cabling is not feasible
3. Project substations to receive the electricity delivered by the collector system and to increase the voltage to 230 kV
4. An overhead transmission line to deliver electricity from the Project substations to the new BPA substation
5. The new BPA substation, which steps up the voltage to the 500kV required for the interconnection to the existing and proposed BPA transmission system

1.5.3.3 Collector System

From each step-up transformer, power will be transmitted via 34.5-kV electric cables. The majority of the collector system will be buried underground in a trench 3 feet wide and 3-to-4 feet deep. Cabling trenches will be sited in areas paralleling existing or new roads where possible to minimize ground disturbance. Trenches will be backfilled, and fill material will be buried with the cable for protection and insulation. Intermittent cable and junction splice boxes will be located on the ground surface above the underground cabling. Junction boxes require a footprint around each location that is graveled for fire protection and maintenance. A limited amount of overhead 34.5-kV cabling may be needed for areas where underground cabling is not feasible. The final siting of the collector system will be identified once final engineering drawings are completed.

1.5.3.4 Substations

Up to eight substations may be needed for the overall Project, in addition to the BPA substation. Depending on the construction phasing, a substation may serve adjoining construction phases within the same WRA. The Project substations are needed to increase the voltage from the 34.5-kV underground collection systems to the 230-kV overhead transmission line. Each Project substation will be located on private land. Indicative locations are identified in Figures 1-8 through 1-11.

1.5.3.5 Overhead Transmission Lines

Approximately 85 miles (53 miles in Garfield County and 32 miles in Columbia County) of 230-kV overhead transmission lines will be needed for the Project. Each transmission line will carry electricity from the Project substations to the new BPA substation. Overhead transmission lines will be supported by H-frame wooden structures, single pole structures, or lattice towers (see Figures 1-8 through 1-11 for overhead transmission line locations).

1.5.3.6 Communication System

Fiber optic communication lines will follow the electrical underground collector system and the overhead transmission system. The communication lines will link each wind turbine to the Project substations and O&M facilities. The communication system will allow individual wind turbines and other Project facilities to be monitored and controlled both onsite (in the O&M facility) and from remote locations. Additional fiber optic lines and/or microwave towers will be required, capable of transmitting data to PSE, BPA, and other utilities as appropriate. These facilities will be sited within the existing Project area and within the environmental permitting corridors.

1.5.3.7 Operations and Maintenance Facility

Up to six O&M facilities will be needed for the Project. Where possible, multiple WRAs may be served by one O&M facility The O&M facilities may have office space, workshop areas, storage, and a kitchen facility, bathroom, shower, and utility sink. A graveled permanent parking area for employees, visitors, and equipment will be adjacent to the building. Figure 1-14 shows a typical O&M facility.

1.5.3.8 Permanent Meteorological Towers

Up to 11 permanent meteorological towers will be needed for the Project. The meteorological towers will be equipped with multiple sensors to track and monitor wind speed, direction, and temperatures. Each tower will be up to 220 feet tall and consist of a single, non-guyed pole or lattice tower secured by a concrete foundation (see Figure 1-15 for an example of a permanent meteorological tower). Installation of permanent meteorological towers requires approximately 3 acres of temporary disturbance per tower. Permanent meteorological towers will also be fitted with safety lighting as required by the FAA. These towers may also serve as potential locations for microwave communication.

O&M BUILDING ISOMETRIC DRAWING

Source: Noble Environmental Power.

Figure 1-14
Typical Operations and Maintenance Building

Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

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Figure 1-15
Typical Meteorological Tower

Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

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1.5.3.9 Roads

Access to the Project will be provided by U.S. Route 12, State Routes (SRs) 127 and 261, and a combination of existing private and county roads, as well as by new roads constructed for Project access (see Figure 1-16). New road construction and upgrades to existing roads will be done according to Garfield and Columbia county ordinances and through approval of the respective county engineers and public works directors.

Existing Roads

Existing roads in the Project area are generally 16 to 20 feet wide. Some road improvements, including widening, will be needed to allow use of construction vehicles and transport of turbine parts. All road improvements will be completed in compliance with the Garfield and Columbia county road standards for items such as width, geometry, culvert size, etc., and will meet or exceed those standards. Any improvements will need to be approved or authorized by the County Engineer. Finished upgraded roads will include a gravel, surfaced roadbed up to 20 feet wide, and 5 feet of shoulder on each side. An additional 5-foot temporary shoulder on each side of the road may be needed during construction. The 5-foot temporary shoulders will be reclaimed upon completion of construction, leaving a permanent 20-foot wide road and 5 feet of shoulder on each side. During construction, some roads may need additional turn-around areas for larger vehicles. These areas will also be reclaimed upon completion of construction, unless the turn-around areas remain necessary for future maintenance and operations equipment. Some existing culverts may need to be replaced with larger-diameter or longer culverts. Impacts to drainages or jurisdictional waters will be identified during micrositing and mitigated through application of state and federal permits to be obtained before construction.

New Permanent Roads

Approximately 120 miles of new private roads will be constructed for the entire Project, to be maintained by the Project. These private roads will meet or exceed county standards. New private roads will be built and reclaimed according to the same standards, widths, and surface materials described above for existing roads.

Temporary Access Roads

Approximately 83 miles of temporary access roads will be required for construction. When grading occurs, the topsoil will be stripped and stockpiled for restoration once construction is completed. All temporary roads and disturbance areas will be restored to their original condition.

1.5.3.10 Rock Quarries, Rock Crushing Facilities, and Batch Plant

Rock quarries and temporary concrete batch plants will be established on the Project sites to supply gravel and concrete. This will reduce use of off-site rock pits and concrete mixing plants that would require heavy truck trips to and from the Project site. Each rock quarry is anticipated to have a disturbance footprint of under 3 acres, and the depth will be determined by the type of rock encountered at each location. Specific quarry locations will be determined following a geological and geotechnical survey of the Project area. Most of the crushed rock will be used for road building during early construction phases, with a smaller amount of gravel transported to the concrete batch plant for use in concrete slurry during the foundation construction phase. Blasting activities will be conducted by professionally trained and certified explosives experts and will employ industry-standard techniques.

Portable rock crushers will be used to create road construction material and concrete batch plants will be used for mixing concrete. The rock crushers may be located at the onsite quarry pits for the duration of the construction periods. The crushers will operate with appropriate BMP measures employed, including, but not limited to, measures for water runoff and dust control. More details on dust suppression are contained in Section 2.12 Climate and Air Quality. General Orders of Approval for concrete batch plants and portable rock crushers will be obtained from the Washington State Department of Ecology (Ecology). The rock crushing facilities will be required to receive coverage under a National Pollutant Discharge Elimination System (NPDES) General Sand and Gravel Permit. In addition, the concrete batch plants will require Temporary Air Quality permits.

Rock crushers, quarry sites, stockpile sites, portable concrete batch plants (located temporarily on the Project site during construction) and other operations identified as part of this Project will not be required to undergo further CUP application processes beyond the CUP process being conducted at this time for this Project. However, prior to construction, additional site-specific review and permitting will be required and as part of the micrositing process. Once the Applicant has identified a specific site or sites for these operations, the Applicant will be required to submit a site plan to the respective county for administrative review and approval prior to commencing gravel extraction or prior to installation of the concrete batching equipment in accordance with applicable county standards. The site plan shall provide site-specific information sufficient to allow the County to evaluate potential impacts from the quarry and concrete batch operations to determine compliance with County code and with the Conditions of the Project CUP.

1.5.3.11 Safety Features and Control System

Turbine Setbacks

Turbine setbacks associated with wind projects are based on applicable regulations and ordinances, and the Applicant’s experience in constructing and operating wind power projects. The minimum turbine setbacks for wind energy facilities are shown in Table 1-2 and illustrated in Figures 1-17 and 1-18.

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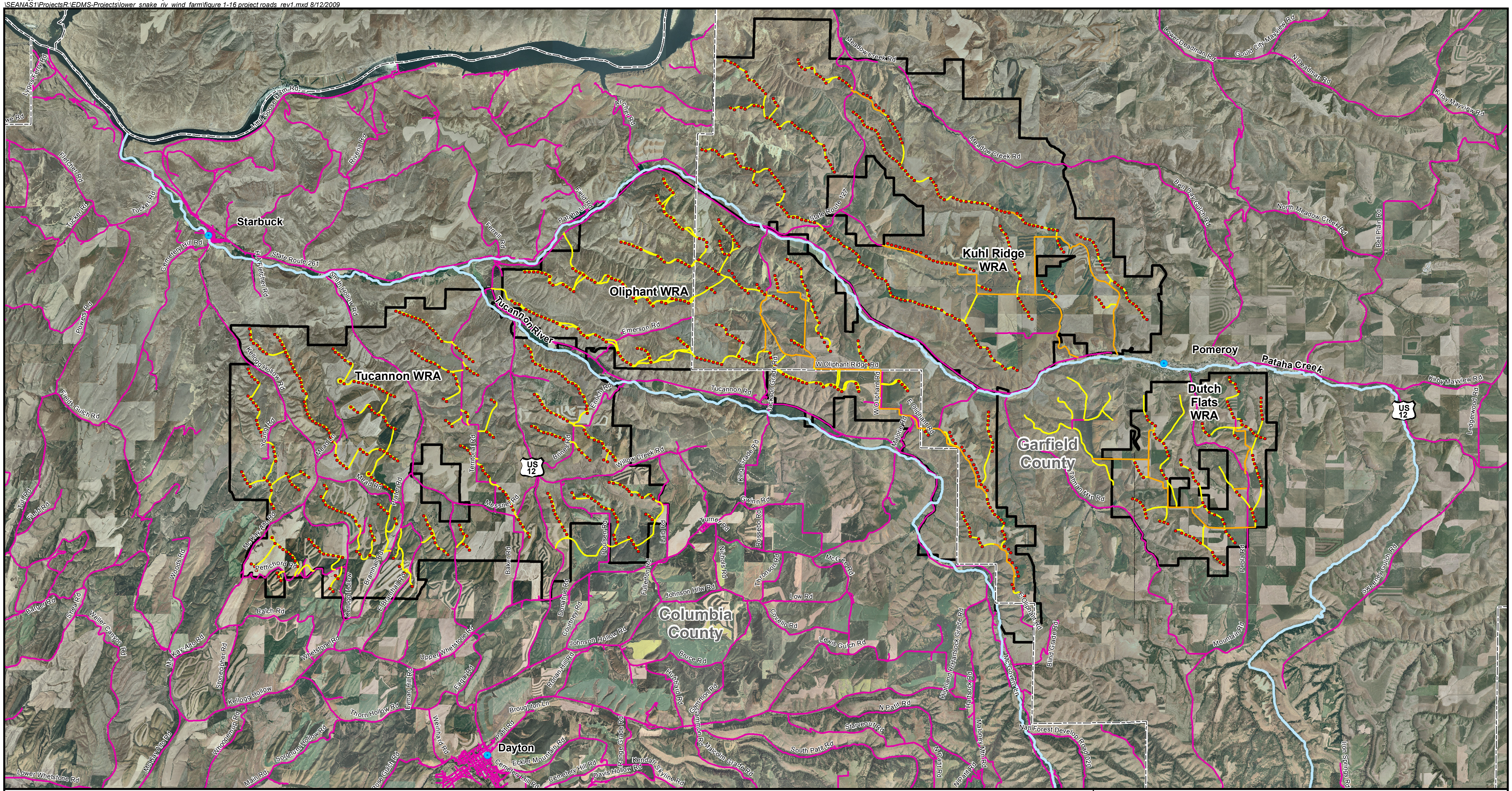


