DOE/EIS-0173-D

# Draft Environmental Impact Statement

## BPA / Puget Power Northwest Washington Transmission Project

File Copy

Bonneville
POWER ADMINISTRATION

Prepared by:
Bonneville Power Administration and
Whatcom County, Washington

November 1993

DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)

**Responsible Agencies:** U.S. Department of Energy, Bonneville Power Administration (BPA); Whatcom County, State of Washington

**Title of Proposed Action:** BPA/Puget Power Northwest Washington Transmission Project.

**States and Provinces Involved:** Washington

**Abstract:** Bonneville Power Administration (BPA) and Puget Sound Power & Light (Puget Power) propose to upgrade the existing high-voltage transmission system in the Whatcom and Skagit County area between the towns of Custer and Sedro Woolley, including within the city of Bellingham starting in 1995. The upgrades of the interconnected 230,000-volt (230-kV) and 115-kV systems are needed to increase the reliability of the local transmission system and to increase the import capacity on a nearby U.S.-Canada 500-kV intertie by about 850 megawatts (MW). The increase in north-south transfer capability would be shared by BPA and Puget Power (about 425 MW each). Other actions would include replacement of an existing BPA 230-kV single-circuit, wood-pole H-frame transmission line with a lattice-steel double-circuit line; an existing Puget Power 115-kV single wood-pole transmission line rebuild, two short 115-kV Puget Power lines added at BPA's Bellingham Substation; and improvements made at existing BPA and Puget Power substations.

Impacts would generally be low to moderate and localized. Major environmental issues identified during scoping were: (1) potential soil erosion, (2) electric and magnetic field effects/public health, (3) noise from lines and substations, (4) property values, and (5) land use/management. Effects on soils and water resources in sensitive areas (e.g., near Lake Whatcom) would be low to moderate; there would be none-to-some increase in magnetic fields, depending on option; noise levels would be at existing or reduced levels; and land use and property value impacts would be low. Also, threatened and endangered species would not be adversely affected, and all but one proposed action in wetlands would be covered by Nationwide permit. Filling of about 0.1 hectare (0.25 acre) of wetland would be required at the BPA Bellingham Substation. Visual impacts would be low to moderate; socioeconomic impacts would be low to moderate from additional clearing and potential removal of up to four homes. No cultural resources listed on the National Register of Historic Places would be affected; there would be low to moderate effects on cultural resources.

The proposed action would allow BPA to use its portion of the transmission capability increase to displace other generating resources in the U.S. when stored energy is returned from Canada. It would facilitate short- and long-term power purchases from Canada, reducing BPA's need either to supply power from its own resources or to purchase power from other suppliers. Any displacement of thermal generators would reduce adverse impacts on the environment, including air and water emissions in the Pacific Northwest. BPA's ability to increase the value of generation from flow releases to aid fish migration would be improved. Puget Power would also be able to enter into short- and long-term sales and transfers with Canada and thus delay the need to acquire additional thermal resources or purchase additional power from BPA or other suppliers to meet future needs.

The Draft EIS is being mailed to about 400 agencies, groups, and individuals (see Chapter 6). Public comment is being accepted through January 14, 1994, including opportunities at a public meeting in Sedro Woolley, Washington, on December 8, 1993, and in Bellingham, Washington, on December 9, 1993.

To request additional copies of the EIS, please contact: Public Involvement Manager, P.O. Box 12999, Portland, OR 97212. For additional information on the EIS please contact: John Taves, Environmental Coordinator for the Office of Engineering, P.O. Box 3621, Portland, OR 97208. Copies may also be obtained by calling BPA's document request line: 1-800-622-4520.

# BPA/ PUGET POWER
# NORTHWEST WASHINGTON TRANSMISSION PROJECT

## SUMMARY OF THE ENVIRONMENTAL IMPACT STATEMENT

*Below is a summary of the environmental impact statement (EIS) jointly prepared by the Bonneville Power Administration and Whatcom County (Washington) for the proposed Northwest Washington Transmission Project. This Summary begins with some useful background for the reader, and includes the major focus points of the EIS, including: the need and purpose of the proposed project, alternatives to and within the proposed project, possible effects of the proposed project on the environment, and alternatives to the project that were eliminated from detailed consideration.*

Bonneville Power Administration (BPA) and Puget Sound Power & Light (Puget Power) are proposing, starting in 1995, to upgrade the existing electric power transmission system in the Whatcom and Skagit County area in Northwest Washington. Puget Power's portion of the project lies in Bellingham, Washington, and out into Whatcom County, with some substation work in Skagit County. BPA's portion of the project extends from Sedro Woolley in Skagit County, into Whatcom County, by Lake Whatcom and Bellingham, continuing towards Custer, Washington. (See Figure S-1.)

## A. BACKGROUND

The environmental analysis for this project focuses on construction that would take place in the Whatcom and Skagit County area. However, the project also affects the BPA power system on the entire west side of the Cascade Mountains.

### 1. THE LOCAL SYSTEM

Whatcom and Skagit Counties get most of their electric power from an interrelated network of lines--some owned and operated by BPA, some by Puget Power. Power is supplied through several substations and a web of 230,000-volt (230-kV) and 115-kV lines interconnected lines (often eliminating the need for one utility to duplicate another's facilities).

Power can also come off the nearby Northern Intertie and flow through the Whatcom/Skagit County area on BPA's 230-kV line or on Puget Power's local network.

## 2. BPA AND THE INTERTIE SYSTEM

The Northern Intertie consists of both an east and a west side. **This project affects only the lines that make up the *west side* of the Northern Intertie,** which consists of two parallel 500-kV BPA transmission lines from the U.S. - Canada border at Blaine, Washington, through BPA's Custer Substation, running east of Bellingham, past Sedro Woolley, and south to BPA's Monroe Substation. The Monroe Substation connects with other high-voltage lines serving the Pacific Northwest and the West Coast. These 500-kV lines allow the U.S. to import, export, store, and exchange power with Canadian utilities.

## 3. THE INTERCONNECTED AREA NETWORK

The Intertie and the local transmission system are related to each other much like the parts of a highway system. The 500-kV line and Northern Intertie are like the "interstate" bypass around a metropolitan area. The 230-kV lines are the "local highway" that accesses the metropolitan area. The local highway supplies power to the local "neighborhood streets" or 115-kV lines by way of "off ramps" or substations.

Figure S-2 shows a simplified version of this area network. The Intertie comes from Canada into BPA's Custer Substation. Among other lines which leave the station are the following:

- Two 500-kV lines. These BPA lines are referred to as the Monroe-Custer No. 1&2 lines because they go from Monroe Substation to Custer Substation.
- BPA's Bellingham-Custer 230-kV line.
- A 230-kV line that connects to Puget Power's Portal Way Substation, allowing Puget Power's network and the Intertie to exchange power.

The BPA Bellingham-Custer line can also connect the Intertie and Puget Power's network because it ties into BPA's Bellingham Substation, where Puget Power also has lines . South of BPA's Bellingham Substation, BPA's 230-kV line is called the Murray-Bellingham line. The power on this line can hook up with the Intertie on the south side of the

# BPA/Puget Power NW Washington Transmission Project

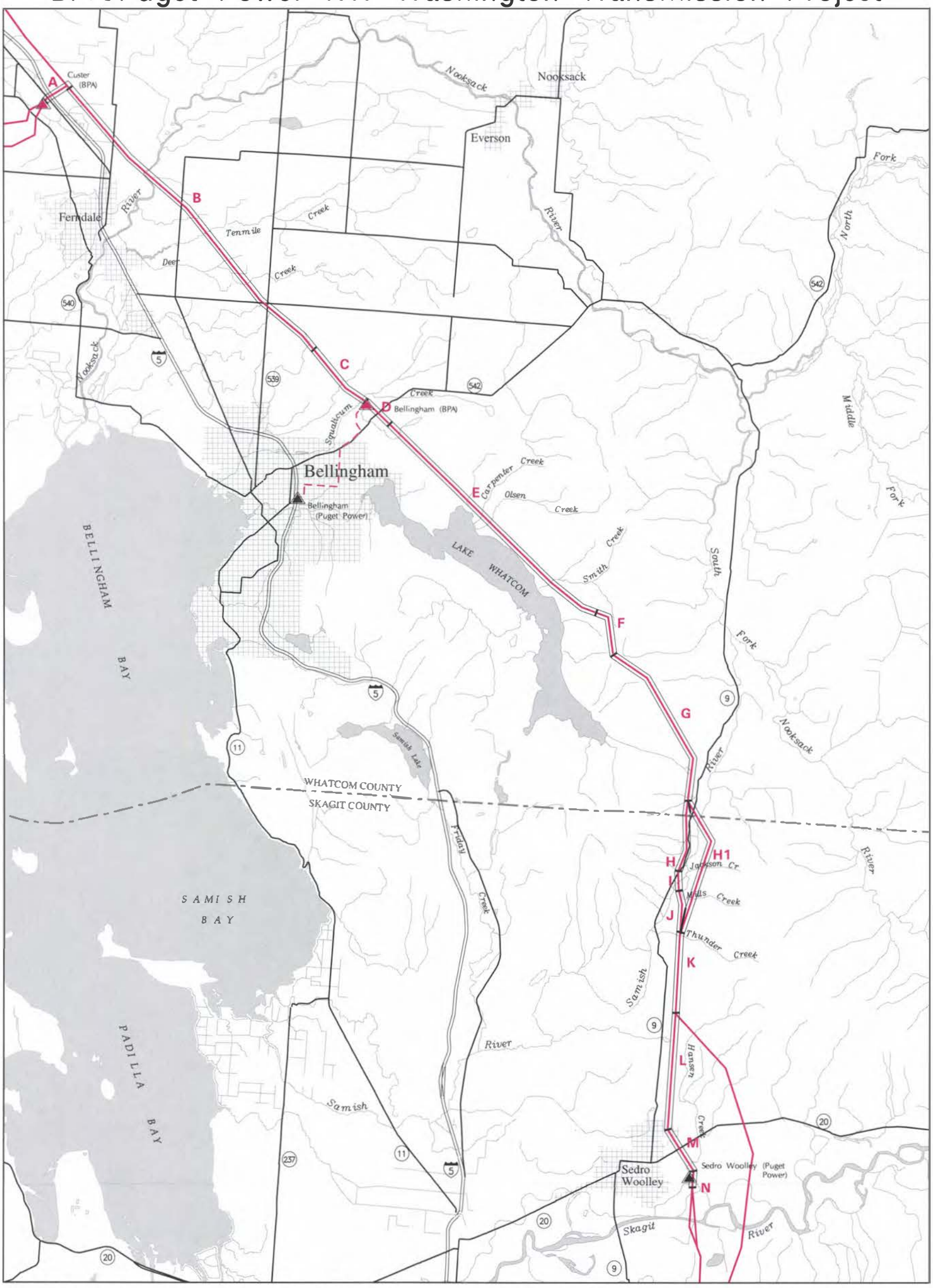



FIGURE S-1 **PROJECT AREA and CORRIDOR SEGMENTS**

## LEGEND

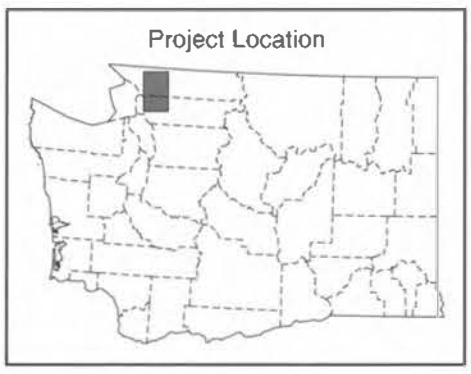
- *BPA Transmission Line*
- *Puget Power Trans. Line*
- *BPA Substation*
- *Puget Power Substation*
- *Interstate Route*
- *State Route*
- G *Corridor Segment*

Scale 1:173,500

0 1 2 3 4 5 6 MILES

0 1 2 3 4 5 10 KILOMETERS

Project Location



*BPA Division of Facilities Engineering*

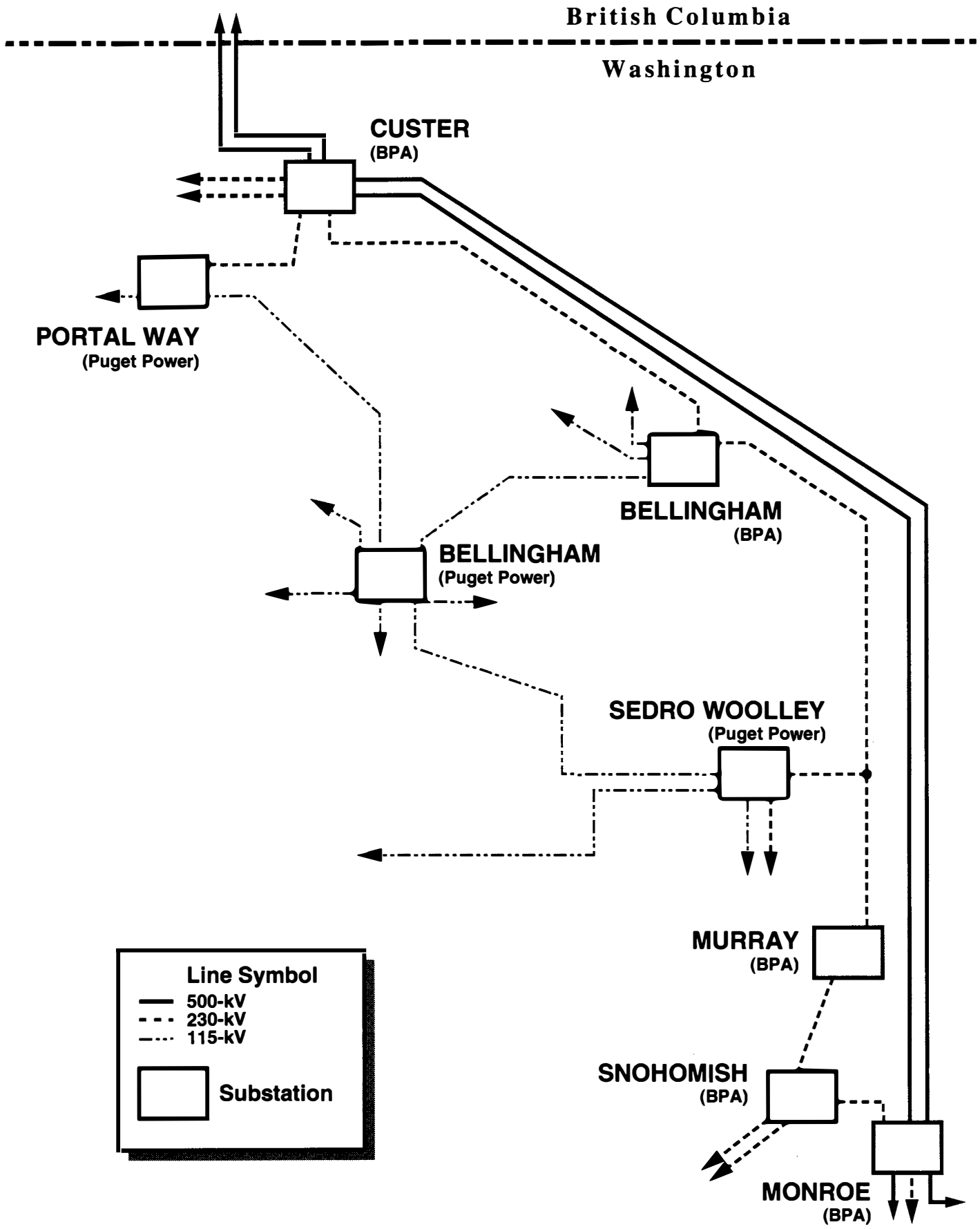



***Figure S-2***
***Schematic Line Diagram***

Whatcom/Skagit County area. BPA's Murray-Bellingham line has a connection, or tap, into Puget Power's Sedro Woolley Substation. Puget Power's lines out of this substation are part of the local 115/230-kV network which can transfer power through Bellingham to Custer and around the local counties.

## 4. SEASONAL EXCHANGE OF POWER

A project affecting the transmission system in the Whatcom and Skagit County area can also affect power transfers all along the West Coast. This is because utility systems on the West Coast are interconnected so that when utilities in the southern states have extra power (winter, when air conditioning needs are low), they can send it north to heat homes in Oregon, Washington, and Idaho. Similarly, when utilities in Northwest states have less demand for power (in summer, when heating is not needed), they can send the extra power south to California and the inland Southwest. Since each utility's system must be planned to meet the highest demand (load) of the year, there is often extra generating capability available during the non-peak load season.

During the summer, Pacific Northwest hydro generation can supply peaking power from the increased water flow for fish migration. This water will flow down the river system whether power is made from it or not. Shipping power to the Pacific Southwest allows the potential electricity from the water (stored electricity) not to be wasted, or spilled. During the winter, Southwest thermal resources (fueled by natural gas, oil, or coal) can supplement Pacific Northwest power generation during the nighttime hours. In the Southwest, loads are smaller at night and it is more efficient to continue to operate generation plants than to shut them down and start them up during the day.

Canada also has utilities which can transfer and exchange power with utilities in the Western United States. The Canadian utilities already send power to the United States in an assortment of power purchases, exchanges, agreements and treaties with different entities (both Federal and private) in the United States. A more detailed look at these arrangements is found in Appendix A of the EIS.

## B. NEED

The improvements are needed to increase the reliability of the local electric power transmission system and to increase the capacity to import electric power over an existing Intertie line from Canada by about 850 megawatts (MW).

### 1. RELIABILITY

***Under certain conditions, the local power system is inadequate and tends to overload.***

Joint studies on the area transmission system were done by BPA and Puget Power in 1989 and 1990. These studies found that the local 230-kV and 115-kV transmission systems in Whatcom and Skagit Counties cannot reliably carry all the power needed when any critical element of the transmission system (such as a transmission line or piece of equipment at a substation) is out of service. Conditions like this have occurred during the last 5 years. They have caused various other system problems, to the system ranging from lines that did not have enough voltage to overloading. When a part of the system comes close to overloading, it is taken out of service to protect the equipment from damage. These problems/weaknesses result in a system that cannot reliably supply power to customers.

### 2. CAPACITY

***The weakness of the local system affects the Intertie, reducing its ability to transfer power from Canada to the U.S.***

At the same time, the studies also found that the local system weakness reduces the Intertie's ability to carry power into the United States. Since the Pacific Northwest no longer has surplus power to meet growing needs, BPA and regional utilities must buy extra power from elsewhere. To get the power here, the electric power network must have enough "room" or capacity. The joint studies found that more transmission capacity is needed to maintain and increase the ability to import power from Canadian utilities. Puget Power's Consumer Panels also identified the need to secure Puget Power's ability to contract directly with British Columbia Hydro and Power Authority (B.C. Hydro) or its affiliates for future power purchases.

Additional transmission capacity which would result from this project could increase sales and exchanges of power between Canada and the Pacific Northwest. Such an increase could help BPA and Pacific Northwest utilities supply power to increasing loads and to defer the need to build new energy resources in the region.

However, the local reliability problem described above is affecting the transfer capability of the Northern Intertie. With a single local outage, when local loads are low (most often in summer), power is not able to flow through the local area creating a "bottleneck", and the Intertie lines cannot be used to their full capacity. The current transfer capability of the west-side Northern Intertie is about 2000 MW. The Intertie was designed to transfer more power than that, but cannot under the present conditions. If the bottleneck in the local system is eliminated, the Intertie would be able to transfer 2850 MW.

In a separate action, Puget Power has contracted to acquire up to 760 MW of power from new co-generation plants. The capacity problem described above might be accentuated by this co-generation. While co-generation would provide some of the needed power to the area, it would also provide "surplus" power when the local area does not need it. The surplus power would further congest the local system. The proposed project would help alleviate the capacity problem by supplying another route for power to take through the area. As a separate action, the co-generation arrangements are not covered in this EIS.

## C. PURPOSE

This project must also meet the following goals.

- provide the ability to supply power in the event of an outage on part of the existing system;
- minimize environmental impacts, as directed by the National Environmental Policy Act (1969);
- save energy by reducing energy losses on the existing system;
- facilitate power sales and exchanges between Canada and the United States on the Northern Intertie;
- aid BPA in meeting its contractual obligations to supply electric power to its customers by creating additional opportunities for BPA to acquire and exchange power resources and to market transmission services;

- facilitate the storage in and return from Canada of energy generated by Water Budget[1] releases and other releases from hydro storage projects in the Pacific Northwest;
- minimize costs; and
- achieve consistency with other National policies.

## D. SCOPING AND MAJOR ISSUES

Public meetings were held to determine the nature and range ("scope") of the issues of concern from the public and from other agencies in Sedro Woolley (February 5, 1992) and Bellingham (February 6, 1992). Oral and written comments made during the scoping period were used by the environmental specialists in their impact analysis. Major issues within the scope of this project are listed below.

- Potential Soil Erosion
- Electric and Magnetic Field Effects/Public Health
- Property Values
- Noise from Lines and Substations
- Land Use/Management

## E. ALTERNATIVES

There are several choices (alternatives) to be made within the framework of this project. The primary choice is between **NO ACTION** and the **CONSTRUCTION ALTERNATIVE**. Under the Construction Alternative, both BPA and Puget Power would have further choices. BPA would choose among designs, locations, and amount of added capacity to share with Puget Power. Puget Power would choose among locations for their actions.

---

1 "Water Budget" means water stored behind dams on the Columbia River system to aid in fish migration.

## 1. NO ACTION

One alternative is **No Action**. If this alternative were chosen, the local transmission system would not be upgraded. No BPA or Puget Power construction would occur at this time. The transfer capability of the Northern Intertie would not change.

The local system would still be unable to handle an outage without causing overloads. As local winter demand for power increased, the local system would be more heavily stressed, and increased outages could occur.

The United States would not be able to increase its imports and agreements with Canada for power, since the transfer capability would remain limited. Puget Power would not gain increased access to Canadian power over the Intertie, and might decide to reopen their application for a Presidential permit to construct a 230-kV transmission line to the Canadian border (see **Alternatives Eliminated from Consideration**). Any such action would be covered by a separate environmental document and separate decision-making process. It would also have to address local ordinances.

The environmental impacts associated with construction of the proposal (see below) would not occur. Capital expenditures, materials, labor, and other resources would not be committed to the project.

## 2. CONSTRUCTION ALTERNATIVE

BPA proposes to undertake the Construction Alternative and to share the resulting increased transfer capability with Puget Power. Under this alternative, BPA must decide on design options and route options.

At this time, there is no designation of an environmentally preferred design. All reasonable choices within the Construction Alternative are described in the EIS and summarized below.

**Intertie Use Alternatives**

If the Construction Alternative were chosen, BPA would have to decide how the added transfer capability on the Northern Intertie would be used. There are three alternatives.

1. ***Sharing use of increased transfer capability with Puget Power.*** BPA and Puget Power would share the cost of making the needed improvements, and in the resulting increased transfer capability on the Intertie. Each party would then individually be able to enter into power exchange agreements up to a maximum of about 425 MW of allocated transfer capability.
2. ***Reserving the entire increase for BPA use alone.***
3. ***Reserving the entire increase for non-Federal use.***

BPA proposes to share the increased transfer capability with Puget Power.

BPA and B.C. Hydro have signed agreements to make improvements on the B.C. Hydro system to increase the transfer capability of the west-side Northern Intertie beginning October 1996. Improvements would be made when specific power transfer agreements are proposed.

**BPA Construction Alternatives: Design and Location Options**

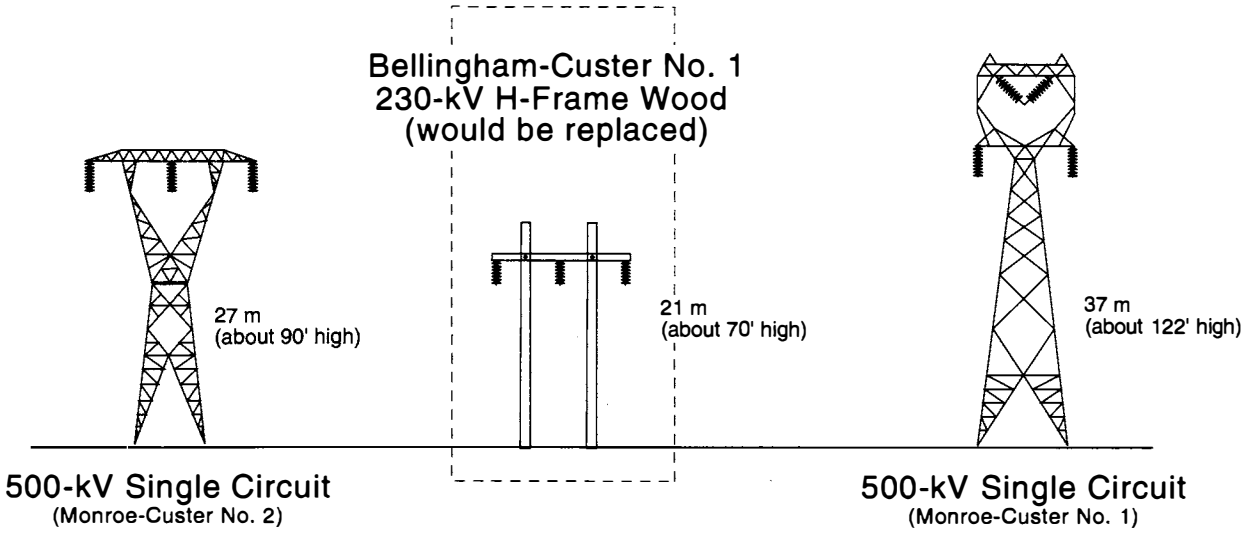
BPA is proposing to rebuild its existing single-circuit, wood-pole H-frame 230-kV transmission line between its Custer Substation and Puget Power's Sedro Woolley Substation (about 61 km or 38 miles)[2] by removing the existing poles, wires, and insulators and replacing them with equipment for a double-circuit, lattice-steel line. Exact location of towers, effects on access roads, and precise clearing needs will be known after this environmental process has helped to avoid sensitive areas.

**BPA Design Alternatives.** There are three design alternatives for the BPA rebuild of the existing 230-kV transmission line. (See Figure S-3.)

1. ***Option 1.*** The existing structures would be replaced with *230-kV* double-circuit lattice-steel structures about 37 m (122 feet) tall. These new structures would be about as tall as the existing adjacent 500-kV structures or about 16 m (52 feet) taller than the H-frame structures they would replace. The new structures would mostly be located next to the existing 500-kV structures.

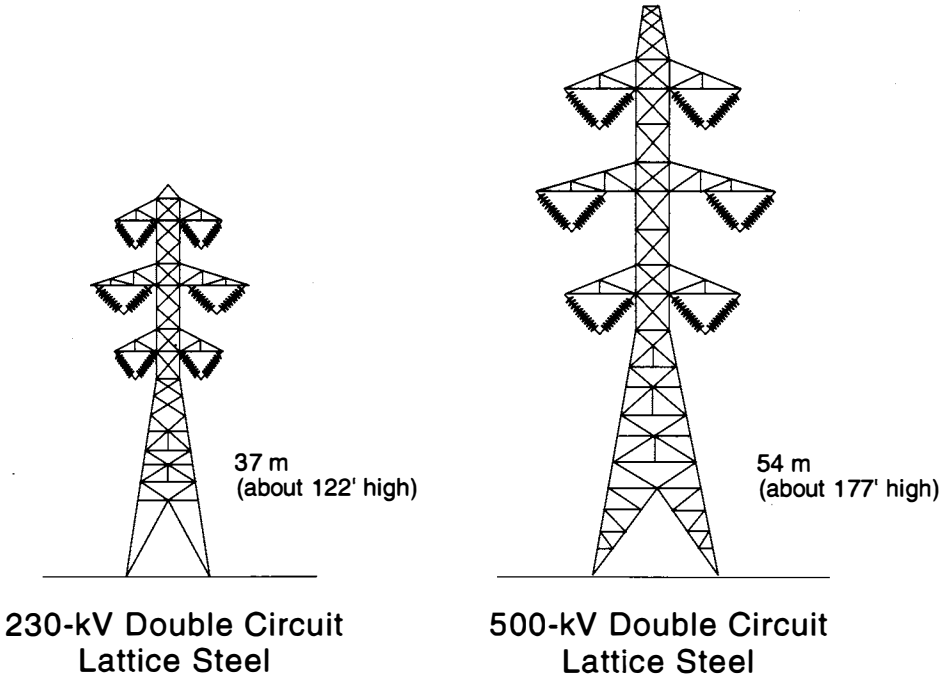
---

2 BPA is using metric measurements to comply with Public Law 100-418.




## *Existing Custer-Bellingham Corridor*

***Typical Example***




## *Potential Replacement Structures*

BPA/PUGET POWER NW WASHINGTON TRANSMISSION PROJECT

***Figure S-3***

***Possible Structure Types for Options 1, 2, & 3***

2. ***Option 2.*** The existing structures would be replaced with *500-kV* double-circuit lattice-steel structures. The lines would be *operated at 230-kV.* This alternative would allow BPA to convert the line to 500-kV operation sometime in the future without having to build/rebuild another transmission line. (Such conversion would require a separate environmental document before this step would occur.)
3. ***Option 3.*** The existing structures would be replaced with *500-kV* double-circuit lattice-steel structures. The line would also be *operated at 500-kV,* while operation of the two *existing* 500-kV lines would be "switched over" to *230-kV.* Near three substations (Custer, BPA's Bellingham, and Sedro Woolley) as well as at a location about 8 km (5 miles) north of Sedro Woolley, this alternative would require a few more structures to be built in order to switch the existing/new 500-kV lines back and forth.

**BPA Location Alternatives.** BPA has one location alternative for this project. Between Bellingham and Sedro Woolley, near the Whatcom/Skagit County line, one of the 500-kV lines in the corridor splits off and then rejoins with the other two lines. (See Figure S-1.)

1. ***Existing.*** The preferred alternative would follow the existing corridor, and rebuild the line in the same alignment.
2. ***H1 Alternative.*** The other alternative would remove the 230-kV H-frame structures, and build the new double-circuit line parallel to the split-off 500-kV line which leaves and then rejoins the main corridor. This split is about 11 km (7 miles) north of Sedro Woolley. BPA would need to acquire new right-of-way adjacent to the 500-kV line.

**Puget Power Construction Location Alternatives**

**115-kV Line Rebuild.** Puget Power is proposing to rebuild its BPA-Bellingham #2 115-kV transmission line between the BPA Bellingham Substation and the Puget Power Bellingham Substation. The existing poles, insulators, and conductors would be taken down. New poles, insulators, and conductors would be put in their place. The conductors would be bundled (two wires per phase), the insulators would be longer, and the poles would be about 4.6 m (15 feet) taller than the existing ones. The rebuilt line would still be energized at 115-kV, and would look similar to the existing line. Puget Power has two location alternatives for rebuilding this line. (See Figure S-4.)

1. ***Existing location.*** Puget Power would replace the existing BPA-Bellingham #2 transmission line using the same route along Virginia/Pacific/North/St. Clair Streets, Sunset Drive, and Dewey Road. The new poles would be placed in about the same places as the existing poles. The entire rebuild would be about 6.9 km (4.3 miles) long. (See Figure S-4.)
2. ***Pipeline alternative.*** An alternative route would diverge from the existing route, crossing Sunset Drive and continuing north to the existing Trans Mountain Oil Pipeline and Cascade Natural Gas pipeline corridor, where it would turn northeast and parallel the pipeline until the intersection of Ross and Dewey roads, then would follow the existing route.

**Loop Line Alternatives.** Puget Power's Bellingham-Kendall 115-kV line currently passes BPA's Bellingham Substation, but does not attach to the substation. Puget Power is proposing to loop the line into and out of the BPA substation. This would involve building about 2.1 km (1.3 miles) of new 115-kV transmission line between the BPA Bellingham Substation and Mt. Baker Highway, next to Mt. Baker Highway and Britton Road. The new 115-kV transmission lines (one into, one out of, the substation) would be similar to the existing 115-kV transmission lines on Mt. Baker Highway/Britton Road. The new lines would be made up of single wood poles, horizontal post insulators, and single conductors.

About two-thirds of the new 115-kV transmission lines would be on public right-of-way. Elsewhere, Puget Power has, or would obtain, sufficient easements. Additional vegetation clearance rights may also be needed for danger trees outside the public right-of-way. There are four alternative routes for looping this line. (See Figure S-5.)

1. ***PP Alternative 1.*** The two new 115-kV lines would leave BPA's Bellingham Substation at the southwest corner, wrap around the substation to the south, and parallel the existing BPA transmission corridor on the southeast side. This would add about 23 m (75 feet) to the corridor. Where the corridor crossed Mt. Baker Highway, one line would turn northeast and follow the highway to the existing Bellingham-Kendall 115-kV transmission line, while the other line would cross the BPA corridor and then continue to parallel on the northeast side of Britton Road. It would connect to the Bellingham-Kendall 115-kV line, where the lines intersect.
2. ***PP Alternative 2.*** The two new 115-kV lines would leave BPA's Bellingham Substation on the northwest corner, wrap around the substation on the north side, and meet up with the BPA transmission corridor. They would parallel the BPA

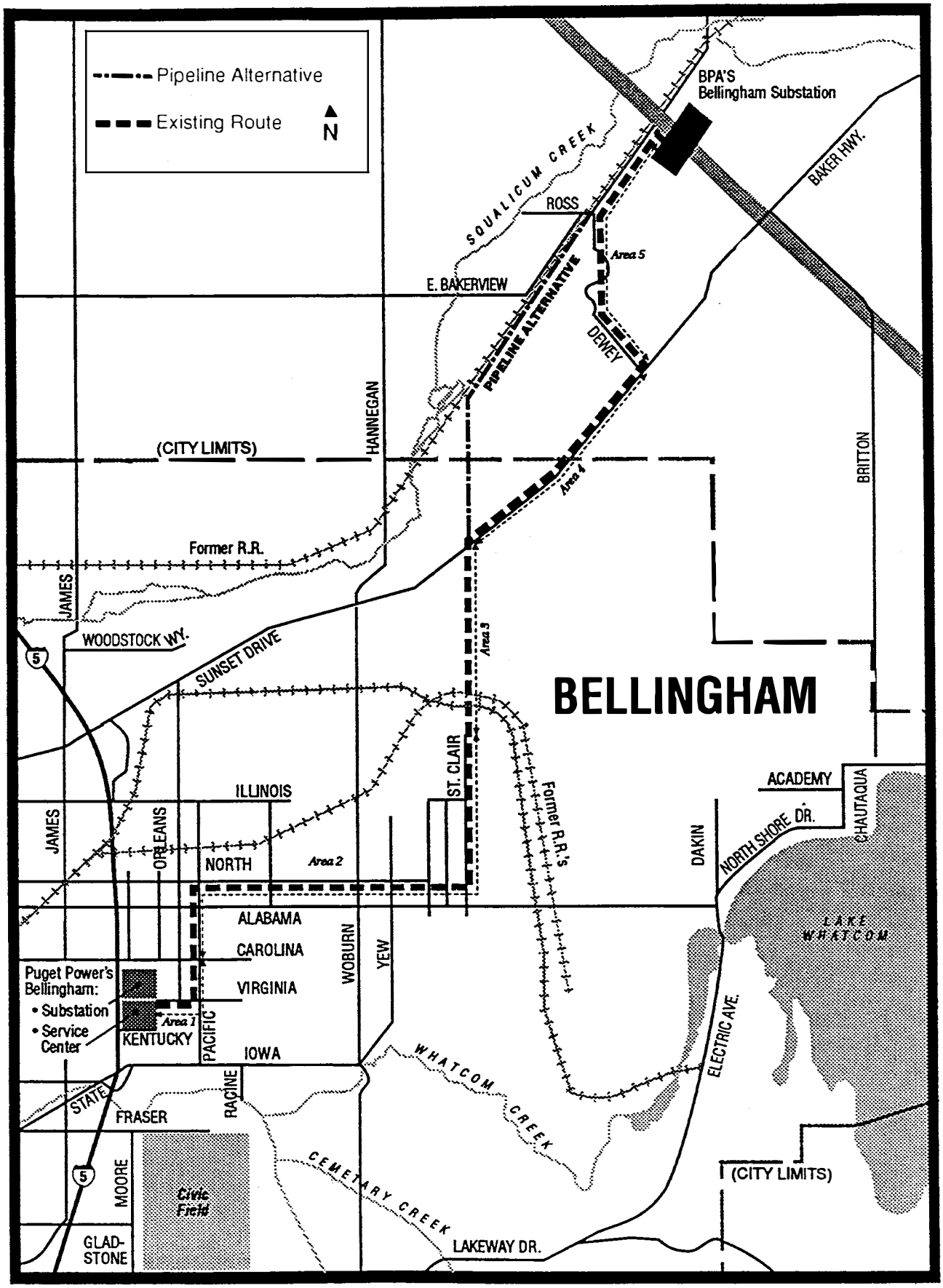
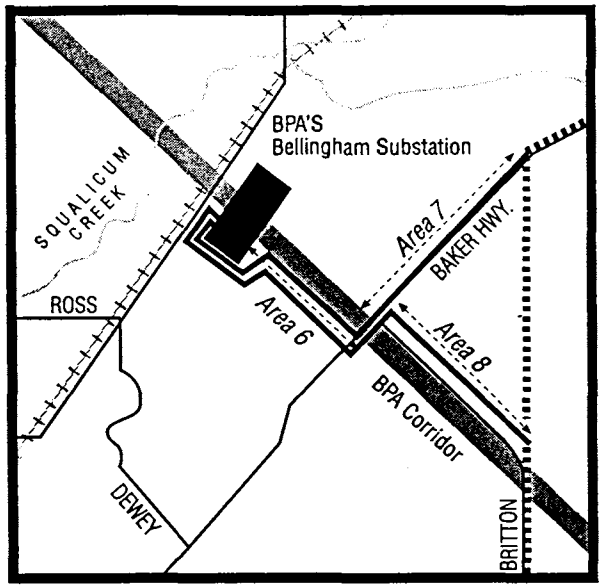
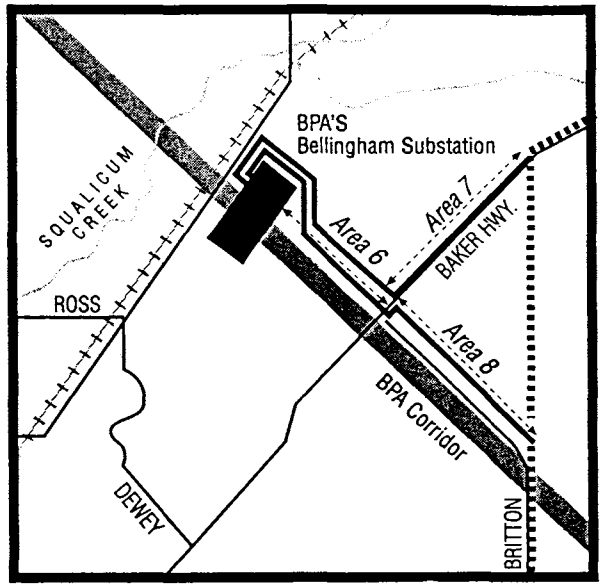


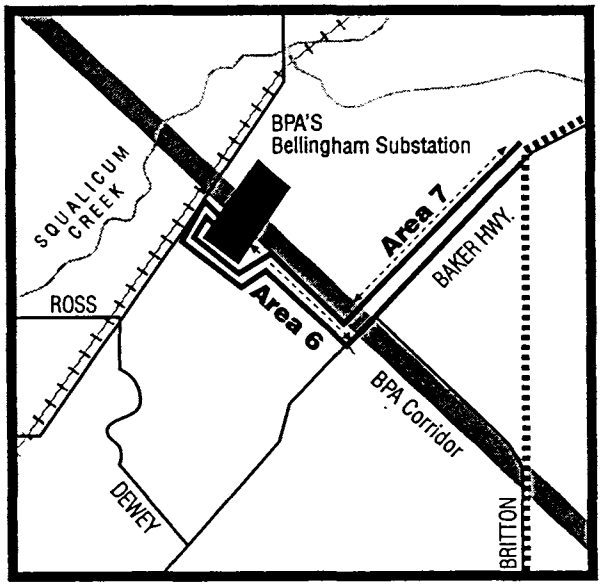

**Figure S-4**
**Puget Power BPA-Bellingham #2 Rebuild**



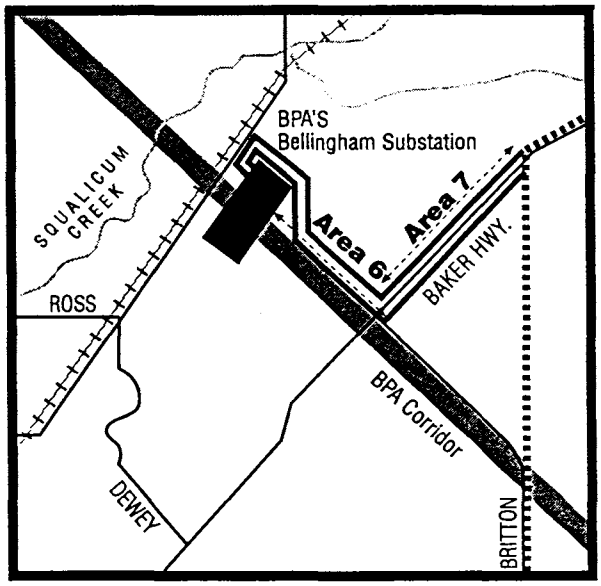

ALT 1




ALT 2




ALT 3




ALT 4

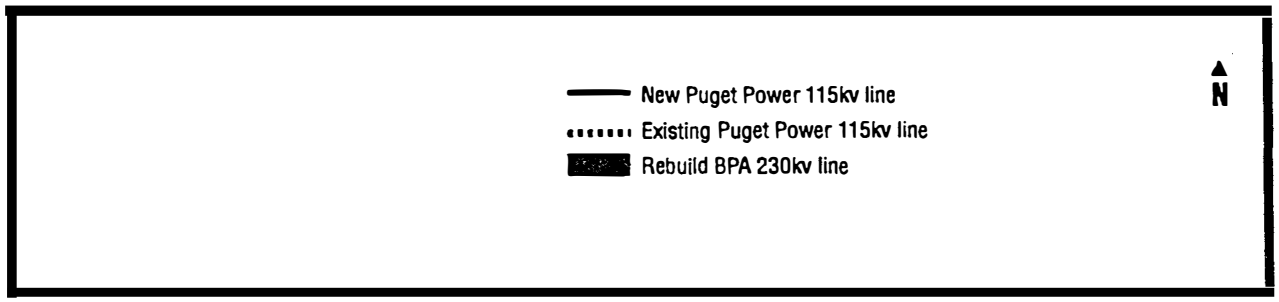



***Figure S-5***
***Puget Power: Loop Line Alternatives at BPA Bellingham Substation***

corridor on the northeast side, adding about 23 m (75 feet) to the corridor. Where the corridor crosses Mt. Baker Highway, this alternative is the same as Alternative 1.

3. ***PP Alternative 3.*** This alternative resembles Alternative 1, except that at Mt. Baker Highway, both lines would follow on the northwest side of the highway till they tie into the existing Bellingham-Kendall 115-kV line.

4. ***PP Alternative 4.*** This alternative resembles Alternative 2, except that at the Mt. Baker Highway, both lines would follow the highway, one to the northwest of the highway and the other to the southeast, until they intersect the existing Bellingham-Kendall 115-kV line.

**Puget Power Bellingham Substation Improvements.** Puget Power would use an existing 115-kV circuit breaker to end the Bellingham-Kendall line that would be rerouted into the BPA Bellingham Substation (see **Loop line alternatives,** above). The portion of the line between Puget Power's Bellingham Substation and BPA's Bellingham Substation would be renamed BPA-Bellingham #3. Puget Power is also proposing to re-align its existing BPA-Bellingham #1 line as it comes into the Puget Power Bellingham Substation.
(See Figure S-6.)

1. ***Alternative 1 (Preferred).*** The BPA-Bellingham #3 line would be shifted slightly to the east inside the substation. The BPA-Bellingham #1 line currently follows Orleans Street; it would be rerouted to the west along Carolina Street and would enter the substation at the corner of Nevada and Carolina Streets. The part of the existing line between Carolina and Virginia Streets would be removed.

2. ***Alternative 2.*** Changes outside the substation would be identical to those under Alternative 1. Inside the substation, the BPA-Bellingham #3 would stay at its present location. The #1 line would follow a different alignment, and an additional 115-kV bay and circuit breaker would be added within the substation.

**Puget Power Sedro Woolley Substation Improvements.** A new 230-kV circuit breaker, steel poles, and foundation would be installed in the substation. BPA's new 230-kV line would enter the substation on the east side and terminate at the circuit breaker. All new equipment would be within the existing substation boundaries.

## F. ALTERNATIVES ELIMINATED FROM DETAILED CONSIDERATION

### 1. PUGET POWER'S ORIGINAL PROPOSED 230-KV INTERTIE WITH B.C. HYDRO

In May 1989, Puget Power applied to the Department of Energy, Office of Fuels Programs (OFP) for a Presidential Permit for electric transmission facilities at the international border between the U.S. and Canada. Two new 37-km (23-mile), 230-kV overhead transmission lines would be built across the U.S.-Canadian border near Lynden, Washington. In Bellingham, one line would terminate at the existing Puget Power Bellingham Substation; the other would interconnect with existing Puget Power transmission lines about 3 km (2 miles) south.

In January 1990, the OFP initiated an EIS scoping process in response to the Puget Power application. The Notice of Intent to Prepare an EIS included the alternative of rebuilding the existing BPA single-circuit 230-kV transmission line (between BPA's Custer and Bellingham Substations) to double-circuit 230-kV on the existing right-of-way.

In November 1990, voters in Whatcom County amended the County planning ordinance to restrict the construction of transmission facilities over 115 kV, except on land where conditional use permits have already been granted or in areas classified as Industrial.

Subsequent BPA/Puget Power technical studies of the transmission system showed that an electrical plan focusing on rebuilding existing BPA and Puget Power facilities would meet the combined needs for solving local reliability problems and increasing the transfer capability of the Intertie. Both agreed to pursue such a plan jointly; it has evolved into the present proposed project. Subsequently, BPA and OFP issued a notice indicating the OFP suspension of Puget Power's Presidential Permit application (at Puget Power's request) and BPA's intent to prepare an EIS on the resulting BPA/Puget Power proposed project.

Because of the joint technical studies recommending other electrical plans of service, the restrictive zoning within Whatcom County, and OFP's suspension of the Presidential Permit process, it is unreasonable to pursue the original Puget Power proposal; it is, therefore, not examined in detail in this EIS.

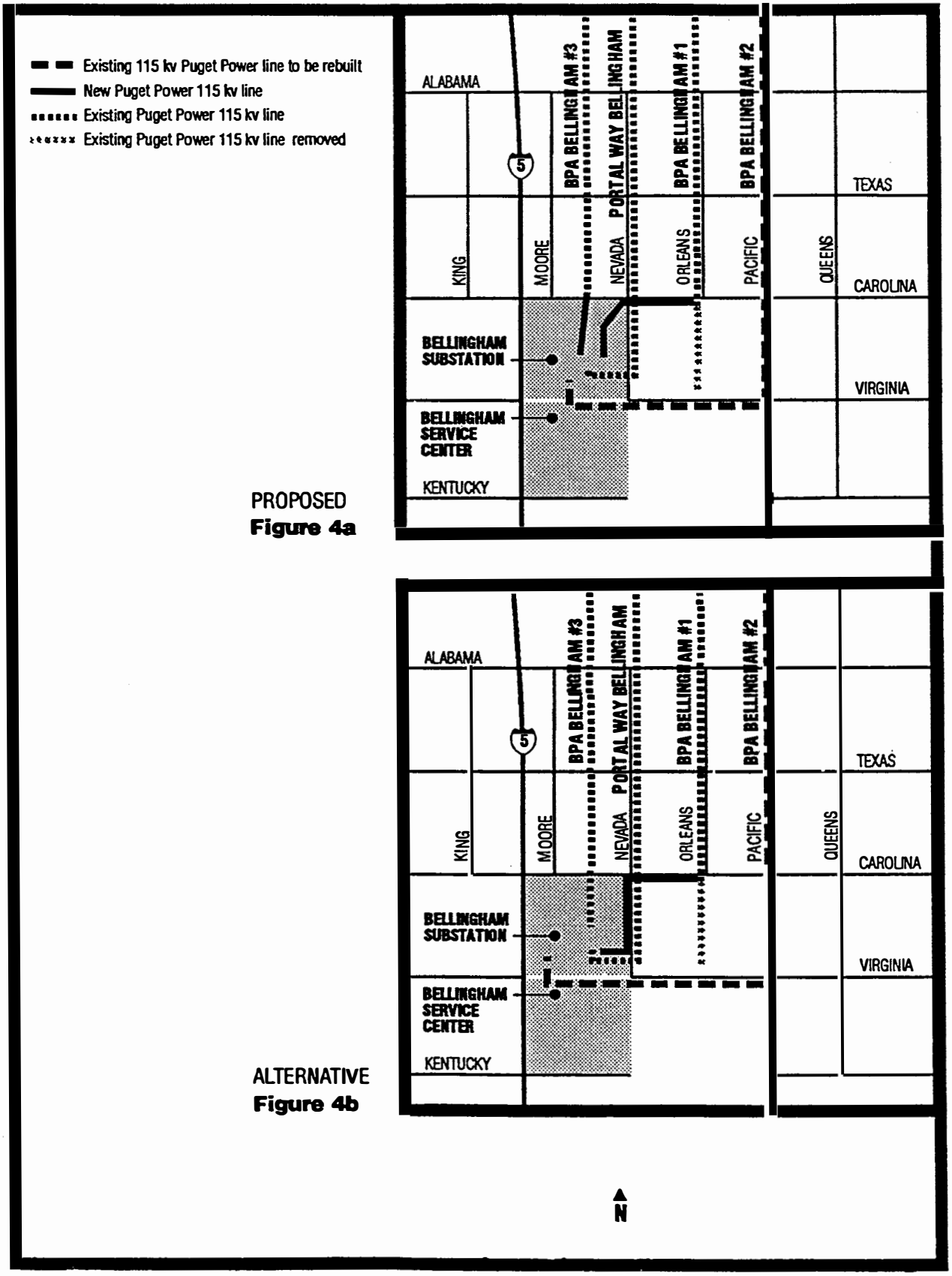



***Figure S-6***
***Puget Power Bellingham Substation Improvements***

## 2. E4A PLAN (PUGET POWER)

The E4A Plan is made up solely of new 115-kV transmission lines. Most of the construction would be on Puget Power's system; however, some improvements would be made to BPA's Custer Substation. Puget Power would undertake the following actions:

- Adding a second 230/115-kV transformer at its Portal Way Substation,
- Constructing a 115-kV line from Puget Power's Portal Way Substation through its Terrell Substation and to Puget Power's Bellingham Substation, and
- Rebuilding an existing 115-kV line between Puget Power's Bellingham and Sedro Woolley Substations.

This alternative was included in the technical study; however, it is considered as more of a short-term solution, and is not equal to plans composed of 230-kV lines. Compared to the proposed plan, E4A would be electrically inferior and would not fully meet the stated need.

## 3. B2A PLAN (BPA/PUGET POWER)

This plan is similar to Option 1 of the proposed plan; it would include the Custer-BPA Bellingham line rebuilt to 230-kV double circuit. However, the two plans differ between BPA's Bellingham Substation and Puget Power's Sedro Woolley Substation. Under the B2A plan, the following actions would take place:

- Replacing the Custer-BPA Bellingham single-circuit 230-kV line with a double-circuit 230-kV line [BPA action];
- Building a 230-kV single-circuit line between BPA's Bellingham and Puget Power's Bellingham Substations, connected to a new 230/115-kV transformer at Puget Power's Bellingham Substation [Puget Power action];
- Rebuilding portions of its Sedro Woolley-Bellingham #3&4 115-kV lines to 230-kV [Puget Power action]. This would provide a second 230-kV circuit between BPA Bellingham and Sedro Woolley. (One 115-kV line would remain between Puget Power's Bellingham and Sedro Woolley Substations.)

The Whatcom County initiative passed in November 1990 would not allow Puget Power to qualify for a conditional use permit because of the 230-kV lines. The B2A plan could not be reasonably pursued.

## 4. CONSERVATION (BPA/PUGET POWER)

Conservation would mean using electricity more efficiently. Conservation typically reduces electricity use at all hours, and can reduce transmission requirements.

This project has no "conservation emphasis" alternative. The technical studies have shown that a conservation alternative would not eliminate or postpone the need for this project. Conservation-produced local load reductions would not reduce the bottleneck problem in the local area when there is high local generation and when north-to-south power transfers from Canada are occurring.

Conservation could result in increased transmission system loading that would result in a less reliable system not able to handle outage conditions.

# G. POTENTIAL IMPACTS OF THE PROPOSED PROJECT

BPA's transmission corridor has been broken up into segments (shown on Figure S-1). Table S-1 defines each segment. Tables S-2 through S-4 show potential impact ratings of environmental issues for each of the alternatives under consideration. The narrative below provides a commentary on the more noteworthy issues.

**Tables S-1. BPA Corridor Segments**

| SEGMENT | ENDING TOWER # ON MONROE-CUSTER # 2[a] | LANDMARK |
|---|---|---|
| A | 87/1 | Intersects main corridor after crossing I-5 |
| B | 77/1 | Between Kelly and Kline Rds |
| C | 75/1 | BPA's Bellingham Substation at Dewey Rd. |
| D | 73/5 | At Britton Rd. & Emerald Lake Way |
| E | 66/3 | East of Lake Whatcom |
| F | 65/1 | East of Lake Whatcom |
| G | 60/2 | Just north of County line |
| H | 58/2 | Highway 9 crosses under lines |
| H1 | [rejoins at 56/4] | [Leaves main corridor at 60/2] |
| I | 57/4 | Just south of Samish River |
| J | 56/4 | Near Upper Samish Rd |
| K | 54/4 | Near Fruitdale Rd |
| L | 51/2 | Southwest of Northern State Hospital |
| M | 50/1 | South of Minkler Rd |
| N | 49/3 | At Puget Power's Sedro Woolley Substation |

## 1. MAJOR ISSUES

Major issues were identified during the scoping period. Some were identified because a large number of people expressed concern about the subject; some are "umbrella" issues which affect a large number of other issues. For instance, potential soil erosion may affect many other aspects of the environment, such as vegetation, fish, water quality, and wetlands. Issues are not discussed in any order of importance.

### Noise from Lines and Substations

The primary concern for noise related to this project stems from the amount of noise made by one of the *existing* 500-kV lines. The proposed project would not add to the noise level of the transmission lines. Along the main corridor, Option 3 of the BPA design options would

[a] BPA's portion of the project has been divided up into segments. They start at the BPA Custer Substation and continue to the Puget Power Sedro Woolley Substation. The Monroe-Custer # 2 500-kV line was used to reference tower numbers, since it is the constant through the main corridor. (Monroe-Custer # 1 creates the **H1** route.) The segments were identified to mark places where the transmission lines arrangement in the corridor changes. Some landmarks have been provided to help the reader locate these transition points.

result in an overall decrease in the noise level. Puget Power's lines would be within State noise levels.

**Land Use/Management**

The concern about land use arose from plans for schools or other structures potentially being compromised by the proposed project. For BPA's portion of the project, most of the construction would occur on land already committed for this type of use. The **H1 route alternative** would remove some land from rural residential use.

Most of Puget Power's portion of the project would not change existing land use. The exception would be the additional right-of-way needed for the loop line alternatives into the BPA Bellingham Substation. Any alternative would change the existing land use. The construction that Puget Power is proposing in Whatcom County is subject to conditional land use permit requirements of Whatcom County.

**Property Values (Social and Economic Considerations)**

The impact tables show impacts ranging from low to moderate. Some property owners in the area of the proposed project are concerned that their property values would be affected by the project. If it were necessary for BPA to obtain additional easements (if the **H1** route alternative were selected), BPA would work with landowner(s) to arrive at the fair market value which would be paid for those easements.

For BPA's **H1 route alternative**, forest lands would be permanently removed from production and one (possibly two) residential units would need to be removed. For Puget Power's portion of the project, depending on the choice of loop line alternative, one (possibly two) homes would need to be removed. In the case where a home would be removed because of the project, the owner would be paid fair market value of the property, along with relocation expenses for the occupants.

Along the BPA corridor, owners of agricultural lands would be compensated for any crop damage incurred by the construction.

**Potential Soil Erosion (Geology/Soils)**

Concern was expressed over potentially sensitive areas around the BPA corridor. Some areas above Lake Whatcom have historically been subject to debris flows and culvert washouts. Tables 2 - 4 show impacts for geology/soils ranging from low to moderate, all short-term.

## TABLE S-2. COMPARISON OF BPA DESIGN ALTERNATIVES

| Environmental Issues/Factors with Possible Influence on Choice of Alternatives | Option 1 | | | Option 2 | | | Option 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Major Issues** | Segs A-D | Segs E-J | Segs K-N | Segs A-D | Segs E-J | Segs K-N | Segs A-D | Segs E-J | Segs K-N |
| • Noise from Lines & Substations | No Increase | | | No Increase | | | Overall Decrease | | |
| • Land Use/Mgmt. | No Change | | | No Change | | | No Change | | |
| • Geology/Soils | Mod Ero-sion | Mod Ero-sion | Low Ero-sion | Similar to Option 1 | | | Similar to Option 1 | | |
| • Social/Economic: Economic | Low | Low | Low | Similar to Option 1 | | | Similar to Option 1 | | |
| Social | Low/ Mod | Mod | Low/ Mod | Similar to Option 1 | | | Similar to Option 1 | | |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | 49 | | | 50 | | | 3 | | |
| **Other Factors/Issues** • Agricult. Impacts | Slight/ Mod | Slight | Slight/ Mod | Similar to Option 1 | | | | | |
| Visual/Recreation | Mod | Mod | Low/ Mod | Similar to Option 1 | | | | | |
| • Vegetation | Slight/Moderate | | | Similar to Option 1 | | | | | |
| • Water Quality | Moderate | | | Similar to Option 1 | | | | | |
| • Floodplain/ Wetlands | Mod | Mod | Slight | Similar to Option 1 | | | | | |
| • Fish & Wildlife: Wildlife | Mod | Mod | Mod | Similar to Option 1 | | | | | |
| Fish | Mod | Mod | Mod | Similar to Option 1 | | | | | |
| • Cultural Resources | Mod | High | High | Similar to Option 1 | | | | | |

## TABLE S-3. COMPARISON OF BPA LOCATION ALTERNATIVES[a/]

| Environmental Issues/Factors with Possible Influence on Choice of Alternatives | BPA Segs. H, I, J (Proposed) (Design Options) | | | BPA Segment H1 (Design Options) | | |
|---|---|---|---|---|---|---|
| **Major Issues** | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| • Noise from Lines & Subs. | No Increase | | Decrease | No Increase | | |
| • Land Use/Management | No Change | | | Change -- Low, Direct Impact | | |
| • Geology/Soils | Low/Moderate | | | Moderate | | |
| • Social/Economic | | | | | | |
| Economic | Low | | | Low/Moderate | | |
| Social | Low/Moderate | | | Moderate | | |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | 2 | 2 | 3 | 0 | 1 | 1 |
| **Other Issues** (Ratings from Chapter 4) | | | | | | |
| • Agriculture | Slight | | | Slight | | |
| • Visual/Recreation | Moderate/Low | | | Low | | |
| • Vegetation | Slight/Moderate | | | Moderate | | |
| • Water Quality | Low/Moderate | | | Moderate/High | | |
| • Floodplain/Wetlands | Moderate | | | Moderate | | |
| • Fish & Wildlife: | | | | | | |
| Wildlife | Slight | | | Moderate | | |
| Fish | Moderate | | | Moderate | | |
| • Cultural Resources | Moderate Concern | | | Moderate Concern | | |

a/ Rating/characterizations are based on recommended mitigation.

## TABLE S-4. COMPARISON OF PUGET POWER ALTERNATIVES (2 PAGES)

| Environmental Issues/Factors with Possible Influence on Choice of Alteratives | Puget Power's 115-kV Bellingham-Bellingham Line Rebuild | Puget Power's "Pipeline" Alternative |
|---|---|---|
| **Major Issues** | | |
| • Noise from Lines & Subs. | No Change | Minor Increase[b/] |
| • Land Use/Management | No Change/Consistent | Minor Change/Consistent(?)[c/] |
| • Geology/Soils | Low | Low/Moderate |
| • Social/Economic: | | |
| Economic | Low | Low |
| Social | Low | Low |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | 98 | 85 |
| **Other Issues** (Impact ratings based on Chapter 4) | | |
| • Agriculture | Low | Low |
| • Visual/Recreation | Low | Low |
| • Vegetation | Moderate | Moderate |
| • Water Resources/Wetlands | Low | Moderate |
| • Fish & Wildlife: | | |
| Wildlife | Slight | Slight |
| Fish | Slight | Slight |
| • Cultural Resources | Low/Moderate | Low/Moderate |

b/ Due to lower existing background levels.

c/ Subject to review by Whatcom County and City of Bellingham.

TABLE S-4. (CONT'D)

| Environmental Issues/Factors with Possible Influence on Choice of Alternatives | Puget Power's New 115-kV Loop Line Alternatives | | | |
|---|---|---|---|---|
| Major Issues | Alt. 1 | Alt. 2 | Alt. 3 | Alt. 4 |
| • Noise from Lines & Subs. | No Notable Change | | | |
| • Land Use Management | Minor/Localized Change (Subject to Whatcom Co. Approval) | | | |
| • Geology/Soils | Short Term-Moderate | | | |
| • Social/Economic: Economic | Low/Moderate | | | |
| Social | Moderate | | | |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | Refer to BPA Segment D | | | |
| Other Issues (Impact ratings based on Chapter 4) • Agriculture | Slight | | | |
| • Visual/Recreation | Slight-Localized | | | |
| • Vegetation | Moderate | | | |
| • Water Resources/Wetlands | Slight-Localized | | | |
| • Fish & Wildlife | Slight-Localized | | | |
| • Cultural Resources | Low | Low | Low | Low |

There are sensitive areas through Whatcom County, including the Squalicum Creek area, Smith Creek crossing, steep slopes above Lake Whatcom, Carpenter Creek crossing, blown culverts and rutted roads north of Mirror Lake, and the area above Highway 9.

In areas of moderate impacts, there could be new or improved roads and/or clearing required on soils having a moderate erosion potential and a fair revegetation potential after installation of mechanical controls (such as straw bales); or disturbance on soils with a high erosion potential and a good chance of successful revegetation after installation of mechanical controls; or cleared forested areas subject to soil compaction.

BPA and Puget Power have built some mitigation measures into the project to ensure only short term impacts on soils. These include: using vegetative and mechanical measures to control erosion and stabilize disturbed slopes, revegetating disturbed sites as soon as possible, and construction taking place during the dry season.

**Public Health/Electric and Magnetic Field Effects**

Many people in the vicinity of the project are concerned about EMF levels resulting from the proposed project.

The state of scientific evidence relating to EMF has not yet established a cause-and-effect relationship between electric or magnetic fields and adverse health effects. Therefore, specific health risks, or specific potential level of disease, cannot be predicted in relation to EMF exposure.

Exposure assessments of magnetic fields from transmission lines can be carried out in order to provide some comparison of alternatives. These are assessments of the field levels of EMF to which people are potentially exposed. For this project, magnetic field calculations for all options were made for those homes and businesses along the transmission corridor that could experience increases in magnetic field levels (as compared to the levels projected for the No Action alternative).

The number of homes expected to experience an increase in magnetic field levels of more than 1 milligauss (mG) are shown on the matrix tables.

## 2. OTHER ISSUES

### Agriculture

The only affected agricultural land would be along BPA's portion of the project; those impacts would be slight. In the areas where the corridor goes through agricultural fields, there would be some added land taken out of use at tower bases because the steel towers would have a bigger base than the structures they would replace. However, the existing wood poles would be removed and the replacing steel structures would fewer and farther apart, leaving fewer structures to interfere with cultivation and irrigation.

Where BPA's line would affect agricultural land, BPA would locate towers to minimize interference with farm activities; schedule construction to minimize conflicts and crop damage when practical; compensate farmers for crop damage; and work with farmers to control weeds during construction and restore productivity of compacted soils.

### Visual/Recreation

Impacts on visual and recreation resources would range from low to moderate.

Option 1 would use towers about the same height as those for the existing 500-kV lines, so the view of the corridor would not change dramatically. Options 2 and 3 would use towers about 17 meters (55 feet) taller than the existing single circuit 500-kV towers. This would be more noticeable when first erected; however, the structures would be aligned as closely as possible with the existing 500-kV towers. It is believed that, in time, the visual effect of the new taller towers on the corridor would diminish. Any option would be located in an already developed transmission corridor which has several different tower types.

One of the more sensitive areas on BPA's portion of the project is around Lake Whatcom, where residential development has occurred near the corridor. The clearing that would be required in the area would increase the residents' views of the corridor.

Recreation on the whole would not be affected; where a golf course is crossed by BPA's line, the double-circuit line would not increase interference.

Puget Power's portion of the project would result in a view similar to the existing one. The rebuild would use poles that are taller, but they would look like the existing ones. The loop

line would be similar to the present line and would also be in an area already occupied by electrical lines.

**Vegetation**

Vegetation can be affected when roads and rights-of way are cleared before construction, and when rights-of-way are maintained and kept clear of taller vegetation. Direct impacts are removal or modification of vegetation; indirect impacts may be sustained when soils are disturbed/compacted, especially in areas where slopes are steep and revegetation potential is poor. Impacts for this project would range from slight to moderate.

A moderate impact rating would occur where disturbances occurred in the buffer of a sensitive plant species and/or plant community; where disturbances occurred to unique habitat types when appropriate mitigation is also used; where disturbance increase indirect effects, as described above; where there was destruction of a habitat type that is abundant elsewhere; or where restoration of the area would be no more than moderately difficult.

**Water Quality**

Water quality can be affected by soil erosion and sedimentation, removal of shade along water bodies (potentially increasing water temperature); and contamination from runoff of herbicides or other toxic substances. Impacts on water quality would range from slight to moderate.

The project would not cross any sole-source aquifers or Groundwater Management Areas. Since Lake Whatcom is a drinking water source for area residents, there is a concern for sedimentation in the lake. However, the mitigation for soil erosion would limit potential impacts.

BPA no longer uses herbicides on transmission line rights-of-way, except where requested by local weed boards. However, herbicides would be used in the new substation yard.

**Floodplains/wetlands**

Impacts on floodplain/wetlands would range from slight to moderate.

A notice of floodplain/wetland involvement for this project was published in the *Federal Register* on August 4, 1992; the EIS includes a Floodplain/Wetland Assessment.

A moderate impact on floodplains would be expected when transmission line structure(s) must be sited within a 100-year floodplain, but the structures are designed to be floodproof and not to impede floodwaters. Access roads placed in a floodplain which require permanent fill would also have a moderate impact on the floodplain.

Only temporary access road fill would be needed in any of the floodplains crossed by the project. Depending on the final alignment of towers, floodplains at the following water sources would have one or more towers placed in them: the Nooksack River, Squalicum Creek, Samish River, Cranberry Lake, Hansen Creek, and the Skagit River.

Wetlands can be affected by construction when vegetation is cut or soil is eroded and deposited into the wetland.

A moderate impact would occur for wetlands where the hydrology, vegetation, or hydric soils are temporarily altered and wetland functions undergo a seasonal setback. Recovery usually needs assistance.

There are wetlands throughout BPA's and Puget Power's portions of the project. The highest effect on a wetland would occur at BPA's Bellingham Substation where the yard would be expanded. The expansion would occur in a wetland area of about 0.1 hectare (0.25 acre). A Wetlands Delineation Report has been prepared (Appendix D in the EIS), and will be submitted for review by the US Army Corps of Engineers.

In order to mitigate possible effects on floodplains or wetlands, they would be spanned whenever possible. If a road is needed to place a tower in a wetland, that road would be temporary. Matting or other temporary measures would be used, and excavation material would not be left in floodplains or wetlands.

Vulnerable wetlands and buffer areas would be delineated and field-staked for avoidance during construction.

**Fish and Wildlife**

A Biological Assessment has been written on bald eagles and marbled murrelets, the only identified threatened and endangered species in the project area. The US Fish and Wildlife Service has concurred with the finding that this project would not significantly affect either species.

Construction, operation, and maintenance of transmission facilities can create both temporary and permanent impacts on wildlife. The primary impacts are created by modification of habitat.

Impacts on fish and wildlife would range from slight to moderate.

A moderate impact rating on wildlife (see matrix charts) occurs where key habitat would be crossed, but not during a time when animals are present, and when roads can be gated or access controlled. Crossing sensitive wildlife habitats would cause moderate effects where proposed mitigation is used, such as avoiding riparian areas whenever possible and, where it is not, preserving vegetation that would not interfere with the performance of construction work or the line itself.

A moderate impact on fish (see matrix charts) would be expected where high value fishery streams with soils of high erodibility are crossed, but proposed mitigation such as culverts, sediment traps, and water bars would be used.

**Cultural Resources**

To date, there are no sites listed on the National Register of Historic Places along this project. There are two sites with some potential for eligibility, and it is possible that sites in the vicinity of construction could be affected. A high impact (see matrix charts) could occur if there were three or more cultural resource occurrences within 0.8 kilometers (0.5 linear mile) of either side of the corridor. A moderate rating would occur if there were at least two cultural resource occurrences within the same distance.

If a site were found during construction, construction would stop and consultations would begin with the required councils.

## H. MORE INFORMATION

If you would like to receive the entire Draft EIS, please call BPA toll-free at 1-800-622-4520.

You can also obtain a copy at the Whatcom County offices:

Department of Buildings and Codes
5280 Northwest Road
Bellingham, Washington.

