3.2 WATER RESOURCES (SURFACE AND GROUND WATER) AND FLOODPLAINS

This section presents information on the water resources in the Project area. The existing environment is described and potential environmental effects to water resources from the Project are analyzed. The water resources potentially affected by the Project include groundwater aquifers, wells, streams, rivers, and lakes. The following analysis assesses potential effects to water resources from Alternative B – West Route (Proposed Action [including two options of the Proposed Action]), Alternative C – North Route and the No Action Alternative.

3.2.1 Methodology

This analysis focuses primarily on the effects to water resources within 100 feet of Project features. In recognition of the interconnected nature of hydrological systems, the existing environmental conditions analysis also includes information pertaining to the rest of the watersheds crossed by the Project. The analysis of water resources was conducted primarily using a geographic information system (GIS) that included the following data sources:

- Digital surface water data for streams and lakes based on those present in the U.S. Geological Survey (USGS) 1:24,000-scale topographic maps, also know as 7.5 minute quadrangles.
- Floodplain maps as defined by the Federal Emergency Management Agency's (FEMA) Flood Insurance Rate Maps.
- 10-meter resolution digital elevation model (DEM) acquired from the Bureau of Land Management (BLM).
- Topographic maps from the USGS Digital Raster Graphics of original 1:24,000 maps developed between 1940 and 1995.
- Watershed maps based on digitized USGS 1:250,000-scale Hydrologic Unit Maps.

In addition, wetland and water resources surveys were conducted by Schott and Associates in July 2008 and November 2009. The survey data was used to confirm the map data.

The GIS data was used to determine the number and locations of surface water features in proximity to Project features. The GIS analysis focused on the locations of surface waters and floodplains that were crossed by the proposed transmission line alternatives, located within the 150-foot transmission line ROW, crossed by access roads, or located within other areas potentially affected by project features, including the Echanis Wind Energy Project.

The analysis was informed by comments from the public scoping process which occurred from July to September, 2009. Comments from agency representatives, local organizations and private citizens requested that the following issues be addressed with regards to water resources:

- Identification of all affected waters of U.S.
- Potential effects on groundwater basins, springs, and other open water bodies.
- Potential effects to water resources from the following:
  - Waterway crossings.
  - Activities in floodplains and riparian areas.
  - Runoff to water bodies.

  - Water use in the operation of Project.
  - Hazardous waste spills.
  - Any waste or waste water disposal from construction or operation of the Project.
  - Infrastructure, access roads, and facilities.
- Mitigation or avoidance of effects to source water areas ("Source water" is the drinking water supplied by streams, rivers, lakes, springs, and aquifers for any federally regulated public water system).
- Effects to existing restoration and enhancement efforts.
- Regulatory compliance.
  - Section 303(d) of the Clean Water Act that lists water bodies whose impairment has an adverse effect on beneficial uses.
  - Section 404 of the Clean Water Act and Executive Order 11988 that regulates the discharge of dredge or fill material into waters of the U.S., including wetlands and other special aquatic sites.
  - National Pollutant Discharge Elimination System (NPDES) permit for discharges to waters of the U.S.

3.2.2 Affected Environment

3.2.2.1 Surface Water

The Alternative B – West Route options are completely within the Donner und Blitzen subbasin while the Alternative C – North Route is in both the Donner und Blitzen and Harney-Malheur Lakes subbasin. Both of these subbasins are within the Oregon Closed Basin. The Alternate C-North Route is also partially in the Upper Malheur subbasin, part of the Middle Snake Basin. The Echanis Wind Energy Project site is on the ridge between the Donner und Blitzen and Alvord Lake subbasins, also in the Oregon Closed Basin. In the alluvial systems of the Oregon Closed Basins nearly all surface and groundwater discharge is to lakes, ponds, or marshes. Evapotranspiration is the only means by which water leaves the basins. Evaporation concentrates any minerals present in the water, leaving salt water in surface water and shallow ground water.

The Donner und Blitzen subbasin is comprised of 506,000 acres (NRCS 2006). Portions of the lower Donner und Blitzen River flows through the Malheur High Plateau, from its headwaters in the Steens Mountains to its terminus in Malheur Lake in the northern end of the basin. Steens Mountains is a large single fault-block mountain spanning more than 50 miles, with a crest elevation of about 8,000 feet above sea level, and one peak at 9,354 feet. The Donner und Blitzen River was straightened for agricultural irrigation into its present condition in the Project Area.

The Harney-Malheur Lakes subbasin consists of 950,000 acres (NRCS 2005). Malheur Lake is a freshwater lake with extensive marshes and Harney Lake is an alkali playa which receives flow from Silver Creek and very rarely from Malheur Lake when water levels are highest (USACE 1977). Primary lake inputs are from the Donner und Blitzen River, which originates on Steens Mountain, and the Silvies River, with headwaters on Strawberry Mountain. The Upper Malheur subbasin consists of 1,558,100 acres (NRCS 2006). The Upper Malheur River headwaters are in the Strawberry Mountains at about 8,600 feet in elevation. The river eventually joins the Snake River at about 2,100 feet (Malhuer Watershed Council and Burns Paiute Tribe 2004).

The average annual precipitation in the Project area ranges from 40 inches in the headwaters of Steens Mountain to 10 inches in the lowlands. Only about 10 percent of annual precipitation occurs during the summer. The average discharge for the Donner und Blitzen River is 126 cubic feet per second (cfs) or 91,370 acre-feet/year at 3.5 miles southeast of Frenchglen, OR over the period of record (continuous data from 1937 to the present and sporadic data from 1911 to 1937) (USGS 2008). The maximum discharge was on April 26, 1978 at 4,270 cfs with a gauge height of 7.15 feet. The minimum discharge was 4.2 cfs on December 9, 1972 during a freeze. For the Malheur River near Vale OR, the period of record is June 1926 to September 1934, October 1950 to September 1954, and October 1993 to the present. The maximum discharge was outside this period on February 24, 1957 with a discharge of 21,000 cfs and a stage of 14.6 feet. There is no flow at times some years at this location (FEMA 2009). For both rivers, the highest flows tend to be in the spring and lowest in the winter months.

There is a complex network of canals and ditches that are used for irrigation in the Blitzen Valley. Meadows, ponds and wetlands within the valley are irrigated using seasonal diversions of river water at dams on the Blitzen River. Diverted water is carried to a variety of wildlife habitats using a series of canals and irrigations ditches.

3.2.2.2 Floodplains

FEMA identifies and maps the floodplains of the U.S. through the National Flood Insurance Program. These maps are available to communities to help them reduce future flood damage. In the Project area, FEMA has designated 100-year floodplain, areas of minimal flooding and areas of undetermined flooding (Figure 3.2-1). FEMA considers areas of minimal flood hazard as being outside the 500-year flood level (FEMA 2009). Areas with undetermined flooding may have possible flood hazards, but no flood hazard analysis has been conducted.

3.2.2.3 Groundwater

Malheur Lake is part of a deep structural basin with aquifers in volcanic and sedimentary rock over basalt aquifers (Whitehead 2004). The upper parts of the basin are interbedded with unconsolidated deposit aquifers, leading to complex groundwater systems. Unconsolidated deposit aquifers usually consist of sand and gravel and are the main source of fresh water in the region (ODEQ n.d.). In south-eastern Oregon, these aquifers may sometimes contain salt water due to evaporation and concentration of dissolved salts (ODEQ n.d.). The basaltic aquifers are used primarily for irrigation. Volcanic and sedimentary aquifers vary considerably in geology and permeability and are generally not as productive as the other types of aquifers (ODEQ n.d.).

Groundwater recharge occurs with summer storms or winter snows and discharge occurs with evapotranspiration or water withdrawals. Spring-fed surface waters, such as the Donner und Blitzen River, and wells supply local communities and agriculture, particularly livestock and wildlife needs (ODEQ n.d.). Well depths range from 15 to 300 feet and the depth to water is 10 to 90 feet below the ground surface in northern Harney County and 15 to 100 feet in southern Harney County (ODEQ n.d.). In the uplands of the northern part of the study area, there are numerous fields irrigated with groundwater (FEMA 2009).

The State of Oregon has designated Groundwater Management Areas to address issues of groundwater quality for elevated concentrations of pollutants. Oregon also designates Critical Groundwater Areas to address long-term groundwater declines where pumping exceeds recharge. The Project area is neither in an Oregon Groundwater Management Area (ODEQ n.d.) nor in a Critical Groundwater Area (ODEQ 2007).