Legend

- Turbine Location
- City
- Other Roads
- Waterways
- County Lines
- Existing Roads
- New Roads
- Existing Roads to be Upgraded
- Project Area

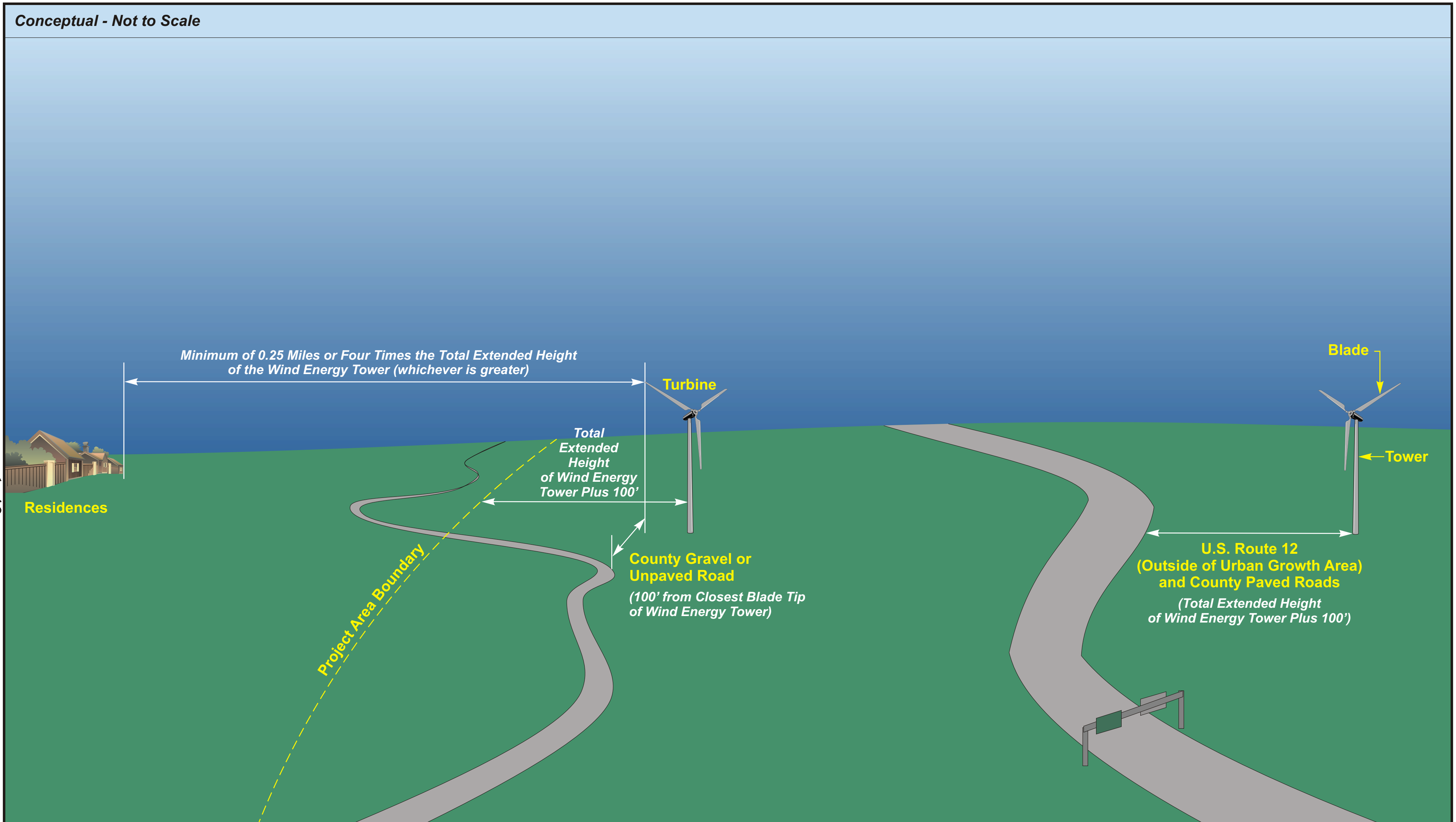
Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

Figure 1-16
Project Roads and
Existing Road Network

0 1 2 4 6 8
Scale 1:160,000 Miles

Source Information:



Note: Lands within the Historical District Impact Area are excluded from the siting of wind energy towers.

Figure 1-17
Graphical Depiction of Garfield County Setback Requirements

Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

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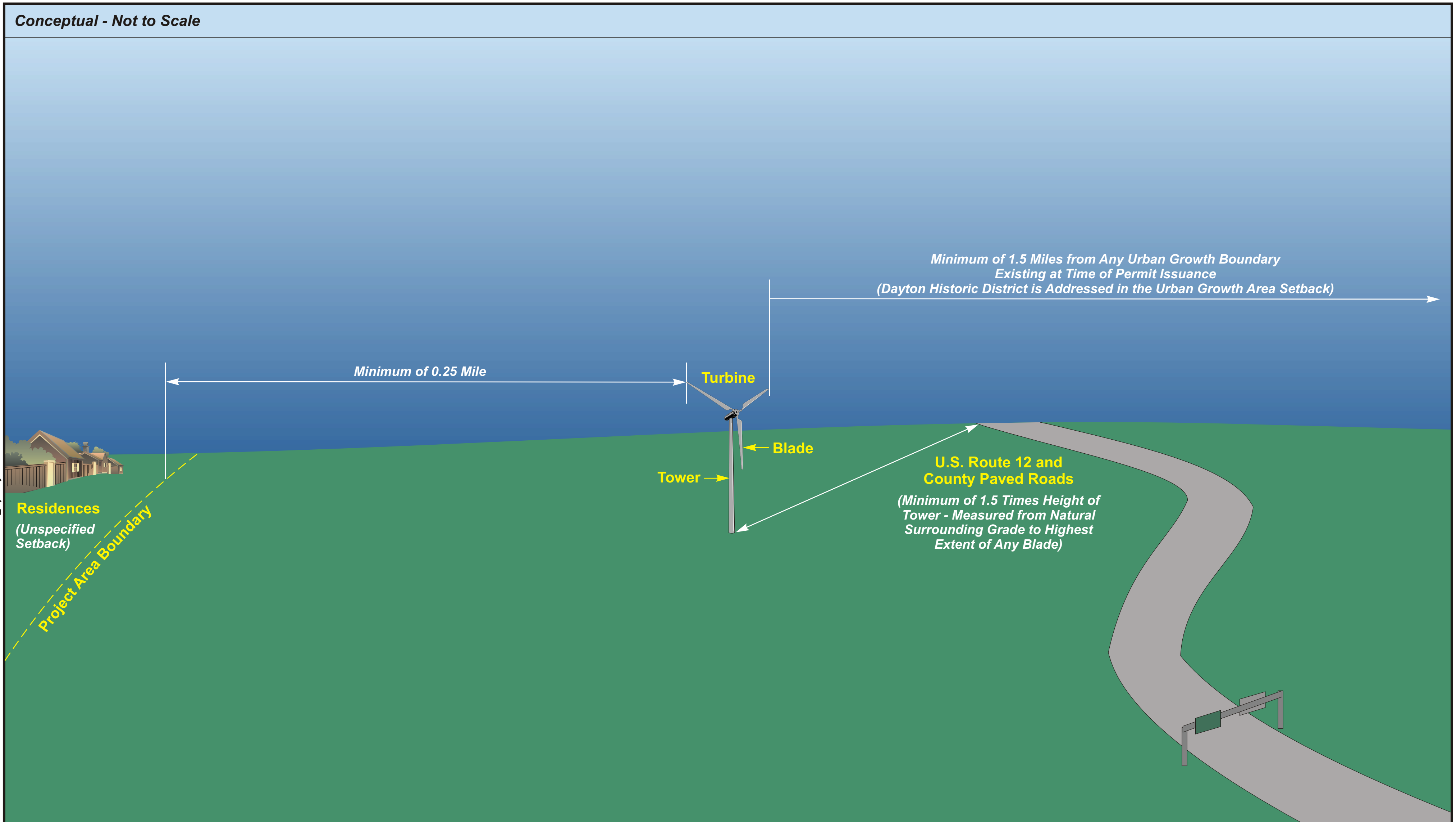

Figure 1-18
Graphical Depiction of Columbia County Setback Requirements

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Columbia & Garfield Counties
Washington

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Table 1-2 Setbacks for Wind Turbines in Garfield and Columbia Counties

Element	Garfield County Required Setback	Columbia County Required Setback
Urban Growth Area	Lands within the Urban Growth Area are excluded from wind energy tower siting	Minimum of 1.5 miles from any Urban Growth Boundary existing at the time of permit issuance
Historical District Impact Area	Lands within the Historical District Impact Area are excluded from the siting of wind energy towers. These lands include all of Section 36, Township 12 N, Range 41 E, W.M.; all of Sections 31 and 32, Township 12 N, R 42 E, W.M.; the north half of Section 1, Township 11 N, Range 41 E, W.M.; and the north half of Sections 5 and 6, Township 11 N, Range 42 E, W.M.	Dayton Historic District is addressed in the Urban Growth Area setback described above.
U.S. Route 12	Outside of the Urban Growth Area: Wind energy tower total extended [tip] height plus 100 feet	Minimum of 1.5 times the height of the tower measured from the natural surrounding grade to the highest extent of any blade
County Roads	From the rights-of-way of all county paved or bituminous-surfaced roads: the total extended height of the wind energy tower plus 100 feet From the rights-of-way of all county gravel or unpaved roads: 100 feet from the closest blade tip of the wind energy tower	From paved county roads: minimum of 1.5 times the height of the tower measured from the natural surrounding grade to the highest extent of any blade
Project Area Boundary	Total extended height of the wind energy tower plus 100 feet, unless waived	Minimum of 0.25 miles to the Project area boundary
Residences	Minimum of 0.25 miles or four times the total extended height of the wind energy tower, whichever is greater unless waived	Columbia County does not have a residential setback specified for residences.

Turbine Safety Features

Safety features associated with each turbine are discussed below. Several of these safety elements will be located within the nacelle, including the turbine control systems, heat dissipation system, safety system, and braking systems.