**BPA/PUGET POWER**

# NORTHWEST WASHINGTON TRANSMISSION PROJECT

## TABLE OF CONTENTS


| | Page |
|---|---|
| Cover Sheet | |
| Summary | S-1 |
| Table of Contents | |
| List of Tables | |
| List of Figures | |
| **1. PURPOSE OF AND NEED FOR ACTION** | **1/1** |
| A. Background | 1/1 |
| 1. The Local System | 1/1 |
| 2. BPA and the Intertie System | 1/2 |
| 3. The Interconnected Area Network | 1/2 |
| 4. Seasonal Exchange of Power | 1/3 |
| B. Need | 1/4 |
| 1. Reliability | 1/4 |
| 2. Capacity | 1/7 |
| C. Purposes | 1/8 |
| D. Other Projects in the Region | 1/9 |
| 1. Co-generation Projects | 1/9 |
| 2. Canadian Entitlement EIS | 1/10 |
| 3. System Operation Review EIS Interim Flow Supplemental EIS | 1/11 |
| E. Decisions to be Made | 1/12 |
| F. Scoping and Major Issues | 1/12 |
| G. Document Structure | 1/13 |
| **2. ALTERNATIVES INCLUDING THE PROPOSED ACTION** | **2/15** |
| A. Introduction | 2/15 |
| B. Evaluating Alternatives | 2/16 |
| 1. Development of the Project | 2/16 |
| 2. Taking Action (Construction) | 2/17 |

| | Page |
|---|---|
| C. Description and Comparison of Alternatives, Including the Proposal | 2/18 |
| 1. No Action | 2/18 |
| Power Supply | 2/18 |
| Environment and Cost | 2/20 |
| 2. The Proposed Plan | 2/21 |
| Intertie Use Alternatives | 2/21 |
| BPA's Part of the Project: Physical Alternatives | 2/24 |
| BPA Design Options | 2/26 |
| BPA Location Alternatives | 2/31 |
| Puget Power's Part of the Project | 2/34 |
| Puget Power Line Rebuild | 2/35 |
| Puget Power Loop Line Alternatives | 2/38 |
| Options for Line Access into Puget Power Bellingham Substation | 2/41 |
| 3. Mitigation | 2/42 |
| BPA's Part of the Project | 2/42 |
| Puget Power's Part of the Project | 2/45 |
| 4. Cumulative Effects | 2/46 |
| D. Alternatives Considered and Eliminated from Detailed Discussion | 2/47 |
| 1. Puget Power's Original Proposed 230-kV Intertie with B.C. Hydro | 2/47 |
| 2. E4A Plan (Puget Power) | 2/48 |
| 3. B2A Plan (BPA/Puget Power) | 2/50 |
| Background | 2/51 |
| The New Situation | 2/51 |
| 4. Conservation (BPA/Puget Power) | 2/51 |
| **3. AFFECTED ENVIRONMENT** | **3/50** |
| A. BPA Portion | 3/50 |
| 1. Land Use | 3/50 |
| 2. Soils | 3/54 |
| 3. Vegetation | 3/55 |
| 4. Water Resources | 3/56 |
| 5. Floodplains | 3/57 |
| 6. Wetlands | 3/57 |
| 7. Fish and Wildlife | 3/58 |
| 8. Agriculture | 3/60 |
| 9. Visual Resources | 3/60 |
| 10. Recreation | 3/61 |
| 11. Cultural Resources | 3/61 |
| 12. Social and Economic Considerations | 3/61 |

| | Page |
|---|---|
| 13. Air Quality | 3/62 |
| 14. Health and Safety | 3/63 |
| B. Puget Power's Portion | 3/63 |
| 1. Land Use | 3/63 |
| 2. Soils | 3/64 |
| 3. Vegetation | 3/65 |
| 4. Water Resources and Wetlands | 3/66 |
| 5. Fish and Wildlife | 3/66 |
| 6. Agriculture | 3/67 |
| 7. Visual Resources | 3/67 |
| 8. Recreation | 3/68 |
| 9. Cultural Resources | 3/68 |
| 10. Social and Economic Considerations | 3/69 |
| 11. Health and Safety | 3/70 |
| **4. ENVIRONMENTAL CONSEQUENCES** | **4/71** |
| A. Introduction | 4/71 |
| B. Description of Construction Actions | 4/72 |
| 1. BPA Portion of the Project | 4/72 |
| 2. Puget Power Portion of the Project | 4/77 |
| C. Intertie Use Alternative Implications | 4/78 |
| 1. Proposed Action (Preferred Alternative 1) | 4/79 |
| 2. Reserve Increase for BPA Use | 4/80 |
| 3. Reserve Increase for Non-Federal Use | 4/80 |
| D. Resource Impacts and Mitigation Actions: BPA Physical Alternatives | 4/81 |
| 1. Land Use/Management | 4/81 |
| 2. Geology/Soils | 4/83 |
| 3. Vegetation/Noxious Weeds | 4/87 |
| 4. Water Quality | 4/91 |
| 5. Floodplains/Wetlands Assessment | 4/97 |
| 6. Fish and Wildlife | 4/107 |
| 7. Agriculture | 4/113 |
| 8. Visual/Recreation | 4/117 |
| 9. Cultural Resources | 4/122 |
| 10. Social and Economic Considerations | 4/127 |
| Short-term Effects of Construction | 4/127 |
| Long-term Social and Economic Effects | 4/130 |

| | Page |
|---|---|
| 11. Noise and Radio/TV Interference | 4/141 |
| Audible Noise | 4/141 |
| Radio and Television Interference | 4/144 |
| 12. Air Quality | 4/144 |
| 13. Global Warming | 4/146 |
| 14. Health and Safety | 4/147 |
| E. Resource Impacts and Mitigation Action: Puget Power Portion of the Proposal | 4/155 |
| 1. Land Use and Zoning | 4/155 |
| 2. Geology/Soils | 4/159 |
| 3. Vegetation | 4/160 |
| 4. Water Resources and Wetlands | 4/161 |
| 5. Fish and Wildlife | 4/164 |
| 6. Agriculture | 4/164 |
| 7. Visual Resources | 4/165 |
| 8. Cultural Resources | 4/168 |
| 9. Social and Economic Considerations | 4/172 |
| 10. Noise and Radio/TV Interference | 4/175 |
| Corona | 4/175 |
| Audible Noise | 4/175 |
| Radio/TV Interference | 4/177 |
| 11. Health and Safety | 4/177 |
| F. Consultation, Review, and Permit Requirements | 4/180 |
| 1. Environmental Policy | 4/180 |
| 2. State, Areawide, and Local Plan and Program Consistency | 4/181 |
| 3. Coastal Management Program Consistency | 4/183 |
| 4. Permit for Structures in Navigable Waters | 4/185 |
| 5. Permit for Discharges into Waters of the United States | 4/185 |
| 6. Recreation Resources | 4/187 |
| 7. Permits for Rights-of-Way on Public Lands | 4/188 |
| 8. Heritage Conservation | 4/188 |
| 9. Threatened and Endangered Species | 4/190 |
| 10. Fish and Wildlife Coordination | 4/191 |
| 11. Farmlands | 4/192 |
| 12. Floodplains/Wetlands | 4/192 |

| | Page |
|---|---|
| 13. Energy Conservation and Pollution Control at Federal Facilities | 4/195 |
| Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) | 4/195 |
| Solid Waste Disposal and Resource Conservation and Recovery Act (RCRA) | 4/195 |
| Toxic Substances Control Act (TSCA) | 4/197 |
| Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) | 4/197 |
| Energy Conservation at Federal Facilities | 4/197 |
| Noise Control Act | 4/198 |
| Safe Drinking Water Act | 4/198 |
| Clean Air Act | 4/198 |
| Compliance with Federal Aviation Administration (FAA) Requirements | 4/198 |
| **5. LIST OF PREPARERS** | **5/199** |
| **6. LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT** | **6/203** |
| **7. REFERENCES** | **7/207** |
| **8. GLOSSARY** | **8/218** |
| **INDEX** | |
| **APPENDICES** | |
| APPENDIX A Power Marketing | |
| APPENDIX B Public Involvement | |
| APPENDIX C Health and Safety | |
| APPENDIX D Wetlands Delineation Report | |
| APPENDIX E Biological Assessment and Concurrence | |

## List of Tables


| | | Page |
|---|---|---|
| Table 1 | BPA Corridor Segments | 2/25 |
| Table 2 | Comparison of BPA Design Alternatives | 2/42a |
| Table 3 | Comparison of BPA Location Alternatives | 2/42b |
| Table 4 | Comparison of Puget Location Alternatives (2 pages) | 2/42c<br>2/42d |
| Table 5 | Water Resources Type and Quality | 4/92 |
| Table 6 | Floodplains Crossed | 4/100 |
| Table 7 | Potential Wetlands in the Project Area | 4/103 |
| Table 8 | Cultural Resources Data by Segment | 4/125 |
| Table 9 | Motel Accommodations in the Project Area | 4/129 |
| Table 10 | Estimated Existing Range of Audible Noise Level | 4/143 |
| Table 11 | Typical Electric and Magnetic Field Strengths 1 Foot from Common Appliances | 4/149 |
| Table 12 | Typical Electric and Magnetic Field Strengths from BPA Transmission Lines | 4/150 |
| Table 13 | Number of Homes and Commercial Buildings Expected to Experience an Increase in Magnetic Fields | 4/154 |
| Table 14 | Land Use Zoning Information | 4/156 |
| Table 15 | Cultural Resources Data by Route Variation | 4/168 |
| Table 16 | State of Washington Environmental Noise Limits | 4/176 |


## List of Figures


| | | After Page |
|---|---|---|
| Figure 1 | General Project Map | 1/2 |
| Figure 2 | Schematic Line Diagram | 1/2 |
| Figure 3 | Schematic of Alternatives | 2/18 |
| Figure 4 | Project Area and Corridor Segments | 2/26 |
| Figure 5 | BPA Bellingham Substation Expansion | 2/26 |
| Figure 6 | Possible Structure Types for Options 1, 2, and 3 | 2/26 |
| Figure 7 | Puget Power BPA-Bellingham #2 Rebuild | 2/34 |
| Figure 8 | Puget Power: Typical Structure Type for Rebuild | 2/34 |
| Figure 9 | Puget Power: Typical Structure Type for Loop Line Alternative | 2/40 |
| Figure 10 | Loop Line Alternatives at BPA Bellingham Substation | 2/40 |
| Figure 11 | Puget Power Bellingham Substation Improvements | 2/42 |
| Figure 12 | Puget Power: Original Proposed 230-kV Intertie | 2/48 |
| Figure 13 | The E4A Plan | 2/48 |
| Figure 14 | The B2A Plan | 2/50 |
| Figure 15 | City of Bellingham and Whatcom County Land Use Zoning | 3/64 |
| Figure 16 | Potential Wetlands, Puget Power's Part of the Project | 3/66 |

| | | After Page |
|---|---|---|
| Figure 17 | Soil Revegetation Potential | 3/70 |
| Figure 18 | Soil Erosion Susceptibility | 3/70 |
| Figs. 19a/19b | Water Resources | 3/70 |
| Figure 20 | Protected and Wild and Scenic Rivers | 3/70 |
| Figure 21 | Resident and Anadromous Fish Habitat | 3/70 |
| Figure 22 | County Zoning | 3/70 |
| Figure 23 | Land Ownership -- Public and Tribal | 3/70 |

# CHAPTER 1
# PURPOSE OF AND NEED FOR ACTION

Bonneville Power Administration (BPA) and Puget Sound Power & Light (Puget Power) are proposing to upgrade the existing electric power transmission system in the Whatcom and Skagit County area, starting in 1995. Puget Power's part of the project is mainly in Bellingham, Washington, and within Whatcom County, with minor substation work in Skagit County. BPA's part of the project extends from Sedro Woolley in Skagit County, into Whatcom County, by Lake Whatcom and Bellingham, continuing towards Custer, Washington The proposed work aims to make the local system more reliable and to increase the ***capacity***[1] of a nearby U.S. - Canada Intertie transmission line. See Figure 1.

## A. BACKGROUND

The environmental analysis for this project focuses on construction that would take place in the Whatcom and Skagit County area. However, the project also affects the BPA power system on the entire west side of the Cascade Mountains.

### 1. THE LOCAL SYSTEM

Whatcom and Skagit Counties get most of their electric power from an interconnected network of lines--some owned and operated by BPA, some by Puget Power. Power is supplied through several ***substations*** and a web of 230,000-***volt*** (230-kV) and 115-kV lines interconnected lines. These interconnections often eliminate the need for one utility to duplicate another's facilities. Power can also come off the nearby Northern Intertie and flow through the Whatcom/Skagit County area on BPA's 230-kV line or on Puget Power's local network.

[1] Words in boldface/italics are defined in **Chapter 8, GLOSSARY.**

## 2. BPA AND THE INTERTIE SYSTEM

The Northern Intertie consists of both an east and a west side. **This project affects only the lines that make up the *west side* of the Northern Intertie,** which consists of two parallel 500-kV BPA transmission lines from the U.S. - Canada border at Blaine, Washington, through BPA's Custer Substation, running east of Bellingham, past Sedro Woolley, and south to BPA's Monroe Substation. The Monroe Substation connects with other high-voltage lines serving the Pacific Northwest and the West Coast. These 500-kV lines allow the U.S. to import, export, store, and exchange power with Canadian utilities.

## 3. THE INTERCONNECTED AREA NETWORK

The Intertie and the local transmission system work much like the parts of a highway system. The 500-kV line and Northern Intertie are like the "interstate" bypass around a metropolitan area. The 230-kV lines are the "local highway" that accesses the metropolitan area. The local highway supplies power to the local "neighborhood streets" or 115-kV lines by way of "off ramps" or substations.

Figure 2 shows a simplified version of this area network. The Intertie comes from Canada into BPA's Custer Substation. Among other lines which leave the station are the following:

- Two 500-kV lines. These BPA lines are referred to as the Monroe-Custer # 1&2 lines because they go from Monroe Substation to Custer Substation.
- BPA's Bellingham-Custer 230-kV line.
- A 230-kV line that connects to Puget Power's Portal Way Substation, allowing Puget Power's network and the Intertie to exchange power.

The BPA Bellingham-Custer line can also connect the Intertie and Puget Power's network because it ties into BPA's Bellingham Substation, where Puget Power has lines. South of BPA's Bellingham Substation, BPA's 230-kV line is called the Murray-Bellingham line. The power on this line can hook up with the Intertie on the south side of the Whatcom/Skagit County area. BPA's Murray-Bellingham line has a connection, or ***tap***, into Puget Power's Sedro Woolley Substation. Puget Power's lines out of this substation are part of the local

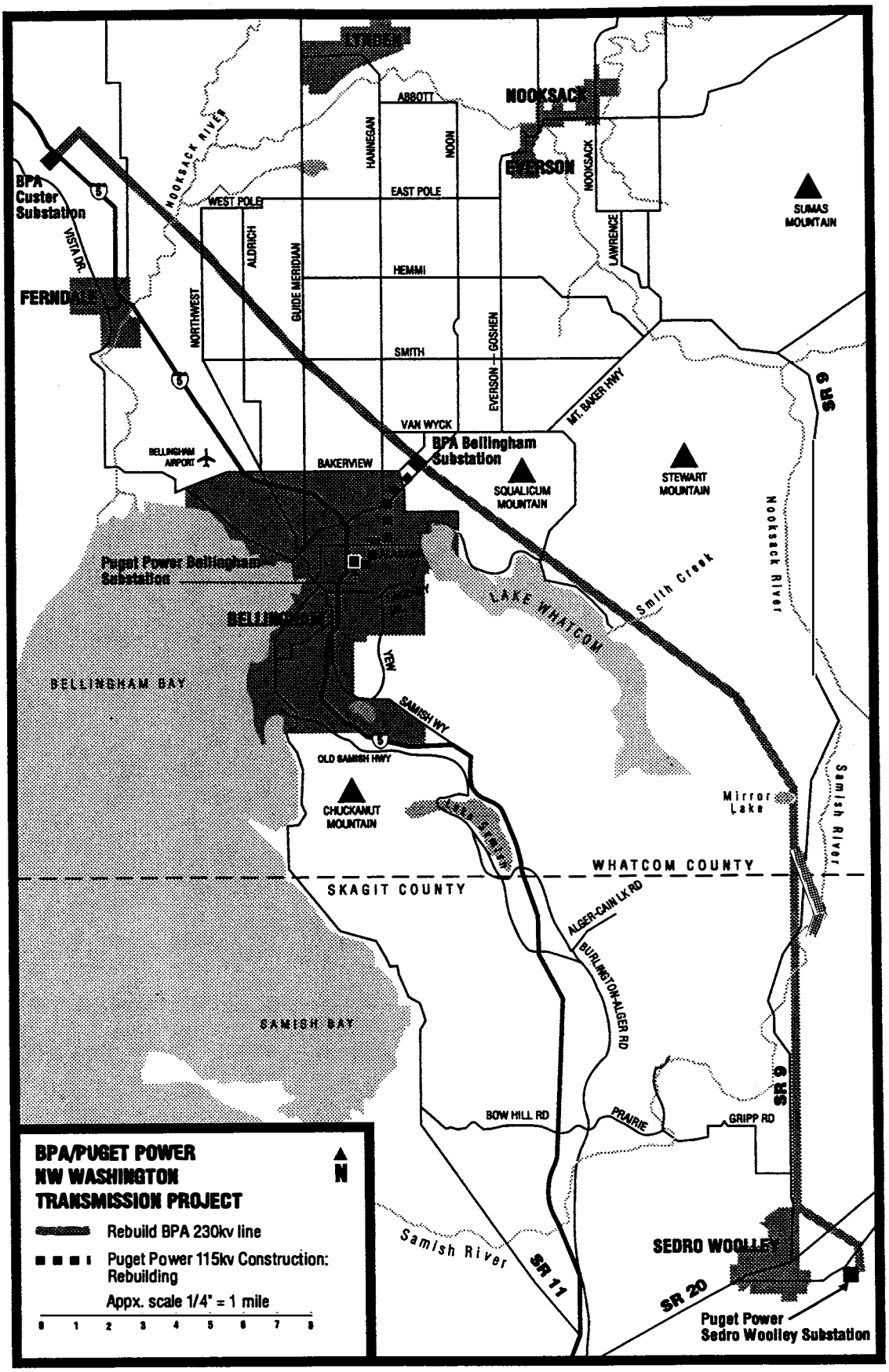



***Figure 1***
***General Project Map***

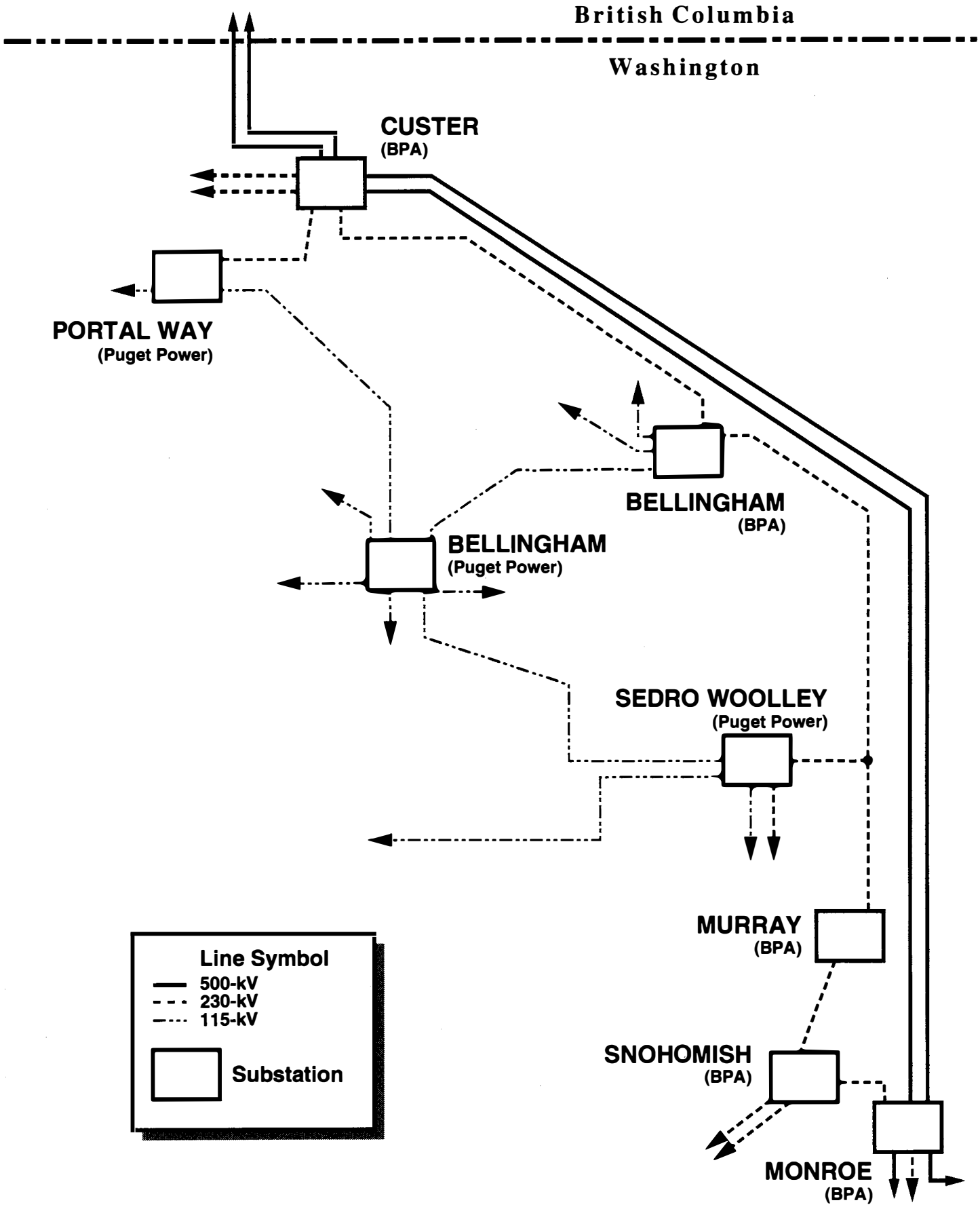



***Figure 2***
***Schematic Line Diagram***

115/230-kV network which can transfer power through Bellingham to Custer and around the local counties.

## 4. SEASONAL EXCHANGE OF POWER

A project affecting the transmission system in the Whatcom and Skagit County area can also affect power transfers all along the West Coast. This is because utility systems on the West Coast are interconnected, so that when utilities in the southern states have extra power (winter, when air conditioning needs are low), they can send it north to heat homes in Oregon, Washington, and Idaho. Similarly, when utilities in Northwest states have less demand for power (in summer, when heating is not needed), they can send the extra power south to California and the inland Southwest. Since each utility's system must be planned to meet the highest demand (***load***) of the year, there is often extra generating capability available during the non-***peak*** load season.

During the summer, Pacific Northwest hydro generation can supply peaking power from the increased water flow for fish migration. This water would flow down the river system whether power is made from it or not. Shipping power to the Pacific Southwest allows the potential electricity from the water (stored electricity) not to be wasted, or spilled. During the winter, Southwest thermal resources (fueled by natural gas, oil, or coal) can supplement Pacific Northwest power generation during the night-time hours. In the Southwest, loads are smaller at night, and it is more efficient to continue to operate generation plants than to shut them down and start them up during the day.

Canada also has utilities which can transfer and exchange power with utilities in the Western United States. The Canadian utilities already send power to the United States in an assortment of power purchases, exchanges, agreements and treaties with different entities (both Federal and private) in the United States. A more detailed look at these arrangements is found in **Appendix A.**

## B. NEED

The proposed upgrades of the transmission system are needed to increase the ***reliability*** of the local transmission system and to increase by about 850 ***megawatts*** (MW) the capacity of Intertie lines to import power from Canada.

In 1989 and 1990, BPA and Puget Power undertook joint technical studies to study the Whatcom/Skagit County area needs and transmission system. The studies identified problems of reliability for the local area transmission system, and related problems affecting capacity on the Northern Intertie system linking Canada and the U.S. (Power imported on the Intertie from Canada cannot be sustained if a single ***outage*** of local 230- and 115-kV equipment were to occur.) These problems are described below.

### 1. RELIABILITY

***Under certain outage conditions, the local power system is inadequate and tends to overload.***

When any one critical element of the existing transmission system in Whatcom and Skagit Counties is out of service, the system cannot carry all the needed power. This means that local reliability of power supply is compromised: Power cannot be reliably supplied to customers because of weakness in the 230- and 115-kV systems. The Puget Power 115-kV transmission line, for instance, is proposed for rebuild because poles and equipment have deteriorated since the existing transmission line was installed in 1958.

Over the last 5 years, there have been several failures on the local system (see Figure 2). These included removal of a line from service in order to prevent ***overloading***, ***voltage drop*** (which can damage appliances served by power and shut down industrial customers), and ***failure***.

- **Loss of a BPA 500/230-kV *transformer*.** The loss required that the BPA 230-kV Custer-Bellingham line be taken out of service. BPA also took a second line (Puget Power's BPA-Bellingham #1 115-kV line at BPA's Bellingham Substation) out of

service to keep from overloading the BPA Bellingham-Murray 230-kV line. (March 22, 1987)

- **Removal from service of Puget Power's Portal Way 230/115 kV transformer, for maintenance.** When the transformer bank was switched out of service, voltage dropped from the normal 115-kV level at Puget Power's Portal Way Substation (to 109 kV), Arco North Substation (to 111.1 kV), and Bellingham Substation (to 111.7 kV). (September 26, 1988)

- **Removal of lines from service.** Puget Power took three lines (its Portal Way-Arco 115-kV line, the Portal Way-Bellingham 115-kV line, and the BPA Bellingham #1 115-kV line) out of service to make minor facility improvements. The remaining elements of the system were unable to meet demand for power without support from the Whitehorn ***combustion turbines*** in northwest Whatcom County. Combustion turbines are usually operated during times of peak demand. (November 1989)

- **Fire.** One of the two 500/230 kV transformer banks at the BPA Custer Substation failed, creating a fire that destroyed the bank and caused $6 million worth of damage. The other transformer remained in service and allowed the power system to remain stable. It took several months to replace the destroyed bank. If, during that time, the remaining transformer had been lost from service, Intalco Aluminum Company would have been without power for an extended period of time. (August 30, 1990).

- **Storm-caused loss of lines.** During the high winds of the 1990 "Arctic Express" storm, BPA's Bellingham-Murray 230-kV transmission line was knocked out of service. Just after it was restored, the Puget Power Sedro tap to the Monroe-Snohomish 230-kV line was lost. Had these two lines been out of service concurrently, all of Skagit and Island Counties would have been without power. (December 17, 1990)

- **Ice storm line outages.** During ice storms, outages occurred on several Puget Power transmission lines (Whatcom #1 115-kV line, the Whatcom #2 115-kV line, the Portal Way-Bellingham 115-kV line, and the Sedro Woolley-Bellingham #3 and #4). This left a single line, the BPA Bellingham #1 line, to serve the Bellingham load. That line alone was sufficient only because much of Bellingham was out of power. Shortly after

these outages, the Portal Way-Bellingham line was brought back into service, only to be followed by the loss of the BPA-Bellingham #1 line. (February 1991)

- **Line failure.** While the 230/115 kV transformer at the BPA Bellingham Substation was out of service for maintenance, Puget Power's Portal Way-Arco Central 115-kV transmission line failed. This ***double-contingency*** outage (two emergency failures occurring at once) caused an overload on the Portal Way-Bellingham 115-kV transmission line. This most certainly would have caused outages in Bellingham, had not the outage occurred at midnight during the summer, when loads on Puget Power's system were low. (July 21, 1991)

- **Sequential outage.** On September 8, 1992, during a routine maintenance inspection of Puget Power's Portal Way 230/115-kV transformer, the maintenance crew discovered that the transformer had suffered internal damage and needed to be replaced. However, before a replacement transformer could be moved to the Portal Way Substation, a second outage occurred. On September 16, 1992, BPA was carrying out some routine maintenance switching at BPA's Bellingham Substation. BPA's 230/115 kV transformer at Bellingham immediately overloaded and was automatically taken out of service by its protection circuits. The transformer was out of service for 22 seconds before the local operator reversed the switching procedure. During that brief interval, there was a severe overload on Puget Power's Sedro Woolley-Bellingham #3 and #4 115-kV lines, and Bellingham and Lynden had lowered voltage. If the problem had not been caught quickly, Whatcom County most likely would have experienced a serious "brown-out" (damaging low-voltage condition) or "black-out" (total loss of power).

These events show that, under certain outage conditions, the local system is not adequate and tends to overload. This situation jeopardizes both BPA's and Puget Power's utility responsibilities in meeting local power needs. For instance, if the transformer at Puget Power's Portal Way Substation were to fail, the BPA Custer-Bellingham 230-kV line would overload. An overload can cause the conductor to heat, expand, and sag below the National Electric Safety Code (NESC) line-to-ground clearance requirement, creating safety hazards. BPA's ability to provide service to Puget Power would be jeopardized.

## 2. CAPACITY

***The weakness of the local system affects the Intertie, reducing its ability to transfer power from Canada to the U.S.***

In addition to the transmission system which supplies local area needs in Whatcom and Skagit Counties, two 500-kV parallel lines (the Northern Intertie) run from Canada, through Northwest Washington near Bellingham and Sedro Woolley, and south. (See Figure 2.) These large-capacity lines allow power to be sent from Canada to the U.S. and back, as need for power increases and decreases seasonally on each side of the border and as surplus power becomes available.

Today, the Pacific Northwest no longer has surplus power. Continuing growth in electrical loads has meant that BPA and regional utilities must purchase extra power from new sources, both within and outside the region. The 1989/1990 technical studies found that more transmission capacity is needed to maintain and increase the ability to import power from Canadian utilities. Puget Power's Consumer Panels also identified the need to secure the ability to contract directly with British Columbia Hydro and Power Authority (B.C. Hydro) or its affiliates for future power purchases. This was identified as a priority in Puget Power's least-cost plan on file with the Washington Utilities and Transportation Commission.

At the same time, there has been increased planning and marketing of potential new generating resources in western Canada. If this project were to provide additional transmission capacity, sales and exchanges of power between Canada and the Pacific Northwest could increase. Such an increase could help BPA and Pacific Northwest utilities supply power to increasing loads and defer the need to build new energy resources in the region.

However, the Northern Intertie--BPA's 500-kV lines that can import power from Canada--is affected by the unreliable local system. If there is an outage on the local system when local loads are low, the power being generated does not have an open path out of the area, and the local bottleneck is made worse. This increased bottleneck reduces both the maximum amount of power the Intertie can carry when all parts of the system are operating (***rated transfer capability*** or ***RTC***) and the amount of power that can be transferred even when a major facility on the transmission path is lost during peak winter conditions (***single-contingency***

***rating*** or ***SCR***). The SCR is a measure of how much power a line can deliver on a ***firm*** (guaranteed) basis.[2] The Northern Intertie's present RTC is 2300 MW north to south (from Canada to the U.S.): 2000 MW on the west side and 300 MW on the east side. The present SCR is very low: only 230 MW north to south on the west side and nothing on the east side. All of this capacity is reserved for Seattle City Light, as required by the Skagit/Ross Lake Treaty. **This EIS and the following discussions pertain only to the west-side Northern Intertie.**

Use of the west-side Northern Intertie can be limited by numerous factors such as extremes in air temperature, availability of storage, existing contractual obligations, maintenance, and equipment outages. During recent years, peak north-south usage has occurred August through February as ***stored energy*** is returned from Canada (see **Appendix A**) and Canadian sales or exchanges are made with the Pacific Northwest, including BPA, and the Pacific Southwest. However, peak transfers can occur during any month, depending on power system, weather, and market conditions.

Finally, Puget Power has contracted to acquire up to 760 MW of ***co-generation*** power in Skagit and Whatcom Counties (see **Section D.1**). Co-generation may accentuate the capacity problem described above. While co-generation would provide some of the needed power to the area, it would also provide power when the local area does *not* need it. This "surplus" would further congest the local system. Another path is needed for the power to flow within and beyond the local transmission system in order to be able to increase import capacity and to supply customers reliably with power.

## C. PURPOSES

Any alternatives proposed to meet the need must also achieve certain purposes:

- to provide the ability to supply power in the event of an outage of part of the existing system;
- to minimize environmental impacts, as directed by the National Environmental Policy Act (1969);

---

[2] For more detail on this concept and how it applies to the Northern Intertie, please see **Appendix A, POWER MARKETING**.

- to save energy by reducing ***energy losses*** on the existing system;
- to facilitate power sales and exchanges between Canada and the United States on the Canadian-U.S. Intertie;
- to aid BPA in meeting its contractual obligations to supply electric power to its customers by creating additional opportunities for BPA to acquire and exchange power resources and to market transmission services;
- to facilitate the storage in and return from Canada of energy generated by ***Water Budget releases*** and other releases from hydro storage projects in the Pacific Northwest;
- to minimize costs; and
- to achieve consistency with other National policies.[3]

## D. OTHER PROJECTS IN THE REGION

### 1. CO-GENERATION PROJECTS

Puget Power has acquired at least 760 MW of power from local co-generation planned at four locations in Skagit and Whatcom County. In order to integrate the additional generation, minor improvements must be made on the Puget Power 115-kV transmission system. These improvements are required regardless of the proposed joint project covered in this ***environmental impact statement (EIS)***. System studies carried out for this project have incorporated planned generation as an existing condition, in order to model the transmission system realistically. The studies show that the local wintertime reliability problem is reduced by the addition of the local generation; however, reliability problems during the spring/summer period are accentuated.

---

3 Consistency with applicable National policies includes conformance to Acts and regulations governing the following: noise; air and water quality; protection of archeological and historic resources and of endangered and threatened species of plants and animals; management and protection of floodplains and wetlands, National Trails System, and Wild and Scenic Rivers; contract compliance; use and disposal of insecticides, herbicides, fungicides, rodenticides, and toxic and hazardous wastes; rights-of-way on public land; discharges into waters; structures in navigable waters; resource conservation and recovery; energy conservation; consistency with intergovernmental plans and programs. Also applicable are regulations of the Council on Environmental Quality as developed from the National Environmental Policy Act. See **Consultation, Review, and Permit Requirements** (Chapter 4, Section E).

Local proposed co-generation is not covered in this EIS because:

- The combination of needs for the proposed joint project are not satisfied by the planned co-generation.
- The co-generation projects have progressed individually, at different rates and times. They have been planned independent of the proposed joint project. BPA has not been involved in approving, financing, or detailed planning for them. The projects proceeded regardless of the proposed joint project.
- Although co-generation is accounted for in the technical studies, it is not an interdependent part of a larger action or dependent on a larger action for its justification. The decisionmaking process has not involved BPA, and neither causes nor prevents the proposed joint project.

## 2. CANADIAN ENTITLEMENT EIS

The Columbia River Treaty between the U.S. and Canada, which was signed in the early 1960's, is an agreement to develop cooperatively the water resources of the Columbia River Basin for flood control and power. It involves the construction and operation of several dams which store water for later release and, thus, power production. Canada agreed to construct three storage dams on the Columbia River system in British Columbia and to allow the U.S. to build Libby Dam in northwestern Montana. Canada and the U.S. agreed to split equally the downstream power benefits of the additional water storage. Canada sold its share of the downstream power benefits (the "Canadian Entitlement") to the U.S. for 30 years from the completion of the dams. The first 30-year sale expires in 1998, at which time the U.S. must begin delivering the Entitlement (the downstream power benefits) to Canada. The Treaty specifies that the Entitlement be delivered to a point on the Canada-U.S. boundary near Oliver, B.C., unless an alternate point of delivery is agreed upon or a new sale is authorized.

In its role of supporting the U.S. Entity, BPA is preparing an EIS to assess the environmental impacts of a range of alternative ways to deliver the Canadian Entitlement. The components of these alternatives include delivering power to Oliver, B.C.; agreeing to deliver to points other than Oliver (such as Blaine); the construction of generating facilities in B.C.; or selling some of the Entitlement. Combinations of these components are likely to make up the alternatives considered.

In the event that delivery at Blaine is considered, it would increase the **South-North** transfer of power over the system in the Whatcom County area. The needs for proposing improvements as described in this EIS are separate from those of the Canadian Entitlement. Therefore, Canadian Entitlement is not evaluated in this EIS, and impacts associated with Canadian Entitlement are addressed in a separate BPA EIS.

## 3. SYSTEM OPERATION REVIEW EIS INTERIM FLOW SUPPLEMENTAL EIS

Two environmental reviews regarding power and other uses of the Columbia and Snake Rivers are underway/just completed. These EIS's--the System Operation Review (SOR) and the Interim Columbia and Snake Rivers Flow Improvement Measures for Salmon Supplemental EIS (Interim Flow SEIS)--address the operation of Federal hydro projects on the Columbia and Snake rivers to balance the operation of the projects among river users.

The Interim Flow SEIS has been completed and the SOR EIS is now being prepared. The SOR process, which involves BPA, the U.S Army Corps of Engineers, and the Bureau of Reclamation as cooperating agencies, will provide long-term system operation guidelines that will consider the needs of all river users. The Interim Flow SEIS addresses near-term Federal hydro operations in response to the listings of certain salmon runs as threatened or endangered species under the Endangered Species Act, pending the development of longer-term plans of action.

Operation of Federal hydro resources in relation to the use of the Bellingham upgrade will not deviate from the constraints to be established by the SOR or from interim operations established in the Interim Flow SEIS.

## E. DECISIONS TO BE MADE

**The Bonneville Power Administration is to decide:**

- Whether or not to build this project.

If BPA should decide to build this project, the following decisions would also need to be made:

- Which design options to choose for the proposed transmission facilities;
- Which routing to select;
- Whether to share added transfer capability on the existing Intertie with Puget Power.

**Whatcom County is to decide:**

- Whether or not to grant Puget Power a conditional use permit in order to build new transmission facilities in Whatcom County.

**The Washington State Energy Facility Siting Evaluation Council is to decide:**

- Whether the environmental impact statement achieves substantive compliance with the provisions of the State's energy facility siting code (Title 463, Washington Administrative Code).

## F. SCOPING AND MAJOR ISSUES

Federal and State of Washington agencies must include a ***scoping*** process as part of their environmental impact study for a project (CEQ Regulations 40 CFR 1501.7 and WAC 197-11-408). This means finding out the nature and range of the issues of concern from the public and from other agencies. By doing so, the project and its alternatives can be better defined. The agency can also plan better for different ways and times to involve the public in its study and decisionmaking.

Issues were being identified before the formal public process for this project began. In 1989, Puget Power proposed a project with two 230-kV lines forming a new corridor to the Canadian border. This proposal required that the utility apply for a Presidential Permit from the Department of Energy Office of Fuels Program. (See **Alternatives Eliminated from Detailed Consideration,** in **Chapter 2.**) In 1990, people in Whatcom County passed an initiative that limited the granting of conditional use permits for transmission lines greater than

115-kV, and emphasized the use of existing corridors. This initiative helped to shape this project into the current proposal using BPA's existing corridor.

For the current project, scoping meetings were held in Sedro Woolley (February 5, 1992) and Bellingham (February 6, 1992), and comments on the proposal were taken. Comments received during the scoping period were used by environmental specialists in their impact analysis. Some comments (such as those referring to BPA's maintenance practices) were outside the scope of this proposal and EIS; they were referred to the responsible offices for attention. Major issues within the scope of this project are listed in the box below. The public involvement process is discussed in greater detail in **Appendix B: PUBLIC INVOLVEMEN.**

**MAJOR ISSUES**

**Potential Soil Erosion**
**Electric and Magnetic Field Effects/Public Health**
**Property Values**
**Noise from Lines and Substations**
**Land Use/Management**

Many other issues were raised during the scoping period. These ranged from impacts on wildlife to the visual aspects of the project. These issues, and others, are discussed under each resource in **Chapter 4, Environmental Consequences**. Some issues, such as impacts on fish, are actually related to one of the major "umbrella" issues above. For instance, potential soil erosion may affect many other aspects of the environment, such as vegetation, fish, water quality, and wetlands.

## G. DOCUMENT STRUCTURE

BPA has prepared this EIS for a joint BPA/Puget Power project. Puget Power's proposed activities in Whatcom County require a permit. That permit process triggers the State of Washington environmental process. This document is intended to satisfy both Federal and State environmental requirements.

Puget Power has submitted information to BPA about the design and environmental aspects of their potential construction. In order to simplify review of this document, discussions associated solely with Puget Power's portion of the project have been kept separate from BPA's portion. For example, the affected environment for Puget Power's portion of the project follows the BPA affected environment discussion in **Chapter 3, Affected Environment.**

# CHAPTER 2
# ALTERNATIVES INCLUDING THE PROPOSED ACTION

## A. INTRODUCTION

This chapter is the heart of the EIS. It provides the reader with a close comparison of the ***alternatives***, so that he or she may readily see the advantages and disadvantages of each and the kinds of ***mitigation measures*** which would lessen their impacts.

The major alternatives include a Construction Action alternative and No Action (deciding not to take any additional action at this time). Within the Construction Action alternative, there are additional options or choices to be made on design and location for both BPA's and Puget Power's part of the project. The chapter also discusses other alternatives (such as Conservation) which have been suggested but eliminated from detailed discussion.

**THE PROPOSED ACTION**

**BPA proposes to undertake the Construction Action alternative. Within that alternative are choices as to route and design. At this time, there is no designation of an environmentally preferred design. All reasonable choices are described in detail in the following sections. In addition, as its preferred alternative, BPA proposes to share access to increased Intertie capacity with Puget Power.**

**ALTERNATIVES TO THE PROPOSED ACTION**

**Discussed in Detail**

- No Action

**Considered and Eliminated From Detailed Discussion**

- Puget Power's Original Proposed 230-kV Intertie with B.C. Hydro
- B2A Plan
- E4A Plan
- Conservation

## B. EVALUATING ALTERNATIVES

Before comparing the alternatives, it is useful to know something about how a project develops, and what might be involved in construction actions.

### 1. DEVELOPMENT OF A PROJECT

An electric power supply support project is developed in several stages.

- First, the need is identified, usually by a combination of load forecasts and actual problems experienced on one or more parts of the transmission system.

- System planners develop potential solutions to address the need.

- Engineers and environmental specialists identify possible places to locate and/or rebuild any transmission facilities proposed as part of the solution.

- A project team seeks ideas and information from landowners, concerned citizens, and government bodies in the project area in order to define the scope of an environmental study on the project and to define the issues. (Public involvement extends throughout the life of the project.)

- A team of specialists representing a variety of disciplines researches what is known about each resource in the study area, checks on field conditions, and participates in a comprehensive evaluation of impacts to determine, if possible, environmentally preferred design options and location choices. The specialists identify mitigation measures to lessen or avoid impacts. They consider all public ideas and comments in the course of their evaluation.

- A draft environmental impact statement is published, detailing their findings. It is circulated for public review and comment, then revised into a final EIS.

- A Record of Decision documents the final decision.

- The selected action is taken.

## 2. TAKING ACTION (CONSTRUCTION)

One alternative (No Action) would not involve construction of new transmission facilities. However, the proposed alternative (and three of the alternatives eliminated from detailed discussion) would involve construction. Below is a brief summary of what this means. More detail on construction actions is found at the beginning of **Chapter 4, Environmental Consequences.**

When transmission facilities are built, the many construction activities may have both positive and negative effects on the environment. For instance, clearing in a forested area would remove some trees, but the opening might provide more forage for some wildlife.

A specific sequence of actions occurs: one for removing an existing line; another for rebuilding or replacing facilities on existing ***right-of-way***; a third for building on a new right-of-way (which might occur on a short section north of Sedro Woolley). These are outlined below, to help the reader review the comparison of alternatives, which follows.

- **For taking down (removing) a line:**
  Vehicles are used to reach the existing structures, which are removed, except for below-ground braces and footings. Wood pole components are removed; ***conductors*** (wires) are rewound or cut up and removed. Parts are scrapped or salvaged for reuse. In areas with difficult accessibility, untreated wood parts may be cut up and left to decay at the site.

- **For rebuilding/replacing on existing right-of-way:**
  Existing ***easements*** are reviewed to determine whether they are adequate; additional rights are acquired, as needed; existing ***access roads*** are assessed and upgraded, if necessary; areas are cleared to store and assemble components for the facility; old structures are taken down and parts disposed of or recycled, if possible; new structures to carry the conductors are erected; the wires themselves are strung; and site restoration is undertaken.

- **For building on new right-of-way:**
  Right-of-way and access road easements are acquired, if needed; new access roads are built and/or existing access roads evaluated and upgraded (if needed); areas are cleared

to store and assemble components for the facility; new or additional right-of-way is cleared; structures to carry the conductors are erected; the wires themselves are strung; and site restoration is undertaken.

## C. DESCRIPTION AND COMPARISON OF ALTERNATIVES, INCLUDING THE PROPOSAL

There are several decisions which must be made. The primary decision is whether to proceed with the proposal. Within the proposal, decisions need to be made on Intertie use; on transmission design; and on transmission line locations. See Figure 3 for a schematic of those decisions.

### 1. NO ACTION

The No Action alternative would mean no construction occurring at this time. Therefore, there would be no construction impacts on the environment. The BPA corridor would remain as it is, and Puget Power would not construct or upgrade any of the proposed lines. The demand for power in the area would still increase as projected, so the present system would be further pushed against its limits. The loss of power from operation of the lines (***line losses***) would tend to increase. Intertie transfer capability would not be increased from present ratings, and more power could not be imported from Canada. The No Action alternative would not meet the needs for the proposed project.

**POWER SUPPLY**

Overloading of the local system would remain a threat. The local system would still be unable to handle a single-contingency outage without overloads. As winter demand for power in the local area increases over time, additional stress would be placed on the 115/230-kV transmission system; increased outages and repair times could occur.

Examples of a single-contingency or emergency outage of one part of the system are:

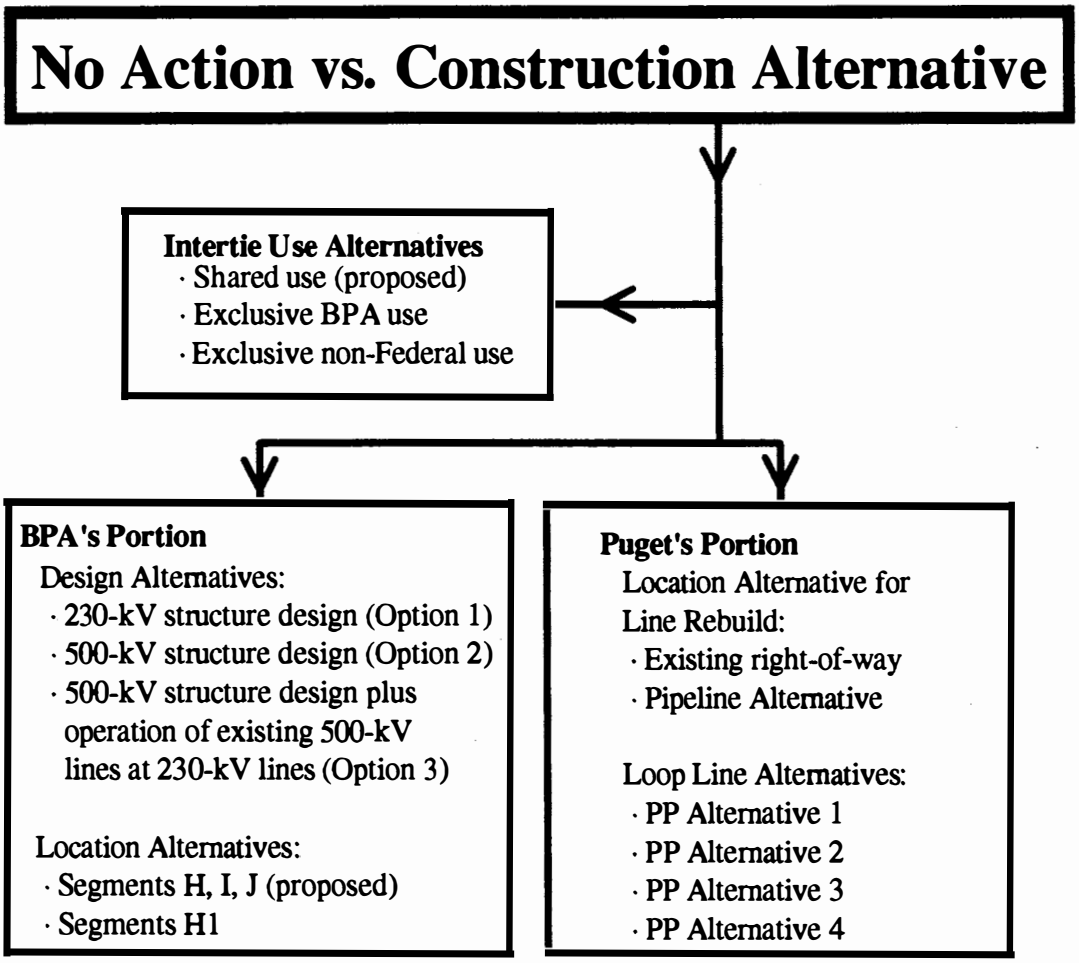



**FIGURE 3**
**SCHEMATIC OF ALTERNATIVES**

- **Outage of BPA's Custer-Bellingham 230-kV line.** This would cause the transformer at Puget Power's Portal Way Substation to overload. Puget Power's ability to provide reliable service to its customers would be jeopardized.
- **Failure of the transformer at Puget Power's Portal Way Substation.** This would overload BPA's Custer-Bellingham line. Overloading of a line can cause the conductor to heat, expand and sag below NESC line-to-ground clearance requirements, creating safety hazards. BPA's ability to provide service to Puget Power would be jeopardized if this were to occur.

The ability to transfer power in, out, and through the area would remain restricted.

Furthermore, Puget Power's local co-generation projects would alleviate this situation only in some cases, and would aggravate it in others. Co-generation will help to supply power during the peak demand time (winter) in the Bellingham area. However, an outage on the 115/230-kV system would still impede transfer capability into the area from the Intertie, and the co-generation would actually accentuate the system's inadequacy to transfer power out of the area. There could also be power outages if the local co-generation were *not* on line.

Further, if an outage were to occur in the summer when local loads are low, some of the local co-generation might have to be dropped (shut off) in order to avoid overloading the system. This power could then not easily be marketed to areas that need it. The added co-generation bottleneck on the local system would limit the Intertie in transferring power from Canada. Since BPA uses the Intertie to exchange power with Canada, and to provide power to areas of the western United States, not being able to have power flow smoothly through this area would also affect BPA's ability to enter into other power supply agreements.

Conservation also would both alleviate and aggravate the situation. With the No Action alternative, more conservation might be emphasized in the Bellingham area. This could help the high winter demand. However, with the added co-generation, reducing the local loads would actually contribute to the bottleneck problems that could occur during periods of high local generation and north-south power transfers from Canada.

Finally, the No Action alternative would create no change in current Northern Intertie use. BPA's ability to store and receive energy from the Canadian system would continue to be limited by existing capacity. If replacement energy were generated by combustion turbines and co-generation facilities, air and water quality impacts could increase. The No Action

alternative would preclude the use of Canadian resources to supply increasing Pacific Northwest needs for power, requiring utilities in the study area to obtain power from suppliers within the Pacific Northwest or in regions other than Canada. Replacement energy would have accompanying air and water quality impacts.

In addition, Puget Power would not gain increased access to Canadian power over the west-side Northern Intertie. Puget Power might then decide to reopen its application for a Presidential permit to construct a transmission line to the Canadian border. (See **Alternatives Eliminated from Detailed Consideration**.) Any such action would be covered by a separate environmental document and separate decision-making process.

## ENVIRONMENT AND COST

With the No Action alternative, the environmental impacts associated with the development of this proposal would not occur. BPA's 61-km (38-mi.)[4] transmission line would not be rebuilt and the substations would not be modified. Capital expenditures, materials, labor, and other resources would not be committed to this project. Short- and long-term impacts associated with the line, substation modifications, and access road upgrades would not occur. Comparable impacts from the Puget Power part of the project would also not occur.

Effects from the project on land use, social, economic, and cultural values would not occur.[5] Short-term construction disruption of land uses would not occur. Agricultural lands would continue to function as at present; wood towers would not be removed or steel towers built. The appearance of the corridor would not be altered. No disturbance of historic or archeological resources would occur. No jobs would be created by the project; no local expenditures from the project would be made.

Impacts would, however, occur from the daily use of the existing system. The local system would continue to have a danger of overloading, possibly causing blackouts in the Whatcom/Skagit County area. Voltage fluctuations would add costs to the communities affected. If the voltage were to drop, affected electrical equipment can be damaged. If a blackout were to result from an overload, light and heat would have to be supplied by other means. Hospitals and other emergency facilities would have to fall back on emergency fuel

---

[4] BPA is using metric measurements to comply with Public Law 100-418.

[5] A more detailed look at these impacts is found in Section C.3.

and generator supplies to keep minimal services supplied. Alarm and communication systems would not work. Traffic lights would not function. More money might need to be allocated to pay for fire, police, and other personnel responsible for safety in blackout conditions.

## 2. THE PROPOSED PLAN

The proposed joint plan would improve the reliability of the local system and therefore would increase the Intertie's ability to transfer power from Canada to the U.S. by about 850 MW (from 2000 MW now to 2850 MW RTC). The proposal would require additions/ improvements to both BPA and Puget Power facilities; therefore BPA proposes to share the increase in north-south transfer capability (about 425 MW each).

In Canada, B.C. Hydro would improve its transmission system in stages to facilitate increased transfers of power produced in Canada. Accordingly, BPA and B.C. Hydro have proposed to increase the transfer capability of the west-side Northern Intertie beginning October 1996. Improvements would be made when specific power transfer agreements were proposed.

The following sections describe the proposed action(s), then describe and compare impacts for each of the several alternatives. **Intertie use alternatives are covered first; then BPA's part of the project, followed by Puget Power's part.**

### INTERTIE USE ALTERNATIVES

#### Description

This section addresses three marketing alternatives. The proposed alternative is Alternative 1, which provides for sharing the increase in transmission capability between BPA and Puget Power.

1. **Alternative 1: Sharing use of increased transfer capability with Puget Power (Proposed).** Technical studies show that both BPA and Puget Power need to make transmission system improvements in order to maintain a reliable system in the local area. Both would share the cost of making the improvements. Therefore, it is proposed that BPA and Puget Power share in the resulting increased transfer capability. Under this alternative, each party would individually be able to enter into

power exchange agreements (a combination of firm and ***non-firm*** power) up to an individual maximum of about 425 MW allocated transfer capability. The total 850 MW increase is only an estimate; the proposal is, in any case, to share in the actual increase.

2. **Alternative 2: Reserve increase for BPA use.** This alternative would reserve the entire estimated 850 MW increase of transfer capability exclusively for BPA use.

3. **Alternative 3: Reserve increase for non-Federal use.** This alternative would reserve the entire increase for unconditional use by non-Federal users.

**Comparison**

All three alternatives make use of BPA's "single utility planning" approach when planning transmission system improvements. (BPA approaches planning as though all Pacific Northwest needs were to be met by a single entity, not by separate business concerns making separate decisions.) Under single utility planning, reliability and cost efficiencies can be realized without duplicating transmission facilities.

In order to provide the necessary system reliability, the total cost and extent of transmission developments under Alternatives 2 and 3 would be greater than those under the proposed plan. The second or third alternatives would probably mean that BPA and Puget Power would individually make improvements on their systems (duplicating facilities and increasing overall associated cost).

**Discussion**

Selection of an option must be made in the context of prospects for future use of the Northern Intertie transmission. Existing obligations for firm power, together with transfers of non-firm power, load the Intertie to its capacity on peak hours in most months. BPA's contracts with Seattle City Light and Portland General Electric guarantee those utilities first and second priority, respectively, over all other Northern Intertie schedules. Transactions with lower-priority users include non-Federal non-firm sales, Federal purchases, and storage.

To date, BPA has not needed to prioritize the Intertie capacity among competing users. However, increasing demand may compel BPA to make decisions regarding priority for Northern Intertie capacity.

In addition, the capability of the west-side Northern Intertie is affected by interconnected facilities in Canada. When the proposed system improvements under the BPA/B.C. Hydro agreements are completed, the RTC would increase to 2850 MW north-to-south, and the SCR would be gradually increased by 200 MW for 5 years for *short-term* firm transactions. B.C. Hydro would also reinforce its system to increase the SCR for any *long-term* firm transactions. The B.C. Hydro upgrades correspond to the proposed BPA/Puget Power Northern Intertie upgrades in the Bellingham area.

Increasing the transfer capability of the west-side Northern Intertie would enhance opportunities for taking advantage of seasonal diversity along the West Coast, by making it possible to use hydro generation in Canada for loads elsewhere. More opportunities would be created for Northwest hydro generation to help meet summer peaks in the Southwest, and for Southwest generation to supply energy to the Northwest in winter and at times when surplus Southwest power is available.

A number of short-term non-Federal transactions are occurring between Canada and the Pacific Northwest and Pacific Southwest for capacity or energy as a result of an Interconnection and Exchange Agreement between BPA and B.C. Hydro and British Columbia Power Exchange Corporation (POWEREX). Similar transactions are expected to continue in the future. British Columbia (BC) has recently approved a policy for long term exports that could increase BC/U.S. long-term transactions.

As hydro operations become more constrained, BPA would prefer to use the Northern Intertie more for additional two-way storage that could provide greater coordination between the Pacific Northwest and B.C. power systems. The potential return of the Canadian Entitlement (see **Other Projects in the Area**) might cause increased firm power use of the Intertie. In addition to the Seattle City Light transfer, potential future long-term firm north-to-south transactions could include 130 to 180 MW for Sacramento Municipal Utility District, and 200 MW for The Washington Water Power Company; other requests are also likely to emerge as marketing policies in the U.S. and Canadian export policies become clear. Increased firm use of the west-side Northern Intertie for the transactions proposed above could limit the opportunity to continue the existing peak non-firm transfers over the Intertie.

Finally, the alternatives could differ in how the costs of financing, operating, maintaining, and replacing the transmission facilities are recovered. Each alternative assumes that BPA owns a given set of the proposed facilities. These costs would then be included when BPA calculates the rates it must charge its customers. If only BPA owns the new incremental capacity (Alternative 2), the costs would be recovered in BPA's rates from transmission system users. If, however, arrangements are made for a non-Federal entity, such as Puget Power, to own some or all of the capacity (Alternatives 1 and 3), the new owner would pay a portion of the facility costs. BPA would then reflect this contribution in the rate development process to avoid double-counting of costs, and thus, overcollecting.

## BPA'S PART OF THE PROJECT: PHYSICAL ALTERNATIVES

The information in this section is based on the discussion of impacts (**Chapter 4**), with a focus on issues and differences between alternatives in comparative form. Impacts for each design alternative are characterized by intensity, magnitude, and duration, where possible. For subjects/issues not identified as "major," there is only minimal discussion in this section; more detail is available in **Chapter 4, Environmental Consequences.** Impacts are also compared in matrix form, at the end of this section (Tables 2 and 3 ). BPA's physical alternatives fall into two sets: **design alternatives** and **location alternatives.** Design differences associated with the location alternative (**SEGMENT H1** vs. **SEGMENTS H, I, J**) are described under that alternative.[6]

Major issues identified in scoping that pertain to the selection of options are listed below (not in order of importance):

- Noise from Lines and Substations
- Land Use/Management
- Property Values
- Potential Soil Erosion
- Public Health/Electric and Magnetic Fields

[6] In order to focus the discussions of impacts and calculate magnetic fields, the BPA corridor from Custer to Sedro Woolley was divided into "segments," each segment having a different arrangement of transmission lines. The discussions group these segments, where possible, to simplify explanation. Segments are shown on Figure 4, and are described in Table 1.

**Table 1. BPA Corridor Segments**

| SEGMENT | ENDING TOWER # ON MONROE-CUSTER # 2[a] | LANDMARK |
|---|---|---|
| A | 87/1 | Intersects main corridor after crossing I-5 |
| B | 77/1 | Between Kelly and Kline Rds |
| C | 75/1 | BPA's Bellingham Substation at Dewey Rd. |
| D | 73/5 | At Britton Rd. & Emerald Lake Way |
| E | 66/3 | East of Lake Whatcom |
| F | 65/1 | East of Lake Whatcom |
| G | 60/2 | Just north of County line |
| H | 58/2 | Highway 9 crosses under lines |
| H1 | [rejoins at 56/4] | [Leaves main corridor at 60/2] |
| I | 57/4 | Just south of Samish River |
| J | 56/4 | Near Upper Samish Rd |
| K | 54/4 | Near Fruitdale Rd |
| L | 51/2 | Southwest of Northern State Hospital |
| M | 50/1 | South of Minkler Rd |
| N | 49/3 | At Puget Power's Sedro Woolley Substation |

a BPA's portion of the project has been divided up into segments. They start at the BPA Custer Substation and continue to the Puget Power Sedro Woolley Substation. The Monroe-Custer # 2 500-kV line was used to reference tower numbers, since it is the constant through the main corridor. (Monroe-Custer #.1 creates the **H1** route.) The segments were identified to mark places where transmission lines arrangement in the corridor changes. Some landmarks have been provided above to help the reader locate these transition points.

Under the construction alternative, BPA is proposing to rebuild its existing ***single-circuit***, wood-pole ***H-frame*** 230-kV transmission line between its Custer Substation and Puget Power's Sedro Woolley Substation (about 61 km or 38 mi.) in 1996. This would involve removing the existing poles, wires, and ***insulators*** and replacing them with equipment for a ***double-circuit, lattice-steel*** line. (See Figure 4.)

The new line would be built at 230 kV or 500 kV, depending on which of three design options were chosen (see **BPA Design Options**).

- If Option 1 (230-kV design option) were selected, the towers would be about 37 m (122 ft.) high; if Options 2 or 3 (500-kV options) were chosen, the towers would be about 54 m (177 ft.) high.

- The conductor (wires) for the line would be twin conductors for Option 1 or ***bundle*** conductors (3 per phase) for Options 2 or 3; each bundle would be about 50 cm (20 in.) in diameter.
- The new steel structures would be located next to the existing adjacent 500-kV steel structures of the Northern Intertie as much as possible, and would have about the same spans as existing lines (about 350 m or 1150 ft.).
- Existing access roads in the mountainous parts of the project would be used; however, short new spur roads might be needed (also see **Chapter 4, Section B: Description of Construction Actions**).

The BPA Bellingham Substation yard would be expanded to allow ***terminal*** positions for the added BPA 230-kV circuit and three new line connections (see **Puget Power's Part of the Project**). This would involve adding about 0.6 hectares (ha) (1.5 acres) of substation yard between the existing substation and an adjacent ***capacitor yard*** on BPA property. A new 230/115 kV transformer would be added. (See Figure 5.)

**BPA Design Options**

**Description.** Three options have been identified for design.

1. **<u>BPA Option 1</u>: 230-kV Structure Design.** The existing 230-kV wood-pole H-frame structures would be removed and replaced with 230-kV double-circuit lattice-steel structures (see Figure 6).

   Except for the short **SEGMENT A**, the existing 230-kV line lies between two BPA 500-kV lines (the Northern Intertie) between BPA's Custer and Bellingham Substations. The new 230-kV double-circuit line would be placed on the same alignment as the existing 230-kV line. The new structures would be about 37 m (122 ft.) tall; this is about as tall as the existing adjacent 500-kV structures or about 16 m (52 ft.) taller than the existing H-frame structures (Figure 6). The new line would have longer spans (about 350 m or 1150 ft.) than the one it replaces, and the new structures would mostly be located next to the existing 500-kV structures. Along **SEGMENTS A - D**, existing access rights along the right-of-way would be used; these do not involve an established system of roads. No new permanent road construction would be needed.

# BPA/Puget Power NW Washington Transmission Project

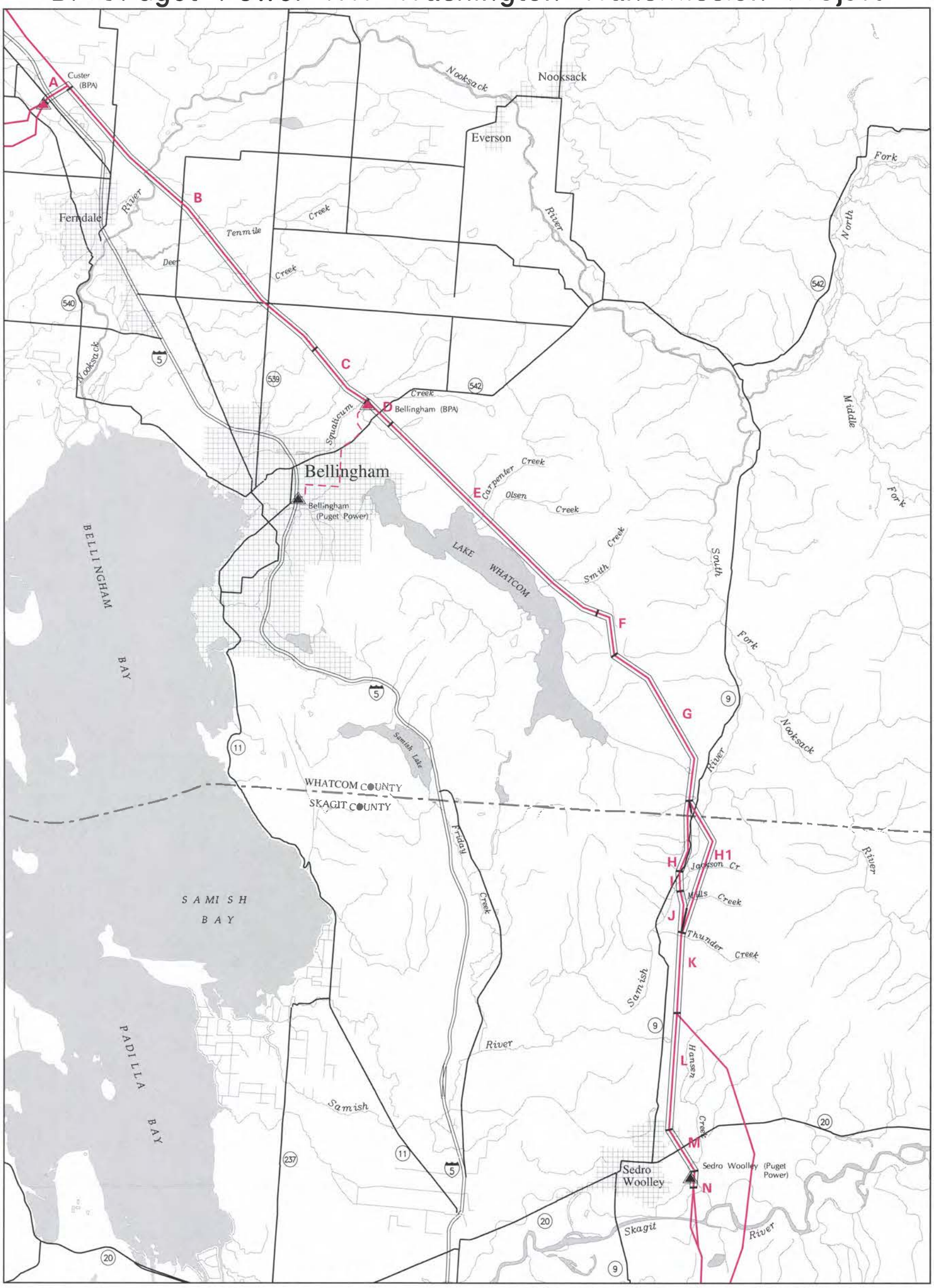



FIGURE 4 **PROJECT AREA and CORRIDOR SEGMENTS**

## LEGEND

- BPA Transmission Line
- Puget Power Trans. Line
- BPA Substation
- Puget Power Substation
- Interstate Route
- State Route
- G Corridor Segment

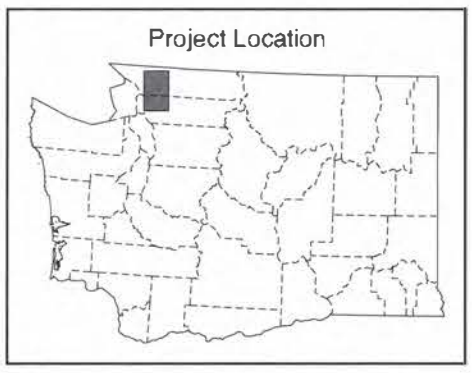
N W E S

Scale 1:173,500

0 1 2 3 4 5 6 MILES

0 1 2 3 4 5 10 KILOMETERS

Project Location



BPA Division of Facilities Engineering

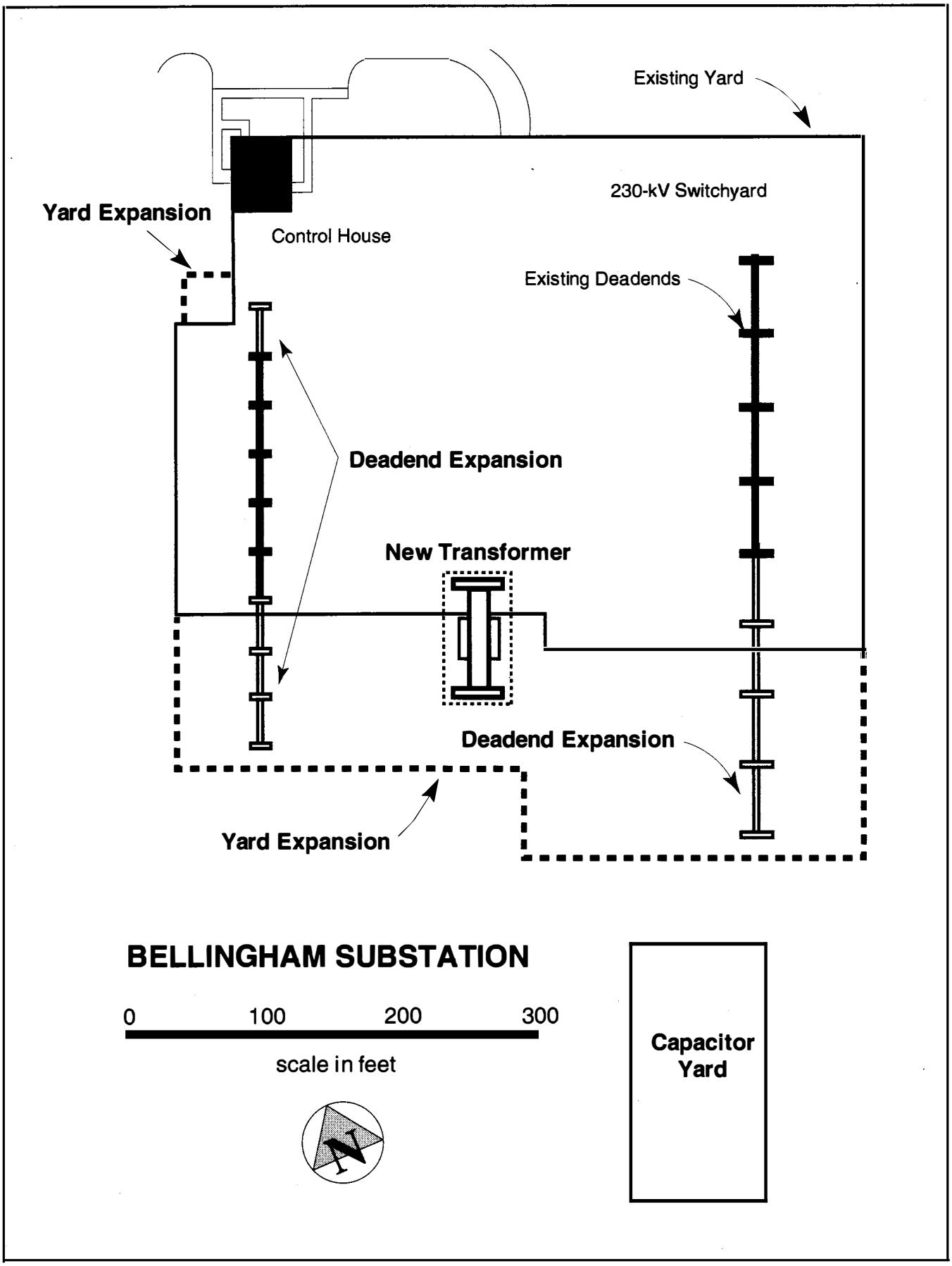
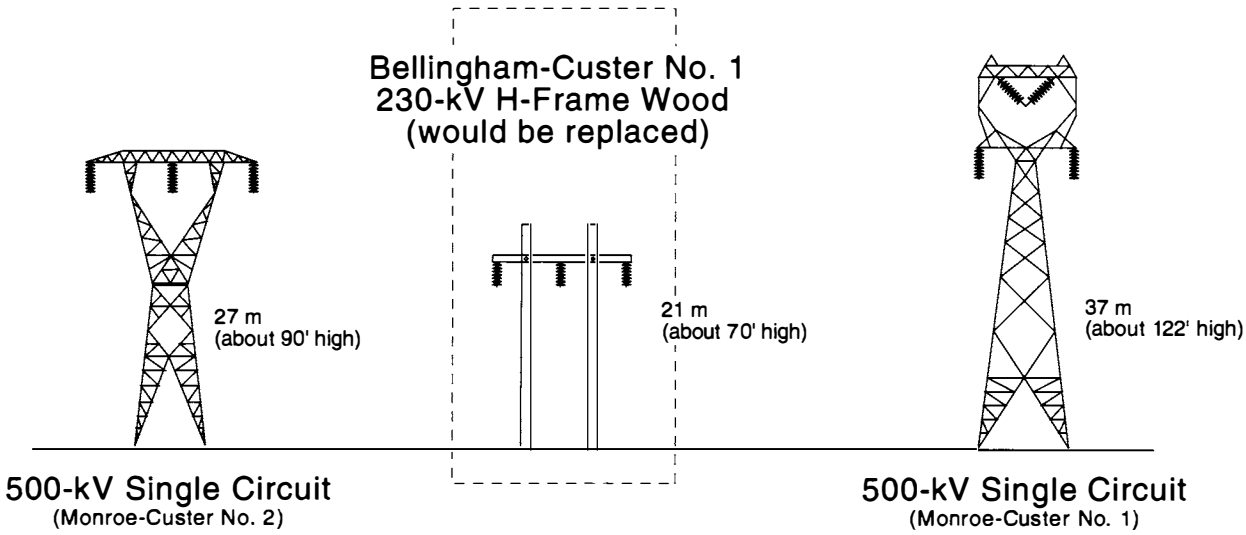
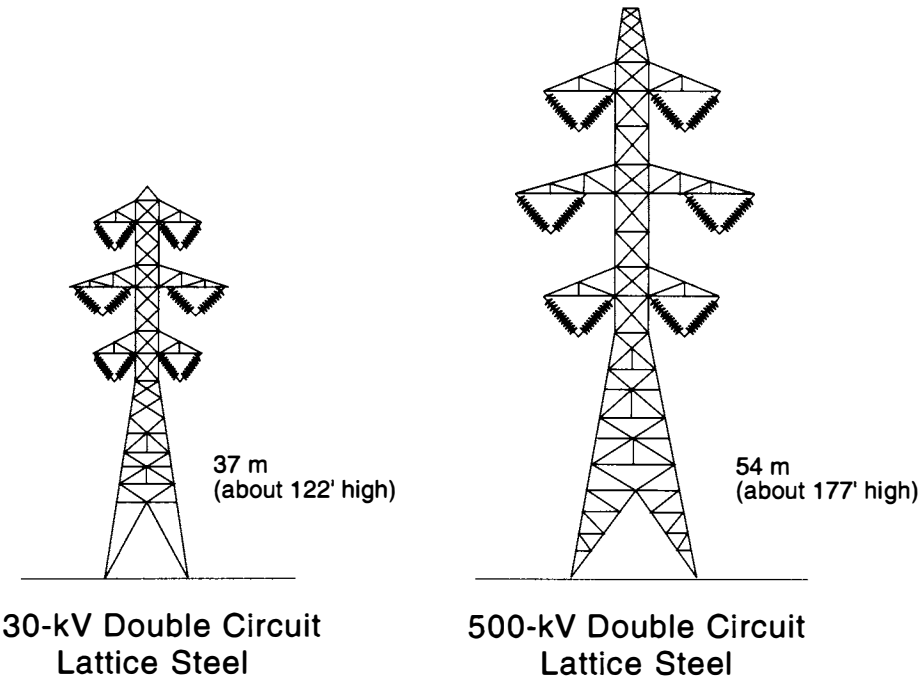



***Figure 5***
***BPA Bellingham Substation Expansion***




## *Existing Custer-Bellingham Corridor*

***Typical Example***




## *Potential Replacement Structures*

BPA/PUGET POWER NW WASHINGTON TRANSMISSION PROJECT

***Figure 6***

***Possible Structure Types for Options 1, 2, & 3***

Between BPA's Bellingham Substation and Puget Power's Sedro Woolley Substation (**SEGMENTS D-N**), the H-frame line to be replaced lies either on the edge of the right-of-way or between the 500-kV lines, depending on the segment (see Figure 4). Access for this section would be through existing access rights or by permanent access roads in the mountainous areas; the situation varies from segment to segment. In areas where there is an established access road system, new road construction would be limited to short spurs to new structure sites, and to places where they are needed for stringing/tensioning equipment.