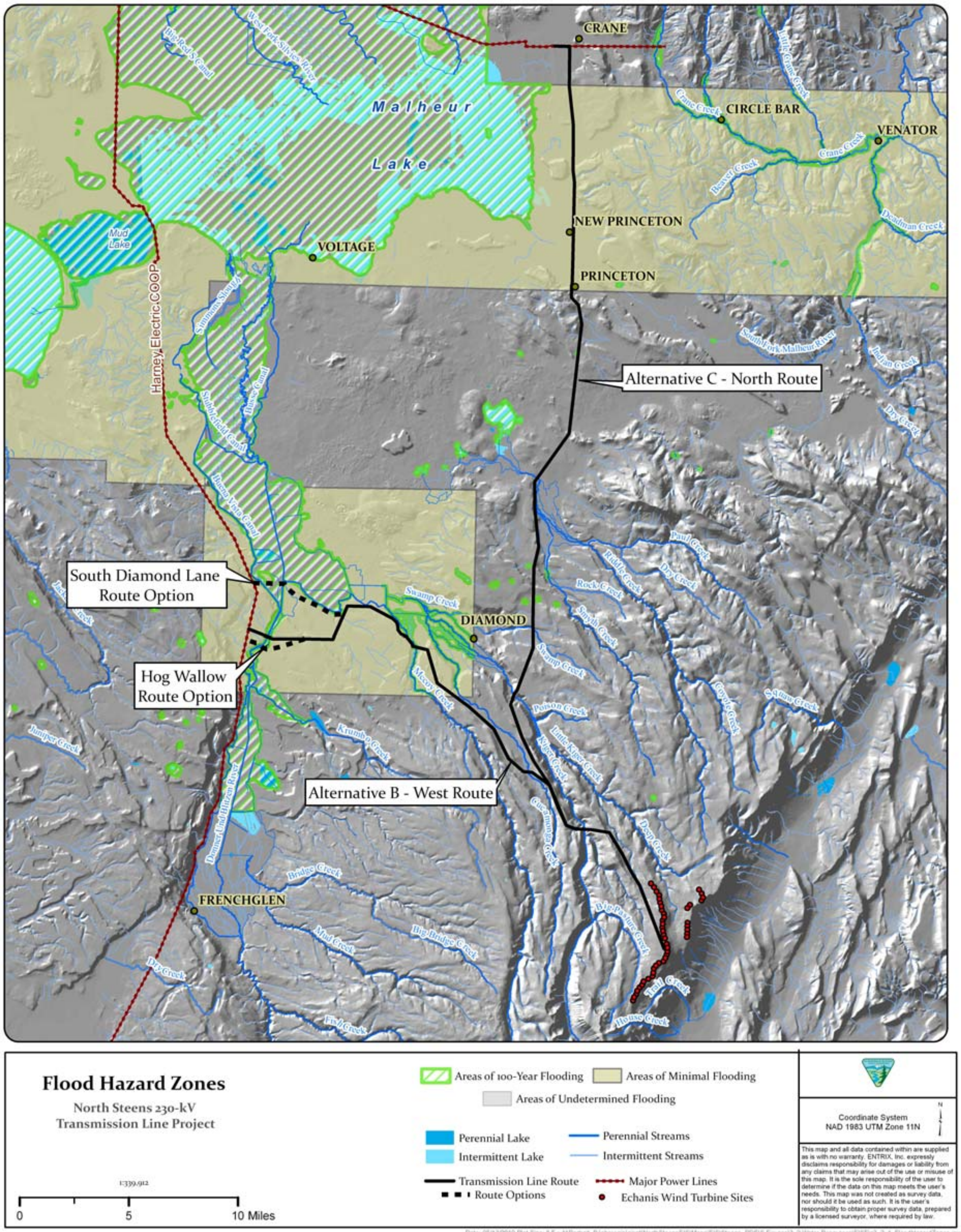

Figure 3.2-1 Flood Hazard Zones

3.2.2.4 Water Quality

Water bodies whose impairment has an adverse effect on beneficial uses are listed under Section 303(d) of the Clean Water Act. Beneficial uses are those uses supported by water quality, such as recreational use, drinking water supply, and aquatic life support. Each beneficial use has its own suite of water quality criteria; a water body is considered to be impaired when these criteria are not met. The Oregon Department of Environmental Quality (ODEQ) assesses surface water through an ambient water quality monitoring network that measures temperature, dissolved oxygen, biochemical oxygen demand, pH, total solids, ammonia and nitrate nitrogens, total phosphorus, and fecal coliform. ODEQ also sets the water quality standards for the state and implements corrective actions where necessary.

Water quality in the Project area is influenced by past and present human uses. Agriculture can add pesticides, herbicides or excess nutrients. Dryland grazing, the primary agriculture in the Project area tends to be concentrated around areas with water availability. Grazing can reduce bank stability, increase turbidity and increase levels of fecal coliform. Of the 516 major streams mapped in the watershed, 20 percent are listed as having total maximum daily load (TDML) requirements by the Oregon State Department of Environmental Quality (ODEQ 2006). Of these, all are listed for excess temperature. This may be due to loss of riparian vegetation or stream widening which reduces shade cover. It may also be due to irrigation returns. Other concerns in the watershed include erosion and availability of water for irrigation (USEPA 2009). ODEQ has not yet analyzed TDMLs for the Donner und Blitzen, Harney-Malheur Lakes and Upper Malheur subbasins. The Alvord Lake sub-basin has TDMLs listed for water temperature and dissolved oxygen (ODEQ 2007).

A number of water bodies crossed by the transmission line routes and access roads are listed by the State of Oregon and the US Environmental Protection Agency as water quality limited (Table 3.2-1) (ODEQ 2006; USEPA 2009). All of those listed are cited for the beneficial use of resident fish and aquatic life; a number are also listed for salmonid spawning (USEPA 2009). While the movement of sediment through surface water is a natural process vital to healthy aquatic systems, increased sediment above background levels can harm some aquatic functions. Sediment travels through water courses along the bottom of the channel as bed load, in the water column as suspended load, or in solution as dissolved load. Fine-grained sediment in suspension increases turbidity; this reduces penetration of light and hence productivity in the stream. Suspended sediments in streams also interfere with salmonid spawning and respiration.

Table 3.2-1 Water Quality Limited Streams in the Project Area

Water Body	Oregon DEQ Status	ODEQ Parameter of Concern	USEPA Parameter of Concern	Route
Donner und Blitzen River	Cat 5: Water quality limited, 303(d) list, TMDL needed	Temperature	RM 45-73: Nutrients, sediment; RM 43-59: acidity; temperature	Alternative B – West Route (Proposed Action), South Diamond Lane Option, Hog Wallow Option
McCoy Creek	Cat 5: Water quality limited, 303(d) list, TMDL needed	Temperature	Nutrients, sediment, temperature	Alternative B – West Route (Proposed Action), South Diamond Lane Option, Hog Wallow Option
Mud Creek	303(d)	Temperature	Nutrients, sediment, temperature	Alternative B – West Route (Proposed Action), South Diamond Lane Option, Hog Wallow Option
Cucamonga Creek	Water quality limited not needing a TMDL	Flow modification	Nutrients, sediment	Alternative B – West Route (Proposed Action), South Diamond Lane Option, Hog Wallow Option
Kiger Creek	Water quality limited not needing a TMDL	Flow modification	Nutrients, sediment	Alternative B – West Route (Proposed Action), South Diamond Lane Option, Hog Wallow Option; Alternative C – North Route
Swamp Creek	Water quality limited not needing a TMDL	Flow modification	Nutrients, sediment	Alternative C – North Route
Riddle Creek	Water quality limited not needing a TMDL	Flow Modification	Nutrients, sediment, temperature	Alternative C – North Route

3.2.3 Environmental Effects and Mitigation

This section analyzes the potential effects of the Proposed Action and Alternatives. Although transmission lines consist primarily of aerial crossings of the landscape, including water bodies, they do have the potential to affect water resources and floodplains during construction and operation of access roads, transmission line poles, and structures associated with the transmission of power across the lines. Similarly, construction of access roads to the site of the Echanis Wind Energy Project, including erection of the turbine towers, internal service roads, underground power collection cables, and other project features could also affect water resources. These effects could occur through the following means:

- Increased sediment delivery to streams due to increased erosion as a result of construction activities or clearing of vegetation.
- Increased runoff due to more impervious surfaces resulting in greater flooding or erosion.
- Permanent structures in floodplains resulting in increased flooding or erosion locally.
- Groundwater degradation through excavation during construction.
- Spills of harmful materials during construction.

Construction effects may occur due to the introduction of excess sediment above background conditions from excavation, the clearing and trampling of vegetation, the construction and improvement of roads, or both. Runoff is dependent on precipitation, geology, soils and vegetation cover. Impervious surfaces reduce precipitation infiltration and increase the rate and amount of erosion or flooding. For the Project, total areas of impervious surfaces are limited to buildings and concrete pads used for equipment. Roads and work areas covered with gravel are not included in the impervious surfaces calculations. Effects would likely be limited to local increases to run-off. Spills of harmful materials can also occur during construction. For example, pollutants could be introduced from equipment use or during fueling. Contamination can occur in both surface and groundwater.

The line would be constructed on double-circuit steel-pole towers. Initially, a single circuit (three conductors) would be installed on one side of the tower (Phase I). Future plans call for a second line operating at 230 kV to be placed on the other side of the tower (Phase II). Finally, the Phase I 115-kV line could be "energized" (no construction required) to 230-kV operation (Phase III). Implementation of Phases II and III would be contingent on the upgrade of existing transmission lines in the area to 230-kV operation. Note: there would only be two "construction" phases. The first circuit would be installed concurrently with the erection of the poles and construction of access roads. The second circuit would be installed later (date unknown) when additional capacity on the line is required. The second phase of construction would use the same laydown areas, tensioning sites, and overland routes used during the first phase.

The potential effects on water resources during the short-term construction phase and the long-term operational phase of the Project are described below. It should be noted that a variety of project design features and best management practices to reduce the effects on water resources from both the Echanis project and the transmission line alternatives, would be implemented as part of proposed action. These measures are not repeated in the mitigation sections below, but are summarized in Chapter 2 and are listed in Appendix A.

3.2.3.1 Alternative A – No Action

Under the No Action Alternative, the Project components would not be constructed and access roads would not be improved or constructed. Water resources would continue to be affected by current use. These current uses include:

- Irrigation for dryland grazing, which diminishes groundwater supplies.
- Numerous canals divert surface water.
- Irrigation returns may be impaired with sediment, excess nutrients or high temperatures.
- Permanent access roads that are currently in place.

3.2.3.2 Echanis Project Effects Common to All Action Alternatives

The permanent and temporary effects on wetlands and riparian areas from construction and operation of the Echanis project would be the same for all action alternatives: Alternative B, the Alternative B route options, and Alternative C. The effects associated with each transmission line alternative are described separately below.

PERMANENT EFFECTS

The Echanis Wind Energy Project consists of the installation and operation of 40 to 69 wind turbines along the ridges on the north side of Steens Mountain. The project would include several miles of 34.5-kV underground power collection cables connecting the turbines to a substation. The substation site would consist of approximately 0.46 acres which would be cleared and covered with gravel and concrete foundations for electrical equipment. The adjacent maintenance building would add another 1,150 square feet of impervious surfaces. The Echanis Wind Energy Project turbines, power collection, substation and building are located outside any water courses or 100-year floodplains (Figures 3.2-2 to 3.2-12 Stream Crossing Maps).