Turbine Control Systems

Wind turbines will be equipped with computer control systems to monitor variables such as wind speed and direction, air and machine temperatures, electrical voltages, currents, vibrations, blade pitch, and yaw angles. Each turbine will be connected to a central Supervisory Control and Data Access (SCADA) system, which allows for remote control and monitoring of individual turbines and the wind plant as a whole from the central host computer or from a remote computer.

Heat Monitoring, Dissipation, and Control

Heat-generating equipment such as the generator and gear box inside the nacelle will be closely monitored for temperature variation to prevent overheating. All electric, mechanical, and hydraulic equipment will be monitored and cooled with a radiant cooling system or other suitable system as indicated by the equipment manufacturer.

Safety Systems

All turbines are designed with several redundant levels of built-in safety systems and comply with the codes set forth by Occupational Safety and Health Administration (OSHA) and with American National Standards Institute (ANSI) standards. The safety system will include braking systems, climbing safety, lightning protection, and the grounding system for the towers, underground collection system, and substations.

Braking Systems

The turbines will be equipped with two fully independent braking systems that operate either together or independently. The braking systems are designed to bring the rotor under control in all foreseeable conditions. The system will include aerodynamic braking by the rotor blades and by mechanical braking by a separate hydraulic disc brake system. Each rotor blade has a fail-safe mechanism that pitches the blade against the rotation of the rotor, effectively increasing the drag so that the rotor rapidly decelerates. Each blade can operate independently and any one blade is capable of decelerating the rotor. The fail-safe mechanical system then brings the rotor to a complete stop. Remote restarting of the turbine will not be possible following an emergency stop. The turbine will be inspected in person and the stop-fault reset manually to reactivate automatic operation. The turbines will also be equipped with a parking disc brake used to “park” the rotor while maintenance routines or stationary rotor inspections are performed.

Lighting

The Applicant must comply with FAA’s aircraft safety lighting requirements for structures greater than 200 feet tall, which includes turbines and meteorological towers. The FAA does not require daytime (white) lights if the turbines are painted a light color. The FAA requires periodically spaced nighttime red aviation synchronized warning lights controlled by a time clock. The lighting system will be developed in consultation with the FAA. An effort will be made to limit or minimize the visual effects of lighting, to the maximum extent possible, around the cities of Pomeroy, Dayton, and Starbuck; however, minimum FAA requirements must be met.

1.5.4 Project Phases and Construction Activities Description

The Project will be built in four or more phases, referred to herein as construction phases. Construction may occur within more than one WRA in any construction phase. The first construction phase will likely begin in 2010. Due to the unique nature of wind energy facility construction and operation, some of the construction elements listed in this section may occur simultaneously. Facilities may also be shared between construction phases. The following construction sequence is typical for wind energy project construction. Delays in equipment delivery or weather may necessitate changes. Construction activities are discussed in more detail below and are listed here in the order in which they are most likely to occur:

- Road construction and staging areas
- Construction of turbine foundations
- Installation of the crane pads
- Installation of the electrical collector system and transmission line work
- Construction and installation of the substation and/or switching yard
- Construction of the O&M facilities
- Assembly and erection of the wind turbines
- Commissioning of the wind farm

Table 1-3 lists the equipment that will be used during construction.

Road Construction and Staging Areas

Construction of new Project roads includes surveying, clearing, and grading. Cut and fills will be completed where required. Roads will be suitably compacted. Permanent roads will be maintained for the life of the Project, while temporary roads will be reclaimed upon completion of construction.

Temporary staging areas will be needed through the Project area to serve as temporary storage for turbine parts, other Project components, and temporary employee parking. Each staging area will be approximately 2 to 5 acres. These temporary areas will be restored to pre-Project conditions following completion of construction.

Turbine Foundation Construction

Foundations will be one of two types, either a spread-footing foundation or a pier-type foundation, depending on the geologic substrate at each proposed footing location. Spread-footing foundations typically require a 40-by-40-foot hole, which is excavated and filled with a layer of backfill, a 3.5-foot layer of reinforced concrete, a 3-foot high reinforced concrete pedestal, 2.5 feet of additional backfill, and 6 inches of topsoil. Pier-type footings require a hole approximately 30 feet deep and 16 feet in diameter. Two concentric corrugated metal cylinders are placed inside the hole. The space between the two forms is filled with reinforced concrete and the inner cylinder is filled with backfill. The type of footing is determined after geotechnical testing is conducted at each foundation. See Figure 1-13 for examples of the two footing types.

Table 1-3 Typical Construction Equipment

Construction Equipment	Use
Excavator	Clearing
Bulldozers	Moving fill, clearing, grading
Multiple graders	Cutting subgrade and final grade
Off-road dump trucks	Moving cut or fill material
Compactor	Subgrade
Smooth drum vibrating compactor	Final subgrade and final grade
Large rubber tire rollers	Final grade
Belly dump trailers on tractors	Placing base material
Large excavator	Digging foundation hole
Water truck or other vehicle	Point load testing of foundation bottom
Loader	Backfilling
Small sheep's foot roller	Compaction of each lift for backfill
Telescopic forklift	Moving and lowering steel into hole; assembling
40–60-ton crane	Lowering anchoring assembly
Graders (maintainers)	Cutting subgrade and final grade on pad; leveling and clearing work along trench line and leveling at completion of backfill
Off-road dump trucks	Moving fill and placing base material
Larger trencher machine	Trenching
Padding machine	Placing cable bedding above and below cable
Remote dual drum compactor	Compacting the trench line in lifts
Smooth drum roller	Final compaction on top
Vertical drill rig	Drilling
Concrete truck or dry mix machine	Pouring concrete
Rotating boom derrick (RBD)	Holding pole level and in place in preparation for concrete
Pulling trailers and pulling trucks	Guiding the cable
Boom trucks with man baskets	Providing worker access to cables
Rubber tire backhoe	Excavation and loading truck
Vibrating roller	Compaction
Small compaction machine	Compacting around foundation
Cranes (multiple sizes)	Setting breakers, placing transformers, lifting structures
Man lifts	Connecting steel electrical structures and installing overhead equipment
Jumping jack	Compaction following pouring of foundation (in small areas)

Installation of Crane Pads

A permanent 60-by-100-foot crane pad and cleared area will be maintained around each turbine for maintenance and access. All temporary impacts associated with turbine installation will be reclaimed as described elsewhere in this application.

Once backfilling to create a level surface is complete and the excess spoils have been removed from the turbine area, the crane pad will be installed. During preparation of the subgrade for the crane pad, areas adjacent to the crane pad may be leveled and compacted for placement of tower components.

Collector System and Transmission Line Installation
The majority of the collector system will be direct buried cable placed in a trench or constructed overhead. Trenching for underground cabling will include trenches 3 to 4 feet deep and 3 feet wide. The trench may be excavated with a trenching machine if ground conditions permit. If competent rock is encountered at shallow depth, it may be necessary to jack hammer rock locally or drill and blast sections so a trench can be opened up. A backhoe is typically used in more confined spaces adjacent to towers where several underground circuits are run parallel. Selected fill will be used to protect the buried cables. A fiber optic cable will be installed in the trench for the wind turbine SCADA system.

The overhead transmission lines will be placed on wooden H-frame structures, wooden or steel monopoles, or lattice towers, depending on the spans required and other design constraints.

Substation and/or Switching Yard Installation
Each Project substation will cover approximately 2 acres. The substation sites will be cleared and graded, and will include concrete foundations, steel support structures, a small control building, and above-ground electrical equipment. Each substation will require an access road and communications links via fiber optic cable or microwave. The substation perimeter will be secured by a chain link fence with a locked gate, intrusion detection, and other security features.

BPA will manage construction of the interconnection substation, which it will own and operate. Construction of this facility is anticipated to begin in 2010.

Construction of the O&M Facilities
Construction of the O&M facilities will commence with clearing and grading, followed by installation of foundations and conduit; building construction will follow. The disturbance area will be limited to the size of the O&M yard to minimize the need for restoration later.

Assembly and Erection of the Wind Turbines
Tower and turbine parts will be either transported directly to the turbine foundation or transported to a central staging area and then transferred to another truck for transportation to the foundation. The towers come in 3 to 4 sections: the nacelle, the rotor and blades, and the switch gear or controller. These pieces are placed around the tower and crane pad on the compacted area. Tower sections are erected using a crane. A graveled area approximately 23 feet in diameter is

maintained around each turbine, and the remaining temporarily disturbed area is reclaimed. Additionally, a crane pad is maintained at each turbine for future maintenance.

Commissioning the Wind Farm

After completion of construction, all inspections are carried out and the Project is commissioned. Once all communications are verified, the Project can commence commercial operation.

Final Road Grading Restoration and Site Clean-up

The applicant will ensure that roads are built and maintained to applicable standards, temporarily disturbed areas are restored, and cleanup of construction and material waste accord with requirements.

1.5.5 Construction Workforce

The number of employees per construction phase is shown in Table 1-4. Overall, 250 onsite personnel per construction phase are anticipated.

At peak, up to 160 personnel would be onsite at once as multiple disciplines of contractors complete their work simultaneously. Employees are assumed to work single 10-hour shifts, 5 or 6 days per week, as the work demands, for the duration of construction. Stand-by days, days with double shifts, and possible night work are anticipated during turbine erection to allow for completion in low-wind conditions.

Table 1-4 Construction Labor Force per Construction Phase

Construction Activity	Project Management & Engineers	Field Technical Staff	Skilled Labor & Equipment Operators	Unskilled Labor	Total
Engineering/Surveying/Design	6	12	0	0	18
Road Construction	5	5	15	5	30
Foundations Construction	3	4	23	30	60
Electrical Collection System Construction	2	3	23	12	40
Substation Construction	5	3	8	4	20
Wind Turbine Assembly and Erection	4	6	15	15	40
Plant Energization and Commissioning	5	10	15	0	30
Construction Punchlist	1	1	3	10	15
Total	**31**	**44**	**102**	**76**	**253**

A detailed discussion of construction workforce origin, housing, and travel is given in Section 2.15 Socioeconomics.

1.5.6 Operation and Maintenance Activities

The Project will operate 24 hours per day, 365 days per year. The O&M team will staff the Project during core operating hours 9 hours per day, 5 days per week, from 8 a.m. to 5 p.m., with weekend shifts and extended hours as required. The Project's central SCADA system will stay online full time, 24 hours per day, 365 days per year.

The Project will require asset management and project planning, preventive and corrective maintenance of the wind turbines, preventive and corrective maintenance of the electrical collection system and substation, and direct operations dispatch to assure continuing plant and transmission system safety and reliability. Professional management staff of 4 to 5 people will support planning, accounting, and other operations functions. Typically, one maintenance technician is required for every six to eight turbines. Therefore, an aggregate local staff of approximately 89 total will be involved in the day-to-day management, operation, and maintenance of the Project as a whole. Additional personnel will be used to test and maintain the electrical collection system and substation on a recurring basis, but these infrequent duties will likely be allocated to electrical subcontractors or local utility crews.