2. **BPA Option 2: 500-kV Structure Design, with Operation at 230 kV.** This alternative, like Option 1, would also replace the existing wood-pole 230-kV line. However, the new structures would use 500-kV double-circuit lattice structures. The new structures would be about 54 m (177 ft.) tall; this is about 17 m (55 ft.) taller than the taller of the structures on the two existing 500-kV lines in the right-of-way (see Figure 6). As with BPA Option 1, the new structures would mostly be placed next to the existing structures. Access would be provided as with Option 1.

   Although built as 500-kV, the new line would still be operated at 230 kV. No additional 500-kV transformers are needed as part of this project. This alternative would allow BPA to convert the line to 500-kV operation sometime in the future without having to build/rebuild another transmission line. **(If this action were taken, additional 500-kV transformers would be needed at the substations. BPA would prepare a separate environmental document before this would occur.)**

3. **BPA Option 3: Construct as in BPA Option 2, with Operation of the *Rebuilt* Line at 500 kV and of the *Existing* 500-kV lines at 230 kV.** This option is physically very similar to BPA Option 2, but would be operated differently. Instead of operating the new 500-kV double-circuit line at 230 kV, it would be operated at 500 kV. However, the two *existing* 500-kV lines would be operated at 230 kV. No additional 500-kV transformation would be included. This option would also have a few more structures near three substations (Custer, BPA Bellingham, and Sedro Woolley) as well as at a location about 8 km (5 mi.) north of Sedro Woolley.

**Comparison.** The three design options are compared below under the five major issue categories. (Note that design differences associated with the location alternative **H1** are

discussed under the location alternative.) A comparison of BPA alternatives is also shown in Tables 2 and 3 at the end of this section.

1. **Noise from Lines and Substations.** Noise impacts result from construction activities and from the operation of transmission and substation facilities. Construction noise is short-term and typically does not result in serious disturbances for residents. All three design options would be designed to operate individually at or below the existing State of Washington noise standard of 50 dBA at night.

   Under BPA Options 1 and 2, the current noise levels associated with the existing 500-kV Monroe-Custer #2 line would not change and would continue not to meet present noise standards.

   Under BPA Option 3, the Monroe-Custer #2 line would be operated at 230 kV instead of at 500 kV. The current noise levels on this line would therefore be reduced, altering the noise levels at the edge of the right-of-way so that they would be within the State noise standards.

2. **Land Use/Management.** Except for SEGMENT **H1**, all design alternatives use the existing right-of-way for its entire length, land which has already been committed for this use. Land next to the right-of-way has been designated by local governments and developed in conjunction with the right-of-way. Land use impacts are discussed in **Chapter 4**, under sections on **Agriculture, Vegetation, Visual/Recreation, Noise/Radio-TV Interference, Public Health and Safety**, and **Social and Economic Considerations.**. SEGMENT **H1** is discussed under location alternatives. There are no differences among the three options.

3. **Social and Economic Considerations**

   SEGMENTS A - E. Economic impacts on agriculture across these segments would be low, direct, and both short- and long-term. Construction of the transmission line would cause short-term impacts such as possible soil compaction, damage to existing crops, and proliferation of noxious weeds following construction activities. All of these impacts would be mitigated (see **Section 3, Mitigation**, in this chapter).

   Long-term impacts are those related to the permanent removal of agricultural lands from production beneath tower bases. This impact would, however, be offset by the

removal of the more numerous 230-kV, H-frame wood poles from the existing right-of-way. The double-circuit steel structures would individually occupy more room than the H-frame wood poles, but there are more H-frame wood-pole structures per mile than there would be steel structures (8 vs. 4.5).

Since the amount of Prime farmland that would be permanently lost to production is not considered to be significant (less than 0.4 ha or 1 ac.), this impact would also be low. BPA Option 1 would remove 0.15 ha (0.38 ac.) of Prime farmland permanently from production; BPA Options 2 or 3 about 0.3 ha (0.72 ac.).

Social impacts are expected to range from low to high across these segments. Impacts are related to the number of residences within 152 m (500 ft.) of the transmission line and to concern expressed over the perceived loss in property values as a result of the construction and operation of the higher-voltage transmission line. Impacts on **SEGMENTS A AND D** are expected to be low, direct, and long-term. Impacts on **SEGMENTS B AND C** are expected to be moderate, direct, and long-term. Impacts on **SEGMENT E** near Agate Bay are anticipated to be considerable, direct, and long-term, due in part to public concern over property values, as expressed at scoping meetings. Other than improved noise levels for BPA Option 3 (see above), there would be no appreciable difference in degree of impact among the three design options.

SEGMENTS **F - J**. Economic impacts on agriculture would be low, direct, and both short- and long-term across **SEGMENTS I AND J**. The short-term impacts would be the same as those described above. The long-term impacts would remove very little agricultural land from production: 0.01 ha (0.03 ac.) of Prime farmland for BPA Option 1, and 0.02 ha (0.04 ac.) for BPA Options 2 or 3. No agricultural land is crossed by **SEGMENTS F, G, AND H**. No appreciable difference would exist among the options.

Social impacts are expected to range from low to moderate and would be direct and long-term, caused by the physical presence of the line. Other than improved noise levels for BPA Option 3 (see above), there would be no appreciable differences among the options.

SEGMENTS **K - N**. Economic impacts on agriculture would be low, direct, and both short- and long-term across **SEGMENTS K THROUGH N**. The short-term impacts

would be the same as those described above. The long-term impacts would remove very little agricultural land from production: 0.03 ha (0.08 ac.) of Prime farmland for BPA Option 1, and 0.06 ha (0.14 ac.) of Prime farmland for BPA Options 2 or 3.

Social impacts are expected to be moderate, direct and long-term; they would be caused by the construction and operation of the transmission line over the life of the line. Other than improved noise levels for BPA Option 3 (see above), there would be no appreciable differences among the three design options.

4. **Geology/Soils.**

SEGMENTS A-J. Moderate, short-term impacts would occur from soil surface disturbance in erosion-prone areas and from impaired soil productivity. There would be no notable difference in impacts among BPA Options 1, 2, and 3; sensitive areas would occur in **SEGMENTS B, C, D, E, F, G, AND H.**

- **SEGMENT B:** Nooksack River, Tenmile Creek, Deer Creek crossings;
- **SEGMENT C:** tributary to Squalicum Creek crossed near Van Wyck Road;
- **SEGMENT D:** Squalicum Creek area;
- **SEGMENT E:** Toad Lake outlet, east slope of Squalicum Mountain, Smith Creek crossing, steep slopes above Lake Whatcom on Stewart Mountain, and Carpenter Creek crossing.
- **SEGMENT F:** steep erosive soils on divide of upper Smith Creek basin;
- **SEGMENT G:** blown culverts, deeply rutted access roads north of Mirror Lake; and
- **SEGMENT H:** all creek crossings and slopes above Highway 9.

SEGMENTS K-N. Low, short-term impacts would be associated with a slight increase in erosion and associated temporary sedimentation.

5. **Health and Safety (Focus on EMF).** Because the state of scientific evidence relating to EMF has not yet established a cause-and-effect relationship between electric or magnetic fields and adverse health effects, specific health risks or specific potential level of disease cannot be predicted in relation to EMF exposure.

However, exposure assessments of magnetic fields from transmission lines can be carried out in order to provide some comparison of alternatives. These are assess-

ments of the field levels of EMF to which people are potentially exposed. For this project, magnetic field calculations for all options were made for those homes and businesses along the transmission corridor that could experience increases in magnetic field levels (as compared to the No Action alternative).

The number of buildings expected to experience an increase in magnetic field levels[7] of more than 1 mG (based on estimated annual average loading information) are:

- BPA Option 1 = 49
- BPA Option 2 = 50
- BPA Option 3 = 3

**BPA Location Alternatives**

**Description.** As the existing right-of-way heads south of Bellingham, towards Sedro Woolley, two route locations are possible. (See Figure 4.)

1. **SEGMENTS H, I, J:** The proposed line (**SEGMENTS H, I, J**) would stay on the original existing route.

2. **SEGMENT H1:** The line could also take a dogleg east (**SEGMENT H1**). **SEGMENT H1** would involve constructing a new double-circuit line parallel to an existing 500-kV single-circuit line east of the **SEGMENT H-I-J** right-of-way. This alternative would involve acquiring about 34 m (112 ft.) of new right-of-way width along the west side of the existing 38-m (125-ft.) right-of-way; clearing about 34 ha (84 ac.) of trees; building new spur access roads to structure sites; and removing one or two homes where **SEGMENT H1** rejoins **SEGMENT J**.

**Replacing the existing line with BPA Design <u>Options 1, 2, or 3</u> is preferred over the H1 alternative.**

**Comparison.** Comparisons follow for the five major issues. A comparison for BPA alternatives is also presented in Tables 2 and 3 at the end of this section.

---

[7] Note: These are increases above levels expected with the existing system in the year 2000--the No Action alternative. (Also see Section 14 in **Chapter 4** and **Appendix C: HEALTH AND SAFETY.**

1. **Noise from Lines and Substations.** As noted above, under **BPA DESIGN OPTIONS**, audible noise from BPA Options 1 or 2 would be within State of Washington standards. Both new and old lines would be within State standards under BPA Option 3, as it would reduce audible noise on the existing 500-kV Custer - Monroe #2 line. Findings of the BPA location alternative comparison are as follows:

   SEGMENT H1 **(All BPA Design options)**. There would be no significant increase in audible noise. The new line would be within State noise standards.

   SEGMENTS H, I, J **(All BPA Design options)**. There would be no significant increase in audible noise. The new line would be within State noise standards. The use of BPA Option 3 would reduce total noise levels at the edge of the right-of-way.

2. **Land Use/Management.**

   SEGMENT H1. The new route would cross about 0.8 km (0.5 mi.) of rural residential land. About 1.4 ha (3.5 ac.) of such land would be permanently removed from rural residential use. In addition, about 2 ha (5 ac.) of rural residential land would be temporarily removed from use during construction. That is considerably less than 1 percent of Whatcom or Skagit County's supply of rural residential land. This reduction would make one parcel unbuildable. Impacts would be local, direct, but slight. There would be no difference among the three design options.

   SEGMENTS H, I, J **(preferred)**. For this portion of the project, the existing right-of-way would be used. This is land which has been committed for electrical transmission line right-of-way since the corridor was established in the 1940's. Any land use impacts on the existing right-of-way or adjacent property would be those discussed in **Chapter 4** sections on **Agriculture, Vegetation, Visual/Recreation, Air Quality, Public Health and Safety, Social and Economic Considerations, and Noise/ Radio-TV Interference.**

3. **Social and Economic Considerations**

   SEGMENT H1. Economic impacts on the forest resource would be moderate along this segment. The impact would be direct and long-term. There would be no differences among three BPA design options. Any would require about 20 ha (51 ac.) of forest lands to be cleared, plus an additional 13 ha (33 ac.) to be selectively cut.

Although the regional housing supply would not be adversely affected to a significant degree, one and possibly two residential housing units would need to be moved or demolished to accommodate this route option. This would be a considerable, direct and long-term impact for those occupants. The area of concern would be in Section 18, 36 N 5E, near where **SEGMENT H1** intersects **SEGMENT J**. It should be noted, however, that the taking of one of two housing units would not significantly affect the area's housing supply; therefore, the overall impact rating would be low to moderate. No appreciable difference would exist among the design options.

**SEGMENTS H, I, J**. Economic impacts on agriculture would be low, direct, and both short- and long-term. BPA Option 1 would remove only 0.01 ha (0.03 ac.) of Prime farmland from production; BPA Options 2 and 3 would each remove only 0.02 ha (0.04 ac.).

Social impacts would range from low to moderate, and would be direct and long-term due to the physical presence of the line; there would be no appreciable differences among the three design options.

**4. Geology/Soils**

**SEGMENT H1**. Direct, moderate impacts would be caused by construction and clearing; they would be mainly short-term, resulting in disturbance of soil surface, increased erosion, run-off, sedimentation, and impaired revegetative capacity. There would be no appreciable differences among BPA Options 1, 2, and 3. Areas of concern are:

- Mills Creek sideslopes,
- along the right-of-way to be cleared,
- at Jackson Creek and an unnamed tributary of the Samish River.

**SEGMENTS H, I, J**. Concern for impacts here would be low to moderate. Direct impacts would be caused by line construction and associated activities. Short-term impacts would be most intense; intensity of long-term impacts would be partially reduced through mitigation. Areas of particular concern are creek crossings and slopes above Highway 9 in **SEGMENT H** and at the Mills Creek crossing in **SEGMENT I**. There would be no appreciable differences among the three design options.

5. **Health and Safety (focus on EMF).** As indicated above, it is not possible to specifically determine what level of health-related consequences might be associated with exposure to EMF.

   The number of buildings expected to experience an increase in magnetic field levels of more than 1 mG (exposure assessment) are:

   SEGMENT H1 (one building)[8]
   BPA Option 1 = less than 1 mG
   BPA Option 2 = between 1 and 2 mG
   BPA Option 3 = between 1 and 2 mG.

   SEGMENTS H, I, J. (buildings with estimated annual increase of 1 mG or more)[9]
   BPA Option 1 = 2 buildings
   BPA Option 2 = 2 buildings
   BPA Option 3 = 3 buildings

## PUGET POWER'S PART OF THE PROJECT[10]

Puget Power would rebuild its 6.9-km (4.3-mi.) existing 115-kV transmission line between the BPA Bellingham Substation on Dewey Road, and the Puget Power Bellingham Substation. (See Figure 7.) Poles, insulators, and conductors would be replaced. Instead of the light-weight single-wire conductors (existing), the new wires would be bundled (two wires per phase). The new insulators would be about 100 cm (40 in.) longer in order to handle the new conductors. Wood, laminated wood, and steel are three types of poles being considered for the rebuild line. (See Figure 8.) The new poles would be about 23 m (75 ft.) high, and would stand about 5 m (15 ft.) taller than the existing poles; they would be placed at about the same

---

[8] It was possible to calculate estimated annual average magnetic fields for only one home along this corridor; see Section14 in **Chapter 4**.

[9] These are increases above levels expected with the existing system in the year 2000, the No Action Alternative. (Also see Section 14 in Chapter 4, and **Appendix C.**)

[10] Much of the information on Puget Power's portion of the project is based on the Puget Sound Power & Light Company's BPA/Puget Power Northwest Washington Transmission Project Environmental Report (1993).

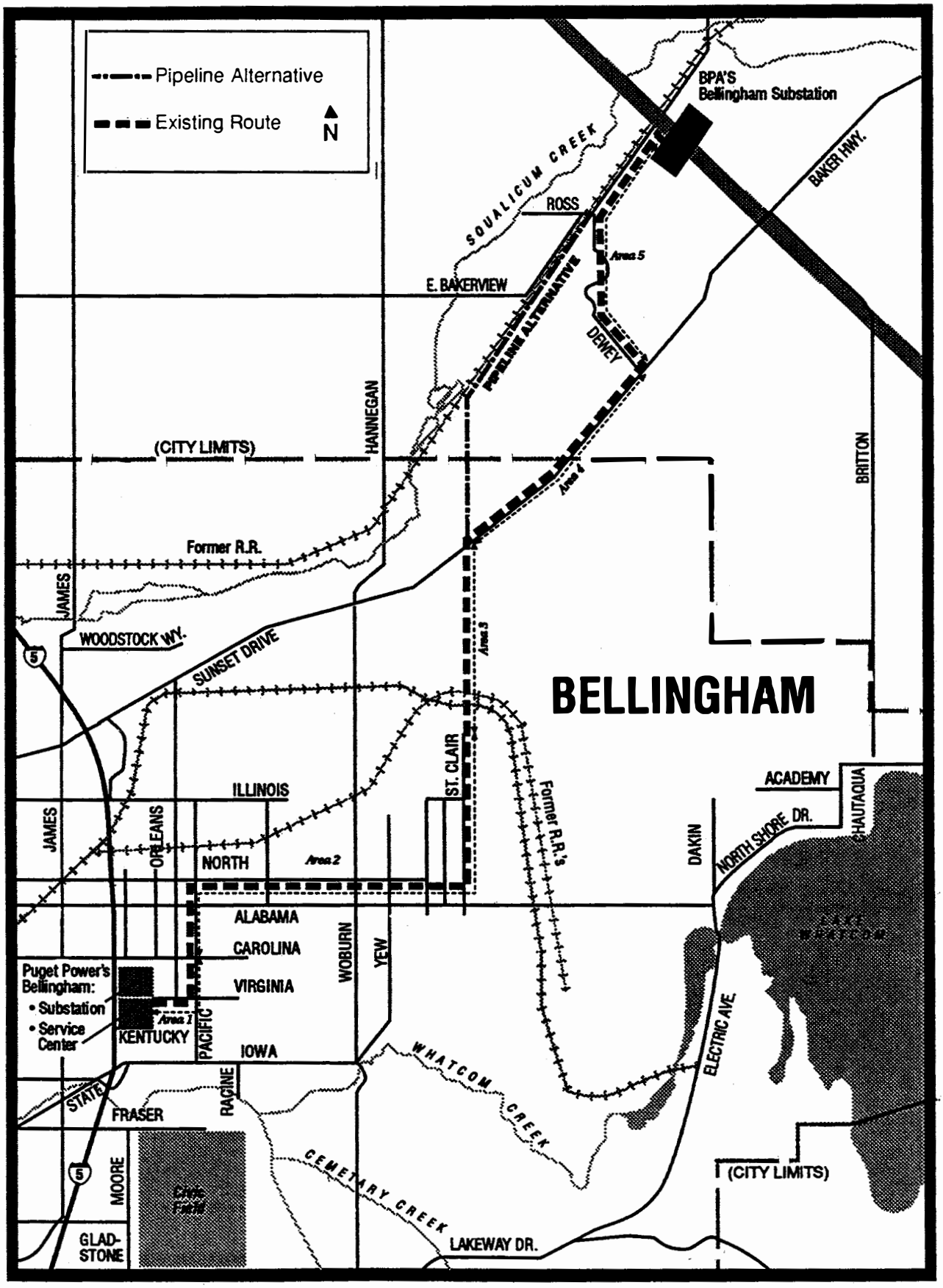



***Figure 7***
***Puget Power BPA-Bellingham #2 Rebuild***

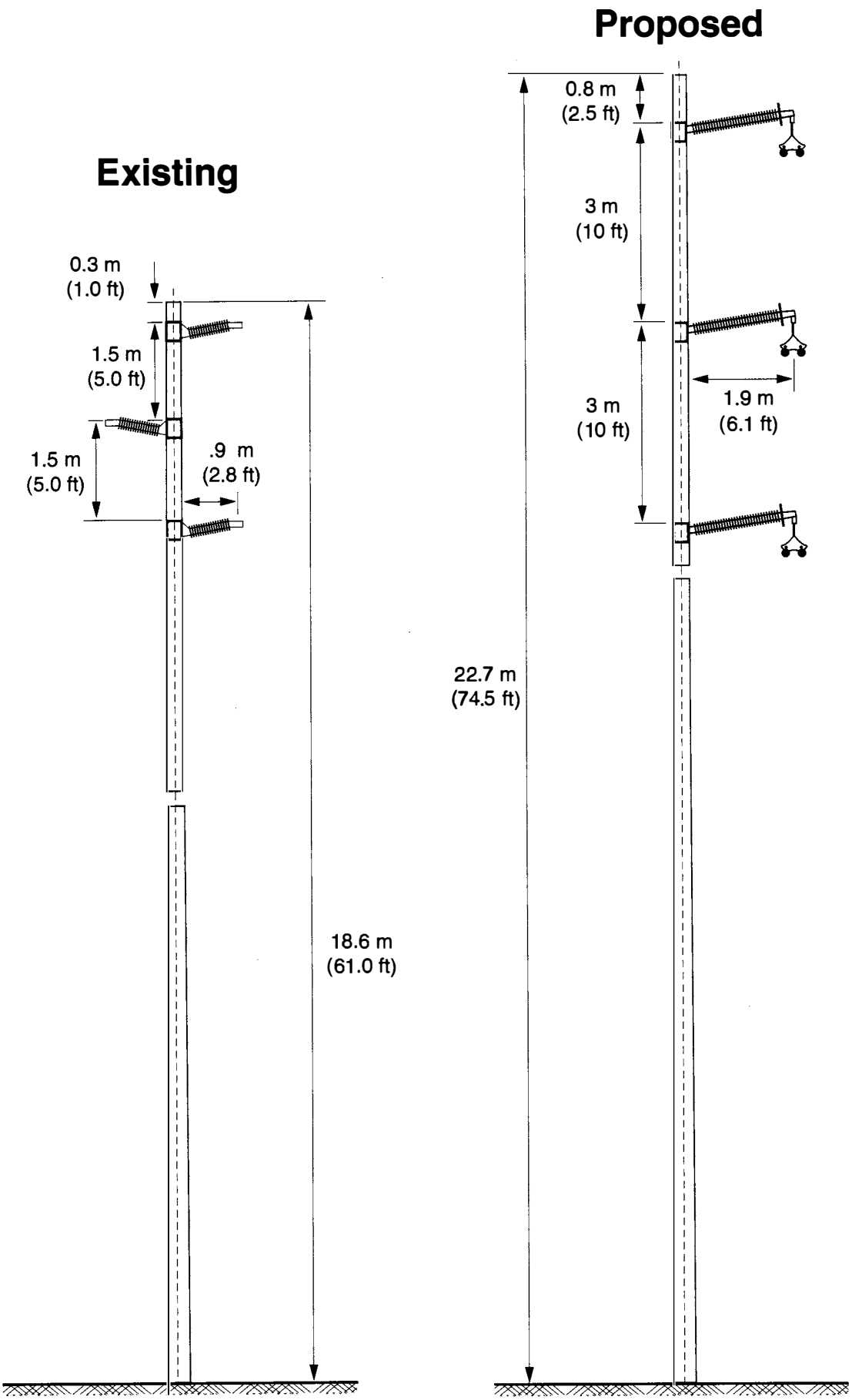



***Figure 8***
***Puget Power: Typical Structure Type For Rebuild***

locations as the existing poles. The rebuilt transmission line would still be energized at 115-kV, and would look very similar to the existing 115-kV transmission line.
Puget Power would loop its existing Bellingham-Kendall line into the BPA Bellingham Substation. This would mean constructing two new short sections of 115-kV line (a total of about 2.1 km or 1.3 mi.) mostly parallel to the existing BPA right-of-way between Dewey Road and Mount Baker Highway. Puget Power would also add a bay within the fenced area of its Bellingham Substation. See Table 4 (at the end of this section) for a matrix comparison of impacts from proposed Puget Power actions.

Puget Power's Sedro Woolley Substation is located on Minkler Road, east of the city of Sedro Woolley. An additional ***power circuit breaker*** would be installed at the Sedro Woolley Substation to terminate the new 230-kV line between the BPA Bellingham Substation and Puget Power's Sedro Woolley Substation. The power circuit breaker would protect the 230-kV line in the event of a system fault. The new BPA Bellingham-Sedro Woolley 230-kV line would enter the substation from the east side. Two steel poles and foundations would be installed to extend the new 230-kV line inside the substation. The improvements would occur within the existing fenced substation site.

**Puget Power Line Rebuild**

**Description.** There are two alternative locations for the line rebuild.

1. **Existing 115-kV Transmission Line Location**
   Puget Power would rebuild the existing BPA-Bellingham #2 115-kV transmission line between the BPA Bellingham Substation and the Puget Power Bellingham Substation, a distance of about 6.9 km (4.3 mi.). The insulators and conductors would be installed on the road side of the poles, away from nearby residences.

2. **Pipeline Alternative**
   An alternative route for the first (approximately) 1.6 km (1 mi.) of the rebuild from BPA's Bellingham Substation would extend from the intersection of East Bakerview Road and Ross Road to a projected intersection of St. Clair Street and Sunset Drive. This alternative was developed in order to keep the line farther from Mt. Baker Highway, which is scheduled to be widened. In 1997, the Washington State Department of Transportation (WDOT) and the City of Bellingham are planning to widen Sunset Drive/Mt. Baker Highway (S.R. 542) from two to five lanes between

Orleans Street and Britton Road. Additional right-of-way would be required. The project would require that Puget Power's existing line facilities be relocated. The pipeline alternative would move the existing 115-kV line and eliminate any conflicts with the road-widening project.

The line would proceed cross-country in a northerly direction from the intersection of St. Clair Street and Sunset Drive for about 670 m (2200 ft.) to the abandoned Chicago, Milwaukee, St. Paul & Pacific Railroad (Milwaukee Road) right-of-way. This segment of the alternative route would parallel a Trans Mountain Oil Pipeline corridor which is cleared and maintained free of trees and shrubs. An additional easement of about 9 m (30 ft.) would be required alongside the pipeline corridor.

The line would continue northeast along the abandoned Milwaukee Road right-of-way for about 975 m (3200 ft.) until it met the existing transmission line corridor at Dewey Road. Other facilities in the abandoned Milwaukee Road right-of-way include a 115-kV transmission line and a newly installed Cascade Natural Gas pipeline and access road. The new 115-kV transmission line would be located on the north side of Cascade Natural Gas access road. The properties along this alternative are largely undeveloped and are expected to remain so, as Squalicum Creek and other wetland areas are located near by.

If this alternative were selected, the portion of existing 115-kV transmission line along Sunset Drive between St. Clair St. and Dewey Road and along the Dewey Road between Sunset Drive and Ross Road would be removed. The poles would be cut off about 14 m (45 ft.) above the ground; the other aerial facilities (i.e., Puget Power distribution lines, telephone, and cable television) would remain.

The alternative 115-kV transmission line section would be similar in design to the rest of the BPA-Bellingham #2 115-kV rebuild discussed above. The pipeline alternative would have single poles, horizontal post insulators, and bundled conductors (two wires per phase), except for two locations where the alternative would traverse a steep hill. Three-pole wood dead-end structures would be installed at both the top and the bottom of this slope so that the transmission line might span the entire elevation change without the need for intermediate structures.

If this alternative were selected, Puget Power would obtain enough easements for the new 115-kV transmission line. Additional vegetation clearance rights might also be needed for danger trees outside the transmission line easement.

**Comparison.** Comparisons of impact are provided for the five major issues.

1. **Noise from Lines and Substations.** Based on the preliminary design, audible noise levels would be significantly below the State noise standards for lines. Audible noise levels associated with either the rebuilt or new 115-kV transmission lines would range from 12 - 16 dBA at a distance of 8 m (25 ft.) from the line at the ground (worst case). When existing background noise is considered, the noise associated with the line is expected to be inaudible.

   No significant increases in audible noise levels from the line rebuild or the pipeline alternative are anticipated.

2. **Land Use/Management.** The proposed 115-kV line rebuild would occur in areas of existing utility-line, public right-of-way, or new easements. No change in these conditions is anticipated. For the pipeline alternative, the new line would be located parallel to an existing 115-kV line and underground pipeline routes, and in areas covered by the Whatcom County and Bellingham comprehensive plans. This route would be consistent with existing land use and considered conditionally permitted in the zones identified in those plans. Normal clearing and, if appropriate, wetland permits would be required.

3. **Social and Economic Considerations.** Because the proposed rebuild would occur "in place" (although largely in a populated area) and would not involve a large workforce over an extended period, impacts are expected to be temporary and short-term. Impacts would be associated primarily with localized increased construction activity and visual impacts from slightly increased pole heights.

   For the pipeline alternative, which would involve an unpopulated area, no change in existing land use is anticipated. This, along with factors mentioned above for the rebuild, would cause minimal concern for impacts.

4. **Geology/Soils.** Field observations did not reveal any erosion problems directly under or next to the BPA Bellingham #2 115-kV transmission line. Proposed pole

replacement would not constitute enough land clearing to encounter or create erosion problems. Access to pole locations in localized potential erosion areas might require regrading the right-of-way and using erosion control measures.

The City of Bellingham has mapped a potential landslide hazard area north of the intersection of St. Clair Street and Sunset Drive, in the Trans Mountain Oil Pipeline right-of-way and wooded area adjacent to the proposed transmission line right-of-way. There are no apparent geologic failures or earth movements at the site.

Construction of the transmission line would require clearing about a 10-m-wide (30-ft-wide) right-of-way down the slope. Clearing may be done by hand, with trees and debris yarded off and mulched. No access road would be required for clearing or constructing the transmission line at the hillside.

Revegetation of the cleared area and preventive measures would minimize erosion; impacts would be moderate and short-term. No other sites within the pipeline right-of-way represent landslide or erosion hazards.

5. **Health and Safety (focus on EMF).** As indicated above, it is not possible to specifically determine what level of health-related consequences might be associated with exposure to EMF.

   Approximate numbers of buildings that may experience an increase in magnetic field levels above 1 mG are:

| | |
|---|---|
| Total Rebuild on existing right-of-way | = 98 |
| Total with Pipeline Alternative | = 85 |

**Puget Power Loop Line Alternatives**

**Description.** There are four ways to connect the existing Puget Power Bellingham-Kendall 115-kV transmission line into and out of BPA's Bellingham Substation. Puget Power would build about 2.1 km (1.3 mi.) of new 115-kV transmission line between the BPA Bellingham Substation and Mt. Baker Highway, next to Mt. Baker Highway and Britton Road. The new 115-kV transmission lines (one into, one out of, the substation) would provide an additional

path to transfer power between the BPA Bellingham Substation and the Puget Power Bellingham Substation and would address in part the local transmission system needs described under **Purpose and Need for Action (Chapter 1).**
The new 115-kV transmission lines would be similar to the existing 115-kV transmission lines on Mt. Baker Highway/Britton Road. The new transmission lines would involve the installation of single wood poles, horizontal post insulators, and single conductors (Figure 9).

About two-thirds of the new 115-kV transmission lines would be on public right-of-way. Elsewhere, Puget Power has, or would obtain, sufficient easements. Additional vegetation clearance rights may also be needed for danger trees outside the public right-of-way.

The selection of a preferred option depends on further engineering and environmental studies in conjunction with improvements to the BPA Bellingham Substation and 230- and 500-kV transmission lines within the BPA transmission corridor. The four options are shown on Figure 10.

1. **PP Alternative 1.** The west end of the new construction would begin at the BPA Bellingham Substation. From there, two new 115-kV transmission lines would be constructed southeastward alongside the southwestern boundary of the existing BPA transmission corridor. An additional easement width of about 23 m (75 ft.) would be required next to the existing BPA transmission corridor. Where the new transmission lines meet the Mt. Baker Highway (S.R. 542) right-of-way, one line would continue northeasterly on the southeastern side of S.R. 542 to Britton Road, then southeast along the northeast side of Britton Road about 0.6 km (0.4 mi.) to an intersection with an existing 115-kV transmission line. The other line would continue along the northwestern side of Mt. Baker highway about 0.88 km (0.55 mi.) to a point where it would connect to an existing 115-kV transmission line.

2. **PP Alternative 2.** This option would be similar to PP Alternative 1, except that two new 115-kV transmission lines would be built alongside the northeasterly boundary of the existing BPA transmission corridor to the Mount Baker Highway. An additional easement width of about 23 m (75 ft.) would be required next to the BPA transmission corridor.

3. **PP Alternative 3.** The western end of the new construction would begin at the BPA Bellingham Substation. From that point, two new 115-kV transmission lines would be

built southeast alongside the southwestern boundary of the existing BPA transmission corridor. An additional easement width of about 23 m (75 ft.) would be required next to the existing BPA transmission corridor. When the new transmission lines meet S.R. 542, one line would continue northeast along the northwestern side of the highway; the other line would continue northeast along the southeastern side about 0.88 km (0.55 mi.) until the point where both line segments would connect to an existing 115-kV transmission line.

4. **PP Alternative 4.** This option would be similar to PP Alternative 3, except that two new 115-kV transmission lines would be built alongside the northeastern boundary of the existing BPA transmission corridor to S.R. 542. An additional easement width of about 23 m (75 ft.) would be required next to the BPA transmission corridor.

**Comparison.** Comparisons are provided below for the five major issues.

1. **Noise from Lines and Substations.** Based on the preliminary design, audible noise levels are anticipated to be significantly below the State noise standards for lines. Audible noise levels associated with either the rebuilt or new 115-kV transmission lines would range from 12 - 16 dBA at a distance of 7.6 m (25 ft.) from the line (worst case). When existing background noise is considered, the noise associated with the line is expected to be inaudible.

2. **Land Use/Management.** New sections of 115-kV transmission would be located next to the BPA corridor between the BPA Bellingham Substation and S.R. 542, mostly on undeveloped land and near one or two homes. Depending on the route selected, two homes might need to be removed to make room for additional right-of-way. This reduction in land use would represent a minor amount of total similar land use in the county; land use impact would be minor and long-term. For the rest, the new line sections would be located within public road right-of-way and would not change existing land use; for these sections there would be no difference in land use among alternatives. New construction in this section would be subject to conditional land use permit requirements of Whatcom County and the associated environmental review provided in this joint EIS.

3. **Social/Economic Considerations.** As noted above, the new 115-kV transmission line might require the removal of two single-family dwellings next to the BPA right-of-

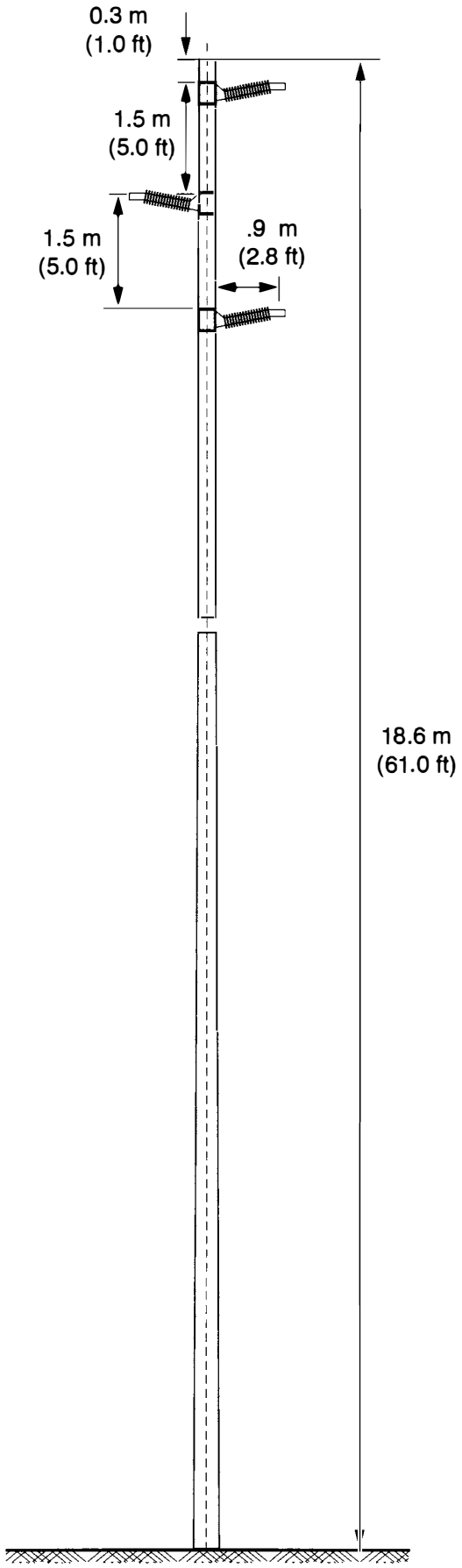
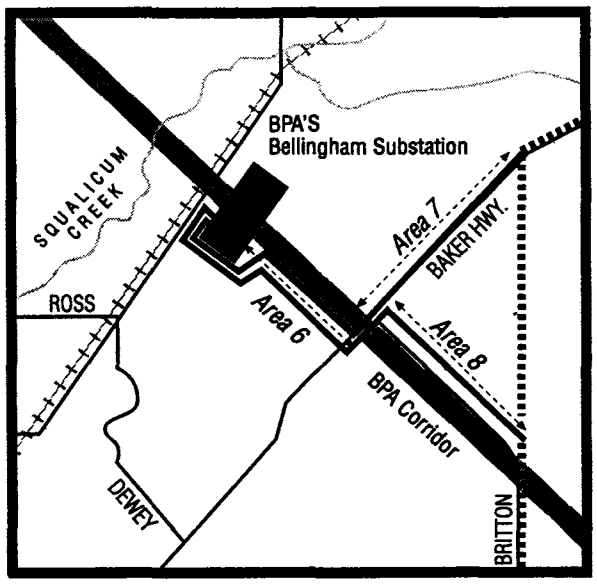
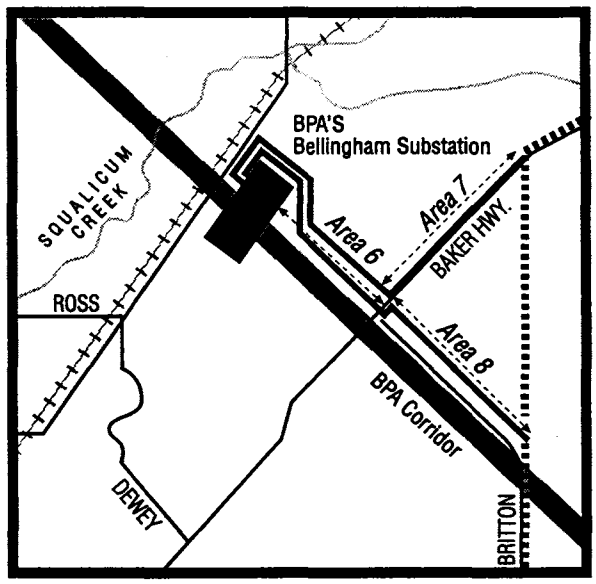


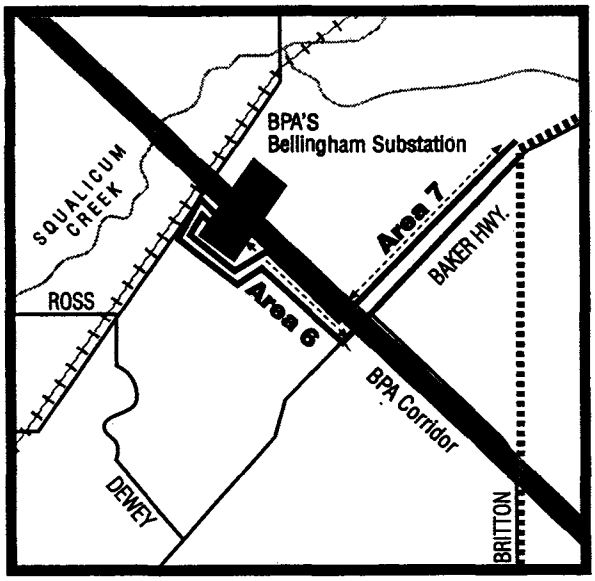

***Figure 9***
***Puget Power: Typical Structure Type For Loop Line Alternative***



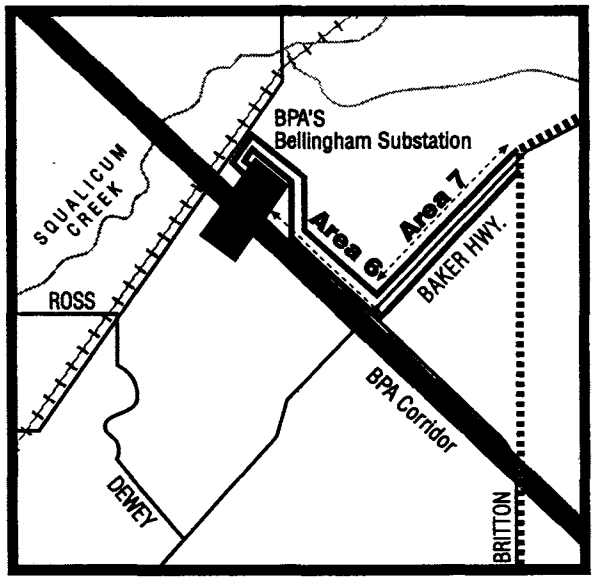

ALT 1




ALT 2




ALT 3




ALT 4

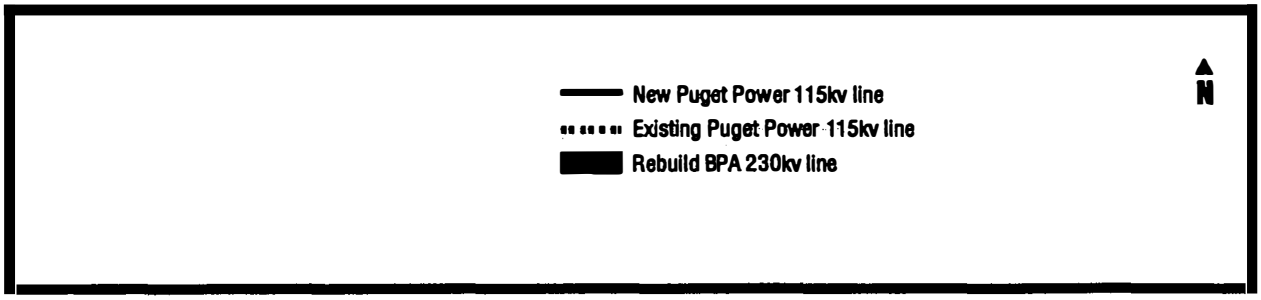



***Figure 10***
***Puget Power: Loop Line Alternatives at BPA Bellingham Substation***

way. Although the affected property owner(s) would be compensated at fair market value for their property, together with any relocation expenses incurred by the occupants, such an acquisition would create a considerable impact on the occupants. It should be noted, however, that the taking of one or two housing units would not significantly affect the area's housing supply.

4. **Geology/Soils.** All alternatives would avoid construction on the steep slope area just south of BPA's Bellingham Substation. No new access roads would be built. There would be no noticeable difference among alternatives. Impacts (with mitigation) would be temporary, short-term, and of moderate intensity.

5. **Health and Safety (Focus on EMF).** As indicated above, it is not possible to specifically determine what level of health-related consequences might be associated with exposure to EMF.

   This portion of the overall project involves a Puget Power line being located near/ adjacent to the BPA corridor. The reader should therefore refer to discussions of SEGMENT **D** (Section 14 in **Chapter 4; Appendix C**).

**Options for Line Access into Puget Power Bellingham Substation**

**Description.** The Puget Power Bellingham Substation is located at the intersection of Carolina Street and Nevada Street and next to Interstate 5. A 115-kV power circuit breaker would be used within the substation to terminate the existing Bellingham #1 115-kV transmission line entering from the BPA Bellingham Substation. The power circuit breaker would protect the 115-kV line in the event of a system fault.

Puget Power is considering location options which involve whether an existing or new power circuit breaker would be used, and how the lines would enter/exit the substation before leaving the substation property. (See Figure 11.) These options mostly occur on substation property and are very short (one span). Very short portions would be extended within public right-of-way. Because they are mostly within the substation, do not involve adding oil-filled equipment or hazardous substances, and so on, these options are not evaluated in this section.

**Tables 2 through 4, following, present in a matrix a close comparison of the differences among the various options. This is a "condensed" way of reviewing the comparison material presented in the discussions above.**

## 3. MITIGATION

Mitigation measures can often reduce or eliminate many adverse impacts from construction, operation, and maintenance of transmission facilities. These measures are actions taken before, during, and/or after construction to ease natural resource and social impacts. "Mitigation" includes avoiding an impact altogether, minimizing impacts by limiting the magnitude of an action, rectifying an impact by repairing or restoring, reducing or eliminating the impact over time by preservation or maintenance, and compensating for the impact by replacing or providing substitute resources or environments.

### BPA'S PART OF THE PROJECT

Project mitigating measures shown below would be carried out should the construction activities evaluated occur:

- The proposed action will be designed to the extent reasonably achievable to comply with the requirements of various Federal and state laws, regulations, and standards, and policies as discussed in the **Compliance, Review, and Permits** section.
- Impacts will be reduced by the use of vegetative and physical measures to control erosion and stabilize disturbed slopes.
  - Vegetative measures include the seeding or the planting of herbs, grasses, shrubs or trees on disturbed areas.
  - Fertilization, mulching, watering, and/or mechanical controls such as erosion netting and fabric may be required to ensure success. Mechanical measures include construction of ***slash windrows***, straw bale dams, erosion netting and fabrics, terracing, benching, ***riprap***, and ***tackifers***.

  Revegetation of disturbed sites will be done as soon as possible.
- There will be follow-up inspection and maintenance of erosion and run-off controls and revegetative efforts to ensure their success.

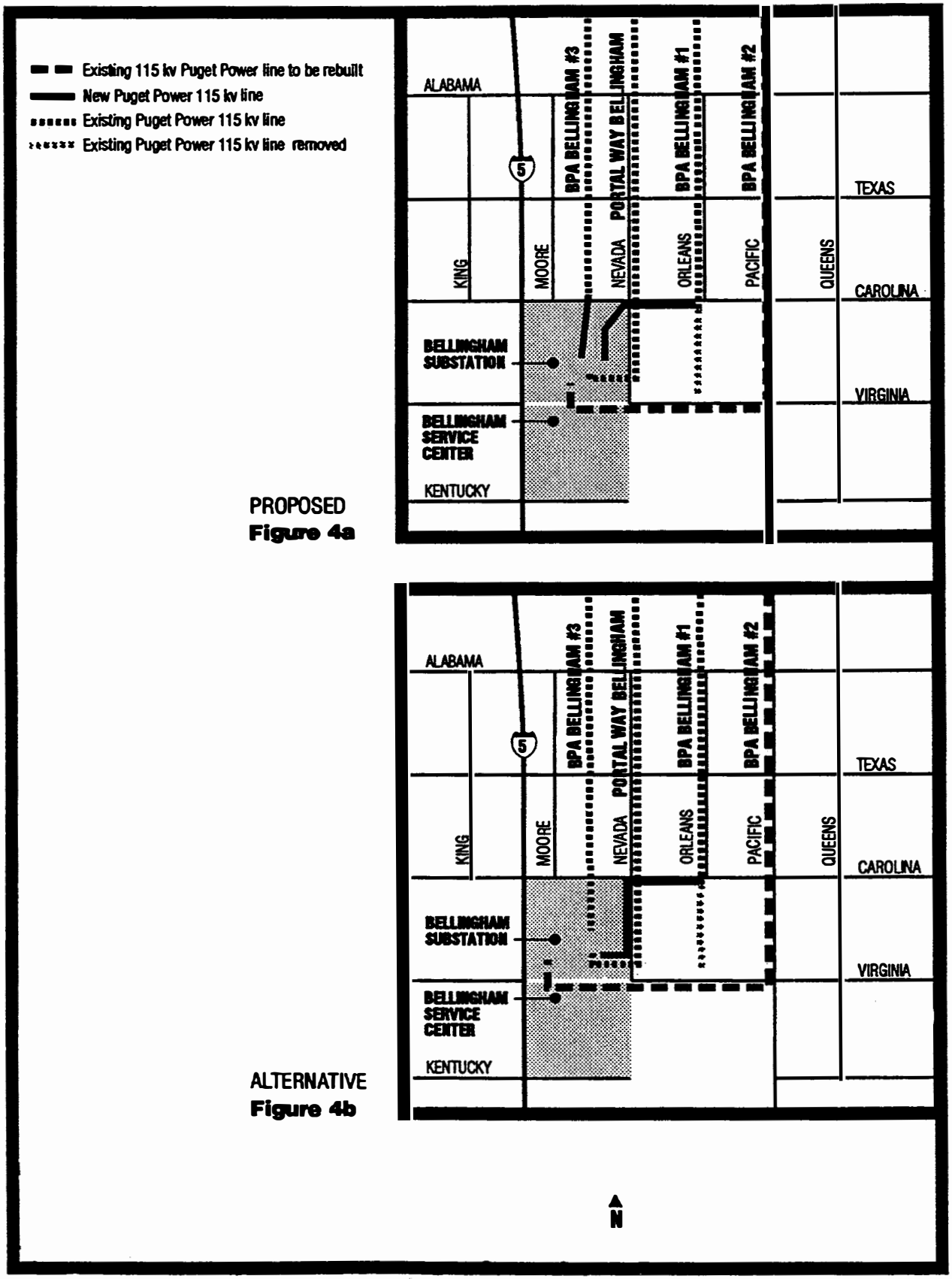



***Figure 11***
***Puget Power Bellingham Substation Improvements***

## TABLE 2. COMPARISON OF BPA DESIGN ALTERNATIVES

| Environmental Issues/Factors with Possible Influence on Choice of Alternatives | Option 1 | | | Option 2 | | | Option 3 | | |
|---|---|---|---|---|---|---|---|---|---|
| **Major Issues** | Segs A-D | Segs E-J | Segs K-N | Segs A-D | Segs E-J | Segs K-N | Segs A-D | Segs E-J | Segs K-N |
| • Noise from Lines & Substations | No Increase | | | No Increase | | | Overall Decrease | | |
| • Land Use/Mgmt. | No Change | | | No Change | | | No Change | | |
| • Geology/Soils | Mod Ero-sion | Mod Ero-sion | Low Ero-sion | Similar to Option 1 | | | Similar to Option 1 | | |
| • Social/Economic: Economic | Low | Low | Low | Similar to Option 1 | | | Similar to Option 1 | | |
| Social | Low/ Mod | Mod | Low/ Mod | Similar to Option 1 | | | Similar to Option 1 | | |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | 49 | | | 50 | | | 3 | | |
| **Other Factors/Issues** • Agricult. Impacts | Slight/ Mod | Slight | Slight/ Mod | Similar to Option 1 | | | | | |
| Visual/Recreation | Mod | Mod | Low/ Mod | Similar to Option 1 | | | | | |
| • Vegetation | Slight/Moderate | | | Similar to Option 1 | | | | | |
| • Water Quality | Moderate | | | Similar to Option 1 | | | | | |
| • Floodplain/ Wetlands | Mod | Mod | Slight | Similar to Option 1 | | | | | |
| • Fish & Wildlife: Wildlife | Mod | Mod | Mod | Similar to Option 1 | | | | | |
| Fish | Mod | Mod | Mod | Similar to Option 1 | | | | | |
| • Cultural Resources | Mod | High | High | Similar to Option 1 | | | | | |

## TABLE 3. COMPARISON OF BPA LOCATION ALTERNATIVES[a]

| Environmental Issues/Factors with Possible Influence on Choice of Alternatives | BPA Segs. H, I, J (Proposed) (Design Options) | | | BPA Segment H1 (Design Options) | | |
|---|---|---|---|---|---|---|
| **Major Issues** | Option 1 | Option 2 | Option 3 | Option 1 | Option 2 | Option 3 |
| • Noise from Lines & Subs. | No Increase | | Decrease | No Increase | | |
| • Land Use/Management | No Change | | | Change -- Low, Direct Impact | | |
| • Geology/Soils | Low/Moderate | | | Moderate | | |
| • Social/Economic<br>Economic | Low | | | Low/Moderate | | |
| Social | Low/Moderate | | | Moderate | | |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | 2 | 2 | 3 | 0 | 1 | 1 |
| **Other Issues** (Ratings from Chapter 4)<br>• Agriculture | Slight | | | Slight | | |
| • Visual/Recreation | Moderate/Low | | | Low | | |
| • Vegetation | Slight/Moderate | | | Moderate | | |
| • Water Quality | Low/Moderate | | | Moderate/High | | |
| • Floodplain/Wetlands | Moderate | | | Moderate | | |
| • Fish & Wildlife:<br>Wildlife | Slight | | | Moderate | | |
| Fish | Moderate | | | Moderate | | |
| • Cultural Resources | Moderate Concern | | | Moderate Concern | | |

[a] Rating/characterizations are based on recommended mitigation.

## TABLE 4. COMPARISON OF PUGET POWER ALTERNATIVES (2 PAGES)

| Environmental Issues/Factors with Possible Influence on Choice of Alteratives | Puget Power's 115-kV Bellingham-Bellingham Line Rebuild | Puget Power's "Pipeline" Alternative |
|---|---|---|
| **Major Issues** | | |
| • Noise from Lines & Subs. | No Change | Minor Increase[b/] |
| • Land Use/Management | No Change/Consistent | Minor Change/Consistent(?)[c/] |
| • Geology/Soils | Low | Low/Moderate |
| • Social/Economic: | | |
| Economic | Low | Low |
| Social | Low | Low |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | 98 | 85 |
| **Other Issues** (Impact ratings based on Chapter 4) | | |
| • Agriculture | Low | Low |
| • Visual/Recreation | Low | Low |
| • Vegetation | Moderate | Moderate |
| • Water Resources/Wetlands | Low | Moderate |
| • Fish & Wildlife: | | |
| Wildlife | Slight | Slight |
| Fish | Slight | Slight |
| • Cultural Resources | Low/Moderate | Low/Moderate |

b/ Due to lower existing background levels.

c/ Subject to review by Whatcom County and City of Bellingham.

TABLE 4. (CONT'D)

| Environmental Issues/Factors with Possible Influence on Choice of Alternatives | Puget Power's New 115-kV Loop Line Alternatives | | | |
|---|---|---|---|---|
| Major Issues | Alt. 1 | Alt. 2 | Alt. 3 | Alt. 4 |
| • Noise from Lines & Subs. | No Notable Change | | | |
| • Land Use Management | Minor/Localized Change (Subject to Whatcom Co. Approval) | | | |
| • Geology/Soils | Short Term-Moderate | | | |
| • Social/Economic: Economic | Low/Moderate | | | |
| Social | Moderate | | | |
| • Public Health - EMF (Buildings w/greater than 1 mG increase) | Refer to BPA Segment D | | | |
| Other Issues (Impact ratings based on Chapter 4) • Agriculture | Slight | | | |
| • Visual/Recreation | Slight-Localized | | | |
| • Vegetation | Moderate | | | |
| • Water Resources/Wetlands | Slight-Localized | | | |
| • Fish & Wildlife | Slight-Localized | | | |
| • Cultural Resources | Low | Low | Low | Low |

- ***Riparian*** areas will be avoided whenever possible.
- Construction will take place in the dry season if possible; as little ground as possible will be disrupted in the vicinity of the water body; mechanical measures will be used to minimize erosion and surface run-off; and disrupted soils will be promptly reseeded and/or revegetated.
- Near any water body crossing, including the line crossing on the ridge above Mirror Lake, towers will be set as far back from stream banks as possible.
- Also, clearing will be reduced to the least amount necessary in the Lake Whatcom watershed.
- Structures placed in floodplains will be designed to be floodproof.
- Off-road driving across wetlands and floodplains will be limited to the minimum number of trips necessary to accomplish the work.
- To reduce the amount of sediment entering streams, a strip of undisturbed vegetation will be provided between areas of disturbance (road construction or tower construction) and stream courses. Buffer strip width will be measured from the high water line of a channel. Recommended buffer strips widths are based upon the following criteria:

| Land slope | Buffer width |
|---|---|
| 0% | 15 m (50 ft.) |
| 10% | 27 m (90 ft.) |
| 20% | 40 m (130 ft.) |
| 30% | 52 m (170 ft.) |
| 40% | 64 m (210 ft.) |
| 50% | 76 m (250 ft.) |
| 60% | 88 m (290 ft.) |
| 70% | 101 m (330 ft.) |

- Fill and side-cast material will not be deposited in any watercourse or stream channel. Where necessary, measures such as hauling of excavated material, construction of temporary barriers, or other approved methods will be used to help keep excavated materials out of watercourses. Any such material entering watercourses will be removed as soon as possible.

- Roads will cross drainage bottoms at sharp or nearly right angles and level with the streambed whenever possible.
- Culverts, arch bridges, or other stream-crossing structures will be installed at all permanent crossings of flowing or intermittent waterways. Bridges and arch-bridges are preferred to culverts. However, where appropriate, culverts will be big enough to handle approximately 25-year floods, and designed to allow for fish passage.
- Towers will be located outside of agricultural fields where possible and/or to minimize interference with farm activities (e.g., aligning towers next to structures of parallel lines).
- Construction and maintenance activities will be scheduled to minimize conflicts and crop damage when practical.
- Farmers will be compensated for crop damage and helped with weed control and the restoration of productivity of compacted soils.
- Non-specular conductors and insulators similar to those on existing lines will be used, as well as treated/painted towers to match existing towers.
- Reduced clearing will be employed in critical areas along **SEGMENTS E AND G**.
- Landowners will be compensated for land rights acquired by easement and for any ***danger trees*** that need to be removed off the right-of-way (based on their stumpage value).
- Water or water-based solutions will be applied to roads during warm/dry periods.
- If any burning should be needed, the construction contractor will be required to coordinate with local air pollution and fire control authorities and to obtain any necessary local burning permits.
- Vegetation impacts will be reduced in forestlands to be cleared by retaining/ creating wildlife trees and/or snags; in this area, at a recommended rate of about 1-2 trees/hectare (2-4 trees/acre). Retention of snags will partially compensate for lost resource functions (wildlife habitat) originally provided by these forestlands.
- Vulnerable wetlands and buffer areas will be delineated and field-staked for avoidance during construction.
- Excess material from the structure foundation excavations in floodplains and wetlands will be disposed of at an upland site.
- Wetlands and floodplains will be spanned wherever possible. If a tower must be placed in a wetland or floodplain, then the structure will be designed to be floodproof; temporary fill

will be used for such roads; and the roads will be temporary and not designed to remain in place. Matting or other temporary measures will be used, and no slash will be piled in floodplains. The fill will be placed on fabric in wetlands and will be removed from floodplains and wetlands after project construction is complete. The areas will be restored and revegetated.

- Stringing sites will be located outside wetland areas.
- The privately owned bridge and driveway may be used to cross Mills Creek southeast of the Samish River crossing; vehicles would not drive through the creek, nor would a culvert be placed in the creek.
- When it is necessary to place steel tower structures in a wetland, the top 30 cm (12 in.) of excavated material will be stockpiled and then replaced when all work is completed. Native and local stock will be used to revegetate.
- Where concrete footings are used next to the Nooksack River, form material will be used temporarily to prevent leaching into the surrounding soil until concrete has set.
- To minimize collision hazard impacts on migratory and resident birds, marker balls will be considered on the overhead groundwires on that portion which crosses over the Nooksack and Samish Rivers.

## PUGET POWER'S PART OF THE PROJECT

Project mitigating measures shown below would be carried out should the construction activities evaluated occur:

- The contractor will be directed to keep the construction area reasonably clean, to maintain all ditches and drainages free of debris, and to employ erosion control measures, per Whatcom County and City of Bellingham standards.

- For the new 115-kV transmission facilities:
  - A site-specific erosion control plan will be developed before construction.
  - Disturbed areas will be replanted with an erosion control seed mix.

- For the existing 115-kV line to be rebuilt
  - In localized potential erosion areas requiring regrading, prudent erosion control measures will be used. These could include the use of straw bales to intercept and

direct surface water flow and reseeding the area with an erosion control seed mix; or the requirement that construction be done during the dry season of the year.

- Clearing may be done by hand, with trees and debris yarded off and mulched.
- Revegetation of the cleared area will include stabilizing the slope to prevent slumping. Preventive measures may include water bars or flow interceptors. The area will be seeded with an erosion control mix. Hydromulching with wood fiber could be used to provide further stabilization on steep slopes.
- Site-specific erosion control measures will be developed as part of the construction specifications.

- For the Pipeline Alternative
  - In the forested portion of wetlands, to reduce impacts from clearing, equipment will be used which exerts the minimum amount of ground pressure, and lost vegetation will be replaced with wetland species.
  - The existing Trans Mountain right-of-way will be used as road for access to pole locations.
  - Replacement of wetlands permanently lost will be considered.

## 4. CUMULATIVE EFFECTS

A ***cumulative impact*** is the impact on the environment which results from the incremental effects of a proposed action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

BPA is aware of co-generation projects in the area (see **Section D1 in Chapter 1**). Although these projects involve some integrating transmission, the transmission required is a minor component of the overall projects. Generally, potential air and water quality impacts are stressed in assessments for these types of projects. The transmission modifications required mostly consists of modifications of Puget Power's existing 115-kV system.

This proposal focuses on 230-kV transmission improvements, as well as some modification of Puget Power's 115-kV system. For the most part, these proposed improvements are not in the same area as the co-generation projects. Also, this proposal does not include new generation, and would result in minor localized air and water quality impacts, as indicated in

the impact discussions (see **Chapter 4**). Therefore, the incremental increase in overall air and water quality impacts would be negligible.

BPA is not aware of other reasonably foreseeable energy/high-voltage transmission projects in the vicinity that would have the potential for notable cumulative effects. Highly localized cumulative effects associated with the proposal are discussed in the individual impact sections as appropriate, in **Chapter 4.**

## D. ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED DISCUSSION

### 1. PUGET POWER'S ORIGINAL PROPOSED 230-KV INTERTIE WITH B.C. HYDRO

In May 1989, Puget Power applied to the Department of Energy, Office of Fuels Programs (OFP) for a Presidential Permit to construct, connect, operate and maintain electric transmission facilities at the international border between the U.S. and Canada. The proposed project was scheduled for service by December 1992, and would have consisted of the construction of two 37-km (23-mi.), 230-kV overhead transmission lines which would cross the U.S.-Canadian border near Lynden, Washington. In the Bellingham area, one line would terminate at the existing Puget Power Bellingham Substation; the other would interconnect with existing Puget Power transmission lines 3 km (2 mi.) south of the Puget Power Bellingham substation. At the north end, the transmission lines would connect at the border with similar transmission lines that would have been constructed by B.C. Hydro. (See Figure 12.)

In January 1990, the OFP initiated an EIS scoping process in response to the Puget application. Included in the OFP Notice of Intent to Prepare an EIS was the alternative of constructing other domestic transmission projects to connect with U.S. utilities: that is, rebuilding the existing BPA single-circuit 230-kV transmission line between BPA's Custer and Bellingham Substations to double-circuit 230 kV on the existing right-of-way (the northern half of the current proposed project). Preliminary contacts with landowners along the

proposed corridor were made by Puget Power, and EIS scoping meetings were conducted by the OFP in Lynden and Bellingham (January 1990).

As Puget Power's proposed Intertie project would have involved establishing about 37 km (23 mi.) of new transmission corridor, much public interest and opposition ensued. There was also additional interest in the alternative of rebuilding the existing BPA transmission line. In November 1990, voters in Whatcom County amended the County planning ordinance to restrict the construction of transmission facilities over 115 kV, except on land where conditional use permits have already been granted or in areas classified as industrial. BPA and Puget Power then jointly conducted technical studies of the transmission system; these studies showed that an electrical plan focusing on rebuilding existing BPA and Puget facilities would meet the combined needs for solving local reliability problems and increasing the transfer capability of the Intertie. Both agreed to pursue such a plan jointly; that plan has evolved into the present proposed project. Subsequently, BPA and OFP issued a notice indicating the OFP suspension of Puget Power's Presidential Permit application (at Puget Power's request) and BPA's intent to prepare an EIS on the resulting BPA/Puget Power proposed project.

Because of the joint technical studies recommending other electrical plans of service, the restrictive zoning in Whatcom County (which encourages the use of existing transmission corridors), and OFP's suspension of the Presidential Permit process, it is unreasonable to pursue the original Puget Power proposal; it is therefore not examined in detail in this EIS.

## 2. E4A PLAN (PUGET POWER)

This plan would focus on construction of 115-kV lines only. It would not involve construction of any higher-voltage lines. It would primarily involve construction on Puget Power's system; there would also be improvements to BPA's Custer Substation. Puget Power would undertake the following actions:

- adding a second 230/115-kV transformer at its Portal Way Substation,
- building a 115-kV line from Portal Way Substation to Terrell Substation and Bellingham Substation, and
- rebuilding an existing 115-kV line between Puget Power's Bellingham and Sedro Woolley Substations (see Figure 13).

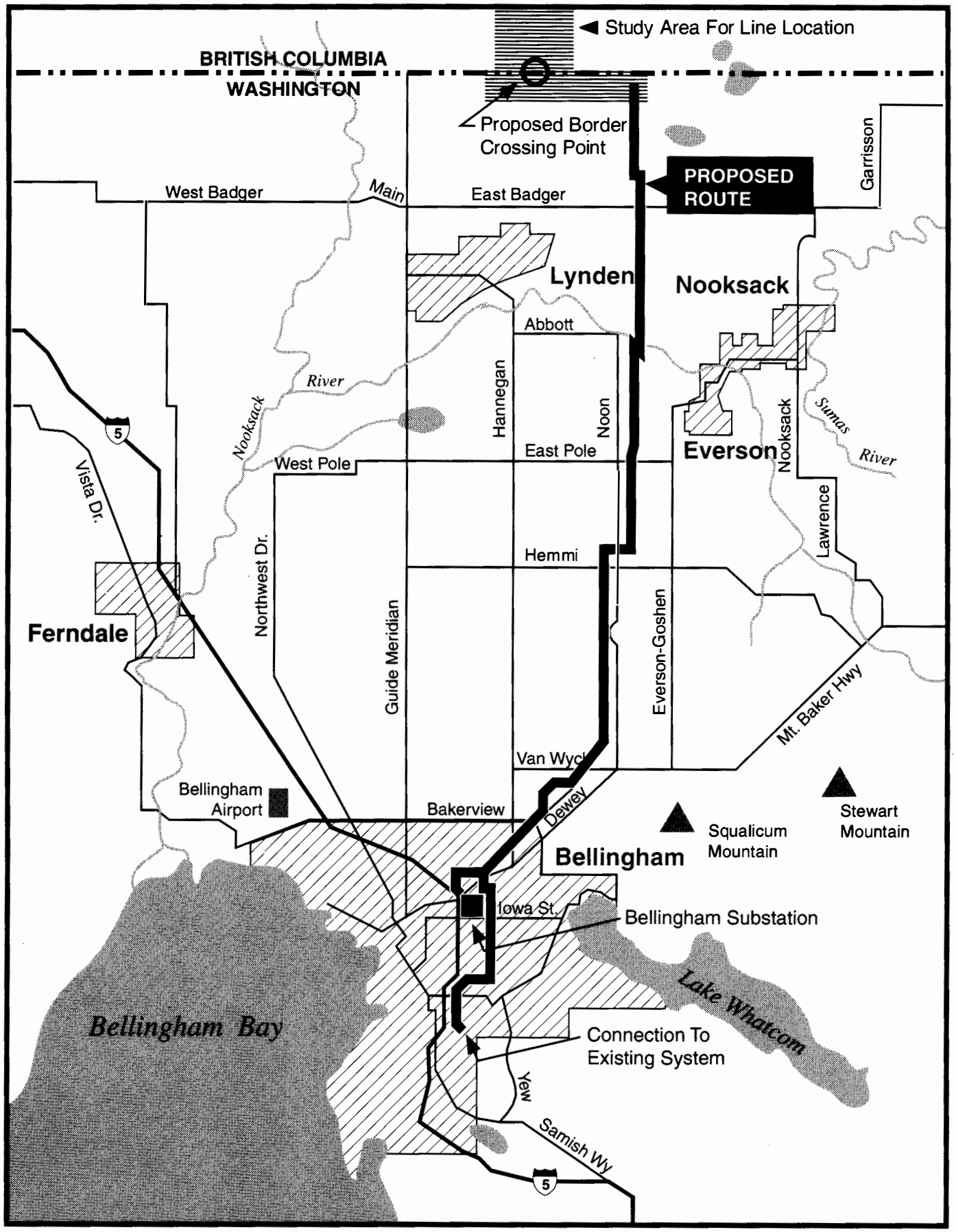
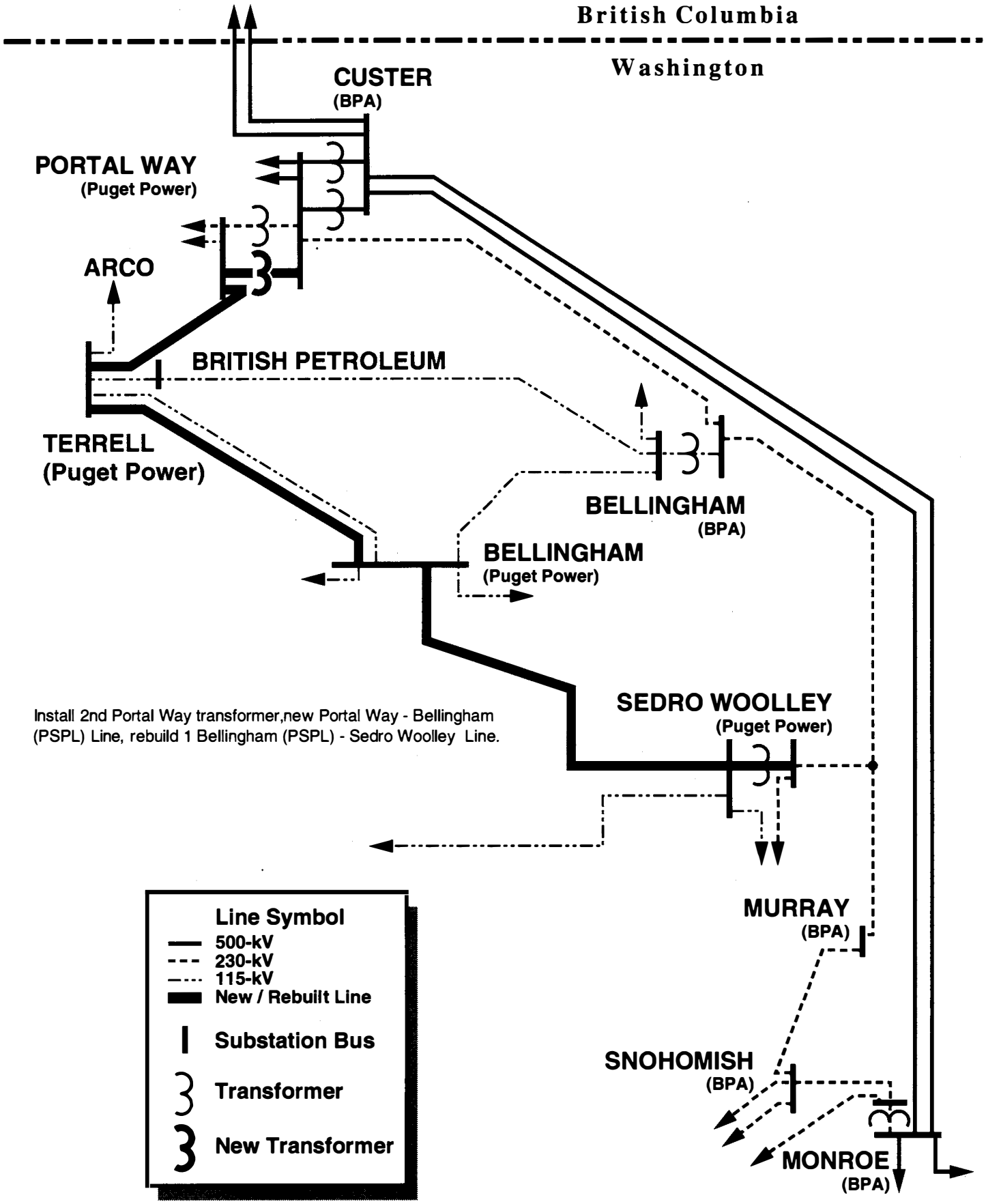



**Figure 12**
**Puget Power: Original Proposed 230-kV Intertie**




Source: BPA/Puget Power N.W. Washington Transmission Project, Volume II - Technical Studies, October 1992.

***Figure 13***
***The E4A Plan***

The joint BPA/Puget Power technical study included this plan; however, this is considered as more of a short-term solution and is not equal to the 230-kV plans. Compared to the preferred plan, E4A would be electrically inferior and would not fully meet the stated need. Reasons are listed below.

1. **E4A would not *unload* parallel lines as well as the proposed 230-kV plan.** One objective of the proposed project is to reduce loading on various components of the existing system. The use of higher-voltage lines can reduce loading on parallel lower-voltage and lower-capacity lines and transformers as they move power in and out of Whatcom County. Because it would use only 115-kV lines, E4A would not unload parallel lines as well as the proposed plan. (Volume II, Technical Studies, BPA and Puget Power, October 1992)

2. **E4A would depend on operation of half the new co-generation facilities.** E4A assumes that a minimum level (380 - 690 MW) of co-generation would be required during winter peak conditions to allow 2850 MW to be imported from Canada. However, not all co-generation facilities may be on-line during a particular outage situation on the transmission system. If this were to occur, an import level of 2850 MW could not be assured.

3. **E4A could not compensate as well as the 230-kV solution for a failure of the 500/230-kV transformer at Monroe Substation.** If the Monroe 500/230-kV transformer were to go out of service when importing 2850 MW during winter peak load, the BPA Custer-Bellingham 230-kV line would overload. Import levels would have to be reduced. With the proposed plan, no such reduction would be needed.

In summary, E4A would not be electrically equivalent to the proposed plan.

- It would not relieve loading on the 115-kV lines as well as the proposed 230-kV plan.
- It would not consistently achieve the goal of importing 2850 MW during winter peak periods.
- It relies on the assumption that 380-690 MW of local generation would be available at all times during critical outage situations.
- It would require potentially expensive local generation to run.
- It would not fully meet Puget Power's needs for increased transmission capacity to Sedro Woolley Substation.

- It would involve higher transmission line losses (since it would rely on highly loaded 115-kV lines).
- It would not serve future loads as well as the 230-kV solution.
- It could not endure double-contingency outages which have been experienced in the area (see project need statement in **Chapter 1**).
- It would require ***generation dropping*** for outages on additional 500-kV facilities.
- It would not allow for inter-region power transfer as well as the 230-kV solution.
- It could maintain the same level of reliability for future loads as the230-kV solution, by building more 115-kV lines.

For these reasons, E4A has not been examined in detail for this EIS.