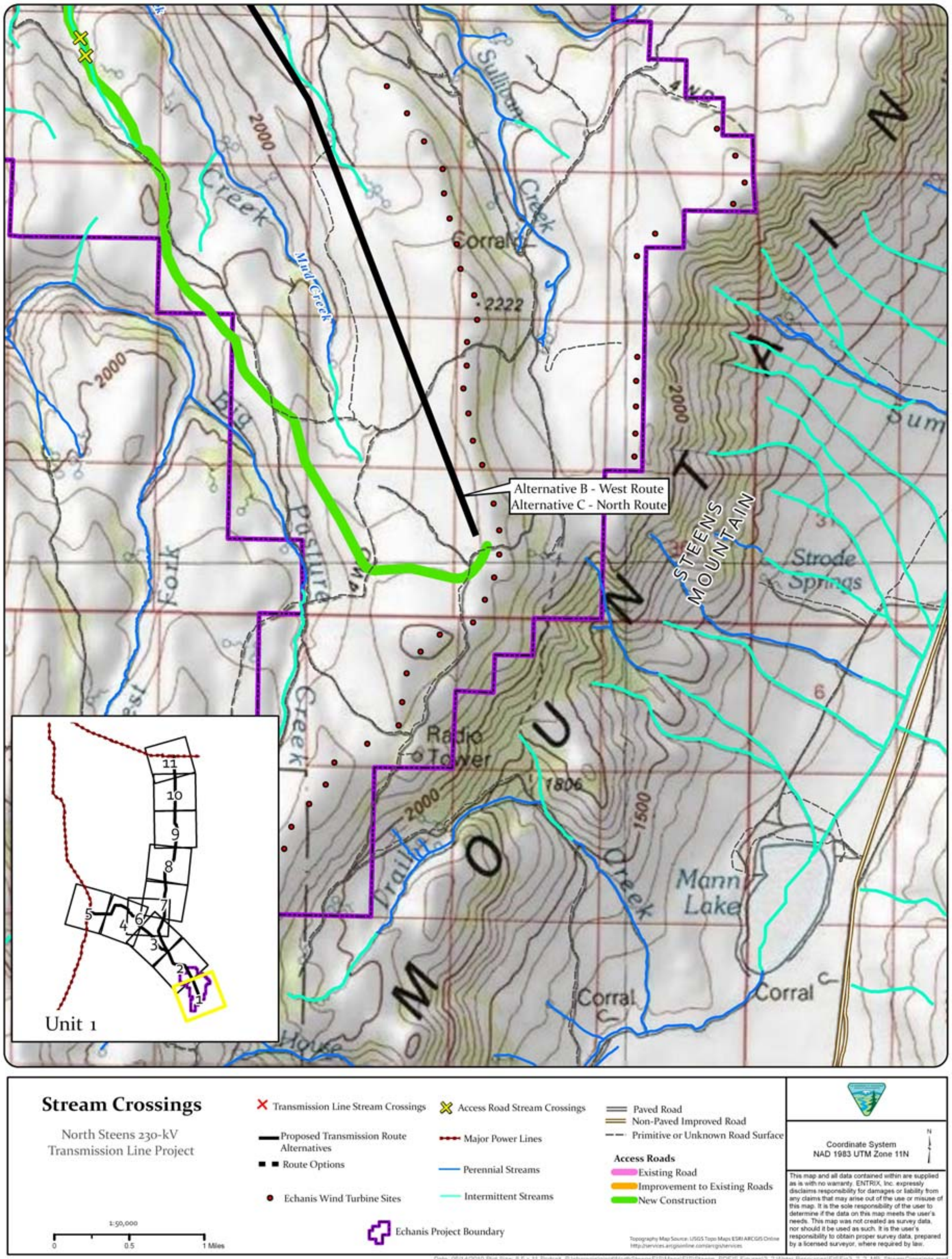

Figure 3.2-2a Stream Crossings Along the Transmission Line ROWS, Unit 1 of 11

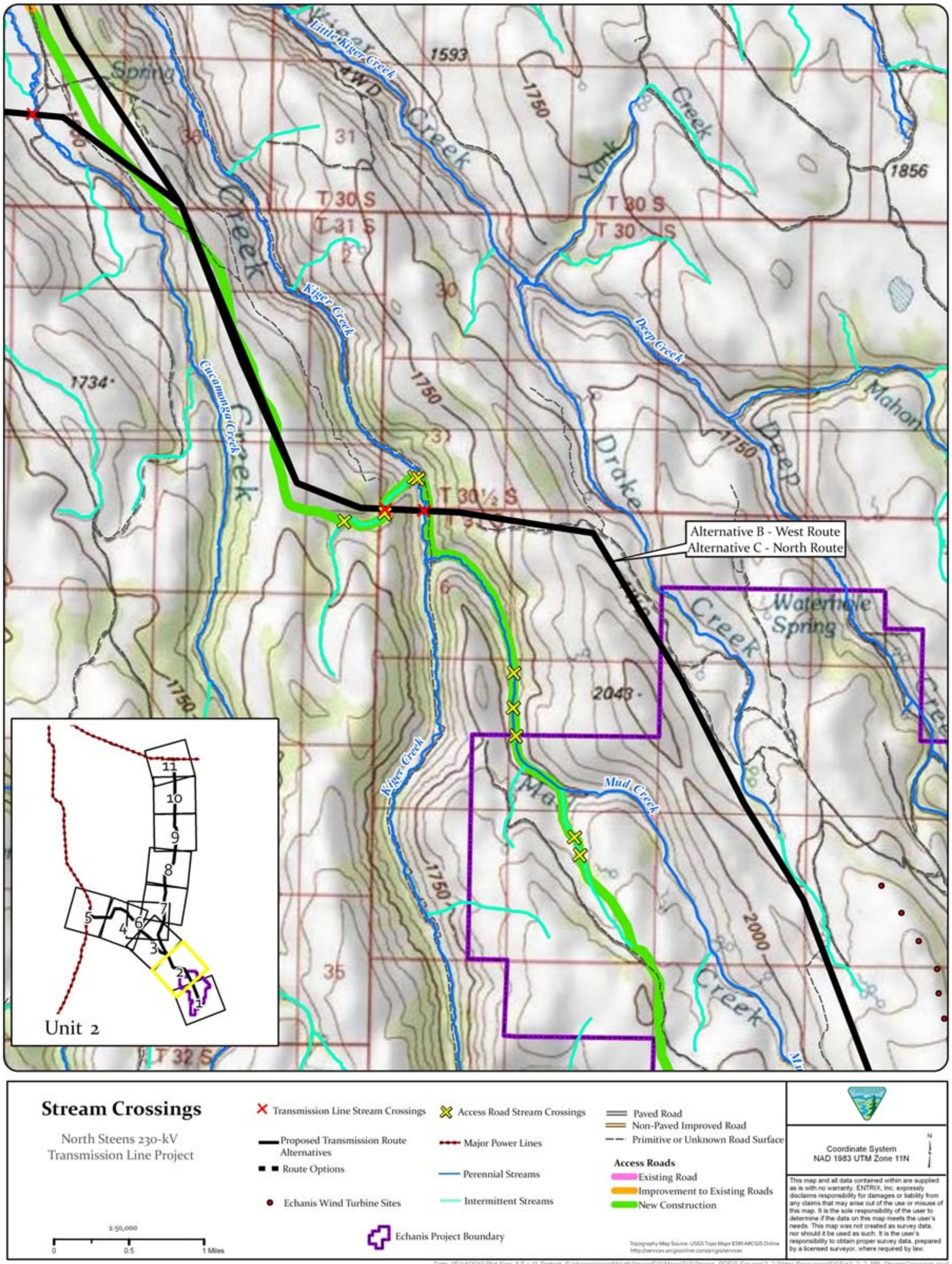

Figure 3.2-3b Stream Crossings Along the Transmission Line ROWS, Unit 2 of 11

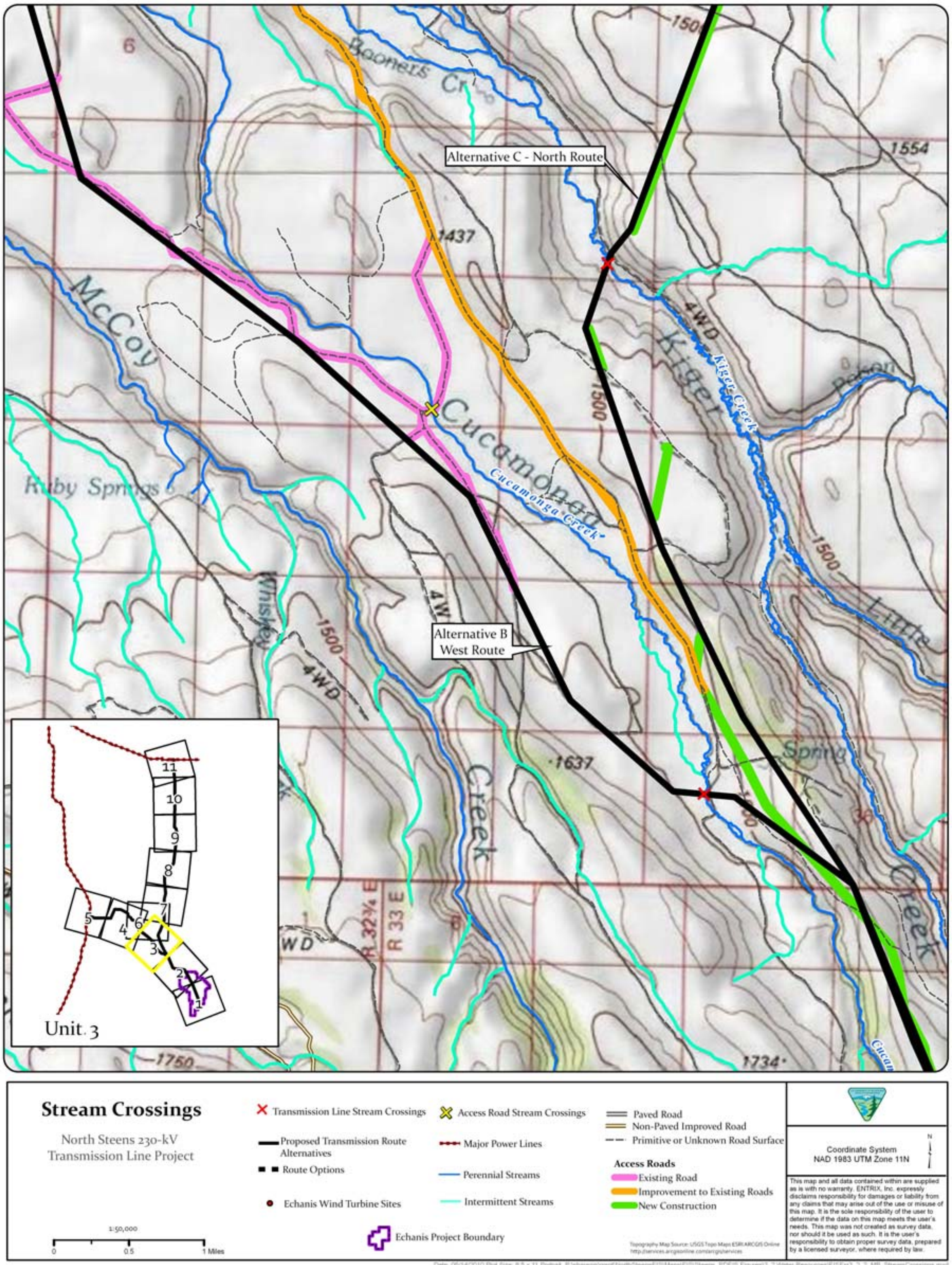

Figure 3.2-4c Stream Crossings Along the Transmission Line ROWS, Unit 3 of 11

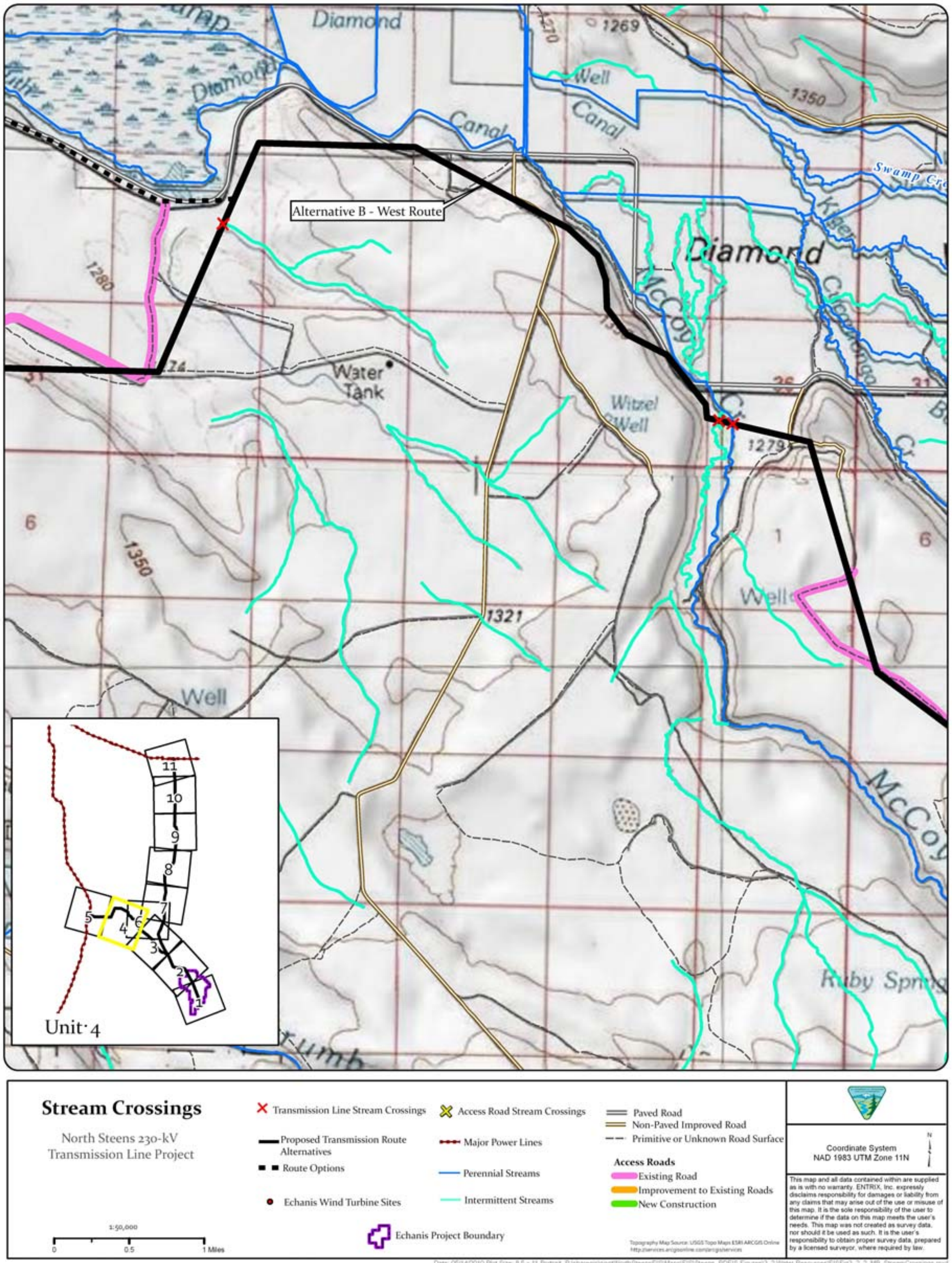

Figure 3.2-5d Stream Crossings Along the Transmission Line ROWS, Unit 4 of 11

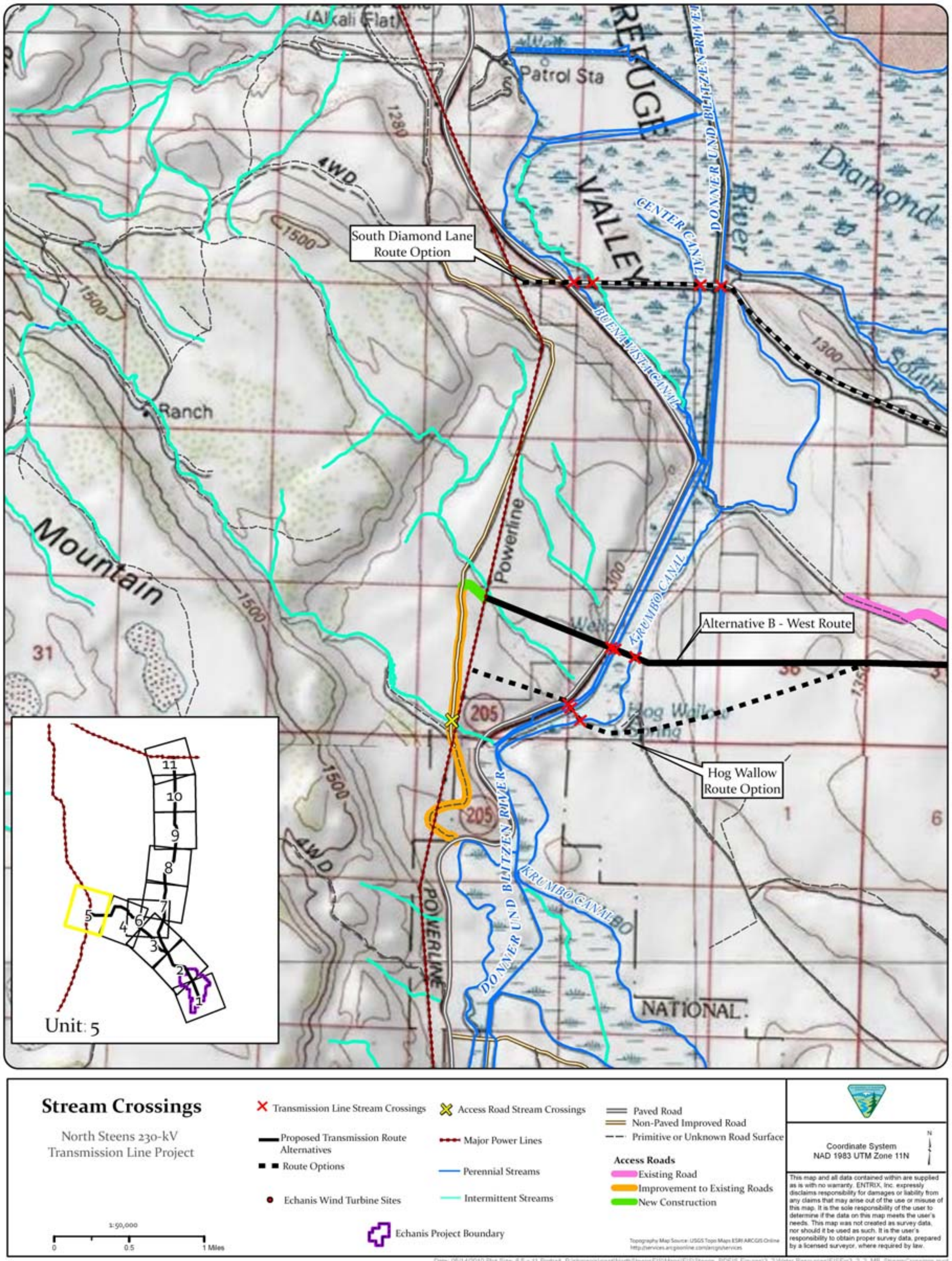

Figure 3.2-6e Stream Crossings Along the Transmission Line ROWS, Unit 5 of 11

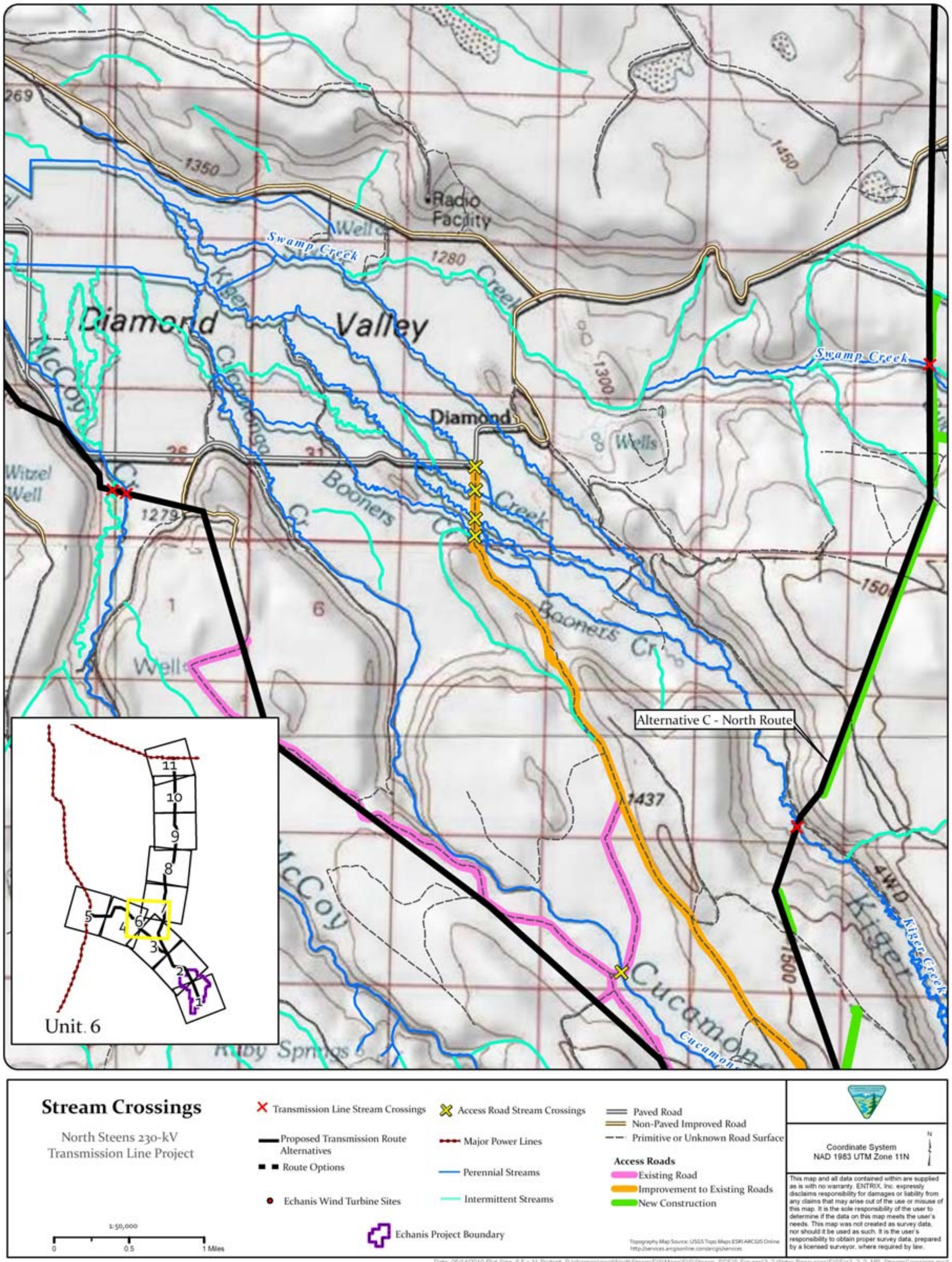

Figure 3.2-7f Stream Crossings Along the Transmission Line ROWS, Unit 6 of 11

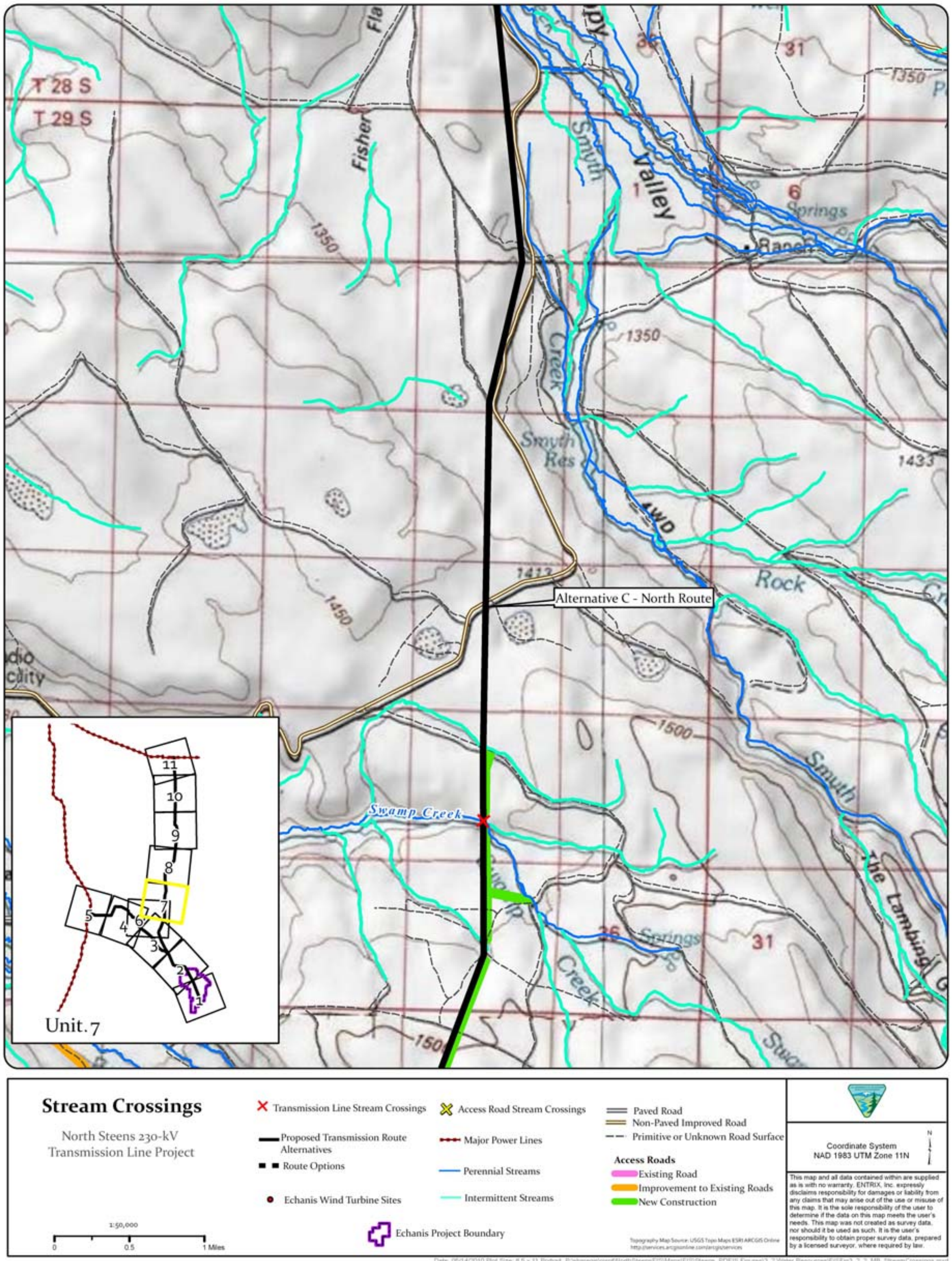

Figure 3.2-8g Stream Crossings Along the Transmission Line ROWS, Unit 7 of 11

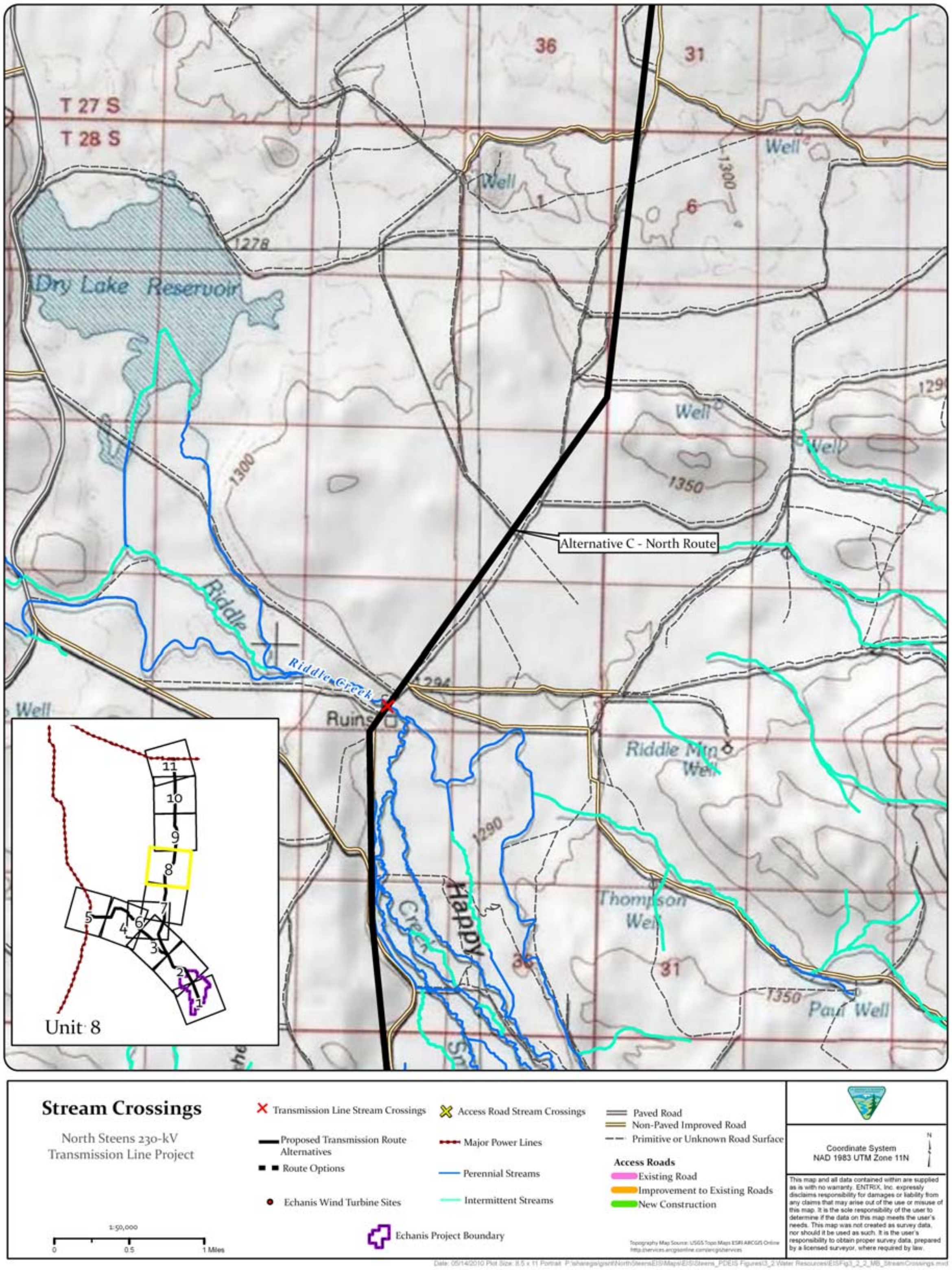

Figure 3.2-9h Stream Crossings Along the Transmission Line ROWS, Unit 8 of 11

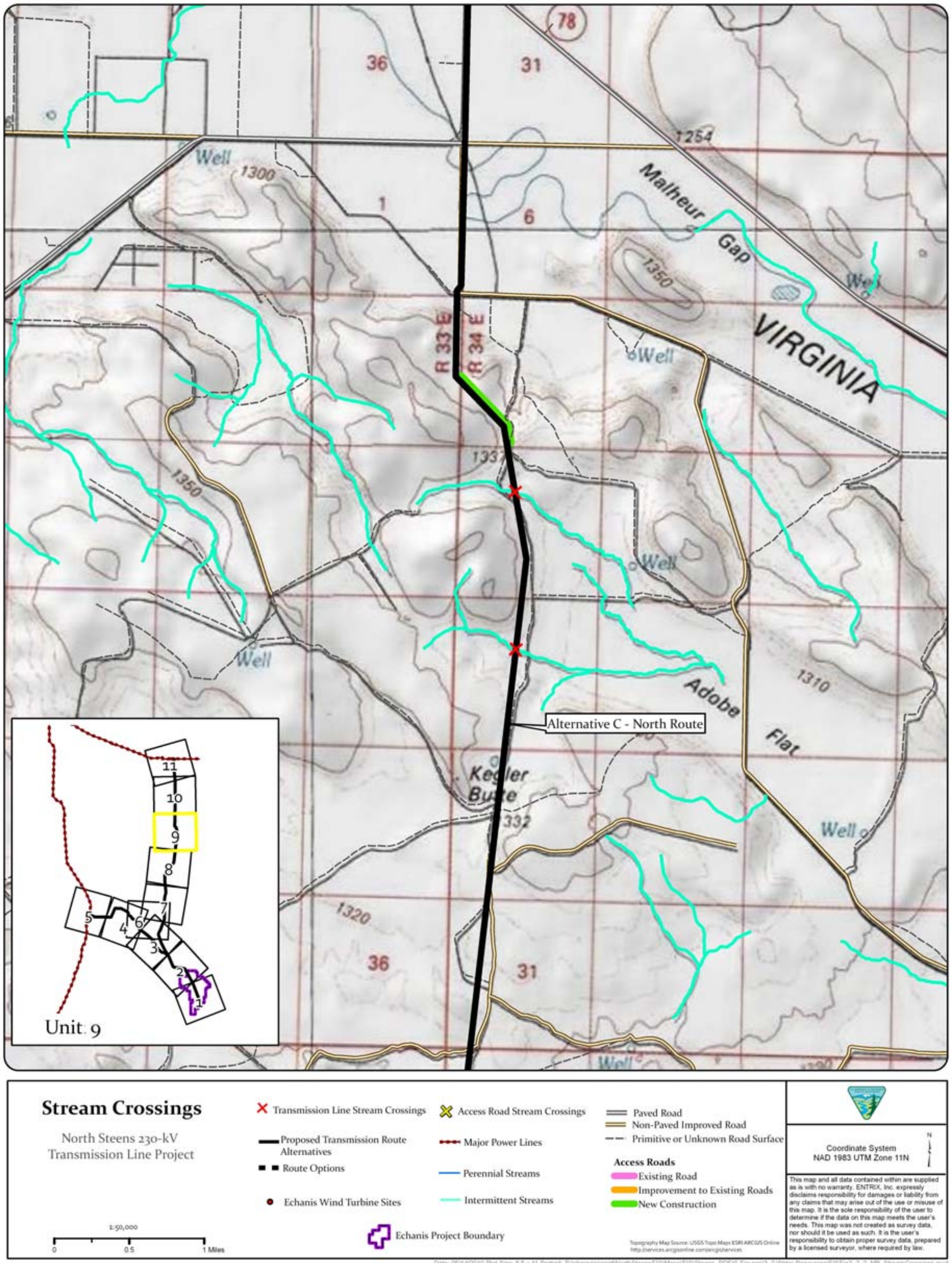

Figure 3.2-10i Stream Crossings Along the Transmission Line ROWS, Unit 9 of 11

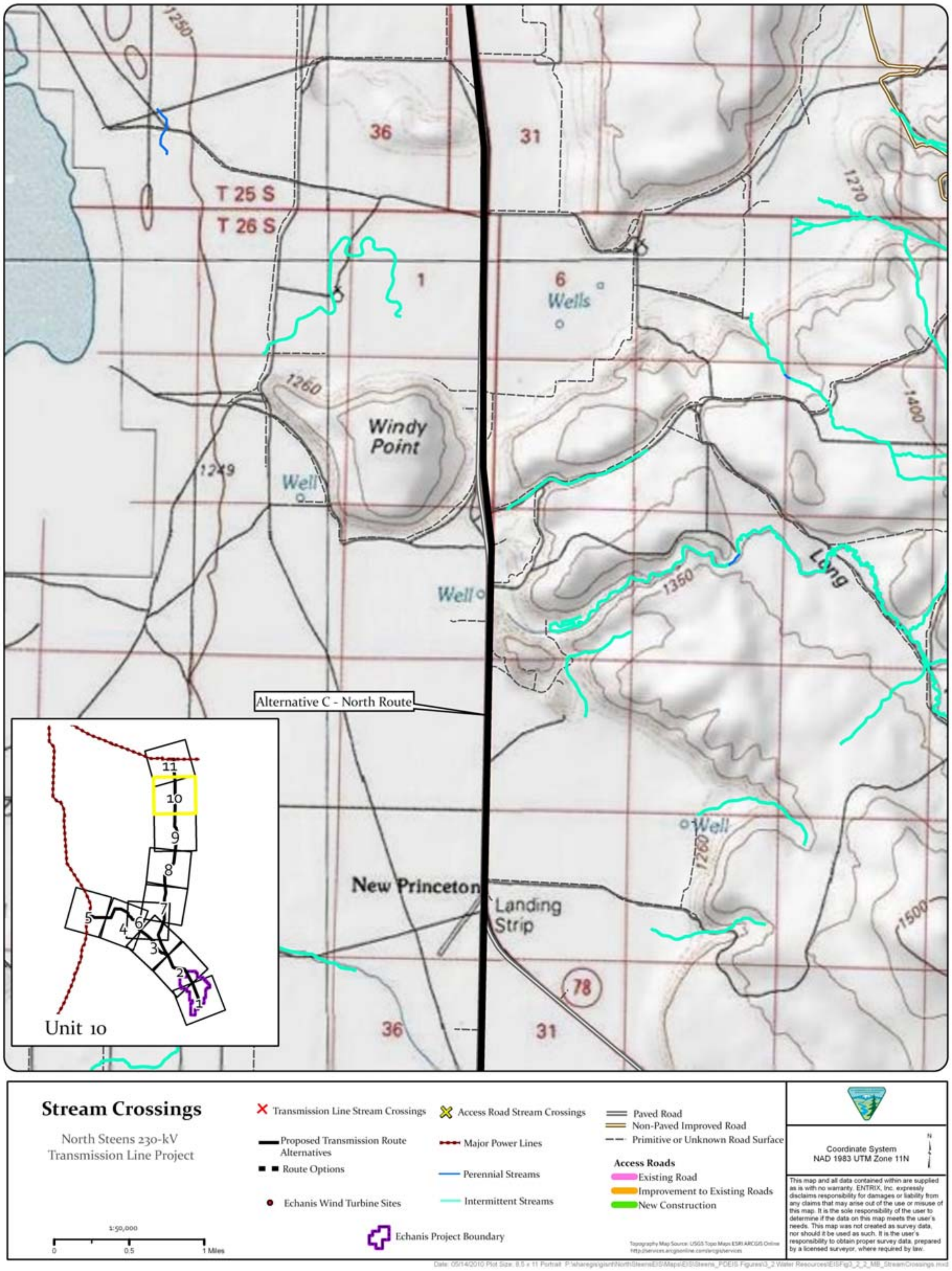

Figure 3.2-11j Stream Crossings Along the Transmission Line ROWS, Unit 10 of 11

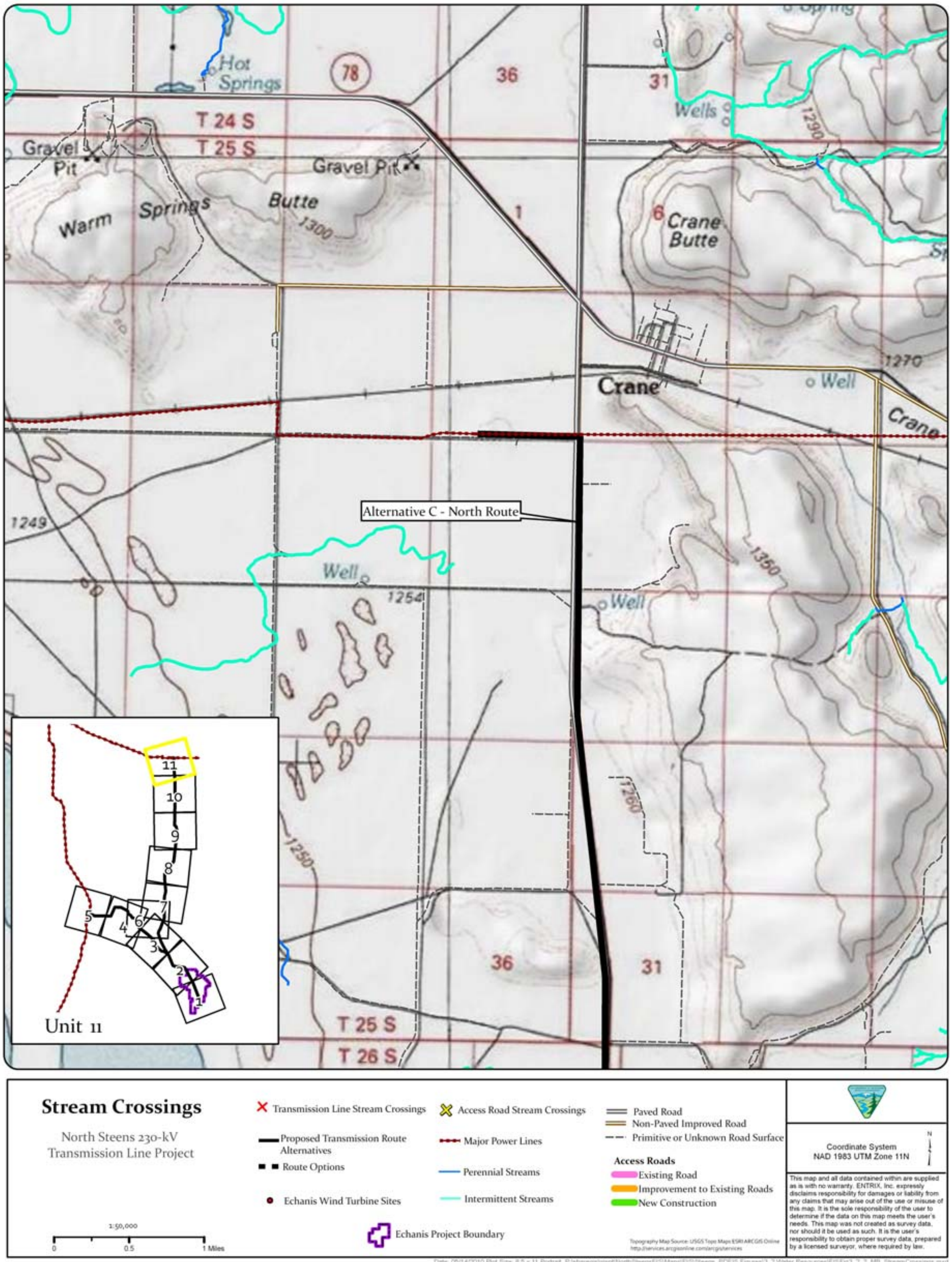

Figure 3.2-12k Stream Crossings Along the Transmission Line ROWS, Unit 11 of 11