1.5.7 End of Design Life Alternatives

The design life of major Project equipment such as the turbines, transformers, substations, and supporting infrastructure is estimated to be at least 25 years. At the end of the Project's design life, options are (1) repowering with newer-model turbines, (2) decommissioning, and (3) continuing to operate if the condition of the equipment warrants. Repowering with newer-model turbines may require county review and approval. If any change/replacement of equipment raises environmental issues, not adequately addressed in this EIS, supplemental environmental review would be conducted.

Decommissioning will be carried out in compliance with the requirements of the Garfield and Columbia counties' zoning ordinances and the conditions of approval in the CUPs issued by both counties. Decommissioning typically involves deconstructing the turbines and removing foundations, as requested by the landowner, to a depth required by the respective jurisdictions. Following decommissioning, properties will be returned to agricultural use.

1.6 Mitigation Measures Inherent in Project Design

Facility design will include mitigating measures and will comply with applicable codes and standards and implementing BMPs. The resource sections in Chapter 2 of this EIS describe additional mitigation measures identified through (1) the impact analysis, (2) applicable wind development standards and conditions required by Garfield and Columbia counties, (3) Washington Department of Fish and Wildlife (WDFW) Wind Power Guidelines, and (4) consultation with agencies and tribes. Micrositing will yield additional information as site-specific environmental data are refined within the environmental permitting corridors, resulting in further mitigation measures such as avoidance being undertaken as Project elements are definitively sited and constructed.

1.7 Alternatives

SEPA requires consideration of the Proposed Action (or Preferred Alternative), the No Action alternative and other reasonable project alternatives that meet the objectives of the Proposed Action (discussed in Sections 1.3 and 1.4 above). WAC 197-11-440(5). For a private action, such as this Project, SEPA does not require consideration of alternative sites for the Project. WAC 197-11-440(5)(d). As such, this DEIS considers the potential impacts from approximately 1,000 individual turbine locations, even though only approximately 795 turbines will actually be constructed in the Project to satisfy SEPA's requirement to consider other reasonable project alternatives. The Preferred Alternative, based on meeting the Project objectives and purpose and need (see Sections 1.3 and 1.4), is discussed below, followed by the No Action Alternative. As previously indicated, the study area for the Preferred and No Action alternatives was chosen primarily for its energetic wind resource, which is suitable for producing electricity at competitive prices, as well as its access to power transmission lines that traverse the site and have adequate capacity to allow the wind-generated power to be integrated into the power grid.

1.7.1 Preferred Alternative

The Applicant has prepared indicative layouts (see Figures 1-8 through 1-11) showing approximately 1,000 possible turbine locations within the Project Area. Environmental impacts of all the proposed turbine locations will be considered. Not all of the turbines displayed on the indicative layouts will be built; however, the indicative layouts cover a broad enough geographical area to allow for micrositing of turbines and other facilities. The final microsited layout will consist of approximately 795 turbines, which will have a total capacity of approximately 1,432 MW.

Under the Preferred Alternative, the overall Project will use shared infrastructure, including overhead transmission lines, roads, and O&M facilities. Construction activities may occur simultaneously within adjacent WRAs. Each of the four WRAs and design scenarios are discussed in Section 1.5.2.1.

1.7.2 No Action Alternative

Under the No Action Alternative, the Project will not be constructed and no wind energy will be produced from the Project area. It is assumed that existing land uses will continue. Fewer renewable energy resources will be created, eliminating this Project's contribution to utilities' requirement to meet the State's renewable portfolio standard (RPS) of obtaining 15% of the State's power from renewable energy resources by 2020. Economic benefits to the local economy, including harvesting of wind resource on existing agricultural lands, will not be realized. The counties, their citizens, and local institutions such as hospitals and fire and school districts will not benefit from a Project-related enhanced tax base and tax rate reductions, increased local revenues, or creation of temporary and permanent jobs.

Utilities will continue to use other or new power sources to meet the needs of their customers. It is likely that the region's need for power will be addressed by a combination of energy efficiency and conservation measures at the user's end, existing power generation sources, or development of new renewable and non-renewable generation sources. Baseload demand would likely be filled through expansion of existing, or development of new, thermal generation sources such as gas-fired combustion technology and associated transmission facilities. Such development could occur at appropriate locations throughout the State of Washington.

1.8 Alternatives Considered but Not Evaluated in this EIS

Washington's SEPA rules applicable to privately proposed projects such as the Project specify that the lead agency must evaluate the No Action Alternative and only those other reasonable alternatives for achieving the Project objectives on the same site (WAC 197-11-440 (5) (d)). "Reasonable alternatives" are those that would attain the Project objectives but at a lower environmental cost compared with the proposed action. Several potential alternatives were considered during the development of this EIS, but were not analyzed in detail because they were not deemed reasonable, or they did not meet the Project objectives. Accordingly, an entirely discrete alternative to the Project as proposed by the Applicant is not included in this environmental review. Alternative technologies and alternative Project layouts are further discussed below.

Alternative Technologies

Alternative forms of energy generation (both renewable and non-renewable) would theoretically be feasible for development at the Project site. Fossil-fuel projects are non-renewable energy generation facilities that would not meet the Project objective of providing a renewable energy source to help Washington utilities fulfill the renewable production standard set by Chapter 19.285 RCW. Alternative renewable energy technologies, such as solar generation, would result in similar or greater environmental impacts and at a much higher cost per unit of energy than the proposed action, and thus would not represent a reasonable alternative to the proposed action. Neither Garfield County nor Columbia County currently has other eligible renewable resources, defined by state law to include wave, ocean or tidal projects, geothermal energy, landfill gas, biodiesel, or biomass energy, in volumes sufficient to support a large utility project. Development costs for these other renewable resources are also presently much higher than equivalent costs for developing a large wind project.

Use of vertical axis wind turbines (VAWTs) was considered because they could theoretically minimize visual impacts due to their reduced height. VAWTs have also been marketed as wildlife friendly. However, there is no data to show that

VAWT turbine installation and operation results in fewer wildlife impacts. VAWT technology is currently limited to machines that produce less than 750 kW each. To meet Project objectives, greater than 1,900 VAWT towers (far in excess of the number of towers in the proposed action) would be needed. This would create a more geographically widespread visual impact and a larger footprint of disturbed ground surface.

Alternative Site Layout

The arrangement of the turbines and other facilities could be reconfigured within the boundaries of the Project area. Relocation of turbines from ridge tops could lessen the visual impacts associated with the Project. However, turbines must be sited on ridge tops to capture the maximum wind resource. Moving turbines off the ridge tops could result in other impacts, such as encroachment on setbacks from residences and other sensitive areas. Therefore, a proposal with turbines below ridge tops is not a reasonable alternative to the proposed action. However, it is the intention of the Applicant to microsite the Project to avoid specific impacts as conditions warrant.

2 Affected Environment and Impacts

The Project lies between the Snake River to the north and the Blue Mountains to the south. The region is characterized by rolling hills and prairie, and is part of the Columbia Plateau, a semi-arid region lying in the rain shadow of the Cascade Mountains. The rolling hills create ridgetops where there is a good wind resource. The majority of the Project area is dominated by agricultural fields, with smaller areas of grassland and sagebrush steppe habitats. Drainage features are generally best characterized as ephemeral, due to the low precipitation levels.

2.1 Impact Assessment Overview

The remaining subsections of this chapter address, by resource, the existing conditions (affected environment) and the impacts of the Preferred Alternative and the No Action Alternative. A detailed discussion of the Preferred Alternative impacts is provided, including direct and indirect impacts and measures to mitigate identified impacts.

Direct impacts are defined as those that occur as a result of an action on the resource being addressed. Indirect impacts are those that occur as a result of actions on other resources.

Impacts occurring as a result of the Preferred Alternative are evaluated for the following periods of the Project:

- Construction (Section 1.5.4)
- Operations and Maintenance (Sections 1.5.3 and 1.5.6)
- End of Design Life (Section 1.5.7)

End of design life impacts were addressed in a general manner, focusing on compliance with the counties' requirements for decommissioning. Specific impact analyses were not conducted due to the fact that impacts cannot be predicted that far out in time (the design life of the Project is assumed to be approximately 20-25 years).

All impact analyses except that for visual resources are based on the 1.8-MW turbine, as that machine requires evaluation of the greatest number of turbines, yielding a more conservative impact assessment. The tallest turbine suitable to the Applicant's purpose is the 2.3 MW model, and its taller height is used in the visual analysis so that the maximum possible visual impacts are assessed.

Environmental permitting corridors were assessed as part of the impact analysis for this EIS (see Figure 1-7). These corridors encompass the proposed turbines and Project-specific roads, underground collector and overhead transmission lines, and other Project features, plus an additional area surrounding these Project features. These environmental permitting corridors allow for micrositing considerations and siting flexibility based on environmental constraints.

The Applicant has estimated the total number of permanent and temporary footprint impacts associated with the proposed Project. These numbers take into consideration an estimate of the temporary and permanent impacts associated with all proposed facilities. The total number of temporary footprint impacts is estimated to be approximately 2,750 acres and the total number of permanent footprint impacts is estimated to be 600 acres. The permanent estimated footprint impact is approximately one half of one percent of the total number of acres included in the leased lands.

Geographic Information System (GIS) was used to conduct the resource-specific impact analyses. Project facilities (turbines, roads, substations, O&M facilities, collector and transmission lines, construction staging areas, and meteorological towers) were overlaid on top of resources such as geology, soils, vegetation, streams, wetlands, and agricultural areas to identify common Project feature areas, and to calculate areas of temporary and permanent impacts specific to these resources.

Micrositing will yield final locations, which will allow for final precise impact calculations such as disturbed acreages. Mitigation for all impacts will correlate to data generated through this environmental review and micrositing. Please refer to the micrositing discussion in Section 1.2 of this EIS for further details.

Potential cumulative impacts of construction and operation of the Project, when added to other past, present, and reasonably foreseeable future actions, is also discussed. Table 2-1 lists identified projects used for the cumulative impact analysis, and Figure 2-1 illustrates the locations of these projects. These projects are within a 20-mile radius of the Project and were identified through consultations with County officials and others with knowledge of development trends, and through a review of Western Electricity Coordinating Council (WECC) interconnection reports. The WECC interconnection reports are not limited to a 20-mile radius, as locational details for each interconnection request are not provided; only an indication of which county the request was applied for. For interconnection requests, the cumulative impacts area of impact was widened to the county level, inclusive of both Garfield and Columbia counties.

Detailed discussions of cumulative impacts for each resource are found in the subsections that follow in Chapter 2.