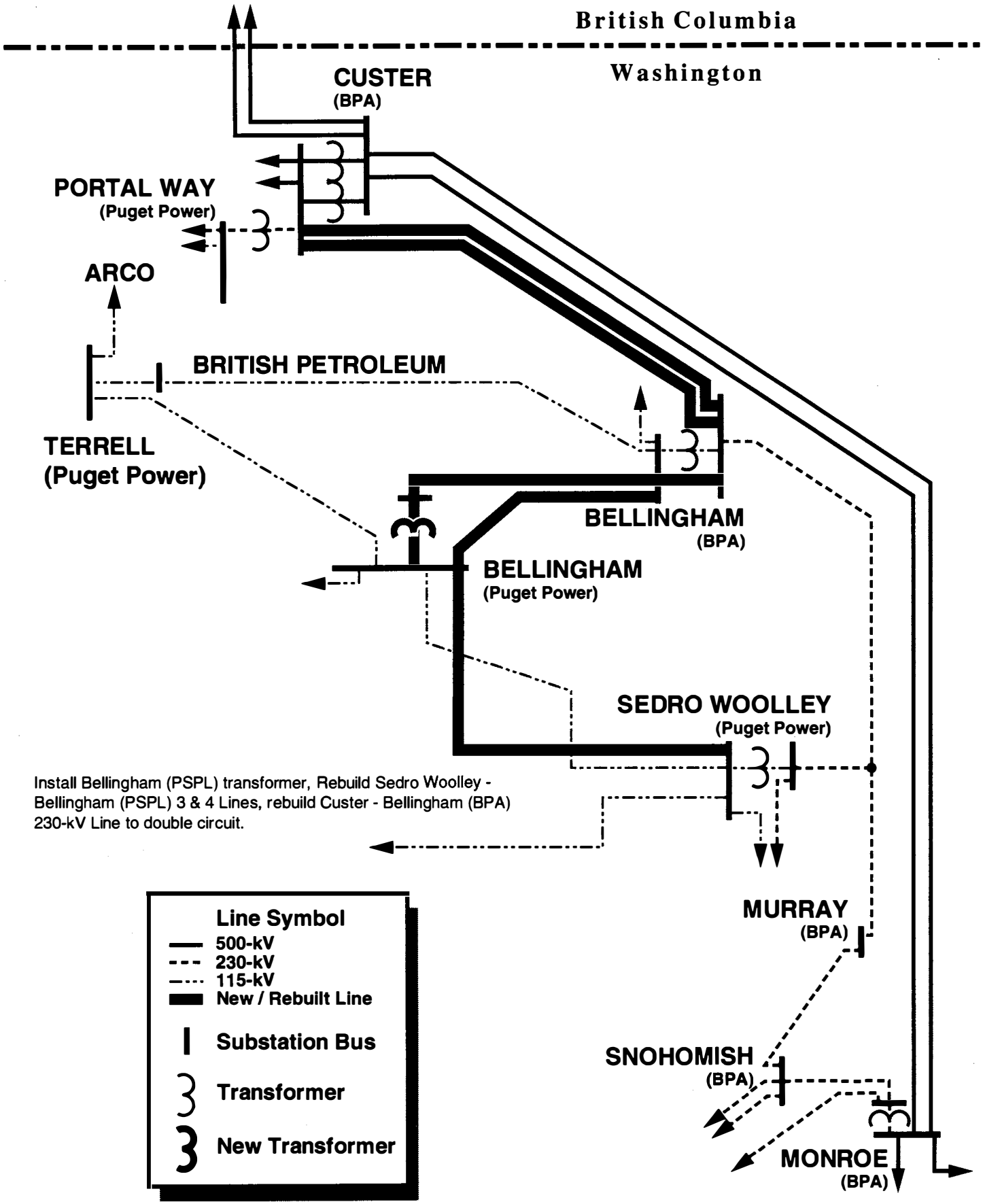
## 3. B2A PLAN (BPA/PUGET POWER)

Alternative electrical plan B2A, like Option 1 of the proposed plan, would include the Custer-BPA Bellingham line as rebuilt to 230 kV double circuit. However, the two plans differ between BPA's Bellingham Substation and Puget Power's Sedro Woolley Substation. Under Plan B2A, the following actions would take place:

- *BPA* would replace the Custer-BPA Bellingham single-circuit 230-kV line with a double-circuit 230-kV line.

- *Puget Power* would build a 230-kV single-circuit line between BPA's Bellingham and Puget Power's Bellingham Substations, connected to a new 230/115-kV transformer at Puget Power's Bellingham Substation.

- *Puget Power* would rebuild portions of its Sedro Woolley-Bellingham #3&4 115-kV lines. This would provide a second 230-kV circuit between BPA's Bellingham Substation and Puget Power's Sedro Woolley Substation. (One 115-kV line would remain between Puget Power's Bellingham and Sedro Woolley substations.) (See Figure 14.)




Source: BPA/Puget Power N.W. Washington Transmission Project, Volume II - Technical Studies, October 1992.

***Figure 14***
***The B2A Plan***

## BACKGROUND

In August 1990, BPA and Puget Power announced that they had entered into an agreement to pursue this plan-of-service jointly. Puget Power asked the Department of Energy to suspend its Presidential Permit application process for a new Puget Power 230-kV Intertie with British Columbia (see first **Alternative Eliminated**). The new plan would use existing transmission corridors/lines to a great extent, but would retain much of Puget Power's plan for upgrading its facilities between the BPA Bellingham Substation and Puget Power's Bellingham and Sedro Woolley substations. The BPA/Puget Power agreement was based on the 1989/1990 technical review, which looked at ways to improve electrical service in Whatcom and northern Skagit Counties and increase power transfers between Canada and the United States.

However, the initiative, passed in November 1990, stated:

> "Except on land where such permits have already been granted or in those districts classified as industrial, no conditional use permit shall be granted for electric power transmission lines carrying more than 115,000 volts."

Because the Puget Power lines in the joint plan would be 230-kV and would not qualify for a conditional use permit under the revised ordinance, the proposed plan could not reasonably be pursued.

## THE NEW SITUATION

With the new restrictions, more technical studies were needed to evaluate, from an electrical standpoint, viable plans-of-service, including the B2A plan. The studies confirmed that the proposed plan (a variation of the B2A plan) could meet the already identified needs. Because the restrictive zoning now makes it unreasonable to pursue the B2A plan-of-service, that plan has not been examined in detail in this EIS.

## 4. CONSERVATION (BPA/PUGET POWER)

Conservation means using electricity more efficiently. Conservation typically reduces electricity use at all hours, and can reduce transmission requirements. Conservation programs traditionally are programs used to reduce annual energy consumption rather than just energy use during peak hours.

Examples of conservation measures in current residential programs are wall and ceiling insulation in homes, and installation of energy-efficient shower heads, appliances, and water heaters. For commercial programs, conservation measures improve the energy efficiency of heating, ventilation, and air conditioning systems, refrigeration systems, water heaters, and lighting in buildings.

For this project, there is no "conservation emphasis" alternative. Technical load flow studies have shown that a conservation alternative would not eliminate the need for this project. In fact, local load reductions would actually contribute to transmission system problems that could occur during periods of high local generation and north-to-south power transfers from Canada to the Pacific Northwest. However, conservation efforts in the areas of greatest demand for power, within and outside the Northwest, have an effect on PNW generation and acquisition of power from other regions. The effects of local conservation measures on local load problems and power transfer capacity are discussed below.

Local conservation measures would aggravate local outage overloads on the transmission system when increased amounts of power were transferred out of the area. Conservation would help only during periods of low local generation. However, this advantage may not be significant, since Puget Power plans to use this new generation as a "base load" resource which would be on-line most of the time.

Likewise, north-to-south transfer capacity from Canada to the Pacific Northwest would be adversely affected by local area conservation since the reduced local load would result in the transfer of more power through the area. These increased transmission system loadings would result in higher overloads during outage periods.

# CHAPTER 3
# AFFECTED ENVIRONMENT

***Resource maps corresponding to the AFFECTED ENVIRONMENT discussions are found at the end of the chapter.***

The project study area, which covers about 2100 square km (800 square mi.), lies primarily in Whatcom and Skagit Counties in the northwestern corner of the State of Washington. This area ranges from flat floodplains along the many creeks and rivers, to hills and mountains. The marine climate has helped establish fertile fields and forests which have contributed to the development of the region.

The power transfers that may result from this project could extend from the United States-Canada border south into the Pacific Southwest. In BPA's service area, the potential customers of the transfers are located on the west side of the Cascade Mountain Range.[11]

## A. BPA PORTION

### 1. LAND USE [BPA]

Land along the existing transmission corridor is used predominantly for agriculture and forestry, but other uses (including residential) occur in both rural and urban areas.

Skagit and Whatcom Counties and the City of Bellingham have adopted comprehensive land use plans. Each is currently revising its plans to ensure consistency with Washington's Growth Management Act. In Whatcom County, the proposed project crosses land covered by five different subarea plans: Lynden Nooksack Valley, Cherry Point-Ferndale, South Fork Valley, Lake Whatcom, and the Urban Fringe. In Bellingham, the Puget Power part of the project crosses an area covered by four neighborhood plans: Alabama Hill, Roosevelt, Silver Beach, and Mount Baker.

[11] This is because the transmission facilities crossing the Cascades are currently being used near the limits of existing capacity.

Plans from the three jurisdictions have common characteristics such as encouraging development of a compact urban growth form, preserving natural resources, and protecting water resources including floodplains and wetlands.

## 2. SOILS [BPA]

The study area is predominantly within the Puget Sound Basin. The area is characterized by a variety of landforms, including floodplains, glacial and post-glacial ***fluvial*** and marine terraces, rolling uplands and steep mountains. Three major rivers (the Nooksack, Samish, and Skagit) drain the area from east to west. Bedrock geology is complex, and varies in terms of origin, age, and rock sequence. Folding of older ***sedimentary*** rocks is complicated by the more recent uplift of the Cascade Range. Scoured by past ***glaciation***, bedrock occurs near the surface in the mountainous areas, influencing soil development and vegetation type and vigor.

The area's relatively recent glacial history has been the most influential factor in shaping the area's topography and providing parent material for soil development. The Puget Lowlands were invaded by continental ice sheets at least four times during the Pleistocene Epoch. Sediments deposited by glacial meltwaters cover much of the low-level elevation areas. These materials are well-sorted, and contain significant amounts of sand and gravel. Glacial ***drift*** consisting of pebbly silty clay of low ***permeability*** underlies much of the rolling uplands. Glacially scoured steep mountainous areas are often covered with a thin layer of glacial ***till*** and ***colluvium***. Soils on the steep mountain slopes near Lake Whatcom are highly susceptible to erosion when vegetative cover is removed. ***Debris torrents*** are also a concern.

Thin layers of volcanic ash from Cascade volcanoes occur as a distinct surface layer or have been incorporated into area soils. The youngest soil-parent materials are recent ***alluvial*** deposits along floodplains. Extensive areas of soils developed in these deposits occur along the Nooksack, Samish, and Skagit Rivers.

## 3. VEGETATION [BPA]

Before settlement and the subsequent forestry and agricultural practices in the late 1800's, the area was predominately a ***coniferous*** forest, with western hemlock and western red cedar. Today, three broad vegetative plant communities have been identified within the project study area: 1) forest plant communities; 2) fields, disturbed areas, and residential plant communities; and 3) aquatic and wetland plant communities.

Much of the area has been and continues to be owned by private timber companies and the State of Washington for timber-growing and harvesting purposes. As a result, second- and third-growth forests are dominated by Douglas fir, the most commercially significant tree species in the area. Douglas fir is a natural successional species; it has been augmented by reforestation practices. Other coniferous, or evergreen, tree species are also represented in the area. Shade-tolerant Western hemlock is found in the understory of Douglas fir. At higher elevations, silver and grand firs occur sparingly, in small clusters, and in association with Douglas fir. In local areas of wet, swampy lowland areas, western red cedar dominates Douglas fir.

Deciduous trees associated here with conifers include red alder, bigleaf maple, black cottonwood, western paper birch, willow, and cherry. Red alder predominates as a pioneer species on logged, burned, or otherwise cleared and abandoned lands. Birches, willows, and cottonwoods are common beside streams and lakes in low, moist areas.

A variety of understory shrubs and herbaceous plants is typically found in coniferous and deciduous forests. Predominant shrubs and herbs of moderately moist, or ***mesic***, forest plant communities include Pacific dogwood, vine maple, Oregon grape, salal, red huckleberry, red elderberry, wild rose, snowberry, trailing blackberry, twinflower, bedstraw, starflower, pyrola, sword fern, bracken fern, youth-on-age, yellow violet, miners lettuce, and trillium. Common shrubs and herbs of very moist, or ***hydric***, forest plant communities include Devils club, vine maple, salmonberry, various members of the huckleberry family, lady fern, deer fern, wild ginger, vanilla leaf, Solomon's plume, and stinging nettle.

Fields and residential plant communities are dominated by common cultivars and popular landscape varieties. Cultivated crops are mainly row (corn, wheat, rye, peas, carrots, berries, bush beans, and potatoes) or hay and pasture crops (bent grass, wheat grass, orchard grass,

rye grass, clover, plantain, and meadow buttercup). In all areas used for intensive human purposes (such as fields, pasture, residential areas, and power-line rights-of-way), there is a tendency for "weedy" species such as thistle, chickweed, mustards, tansy ragwort, common mullein, fireweed, and Himalayan blackberry to invade. These and successional growth vegetation are mechanically controlled for a variety of reasons such as "unsightliness," interference with cultivation, or hazard to electrical transmission.

Aquatic and wetland plant communities, including shallow open-water areas of lakes and ponds, marshes, bogs, and other wetlands, occur at several locations throughout the area. These areas typically support relatively low-growing plant species. Shallow open-water areas support pondweed, milfoil, pond lilies, and duckweed, whereas cattail, bulrushes, rushes, sedges, skunk cabbage, marsh cinquefoil, reed-canary grass, Douglas spiraea, and dwarf birch typically dominate the plant life around lakes, ponds, bogs, swamps, and other wetlands.

## 4. WATER RESOURCES [BPA]

The transmission line route passes by two lakes (Lake Whatcom and Mirror Lake), and crosses two rivers (Nooksack River and Samish River) and about 17 creeks. Most of the creeks and rivers run through pasture lands with little-to-no slope on either side. The area along Whatcom Lake and Mirror Lake is more mountainous and tree-covered. Three creeks (Carpenter, Olsen, and Smith) flow into Whatcom Lake. The Nooksack River, Samish River, Tenmile Creek, and Snoqualicum Creek are officially protected from hydropower development by the Pacific Northwest Electric Power and Conservation Planning Council.

About 16 km (10 mi.) of the line route crosses the Lake Whatcom watershed along the north shore of Whatcom Lake. The lake has various levels of development along its banks, and is used for recreation (fishing, boating, and swimming) and for drinking water.

The City of Bellingham draws water from the lake at its Whatcom Falls treatment plant, distributing finished water to residents of the city and selling it to several water districts in the county. The city also supplies water for industrial processes at the Georgia-Pacific Corporation mill. Georgia-Pacific is the largest user of water from the lake, consuming about five times the average municipal demand (Institute for Watershed Studies, 1987). Water District 10 draws water from the lake near Sudden Valley, serving most of the residents of the

watershed outside of the City. Both water suppliers' water treatment includes filtration and chlorination (except for filtered-only water supplied to Georgia-Pacific). About 150 households draw water directly from the lake for drinking water (URS, 1986, cited Institute for Watershed Studies, 1987). In many of the homes, the water is untreated. The Whatcom Falls trout hatchery also draws water from the lake, returning the water to Whatcom Creek.

Non-point-source pollution in the lake due to timber harvesting and septic system leakage has been an ongoing concern in the area. However, the lake is considered to be ***oligiotrophic***: It contains a relatively low quantity of organic matter and is typified by small quantities of plant material, low nutrient concentrations, and high water column transparency (Washington Department of Ecology, 1992).

## 5. FLOODPLAINS [BPA]

The proposed project crosses the floodplains of the Nooksack and Samish Rivers and a portion of the Skagit River floodplain. Also crossed are the floodplains of several smaller creeks and a lake and a wetland: Tenmile Creek, Squalicum Creek, Carpenter Creek, Olsen Creek, and Mirror Lake.

## 6. WETLANDS [BPA]

Wetlands are encountered along the existing corridor and within the property boundaries of BPA's Custer and Bellingham Substations. Most of the wetlands in the corridor are farmed and are seasonally dry. Some of the larger, permanently inundated or saturated wetlands that occur within the corridor are at Cranberry Lake, marshes within the floodplain of the Samish River, the riparian edges of the outlet of Mirror Lake, and wetlands that are within the floodplain of the Nooksack River. Most wetlands are either seasonally dry ***palustrine*** types, with vegetation that is adapted to periodic inundation or saturation, or ***riverine*** types with adjacent vegetation adapted to periodic flooding.

## 7. FISH AND WILDLIFE [BPA]

The study area encompasses diverse habitats which support a wide variety of fish and wildlife species. Habitat conditions (the kind and amount of food, cover, and water) are the prime determinants of wildlife abundance, both in the number of species and the number of individuals. About 500 fish and wildlife species are known to occur west of the crest of the Cascade Range.

*Forest wildlife habitats* consist of areas dominated by coniferous and/or deciduous tree cover, and associated forest understory vegetation. Typical mammals include elk, black-tailed deer, black bear, cougar, bobcat, coyote, red fox, Douglas' squirrel, northern flying squirrel, Townsend's chipmunk, and mountain beaver. Common birds include ruffed grouse, hawks, owls, ravens, jays, woodpeckers, towhees, and finches. Forest amphibians and reptiles include newts, salamanders, western toads, and Pacific treefrogs.

*Riparian wildlife habitats* occur along rivers, streams, lakes, reservoirs, ponds, and springs. These zones are transitional between aquatic and upland zones. Mammals include black-tailed deer, coyote, red fox, beaver, river otter, mink, raccoon, opossum, and bushy-tailed woodrats. Common riparian birds include bald eagles, hawks, owls, kingbirds, swallows, robins, black-headed grosbeaks, juncos, bushtits, and starlings. Riparian reptiles and amphibians include northern alligator lizards, racer snakes, garter snakes, salamanders, rough-skinned newts, western toads, and several species of frogs.

*Habitats for open-land wildlife* consists of cropland, pasture, meadows, and areas overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, berries, browse, and wild herbaceous plants. Winter cover crops and grain stubble fields also provide winter feeding areas for many wildlife species. Shrub and thicket habitats are mostly areas which have been recently logged or have been cleared for other human uses such as agriculture and power-line rights-of-way. Typical mammals include black-tailed deer, coyote, red fox, skunk, snowshoe hare, cottontail rabbit, and deer mice. Birds commonly observed in open-land habitats include California quail, ring-necked pheasant, red-tailed hawk, great-horned owl, crows, meadowlarks, goldfinches, swallows, wrens, blackbirds, brown-headed cowbirds, sparrows, starlings.

*Wetland habitats* are permanently or intermittently flooded, and include such areas as freshwater marshes, swamps, bogs, seeps, wet meadows, and shallow ponds and lakes. Some of the wildlife attracted to such areas include beaver, muskrat, mink, raccoon, bald eagle, osprey, marsh hawk, ducks, geese, coots, rails, herons, kingfishers, snipe, sandpipers, plovers, killdeer, swallows, common yellowthroat, painted turtle, garter snake, newts, salamanders, toads, and several species of frogs. The project is located within the boundaries of the Pacific flyway, an area of ecological importance for migratory waterfowl.

Fisheries resources located within the project study area are important for commercial, recreational, and ecological reasons. The Nooksack, Skagit, and Samish Rivers are important migration routes for several species of salmon and sea-run trout. Gravel-bedded tributaries of the river, fed by glaciers, provide vital spawning and rearing habitats for king, silver, sockeye, pink, and chum salmon, along with steelhead and cutthroat trout, Dolly Varden char, and mountain whitefish. Many glacially formed lakes are also located within the project area. Lake Whatcom hosts a variety of fish, including cutthroat and rainbow trout, Kokanee, bass, perch, chubs, and suckers. Mirror Lake contains stocked cutthroat and rainbow trout, as well as chubs and suckers.

The bald eagle and Marbled Murrelet are Federally protected species and classified as "Threatened." There is one bald eagle nesting territory near the northeast shore of Lake Whatcom, and two documented communal night roosts near the Samish River. Wintering bald eagles are commonly sighted along the Samish River and Innis Creek near Wickersham. The eagles gather in the area from November to March to feed on salmon in the Nooksack River. (See **Appendix E, BIOLOGICAL ASSESSMENT**.)

The Nooksack elk herd, located east of the project area, numbers less than 1,000 animals. The range of the elk (about 1800 ha or 4500 ac.) includes the area about 13 km (8 mi.) south of the Whatcom/Skagit County border, and as far north as the North Fork of the Nooksack River. The range is bounded by the Sultan and Anderson Mountains to the west of Highway 9. Their winter range includes the Larsen's Bridge and Dye's Ranch areas, and their summer range includes the areas around Daley Prairie and Cavanaugh Creek, all primarily in the northern Skagit County area

## 8. AGRICULTURE [BPA]

Agricultural and forest products are two of the main contributors to the economies of Skagit and Whatcom Counties. The mild marine climate and fertile soils of the low-elevation floodplains and terraces support high crop yields and a productive dairy industry. Many of these soils have been designated as Prime farmlands by the Soil Conservation Service (SCS). The importance of the dairy industry is reflected by the extensive acreage in hay and pasture. Other principal crops include small grains, vegetables, and small fruits. The frost-free growing season is about 150 days, and the mean annual precipitation about 91 cm (36 in.) near Bellingham. Most of the annual precipitation occurs from October through March. During the summer, precipitation is low, and crops require irrigation for active growth. The uplands and mountains receive greater precipitation than the lowlands, and support timber production for the forest products industries.

## 9. VISUAL RESOURCES [BPA]

The project area contains all the mountains, forests, streams, and farmlands typical of other areas in the Pacific Northwest. In addition, it includes a rich diversity of geographic features, giving it a unique visual character. It is bordered to the west by saltwater coves of Puget Sound, to the east by Mt. Baker and the Cascade Mountains. Visual elements range from urban centers, rural residential areas, and farms, to dense forestlands, narrow valleys, lakes and rivers. The highly developed area around Bellingham becomes less dense but is still relatively populated at the fringes. Many small farms and rural residential areas dot the outlying areas. Farther east, the terrain becomes more mountainous and heavily forested. Whatcom Lake is a popular recreation area; many new homes are being built around it. The Nooksack River valley is narrow and picturesque, containing many small farms, open pastures, and woodlots. The Skagit River valley is broader, also containing many small farms and the town of Sedro Woolley. Portions of several state highways are listed on Washington State's inventory of scenic roads and highways.

## 10. RECREATION [BPA]

Recreation opportunities in and around the Bellingham and Sedro Woolley area are numerous and diverse. They include dispersed activities such as bicycling, hiking, fishing, and water-oriented sports on Lake Whatcom. Developed recreation sites include parks, picnic areas, and a golf course.

## 11. CULTURAL RESOURCES [BPA]

Cultural resources information was collected for a 1.6-km-wide (1-mi-wide) area centering on the existing BPA right-of-way. The focus of background research was a compilation of previously recorded sites. Generally, resources in the potentially affected area comprise historic trails, historic communities (e.g., Wickersham in Skagit County), and homesteads. These are fairly well distributed between Custer and Sedro Woolley, with homesteads mostly in Skagit County. Native American trails and villages are also found in the lower portion of the area. No cultural resources eligible for or on the National Register of Historic Places would be affected by the project. Particular cultural resources known and their sensitivity rank are presented in **Chapter 4, Environmental Consequences.**

## 12. SOCIAL AND ECONOMIC CONSIDERATIONS [BPA]

The northwestern corner of the State of Washington is largely rural. Just 4 percent of the State's population resides in these two counties, and almost half (44 percent) of those residents reside in rural areas (versus just 24 % for the State as a whole). Agriculture contributes a large share to the area's economy, with dairying and poultry raising being major contributors. Small grains, vegetables, fruits, and berries are among the principal crops of the area.

Other major contributors to the area's economy are:

- A strong retail base (particularly convenience goods and nondurable items) and tourism, as the area is close to Canada;

- Natural resources processing, especially those industries unique to the Pacific Northwest, such as food processing, lumber and wood products, aluminum production, and, to a lesser degree, oil refining and steel production; and
- Wholesale trade and services.

While important to the area's economy, natural resources processing has declined in relative importance to the local economy since the early 1970's. Most of the increase in employment in the area since that time has been in retail and wholesale trade and within the service sector. This has contributed to the relatively low per-capita income levels in the area.

The most recent available United States Census data reveals that the 1989 per-capita income for Whatcom and Skagit Counties was 8 percent lower than the statewide per-capita income ($13,778 compared to $14,923). Skagit County fared slightly better than Whatcom County in 1989 ($13,804 vs $13,753). This level of per-capita income is not unexpected, given the relatively sparse population of the area and the low wage rates typically paid in the trade and service sectors. Per-capita income is generally higher in counties with larger populations. King County, for example, has the largest population in the State and also the highest per-capita income, except for San Juan County in Puget Sound (which has a relatively high per-capita income due to the high percentage of comfortably retired people who live there).

## 13. AIR QUALITY [BPA]

Most of the winds in the area come from the south-southeast, with a good portion coming from the northeast. A changing jet stream during the third quarter of the year, however, shifts winds so that they are predominately from the west. Temperatures in the Bellingham area are generally moderate, with winter lows at slightly less than freezing and summer highs in the 70's and 80's (F). Precipitation during summer months ranges from 2.9 cm (1.2 in.) in July to 5.5 cm (2.2 in.) in September. Moisture-laden winter storms from the southwest occasionally strike the area and cause severe local flooding. Daytime relative humidity during the construction season ranges between 60 and 70 percent. Whatcom County is characterized as being in attainment under the pollutants criteria identified in the National Ambient Air Quality Standards, as monitored by the Northwest Air Pollution Authority.

## 14. HEALTH AND SAFETY [BPA]

The BPA portion of the Bellingham project encompasses 61 km (38 mi.) of transmission line from BPA's Custer Substation to Sedro Woolley. All of the project is on existing transmission right of way, with the exception of **SEGMENT H1** (about 5.6 km or 3.5 mi.). The first 14 km (9 mi.) of the line from Custer Substation to the town of Bellingham are largely rural. The last portion of the proposed project, from Bellingham to Sedro Woolley, includes areas consisting of farms, rural development, and suburbs.

# B. PUGET POWER'S PORTION

## 1. LAND USE [Puget Power]

The Puget Power Bellingham Substation and the BPA-Bellingham #2 115-kV transmission line are within the Roosevelt and/or Mount Baker planning area of the Bellingham Comprehensive Plan. Within the County, the transmission line passes through the urban fringe area of the Whatcom County Comprehensive Plan.

The zoning for the substation and transmission line is shown in Figure 15. The substation is located in an area that is zoned *Industrial.* The transmission line leaves the substation on Virginia Street to Pacific Street, passing next to an area zoned *Public.* This area is used as a center for the City of Bellingham Public Works Department and Whatcom Transportation Authority.

At the intersection of Virginia and Pacific Streets, the transmission line turns north to North Street and east on North Street to St. Clair Street. At this point the transmission line runs north to Sunset Drive. The transmission line passes through areas which are zoned *Residential Multi* and *Residential Single,* to the City of Bellingham Railroad Trail (old railroad right-of-way which crosses the St. Clair unimproved road right-of-way), where lands are zoned *Industrial* to another *Residential Single* zone abutting Sunset Drive. At the City/County boundary, the transmission line passes into an area zoned *Urban Residential* and then *Rural* near the BPA-Bellingham Substation.

Development of the property next to the Puget Power Bellingham Substation is predominantly industrial. Along Virginia Street, land uses include industrial yards, lumberyards, and maintenance buildings for the City of Bellingham Public Works Department and Whatcom Transportation Authority. Single-family residences and a few apartments are next to the transmission line along most of Pacific Street.

Residential neighborhoods exist along both sides of North Street and St. Clair Street. Portions of St. Clair Street are improved. Beyond the improved portions of St. Clair Street, the road is graveled and gated to prevent the public from driving to an existing trail maintained by the City Parks and Recreation Department.

North of the trail, the land is being developed for industrial/commercial uses; much of this area is undeveloped. The St. Clair Street right-of-way is a multi-use utility corridor. In addition to the BPA-Bellingham #2 transmission line, this street right-of-way is occupied by the Trans Mountain Oil petroleum pipeline, which provides service between the United States and Canada. Within the City of Bellingham a new road, Barkley Boulevard, is under construction. Ir runs perpendicular to the St. Clair transmission line, petroleum pipeline, and St. Clair Street right-of-way.

Zoning along the "pipeline alternative" is *Residential Single*, followed by *Industrial* within the City limits. Once it reaches the City/County boundary the transmission line runs next to the *General Manufacturing* and *Urban Residential County* Zones.

The new 115-kV transmission lines would pass through an area designated by the Whatcom County Comprehensive Plan as *Rural*, Subarea designation *Urban Fringe*. The proposed facilities lie within areas zoned either *Urban Residential* or *Rural*.

## 2. SOILS [Puget Power]

Landforms of the area are the result of several Ice-Age glaciations, the action of streams and rivers, and wind deposition. Elevations along Puget Power's segment of the project range from about 18 to 61 m (60 to 200 ft.). Dominant soils have formed in volcanic ash and loess (silty material deposited by wind) laid over materials deposited by glacial ice in seawater (***glaciomarine drift***) and uplands (glacial drift). These soils are nearly level to very steep and

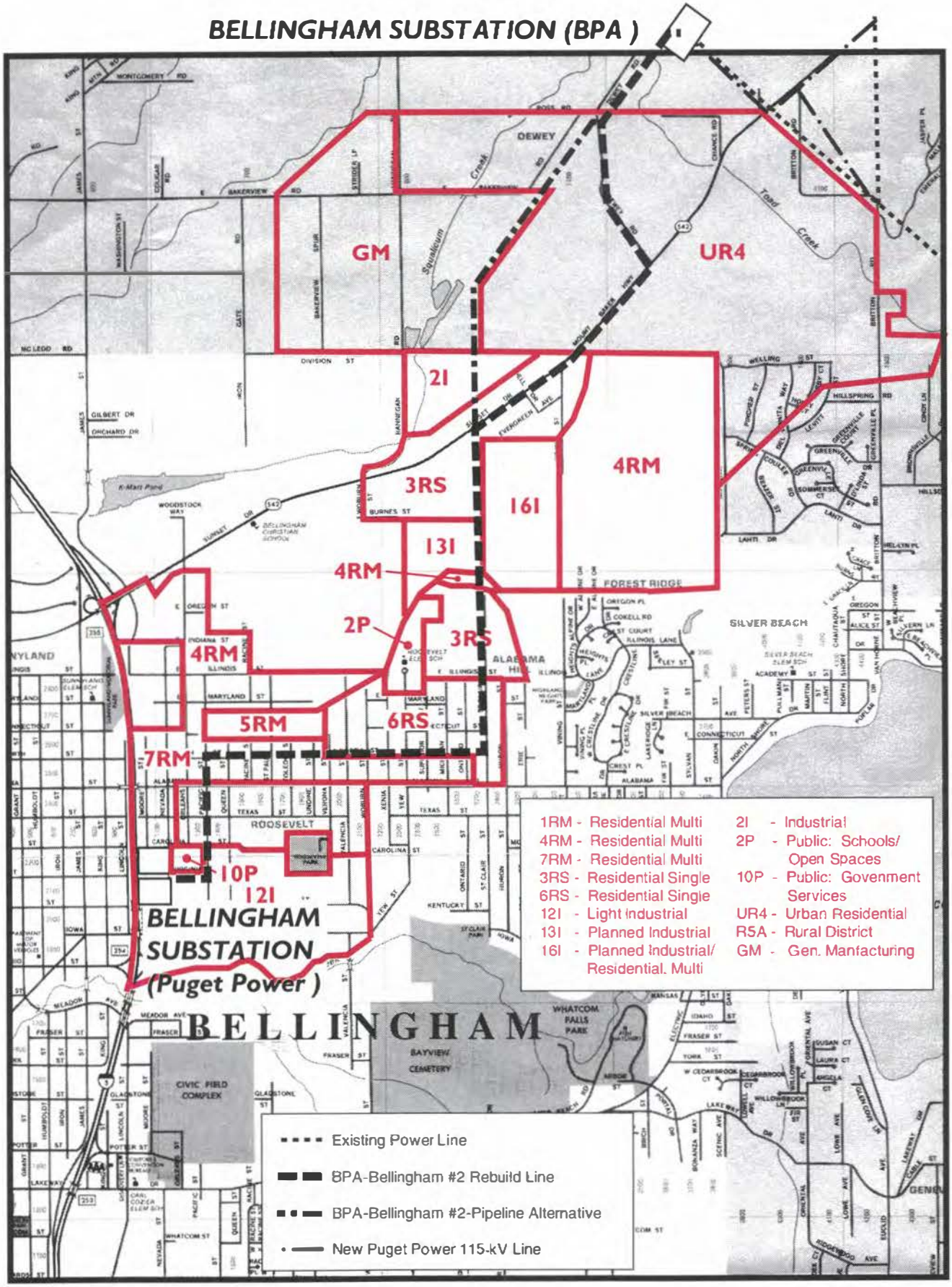



**Figure 15**
**City of Bellingham and Whatcom County Land Use Zoning**

moderately well drained to poorly drained. Other soils encountered by the project have developed in a mix of volcanic ash, loess, and materials deposited within glacial lakes. These soils occur in depressions on terraces and are often poorly drained (USDA-SCS, 1992). In general, soils along Puget Power's segment of the project are suited for the proposed use. Soil limitations include seasonal soil wetness, which increases the soil's susceptibility to rutting and excessive muddiness, and a steep slope near Squalicum Creek.

## 3. VEGETATION [Puget Power]

Most of Puget Power's proposed activities would occur within the Bellingham City Limits. Human activities such as industrial/commercial and residential development, and public rights-of-way dominate the area. Typically, these areas are fenced with structures, landscaped, and maintained as lawns. In all areas used for intensive human purposes, there is a tendency for "weedy" species such as thistle, chickweed, mustards, tansy ragwort, common mullein, fireweed, and Himalayan blackberry to invade. Lawns and ornamental trees and shrubs are also well-established in landscape plans and residential areas. Continuing beyond the Bellingham City Limits, industrial, commercial, and residential developments occur less frequently, and are interspersed with open woodlands and wetland plant communities (forested, scrub-shrub, and emergent, and pasture).

Woodland plant communities are dominated by several tree species, including Douglas fir, big-leafed maple, and western red cedar; understory shrubs and forbs include vine maple, red elderberry, sword fern, bracken fern, and piggy-back plant. Forested wetland plant communities are usually dominated by red alder, black cottonwood, western red cedar, paper birch, salmonberry, lady fern, and skunk cabbage. Douglas spiraea and dwarf birch often dominate scrub-shrub wetlands, while reed canary grass, small-fruit bulrush, sedges, and cattails commonly occur in emergent wetlands. Pasture lands are typically dominated by bent grass, wheat grass, orchard grass, rye grass, clover, plantain, and meadow buttercup.

## 4. WATER RESOURCES AND WETLANDS [Puget Power]

The BPA-Bellingham #2 115-kV transmission line crosses Fever Creek twice. A wetland is mapped to the south of the Sunset Drive intersection. Near the intersection of East Bakerview Road and the Dewey Road, the transmission line right-of-way crosses Toad Creek.

The City of Bellingham has mapped a wetland just north of Sunset Drive along the Trans Mountain Oil Pipeline right-of-way. Two National Wetland Inventory (NWI) wetlands extend from the base of a steep slope along the Trans Mountain Oil Pipeline to and adjacent with the abandoned Milwaukee Road grade. The NWI identifies wetlands in the area adjacent to but below the railroad grade.

Most stream and wetland concerns along the proposed new 115-kV facilities routes occur next to the BPA transmission line corridor. The BPA right-of-way extending from the BPA's Bellingham Substation to Mt. Baker Highway is comprised of grassy fields and wetlands, and is bounded on each side by forest. Figure 16 shows the approximate locations of the potential wetlands.

A small running stream drains from the northeasterly hill above the BPA Bellingham Substation and joins with a headwater wetland to cross the BPA corridor and join an unnamed tributary to Squalicum Creek. Along the center of the BPA right-of-way, an access road extends from Mt. Baker Highway. Drainage occurs along the road in the BPA right-of-way, and a small stream extends from the road and heads toward the west side of the right-of-way.

Another wetland was observed on the east side of right-of-way. The west side of the right-of-way has a large section of wetlands.

## 5. FISH AND WILDLIFE [Puget Power]

Fisheries resources in the Puget Power project area are largely limited to Toad Creek and an unnamed tributary of Squalicum Creek. The Washington Department of Wildlife has identified critical spawning habitats located in Toad Creek. Both Toad Creek and the unnamed tributary flow directly into Squalicum Creek about 0.8 km (0.5 mi.) from the proposed project. Critical spawning habitats and ***anadromous*** fisheries are present in

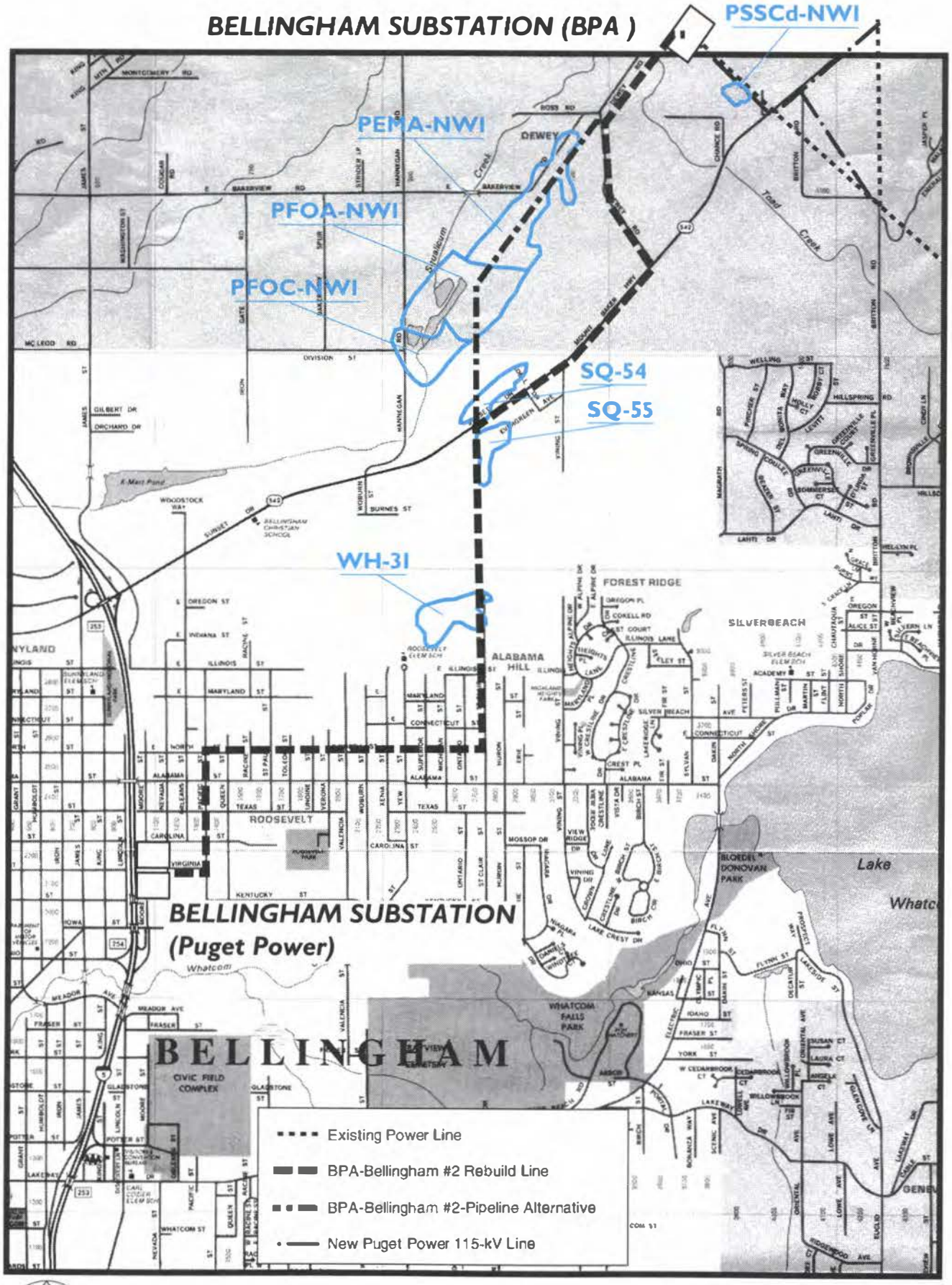



**Figure 16**
**Puget Power: Potential Wetlands**

Squalicum Creek. Fever Creek is also located in the proposed project study area, although its significance for fisheries is limited.

Wildlife species located in the proposed project study area include those species which typically do well in close proximity to humans. Wildlife species associated with forest habitats include raccoon, opossum, striped skunk, Douglas' squirrel, northern flying squirrel, Townsend's chipmunk, ravens, jays, woodpeckers, towhees, finches, robins, black-headed grosbeaks, juncos, bushtits, and starlings. Forest amphibians and reptiles include rough-skinned newts, salamanders, western toads, and Pacific treefrogs. Some of the wildlife attracted to wetland habitats include raccoon, ducks, herons, snipe, sandpipers, plovers, killdeer, swallows, common yellowthroat, painted turtle, garter snake, newts, salamanders, toads, and several species of frogs. Areas that are overgrown with grasses, herbs, shrubs, and vines attract wildlife species such as the red fox, striped skunk, cottontail rabbit, deer mouse, California quail, red-tailed hawk, crows, meadowlarks, goldfinches, swallows, blackbirds, brown-headed cowbirds, sparrows, starlings.

## 6. AGRICULTURE [Puget Power]

Prime farmland, defined according to the criteria of the Farmland Protection Policy Act (FPPA) (7 U.S.C. 4201 *et. seq.*), was identified from the USDA-SCS soil surveys of the Whatcom County and Skagit County areas. Lands currently in agricultural use were identified and mapped from information interpreted from May 1992 aerial photography and field verification. Current agricultural use is limited to areas of small pasture in the Puget Power project area. Distribution of zoned agricultural land is shown on Figure 22. (Also see **Soils** under **BPA PORTION**).

## 7. VISUAL RESOURCES [Puget Power]

Much of the visual environment of the existing 6.9-km (4.3-mi.) 115-kV transmission line corridor between the Puget Power and BPA Bellingham Substations is characterized by residential development and undeveloped rural areas. Residential development is concentrated along the segment of the line from the Puget Power Bellingham Substation to the end of the improved portion of St. Clair Street and along Sunset Drive between St. Clair

Street and the Dewey Road. The remaining segments of the transmission corridor are predominately undeveloped and rural in nature, with only occasional residential structures located near the transmission right-of-way.

Views within many of the residential areas are dominated by housing structures and the linear features of the existing infrastructure, including paved roads and electrical and telephone utility service structures. The BPA-Bellingham #2 115-kV transmission line has been a part of the visual landscape since 1958.

Rural undeveloped property characterizes the visual elements of the alternative (pipeline) route.

## 8. RECREATION [Puget Power]

Recreation activities are generally limited to hiking, biking, and so on in the vicinity of St. Clair Street, where former railroad rights-of-way are in natural trail use. No other areas of notable recreation activity were identified.

## 9. CULTURAL RESOURCES [Puget Power]

As with the BPA portion of the project, the focus of background research was a compilation of previously recorded sites. Generally, resources in the potentially affected area comprise abandoned railroad rights-of-way and the communities of Dewey and Van Wyck. Also, at its southern end, the existing route of Puget Power's Bellingham #2 line passes through several historic additions to the City of Bellingham. To date, no historic properties within these additions or within 0.8 km (0.5 mi.) of the line have been nominated, or determined to be eligible for nomination to the National Register of Historic Places, State Register, or Whatcom County Register.

## 10. SOCIAL AND ECONOMIC CONSIDERATIONS [Puget Power]

The City of Bellingham is a relatively small urbanized area of about 58,000 persons, surrounded by such rural-agricultural activities as dairy farming, truck farms, and the growing of agricultural commodities such as seed potatoes, hay and corn. Whatcom County supports the largest dairy herd of any county in the Pacific Northwest (USDA, 1992).

The major factors that have influenced the City of Bellingham's economic growth and development over the years has primarily been (1) its location relative to Canada, the Puget Sound and Pacific Rim, and to I-5, one of the principal north-south interstate highways in the western U.S.; and (2) the diverse agricultural industry that exists across the western portions of Whatcom and Skagit Counties. Western Washington University has also been instrumental in Bellingham's development. Its presence, together with the in-migration of retirees, has contributed to the major component of population change in Whatcom County since 1940 (Property Counselors,1991). From 1960 to 1990 alone, two-thirds of the population growth county-wide has been due to in-migration (more people moving in than moving out). Much of this population has settled in the City of Bellingham itself. Bellingham is also the seat of county government in Whatcom County.

The county's largest employment sectors, by number of workers, for the second quarter of 1992 (most recent information available), was (1) retail trade with 14,800 workers; (2) services, with 12,200 workers, and (3) manufacturing with 8,200 workers. (Riber, 1992) Of the 56,000 people employed in Whatcom County during this period, 62 percent were involved in these three industries. Employment in retail trade and the services sector are unusually high, due principally to the City of Bellingham's relative location with respect to the Vancouver, British Columbia, metropolitan area and its 1.5 million residents, but also to tourism from south of the border. In addition, the City of Bellingham serves a large trade area in northwestern Washington State. Bellingham's relatively easy access to Canada increases its market for goods and services, particularly convenience goods.

The City of Bellingham's per-capita income lagged behind that for the State as a whole for 1989 (most recent information available), due principally to the lower wages typically paid in the retail and services sectors. While the county's retail and services sectors accounted for 48% of employment, the wages received amounted to only 34% of the personal income from total labor earnings. (Per-capita income is an estimate of total personal income divided by the

area's total population. It includes wages, rents, interest, dividends and all other legitimate sources of income.) For the year 1989, the most recent information available, Bellingham's per-capita income was $13,700, about nine percent less than the state's per-capita income for that same year. Average per-capita income for the State of Washington for 1989 amounted to $14,920. The county's per-capita income is expected to improve in the future, however, due to the increase in importance of non-labor sources of income, such as retirement payments, dividends, interest and rental incomes and transfer payments such as public and private retirement programs. (Property Counselors, 1991).

## 11. HEALTH AND SAFETY [Puget Power]

In the City of Bellingham itself (Puget Power's portion of the project), the proposed line addition would be located in primarily residential neighborhoods composed of both single family and multi-family residences.

# BPA/Puget Power NW Washington Transmission Project

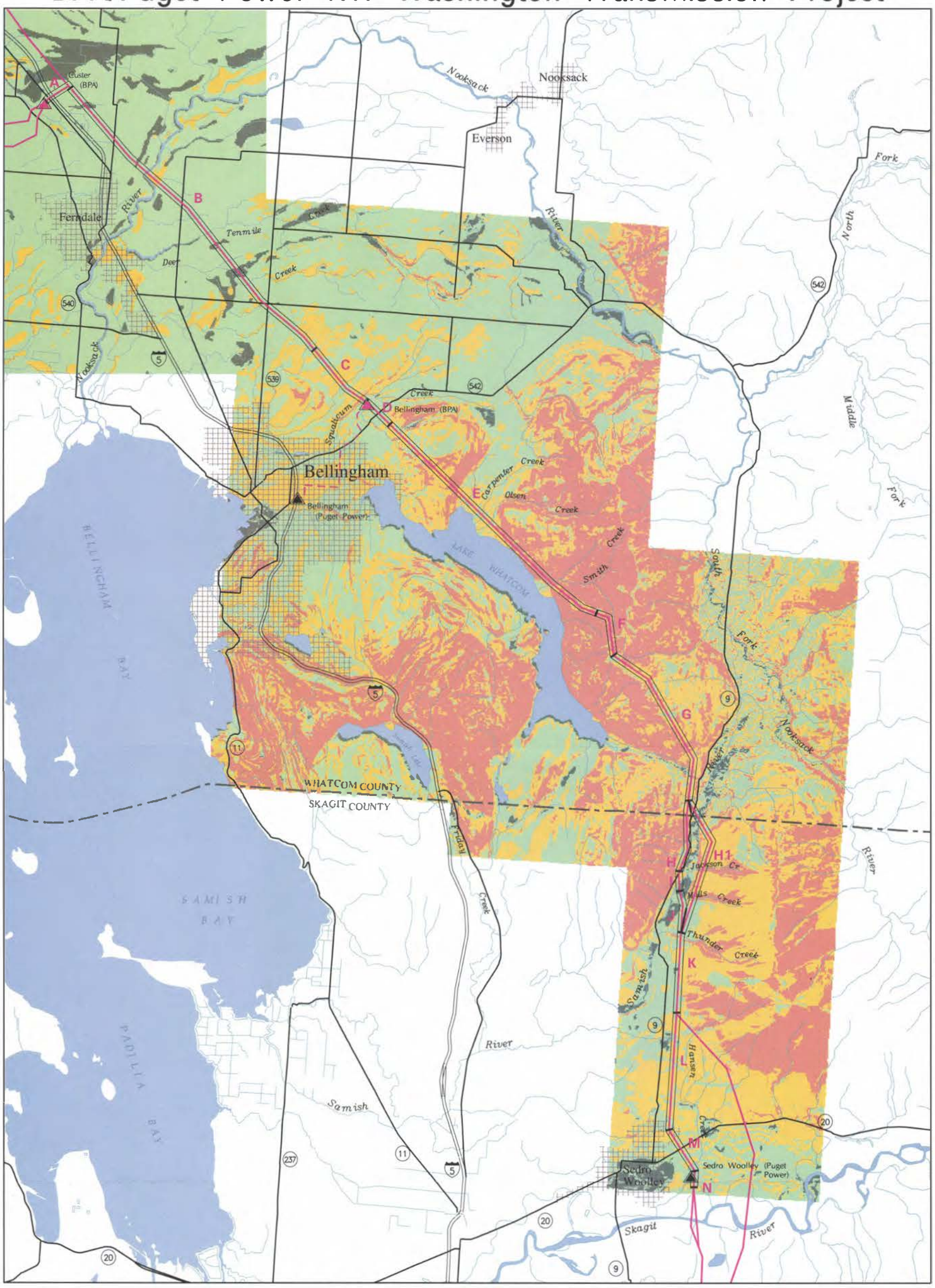



FIGURE 17 **SOIL REVEGETATION POTENTIAL**

## LEGEND

- BPA Transmission Line
- Puget Power Trans. Line
- BPA Substation
- Puget Power Substation
- Interstate Route
- State Route
- G Corridor Segment

N W E S

Scale 1:173,500

0 1 2 3 4 5 6 MILES

0 1 2 3 4 5 10 KILOMETERS

- Too variable to rate
- Good
- Moderate
- Poor

BPA Division of Facilities Engineering

# BPA/Puget Power NW Washington Transmission Project

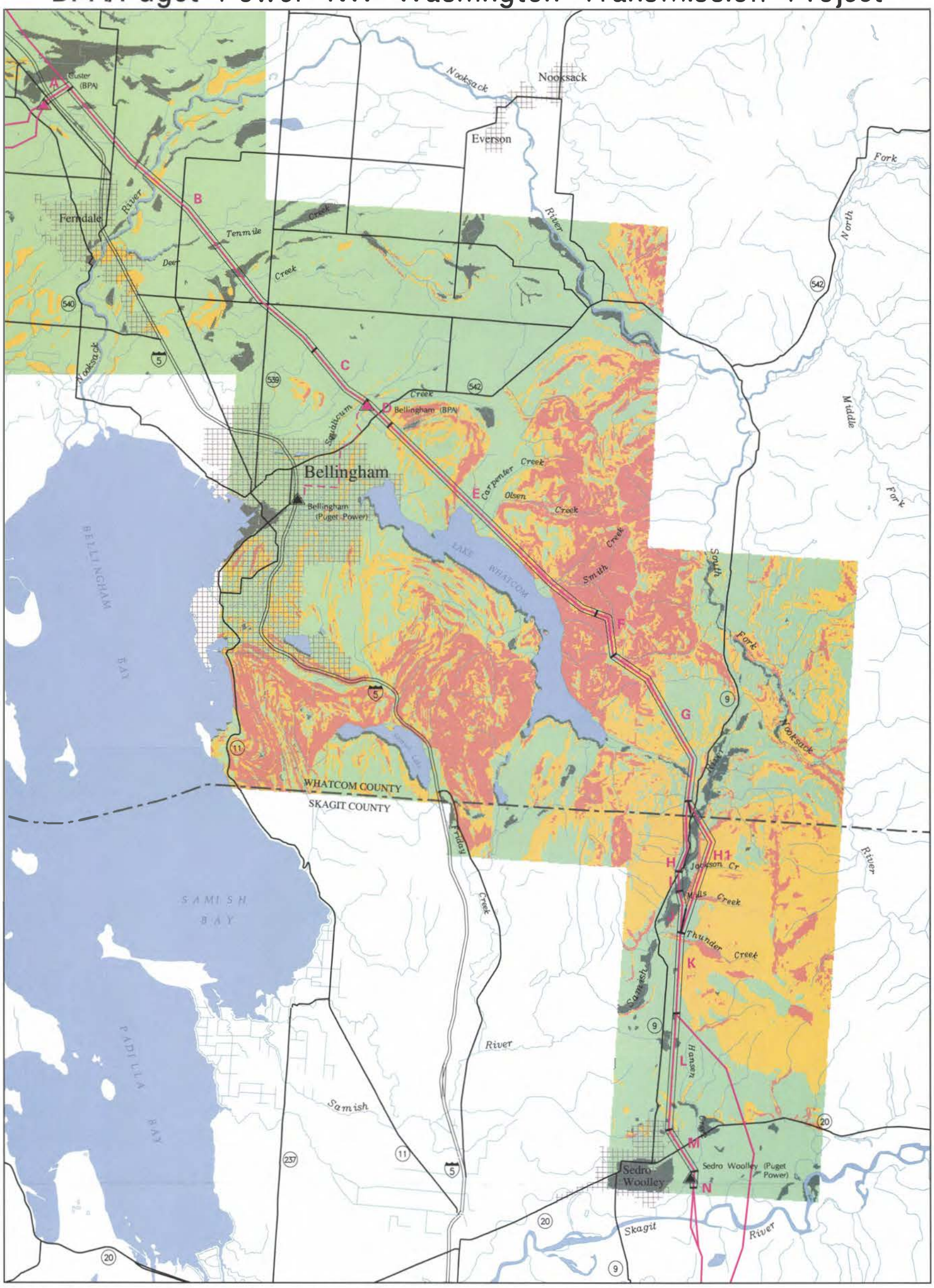



FIGURE 18 **SOIL EROSION SUSCEPTIBILITY**

## LEGEND

- BPA Transmission Line
- Puget Power Trans. Line
- BPA Substation
- Puget Power Substation
- Interstate Route
- State Route
- G Corridor Segment

N W E S

Scale 1:173,500

0 1 2 3 4 5 6 MILES

0 1 2 3 4 5 10 KILOMETERS

- Too variable to rate
- Slight
- Moderate
- High

BPA Division of Facilities Engineering

# BPA/Puget Power NW Washington Transmission Project

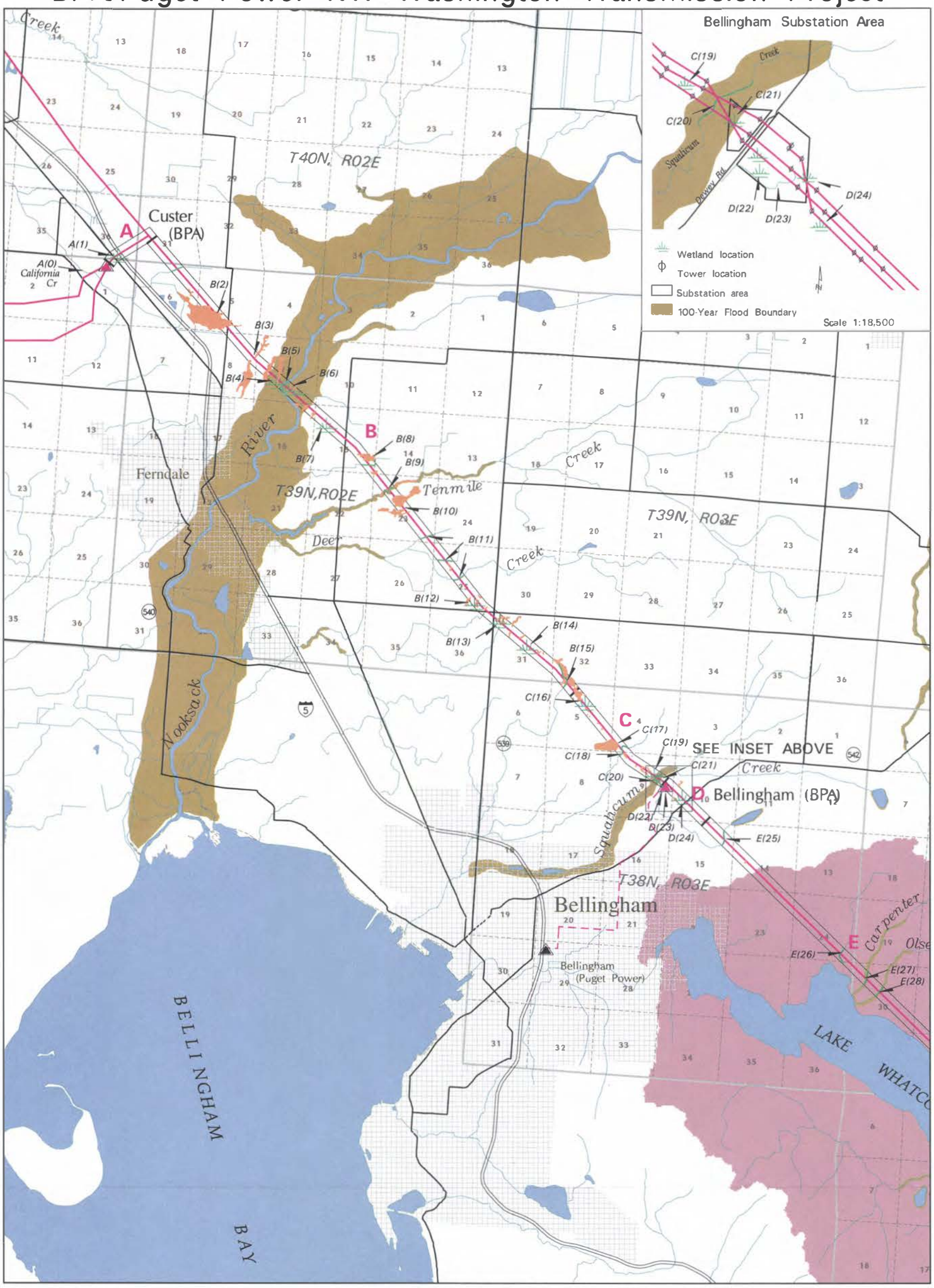



FIGURE 19A

## WATER RESOURCES

### LEGEND

- BPA Transmission Line
- Puget Power Trans. Line
- BPA Substation
- Puget Power Substation
- Interstate Route
- State Route
- Corridor Segment
- Surface Water Site
- Potential Wetland Location
- National Wetlands Inventory
- 100-Year Flood Boundary
- Lake Whatcom Watershed

SCALE 1:100000

KILOMETERS 0 1 2 3

MILES 0 1 2 3

BPA Division of Facilities Engineering

# BPA/Puget Power NW Washington Transmission Project

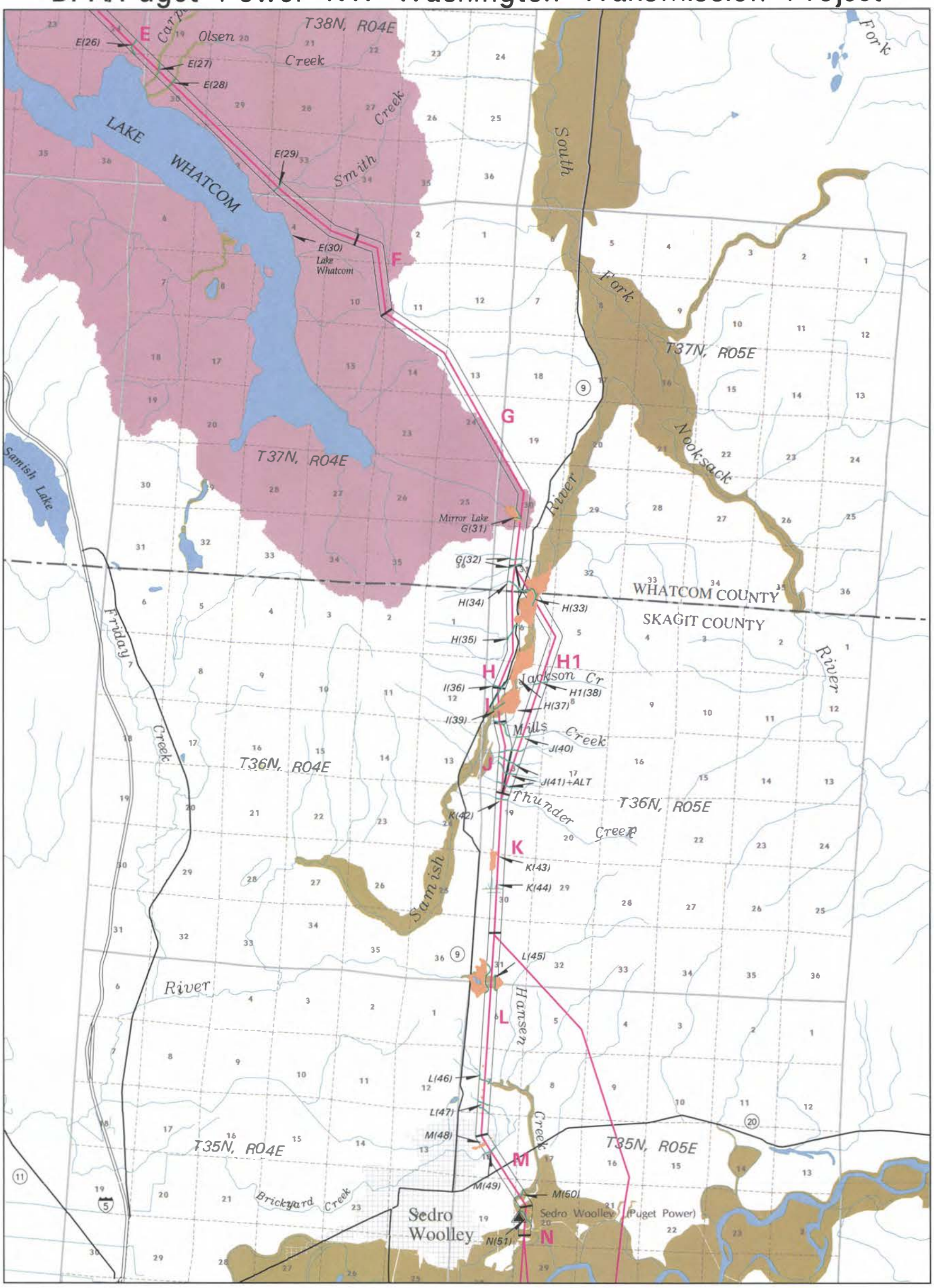



FIGURE 19B

## WATER RESOURCES

### LEGEND

- BPA Transmission Line
- Puget Power Substation
- Interstate Route
- State Route
- G Corridor Segment
- Surface Water Site
- Potential Wetland Location
- National Wetlands Inventory
- 100-Year Flood Boundary
- Lake Whatcom Watershed

SCALE 1:100000

KILOMETERS 0 1 2 3

MILES 0 1 2 3

BPA Division of Facilities Engineering

# BPA/Puget Power NW Washington Transmission Project

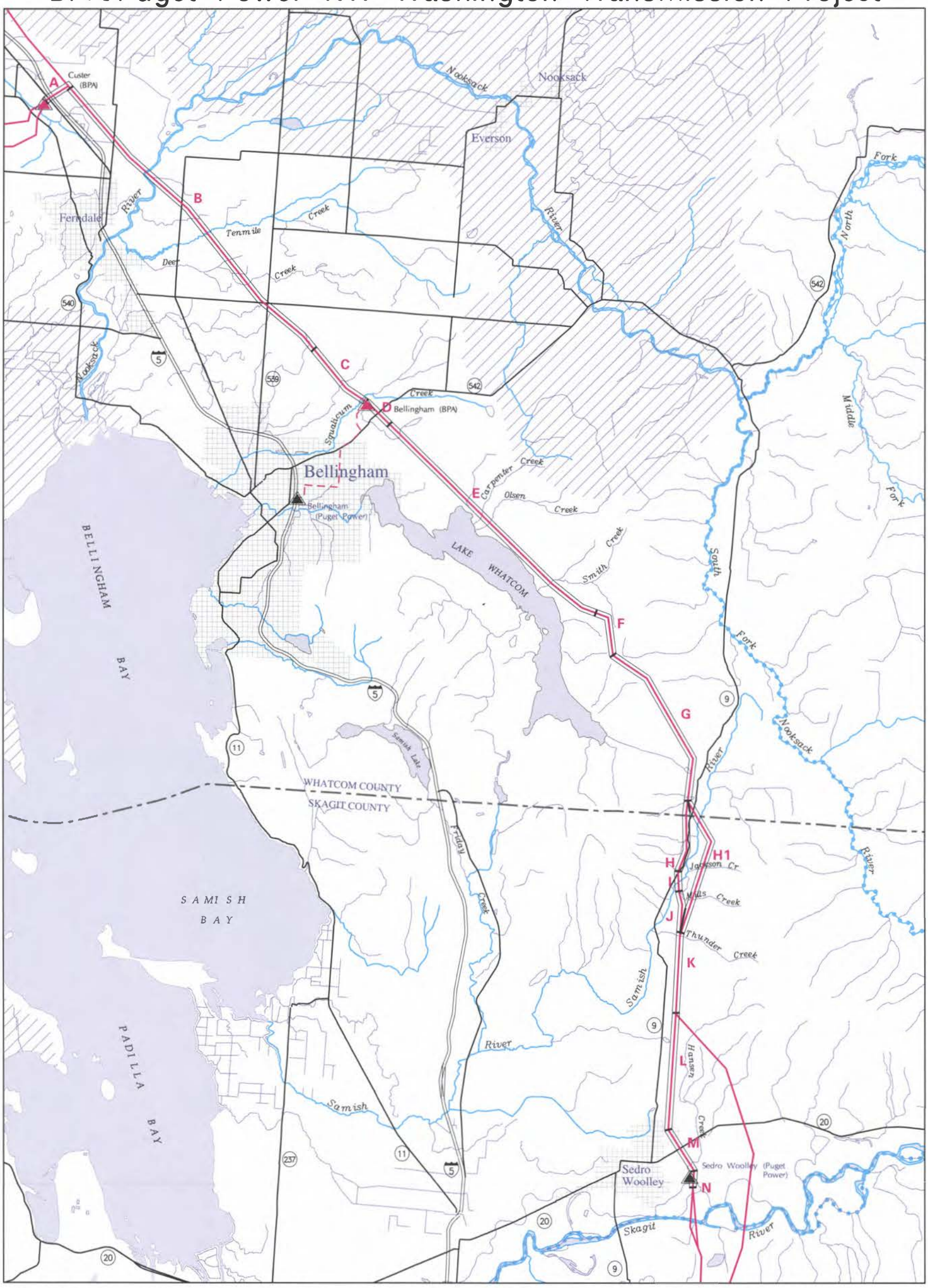



FIGURE 20 **PROTECTED and/or WILD and SCENIC RIVERS**

## LEGEND

- BPA Transmission Line
- Puget Power Trans. Line
- BPA Substation
- Puget Power Substation
- Interstate Route
- State Route
- G Corridor Segment
- Protected River Segment
- Wild and Scenic River
- Groundwater Management Area

Scale 1:173,500

0 1 2 3 4 5 6 miles

0 1 2 3 4 5 10 kilometers

Data source: Northwest Environmental Data Base, 1993; Bonneville Power Administration, Regional database.

# BPA/Puget Power NW Washington Transmission Project

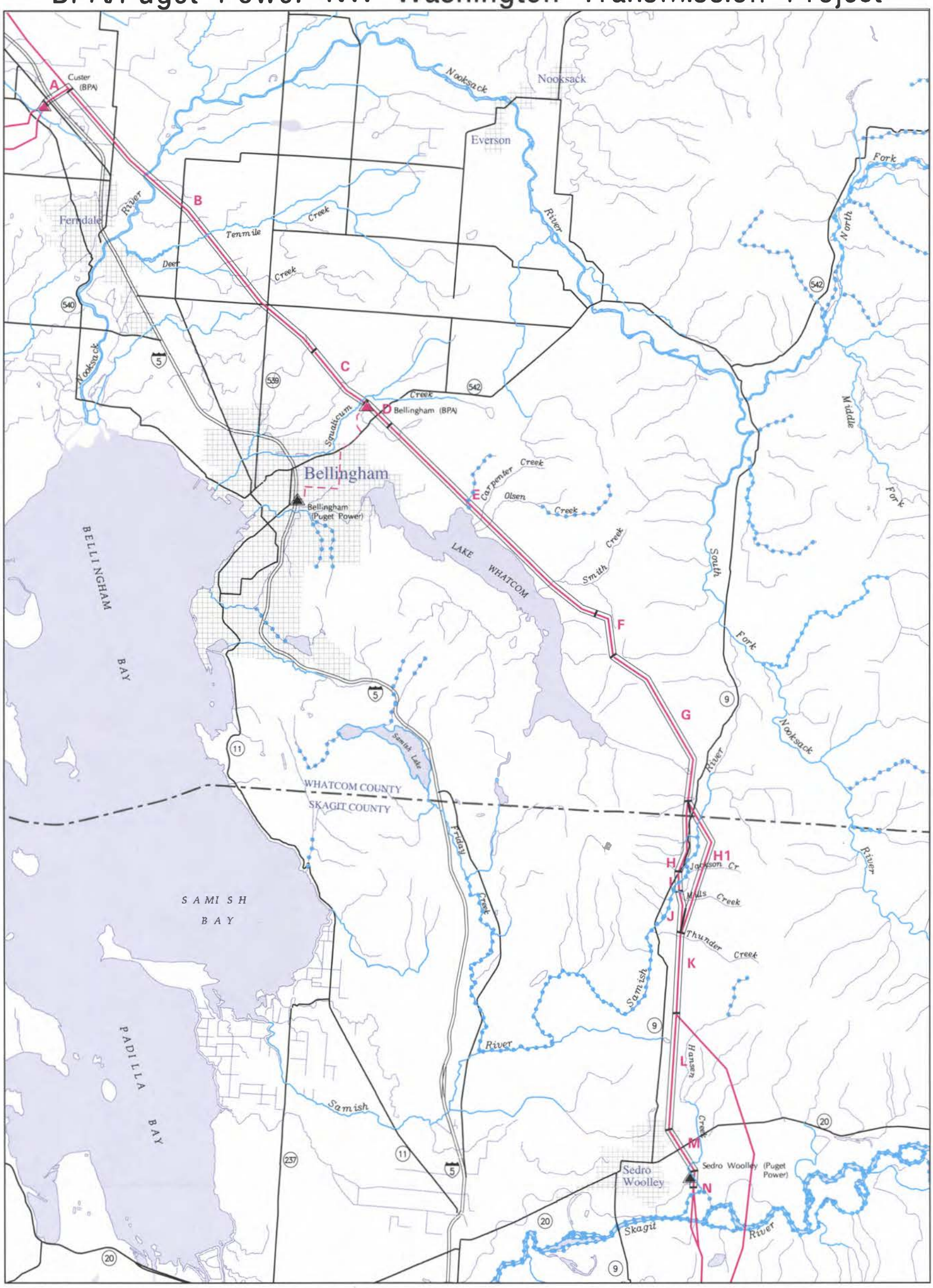



FIGURE 21 **RESIDENT and ANADROMOUS FISH HABITAT**

## LEGEND

- *River Segment with Anadromous Fish*
- *Outstanding and Substantial Resident Fish Habitat*
- *BPA Transmission Lines*
- *Puget Power Trans. Line*
- *BPA Substation*
- *Puget Power Substation*
- (5) *Interstate Route*
- (9) *State Route*
- G *Corridor Segment*

Data sources: Washington Rivers Information System, Washington Department of Natural Resources, 6/91; Bonneville Power Administration, Regional database.