The main access road to the Echanis Wind Farm site would extend 18.95 miles and would cross five creeks: three perennial and two intermittent streams (Table 3.2-2 and Figures 3.2-2 to 3.2-12 Stream Crossing Maps). The access road would also cross 0.35 mile of the 100-year floodplains of Kiger Creek and Booners Creek. These road crossings are presented separately from and as an addition to the access roads discussed for Alternative B.

Table 3.2-2 Water Bodies Crossed by Echanis Wind Farm Access Roads

Water Body	Stream Type	Access Road Type
Booners Creek	Perennial stream	New construction of access road and improvement to existing roads
Kiger Creek	Perennial stream	New construction of access road and improvement to existing roads. Bridge crossing would be constructed.
Mud Creek	Perennial stream	New construction of access road. Three bottomless arch culverts would be installed.
Tributary to Kiger Creek	Intermittent stream	New construction of access road
Tributary to Mud Creek	Intermittent stream	New construction of access road

A bridge over Kiger Creek would be constructed as part of the main access road to the Echanis site. This bridge would be 60 feet long with footings well outside the channel. It would be designed to accommodate 100-year flows and to minimize bank erosion and additional sediment loads (Ellis Ecological Services, Inc 2008). In addition, it would be placed in an existing break in riparian vegetation to prevent unnecessary vegetation removal.