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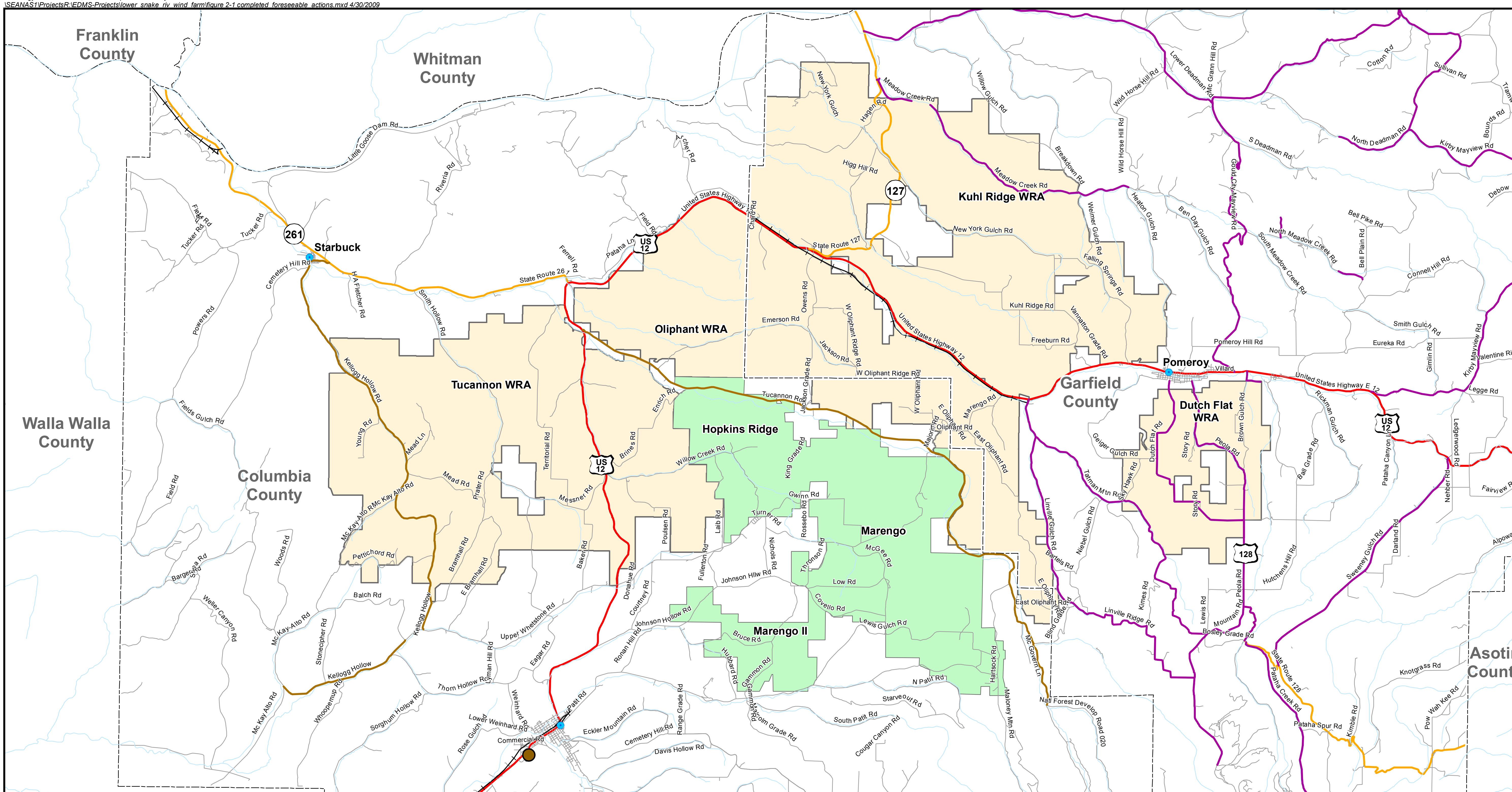

Legend

- City
- Streams
- County Lines
- Project Area
- Port of Columbia
- Garfield County Transportation Projects
- Columbia County Transportation Projects

Lower Snake River Wind Energy Project
Columbia & Garfield Counties
Washington

Figure 2-1
Recently Completed or Reasonably Foreseeable Local Actions Considered for Cummulative Impacts

0 1 2 4 6 8 10
Miles
Scale 1:180,000

Table 2-1 Recently Completed or Reasonably Foreseeable Local Actions

Project Name	Description / Estimated Project Disturbance	Location	Distance to Project Area	Status
Commercial/Industrial Development				
Blue Mountain Station	30-acre private industrial cluster development that will cater to natural and organic food processing. Potential for 15-30 different businesses (food processors). • Assumed 30-acre permanent impact	Columbia County (precise site information unavailable; no site chosen yet – in this analysis, it is assumed that the project is within the current Urban Growth Boundary for Dayton, WA)	Unknown	Funding is still being secured and a site is still being located. Construction will begin within the next 5 years.
Port of Columbia Industrial Park – Columbia County Transportation building	New 8,750-square-foot building to be constructed within the existing Port of Columbia Industrial Park. • Assumed 0.2-acre permanent impact	Port of Columbia Industrial Park, Dayton, WA	Approximately 4 miles south of Tucannon WRA	Project going out for bid in May 2009; construction to start 2009.
Hopkins Ridge	87 turbines on 11,000 acres of farm and rangeland; project footprint of 108 acres.	Columbia County, WA	Immediately south of and adjacent to Oliphant WRA and east of and adjacent to Tucannon WRA	Project completed and operational.
Marengo I	78 turbines (1.8 MW Vestas) (no data)	Columbia County, WA	Immediately south-southwest of and adjacent to Oliphant WRA	Project completed and operational (August 2007).
Marengo II	39 turbines (1.8 MW Vestas) (no data)	Columbia County, WA	Approximately 1 mile south of Tucannon WRA	Project completed and operational (June 2008).

Table 2-1 Recently Completed or Reasonably Foreseeable Local Actions

Project Name	Description / Estimated Project Disturbance	Location	Distance to Project Area	Status
Transmission/Interconnection Requests/Wind Development Projects				
BPA Little Goose-Lower Granite Area Reinforcement	40 miles of new 500-kV transmission line that would start at the new Central Ferry Substation and run to the existing Lower Monumental Substation. • Assumption: Disturbance along 40-mile route due to vehicles, installation of utility poles	Columbia and Garfield counties, WA	Portions within project area – Kuhl Ridge WRA	Project is under environmental review; following review, project will take approximately 4 years from start to energization.
Interconnection for 300 MW of renewable energy	Interconnection at a point on the Tucannon River-North Lewiston No. 1 115-kV transmission line • Assumed 150 turbines • Temporary impact: 630 acres • Permanent impact: 126 acres	Garfield County, WA	Unknown	Projected online date is December 2010.
Transmission request for 300 MW of renewable energy	Interconnection at a point on BPA's 500-kV Little Goose-Lower Granite transmission line	Garfield County, WA	Unknown	Projected online date is October 2014.
Interconnection for 200 MW of renewable energy	Interconnection at a point on the Avista Dry Creek–Talbot 230-kV line • Assumed 100 turbines • Temporary impact: 419 acres • Permanent impact: 84 acres	Garfield County, WA	Unknown	Projected online date is December 2011.
County preapplication discussion of 10 MW of renewable energy	Proposal for approximately 10 MW (5 turbines)	Garfield County, WA	Approximately 4 miles south of Dutch Flats WRA	Unknown

2.2 Geology
2.2.1 Affected Environment
2.2.1.1 Project Area and Regional Geology and Topography

<u>All Four WRAs</u>

Topography in the WRAs is primarily plateaus and incised streams, with few periodic basaltic outcrops and cliffs. Elevations range from 725 feet above sea level (asl) in Kuhl Ridge WRA to 3,143 feet asl in Dutch Flats WRA. Slopes in the Project area range from level ground to over 90%. However, only 27 acres (0.02%) of the Project have slopes exceeding 80%. Construction activity will generally occur in those portions of the Project area where slopes are less than 30%.

The Project lies within the Blue Mountains physiographic province, a sub-province of the Columbia Basin Plateau (WDNR 2009b, Swanson 2006). The geology of the Columbia River plateau consists of older volcanic rock overlain by the Columbia River Basalt group, comprised of younger sedimentary and volcanic units. Individual interbedded bedrock layers in the Blue Mountain province consist of limestone lenses, amphibole-quartz schist, greenstone, greywacke, sandstones, cherty dark argillite, and diorite (WDNR 2009b).

The Columbia River Basalts are a series of flood basalt flows that erupted during the Miocene period in eastern Washington and flowed westward (Brown 1979). Thickness of individual basalt flows varies from 50 to 200 feet. The primary basalts found in the Blue Mountains province are the Grande Ronde Basalt and Wanapum basalts (Swanson 2006). A stratigraphic section in Benjamin Gulch within the Dutch Flats WRA (approximately 2 miles south of Pomeroy, Washington) reveals 13 different basalt flows comprised of the Frenchman Springs, Grande Ronde, Dodge (Wanapum group), and Roza Member basalts as well as an interbedded claystone layer (Swanson 2006).

Overlying the Columbia River Basalts are younger sedimentary and volcanic geologic units consisting of alluvium and deposits from landslides, riverine, catastrophic floods, and loess (Carson 2009). Individual geologic units mapped in the Project area are listed in Table 2-2.

Structural features within the Project area include a northeast-southwest-trending monocline/synclinal bend, which passes through the southern boundaries of Tucannon WRA, Oliphant WRA, and Kuhl Ridge WRA, and a northwest-trending anticline, which passes through the eastern portion of the Tucannon WRA (WDNR 2009a). There are no geothermal sites, oil or gas wells, or active surface mines within the Project area (WDNR 2009d).

Table 2-2 Geologic Units Mapped in the Project Area

Age	Unit	Lithology
Middle Miocene	Grande Ronde Basalt	Basalt flows
Middle Miocene	Wanapum Basalt – Frenchman Springs Member	Basalt flows
Middle Miocene	Wanapum Basalt – Eckler Mountain Member	Basalt flows
Middle Miocene	Wanapum Basalt – Roza Member	Basalt flows
Middle Miocene	Wanapum Basalt – Columbia River Basalt Group	Basalt flows
Pleistocene	Touchet Beds	Outburst flood deposits from glacial Lake Missoula; late Wisconsinan sand and silt
Quaternary	Palouse Formation	Loess
Quaternary	Unspecified Alluvium	Alluvium

Source: WDNR 2009c.

2.2.1.2 Geologically Hazard Areas

<u>All Four WRAs</u>

The Columbia County Critical Areas Ordinance (CAO; 2008) and the Garfield CAO (2008) provide criteria for identifying geologically hazardous areas in the counties. Criteria relevant to this Project are erosion hazard areas, landslide hazard areas, seismic hazard areas, and other hazard areas. The Garfield CAO defers to the Geologic Hazards Evaluation Report for Garfield County, prepared by Howard Consultants, Inc., for identification of geologically hazardous areas in the county. The Geologic Hazards Evaluation Report identifies three potential hazards in Garfield County, slope instability (landslides), flooding, and ground shaking due to earthquakes (Howard Consultants 1992). Areas identified for potential flooding are located primarily along creeks and the Snake River and would not be impacted by the Project.