Scale 1:173,500

0 1 2 3 4 5 6 MILES

0 1 2 3 4 5 10 KILOMETERS

N W E S

*BPA Division of Facilities Engineering*

# BPA/Puget Power NW Washington Transmission Project

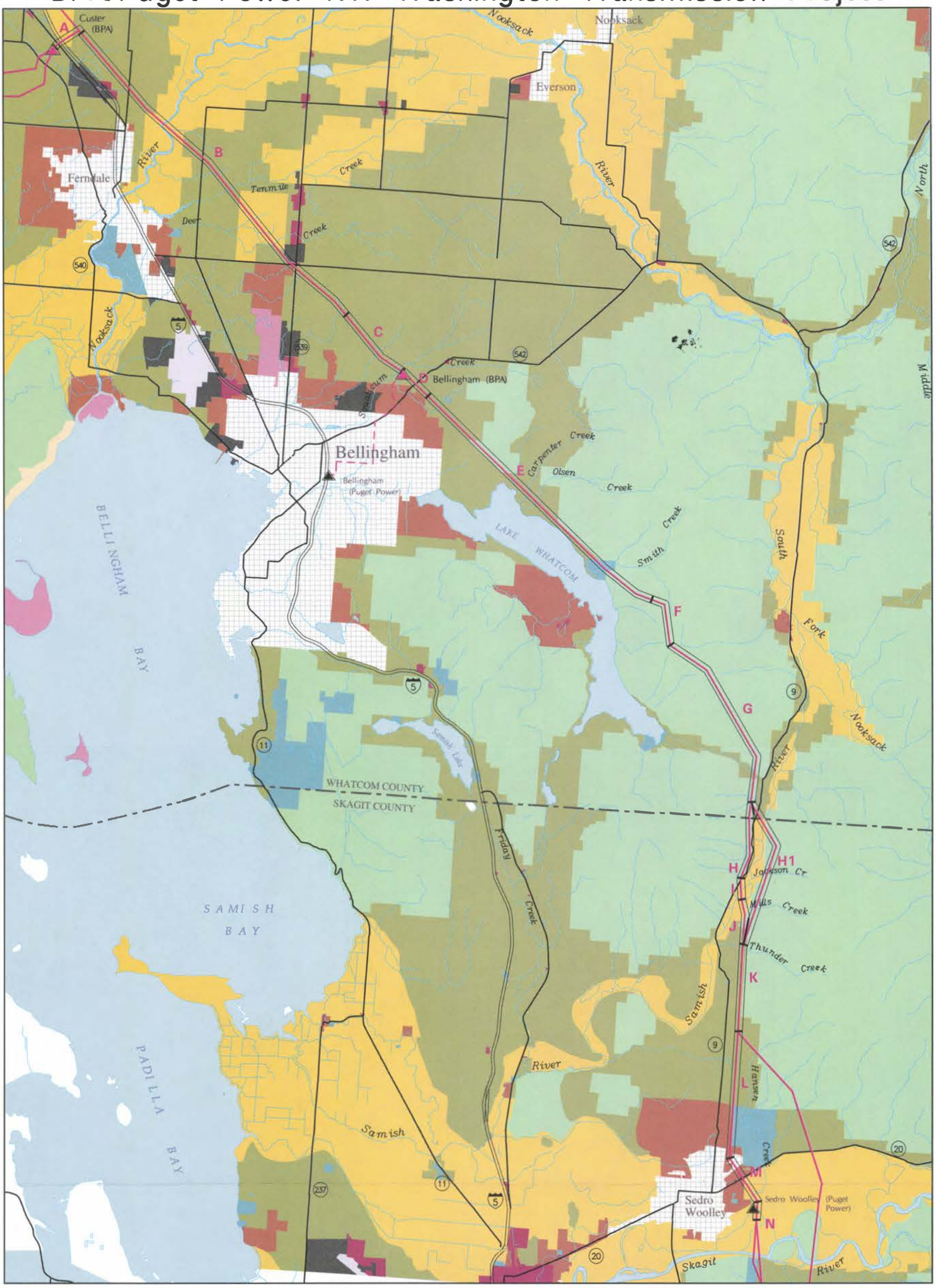



FIGURE 22

## COUNTY ZONING

### LEGEND

- BPA Transmission Line
- Puget Power Trans. Line
- BPA Substation
- Puget Power Substation
- Interstate Route
- State Route
- G Corridor Segment
- Urban Residential
- Rural Residential
- Agriculture
- Forestry
- Public Land – Recreation
- Commercial
- Industrial
- Airfield
- Interim
- Other

This map has been generalized to show broad zoning classifications set forth by the respective counties. The categorical details of each zoning class vary slightly between counties and are not presented here.

Scale 1:160,500

MILES 0 1 2 3 4 5 6

KILOMETERS 0 1 2 3 4 5 10

# BPA/Puget Power NW Washington Transmission Project

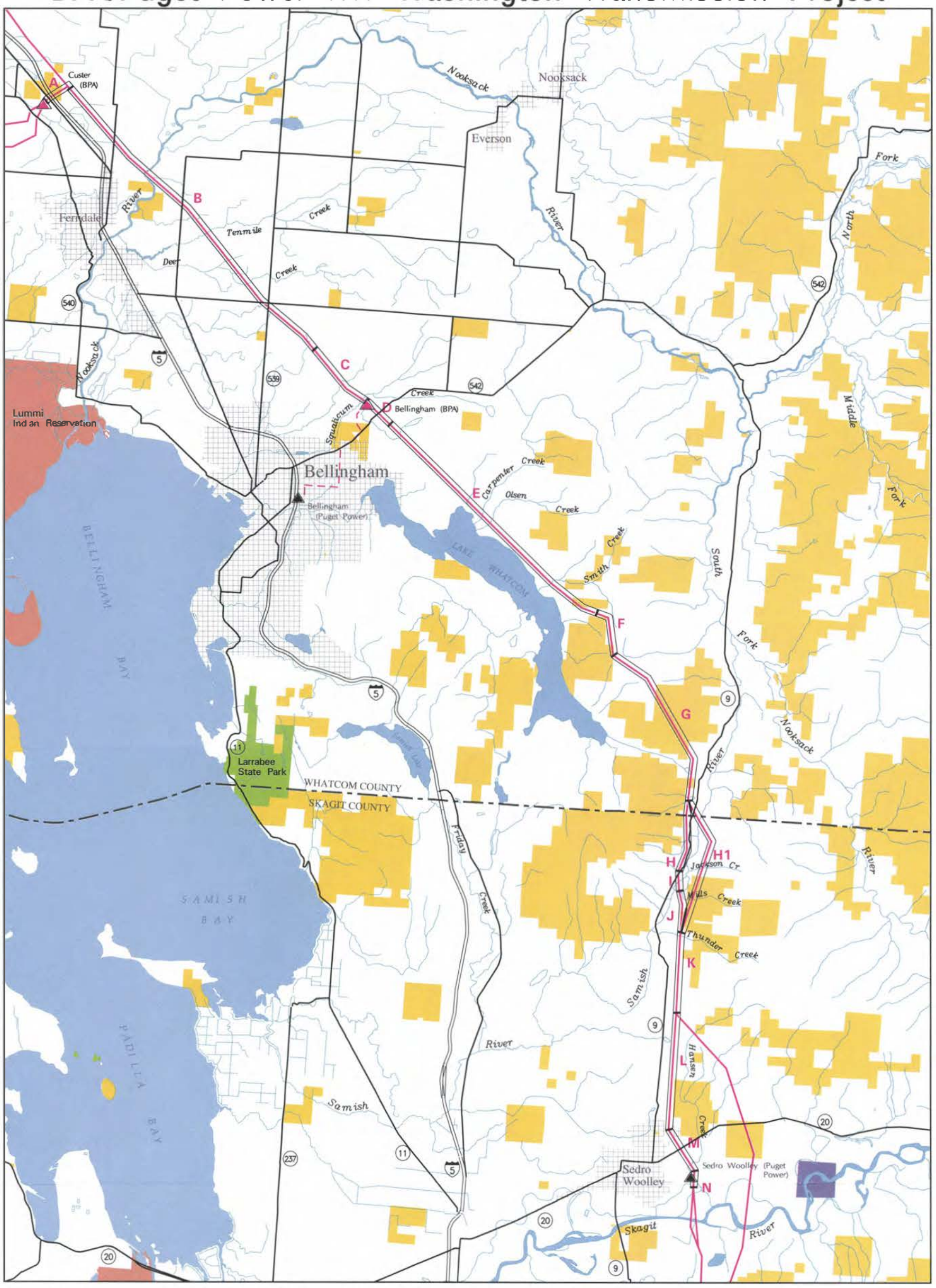



FIGURE 23 **LAND OWNERSHIP - PUBLIC and TRIBAL**

## LEGEND

- BPA Transmission Line
- Puget Power Trans. Line
- BPA Substation
- Puget Power Substation
- Interstate Route
- State Route
- G Corridor Segment

Scale 1:173,500

0 1 2 3 4 5 6 MILES

0 1 2 3 4 5 10 KILOMETERS

- WA Dept. of Natural Resources
- WA Dept. of Wildlife – Wildlife Refuge
- State Park
- Tribal Lands

BPA Division of Facilities Engineering

# CHAPTER 4
# ENVIRONMENTAL CONSEQUENCES

## A. INTRODUCTION

This chapter details the potential impacts of transmission facility construction, maintenance, and operation on human and social uses of the land and on natural and cultural resources in the study area. These resource discussions cover developed land uses and management, agriculture, forestry, recreation and visual effects; air quality, wildlife, soils/geology/water resources; social and economic considerations; health and safety; and cultural resources.

The chapter begins with **DESCRIPTION OF CONSTRUCTION ACTIONS,** which details the sequence of activities in building a line or a substation, from location and acquisition of rights to actual construction and maintenance. The description provides a basis for understanding the kinds of impacts that may occur on environmental resources. Next, in **RESOURCE IMPACTS**, each resource is discussed first in terms of general impacts to be expected from transmission facilities. Then the focus shifts to noteworthy individual resource impacts as they are most likely to occur in specific places (segments) on the route network. The impacts are discussed in terms of expected severity, duration (how long they will last), and importance. Mitigation measures which modify/reduce impacts are also specified at the end of each resource discussion.

Last is the **CONSULTATION, REVIEW, AND PERMITS REQUIREMENTS** section, which begins on page 180. It discusses special laws and mandates protecting particular resources and the obligations of the agency to fulfill those mandates.

Throughout the chapter, the impacts discussion for the BPA proposal generally assumes that the new line would replace the existing 230-kV wood-pole H-frame line, except for **SEGMENT H1**. (See Figure 4.) No new or additional right-of-way would be necessary, except for **SEGMENT H1,** which would require an additional 34 m (112 ft.) of right-of-way width, and for Option 3, which would require small additional amounts of right-of-way for some structures. The new towers would be lattice steel. Construction would occur from April to October in 1996.

## B. DESCRIPTION OF CONSTRUCTION ACTIONS

### 1. BPA PORTION OF THE PROJECT

When transmission facilities are built, the many construction activities may have both positive and negative effects. A specific sequence of actions would occur for this project:

- After publication of the final Environmental Impact Statement and Record of Decision, affected landowners would be contacted to inform them of activities to take place.

- Surveys would be conducted and the new line designed. Right-of-way would be acquired for any new access roads and line realignments, such as for **SEGMENT H1**. Existing access roads would be improved if necessary, and in some instances new access roads may be constructed. Some trees would be cleared, the existing 230-kV wood-pole H-frame line would be removed, and footings for new structures would be installed. Towers would be erected and conductors strung. Site restoration would be undertaken, and then the project would be energized. Once the transmission facilities were built and energized, they would be operated and maintained to ensure continuous and reliable electrical service for the life of the line.

- Modifications at four substations (BPA's Bellingham and Custer Substations; Puget Power's Bellingham and Sedro Woolley Substations) may involve site development (clearing and grading), installation of additional termination and equipment support structures, and installation of terminal equipment, transformers, and power circuit breakers.

#### RIGHT-OF-WAY REQUIREMENTS/LANDOWNER COMPENSATION

Most of the new line would be built on existing right-of-way. However, small amounts of additional right-of-way would be needed for Option 3 to make room for structures. Acquiring right-of-way rights involves obtaining specific access-road and/or line easements from the landowner or land managing agency. These easement rights are just for the right-of-way, not for the entire land parcel. The Government seeks the right to enter property and to locate,

construct, maintain, and operate the electric transmission line. Once the transmission line is in place, the Government has the rights to rebuild, remove and upgrade that line.

New rights may be acquired through negotiated purchase or through an ***eminent domain*** action if agreement on value cannot be reached or a clear title cannot be obtained. If the agency and the landowner cannot agree on compensation for easement rights, a court determines just compensation based on evidence presented by the landowner and by the agency seeking such rights.

## ENSURING ACCESS

Access must also be available to each structure site for construction. On level ground, the road may be just a single track along the right-of-way between structures. When the line is built in an area with many existing roads, new access road construction can usually be limited to additional short lengths of road (spur roads) from the existing road to the structure sites.

Large pieces of equipment need access roads to get to and maneuver about the structure sites. The actual equipment or methods used depends on the design of the line and the construction methods employed by the contractor, but usually includes cranes, large trucks (sometimes semi-trailers, line trucks, augers, cats), and a variety of smaller vehicles. Stringing of the conductor also requires a small helicopter, and heavy equipment such as bulldozers, specialized equipment installed on semi-trailer trucks, and smaller trucks. Stringing sites are generally located at 3 - 5-km (2 - 3-mi.) intervals.

The few new 5-m-wide (16-ft.-wide) access roads that would be required off the right-of-way would need a 15-m-wide (50-ft.-wide) easement. In timbered or brush-covered areas, the entire easement would be cleared. (In situations where existing roads can be used without improvement, only 6 m (20 ft.) of easement would be needed.) These standards would be constant, except where a greater width were needed for vehicle turnouts or around curves. On curves, the road must be about 6 m (20 ft.) wide to allow the rear of large trucks to follow through. A minimum turning radius of 18 m (60 ft.) is specified on access roads, about the minimum practical for a road to handle the equipment needed to build the line. Building roads in steep terrain may also require extensive ***cut-and-fill work*** plus drainage provisions, which can require a total cleared and disturbed area greater than 15 m (50 ft.) wide.

Access roads would be maintained to each structure for maintenance and repair of the line, except in agricultural land, where production may be reestablished after the construction season. Other roads would not be reclaimed. Some vegetation, such as grasses and herbs, would be allowed to grow, but shrubs and trees which might interfere with vehicle access would not be permitted on the roadway.

## REMOVAL OF A LINE

When transmission lines are replaced, the construction of the new line includes removal of the old one. Conductors are removed by putting the wire in ***travelers***, pulling the wire out, and either rewinding or cutting the wire up. Wood poles and ***crossarms*** are removed. Tower steel is removed above ground. Footing stubs and ***guy anchors*** are cut off 1 m (3 ft.) below ground line in cultivated areas; 15 cm (6 in.) below ground line everywhere else. The old poles, conductor, and fittings are scrapped or salvaged for reuse.

## CLEARING

The BPA clearing operation removes trees and high-growing brush that could be hazardous to the transmission line within and adjacent to the right-of way. Generally, trees that, within a 15-year period, would grow to within about 6 m (18 ft.) of the conductor are removed. Low-growing brush and trees that will not become a hazard to the transmission line would not be removed. Those other trees on or off the right-of way that could fall into the line ("danger trees") would be removed. The clearing policy might be modified in sensitive areas (e.g., on highly erodible soils) during the design stage. Trees might be cleared using power saws or tractors equipped with a clearing blade. ***Merchantable*** trees would be sold. Unmerchantable trees, brush and slash are usually burned. Unmerchantable trees and brush that are useful as firewood may be left, if requested by individual landowners. Clearing would be required on between 22.4 and 24.6 km (14.0 and 15.4 mi.) of the proposed route, depending on the route alternative chosen (**SEGMENTS H-I-J** or **SEGMENT H1**).

## FACILITY ERECTION

Lattice-steel structures are erected after a back hoe or auger excavates holes for four footings on each tower. Footings are installed using backhoes; small cranes may be used to install the leg extensions and assemble tower steel. The above-ground lattice-steel structures can then be erected on-site and added on top of the footings by very large cranes, or assembled off-site

and flown in by helicopter. An area equivalent to 46 m by 46 m (150 ft. by 150 ft.) is used for on-site assembly.

## STRINGING THE LINE

Conductors are strung by means of a polypropylene rope ("***sock line***") and steel cable ("***hard line***"). The sock line is threaded between structures with a tractor or helicopter and then is used to pull the hard line into its place. The hard line is used to pull the conductor from a reel through successive 3- to 5-km (2- to 3-mi.) sections of transmission line. After stringing is completed, the conductors are tensioned, using tractors and other tensioning equipment.

The line would require a continuous overhead ***groundwire*** for lightning protection. As part of the groundwire grounding design, ***counterpoise*** would be required at some towers. A counterpoise run consists of a 76-m (250-ft.) length of aluminum wire buried in a trench with a groundrod at the end. Up to 6 runs are required for each tower, depending on the soil's electrical properties.

## RESTORATION

After construction is complete, the ground around the structure sites would be reshaped to fit the natural landscape, and reseeded. Farmers whose land has been compacted by construction activity would receive compensation for lost production, for loosening the soil by subsoiling, and for replanting their crops. If they are no longer needed, access roads would be reseeded and allowed to revegetate. Landowners would be compensated for any property damages caused as a result of design, construction, or maintenance activities associated with this project, such as damages to agricultural crops or clearing outside the right-of-way.

## SUBSTATION CONSTRUCTION

At Bellingham Substation, the existing fenced substation yard would be expanded to accommodate additional equipment. The expansion area would be cleared of vegetation and graded to match the existing yard elevations. The entire area would be surfaced with switchyard rock. The entire expansion would be within the existing BPA property lines.

At all of the substations involved, termination and equipment support structures would be erected on new footings. ***Rigid bus***, terminal equipment, transformers, and power circuit breakers would then be installed, tested, energized and placed in service.

## MAINTENANCE

BPA performs both routine and emergency maintenance on its electrical equipment and transmission structures, substations, access roads, and rights-of- way. Transmission structures are inspected by helicopter every 3-4 months, and on the ground once each year. They are repaired when necessary. Repair activities include repainting airway marked structures, replacing insulators, repairing frayed conductors, and tightening bolts. Access roads are graded, seeded, ditched, and rocked to prevent erosion and ensure access to transmission line facilities at all times of the year. Rights-of-way are managed to prevent tall-growing vegetation from interfering with the conductor.

Although the economic life of the transmission line and substation facilities has been estimated at about 42 years, their useful lives might be much longer.

## DISPOSAL

In the past, when BPA transmission line facilities have proved no longer useful, they usually have been replaced with other BPA facilities, sold, or removed. The decision to abandon or replace any line built now would be affected by the technological and economic conditions of the future and cannot be accurately forecast today.

Substations are very infrequently removed. If removal should someday become necessary, the electrical equipment would be removed and reused or scrapped. Concrete and fixtures might be removed before the site is abandoned or left for another industrial use. All applicable regulations regarding disposal of wastes and hazardous wastes would be followed (see **Consultation, Review, and Permits** section later in this chapter).

The project would result in the irreversible and irretrievable commitment of resources. About 190 structures and up to 1459 km (912 mi.) of wire would be used directly in construction for transmission uses. If any of the facilities should be retired and removed, only some of the materials could be reused or recycled. Labor (as many as 80-150 workers at the peak construction period) and fuel for construction equipment would be irretrievably committed. A

capital investment in the neighborhood of $52,000,000 (including substation work but not Puget Power's part of the project) would be committed in developing the proposed transmission facilities.

## 2. PUGET POWER PORTION OF THE PROJECT

### CONSTRUCTION TECHNIQUES

County roads, city streets, BPA right-of-way, unimproved street right-of-ways, and alleyways would be used to gain access to the pole locations to construct the new transmission lines. Where no access exists, new access would need to be made available, and the landowners would be compensated. If spur roads need to be built, site-specific erosion control plans would be developed before construction. Where the unimproved street rights-of-way have been encroached upon by lawns, gardens, and/or fences, Puget Power would discuss access to the pole locations with the City of Bellingham and the adjacent landowners.

Existing wood poles, insulators and conductors would be removed. This removal and construction of the new transmission lines would use conventional transmission-line construction methods. Line trucks and mobile cranes would be used to remove existing poles and set the new poles. New pole holes would be dug with either a power auger or backhoe. Drainage improvements and clearing of vegetation might also be required. Where necessary, erosion control plans would be developed before any construction activities would take place. Within the City of Bellingham, this would include a best management plan for erosion control.

### MAINTENANCE PRACTICES

Puget Power must control the vegetation within its rights-of-way in order to reduce the potential for outages (due to interference with the conductors) and safeguard the public safety. Puget Power's vegetation management program is designed to control incompatible vegetation on a 5-year maintenance cycle. Vegetation is managed to control tree growth, to promote low-growing plant communities which are compatible with overhead power lines, and to prevent establishment of tree seedlings through competition.

Puget Power also uses a systematic approach to vegetation management for transmission lines next to public rights-of-ways. Proper pruning, selective removal of trees, and discriminating use of growth regulators and herbicides are among the methods employed. Growth regulators and herbicides will be used in accordance with the City of Bellingham and Whatcom County approvals.

Routine vegetation maintenance activities can occur throughout the year. Emergency maintenance will occur on an as-needed basis. With the continuation of the vegetation management program which successfully controls undesirable vegetation, the need for emergency maintenance for tree-related incidents will be minimal.

## C. INTERTIE USE ALTERNATIVE IMPLICATIONS

The environmental effects of the alternatives for use of the increase in capacity arise from changes in acquisition of energy resources or changes in the operation of electric power resources. Because Federal hydro operations are controlled by the decisions made in the Systems Operation Review (SOR) and Interim Flow SEIS processes (see **Chapter 1, Other Projects in the Region**), the selection of an Intertie use alternative could not change hydro operations from the plans established by those processes. Effects are therefore limited to operation of ***thermal generation resources*** and the transfer of power between regions in the form of ***seasonal exchanges***, power sales contracts, and ***energy storage***. (See **Other Projects in the Region**.)

All use alternatives could affect the ways in which Pacific Northwest utilities would operate their resources, market power, and develop or acquire new energy resources. Increased transfer capability over the west-side Northern Intertie would permit increased rates of energy return from storage during winter peak-load periods or autumn dry periods. It would also increase opportunities for long-term purchases of firm power from Canada.

With increased rates of return from energy storage, outages during winter peak-load periods would be less likely. In less extreme winter conditions, enhanced rates of return of energy storage from Canada would permit resource operators to select energy resources that would achieve the most economical operation, or to avoid operating the more environmentally harmful generation, such as oil-fired combustion turbines located in urban ***airsheds***. Returns from energy storage during late summer and autumn could allow hydro operators in the

United States to store water to maintain required reservoir levels, thus reducing purchases of energy in a limited (and therefore higher-priced) market.

With more opportunity for long-term firm imports, some local generation might not be developed in the study area. ***Surplus power*** might not be purchased from other sources (which would be "displaced") within or outside the Pacific Northwest. Recent proposals for firm exports of power from Canada to the United States have been based on either natural-gas-fired combustion turbines or on surplus hydroelectric generation. Resource proposals for energy resource development in the Pacific Northwest have also emphasized natural-gas-fired combustion turbines, but with additional emphasis on energy conservation and system efficiency measures (see BPA's 1992 Resource Program and the Northwest Power Planning Council's 1992 Power Plan). Overall, increased opportunities for long-term firm purchases from Canada are likely to keep the Pacific Northwest from having to seek resource alternatives which might be more expensive and less environmentally desirable.

## 1. PROPOSED ACTION (Preferred Alternative 1)

The proposed action would facilitate transfers of power for both BPA and Puget Power. Sharing ownership of the increase in Northern Intertie capacity would be consistent with the trend in the utility industry (and in the Pacific Northwest electric utility community in particular) for many utilities to use the same transmission facilities.

The proposed action would facilitate short- and long-term BPA power purchases from Canada. This in turn would reduce BPA's need either to supply power from its own resources or to purchase power from other suppliers. The proposed action would allow BPA to use its portion of the increase in transmission capability to displace other generating resources (probably thermal resources) in the U.S. when the stored energy is returned from Canada. Any displacement of thermal generators would reduce adverse impacts on the environment, including air and water emissions, in the Pacific Northwest. Impacts of generation to supply the purchases would occur at resource sites in Canada.

This alternative would also improve BPA's ability to increase the value of generation from flow releases to aid fish migration, by allowing BPA to receive more return power from spring

flows during periods when less generation is available and available generation is more valuable.

Similarly, the proposed action would allow Puget Power to enter into short- and long-term firm sales and transfers with Canada and thus delay the need to acquire additional thermal resources or purchase additional power from BPA or other suppliers to meet future loads.

## 2. RESERVE INCREASE FOR BPA USE

Alternative 2 would allow BPA to use the entire increase in transmission capability for additional energy storage returns or firm power purchases from Canada, probably resulting in greater revenue and operational benefits than the preferred alternative. Alternative 2 would *not* allow Puget Power to benefit from the increase in transfer capability. As a result, Puget Power's resource acquisitions would depend more on local generation, suppliers within the U.S., and access made available through BPA.

This alternative would not promote diversity in the use of transmission facilities in the Pacific Northwest. It might also require changes in the plans for construction of the upgrade if the Puget Power facilities integral to the project were not made available.

## 3. RESERVE INCREASE FOR NON-FEDERAL USE

Alternative 3 would allow Puget Power and other non-Federal entities to use the entire increase in transmission capability for additional energy storage in return or firm power purchases from Canada. The revenue and operational benefits for Puget Power would be the same as or greater than the preferred alternative, and would provide similar benefits to other non-Federal entities sharing in the use of the upgrade. Under Alternative 3, BPA would *not* benefit from the increase in transfer capability, and would be unable to take advantage of the increase in transfer capability to enhance marketing opportunities for generation from ***fish enhancement flows***. BPA's opportunities for energy storage return to enhance fall and winter resources would be limited to those provided by the current transfer capability of the west-side Northern Intertie.

This alternative might require changes in the project plans or financial arrangements to compensate BPA for its costs and the BPA facilities used for the upgrade.

## D. RESOURCE IMPACTS AND MITIGATION ACTIONS: BPA PHYSICAL ALTERNATIVES

### 1. LAND USE/MANAGEMENT [BPA]

Construction, operation, and maintenance of transmission facilities can create both temporary and permanent impacts on land uses. Land uses within the right-of-way are limited to those which do not interfere with the safe operation and maintenance of the line. For instance, no buildings or other structures may be built on the right-of-way, and no flammable materials may be stored there. In addition, BPA no longer encourages new uses of its rights-of-way which might result in large increases in public exposure to electric and magnetic fields. Such uses include parks, playgrounds, and parking lots. Future development of lands that lie immediately adjacent to the right-of-way could be affected by actual or perceived impacts of the line.

Transmission facilities can directly affect land uses associated with other resources. Please see **Agriculture, Visual/Recreation,** and **Vegetation** sections. Impacts on residential uses are discussed under several sections: **Public Health and Safety, Visual/Recreation, Air Quality, Social and Economic Considerations,** and **Noise and Radio/TV Interference.** Consistency between this proposal and state, regional, and local plans is discussed in the **Consultation, Review, and Permits** section, beginning page 180.

#### IMPACT MEASURES

Land use impacts (beyond those discussed in other sections of the EIS) would occur where the existing right-of-way expanded on new right-of-way. The following scale would be used to determine the level of impact.

> Impacts would be **considerable** where transmission facilities would preclude the primary existing or planned use of the affected land and the acreage affected represented a

substantial proportion (more than 10 percent) of the available land designated for that use in the county.

Impacts would be **moderate** where transmission facilities would preclude the primary existing or planned use of the affected land and the acres affected represented 3 to 10 percent of the available land designated for that use in the county.

Impacts would be **slight** where transmission facilities would preclude the primary existing or planned use of the affected land and the acreage affected represented a small proportion (less than 3 percent) of the available land designated for that use in the county, or where the transmission line would pose very minor or temporary conflicts.

## SITE-SPECIFIC IMPACTS

### Segments A - N

With the exception of alternative SEGMENT **H1,** the proposed BPA portion of the project would use existing right-of-way for its entire length, land which has been committed for electrical transmission right-of-way since the corridor was established in the 1940's. Very small additional portions of land would also be required for some structures under Option 3. Land adjacent to the existing right-of-way has been designated by local government for a variety of uses and has developed in conjunction with the established right-of-way. Any land use impacts on the existing right-of-way and adjoining property because of the proposed project are discussed within the sections on **Agriculture, Vegetation, Visual/Recreation, Air Quality, Public Health and Safety, Social and Economic Considerations,** and **Noise and Radio/TV Interference.** Impacts would be the same for all three options.

### Segment H1

The proposed new SEGMENT **H1** for the BPA portion of the project would cause land use impacts beyond those discussed under the topics listed above. The proposed route would cross about 0.8 km (0.5 mi.) of rural residential land. About 1.4 ha (3.5 ac.) of such land would be permanently removed from rural residential use. In addition, about 2 ha (5 ac.) of rural residential land would be temporarily removed from rural residential use during construction. That is considerably less than 1 percent of Whatcom or Skagit Counties' total

supply of rural residential land. This reduction would make one parcel unbuildable. Impacts would be local, direct, but slight.

## 2. GEOLOGY/SOILS [BPA]

Impacts on earth resources are based on a site's susceptibility to long-term degradation from electrical transmission construction and maintenance activities. Areas more vulnerable to these activities include places prone to erosion and ***mass movement***; soils susceptible to compaction; steep slopes; and areas where extensive access road work and clearing are required.

Disturbance of the ground surface and subsurface and removal of vegetation cover during site and right-of-way clearing, access road construction, and structure site preparation increases risk of soil erosion and mass movement, and may change soil productivity and physical characteristics. Impacts may be locally significant in sensitive areas, involving ***rill and gully erosion***, ***mass failures***, and volumes of sediment moved off-site. In areas of steep slopes, substantial amounts of access road construction can make these problems worse and may increase the risk of topsoil being eroded to surrounding areas, as well as the lowering of on-site productivity. Impacts would primarily be caused by construction, and would be short-term with successful erosion control and other mitigative measures. However, with ineffective mitigation, impacts would be long-term and consequences of erosion, sedimentation, and soil compaction could affect other resources (see **Water Quality, Fish and Wildlife**, and **Agriculture**).

### IMPACT MEASURES

A **considerable** impact would occur where new or improved roads and/or clearing is required on: soils with a high erosion potential and a poor or fair ***revegetation potential*** where mitigation measures to control run-off and erosion would be ineffective; or any site susceptible to mass movement. Impacts would be long-term due to limitations in establishing run-off and erosion controls, resulting in significantly increased erosion and sedimentation rates.

A **moderate** impact indicates that new or improved roads and/or clearing would be required on soils having a moderate erosion potential and a fair-to-poor revegetation potential; or where sites have a high erosion potential and a good chance for successful revegetation; or in areas which are subject to soil compaction. Impact would be short-term with an increase in normal erosion rates following soil disturbance until erosion and drainage controls become effective. Mitigation measures would be effective in controlling erosion and sedimentation within acceptable levels.

A **slight** impact indicates that no new roads or clearing would be required; or such work would be required on soils with low erosion hazards; or would occur on soils with a moderate erosion hazard and good potential for successful revegetation, using standard erosion control practices. Erosion and sedimentation would be held at normal levels or below.

## SITE-SPECIFIC IMPACTS

### Segments A - N

Concern for impacts on soils and geology for much of this route would be moderate (except near Sedro Woolley, where concern would be low). Direct impacts would be caused by line construction and removal, and by access road improvements, which could disturb soil surface; increase erosion, run-off, and ***sedimentation*** in nearby water bodies; and impair soil productivity. Short-term impacts (during construction) would be most intense; the intensity of long-term impacts is directly proportional to the success of revegetation and to erosion and run-off control efforts (see ***Mitigation***).

Primary concerns are for ***slumping*** of steep slopes above Lake Whatcom, for debris flows at the Mills creek crossing in **SEGMENT I** and at the creeks coming off Anderson Mountain, and for slumping of steep slopes above Lake Whatcom, as well as for erosion, sedimentation, and slumping in several areas:

- **SEGMENT B:** Nooksack River, Tenmile Creek, Deer Creek crossings;
- **SEGMENT C:** tributary to Squalicum Creek;
- **SEGMENT D:** Squalicum Creek area;

- **SEGMENT E:** Toad Lake outlet, east slope of Squalicum Mountain, Smith Creek crossing, steep slopes above Lake Whatcom on Stewart Mountain, and Carpenter Creek crossing.
- **SEGMENT F:** steep erosive soils on divide of upper Smith Creek basin;
- **SEGMENT G:** blown culverts, deeply rutted access roads north of Mirror Lake;
- **SEGMENT H:** all creek crossings and slopes above Highway 9; and
- **SEGMENT M:** Hansen and Brickyard Creek crossings.

Impacts along most of **SEGMENTS A, B, C, AND D** would be slight. Impacts along **SEGMENT E** and the specific locations listed above would be direct and moderate. An increase in erosion and possible off-site movement of sediment would be caused by clearing, line construction and removal, and access road improvements. Compaction of agricultural soils from heavy equipment use might require ***subsoiling*** to restore productivity. The project would not cause debris torrents in the creek crossing listed, but power-line structures should be located out of flow's potential path. Closer to Sedro Woolley, the primary concern is not an impact which would be caused by the project, but a precaution for structure location. Thunder Creek (**SEGMENT K**) is a known area for debris torrents and flooding. If a tower were to be located in the path of debris torrents and if it were to be hit or knocked over, there would be cumulative impacts affecting the human environment. Thunder Creek is easily spanned by the project; it is highly unlikely that a structure would be located within the torrent danger zone.

Impacts for all options would be similar.

**Segment H1**

Concern for impacts on soils and geology for this section would be moderate. Direct impacts would be caused by line construction and removal, and by access road improvements, resulting in soil surface disturbance, increased erosion, run-off, sedimentation in nearby water bodies, and impaired soil productivity. Short-term impacts (during construction) would be most intense; the intensity of long-term impacts would be directly proportional to the success of revegetation and to erosion and run-off control efforts (see **Mitigation**).

Primary concerns are for erosion and slumping in several areas:

- Mills Creek sideslopes;

- along the right-of-way to be cleared; and
- at Jackson Creek and an unnamed tributary to the Samish River.

These impacts would be direct and moderate. Impacts would primarily be caused by construction and clearing, and would therefore be mainly short-term, resulting in disturbance of soil surface, increased erosion, run-off, sedimentation, and impaired revegetative capacity. Impacts for all options would be similar.

## MITIGATION

Impacts would be reduced and the present environment upgraded by improving existing roads and by using vegetative and mechanical measures to control erosion and stabilize disturbed slopes. Redesign and replacement of failed and inadequate culverts and surface drainage structures on the existing BPA access system (particularly on **SEGMENTS E** and **G**) would control run-off and reduce erosion and sedimentation where the present road system is deeply rutted and culverts are plugged. Prompt revegetation of disturbed sites would be necessary. Follow-up inspection and maintenance of erosion and run-off controls and revegetative efforts would be needed to ensure their success. Vegetation clearing and ground disturbance would be minimized in specific areas listed in the discussions above.

Vegetative measures include seeding herbaceous species or planting shrubs or trees on disturbed areas. Fertilization, mulching, watering, and/or mechanical controls such as erosion netting and fabric may be required to ensure success. Mechanical measures include construction of slash windrows, straw bale dams, erosion netting and fabrics, terracing, or benching, riprap, and tackifers.

A number of measures can be used alone or in combination to minimize the effects of increased surface run-off created by road construction or improvement. These measures include properly spaced culverts, cross drains, water bars, ***rolling dips***, ***energy dissipators***, ***aprons, gabions***, and armoring of ditches and drain inlets and outlets. Run-off dispersal can also be accomplished by rolling the grade, insloping, outsloping, crowning, contour trenching, and installation of water-spreading ditches. Minimizing vegetation clearing near all stream crossings and leaving a vegetative buffer, combined with adequate vegetative and mechanical erosion and run-off controls, will prevent sediment from entering streams and lakes. Scheduling operations during periods when precipitation and run-off possibilities are at a minimum would also reduce erosion and sedimentation risks.

## 3. VEGETATION/NOXIOUS WEEDS [BPA]

Vegetation can be affected by construction and maintenance of transmission facilities when roads and rights-of-way are cleared before construction and when rights-of-way are maintained and kept clear of taller vegetation. Removing or modifying vegetation would be a direct impact; disturbing/compacting soils, especially in areas where slopes are steep and revegetation potential is poor, would be an indirect impact. Soil compaction might reduce the quality of land for agriculture and forest production. Indirect impacts may also result from the loss of function that the removed vegetation provided.

Each plant community (forest land, wetland, and riparian zones) has a characteristic mix of species and structure of vegetation which creates distinct environmental conditions. Associated habitat structure(s) and function(s) are the prime determinants of wildlife welfare, including the kinds and abundance of wildlife species. Certain wildlife species would be adversely influenced, some benefited, and others largely unaffected by habitat change. Wetland and riparian plant communities provide unique habitat types that are sparsely distributed over a large area; they also provide other high-value resource functions such as flood control, sediment stabilization, and ground water recharge (see also **Section 5, Floodplains and Wetlands Assessment,** and the Floodplains/Wetlands section in **Consultation, Review and Permits**). Changing vegetation could change habitat structure and function by reducing biological diversity as effective habitat size is reduced or increasing species diversity by creating new habitat types.

All trees that are a hazard to the transmission lines would be removed from the right-of-way. Clearing width varies with vegetation type, structure height, and conductor sag. Road and tower construction disturbs ground and includes removal of all vegetation to a width that depends upon slope. Flat terrain requires only limited soil grading and little ground disturbance beyond the actual width of the road. Disturbed areas would be promptly reseeded.

A composite vegetative cover component was used to analyze impacts: wetlands, forest lands (harvested and second/third growth), and agricultural land. Impact measures are related primarily to the crossings of these natural and disturbed plant communities.

## IMPACT MEASURES

A **considerable** impact would be expected under the following conditions:

- Where any rare, threatened, or endangered plant species or plant community (habitat type) would be eliminated or put in danger of elimination.
- Where a unique habitat type or a disjunct population is destroyed (one widely separated from the main range).
- Where the impact is unavoidable on a plant community protected by Federal law or regulation;
- Where a high-value resource function (e.g., sediment stabilization, flood flow alteration in riparian zones, or critical habitat for sensitive species) is destroyed.

**Moderate** impacts would be expected:

- Where disturbances occur to a plant community (habitat type) which is sparsely distributed over a large area;
- Where disturbances occur in the buffer of a sensitive plant species and/or plant community;
- Where disturbances occur to unique habitat types when appropriate mitigation is also used;
- Where there is destruction of a habitat type that is abundant elsewhere.

**Low or slight** impacts would be expected:

- Where a small portion of the range of a particular plant community ( not rare, threatened or endangered) would be destroyed, and where populations are secure elsewhere;
- Where the impact is short-term (i.e., vehicular/equipment disturbance, excavation);
- Where agricultural lands or existing power-line rights-of-way are affected. These lands represent an already disturbed, highly managed vegetation systems, where vegetative recovery would represent a minimum problem.

## SITE-SPECIFIC IMPACTS

### Segments A - N

The impacts on vegetation along the existing route would generally be slight to moderate. There would be no significant differences among options.

Impacts on forest land and riparian habitat would be caused by existing right-of-way clearing, selected danger tree removal, and excavation/fill associated with construction and maintenance of the transmission line corridor, access roads, and towers. Most of the construction activities would be restricted to existing transmission line rights-of-way, where vegetation is dominated by regenerating trees and shrubs and other common species. Additional right-of-way clearing of forest lands next to the existing corridor would be required in selected locations to provide adequate electrical clearance for operation, and to keep the "new" line in operating condition. All of these forest lands are characterized by trees of similar age and size classes characteristic of second- and third-growth timber stands. Their habitat structure and function is typically homogeneous, often lacking the large, dominant or co-dominant trees. About 46 ha (116 ac.) of forest land would need to be cleared; 22.2 ha (55.4 ac.) of this amount would be cleared on **SEGMENT E**. Also of this total, about 4.1 ha (10.3 ac.) would be cleared in **SEGMENT F** and 5.1 ha (12.7 ac.) in **SEGMENT H;** about 6 ha (14 ac.) each in **SEGMENTS K** and **L**. Implementation of recommended mitigation measures can reduce potential adverse effects.

Twenty-six riparian habitats would be crossed in these segments (see **Table 5: Water Resources Type and Quality**). The impacts would be slight to moderate because the areas would be spanned with minimal tree removal. A buffer would be maintained.

Wetland plant communities exist in the project area and are discussed further in **Section 5: Floodplains/Wetlands Assessment (BPA)**. See **Appendix D: WETLAND DELINEATION REPORT** for appropriate wetland mitigation measures where impacts are unavoidable.

All impacts would be primarily direct and long-term for as long as the corridor would be maintained in service.

**Section H1**

About 5.7 km (3.5 mi.) of new right-of-way would be required to complete this section of the proposed project. The proposed new right-of-way corridor would be about 34 m (112 ft.) wide, and would cross forest lands influenced to varying degrees by previous timber harvesting activities. About 34 ha (84 acres) of forest land would be affected by the corridor. All of these forest lands are characterized by trees of similar age and size classes characteristic of second- third-growth timber. Concern for impacts on vegetation in this route section

would be moderate. There would be no significant differences in potential impacts on vegetation resulting from either option.

One riparian habitat would be crossed at the Samish River. Impacts would be slight to moderate. Excavation and fill associated with construction and maintenance of access roads and towers would be likely to cause impacts. Some clearing of riparian vegetation might occur.

All impacts would be primarily direct and long-term for as long as the corridor would be maintained in service.

## MITIGATION

The following mitigation measures would be necessary to moderate potential impacts on vegetation riparian zones and forest lands.

- Riparian areas will be avoided whenever possible. Where impacts are unavoidable, vegetation such as trees, shrubs, forbs, and grasses that do not interfere with the performance of construction work or operation of the line itself should be preserved located in the affected (crossed) riparian zones. A regulated buffer of undisturbed vegetation is necessary to moderate impacts on riparian plant communities.

- Clearing will be kept to the minimum required to maintain safety and reliability.

## NOXIOUS WEEDS

Noxious weeds are plants that are injurious to public health, crops, livestock, and other property. A preconstruction weed inventory would be done to document existing weed infestations. The inventory would provide baseline data to establish the need for and/or to develop a weed control plan. Actions to prevent the introduction and/or spread of noxious weeds during construction may include cleaning vehicles before entering and leaving weed-infested properties, and promptly reseeding disturbed areas. BPA no longer uses herbicides on transmission rights-of-way; however, if required by the local weed board, herbicide or biological controls could be applied. BPA will assist and cooperate with landowners and local weed control boards to control noxious weeds along rights-of-way where active weed control

programs are in existence. All proposed actions to control or eradicate noxious weeds would comply with the Carson-Foley Act (P.L. 90-583), the Federal Noxious Weed Act (P.L. 93-629), and other applicable State and Federal regulations.

## 4. WATER QUALITY [BPA]

Construction, operation, and maintenance of a transmission line may affect water quality through erosion and subsequent sedimentation, pollution, and change in water environment. Groundwater contamination can occur through oil leaks and (less likely) through construction excavation which could alter water flow patterns. Herbicide use can also affect both surface and ground water. The intensity of an impact is related to the quality and uses of the water affected and the severity of the impact.

The project would not cross any Sole Source Aquifers (as delineated by the EPA), or Groundwater Management Areas (as defined by the state). BPA no longer uses herbicides on transmission line rights-of-way in Northwest Washington, unless specifically asked to by the local weed control board. All weeding would be mechanical (see **Noxious weeds**). However, herbicides would be used in the substation yard; they would be applied by trained people and according to labeling instructions.

Sediment affects water clarity, plant growth, fish habitat, and water temperatures. Removal of trees from nearby stream banks lessens shade on water surfaces, which reduces leaf litter, increases water temperature, and potentially affects fish and wildlife habitat.

Whatcom County has designated all rivers and streams as Type 1 through 5 waters (Whatcom County Critical Areas Temporary Ordinance, July 1992). Type 1 waters are those inventoried as "Shorelines of the State" (see the ***Coastal Management Program Consistency*** in the **Consultation, Review, and Permits** section). Types 2 through 5 are based on importance from a water quality standpoint, usage as a domestic water source (residential or camping units), and presence of anadromous or resident game fish. (See Table 5.)

For related water quality effects, see separate discussions under **Floodplains/Wetlands Assessment, Geology/Soils,** and **Fish and Wildlife.**

**Table 5: Water Resources Type and Quality**

| Sgt. # | Name | Rank | Action in Area | Location |
|---|---|---|---|---|
| A(0) | California Creek | Type 1 | none | 1/39N-1E |
| B(5) | Nooksack River | Type 1 | Overhead | 9/39N-2E |
| B(9) | Tenmile Creek | Type 1 | Overhead | 23/39N-2E |
| B(11) | Deer Creek & 3 tribes. | Type 4 | Overhead | 24/39N-2E |
| C(18) | unnamed creek | Type 4 | A-B | 4/38N-3E |
| C(20) | Squalicum Creek | Type 1 | Overhead | 9/38N-3E |
| D(23) | unnamed creek | Type 4 | none | 9/38N-3E |
| E(25) | Toad Lake outlet | Type 4 | Overhead | 15/38N-3E |
| E(26) | unnamed creek | Type 4 | A-B-C | 24/38N-4E |
| E(27) | Carpenter Creek | Type 4 | Overhead | 30/38N-4E |
| E(28) | Olsen Creek | Type 4 | Overhead | 30/38N-4E |
| E(29) | Smith Creek | Type 4 | A-B | 33/38N-4E |
| E(30) | Lake Whatcom | Type 1 | none | 33/38N-4E |
| G(31) | Mirror Lake | Type 3 | Overhead | 30/37N-5E |
| G(32) | two unnamed creeks | Type 4 | A-B | 31/37N-5E |
| H(34) | unnamed creek | Type 4 | A | 31/37N-5E |
| H(35) | unnamed creek | Type 4 | A | 6/36N-5E |
| I(36) | unnamed creek | Type 4 | A | 7/36N-5E |
| H1(38) | Jackson Creek | Type 4 | A | 8/36N-5E |
| I(39) | Samish River | Type 1 | Overhead | 7/36N-5E |
| J(40) | Mills Creek | Type 3 | A-B-C | 18/36N-5E |
| J(41) | four unnamed creeks | Type 4 | A | 18/36N-5E |
| K(42) | Thunder Creek | Type 3 | Overhead | 19/36N-5E |
| L(46) | Hansen Creek tributary | Type 2 | Overhead | 7/35N-5E |
| M(49) | Brickyard Creek | Type 4 | Overhead | 18/35N-5E |
| M(50) | Hansen Creek | Type 4 | A-B | 20/35N-5E |
| N(51) | Hansen Creek | Type 4 | A-B | 20/35N-5E |

Definitions

**Sgt. #** Sequential number of system within each segment
**Rank** Water type according to Whatcom County Critical Areas, Temporary Ordinance, July 1992
**Action in Area**
- **A** Removing a wood pole
- **B** Temporary access road possible
- **C** Construction of steel lattice tower possible

**Overhead** Line being located overhead
**Location** Section, Township, Range

Information primarily comes from infra-red and black-and-white aerial photos, reconnaissance flights, drive reconnaissance, National Wetland Inventory Maps, and USGS topographic maps.

Note that Whatcom County's type designation was also applied to lakes and streams in Skagit County.

For measures required for stormwater regulations and suggested mitigation measures, see the discussion on ***Permits for Discharges into Waters of the United States,*** under **Consultation, Review, and Permits.** Please see the Water Resources map (Figures 19a and 19b) and the protected and/or wild and scenic rivers map (Figure 20) for locations of various water resources.

## IMPACT MEASURES

Impacts would be **considerable** where a high-quality water body that supports fish, water fowl, and animal habitat, and/or human uses such as drinking water would be extensively altered so as to affect its uses or integrity. Considerable impacts would be expected if a line were constructed with extensive clearing in highly erodible soils near high-quality water bodies, without appropriate mitigation. They would also be expected if the possibility of oil spills from substation equipment reaching groundwater were high, as in areas with shallow groundwater level or highly permeable soils, or where no secondary spill containment or protective measures were in place. No considerable impacts are expected for this project.

Impacts would be **moderate** where structures were erected and clearing took place on erodible soils near a good-quality water body, with mitigation (construction in dry season; revegetation and stabilizing of soils). Some removal of shade would affect the immediate habitat of water, but not the integrity of the water body as a whole. Any pollution that entered water would be dispersed and diluted, not affecting overall water quality. There would be little possibility of oils or other pollutants affecting groundwater. Groundwater level would be deep, soils relatively non-porous, and facilities would have some minor spill protective measures.

Impacts would be **slight** where structures near water bodies would be in stable soils on even terrain, with little to no clearing, or where structures were located away from water banks and little to no sediments would reach the water. Impacts would also be considered slight, if there were little to no possibility of oil or other pollutants affecting groundwater; where groundwater level were deep, soils were relatively non-porous, and facilities had good oil spill containment protective measures.

## SITE-SPECIFIC IMPACTS

### Segments A - N

Concern for impacts on water quality would generally be moderate except for the portion of the route as it leaves the Lake Whatcom area and heads south (**SEGMENTS F - J**), where impacts would be low. Short-term indirect impacts would be caused by erosion from construction activities; long-term indirect impacts would occur from continued existence and/or operation of the line, as trees would be cleared from the right-of-way for the life of the line. Direct impacts would occur where culverts or other construction is needed in streams, rivers, or other water bodies. At this point it is not known whether or where culverts would be needed. See Figures 19A and 19B for locations.

Areas of concern for water quality are as follows:

- Crossing of Tenmile Creek (**SEGMENT B,** Type 1 water body),
- Crossing of Deer Creek (**SEGMENT B,** Type 4 water body),
- Crossing of Squalicum Creek (**SEGMENT C**, Type 1 water body),
- Crossing of Smith Creek (**SEGMENT E,** Type 4 water body),
- The area along Lake Whatcom (**SEGMENT E**) where the right-of-way parallels the lake (currently, towers 48/2 to 44/4),
- Crossing of Mirror Lake (**SEGMENT G**),
- Crossing of Mills Creek (**SEGMENT J,** Type 3 water body),
- Crossing of Thunder Creek (**SEGMENT K,** Type 3 water body),
- Crossing of Hansen Creek (twice in **SEGMENT M**, Type 3 water body), and
- Crossing of Brickyard Creek (twice in **SEGMENT M**, Type 4 water body).

Impacts on water bodies in **SEGMENTS A - J** would occur from sedimentation in the water during construction, until soils stabilize. Tenmile and Deer Creeks are at present fairly natural, tree-lined creeks, with a cleared swath at the existing transmission crossing. With additional clearing, the creeks would also be affected by reduced shading, which could warm water and alter habitat. However, the areas cleared along creek banks would be small relative to the length of the creeks.

An oil leak that occurred at the existing BPA Bellingham Substation in 1991 reached Squalicum Creek. Oil was found more than 2 km (more than a mile) downstream from where

the spill occurred. As part of the project, an oil spill containment system would be installed at the substation. The system would be designed to contain spills or leaks from both the existing and new substation facilities. Expansion would include placement of a new 230-kV transformer, containing about 68,220 liters (18,000 gallons) of ***"PCB-free" oil.*** The substation expansion site and surrounding area are wetlands. With proper use of an oil spill containment system, chances are slight that substation equipment oil leaks would reach and contaminate surface or groundwater. If there *were* to be a spill outside the containment system, impacts on groundwater would be moderate. Also, because of the nature of the surrounding wetlands, herbicide used in the new substation yard would be used sparingly and during dry periods, to avoid the possibility of having it travel to surrounding areas.

Smith Creek has steep slopes and a history of erosion problems; construction activities and access road upgrading would increase sedimentation in the creek. The transmission line route also crosses the Lake Whatcom watershed and four creeks that flow into the lake. Sedimentation from clearing and construction disturbance could reach the lake, affecting a localized area along the north shore. There have been problems in the past with clogged culverts and rutted access roads along the existing transmission line right-of-way. These impacts, added to those from logging operations in the watershed, could further decrease watershed quality. Although the amount of disturbance from the line is small relative to areas disturbed by logging, mitigation measures must be taken to ensure that unnecessary erosion and sedimentation do not occur.

For Mirror Lake, the transmission line would span from one ridge to another, crossing the east tip of the Lake (the west end of Mirror Lake feeds into Lake Whatcom via Anderson Creek). Water quality might be slightly affected for a time in Mirror Lake in the general vicinity of the line crossing, but sedimentation would not be expected to reach Anderson Creek or Lake Whatcom. The Mills Creek crossing would probably not require any clearing. However, existing transmission structures are close to the creek banks, and construction activities would be expected to cause sedimentation.

Impacts would be moderate at the crossings of Thunder Creek, Hansen Creek, and Brickyard Creek, as trees cleared around the creeks would reduce shade and stability of the stream banks, thereby increasing potential sedimentation. Water quality might be reduced for a time in the general vicinity of the line.

Other water bodies crossed [Nooksack River, California Creek (Type 1 water body), Samish River, and several unnamed creeks] would not be affected by the project: Towers are far enough away from the water bodies so that construction activities would not affect creek or river banks; the terrain is relatively flat so that sediment is not likely to reach the water; and there is little to no vegetation to be cleared.

For the transmission line route, Options 1, 2, and 3 would be essentially similar, with a slightly higher potential for impact for Options 2 and 3 because of the greater amount of ground disturbed at the 500-kV tower sites. Option 3 would also have additional impact at Hansen Creek (**SEGMENT M**) and Squalicum Creek (**SEGMENT C**), where additional dead-end towers would be sited near the creek bank, increasing the amount of sedimentation possible in the creek.

**Section H1**

Concern for impacts on water quality in this route section would be moderate to high. Indirect short-term impacts would be caused by erosion from construction activities as soil is disturbed; indirect long-term impacts would occur from continued existence and operation of the line, as trees would be cleared from the right-of-way for the life of the line.

Areas of concern include:

- Crossing of the Samish River (Type 1 water body; see **Table 6**, site H1(33)),
- Crossing of Jackson Creek (Type 4 water body), and
- Crossing of Mills Creek (Type 3 water body; listed as J(40), it crosses both **SEGMENT J** and **SEGMENT H1**).

With new right-of-way, more clearing is required for this option. Clearing would reduce shade over creeks, potentially raising water temperature, changing habitat for fish and wildlife, and reducing leaf litter and stability of banks. Construction activities could cause sedimentation in water in the construction area and downstream until sediments dispersed.

Options 1, 2, and 3 would have similar impacts. Impacts for Options 2 and 3 would be slightly higher because of the greater amount of ground disturbed for the 500-kV towers.

## MITIGATION

For all areas of concern, mitigation to prevent erosion needs to be undertaken during and after construction. Construction would take place in the dry season if possible; as little ground as possible would be disrupted in the vicinity of the water body; mechanical measures would be used to minimize erosion and surface run-off; and disrupted soils must be promptly reseeded and/or revegetated. Near any water body crossing, including the line crossing on the ridge above Mirror Lake, towers would be set as far back from stream banks as possible.

Existing vegetative buffers of trees and shrubs would be left along stream banks, especially at the crossings of Tenmile Creek, Deer Creek, Smith Creek, Mills Creek, Thunder Creek, Hansen Creek, and Brickyard Creek. Also, clearing would be reduced to the least amount necessary in the Lake Whatcom watershed.

According to the Whatcom County Critical Areas Ordinance, there shall be no activity allowed within a river, stream, or its buffer without a permit or written authorization. The buffer requirements for Water types 1 - 4 (categories potentially affected in the study area) are as follows: for a slope gradient of 0% to 15%, 15m (50 ft.); for a gradient of 15 - 35%, a buffer of 30 m (100 ft.); and for a slope gradient of greater than 35%, a buffer of 60 m (200 ft.).

However, note that "Shorelines of the State" (Type 1 waters) have a 60-m (200-ft.) jurisdictional area or buffer. (See ***Coastal Management Program Consistency***, in **Consultation, Review, and Permits**.) Also note that the **Fish and Wildlife** section has different recommended buffer widths to mitigate potential impacts on fish.

## 5. FLOODPLAINS/WETLANDS ASSESSMENT [BPA]

***This section addresses the requirements for a Floodplains/Wetlands Assessment, as well as impact detail beyond those requirements. It includes segment discussions and impact ratings consistent with other impact sections.***

In accordance with the Department of Energy regulations on Compliance with Floodplain/ Wetlands Environmental Review Requirements (10 CFR 1022.12), BPA has prepared the

following assessment of the impacts of the Northwest Washington Transmission Project on floodplains and wetlands. A notice of floodplain/wetlands involvement for this project was published in the Federal Register on August 4, 1992.

## PROJECT DESCRIPTION

The nature and purpose of the proposed action, and alternatives to it, are described in **Chapters 1 and 2** of the EIS. Figures 19a and 19b show the location of the floodplains and wetlands with respect to the proposed actions and alternatives. The site-specific wetland impact discussions are keyed to these figures by segment and site number.

The floodplain areas indicated are those mapped by the Federal Emergency Management Agency as 100-year floodplains, with flood elevations and flood hazard factors that have not been determined. A 100-year floodplain has a 1 percent chance of being inundated by flood in any given year.

The wetland areas have been determined from the following sources: National Wetland Inventory maps; infra-red photography (1" = 750' scale) flown by BPA in June 1992; low-angle black-and-white photography (1" = 400' scale) flown by BPA in 1992 (see **References** section for specific sites); and personal observation at the Bellingham and Custer Substations and at the Mt. Stewart, Cranberry Lake, and Mirror Lake aqueduct portions of the corridor. Delineations were made according to the guidelines of the 1987 Corps of Engineers Wetlands Delineation Manual.

## FLOODPLAINS

### Impact Measures

A **considerable** impact would be expected when structures are placed in the floodplain such that they would either 1) be in danger of being structurally damaged in a flood, or 2) cause additional flooding due to their displacement of water from the normal floodplain. Transmission lines and access roads normally do not cause this type of impact. Considerable impacts are not expected for this project.

A **moderate** impact would be expected when transmission line structure(s) must be sited within a 100-year floodplain, but the structures are designed to be floodproof and not to

impede floodwaters. Access roads placed in a floodplain which require permanent fill would also result in a moderate impact.

A **slight** impact might occur when a transmission line is designed to span over a 100-year floodplain, with no structures located in the floodplain. Siting an access road in a floodplain would result in a slight impact unless it were to involve the permanent placement of fill material.

**Floodplain Effects**

The effects of Option 1, 2 and 3 alternatives on floodplains would be similar. The floodplains listed in Table 6 would be crossed by the proposed transmission line rebuild between Custer Substation and Sedro Woolley, and by the **SEGMENT H1** alternative. Half of these floodplains would be spanned by the transmission line, and no new structures or access roads would be placed in them. Options 1, 2, or 3 would have new structures and temporary access road fill placed in the floodplains of the Nooksack River (**SEGMENT B**), Squalicum Creek (**SEGMENT C**), Alternative **H1** crossing of the Samish River, Cranberry Lake (**SEGMENT L**), Hansen Creek (**SEGMENT M**), and Skagit River (**SEGMENT N**).

With Option 3, two additional dead-end structures might be placed in floodplains near the BPA Bellingham Substation (**SEGMENT C**). The structures might be located on a slight rise, but because the ridge is fairly narrow and the floodplain is on either side of it, it is likely that at least one structure would be located in the floodplain. Between 3 and 5 structures[12] would be needed in the Skagit River floodplain (**SEGMENT N**) for Options 1 and 2, because the portion of the Sedro Woolley Substation that must be accessed by the line is in the floodplain. With Option 3, two additional dead-end structures would probably be located in the floodplain.

[12] Detailed engineering for the line's approach to the substation has not yet been completed.

**Table 6: Floodplains crossed.**

| Name of Floodplain | Seg-ment | Tributary to | Approx. length of crossing m(ft) | No. of new structures in floodplain | Access road fill needed | Impact |
|---|---|---|---|---|---|---|
| **Nooksack River** | B | Bellingham Bay | 1280 m (4200 ft.) | 2 | temp. | moderate |
| **Ten Mi. Creek** | B | Nooksack River | 152 m (500 ft.) | 0 | no | slight |
| **Squalicum Creek** | C | Bellingham Bay | 122 m (400 ft.) | 1 (+1 - 2*) | temp. | moderate |
| **Carpenter Creek** | E | Lake Whatcom | 122 m (400 ft.) | 0 | no | slight |
| **Olsen Creek** | E | Lake Whatcom | 122 m (400 ft.) | 0 | no | slight |
| **Mirror Lake** | G | Aqueduct | 152 m (500 ft.) | 0 | no | slight |
| **Samish River** | I | Samish Bay | 305 m (1000 ft.) | 0 | temp. | slight |
| **Samish River** | H1 | Samish Bay | 549 m (1800 ft.) | 1 | temp. | moderate |
| **Cranberry Lake** | L | Swede Creek | 305 m (1000 ft.) | 1 | temp. | moderate |
| **Hansen Creek** | M | Skagit River | 274 m (900 ft.) | 1 | temp. | moderate |
| **Skagit River** | N | Skagit Bay | 762 m (2500 ft.) | 3-5 (+2)* | temp. | moderate |

* Option 3 would require 1 - 2 more structures in the Squalicum Creek wetlands, and 2 more in the Skagit River wetlands

No permanent access roads would be required in floodplains for this project. Temporary fill might be required to access the new structures located in floodplains. The temporary fill would be removed when project construction is completed.

In addition to the placement of new structures in the floodplains indicated, existing wood pole structures in the floodplains of the Nooksack River, Cranberry Lake, Samish River (SEGMENT I), Hansen Creek, and Skagit River would be removed. This might require placement of temporary access road fill to get to the existing structures.

The placement of structures and temporary fill in the floodplains would not cause long-term significant impacts on the floodplain. The structures would not be vulnerable to damage by

floodwaters, as they would be designed to withstand flooding. Floodwater displacement by structures would be negligible and would not be expected to alter the floodplain storage volume or cause a local increase in the flood stage. Short-term impacts would occur from the placement of temporary access road fill in the floodplains and from driving across the floodplains during construction, but these are not anticipated to be significant.

## WETLANDS

Construction, operation, and maintenance of transmission lines can affect wetland vegetation, soils, and hydrology temporarily or permanently. Impacts of this project on most potential[13] wetlands are expected to be temporary, resulting from removal of existing wood pole structures, construction of temporary road crossings, and preparation and use of ***stringing areas***. Where construction of footings for lattice-steel towers would occur in wetlands, impacts would be long-term and slight to considerable.

### Impact Measures

Impacts would be **considerable** where vegetation, hydrology and hydric soils are extensively altered by excavation or fill, either as a single event or as a series of cumulative events that would profoundly impair the ecological integrity of a special aquatic site (wetland). Recovery would require restoration or compensation and monitoring over a period of years. Considerable impact could be expected if construction activities were to occur within a sensitive wetland plant community or if activities were to alter extensively or destroy hydrology or hydric soils.

Impacts would be **moderate** where hydrology, vegetation, or hydric soils are temporarily altered and wetland functions undergo a seasonal setback. Recovery usually needs assistance. Moderate impacts could be expected to occur when construction activities represent a single event timed to occur during a seasonal dry period, with temporary, localized disturbance of a large wetland system. Disturbance resulting from temporary use of fabric and fill for access roads, removal of an existing wood pole structure, and construction of a lattice-steel tower would represent a moderate impact to a natural wetland.

---

[13] Wetlands that have been identified in this DEIS have not been verified and therefore are referred to as "potential." The wetlands at BPA Bellingham Substation have been delineated (see **Appendix D**).

Impact would be **slight** where one or two of the three wetland components are temporarily altered so as to reduce vegetation vitality. Recovery usually occurs on its own. Slight impact on a wetland would be expected from temporary use of fabric and fill access roads and removal of existing wood pole structures in a localized area of a large wetland system or within a wetland buffer. Non-damaging methods of installing overhead lines or spanning a wetland would result in slight to no impact.

**Wetlands Effects**

The effects of Options 1, 2, and 3 on wetlands would be very similar. Twenty-five potential wetlands occur within the existing corridor of the proposed transmission line rebuild between Custer Substation and Sedro Woolley and the alternative Samish River crossing route (**SEGMENT H1**). They are listed in Table 7 and shown on Figures 19a and 19b. Construction, operation, and maintenance of this project is not expected to affect the long-term survival, quality, or natural and beneficial values of the wetlands involved, except for wetlands at the BPA Bellingham Substation site. Areas within wetland boundaries which would need fabric and/or fill for construction vehicles would be identified in the field.

Overall, impacts on wetlands would generally be slight to moderate for the project. At BPA's Bellingham Substation some wetland area would be permanently filled. Wetlands at the Nooksack River are also in an area designated as Shorelines of the State under the Shoreline Management Act (see ***Coastal Management Program Consistency*** in **Compliance, Review, and Permits** Section). Impacts on potential wetlands would primarily be indirect for most segments, with some potential for direct impacts which might cause alteration of hydrology, vegetation, soils and sedimentation. There would be no difference among options.

Areas of particular concern are listed below.

**Nooksack River [B(4,6)]**: Impacts on farmed wetlands next to the river would be caused by temporary access roads, removal of wood pole structures and construction of lattice-steel towers (common to all three options). Based on compliance with the General Conditions for Nationwide Permits (Number 33) and mitigation measures (below), impacts would be moderate. Disturbance from the temporary use of fabric and fill for light construction vehicles would cause a moderate impact. Mitigation for farmland is discussed under **Agriculture.**

**Table 7 Potential Wetlands in the Project Area**

| Sgt. # | Comments | Action in Area | Location |
|---|---|---|---|
| A(1) | Custer Substation | Overhead | 1/39N-1E |
| B(2) | | A-B | 5/39N-2E |
| B(3) | | Overhead | 6/39N-2E |
| B(4) | Nooksack Rv, South Shore | A-B-C | 9/39N-2E |
| B(6) | Nooksack Rv, North Shore | A-B-C | 9/39N-2E |
| B(7) | | B | 15/39N-2E |
| B(8) | | Overhead | 15/39N-2E |
| B(10) | | A-B | 23/39N-2E |
| B(12) | | A-B | 25/39N-2E |
| B(13) | | A-B | 31/39N-3E |
| B(14) | | A-B | 31/39N-3E |
| B(15) | | A-B | 32/39N-3E |
| C(16) | headwater wetland | A-B | 5/38N-3E |
| C(17) | | Overhead | 5/38N-3E |
| C(19) | | A-B | 9/38N-3E |
| C(21) | pasture | Overhead | 9/38N-3E |
| D(22) | Bellingham SS | Fill | 9/38N-3E |
| D(24) | | A-B-C | 10/38N-3E |
| H1(33) | Samish River | Overhead | 6/36N-5E |
| H(37) | not crossed by line | | 7/36N-5E |
| I(39) | | | 7/36N-5E |
| K(43) | | Overhead | 30/36N-5E |
| K(44) | stock pond | Overhead | 30/36N-5E |
| L(45) | Cranberry Lk. | A-B-C | 6/35N-5E |
| L(47) | Brickyard Ck. and 2 cks. | Overhead | 18/35N-5E |
| M(48) | golf course pond | Overhead | 18/35N-5E |

Definitions

**Sgt. #** Sequential number of water system within each segment

**Action in Area**

- **A** Removing a wood pole
- **B** Temporary access road possible
- **C** Construction of steel lattice tower possible

**Overhead** Line being located overhead

**Location** Section, Township, Range

Information primarily comes from infra-red and black-and-white aerial photos, reconnaissance flights, drive reconnaissance, National Wetland Inventory Maps, and USGS topographic maps.

**"Pasture Wetland" [C (21)]**: Northwest of the BPA Bellingham Substation, between Dewey Road and Squalicum Creek, is a palustrine emergent wetland of about 0.6 ha (1.4 ac.) that has been disturbed by cattle grazing. The hydrologic source for this wetland appears to be the same as that for D(22). Options 1 and 2 would not affect the area. Under Option 3, a transmission structure would be placed here; 14 $m^2$ (50 $ft.^2$) of fill plus a 6 m by 30 m (20 by 100 ft.) temporary road) would be needed. Based on compliance with the General Conditions for Nationwide Permits, impacts would be long-term and moderate. Additional mitigation would reduce impacts.

**Bellingham Substation [D(22)]**: At the Bellingham Substation, about 0.1 ha (0.25 ac.) of seasonal palustrine wetland would be permanently altered by the expansion of the substation (common to all three options). This wetland would be ranked as a Category III wetland by the Whatcom County Ranking System. Impact would be considerable (long-term conversion). A Delineation Report has been prepared and will be submitted for review by the US Army Corps of Engineers. (See **Appendix D.**)

**Palustrine Wetland above substation [D(24)]**: A temporary access road, removal of existing wood pole structures, and location of a steel lattice structure (common to all options) in this area would cause a moderate impact. D(24) would be ranked as a Category III wetland by the Whatcom County Ranking System.

**Samish River Floodplain [I(39)]**: With implementation of the mitigation measures listed below, construction of a temporary access road, removal of two wood pole structures from wetlands within the floodplain, and construction of one lattice-steel tower within the 15-m (50-ft.) buffer of Mills Creek would represent a moderate impact.

**Cranberry Lake [L(45]**: A combination of activities involving fabric and fill temporary roads, removal of three wood pole structures, and construction of at least two steel tower structures would have a moderate impact at this site. Location of a "stringing area" outside the Cranberry Lake wetland buffer (15 m or 50 ft. beyond the wetland boundary) would not increase the impact on the wetland. (See **Mitigation.**)

Other potential wetlands crossed would be spanned by overhead lines, or temporary roads would be used and existing wood pole structures removed from wetland buffers or farmed wetlands. Slight-to-no impact is expected on these sites.

There would be no differences among options except for Option 3, where a transmission structure would be placed, and fill for a temporary road would be needed in wetlands C(21).

## ALTERNATIVES

Under Executive Orders 11988 and 11990, developments on floodplains and in wetlands are discouraged whenever there is a practical alternative. Alternatives to the proposed action, including the No Action alternative, are discussed in **Chapter 2.** Because the proposed action is oriented perpendicularly to a number of streams and rivers, some floodplains and linear wetlands must be crossed; where the line crosses a wide floodplain or wetland, some structures must be placed in the floodplain. In addition, because the proposed action would use the right-of-way of an existing transmission line, it crosses floodplains and some wetlands that were not avoided in the original siting of the existing line. Because the impacts from construction, operation, and maintenance of a transmission line on wetlands and floodplains can be mitigated to a very low level of impact, BPA determined that considering an entirely new route solely to avoid wetlands and floodplains would be far more expensive and clearly far more disruptive than would be reasonable. BPA will avoid siting the new facilities in wetlands and floodplains wherever possible.

An alternative routing for the crossing of the Samish River was evaluated (**SEGMENT H1**). This alternative route crossing would be longer and would require the placement of a structure and temporary access to it in the floodplain and associated wetland H1(33). The route which follows the existing line location (**SEGMENTS H, I, J**) might require temporary access road fill to remove the existing wood pole structures.

No practical alternatives that would minimize the overall environmental impacts of the expansion of the Bellingham Substation were identified. However, U.S. Army Corps of Engineers Nationwide Permit #26 would apply (see **Consultation, Review, and Permits** section). BPA would confirm the delineation of this 0.1-ha. (0.25-ac.) wetland with the Corps of Engineers. The use of existing corridor in **SEGMENTS H, I, AND J** would affect less than 0.4 ha (1 acre) of wetland. The alternative route (Option **H1**) would also involve actions within the H1(33) wetland. Therefore, there is no practical alternative associated with wetlands encountered by the **H, I, J** route.

## MITIGATION

The following measures would be implemented to avoid or minimize the adverse impacts of the project on wetlands and floodplains; they are a combination of conditions required under Nationwide permits and BPA proposed mitigation:

### Required Conditions

1. Detailed siting of new structures and access roads would be coordinated with environmental staff to avoid/reduce disturbance of wetlands and floodplains. Vulnerable wetlands and buffer areas would be delineated and field-staked for avoidance during construction.

2. Excess material from the structure foundation excavations in floodplains and wetlands would be disposed of at an upland site.

3. Temporary fill would be used for access roads in floodplains and wetlands. The fill would be placed on fabric in wetlands and would be removed from floodplains and wetlands after project construction is complete. The areas would be restored and revegetated.

4. BPA's standard erosion control measures would be used. Additional measures would be taken as necessary to protect wetlands.

5. All conditions applicable to Clean Water Act, Section 404 Nationwide permits (listed in the **Consultation, Review, and Permits** section) would be met.

6. At the Nooksack River, form material/membrane will be used to keep concrete from leeching into the surrounding soil until it has "set up."

7. Structures placed in floodplains would be designed to be floodproof.

### Additional Mitigation Measures

1. The stringing site at the Cranberry Lake wetland would be located outside the wetland area.

2. The privately owned bridge and driveway may be used to cross Mills Creek southeast of the Samish River crossing; vehicles would not drive through the creek, nor would a culvert be placed in the creek.

3. When it is necessary to place steel tower structures in a wetland, the top 30 cm (12 in.) of excavated material would be stockpiled and then replaced when all work is completed. Native and local stock would be used to revegetate.

4. Off-road driving across wetlands and floodplains would be limited to the minimum number of trips necessary to accomplish the work.

## 6. FISH AND WILDLIFE [BPA]

Construction, operation, and maintenance of transmission facilities can create both temporary and permanent impacts on wildlife. A wide range of wildlife species, including waterfowl, birds of prey, big game species, and a variety of nongame species could be affected by the project. Primary impacts are created by modification of habitat: physical changes in ground cover from clearing, physical presence of the line, increased human access into secure areas or new access roads, or disturbance of wildlife through introduction of workers and construction equipment.

Impacts on wetland habitats would be caused by excavation and fill associated with construction and maintenance of access roads, towers, and substations. Riparian habitat crossed would be affected by right-of-way clearing, danger tree removal, and excavation/fill associated with construction and maintenance of the transmission line corridor, access roads, and towers. Wetlands and riparian zones are sensitive wildlife habitats. Vegetation alteration will change habitat structure and function.

Sensitive wildlife habitats, such as wetlands and riparian zones, have a characteristic mix of species and structure of vegetation which creates distinct environmental conditions. Habitat structure and function associated with these distinct environmental conditions are the prime determinants of wildlife welfare, including the kinds and abundance of wildlife species present. Certain wildlife species would be adversely influenced, some benefited, and other species largely unaffected by habitat changes.