The access road to the Echanis site would parallel Mud Creek for 2.5 miles and would parallel an intermittent tributary of Mud Creek for another 1.2 miles. The road bed would be constructed through cut and fill—upslope materials would be removed and placed downslope to build the road bed. The road alignment would be placed as far as possible from the creek. The minimum distance from the creek as allowed by canyon width and the position of creek meanders would range from six feet to greater than 50 feet. Exact locations of the road have not yet been finalized. All construction would be outside of the channel and bed of the stream (Kane, Marl. 2010. Personal communication, January 12). The road crosses Mud Creek in three locations; three bottomless culverts would be installed (Kane, Marl. 2010. Personal communication, January 8). The culverts are 23 feet by 90 feet, 18 feet by 110 feet, and 23 feet by 62 feet in size (Schott and Associates 2008a). The design of these bottomless culverts was chosen because they can be installed without disturbing the active stream channel.

Where the road crosses the tributary to Mud Creek two arch culverts would be installed: 20 feet by 65 feet and 16 feet by 55 feet (Schott and Associates 2008b). The culverts would be wide enough to pass 100-year flows and would have greater than three feet of clearance between the top of the culvert and the bed of the active channel. Native rock retaining walls and native soils would be used to cover the culvert and silt fencing would be installed to prevent sediment from entering the stream. Culvert design would adhere to design recommendations for fish passage as required by ORS 498.351 and ORS 509.605 and described in Oregon Department of Fish and Wildlife Guidelines and Criteria for Stream-Road Crossings. The cut and fill for road building would encroach upon the stream bed of this tributary for total of 24.2 cubic yards (CY) of material (Schott and Associates 2008b).

The road parallels an unnamed tributary to Kiger Creek in Wildcat Canyon for 0.7 miles. Where the road crosses this creek three culverts would be installed: an 80 foot long 18 inch culvert, a 90 foot long 12 inch culvert and a 40 foot long 18 inch culvert (Scott and Associates 2008a). The cut and fill for road building would encroach upon the stream bed of this tributary for total of 170.8 cubic yards (CY) of material (Schott and Associates 2008a).

Roads would not be paved with impervious surfaces, but would be cleared and graded. Permanent effects would include reduced interception and infiltration of precipitation. In addition, the grading of roads and construction of the bridge has the potential to increase erosion near and in stream channels. Greater sediment inputs from roads could exacerbate the sediment impairment already present in Kiger Creek and the Donner und Blitzen River (see Section 3.2.2.4 Water Quality). These potential effects would be minimized by the design features and best management practices (BMPs) described in Chapter 2.