The Columbia County CAO identifies "erosion hazard areas" as those identified by the National Resource Conservation Service (NRCS) as having a "moderate to severe," "severe," or "very severe" rill and inter-rill erosion hazard (Columbia County 2008). These classifications were developed for the construction of roads and trails in forested areas and are not applicable to this Project. Soils in the Project area tend to be deep and well-drained and are not highly susceptible to water erosion. The NRCS also classifies soils into Wind Energy Groups (WEGs) based on their susceptibility to wind erosion. All the soils in the Project area are in a WEG of "5"or higher, indicating a low susceptibility to wind erosion.

The Columbia County CAO identifies "landslide hazard areas" as areas susceptible to landslides due to any combination of bedrock, soil, slope, slope aspect, structure, hydrology, or other factors. There are no areas in the Project delineated by the NRCS as having "severe" limitations for building and development (USDA 2006a, USDA 2006b). Available GIS layers, topographic maps, and field visits indicate no active landslide features are known within the Project area and the Project area is rated as having a "low" incidence of and susceptibility to landslides, as identified on an overview map compiled by the U.S. Geological Survey (USGS) National Landslide Hazards Program (Godt 2001). There are no mapped recent or historical landslides or other mass movements (quaternary slumps, earthflows, mudflows) or areas identified by the Washington Department of Natural Resources (WDNR) as "unstable" in the Project area (WDNR 2008b, WDNR 2008a).

There is one location in the Project area that meets the following geological hazardous criteria presented in the Columbia County CAO: slope steeper than 15%; hillside intersecting a geologic contact with relatively permeable sediment (loam) overlying a relatively impermeable bedrock (basalt); and a seep or spring. This area is in the southwest of the Kuhl Ridge WRA. The spring was identified from a map review and was not reported during field surveys. This area will not be impacted by Project construction or operations.

There is one mapped quaternary fault in the Project area, the Central Ferry Fault in the Kuhl Ridge WRA. There are five areas in the Project area with slopes greater than 80% that are subject to rock fall during seismic events (identified as such because they are mapped by NRCS as either rock outcrop or rock outcrop complexes). These areas occur at the eastern boundary of Tucannon WRA, along the western boundary of Oliphant WRA, and in the northeast portion of Kuhl Ridge WRA.

The Garfield County Geologic Hazards Evaluation identified no mapped landslides in Garfield County. The analysis identifies potential landslides as areas with steep slopes which include sedimentary interbeds (Howard Consultants 1992). As included in the Columbia County CAO, there are several areas in the Project with a 40% or steeper slope and a vertical relief of 10 feet or more, excluding areas of consolidated rock. The following turbines will be microsited to avoid slopes greater than 40%: T1 and T227 in the Tucannon WRA; T1, T2, T18, T45, and turbine A45 in the Oliphant WRA; and T2 and T3 in the Kuhl Ridge WRA.

There are no additional sites in the Project area that are known to be potentially unstable due to erosion, incision, undercutting, snow avalanche, inundation by debris flows, or catastrophic flooding.

2.2.1.3 Seismic Activity

<u>All Four WRAs</u>

The National Earthquake Hazards Reduction Program seeks to mitigate earthquake losses in the U.S. Part of this program is determination of seismic site classes for a given area based on compilations of shear wave velocity measurements. Definitions for these site classes are provided in Table 2-3 (WDNR 2009e).

Table 2-3 Seismic Site Classes within the Project Area

Site Class	Definition
D	Average shear velocity in the upper 100 feet is 600 to 1,200 feet/second
B	Average shear velocity in the upper 100 feet is >2,500 to 5,000 feet/second
D-E	Mean shear velocity in the upper 100 feet corresponds to a D site class and the mean shear wave velocity minus one standard deviation within the upper 100 feet corresponds to an E site class (average shear velocity <600 feet/second)

Source: WDNR 2008c.

The seismic site class for the Project is primarily class D, with areas associated with drainage valleys classified as B and D-E.

Seismic hazard maps prepared by the USGS have replaced the 1997 Uniform Building Code Seismic Risk Zone maps referenced in the CAOs. USGS seismic hazard maps focus on the shaking hazard, the major cause of structural damage during an earthquake (USGS 2009a). The series of maps defining boundaries based on peak acceleration (% acceleration due to gravity [g]) describes the back and forth (horizontal) motion of an earthquake within given areas across the country. For the map Peak Acceleration (% g) with 10% Probability of Exceedance in 50 Years, the peak horizontal acceleration (% g) can vary from 0 to 100%, with 100% occurring along major faults such as the famous San Andreas Fault in southern California. The peak acceleration within the Project area is estimated at 6% g, which is below the threshold for perceived shaking and not expected to produce structural damage (Rukstales 2002; USGS 2003).

The major tectonic element in the region is the northwest-trending Olympic-Wallowa lineament. This fault zone is partly comprised of a strike-slip fault and is aligned with many anticlines of the Yakima fold belt. The northeasterly-striking Hite fault intersects the Olympic-Wallowa lineament at approximately a right angle about 22 miles southeast of Walla Walla. There are two mapped quaternary faults in the vicinity of the Project: the north-south-trending Central Ferry Fault (Class B) within the Kuhl Ridge WRA and the northeast-southwest Hite section of the Hite fault system, approximately 2 miles south of the Oliphant WRA. A Class B fault is one for which there is evidence of Quaternary deformation but not enough evidence of the actual fault, and/or the fault may not extend deep enough to be a potential source of significant earthquakes (USGS 2009a). The Walla Walla area experienced an intensity VII (approximately magnitude 6) earthquake in 1936. The earthquake and its aftershocks may have been caused by movement along the Hite fault (Carson 2009). However, both the Central Ferry and Hite faults have a current slip rate of less than 0.2 millimeters per year (USGS 2009b) and have not experienced recent significant movement. Consequently, the probability of a seismic event in the Project area is low.

2.2.1.4 Volcanism

All Four WRAs

Within the State of Washington, the USGS recognizes five volcanoes as either active or potentially active: Mount St. Helens, Glacier Peak, Mount Rainier, Mount Adams, and Mount Baker (USGS 2009c). These volcanoes rarely erupt; in the last 200 years, only Mount St. Helens, which is approximately 194 miles west of the site, has erupted more than once. The Project site was in the ash fallout zone from the May 18, 1980, eruption of Mount St. Helens (USGS 1990). Mount St. Helens remains a potentially active and dangerous volcano, even though it is currently quiescent. In the last 515 years it is known to have produced four major explosive eruptions, each with at least 1 cubic kilometer of eruption deposits, and dozens of lesser eruptions. However, based on modeling, the Project area has only a 0.2% probability of accumulation of 10 or more centimeters of air-fall debris from a large eruption of Mt. St. Helens (Wolfe and Pierson 1995).

Glacier Peak, approximately 182 miles northwest of the Project, also has a tendency to produce explosive eruptions that generate large quantities of volcanic ash. Eruptions of Glacier Peak have deposited at least nine layers of pumice ash near the volcano in the last 15,000 years. The thickest deposits from some of the earlier eruptions during this period were laid down east, southeast, and south of Glacier Peak (Waitt et al. 1995).

Mount Rainier, approximately 175 miles northwest of the Project, is a moderate volcanic ash producer relative to other Cascade volcanoes. Eleven eruptions have deposited layers of pumice ash near Mount Rainier in the past 10,000 years, most recently in the first half of the nineteenth century. Ash-producing eruptions from Mount Rainier occur about once every 900 years (Hoblitt et al. 1998).

Mount Adams is the closest volcano to the Project, approximately 164 miles to the west. During much of its history the volcano has displayed a relatively low degree of eruptive activity. Highly explosive eruptions have been rare (Scott et al. 1995). Similarly, Mount Baker, approximately 243 miles northwest of the Project, has not had highly explosive eruptions like those of Mount St. Helens or Glacier Peak, nor has it erupted as frequently (Gardner et al. 1995).

Data accumulated following the 1980 eruption of Mount St. Helens indicate that the most likely effect on the Project site would be ash fallout if one of the five Cascade volcanoes described above were to erupt and the resulting ash cloud were to reach the site. There are no mapped volcanic vents within the Project area and the risk of significant damage due to volcanism is low (WDNR 2003).

2.2.2 Impacts and Mitigation

2.2.2.1 Preferred Alternative

Construction Impacts

All Four WRAs

Construction of the Project will alter Project site geology where local topography may be changed to accommodate construction and operation of turbines, roads, substations, and other facilities. Such alterations will include leveling crane pads; excavating and backfilling turbine foundations; road cuts and fills; developing onsite quarries, rock crushers, and concrete batch plants; trenching for underground collection system; and clearing and grading for additional facilities such as substations and O&M buildings. Geologic environmental impacts also include potential land/rock slides on steep slopes from road grading, cuts, and blasting activities. Turbine foundations, roads, and cutslopes will be designed in consultation with a Washington State licensed Professional Engineer to ensure that appropriate slope protection measures are incorporated into the Project design and that the appropriate materials are used in road construction to ensure stability.

Onsite rock quarries and temporary concrete batch plants will be developed for the Project. Depending on the type of rock at each location, each quarry is anticipated to have a disturbance footprint of less than 3 acres each, and depth will be determined by the type of rock encountered at each location. Most of the crushed rock will be used for road construction, with a small amount of gravel transported to the concrete batch plant for construction of turbine foundations. Blasting activities at the quarries will be conducted by trained and certified professionally certified explosives experts and will employ industry-standard techniques.

The amount of cut and fill material for Project roads will be determined based on the final road design and the construction and grading plan. To the degree the material is suitable, excavated (cut) soil and rock will be used for fill material. The total depth of the road base will depend on the soil load bearing capacity to be determined by geotechnical studies planned along the construction corridors. A minimum of 15 cm (6 inch) gravel surface will be applied to temporary roads to reduce wind erosion.

Construction activities will require vegetation removal and disturbances to topsoil in the Project area, potentially increasing erosion hazards. Clearing and grading will be required for building gravel access roads and for construction of the proposed turbine foundations, substation facility, and buildings. When possible, roads, collector lines, and communication lines will share construction corridors to minimize ground disturbance. Following the specifications and BMPs of the Project's NPDES permit and its Storm Water Pollution Prevention Plan (SWPPP) will reduce the erosion potential. Widened existing roads and new roads will be maintained throughout the Project's life to further limit erosion. During the first year following construction and/or until vegetation has been established in disturbed soil, the site will be monitored for erosion on a regular basis following large rainfall and snow events, and corrective action will be taken if any erosion occurs. Soil impacts from construction and erosion mitigation are fully described in Section 2.3 Soils.

Project turbines, associated access roads, collection systems, and associated facilities will generally be sited on ridge tops with slopes less than 30%. Additionally, no Project features will be constructed within or near areas identified as geologically hazardous as defined by the county CAOs. Consequently, the risk of a landslide during or resulting from Project construction is low.

The probability of a significant earthquake event during construction is very low. Crustal fault activity in the region is low and, therefore, the potential for fault displacements during a large earthquake is low. Project construction will follow in accordance with seismic design codes, including foundations for wind turbines. The shaking hazard for the Project area is very low, even if fault displacement did occur. Therefore, no adverse effects due to earthquakes during Project construction are anticipated.