Construction noise and human activity could particularly affect big game found in the study area, by temporarily displacing them. As there would be no winter construction, wintering animals would not be affected. Big game would also be affected where habitat is modified by right-of-way clearing. In timbered areas, cover would be lost, and grasses, forbs, and shrubs would increase. Where cover is abundant, timber removal would have negligible impacts. Where cover is sparse, impacts would be greater.

Specific habitat requirements and low population levels make certain species more easily affected and those effects potentially more significant. Species listed under the Endangered Species Act potentially occur in the area of the proposed project (see ***Threatened and Endangered Species*** under **Consultation, Permits, and Review**).

Waterfowl collision hazards are created where overhead wires cross flyways. However, bird mortality at these river crossings would probably be low and not biologically significant because collision rates are typically low (James and Haak, 1979) and the crossings are not in areas of large bird concentrations. Also, proposed crossings are located where transmission line crossings are already in existence; no problems of bird mortality have been reported.

Impacts on anadromous fish, on critical spawning habitat of fish species of concern, and on resident fish habitat, would be caused by construction and maintenance activities associated with right-of-way clearing, access roads, and towers which are located near rivers, creeks, or streams. Results would be increased sedimentation into rivers, creeks, or streams, which can alter stream habitat and reduce habitat effectiveness for trout and salmon; destruction of spawning habitat; and decreased survival of eggs and ***fry***.

## IMPACT MEASURES

Impact measures are related primarily to crossings of key wildlife habitats, such as habitats used by rare, threatened, or endangered species; big game; and waterfowl; sensitive wildlife habitats such as wetlands, riparian zones, snag-rich areas, ***talus***, and cliffs; or high-value fishery streams.

A **considerable** impact would be expected where key habitat is crossed at a time of the year when the animals are present; where sensitive wildlife habitats are crossed without appropriate mitigation; where access roads are great; and where roads are not ***gated*** and access is not controlled. Considerable impacts would also be expected where high-value

fishery streams, located in areas with highly erodible soils, are crossed by fords or roads without appropriate mitigation.

**Moderate** impacts on wildlife resources are expected where key habitat would be crossed, but not during a time when animals are present, and when roads can be gated or access controlled. Crossing sensitive wildlife habitats would cause moderate effects where proposed mitigation is used. Moderate impacts on fish would be expected where high-value fishery streams with soils of high erodibility are crossed, but proposed mitigation such as culverts, sediment traps, and water bars would be used.

**Slight** impacts on wildlife resources would be expected where key and/or sensitive habitats are not crossed; are crossed only on the edges, so that large portions of key habitats are not fragmented; or are crossed without significantly altering habitat structure and function. Slight impacts are also expected where streams with low fishery values are crossed.

## SITE-SPECIFIC IMPACTS

### Segments A - N

Concern for impacts on wildlife would generally be moderate. All impacts would be direct and long-term for as long as the corridor would be maintained in service.

Areas/resources of particular concern include the following:

- Twenty-five wetlands crossed (possibly 8 significantly affected);
- the Nooksack River flyway;
- the Samish River flyway,
- nine riparian habitat crossings (Smith Creek, Olsen Creek, Carpenter Creek, an unnamed tributary west of Carpenter Creek, Mirror Lake, the Samish River; Hansen Creek (three times)).

Clearing, excavation and fill resulting in vegetation alteration in wetlands and riparian zones would create moderate adverse impacts on wildlife resources, provided appropriate mitigation measures are implemented. Since Hansen Creek is crossed three times, cumulative impacts on wildlife associated with riparian habitats in the Hansen Creek drainage would be anticipated.

Birds flying near the line would be affected by conductors and overhead ground wires (for the Options 2 and 3 only). Migratory and resident bird collisions are likely to occur over those portions of the transmission line which cross the Samish and Nooksack Rivers. The Samish River drainage is used as a flight corridor by many birds, especially waterfowl. Those changes associated with the construction and operation of an electric transmission line which crosses over the river are likely to result in increased bird mortality, especially waterfowl. Collision hazards are primarily related to the small-diameter overhead groundwires used for the 500-kV option. Slight adverse impacts are anticipated, provided marker balls are used (see **Mitigation**). No overhead groundwires are associated with construction and operation of Option 1; therefore, slight adverse impacts related to collision hazards would be anticipated with this option.

Concern for impacts on fish would be moderate from any of the three design options. Areas of concern include the following:

- Anadromous fish presence in the Nooksack River, Deer Creek, Tenmile Creek, Squalicum Creek and its tributaries, the Samish River and its tributaries, Mill Creek, and Hansen Creek.
- Critical spawning habitat for anadromous or fresh water species in tributaries of California Creek, Squalicum Creek, tributaries of Squalicum Creek, Smith Creek, the tributary exiting Toad Lake, the Samish River, the creek exiting Mirror Lake, Hansen Creek, and Thunder Creek.
- Resident fish habitat in Tenmile Creek, Deer Creek, Olsen Creek, Smith Creek, an unnamed tributary west of Carpenter Creek, Mirror Lake, the Samish River, and Mill Creek.

Construction and maintenance activities associated with clearing (and consequent sedimentation) would cause moderate adverse impacts on fish, provided appropriate erosion and sediment control measures are implemented. Except for short-term impacts caused by tower construction activities located near rivers, creeks, or streams, these impacts would all be direct and long-term (more than 3 years).

Impacts on wetlands and riparian habitat would be as described above. Since Hansen Creek is crossed three times, cumulative impacts on wildlife associated with riparian habitats in the Hansen Creek drainage would be anticipated. Moderate adverse impacts on wildlife resources are anticipated, provided appropriate mitigation measures are implemented.

**Section H1**

Concern for impacts on wildlife in this section would generally be moderate. All impacts would be direct and long-term for as long as the corridor would be maintained in service. Areas/resources of particular concern include the following:

- one wetland crossed,
- riparian habitat to be crossed at the Samish River, and
- the 34 hectares (84 acres) of forest habitat which would have to be cleared for this segment.

Trees are the major factor maintaining the ecosystems of these areas. Recoverability is also significant, as it takes many years to grow trees to maturity. Removal of trees would have only slight adverse effects on wildlife because of the abundance of forestlands in the vicinity of the project. Implementation of recommended mitigation measures can reduce potential adverse effects. Other impacts are as described above.

Concerns for impacts on fish in this section would be moderate. There would be no significant differences among options. Areas of concern for this section include the following:

- Anadromous fish presence in the Samish River,
- Critical spawning habitat or fish species of concern present in the Samish River,
- Resident fish habitat in the Samish River.

Impacts on these resources are described above.

**MITIGATION**

The following measures would be necessary to moderate potential impacts on wildlife. Failure to implement these mitigation measures would result in considerable adverse impacts.

- Wildlife impacts can be reduced by avoiding wetland areas whenever possible. See **Appendix D** for appropriate wetland mitigation measures, as well as Section 5, **Floodplains/Wetland Assessment.**

- To minimize collision hazard impacts on migratory and resident birds in the Nooksack River flight corridor, conductors associated with the portion of the transmission line that crosses over the Nooksack River should be provided with marker balls. Additionally, because most collision hazards are associated with the overhead ground

wire, removal of the overhead groundwire over that portion of the transmission line which crosses over the river is recommended. If overhead groundwires are not removed, marker balls may also be provided on the overhead groundwires on that portion which crosses over the Nooksack River.

- Wildlife impacts can be reduced by avoiding riparian areas whenever possible. Where impacts are unavoidable, that riparian vegetation (trees, shrubs, forbs, and grasses) that does not interfere with the performance of construction work or operation of the line itself should be preserved in the transmission line corridor. A minimum 30-m (100-ft.) buffer strip of undisturbed vegetation, measured from the high water line of a channel, is necessary to moderate impacts on riparian habitats.

The following mitigation measures are necessary to moderate potential impacts on fish. Failure to implement these mitigation measures would result in considerable adverse impacts.

- To reduce the amount of sediment entering streams, a strip of undisturbed vegetation should be provided between areas of disturbance (road construction or tower construction) and stream courses. Buffer strip width should be measured from the high water line of a channel. Recommended buffer strips widths are based upon the criteria shown below.

| **Land slope** | **Buffer width** |
|---|---|
| 0% | 15 m (50 ft.) |
| 10% | 27 m (90 ft.) |
| 20% | 40 m (130 ft.) |
| 30% | 52 m (170 ft.) |
| 40% | 64 m (210 ft.) |
| 50% | 76 m (250 ft.) |
| 60% | 88 m (290 ft.) |
| 70% | 101 m (330 ft.) |

- Fill and side-cast material should not be deposited in any watercourse or stream channel. Where necessary, measures such as hauling of fill material, construction of temporary barriers, or other approved methods should be used to help keep

excavated materials out of watercourses. Any such material entering watercourses should be removed immediately.

- Roads should cross drainage bottoms at sharp or nearly right angles and level with the streambed whenever possible.

- Culverts, arch bridges, or other stream crossing structures should be installed at all permanent crossings of flowing or dry watercourses where fill is likely to wash out during the life of the road. Bridges and arch-bridges are preferred to culverts. However, where appropriate, culverts should be big enough to handle approximately 25-year floods, and designed to allow for fish passage.

- Construction-caused bare areas located within the recommended buffer width should be reseeded as soon as possible to prevent soil erosion.

Vegetation impacts can be reduced in forestlands to be cleared by retaining/ creating wildlife trees and/or snags; in this area, a rate of about 1-2 trees/hectare (2-4 trees/acre) is recommended. Retention of snags would partially compensate for lost resource functions (wildlife habitat) originally provided by these forestlands.

## 7. AGRICULTURE [BPA]

Transmission line construction and associated access needs can affect agricultural cultivation and grazing uses in several ways. The extent and duration of effects depend on the scope and timing of line construction. During construction, vehicle travel and construction equipment in the right-of-way and cultivated fields could affect the planting, growing, or harvesting of crops, and might interfere with grazing operations. Equipment traffic and construction activities temporarily remove lands from crop production. Future vegetative productivity from these disturbed lands could be reduced by any residual soil compaction, topsoil removal, or erosion. Weeds might accumulate around structure bases or may be brought in by construction vehicles.

Lands occupied by tower bases would be removed from crop production for the life of the line: Amounts are estimated at 131 $m^2$ (1450 $ft.^{2)}$ for double-circuit 230-kV construction

and 158 $m^2$ (1750 $ft.^2$) for double-circuit 500-kV construction for the life of the line. Orientation of the right-of-way in relation to the irrigation patterns, cropping patterns, and fence rows can increase crop production losses, particularly where large cultivation or irrigation equipment is used.

The transmission lines and poles may make it harder to apply fertilizers or herbicides by aerial spraying or tractor equipment. More passes could be needed to provide full coverage, or additional areas around poles could be missed, causing lower crop production. Additional safety precautions must be taken when operating machinery around poles and lines.

Substation sites can affect agriculture in two ways: by removing land from production at the site itself, and by effects similar to those listed above for the lines which enter the substation. Any area that is cultivated with farm tractors is of special concern, particularly highly productive farmlands. Specifically, pole locations in cultivated areas can substantially affect farming efficiency. In building new facilities, substation and transmission line construction equipment would compact soils and spread weeds. Farm equipment would have difficulty cultivating around the structures. The substation, towers, road, and other right-of-way restrictions would directly remove lands from cropland production.

## IMPACT MEASURES

A **considerable** impact would occur where tower location or transmission line alignment creates large areas of nonfarmable farmland (as defined in the Farmland Protection Policy Act (FPPA) (7 U.S.C. 4201 *et seq.*)) by interference with land patterns and/or prevents or restricts existing farmland operations such as irrigation.

Impacts would be **moderate** where existing farm operations and/or farmlands as defined in FPPA are adversely affected by construction such that previously unaffected productive land is lost around tower structures and/or farm operations are affected by additional inconvenience to operations.

Impacts would be **slight** where short-term disturbances occur such as minor crop damage during construction or where impacts are restricted to previously affected areas (i.e., existing tower locations).

**No impact** would occur where no farmlands as defined in the FPPA or no existing agricultural operations are affected.

## SITE-SPECIFIC IMPACTS

### Segments A - N

Concern for impacts on agriculture would range from slight to moderate at the north and south ends of the project; impacts would be slight in the mid-section. Impacts would be caused by line construction and removal, as well as by maintenance. These activities would have direct, long-term effects through inconvenience for livestock management, and a slight net loss in productive land. Because span length would increase for any of the three options, there would be fewer towers to interfere with cultivation and irrigation. This would represent a potential beneficial impact, especially if towers were located so as to minimize interference with cultivation patterns. Direct, short-term impacts could include possible crop damage and soil compaction from construction and maintenance activities. Also, normal grazing patterns could be interrupted during construction. Gates might be damaged or left open, resulting in dispersal of livestock.

Areas of particular concern would include:

- Dairy farms, irrigated hay and pastureland, and corn and wheat fields on **SEGMENTS B AND C**, particularly in the areas near the Nooksack River.
- Pasture and forage production on **SEGMENTS I AND J**,
- Pasture and forage production, corn and oat fields on **SEGMENTS K AND M.**

Prime farmland, as defined by the USDA, are soils best suited to food and fiber production. Prime farmland soils are either currently used or are available for crop production. Construction of any option would result in a slight net loss of prime farmland (as designated by the U.S. Soil Conservation Service):

- For Option 1, about 0.20 ha (0.49 acres),
- For Option 2, about 0.36 ha (0.9 acres), and
- For Option 3, about 0.46 ha (01.14 acres).

Of land currently in crops or pasture, the following acreage would be removed from production by the various options:

- About 0.18 ha (0.44 ac.) would be removed from production by Option 1;
- About 0.36 ha (0.89 ac.) by Option 2;
- About 0.41 - 0.49 ha (1.03 - 1.23 ac.) by Option 3.

Other direct, long-term impacts would include possible safety concerns for aerial spraying and irrigation. However, operators are currently familiar with the procedures for operating near the existing lines.

Overall significance of impacts for all options is slight and essentially similar, as small amounts of land would be affected and most impacts would present only minor inconveniences.

**Section H1**

Concern for impacts on agriculture in this route section would generally be low. No existing agricultural operation would be affected. For the entire route alternative, construction of any option would result in a slight increase in the amount of Prime farmland lost to future production: less than 0.01 hectares (0.01 acres). These impacts would be direct and long-term. Overall significance of impacts for most of this route alternative is negligible, due to the small amounts of land affected.

**MITIGATION**

Impacts could be mitigated by locating towers outside of agricultural fields where possible and/or locating towers to minimize interference with farm activities (e.g., aligning towers next to structures of parallel lines); by scheduling construction and maintenance activities to minimize conflicts and crop damage when practical; and by compensating farmers for crop damage and helping them with weed control and restoring productivity of compacted soils. Mitigation would be the same for all options.

Impacts on **SEGMENTS A, D, AND N** would be slight, providing that the location of the additional dead-end towers does not substantially interfere with current agricultural use and management. If tower placement were to cause portions of these lands to convert to non-

agricultural use, due to interference with current agricultural practices, then impacts would increase in intensity. Overall impacts for Option 3 would be slight.

## 8. VISUAL/RECREATION [BPA]

Construction, operation, and maintenance of transmission facilities can affect visual resources for both the long and short term.

Facilities can be visible, for instance, from potential viewpoints such as private residences, highways and roads, areas of dispersed recreation use, and commercial areas. Any visible part of the facility can contribute to visual impacts--structures, conductors, insulators, spacers, aeronautical safety markings, right-of-way clearing, access roads, clearing for structures and pulling sites. Facility location in areas where soils are highly erodible or have poor potential for revegetation contributes to visual impact.

Landscape characteristics--differences in landforms and vegetation patterns--influence facility visibility and intensity of visual impact. In the study area, landscapes that are relatively flat forested areas are typically better for hiding or screening a transmission line than are steep hillsides with forest cover. On steep hillsides, right-of-way clearing and access road construction can make the facility highly visible, contributing to visual impact. Hillsides where forests are more open, compared to those where the forest is uniformly dense, can better absorb a right-of-way and reduce visibility of the facility, though structures may still be visible.

Factors that contribute to considerable impact include viewer locations near the proposed facility and sensitivity to change in existing views and settings. Viewers who value existing views and settings may "see" a transmission line as an unwanted intrusion. This sensitivity to change can affect the intensity of impact, especially when many viewers near a proposed facility value an existing setting highly. Viewer sensitivity to change affects the degree of impact.

None of the options would disrupt or alter any of the dispersed recreation activities such as bicycling, hiking, fishing, or water-oriented sports on Lake Whatcom.

## IMPACT MEASURES

Impacts would be **considerable** where

1. A large number of people see the line in foreground and middle ground views and when they are highly sensitive to their surroundings; or
2. The lines dominate views and/or appear uncoordinated and chaotic. This may occur when two or more lines are visible and they are not similar in size, configuration, color and/or spacing

Impacts would be **moderate** under the following conditions:

1. When the line would be visible to large numbers of people but because of competing visual factors is not a dominant element in the landscape:
   - electrical facilities are already commonplace in the area,
   - views are partially screened,
   - large segments of the line may be visible but of short duration,
   - most views are in the middle ground;
2. When scarring from access roads or clearing swaths is evident but not severe or extensive;
3. When the line would conflict with prevailing land patterns but be visible to few people or for short duration.

Impacts would be **slight** under one or more of the following circumstances:

1. Few viewers would see the line because it is isolated, it is screened, or it is seen at a distance;
2. Existing conditions (transmission lines) have already established impacts (the incremental change from existing conditions would not be distracting to the casual viewer);
3. Access roads scars, clearing swaths would not significantly detract from the setting;
4. Views would be of short duration;
5. No visually sensitive resource would be affected.

## SITE-SPECIFIC IMPACTS

### Segments A - N

Concern for visual impacts is generally low for any option except on the northern portion of the route. There, Options 2 and 3, which have more visually dominant towers and conductors, would raise moderate concern. Impacts would be direct and long-term; they would occur from construction through operation for the life of the line. Impacts would be directly related to the visibility of towers, conductors, insulators, and other components from critical viewpoints, their prominence in those views, and the sensitivity of viewers. Where clearing would be required, the facilities might be more visible, increasing people's awareness of the existing corridor, and possibly raising questions about health issues, land use, and property values.

In the northern part of the route, 159 residences lie within 152 m (500 ft.) of **SEGMENTS A - E**. Viewer sensitivity here would be moderate to high. Most of the 28 residences within 30 m (100 ft.) of the line would have unobstructed views of skylined towers. Because residents normally are highly sensitive to changes in their views, they would be adversely affected by the new line; however, the incremental increase in impacts would be much less than with a new line and corridor because this is an existing corridor where impacts have already been established.

The size of the 500-kV towers and conductors (Options 2 and 3) would allow them to dominate nearby objects more than the existing structures. Initial impacts would be higher than with Option 1, but would moderate over time. Most residents beyond 152 m (500 ft.) would have low impacts because most are partially or fully screened from view by topography and or vegetation. Where the new line would be located in the middle of the corridor, it would be less noticeable.

On **SEGMENT A**, near Custer Substation, the character of the corridor would not be altered by Option 3. Existing structures have already established the primary impact. Replacement of wood with steel towers would not be likely to have a noticeable effect on the casual observer. The primary view is from I-5, a high-speed highway; only a glimpse of the corridor is possible. Near Zell Road, the large dead-end structures needed for extra clearance would have minimal additional visual impacts. This area already contains a complex array of existing towers and

lines of varying size and heights. Viewing opportunities are also limited to a lightly traveled local access road. Few if any residents would see the line from their homes.

Near Bellingham Substation (**SEGMENT C**), Option 3 would have impacts similar to those for Options 1 and 2. The dead-end structure, although in a different location and larger, would not change the character of the area or be more visible. The structure would be backdropped by a hill, preventing a "skyline" situation and reducing its apparent size.

On **SEGMENT E**, near Lake Whatcom, perceived impacts could be high because the corridor is near active residential development. Also, the structures would be at the edge of the corridor nearest to those residents. Additional clearing (10,500 linear m or 34,450 linear ft.) would be required for this segment, increasing visibility of the power line.

Farther south, in the middle portion of the route (**SEGMENTS F - J**), 39 residences lie within 152 m (500 ft.) of the corridor; 27 of those are within 30 m (100 ft.). Some of the residences would have unobstructed views of skylined towers. However, their viewing angle would be such that adverse impact would be low for the 230-kV option. The size of the 500-kV towers and conductors would make them more visible. Initial impacts would be moderate, lessening over time. Most residents beyond 152 m (500 ft.) would experience low-to-moderate impacts because most are partially or fully screened from view by topography and or vegetation.

Concerns for visual impacts in this portion of the route would be low for any option. The area is isolated, and additional structures or other configurations would have little, if any, additional impacts. Impacts would be direct and long-term, and would be related to visibility and viewer sensitivity, as described above.

In the southern portion of the project (**SEGMENTS K - N**), 93 residences would fall within 152 m (500 ft.) of the corridor; 82 would be within 30 m (100 ft.). Some residences in the 152-m zone would have unobstructed views of skylined towers. However, their views already contain competing visual elements such as an existing 500-kV line, distribution lines, highway traffic, other homes, buildings and so on. The addition of the new towers and conductors would make the corridor more visible, but would not dramatically change existing conditions. Due to population density near Sedro Woolley, sensitivity could be moderate along this section. Initial impacts would be moderate, lessening over time. Because the line would parallel another 500-kV line, adverse impact would be low for Option 1. Most residents

beyond 152 m (500 ft.) would have low-to-moderate impacts because most are partially or fully screened from view by vegetation or other obstructions.

Outside Sedro Woolley Substation (**SEGMENT N**), the dead-end structures for Option 3 would be larger than the adjacent ones, but they would be consistent with the existing established corridor. Although they would be visible from nearby residences and to travelers on Minkler Road, other structures would be closer and more dominant. The incremental increase in visual impacts would be low.

Recreation opportunities are limited because of the large amounts of fenced private property or areas of limited access. Dispersed activities include cycling on local roads. No recreation facilities or activities, except for a golf course on **SEGMENT M**, would be affected. The golf course is already crossed by two lines. The new line would replace one of those lines. Although larger, the line would have longer spans, eliminating several of the existing structures now within the golf course. Overall impact should be less (a positive benefit) because fewer obstacles will appear in the course. See also the **Consultation, Review and Permits** discussion on an historic trail.

**Section H1**

Concerns for visual impacts on this segment would be low to moderate for any option. As with the existing route, impacts would be direct and long-term, and would occur from construction through operation for the life of the line.

Four residences would fall within the 152-m zone (about 500 ft.); one of these would be within 30 m (100 ft.). All four already have views containing the line. Even though the size of the 500-kV double-circuit towers and conductors would make them more prominent, they would still be similar and thus compatible with the existing line. Impacts would be low because they would be incremental (additions to what is already established) and because most of the line would not be visible.

No recreation facilities or activities would be affected by this segment.

## MITIGATION

Impacts can be reduced to low-to-moderate by the use of non-specular conductors and of insulators similar to those on existing lines; by treating/painting towers to match existing towers; by matching existing tower sites; and by reducing clearing in critical areas along **SEGMENTS E AND G.**

## 9. CULTURAL RESOURCES [BPA]

The construction/removal, operation, and maintenance of transmission facilities can create temporary and permanent impacts on historic and archeological resources. However, extensive protective laws and regulations for these resources provide acceptable forms of mitigation of such impacts.

To date, there are no sites listed on the **National Register of Historic Places (NRHP).** (For consultation requirements, see the ***Heritage Conservation*** section under **Consultation, Review, and Permits.**)

Cultural resources are vulnerable to impacts from surface or subsurface disturbance and from visual intrusion. Structures are vulnerable to tree felling and to movement of heavy equipment. Vehicle traffic, dragging of objects, and erosion caused by project activities can cause minor disturbance or can totally destroy deposits on or below the surface. Increased public access to previously isolated areas, an indirect result of the project, may increase likelihood of further disturbance. A line or substation may also intrude visually upon the setting of cultural sites, especially historic sites with potential as interpretive locations.

## IMPACT MEASURES

The significance of a site depends partly on its sensitivity to impact. These also depend on the present condition of the cultural resources and on its relative importance. Sites are considered highly sensitive when they contain information important to the understanding of history and prehistory, are distinctive or unique, or are associated with peoples or events important in the history of the nation, region, or local area in which they occur. Disturbance of or visual

intrusion on such sites or areas could constitute a significant impact. (See **Mitigation** measures, below.)

The overall evaluation for each segment and site was determined on the basis of previously recorded site occurrences and potential for unrecorded cultural resources. The latter assessment was based on landform data, proximity to water and other resources, and general knowledge of the project area.

A **considerable** impact would occur where three or more cultural resource occurrences are found within 1.6 linear km (one linear mi.) of the corridor.

A **moderate-high** impact would occur where two cultural resource occurrences are found with a high potential for additional occurrences within 1.6 linear km (1 linear mi.) of the corridor.

A **moderate** impact would occur where at least two cultural resource occurrences are found within 1.6 linear km (1 linear mi.) of the corridor.

A **low-moderate** impact would occur where at least one site with the potential for additional cultural resource occurrences are found within 1.6 linear km (1 linear mi.) of the corridor.

A **low** impact would occur with one or no cultural resource occurrences are found per 1.6 linear km (1 linear mi.) of corridor.

## SITE-SPECIFIC IMPACTS

### Segments A - N

Concern for impacts on cultural resources would generally be high, except for the northern portion of the route, where concern would be moderate. Impacts would be caused primarily by construction of the line and access roads, which would directly affect cultural resources for the long term. Sites farther away from the line might be directly or indirectly affected for the long or short term. Most previously inventoried/ recorded sites would require additional evaluation. There would be no differences among options.

Specific areas of concern include the following (see Table 7 ):

- **SEGMENT A**: Several possible sites within 0.4 km (0.25 mi.).
- **SEGMENT B**: Possible sites under line at the Nooksack River; two prehistoric sites within 0.4 km (0.25 mi.).
- **SEGMENT C**: One site under the line.
- **SEGMENT D**: Possible sites under the line at Squalicum Creek; historic sites at Van Wyck within 0.4 km (0.25 mi.).
- **SEGMENT E:** Prehistoric sites at Olsen Creek under or within 0.8 km (0.5 mi.); BB&E Railbed; historic sites along Lake Whatcom and within 0.8 km (0.5 mi.).
- **SEGMENT F**: None known at this time.
- **SEGMENT G**: Historic sites at Wickersham and within 0.4 km (0.25 mi.); BB&E railbed; Acme Trail within 0.5 km (0.3 mi.); one Mirror Lake site under line.
- **SEGMENT H**: One site within 0.2 km (0.1 mi.); two sites within 0.4 km (0.25 mi.); one site within 0.8 km (0.5 mi.).
- **SEGMENT I**: Two sites under or within 0.4 km (0.25 mi.); three homesteads in Sec. 7, T36N, R5E.
- **SEGMENT J**: Two homesteads in Sec. 18, T36N, R5E.
- **SEGMENT K**: Seven homesteads in Sections. 19, 30, & 31, T36N, R5E; historic sites at Thornwood and within 0.5 km (0.3 mi.).
- **SEGMENT L:** Two homesteads in Sec. 31, T36N, R5E; Northern State Hospital (which has the potential to become a NRHP property) within 0.5 km (0.3 mi.).
- **SEGMENT M:** None known at this time.
- **SEGMENT N:** Sedro Woolley Substation (which has the potential to become a NRHP property), under line.

**Table 8. Northwest Washington Transmission - Cultural Resources Data by Segment**

| Segment Designation | Segment Type[c] | Number of Recorded Sites[a] | Cultural Resources Sensitivity Rank[b] |
|---|---|---|---|
| A | existing | 0 | low-moderate |
| B | existing | 0 | moderate |
| C | existing | 0 | moderate |
| D | existing | 0 | low-moderate |
| E | existing | 1 | moderate |
| F | existing | 0 | low |
| G | existing | 3 | high |
| H | existing | 0 | low-moderate |
| H1 | existing | 0 | moderate |
| I | existing | 0 | moderate |
| J | existing | 0 | moderate |
| K | existing | 0 | high |
| L | existing | 0 | moderate |
| M | existing | 0 | low |
| N | existing | 1 | moderate |

a Within 0.5 mi. of segment
b See text for definition of ranking elements
c Existing transmission line

**Section H1**

Concern for impacts on cultural resources in this section would generally be moderate. Impacts would be caused primarily by construction of the line and access roads, which would directly affect cultural resources for the long term. Sites farther away from the line may be directly or indirectly affected for the long or short term. Most previously inventoried/ recorded sites would require additional evaluation. There would be no differences among Options.

Specific areas of concern include the following:

- Eight homesteads in Sections 5, 7, 8, and 18, T36N, R5E; three sites under or within 0.8 km (0.5 mi.).

## MITIGATION

For directly affected sites, mitigation would include compliance with Section 106 of the National Historic Preservation Act: test excavation and possibly full-scale data recovery.

For any sites identified as above in the site-specific impact sections, BPA will comply with the National Historic Preservation Act of 1966, as amended, and all other laws and regulations protecting historic and archeological resources. Procedures include gathering of data, definition of specific site locations during the line location phase, and the developing of mitigation or avoidance measures with help from the Advisory Council on Historic Preservation and from the State Historic Preservation Office (SHPO). Where sites cannot be avoided, salvage will be undertaken in consultation with the SHPO, the Advisory Council on Historic Preservation, and the Secretary of the Interior.

The possibility of the late discovery of historic properties (i.e., the discovery of archeological remains during the construction phase of the project) is recognized by BPA. As stipulated in the regulations of the Advisory Council on Historic Preservation governing the Section 106 process, BPA will develop a plan for the treatment of such properties if discovered. Such a plan shall satisfy the requirements of Section 106, including evaluation of potential eligibility to the **National Register**. BPA will make reasonable efforts to avoid or minimize impacts on the property until requirements are satisfied.

## 10. SOCIAL AND ECONOMIC CONSIDERATIONS [BPA]

Impact measures for socioeconomics include the proposed project's short-term and long-term effects on the social and economic vitality of the affected communities, the value of agricultural and forest lands that could be removed from production and the perceived impacts on property values, particularly residential property values.[14]

The construction, operation and maintenance of transmission facilities can create both short-term and long-term social and economic impacts. **Short-term impacts** associated with construction of the proposed project include those impacts on the local communities, including the area's housing supply, infrastructure and schools, and any damage to agricultural crops as a result of project construction. **Long-term impacts** could include the removal of housing units or outbuildings in the right-of-way, the proposed project's effects on the local taxing districts, a perceived reduction in the quality of life and the loss of property value, the permanent loss of agricultural lands around and under tower bases, and the impacts caused by maintenance and/or lack of maintenance of the transmission line over the life of the project, including the proliferation of noxious weeds.

### SHORT TERM EFFECTS OF CONSTRUCTION

Construction of the proposed project is expected to be completed in a single construction season by 80 to 150 construction workers (Leonard, pers. comm., September 1992). Construction is anticipated to begin in the early April 1996 and be completed in October 1996; however, the actual construction period may vary by a month or two, depending on unforeseen environmental factors, including weather. The proposed project would be constructed in two segments: first from Sedro Woolley to Bellingham, and then (after energization of the first part) from Bellingham to Custer (see Figure 4).

#### Workforce

Most of the construction labor is expected to come from outside the local area, as transmission line construction work typically requires specialized skills not found locally. Most of the construction workers, such as lineman and assembly workers, would likely come

[14] Note: For related social and economic effects, see separate discussions on **Noise and Radio/TV Interference, Health and Safety, Visual/Recreation, and Vegetation/Noxious Weeds.**

from the Seattle, Spokane, and/or Portland areas and return home following project completion.

**Housing/Public Services**

Socioeconomic impacts on public services and temporary housing facilities are relatively minor and short-term for transmission line construction projects in most areas. A 1982 report prepared for BPA found that linear facilities, such as transmission line projects, typically use relatively older workers and have a smaller family accompaniment than other large-scale energy projects that involve fixed sites (Mountain West, 1982). Their study found that a population increase of 167 persons per 100 non-local transmission line workers (accompanied by 30 spouses and 37 children) could be anticipated for transmission line projects. This formula would predict a range of from 135 to 250 persons who would temporarily relocate to the local area, as a result of the proposed construction project. The actual number could well be smaller, however, since most of the non-local work force is likely to come from nearby Seattle (144 km or 90 miles from Bellingham). Those non-local construction workers who did not bring their dependents to the project area would be likely to stay in the local area through the week and return home on the weekends.

It is unlikely that many workers would permanently settle in the Bellingham-Sedro Woolley region. Most would leave following project completion, though some might stay permanently.

Lodging facilities are available to accommodate the anticipated number of non-local construction workers. Table 9 shows the amount of overnight lodging facilities currently available in the local area. A number of these facilities have kitchen units and are typically used for extended stays by contract workers. Numerous state parks and RV campgrounds also provide overnight stay possibilities, although they need to be reserved well in advance during the summer season, as they are popular with tourists from both sides of the border.

**Table 9: Motel Accommodations in the Project Area**

| Local Area | Number of Motels | Number of Motel Rooms |
|---|---|---|
| | | |
| **Bellingham** | 30 | 1225 |
| **Ferndale** | 1 | 96 |
| **Lynden** | 3 | 33 |
| **Sedro Woolley** | 1 | 47 |
| **Burlington** | 1 | 61 |
| **Mt. Vernon** | 3 | 274 |
| | | |
| **Total** | **39** | **1736** |
| | | |

Source: Donna Keller, Whatcom County Convention and Visitors Bureau
Bellingham, Washington (telephone communication, September 1992)

**Income Effects and Economic Activities**

Total payroll for the project is estimated at approximately $8.4 million (1992 dollars) based on an average hourly wage of $35 (Leonard, pers. comm., November 1992). This would represent less than one percent of the average annual total household income for the study area, which was $1.4 billion in 1989, the most current information available (1990 Census).

Research indicates that non-local workers spend about 40 percent of their pay locally (Mountain West Research Inc., 1982). Assuming that net income would amount to about 75 percent of gross income, local expenditures by the non-local construction workers would amount to about $2.4 million to $ 2.6 million (1992 dollars). These expenditures would be made primarily in Bellingham and in the other smaller communities where the project workers would be located. The expenditures would have a beneficial impact on the local economy within the study area over the 7-month construction period.

As contractors purchase supplies and materials locally (at an estimated value of about 10 percent of total project costs), a second short-term economic benefit may be realized by the local economy (Leonard, pers. comm., November 1992). With the total project costs estimated at approximately $36.8 million, the local purchase of fuel, vehicle parts and other goods and services could approach $3.7 million.

## LONG-TERM SOCIAL AND ECONOMIC EFFECTS

### Tax Effects

**Property Taxes.** The proposed project would have no beneficial effect on the local taxing districts with respect to property taxes, since, as a Federal agency, BPA pays no local property taxes on the value of its facilities. One, and possibly two, single-family residential dwellings might need to be removed in Skagit County if alternative route **H1** were selected near Wickersham. If these unit(s) were removed, rather than relocated, the amount of property taxes paid to the local taxing authority would be directly reduced. The actual amount of tax reduction would be insignificant, however, as so few units would be involved. If the housing unit(s) were relocated elsewhere within the County, there would be little, if any, effect on local property taxes.

**Personal Income Tax.** The State of Washington does not collect a personal income tax; therefore, this project would not generate any income taxes for the State of Washington.

**Sales Tax.** Washington State currently has a sales tax rate of 5%; however, contract workers would be exempt from paying any sales tax, because they would be working on government contracts within the State. Therefore, this project would have no impact on the amount of sales taxes collected by the State of Washington.

### Agriculture and Agricultural/Forest Products

The economic value associated with the loss of productive farmland was calculated for long-term loss where structure bases would displace farmland. Short-term loss of crops during the construction season was also evaluated. Affected agricultural commodities would be limited primarily to pasture and small grains; however a cornfield, canefield, and a tree farm would also be affected. All but a small amount of agricultural land crossed is non-irrigated.

The local hay crop has a current value of between $60 and $95 per metric ton ($55 and $85 per short ton), with an average yield of 12.4 metric tons (13.8 short tons) per ha (2.5 ac.) (Grushenmeir, pers. comm., 1993). Small grains such as barley and wheat are currently trading at between $3.00 and $4.00 per bushel, with a yield of between 124 and 148 bushels per ha (50 and 60 bushels per ac.) for spring barley, and 250 -272 bushels per ha (100 - 110 bushels per ac.) for winter wheat. Corn is grown in the area, usually for silage, with a value of

about $27 per metric ton ($30 per short ton) and a normal yield of 44 metric tons per ha (20 short tons per ac.). Winter wheat in the area is usually grown only as a rotation crop for certified seed potatoes, one of the principal field crops grown. The highest value crop grown locally is caneberries, usually red raspberries. Red raspberries are currently trading at between $1100 and $1300 per metric ton ($1000 and $1200 per short ton), depending on the variety, and usually produce an annual crop of between 6.7 and 8.9 metric tons per ha (three and four short tons per ac.) (Timblin, pers. comm., 1993).

Based on these assumptions, the long-term agricultural impacts of the route options due to loss of productivity at structure bases (occupying an average 135 -165 $m^2$ or 1450 - 1740 $ft.^2$ per base) range from a total of $840 to $1060 per year (1993 dollars). BPA would compensate farmers affected by such losses.

The economic value associated with temporary loss of agricultural crops/grasses was calculated on a worse-case basis: that is, that the entire width of a 30-m (100-ft.) right-of-way could be lost from productive capacity for an entire growing season. Losses, depending on route selected, could range from $63,000 to $88,000, depending on route chosen and particular crop grown. Real losses are more likely to run 10 percent of these figures, since in most cases only the area surrounding the structure sites and the spur roads leading to them would be disturbed. BPA would compensate farmers for any damage to agricultural crops/grasses or to the soil itself.

Impacts would also be caused by removal of danger trees outside the right-of-way and for access road construction for some of the route options. BPA would compensate landowners for any trees removed from off the right-of-way.

**Interference with Agricultural Practices**

This proposed project would likely remove a net 0.2 to 0.5 ha (0.49 to 1.24 ac.) from agricultural production, depending on option selected. However, a number of the H-frame, wood-pole structures would be removed from cultivated fields, a beneficial effect. Fewer towers would interfere less with agricultural practices such as maneuvering farm machinery near these facilities.

**Loss of Productive Farmlands**

New structures on agricultural lands remove farmlands from production beneath steel tower bases. Removing the existing transmission line and rebuilding with one of a higher capacity would reduce the number of towers needed to support the (higher-voltage) conductors. Any option would require about 7.2 structures per km (4.5 structures per mi.). However, the space occupied by each tower would be markedly greater than that occupied by the wood pole H-frame structures replaced: about 135 $m^2$ (1450 $ft.^2$) per 230-kV structure and about 165 $m^2$ (1740 $ft.^2$) per 500-kV structure. The structures would thus typically occupy .06 to .07 ha per km (0.15 to 0.18 ac. per mi.).

Because the existing structures would be removed from the right-of-way, however, the net loss in agricultural land for the project as a whole, would amount to about 0.2 ha (0.49 ac.) for Option 1; or 0.36 ha (0.90 ac.) for Option 2; or 0.42 to .5 ha (1.04 to 1.24 ac.), depending on tower size used, for Option 3. Additional area around structure bases might be lost from production, depending on size of farm equipment and cropping patterns. No additional land would be lost with respect to pastureland, however.

**Nuisance, Trespass, Vandalism**

Where the right-of-way passes through private property, the potential for nuisance, trespass, and vandalism greatly increases. Any new access roads would increase the likelihood much more. The use of these roads for recreational vehicles such as motorcycles could be a source of potential nuisance for farmers, ranchers, and other landowners. Roads could also be used for unauthorized hunting.

Local residents whose land is crossed by the right-of-way might have their land use options restricted for the safe operation and maintenance of the higher-voltage line. They and other residents near the line must also cope with the visual presence of the transmission line.

Maintenance of the line requires periodic inspection and occasional action by maintenance crews. Although landowners are contacted before crew entry, crops may sometimes be damaged by vehicle needed for emergency maintenance. Standard BPA practice includes compensation for any such damage.

**Property Impacts**

Although BPA proposes to rebuild within the existing right-of-way, one of the alternatives would involve acquiring about 6 km (3.75 mi.) of additional right-of-way for **SEGMENT H1**, previously described. This new right-of-way would accommodate constructing a new double-circuit line parallel to an existing 500-kV single-circuit line, as described in **Chapter 2, Section C2**. Generally, the existing access road system would be used for this project; however, short new spur roads might be needed in the mountainous parts of the project. BPA would compensate landowners for any new land rights required for this project.

Landowners would be offered fair market value for new land rights (if needed), established through the appraisal process. Any new land rights needed for transmission line or access road rights-of-way would be acquired as easements. The appraisal process takes all factors affecting value into consideration, including the impact of transmission lines on property value. It may also reference studies conducted on similar properties to add support to valuation considerations. The strength of any appraisal depends on the individual analysis of the property, using neighborhood-specific market data in order to determine fair market value. Impacts on property for existing and new right-of-ways for transmission lines and access roads for this project are discussed below.

**Existing right-of-way.** Land types along the existing right-of-way include farmland, forest land, and residential property, in both rural and urban areas. The existing transmission line has already imposed land use limitations on the farm, forest, and residential properties along the right-of-way by the physical presence of the lines and towers, as well as use limitations imposed by the original easement documents. The original easements were acquired by BPA from 1946-1947, 1963-1965, and 1971-1973. The new double-circuit line would be placed on the same alignment as the existing 230-kV line. Other issues along the existing right-of-way include soils, vegetation, health and safety, visual resources, and recreation.

Rebuilding the transmission line would have the additional impact of replacing the H-frame wood poles with larger lattice-steel towers. Although with Options 2 and 3 the new towers would be taller, all three options have the offsetting benefit that distance between the towers would be increased, so fewer towers would be needed; and new towers would generally line up with the existing 500-kV towers. To the extent possible, when a transmission line is rebuilt, it is designed to minimize the impact on existing and proposed (if known) irrigation systems. If rebuilding the transmission line creates a need to redesign irrigation equipment or

layout, BPA compensates the landowner for this additional cost. Overall, this project is not expected to alter significantly the impacts on land use and resources on or off right-of-way. These impacts are already reflected in the market value of properties in the project area.

**New right-of-way.** The proposed plan does not require the acquisition of any new transmission line right-of-way, except for a potential new right-of-way on **SEGMENT H1** and very small pieces of parcels at two or three locations that might be needed for Option 3. Most of the land types along this segment are rural residential and forestland. The existing access road system would be used for this project; however, short new spur roads might be needed in the mountainous parts of the project primarily affecting forestland.

*For forestland,* fair market value is paid for all timber to be cut on new right-of-way, as well as for any trees off the right-of-way that need to be cut for construction purposes or that pose a danger of falling into the line or across the access roads. A line crossing *forestland* generally leaves little value to the property for its intended use; therefore, fair market compensation for a transmission line easement across forestland may be close to full fee value. If BPA acquires rights on existing access roads and the landowner has equal benefit and need of the access road, fair market compensation is generally 50% of full fee value. If the landowner has little or no use for the access road, fair market compensation is generally close to full fee value. If BPA acquires rights on existing access roads and the landowner is the only other user, fair market compensation is generally 50% of full fee value, or something less than 50% if other landowners share the access road use.

*For rural residential property,* the impact of introducing a new right-of-way for transmission towers and lines can vary dramatically, depending on the placement of the right-of-way in relation to the property's size, shape, and location of existing improvements. BPA's easement documents specify "the present and future right to clear the right-of-way and to keep the same clear of all structures, trees, brush, vegetation, and fire hazards, provided, however, that vegetation and fire hazards shall not include agricultural crops." Therefore, the right-of-way would limit the ability to build structures, as well as the ability to grow ornamental trees and shrubbery (height limitations) within the transmission line right-of-way. A transmission line might also diminish the utility of a portion of property if the line were effectively to sever this area from the remaining property (severance damage). Whether a transmission line introduces a negative visual impact depends on the placement of the line across a property, as well as on each individual landowner's perception of what is visually acceptable or unacceptable. If the transmission line were to cross a portion of the property in agricultural use such as pasture or

cropland, little utility would be lost between the towers, but 100% of the utility would be lost within the base of the tower. Towers may also present an obstacle to operating farm equipment and controlling weeds at tower locations. To the extent possible, new transmission lines are designed to minimize the impact on existing and proposed (if known) irrigation systems. If the introduction of a transmission line creates a need to redesign irrigation equipment or layout, BPA would compensate the landowner for this additional cost. These factors, as well as any other elements unique to the property, are taken into consideration to determine the loss in value within the easement area, as well as outside the easement area in cases of severance.

Other resources that may be affected by the new right-of-way on *forestland* and *rural residential* properties include soils, vegetation, health and safety, visual resources, and recreation. The impacts on these various resources and mitigation actions are described in **Chapter 4 (Environmental Consequences).**

**Property Impact Studies**

Several studies have been conducted throughout the United States and Canada, to identify the impact of overhead electrical transmission lines on property values. A recent publication, The Effects of Overhead Transmission Lines on Property Values (July 1992), was prepared for the Edison Electric Institute Siting and Environmental Planning Task Force by Cynthia A. Kroll and Thomas Priestley. This publication reviews and summarizes several research projects conducted over the past 15 years. Three of the studies occurred within the BPA region. A 1985 study in western Montana, affecting suburban and rural residential property (both improved and unimproved), referencing a 230-kV line and a proposed 500-kV line, concluded that no adjustment to market price was necessary for properties encumbered by or in view of the line. A 1990 study in western Montana, affecting suburban and rural residential property, and referencing a 500-kV line, analyzed interviews with 400 residents. Fifty percent of those residents living within almost 2 km (1 mi.) of a 500-kV line felt there was a negative effect on property value, while only 5% of the residents living within 2 to 5 km (1 to 3 mi.) from the line felt there was a negative effect on property value. A 1983 study along the Oregon/Idaho border affecting agricultural grazing land, referencing a 500-kV line, concluded that value was affected only by the amount of land removed by towers and roads; and that owners perceive effects if a potential exists for residential use or if lines disrupt irrigation. BPA is currently conducting a study on the impact of overhead transmission lines on property value in the Portland, Oregon, and Seattle, Washington, metropolitan areas. After the raw data is verified,

reviewed, and statistically analyzed, the study results will be available to the public (spring/summer 1994). We are not aware of any other studies that have taken place in the immediate project area.

The project area (or neighborhood) can define the general economics, social, and political atmosphere that may have an impact on property values. A neighborhood encompasses the general perceptions of the community relating to what makes a property desirable or not. To determine the impacts of transmission lines on property and property value, several variables must be considered. These variables include but are not limited to neighborhood; site-specific characteristics of the property; whether the project is a rebuild of an existing, or construction of a new, transmission line; and the proposed construction design.

## IMPACT MEASURES

Impact measures for socioeconomics are related to the proposed project's impact on the human environment, including the taking of any residential properties, perceived impacts on residential property values, crop damage during construction activities, and any irrigated or non-irrigated agricultural or timber lands being removed from production. Impacts would also include the proposed project's short-term and long-term effects on the social and economic vitality of the communities affected by the project. Impacts can be both beneficial and adverse.

When private land is crossed, impacts occur from construction activities and from the increased access afforded by the line. These impacts include potential trespass, nuisance during construction and maintenance, potential vandalism, and perceived effects. Severity of impact is measured by the number of residences potentially affected, and amount of agricultural and forestland crossed.

Economic impacts may occur where the transmission line and structures themselves interfere with the livelihood of the area's residents. Much of the transmission corridor passes through rural areas where agriculture activities are a primary economic pursuit. Impacts may occur where the transmission line interferes with agricultural practices. Severity of impact is measured by how much agricultural land is crossed in a given area. For evaluation of specific impacts on agriculture, see **Agriculture**.

Finally, agricultural land taken out of production was measured by amount of land occupied by tower bases. Since the acreage figures for the amount of land taken out of production are small in comparison to the total amount of land in production, this factor is less significant than the others in determining overall impacts.

Because these are measures of social and economic effects, they have more meaning for combinations of segments than for specific locations. Thus, the site-specific impacts identified below focus more on groups of segments than on individual segments within each sector.

**Considerable impacts** would be expected where the effects of the action on the quality of the human environment are likely to raise a high level of concern, such as the perception of a significant decline in property values as a result of the proposed project or the need to remove or relocate homes. Considerable impacts would be realized where a large amount of a landholder's agricultural land were removed from production. Considerable (though short-term) impacts would also be realized if an influx of construction workers were to place a significant burden on the local communities' ability to provide services or if these communities were to experience significant costs for having done so.

**Moderate impacts** for the socioeconomic resource would be expected where residential dwellings are sparsely located within 152 meters (500 ft.) of the proposed transmission line, and although the residents may feel that the proposed project may adversely affect their property values, it is not known to be a significant concern. Moderate impacts would also be realized where some productive farmlands and forestlands might be removed from production, but not a significant amount.

**Slight impacts** for the socioeconomic resource are anticipated where only a relatively few residential dwelling units exist within 152 meters (500 ft.) of the transmission line corridor, no controversy is known to exist, and only a small amount of agricultural land or forestlands, if any, are removed from production. Slight impacts are also anticipated for construction and maintenance activities involved with constructing and maintaining the proposed transmission line.

**Range of Impacts Anticipated**

Socioeconomic impacts are anticipated to include the perception of an overall loss of the quality of life, including the perceived loss in property values and the economic loss in the

reduction of productive farmlands. The reduction of the quality of life for social impacts includes both tangible and intangible impacts.

***Tangible*** social impacts include the following:

- visual degradation of the area as a result of the replacement of the existing 21-m (70-ft.) tall wood poles with either 37-m (122-ft.) steel structures (230-kV double-circuit) or 54-m(177-ft.) steel structures (500-kV double-circuit);
- perception that the new transmission line might interfere with radio and television reception and that transmission line noise would result from increased voltage being carried by the new transmission line;
- potential spread of noxious weeds onto adjacent lands;
- permanent scarring of the landscape following construction activities; and
- potential vandalism and theft from unlawful use of the right-of-way.

***Intangible*** social impacts are those perceived and reflected in attitudes such as anxiety and distress. Intangible impacts are those that cause worry and concern and include:

- the perception of an overall loss in the quality of life, especially where the transmission line crosses residential parcels and separates those properties from relatively undeveloped forested areas;
- perceived loss of property value; and
- concern about health effects such as EMF and the danger of electric shock or fire following a separation in one of the conductors.

Economic impacts would include the impacts the proposed project might cause on the local economy. These impacts would include both beneficial and adverse impacts.

## SITE-SPECIFIC IMPACTS

### Segments A - N

All socioeconomic impacts would be indirect, except for damage to agricultural crops and acreage removed from production. Construction impacts would be short-term. Other impacts would be for the life of the line.

Concern would be low to moderate for the residents who live along most of the transmission line corridor, but potentially high for impacts on residents who live along **SEGMENT E** near Agate Bay, as seen in the concern expressed at the scoping meeting about the proposed project in this area.

Within 152 meters (500 ft.) of the transmission line are found 614 homes. Almost 60% of these are found along **SEGMENTS A THROUGH E.** There would be short-term impacts from removal of the existing 230-kV transmission line and construction of the new transmission line (resulting in increased human activity during these activities). The new transmission line would be likely to be more visible to those residents who live along the corridor than the existing transmission line is, a slight-to-moderate adverse impact (see **Visual/Recreation**). However, the new towers would be aligned with the existing towers (a slight-to-moderate beneficial impact). Some nuisance, trespass, and vandalism may occur as a result of the proposed project. The nearby landscape would be permanently scarred after construction, a long-term impact. The presence of the higher-voltage line within the corridor might negatively affect some people's perception of their quality of life and, therefore, their perception that their property value may be adversely affected by the proposed project. In addition, short-term maintenance impacts would result in increased human activity for the life of the proposed project (42 years).

A second concern for socioeconomics is the linear amount of agricultural land crossed: 17 km (10.5 mi.) in all. About 26.7 ha (66 ac.) of agricultural land would be located within the right-of-way. Concern for impacts on agriculture would be considered low for all segments except **SEGMENT B,** where impact concern would be moderate because 12.7 km (7.9 mi.) of agricultural fields would be crossed. Lesser amounts are crossed in other segments. Impacts on agricultural crops may occur during construction activities, a short-term impact. Steel towers would replace the existing H-frame wood pole structures in this section. Because spans are greater, there would be fewer towers (a slight, beneficial impact for farm

operations); however, the tower bases themselves would occupy slightly larger amounts of ground, a slight-to-moderate adverse impact.

A third concern is the numbers of net acres removed from agricultural production by the tower bases:

- About 0.20 ha (0.49 ac.) for Option 1,
- About 0.36 ha (0.89 ac.) for Option 2, and
- About 0.41 to 0.49 ha (1.03 to 1.28 ac.) for Option 3, depending on tower size selected.

The permanent loss of agricultural land beneath tower bases would be a long-term impact. Weeds could proliferate around tower bases after construction activities, a short-term impact with potential long-term implications.

**Section H1**

One to two residential dwelling unit(s) would need to be removed or relocated from the new right-of-way. The impact on those units would be considerable, but would not affect the area's housing supply. Impacts would be considerable to the forestland that would be permanently removed from production, but in the context of the area, the impacts would be moderate. No agricultural resources would be affected. Four residences are located within 152 m (500 ft.) of this route alternative. Overall impacts with any design option would be moderate.

Selection of this alternative route would involve the acquisition of new right-of-way immediately west of, and adjacent to, BPA's Monroe-Custer # 1 transmission line. A new right-of-way would need to be acquired that would be 34 meters (112 ft.) wide and 6 km (3.75 mi.) long, encompassing an area of about 21 ha (51 ac.). This new right-of-way would be cleared of all trees. Since BPA would acquire the use of the right-of-way through an "easement" rather than "in fee," there would be no change in the amount received by the local taxing authority if this alternative were selected. (If the right-of-way were acquired "in fee," the land would be removed from the local tax rolls, since BPA, as a Federal entity, pays no real estate taxes.)

In addition to the right-of-way that would be acquired and permanently removed from production, an additional 13 ha (33 ac.) would need to be selectively cleared of any "danger trees" adjacent to the right-of-way.

### MITIGATION

None of the impacts identified above could be avoided. However, some could be mitigated to some degree. For example, visual impacts on adjacent property owners would be reduced by using non-specular conductor (see **Visual Resources** section). To address agricultural impacts, BPA engineers would work with the landowners in siting transmission towers to the extent practicable.

As the project involves using the existing right-of-way, no new easements may be needed. However some easements are needed (such as for **H1**), landowners would be compensated for land rights acquired by easement, based on the true market value of the land, improvements, and value of any timber removed. BPA would compensate landowners for any danger trees that would need to be removed off the right-of-way, based on their stumpage value.

With regard to other mitigation measures necessary to minimize any adverse impacts on socioeconomics (particularly to local residents), see those identified under **Visual/Recreation, Health and Safety,** and **Noise and Radio/TV Interference** in this chapter.

## 11. NOISE AND RADIO/TV INTERFERENCE [BPA]

### AUDIBLE NOISE

Noise impacts result from construction activities and from the operation of the transmission facilities. Construction noise is short-term and typically does not result in any serious disturbances to residents.

Audible noise produced by transmission line corona is a hissing, popping, or crackling sound. It is primarily associated with lines of 345 kV and above. A 120-Hz " hum" is also occasionally super-imposed on the corona-generated noise. The sound level depends on the

ambient noise level present, conductor and tower geometry, operating voltage, and weather. Audible noise from transmission lines increases in wet weather.

Transmission line audible noise is usually measured in decibels (dB) on what is called the "A Scale" (dBA). It models how the human ear perceives sound.

Environmental noise limits, applicable to this project, are regulated by the Washington State Department of Ecology regulations, "Maximum Environmental Noise Levels" (WAC 173-60). The state regulation establishes limits on the levels and durations of noise. Allowable maximum sound levels depend on the land use of the source and receiving property. For most sources of noise, the allowable levels are reduced by 10 dBA for residential receiving properties at night (between 10 p.m. and 7 a.m.) (WAC 173-60-040-2b). However, noise from electrical substations is exempt.

The Federal Noise Control Act of 1972 (42 U.S.C. 4901) requires that Federal entities, such as BPA, comply with State and local requirements regarding noise.

For this project, noise limitations in residential neighborhoods are 60 dBA; in commercial areas, 65 dBA; and in industrial areas, 70 dBA. Each of these limitations is reduced by 10 dBA at night. Sound created by the installation or repair of essential utility services is exempt from the sound level limits during daytime hours (WAC 173-60-050-1e). Noise from electrical substations is also exempt (WAC 173-60-050-2a).

Both of the proposed Option 1 and Option 2 new transmission lines would be designed to operate individually at or below the existing Washington State noise limit of 50 dBA at night. However, the existing 500-kV Monroe - Custer # 2 line does not presently meet the Washington State noise limits during foul weather. (See Table 10.) This line was designed and built before these limits were established. Construction of either Option 1 or Option 2 would not affect noise levels of the existing lines and would not increase overall along the corridor.

If Option 3 were selected, the existing 500 kV Monroe - Custer # 2 line would be operated at 230 kV. Thus the existing noise levels on this line would be reduced, decreasing noise levels at the edge of the right-of-way by about 15 dBA. However, in a few instances along the edge of the right-of-way, during foul weather, calculated noise levels might be one to three decibels above Washington State environmental noise limits.

An exception would be for the most northern part of the project (SEGMENT A) near Custer Substation. (See Figure 4.) Because the operation of the existing 500-kV Custer - Monroe # 2 line would remain unchanged in this segment, noise reduction anticipated for Option 3 would not occur here. There are four residences in this segment. They are from 91.5 to 219.5 meters (300 to 720 ft.) from the Monroe - Custer #2 line.

**Table 10: Estimated Existing Range of Audible Noise Level (dBA) at right-of-way edge along BPA line route***

| | Existing | 230-kV Option 1 | 500-kV Option 2 | 500-kV Option 3** |
|---|---|---|---|---|
| | 57-66 | 56-66 | 56-66 | 42-51 |

* Noise levels given above are for foul weather. Less noise is produced during fair weather.
* Noise levels increase with elevation. For 915 meters (3000 ft.), add 2.5 dBA.

** Excludes Segment A.

For Option 1 or 2, noise levels would remain unchanged. Option 3 would decrease existing noise levels produced by the Monroe - Custer # 2 line. Estimated levels associated with Option 3 might not strictly meet Washington State environmental noise limits in a few locations along the corridor during foul weather. The table above indicates that during foul weather the noise levels might reach 51 dBA, or as much as 54 dBA at the highest elevation (853 meters or 2800 ft.) along the corridor. However, there are no residential properties, homes, or other buildings at the higher elevations. Additionally there are only about four homes close enough to the edge of the right-of-way to experience the 51 dBA level, which represents a decrease of about 15 dBA from presently existing levels.

The dBA calculations are based on a range of *conservative* assumptions about the physical and operational characteristics of the transmission lines in the corridor. Consequently, the estimated dBA levels reported above tend to be conservative as well--that is, they may be slightly *higher* than those actually experienced in the field. Therefore, when comparing projected levels (Table 10) with the State standards (based on actual readings), it appears likely that standards would be met with Option 3.

In order to design the transmission system so that estimated noise levels would *strictly* (technically) meet the Washington State noise standards (a calculated reduction of about 1 more dBA), an additional $2.2 million would have to be added to the cost of the project.

## RADIO AND TELEVISION INTERFERENCE

Corona occurs in regions of high electric field strength on conductors, insulators, and hardware when sufficient energy is imparted to charged particles to cause ionization (molecular breakdown) of the air. Corona may result in radio and television reception interference by generating a high-frequency noise called electromagnetic interference (EMI). EMI is the static sometimes heard over an automobile radio when driving beneath high-voltage lines. It is usually associated with higher-voltage lines, i.e., 345-kV and above. Corona activity also produces audible noise. ( See **Audible Noise** section, above.)

Federal Communications Commission (FCC) regulations require that incidental radiation devices (such as transmission lines) be operated so that radio and televisions reception will not be seriously degraded or repeatedly interrupted. Further, FCC regulations require that the operators of these devices mitigate such interference.

BPA policy is to comply with FCC requirements. While none of the proposed alternatives is expected to increase EMI above existing levels, each complaint about EMI will be investigated. If the new BPA transmission line were found to be the source of radio or television interference in areas with reasonably good reception, measures would be taken to restore the reception to a quality as good or better than before the interference.

Overall, BPA receives very few RI or TVI complaints. Essentially, all legitimate complaints are satisfactorily corrected. As a result of these factors, RI/TVI impacts would be minimal.

## 12. AIR QUALITY [BPA]

Air Quality can be affected in the construction, operation, and maintenance of transmission facilities, primarily during construction. Clearing of trees and vegetation can produce debris that would need to be disposed of, either by lop-and-scatter techniques or by burning in the right-of-way, creating smoke and particulates. Construction vehicles on dirt/graveled roads would create dust. The use of machines/vehicles with internal combustion engines would create carbon monoxide and nitrous oxides ($NO_X$). The operation of the line would also create ozone.

## SITE-SPECIFIC IMPACTS

Impacts on air quality would primarily be short-term and temporary, and associated with construction activities. Any of the three design options on the existing right-of-way would require the same amount of clearing: about 46 ha (116 ac.) Clearing would occur in those places where the rebuild would be located along the edge of the right-of-way. With the **SEGMENT H1** alternative, a net increase of 26 ha (65 ac.) of clearing would be added to the total for the project (for a total of about 72 ha or 181 ac. overall).

Typically, impacts would include increased particulates from any slash burning and dust generated during clearing and construction activities. In the worst case, an estimated total of 1.24 tons (1.38 short tons) of suspended particulate would be produced per ha (ac.) of slash burned, if no lop-and-scatter techniques were employed. Such burning would occur in localized areas along **SEGMENTS E** through **L** (between BPA's Bellingham Substation and Sedro Woolley), on a staggered time basis along the right-of-way. However, for this project, a combination of lop-and-scatter and slash burning would occur. Lop-and-scatter would occur when and/or where fire danger would be a major concern. Burning would inject smoke into two rural populated areas of concern. The Whatcom Lake area is a fairly contained ***airshed*** with high concentrations of people. The middle Samish River drainage is a moderately contained airshed with small concentrations of people and a heavily traveled two-lane highway.

Impacts would be short-term and of moderate intensity; they would be associated mainly with clearing activities. Slash burning (where employed) would occur for a few days per occurrence during the 1996 construction season (about April - October) and would be highly localized. Even if all slash were burned and all at the same time, and if particulates were a regulated pollutant under the 1990 Clean Air Act amendments for stationary sources (which they are not), the estimated 145 metric tons (161 short tons) produced would be less than the 250 tons per year that would trigger the Clean Air Act process.

Other particulates generated would include minor amounts of fugitive dust from use of heavy equipment on access roads during dry weather. With mitigation, impacts would be slight, short-term, and highly localized.

Some minor amounts of carbon monoxide (CO) and nitrous oxides ($NO_X$) would be generated by gas-powered construction vehicles. Vehicles used for construction would meet applicable

air emission standards. A trace amount of ozone would be produced by the transmission line. Impacts would be slight, as amounts are very minor compared to the annual production in nearby populated areas. They would also be short-term and localized.

### MITIGATION

Water or water-based solutions would be applied to roads during warm/dry periods. If any burning were to occur, the construction contractor would be required to coordinate with local air pollution and fire control authorities and to obtain any necessary local burning permits.

## 13. GLOBAL WARMING [BPA}

Global warming, although in some respects similar to air pollution in concerns, is highly speculative and generally unregulated. Therefore, it is presented separately. (See also **Air Quality, Section 12**.) Global warming is also characterized by a broad geographic area, as opposed to more localized, regulated air quality issues.

Global climatic change, an extremely complex subject, is not fully understood in the scientific community. Nevertheless, it has been a major concern to scientific institutions and groups around the world. Concerns over issues such as possible atmospheric warming and stratospheric ozone depletion are recurring themes. Much attention has been given to production of "greenhouse gasses" and "ozone-depleting" chemicals in the industrialized nations. However, the relationship between these substances and global climate is uncertain and continues to be the subject of extensive research. Also, much depends on the ability to model the incredibly complex behavior of the global atmosphere.

The United States has taken the approach that it is prudent to take some actions now to reduce some emissions and attempt to build a global understanding/consensus. This has been partially represented by the 1990 amendments to the Clean Air Act ("partially" in that the Clean Air Act has to do with other issues such as acid rain, hazardous chemicals, localized areas of significant air degradation, etc.).

With regard to the proposed project, decisionmakers are faced with the uncertain state of knowledge about the behavior of the global climate and the commitment to focus on reducing

the production of greenhouse gasses. Much attention has been paid to reducing the production of $CO_2$.

Typically, the amounts of $CO_2$ contributed by the construction of transmission lines is relatively minor and short-term (for this proposed project, one construction season). Those amounts attributable to slash burning and forest removal (reduction in $CO_2$ uptake) in general for the project would be a minor amount compared to that annually occurring in the area. (See **Vegetation.**) In particular, for the ***nonattainment*** areas, airborne particulates associated with clearing and construction activities would be subject to applicable air quality standards. (See **Air Quality**)

Due to the relatively minor contribution foreseen by this project, and based on the current national focus on achieving reductions in $CO_2$, global climatic change is not expected to be a significant factor influencing the choice of alternatives.

## 14. HEALTH AND SAFETY [BPA]

BPA recognizes strong public concern regarding the possible effects of the electrical properties of transmission lines on public health and safety. These effects include electric shocks, noise, and potential long-term health effects. In response to this public concern regarding EMF, the agency has taken several steps. These include:

- **Developing Interim Guidelines for EMF.** (See **Appendix C.**) These guidelines name EMF as a major decision factor to be considered in locating and designing new BPA facilities.

- **Discouraging intensive uses of rights-of-way.** In 1990, BPA revised its right-of-way management practice. BPA no longer encourages new uses of its rights-of-way which would increase human exposure to EMF.

- **Exposure Mitigation.** BPA was among the first voluntarily to adopt practices to mitigate EMF exposures. This means taking reasonable or practical actions that will prevent people's exposure to new sources of EMF.

## SAFETY PRECAUTIONS

Power lines, like electrical wiring, can cause serious electric shocks if certain precautions are not taken. These precautions include building the lines to minimize the shock hazard. All BPA lines are designed and constructed in accordance with the National Electrical Safety Code (NESC). NESC specifies the minimum allowable distances between the lines and the ground or other objects. These requirements basically determine the edge of the right-of-way and the height of the line, i.e., the closest point that houses, other buildings, and vehicles are allowed to the line, to limit electric field effects to acceptable levels.

People must also take certain precautions when working or playing near power lines. It is extremely important that a person not bring anything, such as a TV antenna or irrigation pipe, too close to the lines. BPA provides a free booklet that describes safety precautions for people who live or work near transmission lines (Living and Working Around High Voltage Power Lines).

Transmission lines can also induce voltages into objects near the lines. This effect can lead to nuisance shocks if a voltage is induced on something like wire fencing which is on wood posts and, therefore, insulated from ground. Usually, however, this becomes a problem only with lines of voltages above 230 kV. Should problems develop with either high- or low-voltage lines, they can be corrected by simple grounding techniques. For 500-kV lines, grounding of certain objects near the lines is a routine part of the construction process.

## ELECTRIC AND MAGNETIC FIELDS

Power lines, like all electrical devices and equipment, produce ***electric fields and magnetic fields (EMF)***. ***Current*** (movement of electrons in a wire) produces the magnetic field. ***Voltage*** (the force that drives the current) is the source of the electric field. The strength of these fields also depends on the design of the line and on distance from the line. Field strength decreases rapidly with this distance.

Electric and magnetic fields are found around any electrical wiring, including household wiring and electrical appliances and equipment. Throughout a home, the electric field strength from wiring and appliances is typically less than 0.01 kilovolts per m (kV/m). However, fields of 0.1 kV/m and higher can be found *very close* to electrical appliances. Typical electric and magnetic field strengths for some common electrical appliances are given in Table 11 below.

**Table 11: Typical Electric and Magnetic Field Strengths 30.5 cm (1 ft.) from Common Appliances**

| *Appliance* | *Electric Field (kV/m)* | *Magnetic Field* [1] *(mG)* |
|---|---|---|
| | | |
| Coffee Maker | .030 | 1 -1.5 |
| Electric Range | .004 | 4 - 40 |
| Hair Dryer | .040 | 0.1 - 70 |
| Television | .030 | 0.4 - 20 |
| Vacuum cleaner | .016 | 20 - 200 |
| Electric Blanket [2] | .01 - 1.0 | 15 - 100 |
| | | |

kV/m = kilovolts per m

mG = milligauss

1. By 1 to 1.5 meters (3 - 5 ft.), the magnetic field from appliances is usually decreased to less than 1 mG.
2. Values are for distances from a blanket in normal use, not 1 ft. away.

Source for appliance data: Miller 1974, Gauger 1985

Average magnetic field strength in most homes (away from electrical appliances and home wiring, etc.) is typically less than 2 milligauss (mG). *Very close* to appliances carrying high current, fields of tens of hundreds of milligauss are present. Unlike electric fields, magnetic fields from outside power lines are not reduced in strength by trees and building material. So, power lines can be a major source of magnetic field exposure throughout a home located close to the line. Typical electric and magnetic field strengths for some BPA transmission lines are given in Table 12 below.

There are no national standards for electric or magnetic fields. Some states have established electric or magnetic field standards; however, the State of Washington has not set a standard for either. BPA has an electric field standard of 9 kV/m maximum on the right-of-way and 5 kV/m at the edge of the right-of-way. This project will meet this electric field standard.

**Table 12: Typical Electric and Magnetic field Strengths from BPA Transmission Lines**

| | *Electric Fields* | *Magnetic Field* | |
|---|---|---|---|
| ***Transmission Lines*** | ***(kV/m)*** | ***(mG)*** | |
| | | ***Maximum*** [1] | ***Average*** [2] |
| 115-kV | | | |
| Maximum on Right-of-way | 1.0 | 63 | 30 |
| Edge of Right-of-way | 0.5 | 14 | 7 |
| 60 m (200 ft.) from Center | 0.01 | 1 | 0.4 |
| | | | |
| 230-kV | | | |
| Maximum on Right-of-way | 2.0 | 118 | 58 |
| Edge of Right-of-way | 1.5 | 40 | 20 |
| 60 m (200 ft.) from Center | 0.05 | 4 | 2 |
| | | | |
| 500-kV | | | |
| Maximum on Right-of-way | 7.0 | 183 | 87 |
| Edge of Right-of-way | 3.0 | 62 | 30 |
| 60 m (200 ft.) from Center | 0.3 | 7 | 3 |
| | | | |

kV/m = kilovolt per m
mG = milligauss

1. Under annual peak load conditions (occurs less than 1 percent of the time)
2. Under annual average loading conditions

Note: Above information obtained from BPA study to characterize nearly 400 transmission lines located in the Pacific Northwest.

Both electric and magnetic alternating-current (a-c) fields induce currents in conducting objects, including people and animals. These currents, even from the largest power lines, are too weak to be felt. However, some scientists believe that these currents might be potentially harmful and that long-term exposure should be minimized. Hundreds of studies on electric and magnetic fields have been conducted in the U.S. and other countries. Studies of laboratory animals generally show that these fields have no obvious harmful effects.

However, a number of subtle effects of unknown biological significance have been reported in some laboratory studies (Polk, 1991).

Much attention at present is focused on several recent reports suggesting that workers in certain electrical occupations and people living close to power lines have an increased risk of leukemia and other cancers (Sagan, 1991; NRPB, 1992; ORAU Panel, 1992; Stone, 1992). Most scientific reviews, however, find that the overall evidence is too weak to establish a cause-and-effect relationship between electric or magnetic fields and cancer. A review of some of the studies relating to EMF and possible biological and health effects are included in **Appendix C.**

**Data Gathering and Analysis, Magnetic Field Strength Calculations and Exposure Assessments**

All magnetic field calculations were made using industry-accepted computer modeling techniques. This modeling system was coupled with the Geographical Information System, a system that analyzes graphical map data, to create an accurate picture of the possible changes in magnetic field levels to homes and business along the project corridor. A detailed description of how these systems were used for this project can be found in **Appendix C.**

An EMF *exposure assessment* is done by first estimating what future EMF levels would be without the new project. This analysis serves as a baseline measurement. Engineers then estimate the possible change in field levels assuming the proposed project is in place. An increase in public exposure is defined as a situation where field levels with the new project will increase and buildings exist nearby.

**Significance of EMF Exposures**

Because the state of the scientific evidence relating to EMF has not yet established a cause-and-effect relationship between electric or magnetic fields and adverse health effects, we are unable to predict specific health risks, or specific potential level of disease, related to exposure to EMF. We are however, able to conduct *exposure assessments* of magnetic fields from transmission lines. Exposure assessments are estimates of the field levels to which people are potentially exposed.

Today, most of the scientific concern focuses on exposure to magnetic fields. Additionally, people are not shielded from magnetic fields by trees, houses and other objects as with electric fields. Therefore our exposure assessments focus on *magnetic* field levels.

In designing the magnetic field exposure assessment for this project, BPA determined that the affected region encompassed the areas along the transmission corridor that included locations where people spend significant portions of each day. This includes homes, business and schools (if any). Magnetic field calculations were made for homes and commercial buildings along the transmission corridor that could experience magnetic field levels from the transmission lines.