TEMPORARY EFFECTS

While most of the proposed facilities on the Echanis site would be located outside of riparian areas and floodplains, the site itself does drain to a number of streams (Figures 3.2.3-1 to 3.2.3-11). Temporary effects may occur during the installation of the turbines or construction of the associated facilities. Cleared vegetation and surface disturbance may lead to increased run-off and sediment delivery to these streams.

The resulting effects to surface and ground water would be minimized through standard construction BMPs. These BMPs are outlined in the Application for Conditional Use Permit for the Echanis Wind Farm (CEP 2007) and in the Erosion and Sediment Control (ESC) Plans for the Echanis Wind Farm Access Road (Westlake Consultants, Inc. 2008), in accordance with the ODEQ National Pollutant Discharge and Elimination System Stormwater Discharge Permit (ODEQ 2005) and pursuant to Oregon Revised Statutes 468B.050 and Section 402 of the Federal Clean Water Act. All erosion and sediment control measures would be installed to ensure sediment or sediment laden water does not enter surface waters. Project BMPs are discussed in Chapter 2.

MITIGATION

No additional mitigation beyond the project design features and best management practices described in Chapter 2 would be needed.

3.2.3.3 Alternative B – West Route (Proposed Action)

PERMANENT EFFECTS

The proposed 230-kV line transmission line for Alternative B would extend 28.87 miles from the proposed substation at the Echanis site to the proposed Interconnection Station (ICS) west of Diamond Junction. Alternative B would require 524.97 acres for the 150 foot ROW. The ROW would be cleared of vegetation only as is needed and would be chemically treated for noxious weeds only if required as a condition of future permit approval. The transmission line for the Alternative B-West Route would cross eleven streams: four perennial streams, five intermittent streams, and two intermittent canals (Table 3.2-3 and Figures 3.2-1 to 3.2-11). The transmission line poles would be located 600 to 1,000 feet apart. An average of 800 feet between each pole plus three percent for additional poles at turns in the route results in about 196 poles for Alternative B (Kane, Marl. 2010. Personal communication, November 5). The pole locations would be selected to avoid riparian areas and water bodies. The spans are sufficient to keep towers out of the stream areas.

Approximately 0.41 mile of the transmission line would cross 100-year floodplain. This represents one percent of the total length of the transmission line. An additional 43 percent crosses areas of minimal flooding (which generally indicates greater than 500-year floodplain) and 56 percent areas of undetermined flooding (see Figure 3.2-1 Flood Hazard Map above). The 100-year flood zone around the Donner und Blitzen River that would be spanned by this route option is part of the agricultural irrigation program in the valley.

For construction of the Interconnection Station (ICS), vegetation would be cleared and replaced with a gravel surface. Impervious concrete pads would be installed for equipment. While the total area for the ICS is 0.69

acre, the impervious surface area, which prevents infiltration of precipitation and increased run-off would be less than that amount. Gravel surfaces are more permeable than concrete; however, the loss of vegetation reduces interception of precipitation. The small area of the impervious survace of the ICS relative to the total area of the Donner und Blitzen watershed would result in local effects only. In addition, the ICS is not located adjacent to any stream.

Table 3.2-3 Water Bodies Crossed by Alternative B: West Route

Water Body	Type
Kiger Creek	Perennial stream
Tributary to Kiger Creek in Wildcat Canyon	Intermittent stream
Cucamonga Creek	Perennial stream
McCoy Creek	Perennial stream
Tributary to McCoy Creek	Intermittent stream
South Swamp Canal	Intermittent stream
Grain Camp feeder ditch	Intermittent ditch/canal
Donner und Blitzen River	Perennial stream
Unnamed Canal	Intermittent ditch/canal

New gravel access roads would be constructed while some existing roads would be widened to 20 to 22 feet. New and widened access roads on public lands would include a permanent 40-foot wide ROW to accommodate construction, drainage improvements, snowplowing and shoulder work. Approximately 30.64 miles of access roads would be needed for access during construction and for long-term maintenance of the Alternative B transmission line. An existing access road would cross a perennial stream, Cucamonga Creek and an improved road would cross an intermittent tributary to the Donner und Blitzen River (Figures 3.2-2 to 3.2-12 Stream Crossing Maps). These crossings would occur over existing bridges.

New roads would not be paved with impervious surfaces, but would be cleared and graded. Permanent effects would include reduced interception and infiltration of precipitation. In addition, the grading and construction of roads has the potential to increase erosion near and in stream channels. Any disturbance of the existing road that will be used near Cucamonga Creek may increase sediment input, which would exacerbate the sediment impairment already present in the creek (see Section 3.2.2.4 Water Quality). Road encroachment could also reduce the sinuosity of the creek if the roadbed impinges on the stream's ability to meander across the valley floor. The potential effects would be minimized by project design features and BMPs described in Chapter 2.

TEMPORARY EFFECTS

Temporary effects may occur during installation of the Alternative B transmission line poles, ICS, new and widened access roads, and other project features. Trampled vegetation and surface disturbance from tensioning sites, laydown sites and downguys may lead to increased run-off and sediment delivery to streams. At each pole location, a hole approximately 30 inches in diameter would be excavated to a depth of 20 to 30 feet using power augers or excavators or both. Minimum water tables in the western end of the Alternative B transmission line range from 45 inches to greater than six feet. During times of seasonal flooding, digging below the water table could introduce sediment into subsurface or surface waters. In addition, potential spills to ground water during construction may occur from equipment fueling or storage. Potential spills during construction would be prevented and controlled through standard construction practices.

The resulting effects to surface and ground water would be minimized through standard construction Best Management Practices (BMPs). These BMPs are described in the Plan of Development for the transmission lines (CEP 2009), in accordance with the ODEQ Erosion and Sediment Control Manual. In addition, an Erosion and Sediment Control Plan would be developed and implemented for the Project as required by the ODEQ National Pollutant Discharge and Elimination System Stormwater Discharge Permit (ODEQ 2005) and pursuant to Oregon Revised Statutes 468B.050 and Section 402 of the Federal Clean Water Act. The BMPs are described in Chapter 2.

Temporary effects to water resources would also occur where a 1.35 mile long segment of the existing 24.9-kV distribution line would be buried in a six-foot deep trench within the existing distribution line ROW, parallel to South Diamond Lane, east of Highway 205. The excavation of the trench could introduce sediment to surface waters during rain events or if groundwater is present in the trench. If pumping groundwater out of the trench is necessary, sediment-laden water would be controlled through the use of sediment barriers, hay-bale structures, or filter bags at a controlled rate to prevent sedimentation. Additional precautions to avoid impacts from dewatering operations include those described in Chapter 2.

Where the relocated distribution line would cross the Donner und Blitzen River and the Buena Vista Canal, directional boring methods would be used (Kane, Marl. 2010. Personal communication, January 8). This method involves drilling a pilot hole under the waterbody and banks, then enlarging the hole through successive ream borings. Depending on the angle of approach of the pipeline alignment to the water crossing, a temporary work area may need to be cleared. This method generally reduces effects to the water body banks, bed, and water quality. The distribution line burial also crosses two intermittent water courses: Center Canal and an unnamed stream (Figures 3.2-2 to 3.2-12). These would be crossed by trenching through the water courses when they are dry. If groundwater is encountered and must be pumped out of the trench the BMPs described in Chapter 2 would be applied.

FUTURE CONSTRUCTION PHASE – UPGRADE TO 230-KV

The upgrade of the initial single-circuit transmission line to a full double-circuit 230-kV transmission line would require a second construction phase at a future date when additional capacity is required on the transmission line. The second construction phase would not require any additional ROW, access roads, or new permanent features outside of areas previously affected by installation of the initial line. Most effects from installation of the second circuit would be temporary and similar to those described above. Temporary effects would be associated primarily with the use of temporary laydown areas and pulling/tensioning sites. Trampled vegetation and surface disturbance at these locations may lead to increased run-off and sediment delivery to streams. During times of seasonal flooding, digging below the water table could introduce sediment into subsurface or surface waters. In addition, potential spills to ground water during construction may occur from equipment fueling or storage. Potential spills during construction would be prevented and controlled through standard construction practices.

MITIGATION

No additional mitigation beyond the project design features and best management practices described in Chapter 2 would be needed.

South Diamond Lane Route Option

PERMANENT EFFECTS

The South Diamond Lane Option of Alternative B would be approximately 4.59 miles long and would reduce the overall length of the transmission line by 0.62 mile. This route option would require a total of 513.82 acres of ROW from the Echanis substation to the tie-in with the HEC 115-kV line. This route option would cross four perennial streams, three intermittent streams, and three intermittent canals (Table 3.2-4 and Figures 3.2-2 to 3.2-12).

Table 3.2-4 Water Bodies Crossed by Alternative B: South Diamond Lane Option

Water Body	Type
Kiger Creek	Perennial stream
Tributary to Kiger Creek in Wildcat Canyon	Intermittent stream
Cucamonga Creek	Perennial stream
McCoy Creek	Perennial stream
Tributary to McCoy Creek	Intermittent stream
South Swamp Canal	Intermittent stream
Donner und Blitzen River	Perennial stream
Center Canal	Intermittent ditch/canal
Buena Vista Canal	Intermittent ditch/canal
Unnamed Canal	Intermittent ditch/canal

From the Echanis substation to the tie-in with the HEC 115-kV line, approximately 192 towers would be needed for this option. The ROW would be cleared of vegetation only as is needed and the pole locations would be selected to avoid riparian areas and water bodies. The pole spans are sufficient to keep towers out of the stream areas.

Approximately 1.04 miles, or four percent, of the transmission line would cross through 100-year floodplain. Approximately 40 percent crosses areas of minimal floodplains and the remainder through areas of undetermined flooding (see Figure 3.2-1 Flood Hazard Map above). As described for Alternative B, the 100-year flood zone around the Donner und Blitzen River crossed by this route option is part of the agricultural irrigation program in the valley. Fields are flooded through contour ditches; however, flows are sufficiently slow that erosion would not occur around the bases of any poles in meadow habitat. In addition the layout of the transmission line would be designed to minimize infringement of irrigated meadows (Kane, Marl. 2009, personal communication, November 2009).

The South Diamond Lane Route Option of Alternative B would incorporate the same procedures for the 0.69 acre area of the ICS construction as the Alternative B-Proposed Action. Reduced infiltration from impervious and cleared areas would cause local effects only. Potential spills to ground water during construction would be prevented and controlled through standard construction practices.

Access roads constructed or improved for the South Diamond Lane Route Option would the same as those described for Alternative B. Potential effects and methods used to minimize and avoid such effects would be the same as described for Alternative B.

TEMPORARY EFFECTS

Temporary effects may occur during construction of the South Diamond Lane Option. At each pole location, a hole approximately 30 inches in diameter would be excavated to a depth of 20 to 30 feet using power augers or excavators or both. Minimum water tables during seasonal high water in the western end of the transmission line range from six inches to greater than six feet. During times of seasonal flooding, digging below the water table could introduce sediment into subsurface or surface waters. In addition, trampled vegetation and surface disturbance from tensioning sites, laydown sites and downguys may lead to increased run-off and sediment delivery to streams. The resulting effects to surface and ground water would be minimized through the standard construction BMPs described for Alternative B in Chapter 2.