The probability of a significant ashfall event from a volcanic eruption during Project construction is low. Even if ashfall occurred, it will not impact or otherwise conflict with Project activities other than to delay construction temporarily.

Project Facility Impacts

<u>All Four WRAs</u>

Project operations and facilities will not alter the area's topography or increase the risk of geologic hazards in the Project area. Project facilities will not be located on unstable slopes or landslide-prone terrain. The turbines, associated access roads, collection system, and associated facilities will generally be located on relatively flat ridge tops. To minimize landslides or other mass movement events, no structures will be located adjacent to streamside incision or erosion points. Consequently, erosion and mass wasting potential during facility operations is minor.

If roads are constructed below steep slopes (greater than 30%), soil and fractured rock exposed in cuts could fall on the road if the cut slopes were to fail. Cut slope failure could result from an earthquake, seasonal freeze/thaw action, and slope raveling. Under the proposed site layout, access roads parallel turbine strings along ridge tops and avoid steep slopes.

A large earthquake in the region could affect wind power operations, disrupt the regional electrical distribution system, and may affect other Project facilities. However, the likelihood of catastrophic impacts is remote. Project facilities will be designed to at least the minimum current engineering standards applicable in Columbia and Garfield counties (the International Building Code).

Implementation of onsite emergency plans will trigger measures to protect public health and safety and the environment on and off the site. The main hazard from volcanic eruptions would be volcanic ash. Major hazards from ashfall include:

- impact of falling fragments;
- suspension of abrasive fine particles in air and water; and
- burial of structures, transportation routes, and vegetation.

In addition, ash may clog machinery and filters, cause electrical short circuits, and make roads slippery. Ash could also damage computer disk drives and other electronic equipment, strip paint, corrode machinery, and dissolve fabric. Communications and transportation may also be disrupted in the region. Implementation of onsite emergency plans will significantly reduce the potential impacts of ashfall, through activities such as covering sensitive electronics/switchboards and evacuating personnel from the site. Other types of volcanic hazards, such as pyroclastic flow, lava flow, or volcanic gas, pose much less of a hazard because of the distance of the Project site from the five active volcanoes in Washington.

The Project will incorporate into the final engineering design, plans, and specifications any applicable performance standards for geologically hazardous areas as specified in the counties' CAOs for project facilities. The final engineering plans and specifications as well as the geotechnical analysis will be submitted to Columbia and Garfield counties for review and approval prior to construction as required by the CAOs.

End of Design Life Impacts

No permanent impacts to geology are expected to result from repowering turbines or continuing Project operations beyond estimated Project life, as all such future modifications would be expected to remain within the existing Project footprint. Therefore, impacts to geology from repowering or continuing operations of this Project will be less than those impacts described for Construction, assuming all access roads remain in place.

If decommissioning is chosen, it will consist of removing aboveground equipment such as wind turbines, meteorological towers, and their associated foundations. If the overhead power lines cannot be used by the applicable utility, all structures, conductors, and cables will also be removed. Some features, such as the underground electrical collection system, substations, and O&M facilities, may be left in place in accordance with land leases and zoning ordinances. Decommissioned roads will be reclaimed or left in place, depending on landowner preferences. ROWs and the leased property will be vacated and surrendered to the landowners.

Where facilities are removed, restoration activities could include recontouring slopes, grading, ripping compacted areas, filling, excavating, and replanting/seeding as applicable. Footings and foundations will be removed to a level of 3 feet below the ground surface. Erosion control devices will be installed as appropriate.

If the facility is repowered with new turbines, the impacts to geologic resources will be limited to the workspaces required for temporary disturbance around the turbines and other ancillary facilities. The total change to topography will be slightly decreased where permanent roads constructed for this Project can be used during the repowering in lieu of new road construction.

Mitigation

As the Project is unlikely to have significant impacts on geologic resources, no specific mitigation measures beyond those described above developed for the protection of other resources and/or included in the SWPPP are proposed. The Project will incorporate into the final engineering design, plans, BMPs, and specifications the performance standards for geologic hazardous areas as specified in the CAOs for project facilities. Micrositing prior to construction will avoid any potential geologic hazard areas, including those identified in the CAOs. The final engineering plans and specifications will be submitted to Columbia and Garfield counties for review and approval prior to construction, as required by the CAOs.

2.2.2.2 No Action Alternative

Under the No Action Alternative, the Project will not be constructed or operated and the impacts described under the Proposed Action Alternative will not occur. The existing agricultural uses in the Project area would continue with limited or no impacts to geologic resources.

2.2.2.3 Probable Significant and Unavoidable Adverse Impacts

As mitigated, the Project will have no probable significant and unavoidable adverse impact to geology.

2.2.2.4 Cumulative Impacts

The Project will result in minor, localized alterations of Project area topography. These disturbances will be restricted to the construction corridors for facility siting and will not contribute to geologic instability or increase the risk of geologic hazards in the region.

2.3 Soils

2.3.1 Affected Environment

2.3.1.1 Project Area Description

All Four WRAs

The soils underlying each proposed Project feature were determined using the U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) SSURGO Database (USDA 2006a, USDA 2006b), which contains detailed soils data for Columbia and Garfield counties. The data are presented as a map displaying all soils types in the Project (see Figure 2-2). The soils in the Project area include silt loams overlying basalt bedrock with isolated rock outcrops. The soils are generally deep and well-drained and were formed in loess deposits. The dominant soil types in the Project area are the Walla Walla silt loam and the Oliphant silt loam, which cover approximately 41% of the WRAs (USDA 2006a, USDA 2006b).

The characteristics evaluated to describe the Project soils include slope, drainage class, hydric rating, and minimum water table depth. These particular characteristics are reviewed since they indicate which soils may be problematic for such issues as erosion, compaction from equipment during construction, loss of potential farmland areas, and revegetation difficulties during operation of the Project. Prior to construction, the Applicant will conduct geotechnical studies to determine the site-specific soil engineering properties at each turbine site.

2.3.1.2 Soil Erosion Potential and Drainage Characteristics

All Four WRAs

Areas with steep slopes (CAO-defined as >15%) in the Project vicinity are of potential concern. When steep slopes are cleared of vegetation during construction activities, they may be subject to erosion during storm events. In addition, steep slopes may affect Project activities by limiting the delivery and use of heavy equipment. Furthermore, construction activities at these locations may be more involved since the topography may need to be altered. Approximately 68,346 acres (55%) of the Project area has slopes greater than 15%. Project components were sited to avoid steep slopes that can cause potential problems during construction, except for possible road crossings that cannot be avoided. Measures to prevent erosion will be employed, including the incorporation of BMPs that target the minimization of erosion during construction. See Mitigation under Section 2.4 Water Resources for a complete listing of erosion-specific mitigation measures.

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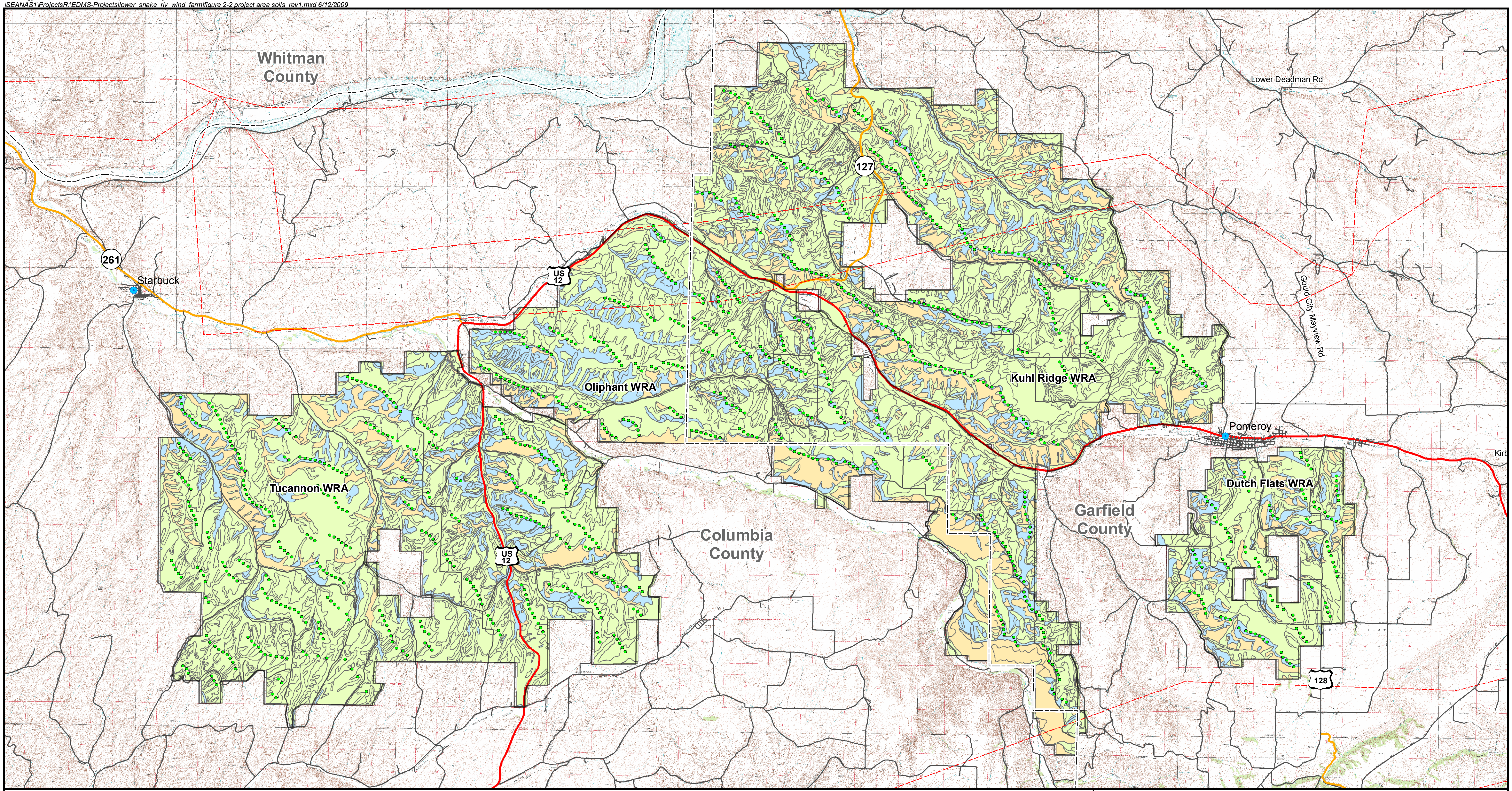

Legend

- Turbine Location
- City
- Transmission Line
- US and State Highways
- State and County Highways
- Local Rural Road
- County Lines
- Project Area

Hydrologic Soil Group Codes

- Soils with moderate infiltration rate when wetted
- Soils with low infiltration rate when wetted
- Soils with a high runoff potential; these soils have a very slow infiltration rate when thoroughly wetted

Lower Snake River Wind Energy Project

Columbia & Garfield Counties
Washington

Figure 2-2
Project Area Soils

0 1 2 4 6 8
Scale 1:140,000 Miles

Source Information: SSURGO

Typically, soils found on level to nearly level landscapes that are coarse-grained in texture and well-drained, have the lowest erosion potential due to water. In comparison, soils found in sloping areas where fine-grained textures predominate and that are poorly drained tend to exhibit the highest erosion potential. Although the Project area contains steep slopes, these areas will be avoided during Project construction and operations. Soils in the Project area are predominantly fine-grained silt loams and over 99% of the Project area is covered by soils classified as "well drained" (USDA 2006a, USDA 2006b).