*The magnetic field exposure levels are only indicators of how this proposed project may affect the magnetic field environment.* Because of the reasons stated above, they are not measures of risk or impact on health. Results of these exposure assessments can be found in the discussion of Segments A-N and in tables in **Appendix C**.

The two major reasons for the Bellingham project are to increase reliability and increase the North-South transfer capability of the electrical transmission system to the Northern Washington area. Thus, there will be more electrical current flowing along the Bellingham corridor from Custer Substation to Sedro Woolley Substation. Those increases are reflected in the magnetic field analysis represented in this section.

BPA also understands that, because of this project, current levels along other parts of the transmission system (specifically north of Custer Substation and south of Sedro Woolley Substation) may be affected as a result of this project. While it is possible that increases in the magnetic field environment may occur in some of these areas, no magnetic field analysis was attempted because it is too difficult to determine, with any accuracy, what the magnetic field environment might be. Tower design, conductor configuration, transmission lines joining and leaving the corridor, and the presence of substations would all affect the magnetic field environment along the system. Not all of these variables are controlled or affected by this project. To try to take all of these variables into consideration and characterize the magnetic field environment would produce numbers that could not be considered reliable.

## SITE-SPECIFIC IMPACTS

### Segments A - N

The following information consists of estimated annual averages for the Year 2000 for magnetic fields that may occur at homes or businesses along the transmission corridor for the three design options. The analysis assumes that the most practical designs which produce the lowest EMF will be used.

For the purposes of magnetic field analysis, the transmission corridor was divided into segments where significant differences in field levels might be expected. Table 13 compares Options 1, 2, and 3 by segment, and by numbers of homes and business expected to experience an increase in magnetic field levels. All expected increases in estimated annual average magnetic field levels for homes are shown in **Appendix C** tables.

Both Options 1 and 2 would increase magnetic field exposure for about 50 homes and commercial buildings. Option 1 and Option 2 are, therefore, essentially the same when analyzed on a segment-by-segment basis. Option 3 would increase magnetic field exposure for only four homes. Information regarding the net change in magnetic field exposure from existing conditions (Year 2000) can be found in **Appendix C**.

Table 13 indicates numbers of homes and commercial buildings expected to experience an increase in magnetic field levels of more than 1 milligauss (mG). Many assumptions are made in the process of calculating these magnetic field levels; therefore, we cannot accurately predict changes in exposure of less than 1 milligauss. The magnetic field levels displayed in this table, and the tables in **Appendix C,** are calculated from levels that would be expected in the Year 2000, if the project were not built. Additional magnetic field analyses and description of how the analyses are done can be found in the appendix.

### Segment H1

It was possible to calculate estimated annual average magnetic fields for only one home along the **H1** corridor. The calculations exclude one house at the north end of **H1** and three houses at the south end of **H1** which could not be modeled effectively by computer-based analysis because they lie between the two existing transmission corridors and experience magnetic fields from both corridors. If the **H1** Alternative were chosen, one or two homes would have

to be removed, as they would be in the transmission corridor right-of-way. However, it is expected that the remaining homes would experience an increase in estimated annual average magnetic field exposure.

**Table 13: Numbers of homes and commercial buildings expected to experience an increase in magnetic field levels of more than 1 mG; based on estimated annual average loading information for the Year 2000**

| SEGMENT* | OPTION 1 230 kV | OPTION 2 500 kV | Option 3 500 kV |
|---|---|---|---|
| A | 1 | 3 | NA |
| B | 28** | 27** | 0 |
| C | 4 | 4 | 0 |
| D | 4*** | 3*** | 0 |
| E | 0 | 0 | 0 |
| H | 0 | 0 | 2 |
| I | 1 | 1 | 0 |
| J | 1 | 1 | 1 |
| K | 6 | 6 | 0 |
| L | 2 | 2 | 0 |
| M | 2 | 3 | 0 |
| N | 0 | 0 | 0 |
| | | | |
| TOTALS | 49 | 50 | 3 |

* There are no buildings in Segments F and G.

** Includes 9 commercial buildings

*** Includes 2 commercial buildings

The estimated annual average magnetic field level increase for the one house along the H-1 route is as follows:

Option 1: Less than 1 mG
Option 2: Between 1 and 2 mG
Option 3: Between 1 and 2 mG

Additionally, if this option were selected, the existing 230-kV wood-pole line that exists on the **H, I, J** route would still be removed and the estimated annual average magnetic field levels for those 14 homes would be reduced.

## E. RESOURCE IMPACTS AND MITIGATION ACTION: PUGET POWER PORTION OF THE PROPOSAL

### 1. LAND USE AND ZONING [Puget Power]

#### EXISTING 115-KV TRANSMISSION LINE AND SUBSTATION

The BPA-Bellingham #2 transmission line occupies an existing utility corridor, extending from the Puget Power Bellingham Substation to the BPA Bellingham Substation. This transmission line has been in place since 1958. An option under consideration is to rebuild the transmission line within the same alignment, with poles replaced at or near the same location as existing poles.

Puget Power's existing Bellingham Substation has been serving the Bellingham area since 1949. This substation is currently a delivery point of bulk power which is then distributed to other neighborhood substations serving the greater Bellingham area.

#### Comprehensive Plan Designations and Zoning

The Puget Power Bellingham Substation and the BPA Bellingham #2 115-kV transmission line are within the Roosevelt and/or Mount Baker planning area of the Bellingham Comprehensive Plan. Within the County, the transmission line passes through the urban fringe area of the Whatcom County Comprehensive Plan. The zoning for the substation and transmission lines is described in Table 14.

**Table 14: Land Use Zoning Information by Assessment Area for the Existing 115-kV Transmission Line and Substation**

| Assessment Area | Jurisdiction | Land Use Zoning Category | Designated Density (DU/Ac) |
|---|---|---|---|
| **Area 1** | City of Bellingham | | |
| | Roosevelt | Industrial 12I | Not Applicable |
| | Neighborhood Plan | Public 10P | Not Applicable |
| **Area 2** | City of Bellingham | Residential Single | |
| | | 3RS | 3 to 4 |
| | | 6RS | 6 |
| | Roosevelt | Residential Multi | |
| | Neighborhood Plan | 4RM | 4 |
| | | 7RM | 6 to 22 |
| | | 1RM | 6 to 12 |
| **Area 3** | City of Bellingham | Industrial 13I | Not Applicable |
| | Roosevelt & | 16I | Not Applicable |
| | Mount Baker | Residential 3RS | 3 to 4 |
| | Neighborhood Plan | | |
| **Area 4** | City of Bellingham | Residential Single | |
| | & Whatcom County | 3RS | 3 to 4 |
| | Mount Baker Plan & | Urban Residential | |
| | Urban Fringe Subarea | UR4 | 4 to 7 |
| **Area 5** | Whatcom County | Urban Residential | |
| | | UR4 | 4 to 7 |
| | Urban Fringe Subarea | Rural District | |
| | | R5A | 0.2 to 1 |

The substation is located in an area that is zoned *Industrial.* The transmission line leaves the substation on Virginia Street to Pacific Street passing adjacent to an area that is zoned *Public.* This area is used as a center for the City of Bellingham Public Works Department and Whatcom Transportation Authority. At the intersection of Virginia and Pacific Streets, the transmission line turns north to North Street and east on North Street to St. Clair Street. At this point the transmission goes north to Sunset Drive. The transmission line passes through areas which are zoned *Residential Multi* and *Residential Single* to the City of Bellingham Railroad Trail (old railroad right-of-way which crosses the St. Clair unimproved road right-of-way), where lands are zoned *Industrial,* to another *Residential Single Zone* abutting Sunset Drive. At the City/County boundary, the transmission line passes into an area zoned *Urban Residential* and then *Rural* near the BPA-Bellingham Substation.

Puget Power understands the Project to be either a use permitted outright, or permitted conditionally, in the zones referenced above.

**Existing Conditions**

Development of the property next to the Puget Power Bellingham Substation and the BPA-Bellingham #2 transmission line in Area 1 is predominantly industrial. Along Virginia Street, land uses include industrial yards, lumberyards, and maintenance buildings for the City of Bellingham Public Works Department and Whatcom Transportation Authority. Single family residences and a few apartments are adjacent to the transmission line along most of Pacific Street.

The transmission line turns east onto North Street, an unimproved public right-of-way. The unimproved right-of-way is predominantly landscaped, fenced with structures, or maintained as lawns by adjacent landowners.

Residential neighborhoods exist along both sides of North Street and St. Clair Street. Portions of St. Clair Street are improved. Beyond the improved portions of St. Clair Street, the road is graveled and gated to keep the public from driving to an existing trail maintained by the City Parks and Recreation Department.

North of the trail, the land is being developed for industrial/commercial uses; much of this area is undeveloped. The St. Clair Street right-of-way is a multi-use utility corridor. In addition to the BPA-Bellingham #2 transmission line, this street right-of-way is occupied by the Trans Mountain Oil petroleum pipeline which provides service between the United States and Canada. The City of Bellingham is constructing a new road, Barkley Boulevard, perpendicular to the St. Clair transmission line, petroleum pipeline, and St. Clair Street right-of-way.

Continuing beyond the City of Bellingham along the Mount Baker Highway and the Dewey Road, houses occur less frequently and are interspersed with open woodlots, pastures, or less intensive uses to the BPA Bellingham Substation.

## PIPELINE ALTERNATIVE

### Comprehensive Plan Designations and Zoning

The pipeline alternative passes through the Mount Baker Planning area of the Bellingham Comprehensive Plan and through the urban fringe area of the Whatcom County Comprehensive Plan.

Zoning along the pipeline alternative is *Residential Single* followed by *Industrial* within the City limits. Once it reaches the City/County boundary, the transmission line runs adjacent to the *General Manufacturing and Urban Residential County Zones.*

### Existing Conditions

The pipeline alternative begins at the intersection of Sunset Drive and the unimproved St. Clair Street right-of-way where the transmission line would parallel the west side of the Trans Mountain Oil Pipeline corridor north to the abandoned Chicago, Milwaukee, St. Clair, & Pacific Railroad (Milwaukee Road) right-of-way. The transmission line would continue within the Milwaukee Road right-of-way until it rejoins the existing BPA-Bellingham #2 transmission line at the Dewey Road.

## 115-KV LOOP LINE ALTERNATIVE

### Comprehensive Plan Designations and Zoning

The new 115-kV transmission lines would pass through an area designated by the Whatcom County Comprehensive Plan as *Rural,* Subarea designation *Urban Fringe*. The proposed facilities lie within areas zoned either *Urban Residential* or *Rural*. Puget Power understands the project to be conditionally permitted in these zones.

### Existing Conditions

New 115-kV transmission lines from the BPA Bellingham Substation to the Mt. Baker Highway would be located next to an existing transmission corridor, mostly on undeveloped land and across one or two residential properties. Along Britton Road, the project would be located within the public road right-of-way next to rural residential development or

undeveloped land. Along Mt. Baker Highway, the Project would be located within the public right-of-way next to forested or cleared areas, some of which are residential properties.

## 2. GEOLOGY/SOILS [Puget Power]

The review of the map inventories and field verification yielded few geologic hazards. No seismic, volcanic, or coal mine hazard areas would affect or be affected by the project.

### EXISTING 115-KV TRANSMISSION LINE REBUILD

Field observations did not reveal any erosion problems directly under or next to the BPA-Bellingham #2 115-kV transmission line. Proposed pole replacement would not constitute enough land clearing to encounter or create erosion problems. Access to pole locations in localized potential erosion areas might require regrading the right-of-way and the use of prudent erosion control measures. These measures could include the use of straw bales to intercept and direct surface water flow and reseeding the area with an erosion control seed mix; or requiring construction during the dry seasons of the year.

### PIPELINE ALTERNATIVE

The City of Bellingham has mapped a potential landslide hazard area north of the intersection of St. Clair Street and Sunset Drive. The hillside (slope: about 80%) is a grassy slope in the Trans Mountain Oil Pipeline right-of-way and wooded area next to the proposed transmission line right-of-way. The existing pipeline right-of-way is maintained by Trans Mountain Oil. There are no apparent geologic failures or earth movements at the site.

Construction of the transmission line would require clearing about a 9-m-wide (30-ft.-wide) right-of-way down the slope. Clearing would be done by hand, with trees and debris yarded off and mulched. No access road would be required for clearing or constructing the transmission line at the hillside.

Revegetation of the cleared area would include stabilizing the slope to prevent slumping, particularly by drainages that carry water. Preventive measures may include water bars or flow interceptors to redirect the surface water flow. The area would be seeded with an

erosion control mix either by broadcasting seed using a cyclone seeder or by hydroseeding. Hydromulching with wood fiber could be used to provide further stabilization on the steep slope. Site-specific erosion control measures would be developed as part of the construction specifications to minimize erosion. No other sites within the pipeline right-of-way represent landslide or erosion hazards. Much of the abandoned railroad right-of-way has had access road improvements as part of the installation of a gas line by Cascade Natural Gas. Construction of the transmission line would use this access road and the railroad bed.

### 115-KV LOOP LINE ALTERNATIVES

A steep slope lies directly south of BPA's Bellingham Substation. Puget Power proposes to span the area of the steep slope and use an existing access road to the pole location at the crest of the hill and at the base of the hill. The new transmission corridor would be cleared to a width of 23 m (75 ft.) and would employ site-specific measures to control erosion and ensure slope stability, as noted in the previous section and discussion of steep slopes.

## 3. VEGETATION [Puget Power]

Concern for impacts on vegetation is generally moderate. Primary concerns are associated with clearing trees in forested wetland habitats. These plants communities are not easily replaced, once lost. Appropriate mitigation such as the creation/replacement of affected forested wetland acreage would moderate these potential considerable adverse effects. Potential impacts on scrub-shrub and emergent wetlands would be considered to be temporary, provided no new permanent access roads are built in wetland areas. Impacts on forest vegetation are considered to be insignificant because the affected area would be restricted to a relatively small area, and because forest habitat in the general area is abundant. Impacts on pasture and other open-land plant communities are not expected to be significant because these plant communities are typically dominated by species which do well in disturbed environments.

## EXISTING 115-KV TRANSMISSION LINE REBUILD

The BPA-Bellingham #2 115-kV transmission line crosses Fever Creek twice: first, along North Street between Superior and Michigan Streets, and second, at the end of the paved portion of St. Clair Street. The first crossing has no associated wetlands, and no impacts would result from rebuilding the line. The second crossing involves the wetlands identified below. Fever Creek is not a regulated stream under the City of Bellingham's Shoreline Master Plan. Activities within 15 m (50 ft.) of Fever Creek are regulated under the Wetland and Stream regulatory chapter of the Bellingham Municipal Code (Ordinance #10267).

The transmission line spans Fever Creek and wetland south of the abandoned Burlington Northern Railroad (BNRR) right-of-way on the improved portion of the St. Clair Street right-of-way. This wetland is classified by the City as a category III (low habitat value) wetland and can be described as palustrine forested, broad-leafed deciduous, and palustrine emergent wetland. The transmission line spans this wetland and the Fever Creek channel. No impacts on Fever Creek or its wetland would occur from rebuilding the transmission line. The poles are located out of the wetland and stream corridor. Access to the poles spanning the wetland is from the existing St. Clair Street road right-of-way. Erosion and sediment control measures would be used.

Mapped to the south of the Sunset Drive intersection is a wetland; classification is category III, and its description is palustrine emergent and forested, broad-leaved deciduous. Vegetation consists of soft rush, sedges, velvet grass, and Douglas spiraea. The wetland occurs primarily east of the transmission line. Rebuilding the transmission line would not significantly affect this wetland, because the line would span it. A topographical survey of this area indicates that the wetland lies within an area from about the edge of the Sunset Drive right-of-way to about 56 m (180 ft.) south of Sunset Drive. At these two points, the land elevation is the same, defining the low area. Puget Power's pole location in this vicinity is about 72 m (235 ft.) south of the Sunset Drive right-of-way and about 2 m (6 ft.) in elevation above the wetland. Access to this pole location would be from the south via the proposed Barkley Boulevard on the existing unimproved St. Clair Street right-of-way, with no anticipated impacts.

Near the intersection of East Bakerview Road and Dewey Road, the transmission line right-of-way crosses Toad Creek. The line spans the creek and would have no impact on the stream or wetlands.

**PIPELINE ALTERNATIVE**

The pipeline alternative parallels the Trans Mountain Oil Pipeline from the intersection of the unimproved St. Clair right-of-way and Sunset Drive to the abandoned Milwaukee Road right-of-way. The transmission line would parallel the northerly side of the abandoned Milwaukee Road right-of-way until it joined the existing corridor at the Dewey Road. The City of Bellingham has mapped a wetland just north of Sunset Drive along the Trans Mountain Oil Pipeline right-of-way. This wetland is described by the Fish and Wildlife Service as palustrine emergent, forested, broad-leafed deciduous and scrub-shrub. About 9 m (30 ft.) of additional clearing adjacent to and parallel with the west side of the pipeline right-of-way would be needed to provide adequate clearance for the transmission line. Moderate clearing impacts on the forested portion of the wetland would be minimized by using equipment which exerts the minimal amount of ground pressure and by replacing lost vegetation with wetland species. The existing Trans Mountain right-of-way and road would provide access to the pole locations, further reducing wetland impacts.

National Wetland Inventory (NWI) wetlands extend from the base of a steep slope along the Pipeline to and adjacent with the abandoned Milwaukee Road grade. These wetlands have been classified as palustrine forested seasonally flooded, and palustrine forested temporarily flooded. Moderate wetland impacts are anticipated for this section of the transmission line. Impacts on the wetlands to the west of the pipeline right-of-way might result from clearing of trees; these impacts would be minimized by using equipment which exerts the minimal amount of ground pressure and by replacing lost vegetation with wetland species. Minimal impacts are also anticipated at the three or four pole locations required in this area. Existing access roads would be used wherever possible, with short new spurs to the pole locations. Additional mitigation might be needed to replace the wetlands that are lost.

The NWI identifies wetlands in the area next to but below the railroad grade. The proposed transmission line would be located on the northerly side of the Milwaukee Road right-of-way; the recently constructed Cascade Natural Gas access road on the abandoned railroad right-of-way would be used for access and construction. Significant access improvements in 1992 have been made along much of the Milwaukee Road right-of-way as part of the installation of

the Cascade Natural Gas pipeline. The new transmission line would not affect these NWI wetlands.

## 115-KV LOOP LINE ALTERNATIVES

Most stream and wetland concerns along the proposed new facilities routes occur next to the BPA transmission line corridor. The BPA right-of-way extending from the BPA's Bellingham Substation to Mt. Baker Highway is comprised of grassy fields and wetlands, and is bounded on each side by forest.

A small running stream drains from the northeasterly hill above the BPA Bellingham Substation and joins with a headwater wetland to cross the BPA corridor and join an unnamed tributary to Squalicum Creek. Along the center of the BPA right-of-way, an access road extends from Mt. Baker Highway. Drainage occurs along the road in the BPA right-of-way, and a small stream extends from the road and heads toward the west side of the right-of-way.

At the east side of the BPA right-of-way, on top of the hill behind the substation, are many small wetlands. These were observed as palustrine emergent seasonally flooded wetlands with scrub-shrub emergents; they may serve as the headwaters to a small stream observed running through this area. Another wetland was observed on the east side of right-of-way: This small emergent wetland, located south of the other areas and bordering the forest, is composed of reed canary grass and soft rushes. A house is located about 61 m (200 ft.) from the lines and borders the right-of-way. The house is surrounded by pastures and wet meadows.

The west side of the right-of-way has a large section of wetlands. The largest area was located just beyond the houses along Mt. Baker Highway. These wetlands were observed as palustrine scrub-shrub, and palustrine forested seasonally flooded wetlands. Observed vegetation in this area includes alder, elderberry, and spiraea. The wetland extends around the houses and may extend into the woods. This wetland may correlate with the NWI classified wetland. A large fill area was observed between the houses and the wetland. Another small wetland was observed north of this area.

Wetland impacts are anticipated for the two transmission lines proposed to parallel either the east or west side of existing BPA transmission line corridor between the BPA Bellingham Substation and the Mount Baker Highway. Impacts on forested wetlands may occur as a result of clearing trees; these impacts would be minimized by using equipment which exerts

the minimal amount of ground pressure and by replacing lost vegetation with wetland species. Minimal impacts are also anticipated at the three or four pole locations required in this area. Existing access roads would be used wherever possible with short new spurs to the pole locations. Additional mitigation would be needed to replace the wetlands that are lost. Mitigation can be accomplished on-site in the adjacent areas.

## 5. FISH AND WILDLIFE [Puget Power]

Because the transmission lines would span all creeks in the proposed right-of-way, very little riparian and/or stream disturbance is expected to occur. Therefore, impacts on fisheries resources are expected to be slight.

Concern for impacts on wildlife is generally slight. Most of the wildlife habitats crossed by the proposed project have been altered by previous human activities. Since human disturbance of these areas is considered to be high, overall wildlife suitability and habitat effectiveness is considered to be low. Potential impacts associated with construction, operation, and maintenance of the proposed project would not significantly affect local wildlife population presently using the area. The number of wildlife species using the area, their abundance, and their movement patterns are expected to remain unchanged following implementation of the proposed project.

## 6. AGRICULTURE [Puget Power]

Prime farmland defined according to the criteria of the Farmland Protection Policy Act (7 U.S.C. 4201 *et. seq.*) was identified from the USDA-Soil Conservation Service soils surveys of the Whatcom County and Skagit County areas. Lands currently in agricultural use were identified and mapped from information interpreted from May 1992 aerial photography and field verification.

### EXISTING 115-KV TRANSMISSION LINE REBUILD

This option crosses about 0.5 km (0.3 mi.) of designated Prime farmland and 0.8 km (0.5 mi.) of small-acreage pasture. The existing poles would be replaced almost one-for-one at existing

pole locations. Therefore, no net loss of either designated Prime farmland or land currently in agricultural use would occur. Given the small amount of land affected, impacts would be minor and short-term, confined to the temporary disruption and inconvenience posed by construction.

### PIPELINE ALTERNATIVE

Where this alternative follows the existing 115-kV transmission line, it crosses about 0.5 km (0.3 mi.) of designated Prime farmland currently in pasture. Replacement of poles and impacts would be similar to those for the rebuild, above.

### 115-KV LOOP LINE ALTERNATIVES

The new transmission facilities would remove from 36 to 81 $m^2$ (400 to 900 $ft.^2$) of designated Prime farmland from future production. In addition, 14 to 45 $m^2$ (150 to 500 $ft.^2$) of small pasture land would be converted. Due to the small amount of land affected, impacts would be minor and short-term, confined to the temporary disruption and inconvenience posed by construction.

## 7. VISUAL RESOURCES [Puget Power]

### EXISTING 115-KV TRANSMISSION LINE REBUILD

Much of the visual environment of the existing 6.9-km (4.3-mi.) 115-kV transmission line corridor between the Puget Power and BPA Bellingham substations is characterized by residential development and undeveloped rural areas. Residential development is concentrated along the segment of the line from the Puget Power Bellingham Substation to the end of the improved portion of St. Clair Street and along Sunset Drive between St. Clair Street and the Dewey Road. The remaining segments of the transmission corridor are predominately undeveloped and rural in nature, with only occasional residential structures located near the transmission right-of-way.

Within much of the residential areas, views are dominated by housing structures and the linear features of the existing infrastructure, including paved roads and electrical and telephone

utility service structures. The BPA-Bellingham #2 115-kV transmission line has been a part of the visual landscape since 1958.

For the BPA-Bellingham #2 transmission line, after the project is complete, the poles would be about 5 m (15 ft.) taller than existing poles and be replaced at or near the existing pole locations. The existing wires would be replaced with bundled conductors (two wires per phase). The new insulators would be longer to handle the bundled conductors.

The project would not introduce new visual elements that would significantly change the visual character of the existing transmission line.

**PIPELINE ALTERNATIVE**

Rural undeveloped property characterizes the visual elements of this alternative route. The pipeline alternative begins at the intersection of St. Clair Street and Sunset Drive and proceeds cross-country in a northerly direction for about 670 m (2200 ft.) to the Milwaukee Road right-of-way. This portion of the route parallels a Trans Mountain Oil Pipeline right-of-way which is cleared and maintained free of trees and shrubs for its 15-m (50-ft.) width. An additional right-of-way about 9 m (30 ft.) wide would be required to build the 115-kV transmission line next to the pipeline corridor. Clearing of the additional right-of-way and construction of the 115-kV transmission line would affect views, but only along a small stretch of Sunset Drive.

The pipeline alternative continues in a northeasterly direction along the Milwaukee Road right-of-way for about 975 m (3200 ft.) until it meets the existing transmission line corridor on the Dewey Road. Other facilities present within the Milwaukee Road right-of-way include an existing 115-kV transmission line and a newly installed Cascade Natural Gas pipeline and access road.

Puget Power proposes to construct the new 115-kV transmission line on the northerly side of the Cascade Natural Gas access road. The new line segment would add additional linear features to the existing visual landscape. Visual impacts would be limited primarily to viewers traveling along East Bakerview Road. Consequently, the duration of views would be relatively short.

If the pipeline alternative were selected as the preferred route, the segment of the existing 115-kV transmission line along Sunset Drive between St. Clair Street and Dewey Road and along the Dewey Road from Sunset Drive to the East Bakerview Road would be removed; the Puget Power distribution lines and telephone and cable television lines would remain. The existing poles would be cut off above the distribution lines. Visual impacts would be slightly reduced as a result.

## 115-KV LOOP LINE ALTERNATIVES

The new 115-kV transmission lines would be similar to the existing 115-V transmission lines on the Mt. Baker Highway and on the Britton Road. The new transmission line segments would involve the installation of single wood poles, insulators, and conductors.

From the BPA Bellingham Substation to the Mt. Baker Highway, the new 115-kV transmission lines would be located next to the existing BPA transmission corridor which is cleared and maintained for its 122-m (400-ft.) width. An additional right-of-way of about 23 m (75 ft.) in width would be required for the new transmission lines. For this transmission segment, the new 115-kV lines would add visual impacts to an existing landscape that is dominated by the physical features of BPA's 500-kV transmission lines.

Along the Mt. Baker Highway and the Britton Road, the new 115-kV transmission lines would be located within the public right-of-way. The new transmission lines would overbuild existing telephone lines and Puget Power distribution lines. The transmission poles would be about 9 m (30 ft.) taller than existing poles and be placed at or near existing pole locations. This transmission line segment, about 1.5 km (0.95 mi.) in length, would add to the existing visual landscape. The visual impacts from the new transmission lines would be similar to the existing 42.7-km (26.7-mi.) Bellingham - Kendall 115-kV line that is located on Britton Road and the Mt. Baker Highway.

## PUGET POWER SUBSTATION IMPROVEMENTS

Proposed improvements at Puget Power's Bellingham Substation would occur within the existing fenced area and would not change the character of the existing visual landscape.

Improvements at the Puget Power's Sedro Woolley Substation include installation of a 230-kV power circuit breaker and two steel poles for the new BPA Bellingham-Sedro Woolley 230-kV line. The improvements would occur within the existing fenced substation site and would not change the character of the existing visual landscape.

## 8. CULTURAL RESOURCES [Puget Power]

An overall evaluation or cultural resources rank has been assigned to each alternative. Each ranking category may reflect a known condition and/or the potential for cultural resource occurrences. Ranking and other route-specific information is provided, by route variation, in the following section, as well as being summarized in Table 15.

**Table 15. Puget Power Alternative - Cultural Resources Data by Route Variation.**

| Route Variation | Route Type[1] | Number of Recorded Sites[2] | Cultural Resources Sensitivity Rank[3] |
|---|---|---|---|
| 115-kV Rebuild | existing | 1 | low-moderate |
| Pipeline Alternative | existing/ new construction | 1 | low-moderate |
| Alternative 1 | new construction | 0 | low |
| Alternative 2 | new construction | 0 | low |
| Alternative 3 | new construction | 0 | low |
| Alternative 4 | new construction | 0 | low |

1 Existing and/or new construction of transmission line.
2 Within 0.8 km (0.5 mi.) of route variation.
3 See text for discussion of ranking definitions.

### EXISTING 115-KV TRANSMISSION LINE REBUILD

A single cultural resource has been previously recorded within 0.8 km (0.5 mi.) of the route of the existing line. The abandoned portion of the Bellingham Bay & British Columbia Railroad (eventually operated by the Chicago, Milwaukee, St. Paul & Pacific Railway Company) grade, with associated wooden trestle, was identified in the cultural resource assessment that accompanied the 1992 construction of the Cascade Natural Gas Corporation (CNG) Pipeline from Bellingham to the vicinity of BPA's transmission line crossing of SR 542.

The BB&BC is associated with its connecting of the "relatively isolated Nooksack lowlands to the principal settlements of the county on Bellingham Bay [including Whatcom, Sehome, Bellingham, and Fairhaven which were consolidated into the City of Bellingham by late 1903]" (Rabins, 1983).

According to King (1992), project archaeologist for Historical Research Associates, Inc. (HRA), "CNG plans to construct 1.5 miles of the proposed pipeline within the railroad grade, but, at the request of the City of Bellingham, installation of the pipeline will not disturb the trestle." This railroad feature was not subsequently recommended for inclusion in the **National Register of Historic Places** (NRHP). However, HRA did identify the "vicinity of Squalicum Creek" as an area with enough potential for cultural resources to warrant monitoring by a qualified archaeologist (King 1992).

Early settlement within the drainage included Section 9, T38N, R3E, in the vicinity of Dewey. The geographical place-name of Dewey is associated with George B. Dewey, a cousin of Admiral George Dewey (of Spanish American War fame). George B. Dewey settled in the south half of Section 9 in 1889, where he operated a farm for many years (Roth 1926). Located along the trackage of the BB&BC, the place designated on modern and historic maps as Dewey also appears to have been an unofficial railroad stop. Upon his death in 1918, George B. Dewey was described in the local newspaper as a Whatcom County "pioneer" (*The Bellingham Herald*, 9 April 1918).

Due to the proximity of the north end of the BPA-Bellingham #2 line to **SEGMENT D** of BPA's proposed project, the proposed Puget Power upgrade is also located within 0.56 km (0.35 mi.) of the historic Van Wyck area (the second BB&BC train station east of Bellingham). For a more comprehensive discussion of Van Wyck's historic significance see Luttrell (1992) and Rabins (1983). A Whatcom County Register Site, Foster House (locally referred to as "The Castle") is located about 5 km (3 mi.) east of Van Wyck, well-removed from the project area (Center for Northwest Studies and Whatcom County Centennial Committee 1989).

At its southern end, the existing route of Puget Power's BPA-Bellingham #2 line passes through several historic additions to the City of Bellingham (including the First Addition to New Whatcom, West Eureka Addition to Whatcom, and the West Eureka Supplemental Addition to Bellingham) (Whatcom County 1889; 1902; and 1904). To date, no historic properties within these additions or within 0.8 km (0.5 mi.) of the line have been nominated,

or determined eligible to, the NRHP, State Register, or Whatcom County Register. Although Puget Power's Bellingham Substation is an excellent example of historic electrical transmission-related architecture, its 1952 construction date (Whatcom County 1985) does not meet the age requirement of the NRHP.

Numerous about-1905 vernacular-style residences are presently located along the existing transmission line route through the above-mentioned historic Bellingham additions. The additions of West Eureka and West Eureka Supplemental are particularly rich in these freestanding late-Victorian row houses (due to modern intrusions, there are not sufficient properties to warrant a historic district). Many of them are located within one or two city lots of the existing power line. While none of these properties appears eligible (if nominated) to the NRHP, some would surely qualify for the Whatcom County Register; the visual effect of any forthcoming transmission line upgrades through these additions could be a future consideration.

Unrecorded cultural resource potential along Option 1 in the Squalicum Creek drainage would appear to be associated either with prehistoric fishing locales/temporary camps, historic railroad and logging features, or with agriculturally-related structures from the pre-1900 settlement in the Dewey vicinity. Option 1 has a cultural resource rank of low-moderate, based on the recorded railroad trestle and the potential for additional prehistoric or historic cultural resource occurrences.

**PIPELINE ALTERNATIVE**

As the alternative would pass within 0.4 km (0.25 miles) of the previously mentioned railroad trestle, it too has a single cultural resource presently recorded in its vicinity. This alternative also shares the cultural resource potential occurrences of the reviews concerning the Squalicum Creek drainage. Since about 1.6 km (1.0 mi.) of new line construction is proposed in this alternative, it appears that a greater potential for historic or prehistoric cultural resources could possibly be encountered. Additionally, the alternative also includes the line rebuild from Puget Power's Bellingham Substation to the vicinity of SR 542 and, accordingly, shares any possible concerns with historic buildings along the existing route of the BPA-Bellingham #2 transmission line.

The potential for unrecorded cultural resources along this alternative in the Squalicum Creek drainage would appear to be associated either with prehistoric fishing locales/temporary

camps, historic railroad and logging features, or with agriculturally related structures from the pre-1900 settlement in the Dewey and Van Wyck vicinities. Although this alternative has perhaps a slightly greater potential for cultural resource occurrences than, since it is closer within the Squalicum Creek drainage, it has a cultural resource rank of low-moderate.

## 115-KV LOOP LINE ALTERNATIVES

No cultural resources have previously been identified within a 1.6-km (1.0-mi.) radius of the BPA-Bellingham Substation, an area containing Alternatives 1-4. No single alternative is considered as preferred, based on a records search of historic and prehistoric cultural resources or local historic and ethnographic accounts. Because all four alternatives are associated with the substation within the Squalicum Creek drainage, they share equally some of the cultural resources potential of Option 1 and Option 2 in this vicinity. The potential for cultural resource rank for Alternative 1-4 are rated as low.

## CONCLUSION

For the purposes of this study, transmission line rebuild and/or new construction options were reviewed: two options for the transmission line rebuild (BPA-Bellingham #2) and four alternatives for accessing an additional transmission line (Bellingham-Kendall) into the BPA Bellingham Substation. As summarized in Table 15, both the rebuild and pipeline alternative have an overall impact evaluation of low-moderate, although since the pipeline alternative lies more within the Squalicum Creek drainage, there is a great probability of discovering sites along this route. All four alternatives for the proposed access of the Bellingham-Kendall transmission line are equally ranked as low, since recorded cultural resources are lacking within their general vicinity. These cultural resource ranks are primarily based on potential for encountering unrecorded cultural resources, since few sites have previously been identified in the general area of any project option.

Both transmission line options pass through the historic Bellingham additions of West Eureka and West Eureka Supplemental, which contain residential properties potentially eligible to the Whatcom County Register. None of the area's properties have been previously included in any registers (NRHP, State, or local) at this time and it does not appear that there are properties in sufficient number to warrant a district nomination. However, if historic properties within the immediate vicinity of any future increases in transmission line potential were determined eligible to the Washington State or Whatcom County registers, adverse

visual effects related to transmission line reconstruction could be a future project consideration.

Before any transmission line construction were to begin, a ground survey must be conducted along the length of the option selected for development. At that time, the project's impact on prehistoric and historic cultural resources, as well as evaluation of individual cultural resource significance, can be addressed on a more specific level.

## 9. SOCIAL AND ECONOMIC CONSIDERATIONS [Puget Power]

The construction impacts of Puget Power's portion of the project on the local economy are expected to be slight due to: (1) a relatively small number of workers expected to be involved in constructing the project (four crews of from three to six persons each); and (2) the work being accomplished over a relatively short period of time (3 to 4 months) (Campion, 1993). There would, however, be temporary and short-term disruption of some activities, including agricultural operations, along portions of the transmission route (see **Section 6, Agriculture**).

**Fiscal effects** are those effects that relate to the financial revenues that are obtained by government action. Identified tax revenues that would be generated by the proposed project include only those revenues that would be collected by state and local governments. Federal tax revenues, if any, are outside the scope of this analysis. These revenue sources include: (1) use taxes paid on equipment used in the construction process; (2) personal property taxes paid on construction vehicles, construction equipment and personal vehicles; (3) liquor, cigarette and fuel taxes; (4) state sales taxes; and (5) real property taxes. No state income tax is currently collected from Washington State residents.

Because of the relatively small size of the anticipated work force (i.e., 12 to 24 workers) and the relatively short duration of the construction period, the revenue sources that would be generated from use taxes, personal property taxes, and cigarette, liquor and fuel taxes are expected to be insignificant.

State sales taxes would be paid on local expenditures made by the construction workers. Washington State currently collects a sales tax of 5%. Construction labor for Puget Power's portion of the project is anticipated to amount to about $1,250,000 (Campion, May 1993). Depending on the workload of Puget Power's local work force when the project is released

for construction, the work would be performed by either Puget Power or contract personnel, a decision not yet made. If the construction were performed by contract, research indicates that non-local workers typically spend about 40% of their pay locally (Mountain West Research Inc., 1982). With an after-tax payroll of about $940,000, this project would generate close to $47,000 in state sales taxes. If the work were performed by the Puget Power employees (i.e., local labor), the workers would typically spend more than 40% locally. No significant difference would exist in selection of alternative routes with respect to sales taxes received by the state.

The utilities within the State of Washington are required to pay **property taxes**. All utilities must annually submit information on their real property holdings to the Washington State Department of Revenue for assessment, including railroads. Puget Power is presently the largest utility in Whatcom County and the third largest entity with respect to taxable assessed value in the county (Williamson, pers. comm., 1993). Puget Power is also the largest utility in Skagit County and the largest taxpayer in Skagit County, in that it heads the list in total assessed value (Skagit County Assessor's Office, pers. comm.,1993).

The cost of Puget Power's portion of the project in Whatcom County would range from $2,950,000 and $3,300,000, depending upon which plan of service would be selected for the Bellingham Substation (Campion, 1993). An additional $500,000 would be spent on improvements to Puget Power's system at the Sedro-Woolley Substation in Skagit County. Assuming a mid-range value of $3,125,000 (for expenditures in Whatcom County), $40,000 would be collected by the Whatcom County Assessor's Office, and an additional $6,500 would be collected by the Skagit County Assessor's Office annually, as a result of the proposed project. This amount of increased taxes, although considered to be a beneficial impact, would be considered insignificant, however, in the context of the total assessed value of all real properties in both counties, i.e., over $10 billion (Whatcom and Skagit County Assessors Offices, pers. comm., 1993).

## EXISTING 115-KV TRANSMISSION LINE REBUILD

The BPA-Bellingham #2 115-kV transmission line is proposed to be rebuilt by Puget Power, or its contractors by 1996, between April 1 and September 31. Rebuilding this 6.9-km (4.3-mi.) transmission line would normally take place between 7:00 a.m. and 4:00 p.m., unless a scheduled outage or construction backlog were to occur in the area (Campion, Puget Power, written communication, May 1993). If contract personnel were used, these would

likely come from outside the local area. However, because of the small size of the crew involved, local services in the area are not expected to be adversely affected.

The rebuilt transmission line would be built in the same alignment, with the poles replaced at or near the existing poles' location. The new transmission line would be similar in appearance to the existing 35-year-old transmission line; however, it would be about 4.6 m (15 ft.) taller than the existing line (see Section 7, **Visual Resources**). There are 93 homes within 15 m (50 ft.) of the proposed alignment (see also Section 14, **Health and Safety**).

## PIPELINE ALTERNATIVE

This alternative would pass within 50 m (164 ft.) of one single-family residence located just west of the abandoned Milwaukee Railroad right-of-way. Although selection of this alternative would eliminate effects on those 14 residences along Sunset Drive and Dewey Road, a beneficial impact, it would affect this single residence located at the intersection of Ross and Dewey Roads. The effect would not be significant. (It should be noted that this residence would be affected under either alternative: Selection of the Pipeline Alternative would require the transmission line to pass to the west of this residence, while selection of the existing site rebuild would require the construction of the transmission line to the east of the residence, on the east side of Dewey Road.) (See Figure 6.)

## 115-KV LOOP LINE ALTERNATIVES

Construction of the loop into and out of the existing BPA-Bellingham Substation would involve building about 2.1 km (1.3 mi.) of new 115-kV transmission line between the BPA Bellingham Substation and the Mt. Baker Highway. Four alternative routes have been identified (see Figure 8). Alternatives 1 and 3 would require the removal of two homes on the south side of the Bellingham Substation; Alternatives 2 and 4 would require the removal of two other homes on the east side of the substation. While removing these residences would be a considerable impact on the individuals who reside in these homes, mitigation would include fair market value for the properties, together with relocation assistance.

It should be noted that demolishing the structures would have a negative, although insignificant, effect on the local taxing district (with respect to property taxes); however, relocating them to another location within the taxing district would likely not affect the

property tax rate. All factors taken into consideration, the overall impact of any alternative would be low to moderate.

In addition to the two houses that would need to be removed if Alternative 1 were selected, the alternative would pass within 60 m (200 ft.) of 13 residences. Alternative 2 would pass within 60 m (200 ft.) of 14 residences, in addition to the two housing units that would need to be removed on the east side of the Bellingham Substation. Alternative 3 would pass within 60 m (200 ft.) of 12 residences, in addition to the two housing units that would need to be removed on the west side of the substation. Alternative 4 would pass within 60 m (200 ft.) of 12 residences, in addition to the two housing units that would need to be removed on the east side of the substation. In addition, all four alternatives would pass within 60 m (200 ft.) of the commercial operation located just east of BPA's transmission corridor.

See suggested mitigation measures outlined in the section below on **Noise and Radio/ Television Interference**; as well as the general discussion on ***Property Values,*** in the BPA **Social and Economic Considerations** Section.

## 10. NOISE AND RADIO/TV INTERFERENCE [Puget Power]

### CORONA

Corona is an energy loss associated with a high electric field and can take the form of light, sound, radio noise, and heat. Corona is well understood by engineers, and steps to minimize corona and hence reduce energy loss are incorporated into transmission line design.

There are many variables that contribute to the presence and degree of corona: line voltage, phase spacing, number and diameter of conductors, nicks and scratches on the conductor surface, loose hardware, and weather. Corona would be minimized on the lines to be built or rebuilt by using larger-diameter or multiple conductors.

### AUDIBLE NOISE

Environmental noise limits, applicable to this project, are regulated by the Washington State Department of Ecology regulations, "Maximum Environmental Noise Levels" (WAC 173-60). The state regulation establishes limits on the levels and durations of noise. Allowable

maximum sound levels depend on the land use of the source and receiving property (see Table 16). For most sources of noise, the levels listed in Table 16 are reduced by 10 dBA for residential receiving properties at night (between 10 p.m. and 7 a.m.) (WAC 173-60-040-2b). However, "noise from electrical substations and existing stationary equipment used in the conveyance of water, waste water, and natural gas by a utility are exempt" (WAC 173-060-050-2a).

**Table 16: Washington Environmental Noise Limits (dBA)**

| | Receiving Property Land Use | | |
|---|---|---|---|
| **Land Use at Sound Source** | **Residential (Class A)** | **Commercial (Class B)** | **Industrial (class C)** |
| **Residential (Class A)** | 55 | 57 | 60 |
| **Commercial (Class B)** | 57 | 60 | 65 |
| **Industrial (Class C)** | 60 | 65 | 70 |
| | | | |

These sound levels are maximum levels that can be exceeded only for certain periods of time: by 5 dBA for no more than 15 minutes in any hour, 10 dBA for no more than 5 minutes of an hour, or 15 dBA for no more than 1.5 minutes of any hour.

The preliminary design of the proposed Puget Power lines anticipates audible noise levels which are significantly less than state standards. For residential areas, these regulations allow noise levels of 60 dBA during the day and 50 dBA at night. Audible noise levels associated with either the rebuilt or new transmission lines will range from 12 dBA to 16 dBA at a distance of 25 ft. from the lines (worst case). Noise levels in this range are just audible, absent any other noise source. When existing background noise is considered, noise associated with the lines would be inaudible.

There would be no increased audible noise levels resulting from terminating the BPA-Bellingham #2 transmission line at Puget Power's Bellingham Substation. Puget Power is not proposing to add a transformer at the substation, and rebuilding the line would not alter the composite background reading of the existing site. The major source of noise at the substation is traffic noise along the I-5 corridor, immediately adjacent to the substation.

There will be no increase in existing noise levels at Puget Power's Sedro Woolley Substation from the proposed project improvements.

## RADIO AND TELEVISION INTERFERENCE

There are two potential sources of interference with normal radio or television reception from transmission lines: corona and gap discharges. Corona may affect AM radios, while gap discharge can affect television, as well as radio reception.

The design of the 115-kV transmission lines would minimize levels of corona so that they would not be a source of interference. For the proposed 115-kV transmission line design, the calculated radio noise levels at a distance of 8 m (25 ft.) from the transmission line for foul weather is 39 dBuV/m (decibels above a 1 microvolt per m reference value). This level meets the FCC guidelines for satisfactory service[15]. As a general rule, average levels during fair weather are 16 to 22 dBuV/m lower than average foul weather levels.

Gap discharges are a more common source of radio and television interference. This type of interference is primarily a fair weather phenomenon caused by broken or loose fitting hardware (i.e., insulators, clamps, brackets). Modern hardware would be installed on the Puget Power 115-kV lines and would reduce the potential for any gap noise. If interference problems should nevertheless arise in isolated cases, Puget Power would provide reasonable corrective measures at its expense.

# 11. HEALTH AND SAFETY [Puget Power]

## EXISTING 115-KV TRANSMISSION LINE REBUILD

### Electric Field Information

Electric field values calculated for the rebuilt Puget Power's BPA-Bellingham #2 115-kV transmission line vary from a high of about 0.5 kV/m directly under the line, to 0.2 kV/m at a distance of 7.6 meters (25 ft.) from the lines. (See Figure 7.) There are no standards adopted

15 Federal Communication Commission 1975. "Federal Communication Commission Rules and Regulations", Vol. II Part 15, 47 LFR Ch. 1 (10/1/88 edition)

in the State of Washington for electric fields within or at the edge of a transmission line right-of-way. However, other States have established set standards. The electric fields calculated for these 115-kV transmission lines are significantly below any known state standard.

### Magnetic Field Information

Under normal operating conditions, the magnetic field level is expected to be 3.3 mG (based on annual average loading) directly under the Puget Power's BPA-Bellingham #2 115-kV transmission line. At about 15 meters (50 ft.) from the center of the line, it is estimated to be less than 2 mG. Magnetic field values at various distances from the BPA-Bellingham #2 line are found in Table C-5 in **Appendix C**. The magnetic field calculations used typical average current levels that can be expected to occur in the year 2000. Typical peak levels would be almost twice the average levels. For unusual situations, the transmission lines could operate under an emergency loading that would temporarily increase magnetic field values. These conditions are usually rare and of short duration.

If this option were selected, about 93 homes and 5 business would experience magnetic field increases from 1 to less than 3 mG. These homes or business lie within about 15 meters (50 ft.) on either side of the center of the transmission line. One of these homes along the BPA - Bellingham #2 line on St. Clair Street has been identified as an in-home children's day care center.

## PIPELINE ALTERNATIVE

### Magnetic Field Information

If the Pipeline Option were selected, there would be about 80 homes and 5 businesses that might experience magnetic field levels above 1 but below 3 mG from the line. The magnetic field levels would be the same as those listed above for the rebuild option. These houses or business lie within about 15 meters (50 ft.) on either side of the center of the transmission line.

The counts of homes or commercial business for both options listed above were made by driving along the transmission line route and estimating the distance between the existing transmission facilities and nearby residential and commercial structures. Survey information was used to confirm the count along the BPA Bellingham #2 115-kV transmission line route between Puget's Bellingham Substation and Sunset Drive (S.R. 542).

In conclusions, if the pipeline option were selected, about 80 homes and 5 businesses would experience increases in magnetic field levels. This is 13 fewer homes than if the 115-kV line were rebuilt without using the Pipeline routing option.

## 115-KV LOOP LINE ALTERNATIVES

Puget Power has identified four possible alternative routes for new transmission lines in the vicinity of BPA's Bellingham Substation. (See Figure 10.)

### Electric Field Information

Electric field values calculated for the either new 115-kV line vary from a high of about 0.5 kV/m directly under the line to 0.2 kV/m at a distance of 7.6 meters (25 ft.) from the lines. There are no standards adopted in the State of Washington for electric fields within or at the edge of a transmission line right-of-way. However, other states have established set standards. The electric field standard for these 115-kV transmission lines are significantly below any known state standard.

### Magnetic Field Information

**Alternatives 1 & 2.** Estimated magnetic field levels (based on system normal Year 2000 annual average loading conditions) for the proposed BPA-Bellingham #3 line are shown in Table C-5 in **Appendix C**. System normal peak levels are expected to be twice the average levels. In brief, the levels would be less than 2 mG at 7.6 m (25 ft.) from the pole and would continue to fall off with distance. For this alternative, the BPA-Bellingham #3 line is proposed to run along the existing BPA corridor. The projected magnetic field levels would be so low that they would not contribute significantly to those levels already established from the existing transmission lines. (See **SEGMENT D**, Section C-4, **Appendix C**.)

Estimated magnetic field levels for the proposed BPA - Bellingham - Kendall 115-kV transmission line are also shown in Table C-5 in **Appendix C.** In brief, the levels are less than 1 mG at 7.6 meters ( 25 ft.) from the pole and would continue to fall off with distance. This line is proposed to run along Mt. Baker Highway. There is an existing distribution line along this proposed route. Because of the existing magnetic field exposures from this distribution line and because the magnetic field levels for the proposed line would be so low, increases in

the magnetic field environment to the homes or businesses along this corridor are not expected.

**Alternatives 3 & 4.** Again, for the segments where either of the two new lines is proposed to run along the existing BPA corridor, the projected field levels would be so small that they would not contribute to those levels already produced from the existing transmission lines.

This alternative proposes that the two new lines be placed along Mt. Baker Highway. As noted in Table C-5, **Appendix C**, the highest magnetic field level estimated for the BPA-Bellingham #3 line is less than 3 mG (based on estimated annual average loads). The highest magnetic field levels estimated for the BPA - Bellingham - Kendall line would be less than 2 mG. Because of the existing magnetic field exposures from the distribution line and because the magnetic field levels for the proposed lines would be so low, increases to the magnetic field environment to the homes and businesses along this corridor are not expected.

Magnetic field levels failed to show any dramatic differences between Alternatives 1, 2, 3, and 4.

## F. CONSULTATION, REVIEW, AND PERMIT REQUIREMENTS

### 1. ENVIRONMENTAL POLICY

The proposed project would be developed in a manner consistent with the National Environmental Policy Act, following "Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act." These rules were issued by the President's Council on Environmental Quality.

In January 1990, the U.S. Department of Energy (DOE), Office of Fuels Program (OFP), initiated an EIS scoping process for the proposed Puget Power transmission line project which would have connected Puget Power's system in the Bellingham area with B.C. Hydro in British Columbia (see Section D1 in **Chapter 2**). Scoping meetings were held in Lynden and Bellingham in January 1990. On August 17, 1990, Puget Power notified the OFP that it was requesting suspension of its application for a presidential permit for the proposed Puget

Intertie with B.C. Hydro. Following a period of conducting technical studies and negotiations between BPA and Puget Power, BPA issued a notice indicating the OFP suspension of Puget Power's Presidential Permit request and BPA intent to prepare an EIS on the resulting joint BPA/Puget Power project (October 4, 1991).

As the proposed joint project involves Puget Power constructing a short 115-kV line in and out of the BPA Bellingham Substation, the utility has applied for a conditional land use permit from Whatcom County. The permit application triggers an environmental review by Whatcom County in accordance with the State Environmental Policy Act (SEPA). As a result, BPA and Whatcom County have agreed to prepare this Federal/State EIS jointly.

## 2. STATE, AREAWIDE, AND LOCAL PLAN AND PROGRAM CONSISTENCY

No conflict with state, areawide, or local plans is anticipated. BPA's activities would be consistent with land use plans. The project would be coordinated with State and local government agencies to ensure that all requirements are met.

### STATE AND AREA-WIDE CLEARINGHOUSES

BPA would distribute the DEIS to clearinghouses for State and local agency review and consultation, as required by Executive Order 12372. Both State and district clearinghouses would be notified when the DEIS is ready for review, and their comments would be addressed by the FEIS. The clearinghouses would also be informed of the availability of the FEIS and the Record of Decision.

### WHATCOM COUNTY INITIATIVE

In November of 1990, a majority of the people of Whatcom County voted for an initiative to prevent construction of transmission lines larger than 115-kV, unless those lines were located on a permitted right-of-way or in industrial areas. While this action does not affect the BPA

portion of the project, it has led to the develop- ment of the Puget Power part of the proposal.

## WASHINGTON GROWTH MANAGEMENT ACT

This 1990 Act requires that most counties and cities in western Washington adopt comprehensive plans, including "a utilities element consisting of the general location, proposed location, and capacity of all existing and proposed utilities, including, but not limited to, electrical lines, telecommunication lines, and natural gas lines." The 1991 amendments to the Act add further planning requirements.

BPA and Puget Power are participants on the Utilities Planning Committee (Whatcom County) and the Citizens Advisory Committee (Skagit County) which are coordinating development of the utilities element. The elements are expected to be adopted by July 1993. This proposal would be consistent with those plans.

## LOCAL PLANS

BPA's proposed activities would cross area covered by the Skagit County Comprehensive Plan and five subarea components of the Whatcom County Comprehensive Land Use Plan: Lake Whatcom, Urban Fringe, Cherry Point/Ferndale, South Fork Valley, and Lynden/ Nooksack Valley.

The proposed project would use an existing corridor which was established in the 1940's. The three lines in the corridor were built in 1947, the 1960's, and 1975. The local comprehensive plans were adopted later, and are being updated now to comply with the State's Growth Management Act.

Both Skagit and Whatcom Counties have recently adopted ordinances to define, identify, and manage environmentally critical areas. The proposal would be consistent with those policies.

## ZONING

Current zoning and comprehensive plan designations are not always consistent. Work underway for the Growth Management Act would correct that.

The existing corridor and proposed transmission lines would be located within the following zoning districts.

***Whatcom County***

| | |
|---|---|
| R 5A | Rural, 1 unit/ 2 ha (5 ac.) |
| F | Forestry, 8-ha (20-ac.) minimum |
| CF | Commercial Forestry - 16-ha (40-ac.) minimum |
| AG | Agricultural, 16-ha (40-ac.) minimum |
| R 10A | Rural, 1 unit/ 4 ha (10 ac.) |
| R 2A | Rural, 1 unit/ 0.8 ha (2 ac.) |
| RF | Rural Forestry, 8-ha (20-ac.) minimum |
| ROS | Recreation and Open Space |
| LII | Light Impact Industrial |
| UR4 | Urban Residential, 2 units/ha (4 units/ac.) |
| GC | General Commercial, 4-ha (10-ac.) minimum |

***Skagit County***

| | |
|---|---|
| RU | Rural - 2-ha (5-ac.) minimum |
| AR | Agricultural Reserve, 8-ha (20-ac.) minimum |
| F | Forestry, 8-ha (20-ac.) minimum |
| R | Single family residential - 1125 $m^2$ (12,500 $ft.^2$) |
| RR | Residential reserve - 0.4 ha (1 ac.) |
| C | Commercial |
| P | Public |

For most of their distance in both Whatcom and Skagit Counties, the existing transmission lines are a non-conforming use. In Whatcom County, transmission lines would be permitted outright in industrial zones or on land where permits have already been granted. In Skagit County, major utility developments are considered a special use subject to review of the Hearing Examiner. BPA has and would continue to coordinate actions with the local planning departments.

## 3. COASTAL MANAGEMENT PROGRAM CONSISTENCY

The Coastal Zone Management Act of 1972 requires that Federal actions directly affecting the coastal zone be undertaken in a manner consistent, to the maximum extent possible, with the State's coastal zone management program. Washington's coastal zone management program

is implemented through the provisions of the State Shorelines Management Act, including shoreline management programs developed/administered by the counties. The Coastal Zone Act Reauthorization Amendments of 1990 also require that proposed Federal facilities fully comply with Federal consistency requirements as determined by and through consultation with a designated coastal zone management agency.

The State's Shoreline Management Act (Chapter 90.58 RCW) identifies "Shorelines of Statewide Significance" and "Shorelines of the State" near the proposed project. Only Lake Whatcom is identified as a "Shoreline of Statewide Significance." The project would be outside the 60-m (200-ft.) jurisdictional area. The existing corridor passes over four "Shorelines of the State" in Whatcom County: the Nooksack River, Tenmile Creek, Squalicum Creek, and the Samish River. Management of these shorelines is described under the Shoreline Master Plan for Whatcom County (revised plan approved Jan. 27, 1993; to be published). California Creek, directly west of Custer Substation, is identified as a "Shoreline of the State." The proposed project is not expected to fall within the 60-m (200-ft.) jurisdictional area. In Skagit County, the Skagit River is identified as a shoreline; the proposed project is not expected to fall within the 60-m (200-ft.) jurisdictional area.

It is possible that structures would be placed within the 60-m (200-ft.) jurisdictional areas of the Nooksack River, Squalicum Creek, and the Samish River. Actual structure locations would not be finally determined until the detailed design stage of project development (after the final EIS). Where possible, BPA would attempt to locate structures out of the 60-m (200-ft.) jurisdictional area. Also, BPA would take the following measures, when practicable, to assure consistency with the counties' Shoreline Master Plans.

1. All options would use an existing utility corridor.
2. Location of structures within the identified shoreline would be avoided if possible. If locations within the shoreline area could not be avoided, BPA would consult with the appropriate state and local agencies to determine the best placement of transmission structure.
3. Transmission line structures would be located in water bodies only if there were no reasonable alternative (not anticipated).
4. In shoreline areas, disturbed land would be restored as closely as possible to pre-project contours and replanted with native and local species. However, there might be locations where site topography would require near-bank disruption. A

restoration and monitoring plan would be prepared before disturbing shoreline areas.

5. Erosion control measures would be implemented within the 60-m (200 ft.) shoreline area.

## 4. PERMIT FOR STRUCTURES IN NAVIGABLE WATERS

Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) requires permits for structures potentially affecting navigation on waters of the United States. The Corps of Engineers has identified navigable waterways and issues permits for actions affecting them. This project would not require any structures *in* a navigable waterway. However, the transmission line would *cross* the Nooksack River between miles 9 and 10. The Nooksack is considered navigable at this point, and BPA would obtain a permit, as appropriate, for this crossing.

The Rivers and Harbors Act requires the applicant to prevent the obstruction or alteration of a navigable water without the specific authorization from the Corps.

## 5. PERMITS FOR DISCHARGES INTO WATERS OF THE UNITED STATES

The Clean Water Act (CWA) regulates discharges into waters of the United States. (See **Floodplains/Wetlands** (Section 12) for compliance with section 404 of the CWA (33 U.S.C. 1344)).

Section 402 of the CWA authorizes storm water discharges associated with industrial activities under the National Pollution Discharge Elimination System (NPDES). For the State of Washington, the Environmental Protection Agency, Region 10, has a general permit (# WA-R-10-000F) authorizing Federal facilities to discharge storm waters from construction activities disturbing land of 2 or more ha (5 or more ac.) into waters of the U.S., in accordance with various set conditions. BPA would comply with the appropriate conditions for this project, such as issuing a Notice of Intent to obtain coverage under the EPA general permit and preparing a Storm Water Pollution Prevention (SWPP) Plan.

Under Section 401 of the CWA, a Federal permit to conduct an activity which results in discharges into navigable waters is issued only after the affected State certifies that existing water quality standards would not be violated if the permit were issued. In the State of Washington, the Department of Ecology would review permits for compliance.

CWA Section 402 requires the applicant to prevent the consequential discharge of pollutants into waters of the US. The pollutants may result from construction or may be in the form of non-point discharges and may fall under the purview of the National Pollutant Discharge Elimination System permit. Erosion control measures would be implemented and maintained during construction.

As required under the NPDES general permit, BPA's SWPP plan would address the following:

- *Stabilization Practices* - Determine the interim and permanent stabilization practices and the implementation schedule of the practices. Existing vegetation would be preserved where attainable, and disturbed portions of the site stabilized. Stabilization measures would be started where construction activities have temporarily or permanently ceased, as soon as practicable but no more than 14 days after activities have ceased.

  Consider: temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffer strips, protection of existing trees, tree and shrub planting, geotextiles, preservation of mature vegetation, erosion control blankets, berms and other appropriate measures.

- *Structural Practices* - Determine the structural measures to divert flows from exposed soils, store flows, or other wise limit run-off and erosion on the site. All temporary measures would remain in place until permanent controls have been established.

  Consider: straw bale dikes, silt fences, earth dikes, brush barriers, berms, drainage swales, check dams, subsurface drains, pipe slope drains, rock outlet protection, sediment traps, temporary sedimentation basins, gabions, level spreaders, and storm drain inlet protection.

  For common drainage areas that serve 4 ha (10 ac.) or more at one time, a temporary or permanent sedimentation basin providing 100 $m^3$ (3,600 cubic ft.) of storage per 0.4 ha (ac.) drained, or equivalent control measure is required. For drainage locations serving less than 4 ha (10 ac.), sediment traps and/or basins would be used, a minimum of

sedimentation fences on all side slopes and down slope boundaries is required unless a sedimentation basin with 100 $m^3$ (3,600 cubic ft.) of storage per 0.4 ha (ac.) drained is constructed.

- *Stormwater Management* - Determine pollution control measures, installed during construction, that would regulate the discharge of stormwater after construction is complete, including an explanation of the technical basis for selecting the control measures where flows exceed pre-development levels. Velocity dissipation devices would be placed at all discharge locations and along the length of any outfall channel to avoid any significant change in the hydrologic regime of the receiving waters.

  Consider: stormwater detention structures (including wet ponds), stormwater retention structures, flow attenuation by use of open vegetated swales and natural depressions, infiltration of run-off on site, and sequential systems (which combine several practices).

- *Other Controls* - No solid materials, including building materials, would be discharged into waters of the United States unless authorized by a Section 404 permit of the Clean Water Act. Off-site tracking of sediment and the generation of dust shall be minimized.

## 6. RECREATION RESOURCES

### WILD AND SCENIC RIVERS, NATIONAL TRAILS, WILDERNESS AREAS, PARKS

A review of the Wild and Scenic River inventory of listed and proposed rivers (16 U.S.C. Sec 1273 (b)) shows no rivers or portions of rivers qualifying for Wild, Scenic, or Recreation River status within the study area. However, the Nooksack River, Squalicum Creek, and Samish River are identified as "protected" under the Pacific Northwest Electric Power Planning and Conservation Council Designation Act of 1980. No National Recreation or National Scenic Trails as inventoried in the National Trail System (16 U.S.C. Sec. 1242-1245) are in the study area. One listed Historic Trail is within the study area (**SEGMENT F**). It would not be physically affected. Visual impacts are considered to be slight because the existing corridor and structures have already established the visual character. The new line

would not change this. (See **Cultural Resources**.) No designated wilderness or other areas of environmental concern are in the study area.

## 7. PERMITS FOR RIGHTS-OF-WAY ON PUBLIC LANDS

This project does not cross lands administered by the U.S. Forest Service, Bureau of Land Management, or other Federal agencies.

## 8. HERITAGE CONSERVATION

The Historic Preservation Act requires that Federal agencies review the consequences of an activity on property that may be listed in the **National Register of Historic Places** (NRHP) or eligible for listing. The State Historic Preservation Officer (SHPO) of Washington has been contacted regarding the presence of properties currently listed in the NRHP. At this time, no previously identified NRHP properties are located within the area of BPA's area of potential effect. However, one or more historic and previously reported, potentially eligible NRHP properties are known to exist in the project area vicinity. Additionally, other historic or prehistoric sites in the project area may also be eligible for inclusion in the NRHP. Field evaluations would be made for sites along the selected route to determine their significance. Historic or prehistoric sites identified by field survey would, at the very least, be inventoried on the appropriate Washington State Cultural Resource Inventory Form. Upon the completion of a Determination of Eligibility for potential NRHP properties, the Washington SHPO would be consulted for findings of effect to the resources in question, prior to consultation with the Advisory Council on Historic Preservation (ACHP). In cases where BPA and the SHPO may not concur on eligibility, the Keeper of the NRHP would be consulted regarding eligibility.

Although no NRHP-listed properties are presently recorded within the study area, the following procedures describe the manner in which such properties would be addressed if identified. Consultation with the Washington SHPO and the ACHP would be completed to evaluate potential effect, adverse effect, and appropriate mitigation measures for eligible properties. If BPA and the SHPO agree that there is no effect, then construction may proceed. However, if BPA, the SHPO, or both determine that the project would affect an

eligible property, consultation to identify appropriate mitigation procedures would be initiated. Recommended mitigation measures would be presented to the ACHP. If the ACHP agrees with the preferred mitigation strategy, a Memorandum of Agreement outlining agreed-upon mitigation measures would be signed by the appropriate parties.

Review of the Catalog of National Historic Landmarks (1985 edition and the current, but unpublished, listing), the World Heritage List (1991), the National Registry of Natural Landmarks (1989), and subsequent addenda indicates no such properties presently listed in the project area. Also, no Native American Traditional Cultural Properties have been listed in cultural resource files maintained by the Office of Archaeology and Historic Preservation (OAHP). Consultation with local native groups is therefore recommended, to ascertain the presence of any sensitive geographical locales with significant traditional associations.

As the proposed project may have effects by excavation, removal, damage, alteration, or defacing of archaeological resources, before construction a qualified archaeologist and/or historian would survey the segment(s) of the selected route to determine whether any unrecorded historic or prehistoric archaeological sites are present and to ascertain the extent of such sites. Before committing any act(s) which might result in damage to, or destruction of, a site which has religious or cultural significance to local Native American tribes or groups, BPA shall notify the appropriate tribal executive officer in writing. In cases where a permit must be issued because of an imminent threat of loss or destruction of an archaeological resource, BPA shall consult with the SHPO and notify any Native American group known to or believed to consider the site as having religious or cultural importance of permit application.

## DISCOVERY SITUATIONS

If, after completion of a cultural resources intensive field survey, all other compliance responsibilities, and/or initiation of construction, previously unidentified cultural resources are identified which would be adversely affected by the proposed project, BPA would follow the procedures set forth in the following regulations, laws, and guidelines: Section 106 (36 CFR Part 800) of the National Historic Preservation Act of 1966, as amended (16 U.S.C. Section 470); the National Environmental Policy Act of 1969 (42 U.S.C. Sections 4321-4327); the American Indian Religious Freedom Act of 1978 (PL 95-341); the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470a-470m); and the Native American Graves Protection and Repatriation Act of 1990 (PL 101-601).

1. To the maximum extent possible, BPA shall redirect work so that it would not affect the resource. Other work or work in areas that would not affect the resource may continue.

2. BPA shall immediately obtain from BPA's contract cultural resource specialist an evaluation of significance for the site and determination of potential impacts on eligible properties.

3. BPA shall immediately initiate consultation with the Washington SHPO and other Federal/state agencies that may be involved in the project regarding the eligibility of the site to meet specific NRHP Criteria. Such consultation shall be initiated by telephone or in person, and corroborated with written documentation.

4. If the SHPO and BPA both agree that the site is not eligible, BPA would document this decision and construction may proceed.

5. If BPA, the SHPO, or both consider the site NRHP-eligible, that determination shall be documented and BPA would proceed with protection and mitigation. BPA would further consult with SHPO on the determination of effect as follows:

    a. If BPA and SHPO agree that there would be no effect, construction may proceed.
    b. If BPA, SHPO, or both consider that the project would affect an eligible property, they would confer to identify appropriate mitigation measures. Recommended mitigation measures would then be provided to the ACHP.
    c. If the ACHP agrees with the proposed mitigation, then a Memorandum of Agreement addressing mitigation of the affected resource would be drafted, and the project may proceed.

## 9. THREATENED AND ENDANGERED SPECIES

The Endangered Species Act requires that Federal agencies review the consequences of an activity on threatened and endangered species and the ecosystem on which these species depend; it also gives review and veto authority to US Fish and Wildlife Service (USFWS) and National Marine Fisheries. In their letter of June 26, 1992, the USFWS listed the bald eagle

(*Haliaeetus leucocephalus*) and the marbled murrelet (*Brachyramphus marmoratus*) as the threatened and endangered species in the area. BPA conducted a Biological Assessment, and concluded that the project would not affect the bald eagle or marbled murrelet. (See **Appendix E, BIOLOGICAL ASSESSMENT.**) The USFWS has concurred with the Assessment. At present, there are no Federally listed Threatened or Endangered plants in the State of Washington; however, 71 plants are proposed for listing in the Northwest, and would need to be addressed by the U.S. Fish and Wildlife Service before the end of 1996. Identification of these plants and associated ecosystems would be reviewed.

Should any changes that might affect a species occur in the project, or if any other species known to occur in the close vicinity of the project becomes officially listed before completion of the project, BPA would reevaluate its responsibilities under the Endangered Species Act. Under section 7(a) of the Act, agencies of the Federal Government are to ensure that their action does not "jeopardize the continued existence of any endangered species or threatened species."

## 10. FISH AND WILDLIFE CONSERVATION

Provisions of the Pacific Northwest Electric Power Planning and Conservation Act (16 U.S.C. 839 *et seq.*) are intended to protect, mitigate, and enhance fish and wildlife of the Columbia River and its tributaries. Although the proposed action is not located within and would not directly affect the Columbia River drainage basin, returns from Energy Storage during late summer and autumn could allow hydro operators in the U.S. to store water better, to maintain required storage levels (also see **Intertie Use Alternatives** discussion earlier in this chapter).

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901 *et seq.*) encourages Federal agencies to conserve and to promote conservation of nongame fish and wildlife species and their habitats. Measures proposed to mitigate potential impacts on wildlife and on vegetation do this to the maximum extent possible within BPA's statutory responsibility.

The Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) requires that Federal agencies consult with the USFWS whenever an agency plans to conduct, license, or permit an activity involving the impoundment, diversion, deepening, control, or modification of a stream or body

of water. BPA would not conduct activities of this nature as a part of the proposed transmission project.

## 11. FARMLANDS

Section 154 (a,b) of the Farmland Protection Policy Act requires BPA to identify and quantify adverse impacts of the proposed action on farmlands. The location and areal extent of Prime and other important farmlands as designated by the Soil Conservation Service (SCS) was obtained from SCS soils surveys for the Whatcom and Skagit County areas. Most of the Prime farmland is located on the low terraces and floodplains north of Bellingham and near Sedro-Woolley. About 26 km (16 mi.) of the designated Prime farmland would be crossed by the proposed transmission line. The existing 230-kV wood pole transmission line would be replaced by a 230-kV or 500-kV line suspended on lattice-steel structures, with fewer towers and longer spans. However, these structures would have bigger bases then the existing wood poles. Therefore, there would be a small net loss of Prime farmland. About 0.2 to 0.4 ha (0.5 to 1 ac.) of Prime farmland would be lost to production due to construction of the proposal. These figures reflect the difference between the amount of land lost to production by construction of the new transmission line and the amount of land that would be restored to production by removal of the existing line. The substation expansion would be located on nonfarmable land between two existing substation yards and thus would not affect Prime farmland. No unique or other designated (i.e., statewide or local) important farmlands would be affected.

## 12. FLOODPLAINS/WETLANDS

***Both floodplains and wetlands are found in the project area. These are specially protected resources. For complete assessment of their significance and of impacts, please see Section D5 in this chapter.***

Wetland management, regulation, and protection is related to several sections of the Clean Water Act (CWA), including Section 401, Section 402 and Section 404, as well as to a combination of other laws originally written for other uses. These are: the Coastal Zone Management Act, the Endangered Species Act, Historic Preservation Act, Rivers and Harbors

Act, and Wild and Scenic Rivers Act. Section 404 of the CWA (33 CFR 320-330) requires either review by the managing agencies or certification of consistency.

Compliance with these regulations is ensured by the ***General Conditions for Nationwide Permits***. These conditions apply to all Nationwide Permits (NWP). The activities proposed by this project are authorized by the following NWP's (33 CFR 330):

NWP #14 - Road Crossings,
NWP #25 - Structural Discharges,
NWP #26 - Headwaters and Isolated Waters,
NWP #27 - Wetland Restoration Activities, and
NWP #33 - Temporary Construction and Access.

In order for a wetland activity to be authorized by a Nationwide Permit, thirteen General Conditions must be met. They are:

1. ***Navigation.*** (Rivers and Harbors Act) Navigation shall not be hindered.

2. ***Proper maintenance.*** (CWA, Section 402) Any structure or fill shall be properly maintained.

3. ***Erosion and siltation controls.*** (CWA, Section 402) Appropriate erosion and siltation controls must be used and maintained.

4. ***Aquatic movements.*** (USFWS review) Aquatic species shall not be substantially disrupted.

5. ***Equipment.*** (CWA Section 402) Activity must minimize the disruption of heavy equipment working wetlands by using mats or other means.

6. ***Regional and case-by-case.*** Seattle District Corps has placed extra conditions on some NWP's including 26, 33 (described under State Regulations)

7. ***Wild and Scenic Rivers.*** (Wild and Scenic Rivers Act) No activity may occur in a component of the Wild and Scenic Rivers System.

8. ***Tribal rights.*** No activity may impair tribal rights.

9. ***Water quality certification.*** (CWA, Section 401) In Oregon and Washington state water quality certification must be obtained for the NWP's listed above.

10. ***Coastal zone management.*** (Coastal Zone Management Act) The activity must be consistent with both Oregon's Coastal Zone Management Act and Washington's Shoreline Management Act.

11. ***Endangered Species.*** (Endangered Species Act) No activity may jeopardize an endangered species or its critical habitat.

12. ***Historic properties.*** (Historic Preservation Act) No activity may affect historic properties.

13. ***Notification.*** (CWA, Section 404) Some NWP's require notification (which includes a wetland delineation) to the Corps before the activity can begin, of the four listed above, notification is required for NWP's # 26 and # 33.