Temporary effects to water resources would also occur where a 1.35 mile long segment of the existing 24.9-kV distribution line would be buried in a six-foot deep trench within the existing distribution line ROW, parallel to South Diamond Lane, east of Highway 205. The effects would be the same as those described for Alternative B and the BMPs used to minimize effects are described in Chapter 2.

FUTURE CONSTRUCTION PHASE – UPGRADE TO 230-KV

As with Alternative B, the second construction phase would not require any additional ROW, access roads, or new permanent features outside of areas already affected by installation of the initial line. Most effects from installation of the second circuit would be temporary and similar to those described above.

MITIGATION

No additional mitigation beyond the project design features and best management practices described in Chapter 2 would be needed.

Hog Wallow Route Option

PERMANENT EFFECTS

The Hog Wallow Route Option of Alternative B would be approximately 2.84 miles long and would reduce the overall length of transmission line by 0.19 mile. This route option would require a total of 528.36 acres of ROW from the Echanis substation to the tie-in. The Hog Wallow Route Option crosses four perennial streams, two intermittent streams, and two intermittent canals (Table 3.2-5 and Figures 3.2-2 to 3.2-12). From the Echanis substation to the tie-in, approximately 198 towers would be needed for this option. The ROW would be cleared of vegetation only as is needed and the pole locations would be selected to avoid riparian areas and water bodies. The pole spans are sufficient to keep towers out of the stream areas.

Approximately 0.4 miles, or one percent, of the transmission line from the Echanis substation to the tie-in would cross areas designated as 100-year floodplain. Approximately 43 percent crosses areas of minimal floodplains and the remainder through areas of undetermined flooding (see Figure 3.2.2-1 Flood Hazard Map). As described for Alternative B, the 100-year flood zone around the Donner und Blitzen River that would be spanned by this route option is part of the agricultural irrigation program in the valley.

Table 3.2-5 Water Bodies Crossed by Alternative B: Hog Wallow Option

Water Body	Type
Kiger Creek	Perennial stream
Tributary to Kiger Creek in Wildcat Canyon	Intermittent stream
Cucamonga Creek	Perennial stream
McCoy Creek	Perennial stream
Tributary to McCoy Creek	Intermittent stream
Grain Camp feeder ditch	Intermittent ditch/canal
Donner und Blitzen River	Perennial stream
Unnamed Canal	Intermittent ditch/canal

The Hog Wallow Route Option of Alternative B would incorporate the same procedures for the 0.69 acre ICS construction as the Alternative B. Reduced infiltration from impervious and cleared areas would cause local effects. Potential spills to ground water during construction would be prevented and controlled through standard construction practices.

Access roads constructed or improved for the Hog Wallow Route Option would the same as those described for Alternative B. Potential effects and methods used to minimize and avoid such effects would be the same as described for Alternative B.

TEMPORARY EFFECTS

Temporary effects may occur during construction of the Hog Wallow Route Option. At each pole location, a hole approximately 30 inches in diameter would be excavated to a depth of 20 to 30 feet using power augers and/or excavators. Minimum water tables during seasonal high water in the western end of the transmission line range from 18 inches to greater than six feet. During times of seasonal flooding, digging below the water table could introduce sediment into subsurface or surface waters. In addition, trampled vegetation and surface disturbance from tensioning sites, laydown sites and downguys may lead to increased run-off and sediment delivery to streams. The resulting effects to surface and ground water would be minimized through the standard construction BMPs described in Chapter 2.

FUTURE CONSTRUCTION PHASE – UPGRADE TO 230-KV

As with Alternative B, the second construction phase would not require any additional ROW, access roads, or new permanent features outside of areas already affected by installation of the initial line. Most effects from installation of the second circuit would be temporary and similar to those described above.

MITIGATION

No additional mitigation beyond the project design features and best management practices described in Chapter 2 would be needed.

115-kV Transmission Line Option

PERMANENT AND TEMPORARY EFFECTS

The 115-kV Transmission Line Option would be a reduced capacity design constructed along the transmission line alignments described above for Alternative B – West Route and the South Diamond Lane and Hog Wallow Route Options. The 115-kV Transmission Line Option would have one 115-kV 3-conductor circuit instead of two. The 115-kV Option would require the same pole heights, pole spacing, ROW widths, construction methods, interconnection points, and access requirements as the 230-kV routes.

The permanent and temporary effects to surface water, groundwater and floodplains from this option would be the same as those presented above for Alternative B and the two route options except that there would only be one line strung on the poles, there would not be the temporary impacts from the phased construction of adding a future circuit.. Operation and maintenance activities would be the same as described for Alternative B and the two route options above.

MITIGATION

No additional mitigation beyond the project design features and best management practices described in Chapter 2 would be needed.

3.2.3.4 Alternative C – North Route

PERMANENT EFFECTS

The proposed 230-kV line transmission line for Alternative C – North Route would extend 45.95 miles from the proposed substation at the Echanis site to the proposed Interconnection Station near Crane. Alternative C would require 834.71 acres for the 150 foot ROW.

As described for Alternative B, the ROW would be cleared of vegetation only as is needed and would be chemically treated only if required as a condition of permit approval. The transmission line for the Alternative C-North Route makes seven crossings: three perennial streams (Kiger Creek is crossed twice) and three intermittent streams (Table 3.2-6 and Figures 3.2-2 to 3.2-12). Assuming an average span distance of 800 feet, approximately 312 transmission line poles would be required for Alternative C. The pole locations would be selected to avoid riparian areas and water bodies and the spans would be sufficient to keep towers out of the stream areas.

No part of the transmission line would cross a 100-year floodplain, nine percent would cross areas of minimal flooding, and the remainder would cross areas of undetermined flooding (see Figure 3.2-1 Flood Hazard Map above).

Table 3.2-6 Water Bodies Crossed by Alternative C

Water Body	Type
Kiger Creek	Perennial stream
Tributary to Kiger Creek in Wildcat Canyon	Intermittent stream
Swamp Creek	Perennial stream
Riddle Creek	Perennial stream
Unnamed Stream in Adobe Flats area	Intermittent stream
Unnamed Stream in Adobe Flats area	Intermittent stream

The ICS site adjacent to the HEC 115-kV line near Crane would be cleared of vegetation and replaced with a gravel surface for a total area of disturbance of 0.69 acre, with impervious surfaces covering only a small portion of that area. Impervious surfaces prevent infiltration of precipitation and increase run-off. Gravel surfaces are more permeable than concrete; however, the loss of vegetation reduces interception of precipitation. Reduced infiltration from impervious and cleared areas would cause local effects. Potential spills to ground water during construction would be prevented and controlled through standard construction practices.

A total of approximately 23.98 miles of access roads would be required under Alternative C. Construction for new or improved access roads would not occur within 100 feet of any streams. In addition, none of the improved or constructed access roads cross 100-year floodplains (Figures 3.2-2 to 3.2-12 Stream Crossing Maps).

Roads would not be paved with impervious surfaces, but would be cleared and graded (see Chapter 2 for a discussion of gravel installation). Permanent effects would include reduced interception and infiltration of precipitation. Existing roads in use near Swamp Creek may introduce additional sediment which could exacerbate the sediment impairment already present in Swamp Creek and Riddle Creek (see Section 3.2.2.4 Water Quality). These potential effects would be minimized by the design features described for Alternative B in Chapter 2.

TEMPORARY EFFECTS

Temporary effects may occur during installation of the Alternative C transmission line. At each pole location, a hole approximately 30 inches in diameter would be excavated to a depth of 20 to 30 feet using power augers and/or excavators. Minimum water tables in the western end of the Alternative C transmission line alignment range from 39 inches to greater than six feet. During times of seasonal flooding, digging below the water table could introduce sediment into subsurface or surface waters. In addition, trampled vegetation and surface disturbance from tensioning sites, laydown sites and downguys may lead to increased run-off and sediment delivery to streams. The resulting effects to surface and ground water would be minimized through the standard BMPs described for Alternative B in Chapter 2.

FUTURE CONSTRUCTION PHASE – UPGRADE TO 230-KV

As with Alternative B, the second construction phase would not require any additional ROW, access roads, or new permanent features outside of areas already affected by installation of the initial line. Most effects from installation of the second circuit would be temporary and similar to those described above.

MITIGATION

No additional mitigation beyond the project design features and best management practices described in Chapter 2 would be needed.

115 k-V Transmission Line Option

PERMANENT AND TEMPORARY EFFECTS

The 115-kV Transmission Line Option would be a reduced capacity design constructed along the transmission line alignments described above for Alternative C – North Route. The 115-kV Transmission Line Option would have one 115-kV 3-conductor circuit instead of two. The 115-kV Option would require the same pole heights, pole spacing, ROW widths, construction methods, interconnection points, and access requirements as the 230-kV routes.

The permanent and temporary effects to surface water, groundwater and floodplains from this option would be the same as those presented above for Alternative C except that there would only be one line strung on the poles, so there would not be the temporary impacts from the phased construction of adding a future circuit. Operation and maintenance activities would be the same as described for Alternative C.

MITIGATION

No additional mitigation beyond the project design features and best management practices described in Chapter 2 would be needed.

3.2.3.5 Residual Effects after Mitigation

Residual effects related to the proposed action that would occur during construction would include increased stream sedimentation. Residual effects that would last at least as long as the life of the project (an expected 40 years) would include changes to creek beds and floodplain encroachment.

3.2.3.6 Summary Comparison of Alternatives

The effect to water resources from development of the Echanis wind development, primary access road, and each alternative, is summarized in Table 3.2-7.

Table 3.2-7 Summary of Effects - Water Resources

Alternative A No Action	Echanis Wind Energy Project	Alternative B West Route (Proposed Action)	Alternative B S. Diamond Lane Route Option	Alternative B Hog Wallow Route Option	Alternative C North Route
Under the No Action Alternative, the Project components would not be constructed and access roads would not be improved or constructed. Water resources would continue to be affected by current use, including : Irrigation for dryland grazing Numerous canals that would continue to divert surface water. Irrigation returns would continue to be impaired with sediment, excess nutrients or high temperatures. Permanent access roads that are currently in place.	Main access road to the Echanis site would cross water bodies in nine locations, including Kiger Creek (once by bridge), Mud Creek (3 times), an intermittent tributary to Mud Creek (2 times), and an intermittent tributary to Kiger Creek (3 times). Temporary effects could include sedimentation in streams adjacent to areas of construction.	Route would cross four perennial streams, five intermittent streams, and two intermittent canals Approximately 0.41 mile of the transmission line would cross 100-year floodplain Increased runoff due to roads and impervious surfaces resulting in greater flooding or erosion	Route would cross four perennial streams, three intermittent streams, and three intermittent canals Approximately 1.04 miles of the transmission line would cross 100-year floodplain. Increased runoff due to roads and impervious surfaces resulting in greater flooding or erosion	Route would cross four perennial streams, two intermittent streams, and 2 intermittent canals Approximately 0.4 mile would cross 100-year floodplain Increased runoff due to roads and impervious surfaces resulting in greater flooding or erosion	Route would cross four perennial and 3 intermittent stream crossings (Kiger Creek is crossed twice) Increased runoff due to roads and impervious surfaces resulting in greater flooding or erosion