The NRCS classifies soils into Hydrologic Soils Groups based on their potential infiltration characteristics. Soils are classified A–D, with "A" having the highest infiltration rate and "D" the lowest. Most soils in the Project area have moderate infiltration rates. Project area soils that are grouped in the "D" class are either rock outcrops or have a large component of impermeable rock fragments or layers. As these soils are surrounded by highly permeable soils, runoff from these areas can infiltrate into surrounding soils.

Soil drainage characteristics are also a concern since soils with poor drainage can result in areas of ponding or significant water buildup during storm events. This can cause problems during construction with equipment access and increased rutting potential in soils that are saturated. A "hydric" soil is defined as a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. In addition to their susceptibility to rutting and erosion, hydric soils are a potential indicator of wetlands, seeps, and springs. Less than 0.5% of the soils in the Project area are classified as "hydric." These hydric soils are in the northeastern portion of the Kuhl Ridge WRA, along Meadow Creek, away from Project facilities. Hydric soils are also located along the northeastern boundary of the Tucannon WRA, along the Tucannon River, away from Project facilities. Consequently, the risk of soil rutting and/or ponding during Project construction or operations is low.

Silt loams tend to have moderate erosion factors due to their relatively moderate to high infiltration capacity and moderate runoff potential. A K factor of 0.25 to 0.4 is moderate. Based on NRCS soil surveys, most soils in the Project area have a K factor of 0.43 for their surface layer. These soils also have relatively high infiltration capacity and are well-drained and non-hydric. Therefore, the risk of severe water erosion is low.

Due to their fine texture, the presence of steep slopes, and the area's climate, Project area soils may be susceptible to wind erosion. Wind erosion can displace topsoil and make revegetation efforts difficult. Based on NRCS soil surveys, Project area soils have moderate to low wind erosivity under natural conditions. Furthermore, the potential for wind erosion can be minimized by keeping soils covered in construction zones, using dust abatement measures (such as watering trucks) and tackifiers, and timely revegetating disturbed areas to allow for optimal seed germination.

2.3.1.3 Soil Compaction Potential

<u>All Four WRAs</u>

The potential for a soil to compact depends on its physical properties, water content, and applied load. Physical properties influencing compaction potential include texture, bulk density, organic matter content, and structure. Generally, there is greater potential for serious compaction with soils that have finer textures, high porosity (low bulk density), low organic matter content, and a weak, poorly-aggregated structure.

When soil is dry, it is more resistant to compaction because of the high bonding or cohesive strength, high degree of particle interlocking, and frictional resistance to deformation. As the soil water content increases, the water film weakens these cohesive bonds and lubricates the particles, resulting in an increased potential for compaction. Compaction reduces the soil pore space, which reduces infiltration and leads to increased surface runoff. Compacted soils that are subject to repeated runoff events typically develop rills and ruts that channelize surface flow. Channelizing runoff creates more volume and increases its erosive power, which can lead to the erosion of topsoil. Sustained surface runoff and erosion cause sedimentation in drainages, which degrades water quality and fish habitat. Compacted soil also inhibits plant roots, which makes it difficult for compacted soils to recover to their pre-compacted state (Castellano 2007). This issue can be addressed by intercepting runoff and redirecting and dispersing flows to upland areas.

Most soils in the Project area have a moderate susceptibility to soil compaction, based on their silty texture, high infiltration capacities, and relatively weak prismatic structures. These soils tend to be moist, but are drier during the summer months, when their compaction potential is low.

2.3.2 Impacts and Mitigation

2.3.2.1 Preferred Alternative

Construction Impacts

<u>All Four WRAs</u>

Overall, construction of the Project will disturb approximately 2,750 acres of soil within the total 124,182-acre Project area (or 2% of the Project area). 2,750 acres of soil disturbed during construction will be restored to pre-existing conditions after construction is completed. Restoration efforts could include grading, ripping of compacted areas, seeding/planting, and post-restoration monitoring. There will also be 600 acres that will be permanently impacted by Project facilities.

Temporary construction impacts may include erosion, soil compaction, and the introduction of large stones and rocks into surface soil layers. Short-term increases in erosion can occur as a result of the removal of vegetation during clearing and grading activities and the subsequent exposure of topsoil to precipitation and high winds. In addition, in areas where vegetation is slow to re-establish, the potential for erosion is increased. Soil erosion potential is influenced, in part, by soil grain size, slope, and drainage characteristics. Project soils are predominantly fine-grained and are well drained to excessively well-drained (USDA 2007). Construction activities will avoid steep areas and no structures will be constructed on unstable slopes or adjacent to drainages. The potential for substantial soil erosion from Project construction or operations is low. Geotechnical analyses will be undertaken when the final engineering drawings are completed. Additional analyses may be needed to determine site-specific construction impacts.

Heavy construction equipment and frequent traffic can cause soil compaction and/or rutting on sensitive soils, such as fine-textured clay soils. Project area soils are all silt loam, some with high rock components, and are moderately susceptible to soil compaction. Consequently, the risk of significant soil compaction from the proposed Project is moderate if soils are moist, and low if construction occurs while soils are drier.

Current agricultural production may be hampered by introduction of stones or rocks with diameters greater than 4 inches into a soil's surface layer. Subsurface rock fragments and stones may be encountered during grading, trenching, and excavation operations. Ripping of shallow bedrock during construction could also introduce rock fragments and stones into an agricultural field's topsoil layer. Some soils in the Project area contain naturally high percentages of rock fragments. However, only 224 acres (0.2%) of the total Project area is a rock outcrop or rock complex. Because of the small area of agricultural land likely to be disturbed by the proposed Project, the risk of future agricultural land being hindered by rock introduction is low. A full discussion of potential impacts to agriculture use is included in Section 2-14, Land Use and Recreation.

Additionally, soil contamination as a result of spills or leaks of lubricants and fuels used in the construction process may also occur. The potential contamination impact is minor due to the limited occurrence of such situations. If a large spill were to occur, spill reporting and initial notification requirements from Washington State's Rules for Oil Spill Contingency Plan (WAC 173-182) will be followed. Flammable and hazardous materials will be managed in accordance with Occupational Safety and Health Administration (OSHA) and state requirements, and implemented through the Project Emergency Action Plan (EAP). An SPCC Plan will be prepared for the Project and adhered to during construction and operation.

Blasting of shallow bedrock for construction could also impact soil integrity. Turbine foundations and some road/cable trenches may require blasting. Full approvals will be obtained from the authority having jurisdiction.

Construction impacts to soils will be confined to the Project site and, upon completion, any temporary areas such as corridors and staging areas will be restored to preclude any long-term effects on soil resources.

Project Facility Impacts

All Four WRAs

Impacts to soils from Project facilities and operations will be minor. Overall, permanent soil impacts (conversion of natural soils to non-soil features such as concrete and gravel) will affect approximately 600 acres, or less than 0.5% of the total Project area.

Landslide impacts to soils are negligible for wind farms (Klickitat County 2004). The proposed Project has been designed to avoid steep slopes and highly erodible soils to minimize the risk of a landslide or mass movement event. As permanent Project features will be stabilized once constructed, no further soil erosion or compaction is expected to occur during facility operations. Facility operations are not expected to impact Project area soils beyond occasional maintenance foot traffic or occasional vehicular traffic on access roads.

End of Design Life Impacts

If decommissioning is chosen, it will consist of removing aboveground equipment such as wind turbines, meteorological towers, and their associated foundations. Additional structures could also be removed and their areas restored in accordance with land leases and zoning ordinances. Where structures are removed, the ground surface will be restored as close as reasonably possible to its original condition. Footings and foundations will be removed to 3 feet below the ground surface. Reclamation procedures will accord with site-specific requirements and techniques commonly used at the time the area will be reclaimed, including excavation or fill as applicable, grading, ripping compacted areas, re-contouring of slopes, and/or seeding and planting of native vegetation. Restoration of these areas will help improve soil conditions.

If the facility is repowered with new turbines, the impacts to soil resources will be less than those described for Project construction under Construction Impacts, as disturbed areas will be limited to the workspaces required for temporary disturbance around the turbines and other ancillary facilities. The total amount of erosion potential and compaction will be slightly decreased where permanent roads constructed for this Project can be used during the repowering in lieu of new road construction.

Mitigation

BMPs that will avoid, minimize, or mitigate for environmental impacts to soils, include:

- Limiting construction disturbance by clearly identifying work areas;

- Locating linear features in shared corridors (such as roads and collector lines) to minimize the extent of soil disturbed;
- Using existing roads wherever feasible, rather than building new roads;
- Minimizing vegetation removal;
- Avoiding construction activities on steep slopes;
- Properly engineering any cut-and-fill slopes;
- Installing appropriate roadway drainage to control and disperse runoff;
- Applying a minimum of 15 cm (6 inches) of gravel surfacing to access roads to minimize wind erosion; and
- Applying appropriate erosion control measures (silt fences, straw bales, reseeding, water trucks for dust control, monitoring, and so forth) during and following Project construction.

Soil erosion and offsite sedimentation is expected to be moderate, and will be controlled through implementation of erosion control measures to reduce unnecessary impacts and to comply with the appropriate regulations. BMPs will be implemented in conjunction with applicable guidelines. These BMPs will be identified in the SWPPP and in a NPDES permit from Ecology before construction.

The Applicant will require contractors to use BMPs for handling materials to help prevent spills. If a fuel or lubricating oil spill occurs, it will be cleaned up immediately by removing and properly disposing of any contaminated soils pursuant to applicable regulatory requirements. Procedures for prevention of and response to spills during construction are a component of the SWPPP.

2.3.2.2 No Action Alternative

Under the No Action Alternative, the Project will not be constructed or operated and the impacts described under the Proposed Action Alternative will not occur. The existing agricultural uses in the Project area would continue and disturbances to soils would be primarily associated with agricultural activities and transportation initiatives.

2.3.2.3 Probable Significant and Unavoidable Adverse Impacts

As mitigated, the Project will have no probable significant and unavoidable adverse impact to soils.

2.3.2.4 Cumulative Impacts

The Project, together with the proposed BPA substation, will contribute to a conversion of approximately 600 acres of soil to development in Columbia and Garfield counties (less than 0.1% of the county soils). These impacts will be additive, when considering the temporary and permanent areas of disturbance predicted for future identified wind projects (see Table 2-1).