In addition to these 13 conditions, there are 9 ***Section 404 Only Conditions***. These conditions are meant to address the actual discharge. They are:

1. No discharge near a water supply intake.
2. No discharge near a shellfish production area.
3. No discharge of unsuitable material.
4. No discharge in a mitigation site, unless approved.
5. No discharge in spawning area, during spawning season.
6. No discharge that restricts or changes location of flows.
7. No discharge that creates an impoundment of water.
8. No discharge in wildfowl breeding areas.
9. Removal of temporary fills.

"Shorelines of the State" are ranked as Type 1 waters in Whatcom County. As such, an area covering the 60 m (200 ft.) from the Ordinary High Water Line on both sides of the river is covered by the Whatcom County Shoreline Management Master Plan.

In this section the line would span overhead eight riverine systems and one aqueduct. Both the Samish River and the Aqueduct are designated Waters of the State, and are ranked as Type 1 waters in Whatcom and Skagit Counties. As such, an area covering the 60 m (200 ft.) from the Ordinary High Water Line on both sides of the system is subject to the jurisdiction of the Whatcom County Shoreline Management Master Plan and the Skagit County Shoreline Management Master Plan.

## 13. ENERGY CONSERVATION AND POLLUTION CONTROL AT FEDERAL FACILITIES

### FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT (FIFRA)

FIFRA provides for the registering of pesticides and regulates their use to ensure that unreasonable environmental impact does not result. BPA uses herbicides (a kind of pesticide) only in a very limited fashion and under controlled circumstances. When herbicides are used, it is pursuant to BPA's vegetative management program on transmission lines rights-of-way, to control weeds in substation yards, to control noxious weeds, and to maintain landscaping at various facilities.

Vegetative management of the existing BPA right-of way is carried out under the direction of the Transmission Maintenance Superintendent of BPA's Puget Sound Area Office in Seattle. The existing rights-of-way have been managed by using the following methods:

1. Clearing of incompatible trees from the right-of-way (by chain saws or other mechanical clearing methods).

2. Manual applications of herbicides when requested by a local agency in order to control undesirable plant species. This is done on a limited, case-by-case basis.

The Substation Maintenance Superintendent of the Puget Sound Area Office directs prevention of vegetative growth within the substation switchyard. In the switchyard, a gravel surface insulates workers from the electric fields occurring during power faults within the substation. Since plants destroy the insulating qualities of the gravel, herbicides are applied to prevent vegetation from growing inside the yard.

When herbicides are applied, the date, dosage, and chemical used are recorded and reported to the appropriate state government officials. Herbicide containers are disposed of according to RCRA standards.

### RESOURCE CONSERVATION AND RECOVERY ACT (RCRA)

This act is intended to bring about:

- the recovery of useful materials which are often needlessly buried in landfills;

- the recovery of solid fuel, oil, and gas that can be converted into energy; and
- environmentally safe disposal of non-recoverable waste residues, particularly those which are toxic or hazardous.

The proposed transmission line and related substation modifications would not generate large amounts of solid waste. Construction materials would either be drawn from BPA materials stockpiles or purchased through competitive procurement. Packaging crates, damaged and excess materials, and other construction byproducts would be stored for use on future jobs, separated and sold as scrap through BPA's Utilization and Disposal Organization, burned in accordance with local burning regulations, or delivered to a licensed landfill for disposal. Wood poles and other wood products that would be removed as part of the project would be assessed for reuse or surplus. Those that have been treated with wood preservative chemicals (i.e., pentachlorophenol) would be stored or disposed of at an approved disposal site.

Small amounts of listed hazardous wastes may be generated by the project. Most of the line's poles and crossarms are likely to have been treated with wood preservatives (creosote or pentachlorophenol), listed as hazardous waste under RCRA. These materials would be disposed of in accordance with state laws and RCRA. Provisions would be added to the construction contract specifications to assure compliance with RCRA.

The substation modifications would not generate toxic or hazardous wastes requiring disposal under RCRA. However, the electrical equipment to be installed or relocated contains transformer oil which is recyclable.

The power circuit breakers required at the substations (BPA's and Puget Power's) would be new and would be competitively acquired. BPA's procurement specifications allow either insulating oil or sulfurhexafluoride gas to be used as the insulating medium in newly acquired breakers. Consequently, it is not possible to say whether the new equipment would contain oil, a recyclable product. Neither of these insulating agents is listed as a hazardous substance requiring disposal under RCRA. Since BPA reprocesses and reuses insulating oil, recycling used oil is already an element of the proposed action.

## TOXIC SUBSTANCES CONTROL ACT (TSCA)

The Toxic Substances Control Act (TSCA) is intended to protect human health and the environment from toxic chemicals. Section 6 of the Act regulates the use, storage, and disposal of PCB's.

BPA has adopted written staff guidelines for PCB's. They provide added assurance that this proposed action would not introduce new toxic substances into the substation switchyards or allow those already in existence to affect people or the environment adversely. The proposed action is, in summary, subject to the PCB provisions of TSCA. However, concentration levels present in the involved electrical equipment are very low and thus do not activate the use, storage, and disposal provisions of the Act.

## COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) was enacted and is generally employed primarily to address past contamination from past activities at inactive sites; however, it can also be used to address active sites with current releases of hazardous substances.

BPA assesses existing fee-owned properties and property planned for acquisition in order to determine the likelihood that hazardous substances may be present. Only the BPA Bellingham substation would be expanded as part of the proposed project. The expansion would occur on existing BPA fee-owned property. The portion of the existing site subject to expansion does not have a history of hazardous materials disposal. No new property is proposed for acquisition. Therefore, the provisions of CERCLA would not be triggered by the proposed project.

## ENERGY CONSERVATION AT FEDERAL FACILITIES

The proposed substation modifications would not require the addition of new structures such as relay houses, but would use those already in existing substations. The proposed action therefore involves the continued use of buildings which would meet Federal energy conservation design standards as they apply to existing structures.

## NOISE CONTROL ACT

The Washington State Department of Ecology regulates maximum environmental noise levels (WAC 173-60). Allowable levels depend on land use of the source and receiving property. The preliminary design of the proposed lines anticipates audible noise levels (12 to 16 dBA worst case, at a distance of 25 ft.) which are significantly below the regulations (maximum of 60 dBA in residential areas). When existing background noise is considered, noise associated with the lines would be inaudible.

## SAFE DRINKING WATER ACTS

The Safe Drinking Water Act (42 U.S.C. sec 300f *et. seq.*) is designed to protect the quality of public drinking water and its sources. In the State of Washington, the Department of Health is responsible for implementing the rules and regulations of the Act (WAC 246-290). This project would not cross or affect any Sole Source Aquifers or require an underground injection well. Although the transmission line crosses the Lake Whatcom watershed (the lake providing a source for local drinking water), the project would not affect the lake's water quality (see the **Water Quality** section).

## CLEAN AIR ACT

The provisions of the Clean Air Act (42 U.S.C. 7412 *et seq.*) would not be triggered by the construction actions proposed.

## COMPLIANCE WITH FEDERAL AVIATION ADMINISTRATION (FAA) REQUIREMENTS

As part of transmission line design, BPA seeks to comply with Federal Aviation Administration (FAA) procedures. Final locations, structures, and catenary heights are submitted to the FAA for the project. The information includes identifying structures taller than 60 m (200 ft.) above ground, and listing all structures within prescribed distances of those airports listed in the FAA airport directory. BPA also assists the FAA in field review of the project by identifying locations using BPA aircraft. The FAA then conducts its own study of the project, and makes recommendations to BPA for airway marking and lighting. General BPA policy is to follow FAA recommendations.

# CHAPTER 5
# LIST OF PREPARERS

The persons listed below work for BPA unless otherwise noted.

**RICHARD A. ALBRECHT** Civil Engineer Technician. Responsible for: access road design. Education: Architecture, Pre-Engineering, and Continuing Education. Experience: survey, mapping, and access road design; with BPA since 1966.

**NORMAN ANDRESEN** Environmental Specialist/Project Environmental Coordinator. Responsible for: study design/coordination, public involvement, environmental interagency coordination, description and alternatives, Clean Air Act, and Coastal Zone Management. Education: Applied Science, Resource Planning. Experience: Twenty years resource/environmental planning, environmental analysis, transmission corridor planning, coordination and project management; associated with BPA and NEPA since 1973.

**JAN BRADY** Economist. Responsible for surplus sales and analysis. Education: B.S. Economics; M.S. Applied Economics. Experience: NEPA and similar duties with BPA since 1991.

**JAMES D. BUTCHER** Clearing Coordinator. Responsible for: clearing design and danger tree assessment. Education: Civil Engineering Technician. Experience: survey and mapping; Clearing Coordinator since 1983; with BPA since 1962.

**LAURENS C. DRIESSEN, P.E.** Project Manager. Responsible for: overall project management and transmission engineering. Education: B.S. Civil Engineering. Experience: facility siting and project management; with BPA since 1969.

**ROBERT R. EDDY** Associate Project Manager. Responsible for: early stages of project development. Education: B.S. Civil Engineering. Experience: similar responsibilities for major transmission projects; with BPA since 1965.

**RICHARD C. EMBREE** Landscape Architect. Responsible for: visual and recreation data collection and analysis. Education: B.S. Landscape Architecture. Experience: environmental analysis, transmission line siting; mitigation design; with BPA since 1975.

**ELMER F. FISCHER** Electrical Engineer. Responsible for: transmission system planning and project coordination. Education: B.S. Electrical Engineering. Experience: system planning engineer; with BPA since 1959.

**JERRY GALM** Program Director, Archaeological and Historical Services, Eastern Washington University. Responsible for: direct cultural resource analysis and preparation of documents. Education: B.A. Anthropology; M.A. Anthropology; Ph.D. Anthropology. Experience: cultural resource field and administrative experience; consultant to BPA since 1981.

**JOHN J. GROVER, P.E.** Project Engineer. Responsible for: transmission engineering and route location. Education: B.S. Civil Engineering. Experience: Similar responsibilities for transmission projects; with BPA since 1980.

**PHILLIP D. HAVENS** Environmental Specialist. Responsible for: coordination of wildlife, vegetation, and cultural resources analysis. Education: B.S. Biological Science; graduate study in wildlife management. Experience: analysis of timber harvest and transmission line impacts on fish and wildlife; with BPA since 1983.

**LESLIE H. KELLEHER** Biologist. Responsible for: vegetation analysis. Education: B.A. Biology; B.S. Secondary Education; M.A. Environmental Science and Secondary Education. Experience: general environmental analysis, vegetation analysis, and wetland ecology; with BPA since 1991.

**MOLLY S. KOESTER** Environmental Planner/Assistant Project Environmental Coordinator. Responsible for: assisting in study design and overall coordination, physical preparation of the EIS, management of the public comment/response process. Education: B.S. Environmental Studies. Experience: general environmental coordination; consultant to BPA 1991.

**RODNEY W. KRAHMER** Environmental Planner/Wildlife Biologist. Responsible for: vegetation, fish and wildlife data collection and analysis. Education: B.S. Wildlife; M.S. Wildlife Biology. Experience: associated with several government agencies, and private firms since 1989, preparing land use and resource management plans, mitigation plans, and environmental assessments and impact statements; consultant to BPA since 1992.

**LINDA KRUGEL** AICP, Planning Consultant. Responsible for: public involvement and land use data collection and analysis. Education: B.S. Related Art; M. of City Planning; M. of Public Administration. Experience: policy development and public involvement; consultant to BPA since 1984.

**R. KIRSTEN LOWE** Public Affairs Specialist. Responsible for: public involvement. Education: B.A. Business; M.B.A. Experience: residential conservation; program planning and implementation; with BPA since 1985.

**CHARLES T. LUTTRELL** Archeologist II. Responsible for: cultural resource analysis and preparation of documents. Education: B.A. Anthropology; B.F.A. Sculpture. Experience: cultural resource management, historic preservation, and archeological excavation and survey for the Pacific Northwest region; consultant to BPA since 1989.

**GENE P. LYNARD** Environmental Specialist. Responsible for: socioeconomic data collection and analysis. Education: B.A. Liberal Arts; M. of City and Regional Planning. Experience: real estate development economics, environmental analysis, facility planning; worked with BPA since 1984.

**STACY L. MASON** Environmental Specialist. Responsible for: water resource data collection and analysis. Education: B.A. Aquatic Biology. Experience: environmental analysis; with BPA since 1988.

**ROLAND MIDDLETON** Whatcom County Deputy SEPA Official. Responsible for: SEPA compliance and Whatcom County land use coordination. Education: B.S. Geology. Experience: engineering geology, wetland science, land use administration, project management; with Whatcom County since 1989.

**JUDITH H. MONTGOMERY** Writer. Responsible for: writing and editing. Education: B.A. English Literature; M.A. English Literature; Ph.D. American Literature. Experience: writing and editing of environmental and public involvement documents for power agency; consultant to BPA since 1980.

**LEROY P. SANCHEZ** Visual Information Specialist. Responsible for: graphics coordination in the Division of Facilities Engineering. Education: Graphic Design, University of Nevada, Las Vegas 1970 - 1973; Portland State University 1983 - 1985. Experience: coordination of environmental impact statement graphics, cartographic technical duties; with BPA since 1978.

**PHILIP W. SMITH** GIS Specialist/Soil Scientist. Responsible for: soils and agriculture data collection and analysis. Education: B.S. Agronomy; M.S. Soil Science. Experience: soils and agriculture analysis; consultant to BPA since 1981.

**COLLEEN A. SPIERING** Environmental Specialist. Responsible for: health and safety coordination and analysis. Education: B.S. Health Education; M.Ph. Health Education & Planning. Experience: health education and planning, public involvement, environmental analysis; with BPA since 1991.

**RICHARD D. STEARNS** Electrical Engineer. Responsible for: engineering aspects of health and safety data. Education: B.S. Electrical Engineering; M.S. Electrical Engineering. Experience: transmission line design issues related to corona and field effects; with BPA since 1978.

**CHRIS R. THOMS** Environmental Planner/Wetland Specialist. Responsible for: wetland identification and delineation. Education: B.S. Natural Sciences. Experience: wetland consulting since 1988; consultant to BPA since 1992.

**NANCY H. WEINTRAUB** Environmental Specialist. Responsible for: coordinating floodplain and wetland analysis. Education: B.S. Ecosystems Analysis; M.S. Aquatic Ecology. Experience: environmental analysis, transmission facility planning, coordination and project management; with Western Area Power Administration and BPA since 1982.

**JOHN R. WEISS** Electrical Engineer. Responsible for: area engineering coordination. Education: B.S. Electrical Engineering. Experience: engineering utility planning since 1971; with BPA since 1978.

**DOUGLAS L. WITTREN** GIS Specialist. Responsible for: GIS database automation, spatial analysis and cartographic production. Education: B.S. in Geography; graduate study in geography and GIS. Experience: environmental planning and resource analysis; consultant to BPA since 1992.

**DONALD WOLFE:** Public Utilities Specialist. Responsible for: Marketing use of portion of project. Education: B.A. Psychology; J.D. Experience: environmental analysis, energy conservation and power sales issues; with BPA since 1976.

**JOHN ZIMMERLY** GIS Specialist. Responsible for: GIS database automation, geographic analysis and cartographic output. Education: B.S. Biology; graduate study in GIS. Experience: GIS development for BPA; consultant to BPA since 1988.

# CHAPTER 6
# LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

**Federal Agencies**

Federal Energy Regulatory Commission, Washington, DC
United States Department of Energy, Office of NEPA Oversight, Washington, DC
United States Department of Energy, Office of Fuel Programs, Washington, DC
United States Environmental Protection Agency, Washington, DC
United States Environmental Protection Agency, Regional Office, Seattle, WA

**Congressional**

Senator Patty Murray
Senator Slade Gorton
Representative Al Swift

**Native American Organizations**

Lummi Tribe, Ferndale, WA
Nooksack Tribe, Deming, WA
Samish Tribe, Anacortes, WA
Sauk-Suiattle Indian Tribe, Darrington, WA
Skagit System Cooperative, LaConner, WA
Swinomish Tribe, LaConner, WA
Upper Skagit Tribe, Sedro Woolley, WA

**State Senators**

Ann Anderson
Harriet Spanel

**State Representatives**

Rob Johnson
Pete Kremen
Kelly Linville

**State Agencies**

Department of Ecology, Olympia, WA
Department of Health, Olympia, WA

Department of Natural Resources, Olympia, WA
Department of Transportation, Seattle, WA
Department of Wildlife, Mount Vernon, WA
Energy Facility Site Evaluation Council, Olympia, WA
House Committee on Health Care, Olympia, WA
Office of Archaeology & Historic Preservation, Olympia, WA
Washington Utilities/Transportation Commission, Olympia, WA

**Regional Agencies**

Whatcom County Council of Governments, Bellingham, WA
Skagit Council of Governments, Mt Vernon, WA

**Local Agencies**

City of Bellingham, Mayor, Bellingham, WA
City of Bellingham, City Council, Bellingham, WA
City of Bellingham, Department of Planning & Community Development, Bellingham, WA
City of Mount Vernon, Mayor and Council, Mt Vernon, WA
City of Sedro Woolley, City Supervisor, Sedro Woolley, WA
City of Sedro Woolley, Mayor and Council, Sedro Woolley, WA
County of Skagit, Commissioners, Mount Vernon, WA
County of Skagit, Department of Planning, Mount Vernon, WA
County of Skagit, Department of Parks & Recreation, Mount Vernon, WA
County of Skagit, SEPA Official, Mount Vernon, WA
County of Whatcom, Department of Environmental Health, Bellingham, WA
County of Whatcom, County Executive, Bellingham WA
County of Whatcom, Council Members, Bellingham, WA
County of Whatcom, Planning Commission, Bellingham, WA
County of Whatcom, Park Board, Bellingham, WA
County of Whatcom, Planning Department, Bellingham, WA
County of Whatcom, SEPA Official, Bellingham, WA
Port of Bellingham, Bellingham, WA
Port of Skagit County, Burlington, WA
Sudden Valley Community Association, Bellingham, WA
Acme/Wickersham Community Association, Wickersham, WA

**Utilities**

B.C. Hydro & Power Authority, Vancouver, BC, CANADA
City of Blaine, Blaine, WA
Puget Sound Power & Light Company, Bellevue, WA
City of Sumas, Sumas, WA
Whatcom County PUD No 1, Bellingham, WA

**Businesses**

Key Bank, Bellingham, WA
BP Refinery, Ferndale, WA
Georgia Pacific Corporation, Bellingham, WA
Horizon Bank & Savings, Bellingham, WA
Intalco, Lynden, WA
Pacific First Federal Residential, Tacoma, WA
Tenaska Power Partners, Omaha , NE
Trillium Corp, Bellingham, WA
US Savings Bank of Washington, Bellingham, WA

**Libraries**

Bellingham Public Library, Bellingham, WA
Ferndale Library, Ferndale, WA
Sedro Woolley Public Library, WA
Skagit Community College Library, Mt Vernon, WA
City of Mt Vernon Library, WA
Western Washington University, Mabel Zoe Wilson Library, Bellingham, WA
Whatcom Community College, Learning Resource Center, Bellingham, WA
Whatcom County Public Library, Bellingham, WA

**Interest Groups**

Associated Students Environmental Center, Western Washington University, Bellingham, WA
Audubon Society, Skagit Division, Mount Vernon, WA
Friends of the Earth, Northwest Office, Seattle, WA
Friends of Lake Whatcom, Bellingham, WA
Lake Whatcom Coalition, Bellingham, WA
League of Women Voters, Bellingham, WA
Natural Resources Defense Council, San Francisco, CA
Nature Conservancy, Seattle, WA
Neighbors Opposed to Powerline Encroachment, Bellingham, WA
Northwest Conservation Act Coalition, Seattle, WA
North Cascades Audubon Society, Bellingham, WA
Puget Sounders, Bellingham, WA
Sierra Club, Portland, OR
Skagit Audubon Society, Mount Vernon, WA
Skagitonians to Preserve Farmland, Burlington, WA
Whatcom Chamber of Commerce/ Economic Development Council, Bellingham, WA
Whatcom County Land Trust, Bellingham, WA
Whatcom Watch, Bellingham, WA

**Newspapers**

Bellingham Herald, Bellingham, WA
Lynden Tribune, Lynden, WA
Seattle Post Intelligencer, Seattle, WA
Seattle Times, Seattle, WA
Skagit Argus, Mount Vernon, WA
Skagit Valley Herald, Mount Vernon, WA
Skagit River Post, Sedro Woolley
Sudden Valley Views, Bellingham, WA
Western Front, Western Washington University, Bellingham, WA
Westside Record Journal, Ferndale, WA

**Radio/TV**

KNWR/KPUG, Bellingham, WA
KBRC Radio, Mt. Vernon, WA
KCTS TV, Seattle, WA
KISM/KGMI Radio, Bellingham, WA
KLYN Radio, Lynden, WA
KUOW, Seattle, WA
KVOS TV Inc, Bellingham, WA

**Individuals**

Larry Kunzler, Sedro Woolley, WA
Bill Black, Bellingham, WA

# CHAPTER 7
# REFERENCES


Ahlbom, A. et al. 1987.
Biological Effects of Power Line Fields. New York State Powerlines Project Scientific Advisory Panel Final Report. New York State Department of Health, Power Lines Project. Albany, New York.

Anonymous. 1906.
An Illustrated History of Skagit and Snohomish Counties. Interstate Publishing Company.

*The Bellingham Herald,* 9 April 1918:3.

Blukis Onat, Astrida A., Lee A. Bennett, and Jan Hollenbeck. 1980.
Cultural Resource Overview and Sample Survey of the Skagit Wild and Scenic River. Three vols. Institute of Cooperative Research, Seattle.

Campion, John. May, 1993.
Puget Power. Written communication.

Center for Northwest Studies and Whatcom County Centennial Committee. 1989.
*Map of Historic Register Sites of Whatcom County.* Center for Northwest Studies and Whatcom County Centennial Committee, Bellingham.

City of Bellingham.
The Bellingham Plan. Mount Baker, ND; Roosevelt, ND; Silver Beach, ND.

Cheever, Bruce Bissel. 1949.
The Development of Railroads in the State of Washington 1860 to 1948. An unpublished Master's thesis, Western Washington College of Education, Bellingham.

Coleman, M. et al. 1985.
Leukaemia and Electromagnetic Fields: A Case-Control Study. Pages 122-125, *in*, International Conference on Electric and Magnetic Fields in Medicine and Biology. Institution of Electrical Engineers. London and New York.

Coleman, M. and V. Beral. 1988.
A Review of Epidemiological Studies of the Health Effects of Living Near or Working with Electricity Generation and Transmission Equipment. International Journal of Epidemiology 17(1):1-13.

Collins, June M. 1980.
Report of the Use of the Skagit River, Including Village Locations, By the Upper Skagit Indians. *In* Cultural Resource Overview and Sample Survey of the Skagit Wild and Scenic River, Vol. 2, by Astrida R. Blukis Onat, Lee Bennett, and Jan Hollenbeck, pp. 2-17. Institute of Cooperative Research, Seattle.

Cowardin, Lewis M. 1979.
Classification of Wetlands and Deepwater Habitats of the United States. U. S. Fish and Wildlife. FWS/OBS-79/31.

Dennis, Helen M. and LaRea J. Gilkey. 1980.
Handbook of Northwestern Plants. Oregon State University Bookstores, Inc.

Detling, LeRoy R. 1968.
Historical Background of the Flora of the Pacific Northwest. Bulletin #13, Museum of Natural History. University of Oregon.

Edson, Lelah Jackson. 1968.
*The Fourth Corner*. Craftsman Press, Seattle.

EMF Health and Safety Digest. June 1993.
"Denmark: No EMF Regulations." Vol. 11, No. 6. Pp. 4-5.

Environmental Laboratory. 1987.
Corps of Engineers Wetlands Delineation Manual. 1987. Tech. Report Y-87-1.

Environmental Protection Agency (EPA). 1990.
Evaluation of the Potential Carcinogenicity of Electromagnetic Fields. Review Draft. CPA/600/6-90/005B. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

Federal Emergency Management Agency Floodplain Insurance Rate Maps

Federal Interagency Committee for Wetland Delineation. 1989.
Federal Manual for Identifying and Delineating Jurisdictional Wetlands. U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture Soil Conservation Service.

Feychting, M., and A. Ahlbom. 1992.
Magnetic Fields and Cancer in People Residing Near Swedish High Voltage Power Lines. IMM-rapport 6/92. Institute of Environmental Medicine, Karolinska Institute, Stockholm, Sweden.

Franklin, Jerry K., and C. T. Dyrness. 1969.
Vegetation of Oregon and Washington. U.S.D.A. Forest Service Research Paper PNW-80.

Fulton, J.P., S. Cobb, L. Preble, L. Leone, and E. Forman. 1980
Electrical Wiring Configuration and Childhood Leukemia in Rhode Island. American Journal of Epidemiology 111:292-296.

Garvield, Leonard. 1992.
Personal communication concerning the status of Northern State Hospital, August 18, 1992.

Gcek Associates. 1990.
Draft and Final Environmental Assessment Smith Creek Timber Harvest Plan. Whatcom County, WA.

General Land Office (GLO). 1859a.
Cadastral Survey Plat T38N, R3E. Microfiche on file, Bureau of Land Management, Spokane.

General Land Office (GLO). 1859b.
Cadastral Survey Subdivision Notes T38N, R3E. Microfiche on file, Bureau of Land Management, Spokane.

General Land Office (GLO). 1873.
Cadastral Survey Plat T39N, R3E. Microfiche on file, Bureau of Land Management, Spokane.

General Land Office (GLO). 1884.
Cadastral Survey Plat T37N, R5E. Microfiche on file, Bureau of Land Management, Spokane.

General Land Office (GLO). 1890a.
Cadastral Survey Plat T36N, R5E. Microfiche on file, Bureau of Land Management, Spokane.

General Land Office (GLO). 1890b.
Cadastral Survey Subdivision Notes T36N, R5E. Microfiche on file, Bureau of Land Management, Spokane.

Grushenmeier, David. 1993.
Washington State University Cooperative Extension Service. Bellingham, Washington. Telephone communication.

Hitchcock, A.S., and Agnes Chase. 1971.
Manual of Grasses of the United States. Dover Publications.

Hitchcock, C. Leo, and Arthur Cronquist. 1973.
Flora of the Pacific Northwest. University of Washington Press.

Institute for Watershed Studies. 1986, revised 1987.
Lake Whatcom Watershed Management Plan. Western Washington University, Bellingham, WA.

Jeffcott, P.R. 1949.
Nooksack Tales and Trails. Sedro-Woolley Courier-Times, Ferndale, Washington.

Keller, Donna. September, 1992.
Whatcom County Convention and Visitors Bureau. Bellingham, Washington. Telephone communication.

King, J. Scott. 1992.
Cultural Resources Assessment of a Proposed Cascade Natural Corporation Pipeline, Whatcom County, Washington. Historical Research Associates, Inc., Seattle. On file, Office of Archaeology and Historic Preservation, Olympia.

Koert, Dorothy, and Galen Biery. 1980.
Looking Back. Lynden Tribune, Lynden, Washington.

Kroll, Cynthia A. and Thomas Priestley. 1992.
Effects of Overhead Transmission Lines on Property Values. Prepared for the Siting and Environmental Task Force. Edison Electric Institute.

Leonard, Albert. September 1992.
Bonneville Power Administration. Telephone communication.

Leonard, Albert. November 1992.
Bonneville Power Administration. Telephone communication.

Lin, R.S. and P.Y.-Lu. 1989.
An epidemiologic study of childhood cancer in relation to residential exposure to electromagnetic fields. Abstract A-40. *In:* The Annual Review of Research on Biological Effects of 50 and 60 Hz Electric and Magnetic Fields. U.S. Department of Energy. Washington DC.

London, S.J., D.C. Thomas, J.D. Bowman, E. Sobel, T. Cheng, and J.M. Peters. 1991
Exposure to Residential Electric and Magnetic Fields and Risk of Childhood Leukemia. American Journal of Epidemiology 134(9):923-937.

Luttrell, Charles T. 1992.
A Preliminary Cultural Resources Evaluation of the Bonneville Power Administration's Proposed Northwest Washington Transmission Line Project, Skagit and Whatcom Counties, Washington. Short Report 322, Archaeological and Historical Services, Eastern Washington University, Cheney.

McDowall, M.E. 1986.
Mortality of Persons Resident in the Vicinity of Electricity Transmission Facilities. British Journal of Cancer 53:271-279.

Meteorological Committee of the Pacific Northwest River Basin Commission. Records of 1948 - 1954. Climatological Handbook for the Columbian Basin States.

Milham, S. 1982.
Mortality From Leukemia in Workers Exposed to Electrical and Magnetic Fields. (Letter to the editor). New England Journal of Medicine 307(4):249.

Mitsch, William J., and James G. Gosselink. 1986.
Wetlands. Van Nostrand Reinhold.

Moore, F. Stanley. 1973.
An Historical Geography of the Settlement Around Lake Whatcom Prior to 1920. Institute for Freshwater Studies, Technical Report No. 21, Western Washington State College, Bellingham.

Moulds, Lisa, L. Hammerle, L. Chandler, S. McCaslin, C. Turenne, J. Belcher, E. Smith, and T. McCracken. 1991.
Silver and Aqualicum Creek Watersheds. An unpublished Winter 1991 class project, Environmental Impact Assessment Class 436536, Huxley College of Environmental Studies, Western Washington University, Bellingham. On file, Wilson Library Archives, Western Washington University, Bellingham.

Mountain West Research, Inc. 1982.
Transmission Line Construction Worker Profile and Community Resident Impact Survey.

Myers, A., et al. 1985.
Overhead Power Lines and Childhood Cancer. Pages 126-130, *in*, International Conference on Electric and Magnetic Fields in Medicine and Biology. The Institution of Electrical Engineers. London and New York.

Oak Ridge Associated Universities (ORAU) Panel. 1992.
Health Effects of Low-Frequency Electric and Magnetic Fields. ORAU 92/F8. Prepared for the Committee on Interagency Radiation Research and Policy Coordination. U.S. Government Printing Office. GPO #029-000-00442-9.

Olsen, J.H., A. Nielsen, G. Schulgen, A. Bautz, and V.B. Larsen. 1992.
Residence Near High-Voltage Facilities and the Risk of Cancer in Children. English Translation of Background Paper in Danish. Cancer Registry of the Danish Cancer Control Agency. Copenhagen, Denmark.

National Oceanographic and Atmospheric Administration. Records of 1951 - 1980.
National Climatic Center. Ashville, N.C.

National Radiological Protection Board. 1992.
Electromagnetic Fields and the Risk of Cancer. Volume 3, No. 1. Chilton, England.

Office of Archaeology and Historic Preservation (OAHP). 1974.
Inventory Form for prehistoric village, Whuid-zaub, the Washington State Inventory of Historic Places. On file, Office of Archaeology and Historic Preservation, Olympia.

Office of Archaeology and Historic Preservation (OAHP).
Survey Form for Caskey and Davidson Shingle Mill, Skagit County Cultural Resource Inventory. On file, Office of Archaeology and Historic Preservation, Olympia,

Office of Archaeology and Historic Preservation (OAHP).
Survey Form for Clark and Lennon Shingle Mill, Skagit County Cultural Resource Inventory. On file, Office of Archaeology and Historic Preservation, Olympia.

Pohl, R.S. 1992.
Artificial Keys to the Genera (Grasses). Modified by K.L. Chambers, Class Notes Oregon State University Bookstores, Inc.

Property Counselors. October 1991.
Population, Economic and Housing Projections 1990 - 2000 - 2010. Real Estate Research and Appraisal. Seattle, Washington.

Rabins, Erick S. 1983.
The Changing Functions of Settlements Along the Northern Pacific and Milwaukee Railroads in the Nooksack Basin: 1900 Through 1960. An unpublished Master's thesis, Western Washington University, Bellingham.

Reed, Porter B. Jr. May 1988.
National List of Plants Species that Occur in Wetlands; Northwest (Region 9). U.S. Fish and Wildlife Service. Biological Report 88 (26.9).

Reid, Alfred. 1987.
An Ecological Perspective of the Intergroup of an Inland Coast Salish Group: The Nooksack Peoples. An unpublished Master's thesis, Western Washington University, Bellingham.

Revised Assessment of Magnetic Fields and Health Hazards. 1993.
Swedish National Board for Electrical Safety. Stockholm, Sweden.

Riber, Michael. August 1993.
State of Washington Employment Security Department. Bellingham Job Service Center. Bellingham, Washington. Written communication.

Roth, Lottie Roeder. 1926.
History of Whatcom County. Volume 1. Pioneer Historical Publishing Company, Chicago.

Savitz, D.A., and E.E. Calle. 1987.
Leukemia and Occupational Exposure to Electromagnetic Fields: A Review of Epidemiologic Surveys. Journal of Occupational Medicine. 29:47-51.

Sagan, L.A. 1991.
Epidemiological and Laboratory Studies of Power Frequency Electric and Magnetic Fields. Journal of the American Medical Association, 268:625-629.

Savitz, D.A. et al. 1988.
Case-Control Study of Childhood Cancer and Exposure to 60Hz Magnetic Fields. American Journal of Epidemiology 128(1):21-38.

Science Advisory Board (SAB). 1991.
Potential Carcinogenicity of Electric and Magnetic Fields. EPA-SAB-RAC-92-013. U.S. Environmental Protection Agency, Washington, DC.

Scott, James W., and Daniel E. Turbeville III. 1983.
*Whatcom County in Maps 1832-1937*. Center for Pacific Northwest Studies and The Fourth Corner Registry, Bellingham.

Sedro-Woolley Rotary Club. 1986.
Sedro-Woolley: Memoirs and Memories. Sedro-Woolley Rotary Club, Sedro Woolley.

Severson, R.K. et al. 1988.
Acute Nonlymphocytic Leukemia and Residential Exposure to Power Frequency Magnetic Fields. American Journal of Epidemiology 128(1):10-20.

Snyder, Sally. 1980.
Aboriginal Settlements in the Skagit Drainage System, *In* Cultural Resource Overview and Sample Survey of the Skagit Wild and Scenic River, Vol. 2, by Astrida R. Blukis Onat, Lee Bennett, and Jan Hollenbeck, pp. 19-39. Institute of Cooperative Research, Seattle.

Skagit County Assessors Office. June 1993.

Sedro Woolley, Washington. Telephone communication.

State of Washington, Employment Security Department. 1992.
Covered Employment and Wages, Second Quarter 1992.

Stone, R. 1992. "Polarized Debate: EMFs and Cancer." Science 258: 1724-1725.

Sudworth, George B. 1967.
Forest Trees of the Pacific Slope. Dover Publications.

Sullivan, Michael.
Bellingham Bay and Eastern Railway Bed Survey-Inventory Form, Community Cultural Resource Survey. Form on file, Washington State Office of Archaeology and Historic Preservation (OAHP).

Timblin, Chuck. March 1993.
Whatcom County Soil Conservation Service. U.S. Department of Agriculture. Bellingham, Washington. Telephone communication.

Tremaine, David G. 1975.
Indian and Pioneer Settlement of the Nooksack Lowland, Washington, to 1890. Center for Pacific Northwest Studies, Occasional Paper No. 4, Western Washington University, Bellingham.

Tomenius, L. 1986.
50-Hz Electromagnetic Environment and the Incidence of Childhood Tumors in Stockholm County, Bioelectromagnetics 7:191-207.

U.S. Department of Agriculture, Soil Conservation Service. 1992.
Soil Survey of Whatcom County Area, Washington, and Hydric Soils List.

_____. 1992.
Soils Survey for Skagit County Area, Washington, and Hydric Soils List.

U.S. Department of Energy, Bonneville Power Administration and Puget Sound Power and Light Company. 1992.
BPA/Puget Power Northwest Transmission Project. Vol. I: Overview; Vol. II: Technical Studies.

U.S. Department of Energy, Bonneville Power Administration. February 1993 (revised).
Electrical and Biological Effects of Transmission Lines - A Review.

U.S. Fish and Wildlife Service. 1987 - 1989.
National Wetland Inventory Maps. (Sedro-Woolley North, Washington, 1989; Acme, Washington, 1989; Lake Whatcom, Washington, 1988; Lawrence, Washington, 1988;

Bellingham North, Washington, 1987; Ferndale, Washington, 1987; Bertrand Creek, Washington, 1988).

U.S. Geological Survey (USGS). 1954.
Bellingham North, Washington. 7.5' Quadrangle, photo-revised 1972 and photo-inspected 1978.

U.S. Geologic Survey 7-1/2-minute topographic maps

Washington State Department of Ecology, 1992.
1992 Statewide Water Quality Assessment.

Washington State Department of Natural resources. 1989.
Thunder Creek Basin. Jerry Thorsen. Skagit County.

Wertheimer, N., and E. Leeper. 1979.
Electrical Wiring Configurations and Childhood Cancer. American Journal of Epidemiology 19:273:284.

Wertheimer, N., and E. Leeper. 1982.
Adult Cancer Related to Electrical Wires Near the Home. International Journal of Epidemiology 11(4):345-355.

Western Washington University. 1987.
Lake Whatcom Watershed Management Plan.

Whatcom County. 1889.
Map of the First Addition to the Town of New Whatcom. On file, Archives of the County Auditor, Whatcom County Courthouse, Bellingham.

_____. 1902.
Map of West Eureka; an Addition to Whatcom, Wash. On file, Archives of the County Auditor, Whatcom County Courthouse, Bellingham.

_____. 1904.
Plat of West Eureka Supplemental; and Addition to the City of Bellingham, Whatcom Co., Washington. On file, Archives of the Whatcom County Auditor, Whatcom County Courthouse, Bellingham.

_____. 1985.
Whatcom County Assessor Calculator Cost Form, Puget Power Bellingham Substation, 2200 Nevada Street, Bellingham. On file, Office of the Whatcom County Assessor, Whatcom County Courthouse, Bellingham.

Whatcom County Assessors Office. June 1993.

Telephone communication.

Whatcom County Planning Department.
Whatcom County Comprehensive Plan. South Fork Valley Subarea, April 1991; Lake Whatcom Subarea, August 1982; Urban Fringe Subarea, April 1984; Lynden-Nooksack Valley Subarea, June 1986; Cherry Point-Ferndale Subarea, May 1981.

Whatcom County Planning Department
Background Document. Lynden-Nooksack-Valley Subarea, December 1983; South Fork Valley Subarea, March 1991; Lake Whatcom Subarea, march 1981; Cherry Point-Ferndale Subarea, November 1979.

Williamson, Betty. June, 1993.
Whatcom County Assessors Office. Bellingham Washington. Telephone communication.

Willis Margaret, Editor. 1975.
Skagit Settlers: Trials and Triumphs, 1890-1920. Skagit County Historical series No. 4, Skagit County Historical Society, Mount Vernon.

Wing. Robert C., Editor. 1987
A Century of Service: The Puget Power Story. Puget Sound Power & Light Company, Bellevue.

## MISCELLANEOUS OTHER SOURCES

Zoning ordinances and Comprehensive Plans for Skagit and Whatcom Counties.

Priority Habitats and Species Program maintained by the Washington Department of wildlife

Nongame Data Systems

Washington Rivers Information System maintained by the Washington Department of Wildlife.

Aerial Photos

- Black-and-white aerial photos (1" = 400 feet)
- Color infrared aerial photos (1"=750 feet)

Soils Surveys (Washington County and Skagit County Area)

Digital Elevation Models

BPA-generated Erosion and revegetation models

SCS and Washington Department of Natural resources soil surveys, airphotos, and field review

GIS maps

Ground photographs

Quad maps

Washington State traffic counts

Scenic classification of State Highways

Local tourism guides

Site visits

Photo maps

Topographic maps

EMF characterization

GIS housing data

Right-of-way photomaps

Clearing estimates

Washington Department of Ecology

Northwest Washington Air Pollution Authority

Public comments

Consultation with State and Federal biologists

State of Washington, Department of Health, Northwest Drinking Water

# CHAPTER 8
# GLOSSARY

**Access road** - Roads constructed to each structure site in order first to build the tower and line, and later to maintain and repair it. Access roads are built from scratch where no roads conveniently exist. Where county roads or other access is already established, access roads are built as short spurs directly to the structure site. Access roads are maintained even after construction, except where they pass through cultivated land. There, the roaded area is restored for crop production after construction is completed.

**Airshed** - An air supply of a given geographic area, usually defined by topographic barriers or atmospheric conditions that confine air emissions.

**Alluvial** - Pertaining to sediments deposited by flowing water.

**Alternatives** - Refers to certain choices which must be made about the project. Alternative *plans* usually differ from each other in where they begin and end. Alternative *routes* usually differ in the paths they follow to get from one common endpoint (usually a substation) to another common endpoint.

**Anadromous** - Descriptive of fish which migrate up rivers from the ocean to breed in fresh water.

**Aprons** - A covering or shield composed of erosion-resistant materials designed to protect an embankment or slope from erosion.

**Bundle** - (Used with conductor, as in "bundled conductor") Two, three, or four conductors (wires) put together to act as a single conductor to carry electricity.

**Bus, rigid** - A metal "bar" used to carry electricity from one piece of equipment to another within a substation.

**Capacitor** - A device to store an electrical charge. It is usually made of two or more conductors separated by an insulator such as plastic film and oil. Series capacitors are used to compensate for voltage drop along a transmission line. Shunt capacitors are generally located in substations and used to increase the voltage of a line.

**Capacitor yard** - Area of a substation that holds capacitors.

**Capacity** - A measure of the ability of a transmission line to carry electricity.

**Co-generation** - An industrial facility that uses its waste energy, such as heat, to generate electricity.

**Colluvium** - Soil material, rock fragments, or both accumulated at the base of steep slopes.

**Combustion turbines** - An integral part of generation facilities operating on burnable materials which convert heat energy to electrical energy.

**Conductor**- The wire cable strung between transmission towers through which the electric current flows.

**Coniferous** - Refers to a cone-bearing plant.

**Counterpoise** - A buried wire system connected to the footings of towers, used to establish a low-resistance path to earth, usually for lightning protection.

**Crossarms** - The crossing member(s) of a wood pole or steel tower, they support the insulators.

**Culvert** - A corrugated metal or concrete pipe used to carry or divert runoff water from a drainage; usually installed under roads to prevent washouts and erosion.

**Current** - The amount of electrical charge flowing through a conductor (as compared to voltage, which is the force that drives the electrical charge).

**Cut and fill** - The process where a road is cut or filled on a side slope. The term refers to the amount of soil that is removed (cut) or added (fill).

**Danger trees** - Trees (or high growing brush) in or alongside the right-of-way, which are hazardous to the transmission line. These trees are identified by special crews and must be removed to prevent tree-fall into the line or other interference with the wires. The owner of trees off the right-of-way is compensated for their value. BPA's Construction Clearing Policy requires that trees be removed that meet either one of two technical categories: Category A is any tree that within 15 years will grow within about 5 m (18 ft.) of conductors with the conductor at maximum sag (100 degrees C or 212 degrees F) and swung by 30 kg per sq/m (6 lb. per sq/ft) of wind (93 kph or 58 mph); Category B is any tree or high-growing brush that after 8 years of growth will fall within about 2 m (8 ft.) of the conductor at maximum sag (80 degrees C or 176 degrees F) and in a static position.

**Debris torrents** - Rapid movement of water-charged mixtures of soil, rock, and organic debris down steep stream channels.

**Double-circuit line** - The placing of two separate electrical circuits on the same row of towers.

**Double contingency** - Affecting two transmission lines, or two transformers (or combination of each); usually two outages on an electrical system.

**Drift (glacial/glaciomarine)** - Rock debris carried and deposited by glaciers.

**Easement** - A grant of certain rights to the use of a piece of land (which then becomes a "right-of-way"). BPA acquires easements for many of its transmission facilities. This includes the right to enter the right-of-way to build, maintain, and repair the facilities. Permission for these activities are included in the negotiation process for acquiring easements over private land.

**Ecosystem** - A community of plants and animals together with its physical environment.

**Electric and magnetic fields** - The two kinds of fields produced around the electric wire or conductor when an electric transmission line or any electric wiring is in operation.

**Embedded** - Fixed securely in surrounding material; for example, a pole may be directly "embedded" in the ground.

**Emergent** - As used here, a plant that is rooted and has parts extending above a water surface.

**Eminent domain** - The Government's right to take private property for public use, with compensation to the owner.

**Endangered species** - Those species officially designated by the U.S. Government that are in danger of extinction throughout all or a significant portion of their range.

**Energy dissipators** - A structure which diminishes the erosiveness and sediment carrying capacity of water.

**Energy losses** - The heat losses on a transmission line that occur when current runs through the wires. Losses increase when current increases or when size of wire is decreased.

**Energy savings** - Savings of energy that can be realized on the transmission systems when conductor size (wire) is increased, current is decreased, or voltages raised on a transmission line. (See ***energy losses***.)

**Environmental impact statement (EIS)** - A detailed statement of environmental impacts caused by an action, written as required by the National Environmental Policy Act.

**Environmentally preferred** - This term designates the lowest-impact alternative locations and/or design options, based on the results of the analysis in an EIS. Mitigation included in the proposal is a major consideration. Engineering or cost factors are not. The environmental preference may not be identical to the proposed option.

**Failure** - When a piece of electrical equipment is not able to perform its function and impedes or stops the flow of electricity on the system.

**Faulting** - The movement which produces relative displacement along adjacent rock masses along a fracture in the earth.

**Fiber-optics** - Special wire installed on the transmission line that is used for communication between one location and another.

**Firm energy** - The amount of electricity that can be transferred over the system in the case of one failure. Firm energy is equal to the single contingency rating of a transmission system.

**Fish enhancement flows** - Generic term for water released from dams to help migrating fish.

**Floodplain** - That portion of a river valley adjacent to the stream channel which is covered with water when the stream overflows its banks during flood stage.

**Fluvial** - Of or pertaining to rivers.

**Forb** - A herbaceous plant, other than a grass or sedge.

**Footings** - The supporting base for the transmission towers. Usually steel assemblies buried in the ground for lattice-steel towers.

**Foreground** - The viewed landscape from 0 to 0.8 km (0 to 0.5 mi.) from an observer.

**Fry** - Recently hatched fish.

**Gabion** - Baskets of heavy-duty wire netting which are filled with stones and used to protect embankments from erosion.

**Gated** - Gate or gates put on access roads to limit the use of those roads.

**Generation** - The power that is produced through some type of power plant.

**Generation dropping** - If a problem on a transmission system arises, generators may be disconnected and caused to stop generating electricity in order to protect the transmission system from overloading.

**Glaciation** - The alteration of the Earth's surface by glaciers.

**Groundwire (overhead)** - Wire that is strung from the top of one tower to the next; it shields the line against lightning strikes.

**Guy anchors** - Metal anchors, buried in the ground, that are attached to the tower with steel cables. These help brace the towers against wind and ice loads.

**H-Frame** - Refers to a type of structure usually made of wood, with vertical poles and horizontal crossarms. When erected, it resembles a capital letter "H".

**Herbaceous** - A plant having the characteristics of an herb, not woody; or having a green color and a leafy texture.

**Hydric** - A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions (where molecular oxygen is essentially absent).

**Insulators** - A ceramic or other non-conducting material used to keep electrical circuits from arcing over to ground.

**Jurisdictional wetlands** - Those areas having the characteristics of hydric soils, hydrologic features which allow surface or ground water to be present for long-enough periods to influence the type of vegetation and hydrophytic vegetation. A wetland that is regulated by Section 404 of the Clean Water Act.

**Kilovolt** - One thousand volts.

**Lattice steel** - Refers to a transmission tower constructed of multiple steel members that are connected together to make up the frame.

**Line losses** - The amount of electricity that dissipates into the atmosphere from a transmission line before reaching the user at the end.

**Load** - The amount of electric power or energy delivered or required at any specified point or points on a system. Load originates primarily at the energy-consuming equipment of the customers.

**Load growth** - Increase in demand for electricity.

**Looping** - Refers to electrically providing two paths for connecting a line to a power user or substation. Provides greater reliability because if one path fails through an electrical outage, the other path can still provide power to the customer.

**Low voltage** - Occurs when the voltage drops below limits established by BPA's reliability criteria.

**Mass movement/Mass failures**- The dislodgment and downhill transport of soil and rock materials under the direct influence of gravity. Includes movements such as creep, debris torrents, rock slides, and avalanches.

**Megavar** - Unit (1,000,000 volts amperes reactive) of reactive power on a transmission system.

**Megawatts (MW)** - A megawatt is one million watts, or one thousand kilowatts; an electrical unit of power.

**Merchantable (unmerchantable)** - Suitable for buying and selling; marketable. In the context of the National Forest Management Act, this term as it relates to timber production has been replaced with *suitable* and *unsuitable forest* as the classifications for lands for timber management purposes.

**Mesic** - Classification of plants, according to their water relationships, that occur between the extremes of wet and dry habitats, with average moisture conditions that are neither very dry nor very wet.

**Mitigation measures** - These are steps taken to lessen the effects predicted for each resource, as potentially caused by the transmission project. They may include reducing the impact, avoiding it completely, or compensating for the impact. Some measures, such as adjusting location of a tower to avoid a special resource, are taken during the study and location process. Others, such as reseeding access roads to desirable grasses and avoiding weed proliferation, are taken after construction is complete.

**National Environmental Policy Act (NEPA)**-This act requires an environmental impact statement on all major Federal actions significantly affecting the quality of the human environment. [42 U.S.C. 4332 2(2)(C).]

**Nonattainment** - An area which does not meet air quality standards set by the Clean Air Act for specified localities and periods.

**Non-firm (power)** - Used to differentiate from "firm" power; amount of electricity that can be transferred over the system under normal operating conditions; may be interrupted.

**Noxious weeds** - Plants that are injurious to public health, crops, livestock, land or other property.

**Oligiotrophic** - A water body that is lacking in plant nutrients and has an abundant supply of dissolved oxygen.

**Outage** - An event, caused by a disturbance on the electrical system, that requires BPA to remove a piece of equipment or a portion or all of a line from service. The disturbances can be either natural or human-caused.

**Overhead groundwire** - See ***groundwire (overhead)***.

**Overloading** - Too much current trying to flow over transmission facilities. Equipment has safeguards: in the event of overloading of the system, switches will disconnect sensitive equipment from the flow of electricity.

**Palustrine** - General freshwater wetlands classification associated with partially saturated areas not part of a surface stream system.

**Peak load** - The maximum electrical demand in a stated period of time. It may be the maximum instantaneous load or the maximum average load within a designated interval such as 15 minutes.

**Permeability (soils)** - The rate at which water can move downward through a given soil layer.

**Physiographic** - Of or pertaining to the genesis and evolution of landforms. A physiographic province is a region of similar structure and climate that has a similar geomorphic history.

**Power circuit breakers** - A switch, installed at a substation, which breaks or restores the flow of current through the line. It clears the fault and minimizes their effects on the rest of the system.

**Power exchange** - Movement of large amounts of electric power from one utility's system to another. One entity can generate power and ship it to the other, which at a future time can send power back to the first.

**Pulling site** - The site where the machinery used to string the conductors is staged.

**Proposed (vs. preferred)** - In an EIS, a course of action on which an agency wishes to proceed.

**Rated transfer capacity (RTC)** - The capability of a transmission line or system to transfer a specified amount of power in a direction, assuming that no major facilities are out of service.

**Rebuild** - The process of removing an existing line (including poles) and building a new line along the same right-of-way in its place.

**Reconductoring** - The process of removing the conductors on an existing line and installing a new, usually bigger, conductor. This usually involves modifying existing or adding some new structures.

**Record of Decision** (ROD) - The document notifying the public of a decision taken on a Federal action, together with the reasons for the choices entering into that decision. The Record of Decision is published in the Federal Register

**Reliability criteria** - BPA standards for designing and operating power systems to ensure reliable electrical service.

**Revegetation potential** - The relative ease of re-establishing vegetation on a disturbed site.

**Right-of-way** - An easement for a certain purpose over the land of another, such as a strip of land used for a road, electric transmission line, pipeline, etc.

**Rill and gully erosion** - Formation of steep sided channels by accelerated erosion. Rills are shallower than gullies and present no obstacle to machinery. Left unchecked, rills can develop into gullies.

**Riparian zone** - An area located adjacent to a water body, may include upland or wetland vegetation.

**Riprap** - Broken stones put in areas to prevent erosion, especially along river and stream banks.

**Riverine** - Located along or in the banks of a river.

**Rolling dips** - Dips, constructed at intervals along a road, which are designed to control runoff and erosion.

**Route segments** - The BPA corridor was divided into segments for the environmental study. These include segments A through N and H1.

**Scope, Scoping** - The definition of the range of issues requiring examination in studying the environmental effects of a proposed action. Scoping generally takes place through public consultation with interested individuals and groups, as well as with agencies with jurisdictions over parts of the project area or resources in the area. Scoping is mandated by the Council of Environmental Quality regulations.

**Sediment** - Solid material, both mineral or organic, that is dislodged, transported, and deposited by water, ice, or wind.

**Sedimentation** - The process whereby sediment is dislodged, transported, and deposited.

**Single-circuit line** - A line with one electrical circuit on the same row of towers.

**Single contingency** - Affecting one transmission line or one transformer, usually an outage of the facility.

**Single-contingency rating (SCR)** - The capability of a transmission line or system to transfer a specified amount of power in a given direction, assuming that any one major facility is out of service.

**Single-utility planning** - The concept under which BPA plans many projects. Local utilities and BPA work together to build facilities that satisfy the needs of both.

**Slash windrows** - Rows of slash or cut vegetation placed on the side of access road to control erosion.

**Slumping** - Downslope rotational movement of a block of earth.

**Sock line** - A strong lightweight line used to install the conductor on the towers. It is essentially the thread line used to pull the conductor through the fittings at the ends of the insulators.

**Storage** - Used in power marketing, when water is held behind a dam on a river system and then released, generating electricity when doing so. This electricity is then transported over transmission lines to areas where it is needed. Agreements can be and are made between Canada and the United States for water to be held in Canada and released at times when the United States cannot release water from some of its dams.

**Stringing areas** - Places along the transmission line where heavy equipment is used to install the conductor on the towers.

**Structure -** Refers to a type of support used to hold up transmission or substation equipment.

**Subsoiling** - Breaking up compacted soils, without inverting them, using a plow or blade.

**Substation** - The fenced site that contain the terminal switching and transformation equipment needed at the end of a transmission line.

**Surplus power** - The amount of electricity produced that exceeds the demand for electricity in a given area.

**Tackifers** - A water-based agent used to bind soil particles together to provide erosion protection.

**Talus** - An accumulation of rock debris that has accumulated at the base of a cliff or steep slope.

**Terminal** - The place where a transmission line segment ends.

**Threatened species** - Those species officially designated by the U.S. Government that are likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

**Till** - Non-sorted, non-stratified glacial drift consisting of a mixture of rocks and fine materials such as clay and silt.

**Tower** - (See ***structure***.)

**Transformers** - Electrical equipment usually contained in a substation that is needed to change voltage on a transmission system.

**Transmission line** - The structures, insulators, conductors, and other equipment used to transmit electrical power from one point to another.

**Travelers** - Temporary sheaves placed at the end of insulators when installing the conductor on the towers.

**Unload** - A reduction of power or energy (load) on a component of the transmission system. The ability of a transmission line to "unload" may be affected by associated components of the system.

**Volt** - The international system unit of electric potential and electromotive force.

**Voltage drop** - The difference between the voltages at the transmitting and receiving ends of a transmission line.

**Water Budget** - A requirement of the Pacific Northwest Regional Power Planning Council's Fish and Wildlife Program, for BPA to store a certain amount of water for release on the Columbia River from April to June to aid migrating fish.

**Wetlands** - An area where the soil experiences anaerobic conditions because of inundation of water during part of any given year. Indicators of a wetland include types of plants, soil characteristics and hydrology of the area.

INDEX


Advisory Council on Historic Preservation ..... 4/126, 188
Affected Environment ..... 1/14, 3/53
Agriculture ..... 2/28, 29, 32, 33, 3/53, 58, 60, 61, 67, 4/71, 81, 82, 83, 87, ..... 102, 113, 114, 115, 116, 130, 136, 139, 164, 172
Air Quality (Description/Impacts) ..... 2/32, 3/62, 4/71, 81, 82, 144, 145, 146, 147
Alternatives ..... 1/8, 10, 12, 2/15, 16, 17, 18, 20, 21, 22, 24, 28, 30, 31, 32, 35, 36, 37, ..38, 39, 40, 41, 46, 47, 48, 50, 51, 52, 3/64, 68, 4/74, 78, 79, 80, 81, 82, 98, ....99, 102, 105, 116, 130, 133, 140, 144, 145, 147, 153, 158, 159, 160, 162, ...163, 165, 166, 167, 168, 170, 171, 173, 174, 175, 178, 179, 180, 184, 191
Alternatives Eliminated from Detailed Discussion ..... 1/12, 2/17, 20, 47, 51
American Indian Religious Freedom Act (Federal) ..... 4/189
Aquifers ..... 4/91, 198
Archaeological Resources Protection Act (Federal) ..... 4/189
Audible noise ..... 2/32, 37, 40, 4/141, 142, 143, 144, 175, 176, 198
B2A Plan ..... 2/15, 50-51
Background ..... 1/1, 2/37, 40, 51, 3/61, 68, 4/176, 198
Bellingham (City of) ..... 2/35, 38, 3/53, 56, 57, 63, 64, 65, 66, 68, 69, 70, 4/77, 78, ..... 156, 157, 158, 159, 161, 162, 169
Canadian Entitlement ..... 1/10, 11, 2/23
capacity problem ..... 1/8
Carpenter Creek ..... 2/30, 3/57, 4/93, 100, 109, 110
Clean Air Act ..... 4/145, 146, 198
Clean Water Act ..... 4/106, 185, 187, 192
Clearing ..... 2/17, 31, 33, 37, 38, 43, 44, 46, 4/72, 74, 75, 77, 83, ..... 84, 85, 86, 87, 89, 90, 92, 94, 95, 96, 97, 107, ..... 108, 119, 120, 122, 144, 145, 147, 159, 160, ..... 162, 163, 166, 195
Coastal Management Program ..... 4/91, 97, 102, 183, 184, 192, 194
Coastal Zone Management Act (Federal) ..... 4/183, 192, 194
co-generation ..... 1/8, 9, 10, 2/19, 46, 49
Comprehensive Environmental Response, Compensation and Liability Act ..... 4/197
Conservation ..... 2/15, 19, 51-52, 3/56, 60, 4/79, 115, 122, 143, 164, ..... 187, 188, 189, 191, 192, 195, 197
Construction Actions ..... 2/15, 16, 17, 26, 4/71, 72, 198
Corona ..... 4/141, 144, 175, 177
Cranberry Lake ..... 3/57, 4/98, 99, 100, 103, 104, 106
Cultural Resources (Description/Impacts) ..... 3/61, 68, 4/71, 122, 123, 125, 126, ..... 168, 169, 170, 171, 172, 188, 189
Cumulative effect ..... 3/46, 47
Decisions to be Made ..... 1/12, 2/18, 22
Deer Creek ..... 30, 84, 93, 94, 97, 110
Description of Construction Actions ..... 2/26, 4/71, 72
E4A Plan ..... 2/15, 48-50

Electric and Magnetic Fields.....1/13, 2/24, 30, 31, 34, 38, 4/81, 144, 148, 149, 150,
..... 151, 152, 153, 154, 155, 175, 177, 178, 179, 180, 195
Eminent Domain .....4/73
Energy Conservation at Federal Facilities .....4/195, 197
Environmental Policy .....4/180
Exposure assessment..... 2/30, 34, 4/151, 152
Facility erection .....4/74
Farmland Protection Policy Act (Federal)..... 3/67, 4/114, 164, 192
Federal Aviation Administration.....4/198
Federal Communications Commission .....4/144
Federal Insecticide, Fungicide, and Rodenticide Act .....4/195
Federal Noise Control Act.....4/142
firm power ..... 2/21, 22, 23, 4/78, 80
Fiscal effects .....172
Fish (Description/Impacts) ..... 1/3, 13, 2/44, 3/58, 59, 66, 67, 4/79, 80, 83, 91,
.....92, 96, 97, 107, 108, 109, 110, 111, 112, 113,
.....117, 164, 170, 191, 194
Floodplains (Description/Impacts)..... 2/43, 44, 45, 3/53, 54, 57, 60, 4/87, 89, 91,
..... 97, 98, 99, 100, 101, 104, 105, 106, 107, 111, 185, 192
Floodplain/Wetland Assessment .....4/87, 89, 91, 97, 98, 111
Global Warming .....4/146
Hansen Creek ..... 4/85, 93, 95, 96, 97, 99, 100, 109, 110
Herbicides .....4/78, 90, 91, 95, 114, 195
Interim Flow Supplemental EIS.....1/11, 4/78
Intertie Use Alternatives:.....2/21, 22-23
Lake Whatcom .....1/1, 2/25, 30, 43, 3/53, 54, 56, 57, 59, 60, 61, 4/84, 93, 94,
.....95, 97, 100, 117, 120, 124, 145, 182, 184, 198
Land Use/Management..... 1/13, 2/20, 24, 28, 32, 37, 40, 3/53, 63, 64, 4/71,
.....81, 82, 119, 132, 142, 155, 156, 176, 181, 182, 198
Local plans ..... 4/81, 181, 182
Maintenance .....2/17, 31, 33, 37, 38, 43, 44, 46, 4/72, 74, 75, 77, 83,
.....84, 85, 86, 87, 89, 90, 92, 94, 95, 96, 97, 107, 108,
..... 109, 110, 117, 119, 120, 122, 144, 145, 147, 159,
.....160, 162, 163, 166, 195
Major Issues .....1/12, 13, 2/24, 27, 31, 37, 40
Marker balls ..... 2/45, 4/110, 111, 112
marketing ..... 1/7, 2/21, 23, 4/80
Mills Creek .....2/33, 45, 4/84, 85, 93, 94, 95, 96, 97, 104, 107, 110
Mirror Lake .....2/20, 43, 3/56, 57, 59, 4/84, 93, 94, 95, 97, 98, 100, 109,
..... 110, 124,
Mitigation .....2/15, 16, 28, 33, 41, 42, 45, 4/71, 81, 83, 84, 85, 86, 88, 89,
..... 90, 92, 95, 97, 102, 104, 105, 106, 108, 109, 110, 111, 112,
..... 116, 122, 123, 126,135, 141, 144, 145, 146, 147, 155, 160,
.....162, 164, 174, 175, 188, 189, 190, 191, 194
National Electric Safety Code..... 1/6, 4/148

National Historic Preservation Act ..... 4/126, 189
National Pollution Discharge Elimination System ..... 4/185
National Register of Historic Places ..... 3/61, 68, 4/122, 126, 169, 188
National Trails ..... 4/187
National Wetland Inventory ..... 3/66, 4/93, 98, 103, 162
Nationwide Permits (wetlands) ..... 4/102, 104, 106, 193
Native American Graves Protection and Repatriation Act (Federal) ..... 4/189
No Action ..... 2/15, 17, 18, 19, 20, 31, 4/105
Noise Control Act (state) ..... 4/142, 198
Noise from Lines and Substations ..... 1/13, 2/24, 28, 29, 30, 32, 37, 40, 4/81-82,
..... 138, 141-144, 147, 175-177, 198
non-firm power ..... 2/21, 22, 23
Nooksack River ..... 2/30, 45, 3/53, 54, 56, 57, 59, 60, 4/84, 93, 96, 99,
..... 100, 102, 103, 106, 109, 110, 111, 112, 115, 124, 169,
..... 182, 184, 185, 187
Northern Intertie ..... 1/1, 2, 4, 7, 8, 2/19, 20, 21, 22, 23, 26, 4/78, 79, 80
Noxious weeds ..... 2/28, 4/87, 90, 91, 127, 138, 195
Nuisance, trespass, vandalism ..... 4/132, 136, 139
Office of Fuels Programs ..... 1/12, 3/47, 4/180
Olsen Creek ..... 3/56, 57, 4/93, 100, 109, 110, 124
Outages1/4, 5, 6, 7, 8, 2/18, 19, 49, 50, 52, 4/77, 78, 173
Parks ..... 3/61, 64, 81, 128, 157, 181
Permits for Discharges into Waters of the United States ..... 4/92, 185
Personal Income Tax ..... 4/130
Prime farmland ..... 2/29, 30, 33, 60, 67, 115, 116, 164, 165, 192
Property Taxes ..... 4/130, 172, 173, 174, 175
Property Values ..... 1/13, 2/24, 29, 4/119, 127, 135, 136, 137, 138, 139, 175
Proposed Plan: description ..... 2/21-22
Public Health ..... 1/13, 2/24, 28, 32, 4/81, 82, 90, 147
Puget Power ..... 1/1, 2, 4, 5, 6, 7, 8, 9, 12, 13, 14, 2/15, 18, 19, 20, 21, 22, 23, 24,
..... 25, 26, 27, 34, 35, 36, 38, 39, 41, 45, 46, 47, 48, 49, 50, 51, 52,
..... 3/53, 54, 60, 62, 63, 64, 65, 66, 67, 68, 69, 70, 4/72, 77, 78, 79,
..... 80, 155, 157, 158, 159, 160, 161, 164, 165, 166, 167, 168, 169,
..... 170, 172, 173, 175, 176, 177, 178, 179, 180, 181, 182, 195, 196
Puget Sound's Original Proposed
Intertie with BC Hydro ..... 2/15, 47-48, 4/180-181
Radio/TV interference ..... 2/28, 32, 4/81, 82, 141, 144, 175, 177
rated transfer capacity ..... 1/7
Recreation (Description/Impacts) ..... 2/28, 32, 3/56, 59, 60, 61, 68, 71, 81, 82,
..... 117, 121, 132, 133, 135, 139, 141, 183, 187
reliability problem ..... 1/9, 2/48
Removal of a line ..... 1/4, 5, 4/74, 84, 85, 139, 192
Resource Conservation and Recovery Act ..... 4/195
Restoration ..... 17, 18, 44, 72, 75, 101, 185, 193
Riparian (zone) ..... 2/43, 3/57, 58, 4/87, 88, 89, 90, 107, 108, 109,

.....110, 111, 112, 164
Rivers and Harbors Act (Federal) ..... 4/185, 192, 193
Safe Drinking Water Act (Federal) .....4/198
Sales Tax ..... 4/130, 172, 173
Samish River .....2/25, 33. 45, 3/54, 56, 57, 59, 4/85, 90, 93, 96, 99, 100, 102,
..... 103, 104, 105, 107, 109, 110, 111, 145, 184, 187, 194
Scoping Process ..... 1/12, 13, 2/24, 29, 47, 48, 4/139, 180
seasonal exchange of power/seasonal diversity ..... 1/3, 2/23, 4/78
Section 106 ..... 4/126, 189
Sedro Woolley (City of) .....2/35, 3/60
Shoreline Master Plan ..... 4/161, 184
Shorelines of the State..... 4/91, 97, 102, 161, 183, 184, 185, 194
single contingency rating .....1/7, 8
Single utility planning .....2/22
Skagit River ..... 1/8, 3/54, 57, 59, 60, 99, 100, 184
Social and Economic Considerations (Description/Impacts)2/28, 32, 37, 40, 4/71, 81, 82, 127,175
Social impacts ..... 2/29, 30, 33, 42, 138
Soil Erosion ..... 1/13, 2/24, 4/83, 113
Soils (Description/Impacts) ..... 2/30, 33, 37, 41, 43, 44, 3/54, 60, 64, 65, 67, 4/71,
..... 74, 83, 84, 85, 87, 91, 92, 94, 97, 101, 102, 109, 114, 115,
..... 116, 117, 133, 135, 159, 164, 186, 192
Squalicum Creek .....2/30, 36, 3/57, 65, 66, 67, 4/84, 93, 94, 96, 99, 100, 104,
..... 110, 124, 163, 169, 170, 171, 184, 187
State Historic Preservation Office.....4/126, 188
State Shoreline Management Act..... 4/102, 184, 194
Storage (energy) ..... 1/8,9, 10, 2/23, 4/78, 80, ?101, 191
Stringing a line .....2/27, 45, 4/73, 75, 101, 104, 106
Substation construction.....4/74
Surplus power .....1/7, 4/79
Surveys .....3/67, 4/72, 161, 164, 172, 178, 188, 189, 192
System Operation Review EIS .....1/11
Tax effects .....4/130
Tenmile Creek ..... 30, 56, 67, 84, 93, 94, 97, 110, 184
Threatened and Endangered Species..... 1/11, 3/59, 4/88, 108, 190-191
thermal resources ..... 1/3, 4/79, 80
Toad Lake .....2/30, 3/66, 4/84, 93, 110, 162
Toxic Substances Control Act .....4/197
Vegetation (Description/Impacts)..... 1/13, 2/28, 32, 36, 38, 39, 42, 43, 44, 46, 3/55,
..... 56, 57, 58, 65, 4/74, 75, 76, 77, 78, 81, 82, 83, 84, 85, 86, 87,
..... 88, 89, 90, 92, 96, 101, 102, 107, 109, 112, 113, 117, 119,
..... 120, 121, 133, 134, 135, 144, 147, 159, 160, 161, 162, 163,
.....164, 186, 191, 195
Visual Resources (Description/Impacts) ..... 3/60, 67, 4/117, 133, 135, 141, 165, 174
Washington Growth Management Act.....4/182
Water Budget .....1/9

Water Resources (Description/Impacts)..... 1/10, 3/54, 56, 66, 4/71, 89, 92, 93, 161
Wetland(s) (Description/Impacts)..... 1/13, 2/36, 37, 43, 44, 45, 46, 3/54, 55, 56,
..... 57, 59, 65, 66, 67, 4/87, 89, 91, 93, 95, 97, 98, 100, 101, 102,
..... 103, 104, 105, 106, 107, 108, 109, 110, 111, 160, 161, 162,
..... 163, 164, 185 192, 193, 194
Wetlands Assessment ..... 4/87, 89, 91, 97, 98, 111,192
Whatcom County Initiative (ordinance) ..... 4/181
Wild and Scenic Rivers..... 4/92, 187, 193
Wilderness Areas ..... 4/187
Wildlife ..... 1/13, 2/17, 44, 3/58, 59, 67, 4/71, 87, 91, 96, 107, 108, 109,
..... 110, 111, 112, 113, 164, 191
Zoning ..... 2/48, 51, 3/63, 64, 4/155, 156, 158, 182

# APPENDICES

**APPENDIX A Power Marketing**

**APPENDIX B Public Involvement**

**APPENDIX C Health and Safety**

**APPENDIX D Wetlands Delineation Report**

**APPENDIX E Biological Assessment and Concurrence**

# APPENDIX A
# POWER MARKETING

# APPENDIX A
## POWER MARKETING

***Below is further information on the present uses of BPA's Northern Intertie transmission system.***

The Northern Intertie presently is used for a combination of Federal and non-Federal transactions. Federal uses of the Northern Intertie include firm and non-firm BPA purchases from Canada, exchanges with Canada, Water Budget storage, Non-Treaty storage, and other storage transactions. (The characteristics of these transactions are explained below.) Much of the Federal use may require two-way use of the Intertie, especially when Canada releases water and BPA sends some of the power generated to Canada. Non-Federal uses of the Northern Intertie include short- and long-term firm and non-firm sales and transfers from Canada to the United States, and storage and return transactions.

**Firm and non-firm power.** Firm and non-firm power are determined by different ratings of a power system. These include rated transfer capability, and single contingency rating.

- The rated transfer capability (RTC) is the maximum amount of power a line is capable of carrying during normal system conditions (when all parts of the system are operating, with no lines or substation devices out of service).
- The single contingency rating (SCR) is the transfer capability of a line with the loss of any one major facility on the transmission path during peak winter conditions.

The SCR determines the amount of power that a line can deliver on a firm basis, or its firm transfer capability. Transmission line owners can enter into firm transfer contracts only to the extent that SCR is available. The full RTC can be used, but only to provide non-firm transfer capability that is subject to interruptions.

**Federal uses.** BPA firm and non-firm purchases from Canada may include transactions with BC Hydro and its export affiliate POWEREX or Transalta utilities corporation, and are generally arrangements for less than 1 year. Recently, however, BPA entered into an agreement with Transalta for a 3-year energy purchase. BPA and BC Hydro have entered into short-term energy exchanges as well.

**Non-Federal uses.** Non-Federal uses consist of firm and non-firm sales from Canada to the United States. Presently, there is only one long-term firm obligation over the Northern

Intertie from BC Hydro to Seattle City Light, as required by the Skagit Treaty for the High Ross Dam on the Skagit River in Washington. This treaty gave Seattle City Light rights to power from BC Hydro, in exchange for their not increasing the storage capacity of the High Ross Dam. Portland General Electric has a contract with POWEREX for a short-term sale of power through September 1995. A number of other short-term transactions have occurred between Canada and the Pacific Northwest and Pacific Southwest for capacity or energy as a result of the interconnection and exchange agreement between BPA and BC Hydro and POWEREX.

**Columbia River Treaty.** Canada and the United States have signed the Columbia River Treaty, under which Canada stores water, principally behind three dams on the upper Columbia River in British Columbia (Mica, Revelstoke and Arrow), for use at projects in the United States. (See **Canadian Entitlement EIS** discussion in **Chapter 1** for more background.) Water released in Canada can be used to generate power on the 11 mainstem Columbia River dams in Washington and Oregon. Under the treaty, part of the energy belongs to Canada to use or sell. In this way, Canada is compensated for the costs of building the dams by receiving a portion of the electricity produced when the stored water flows through dams in the U.S. The Pacific Northwest gains valuable flexibility on its system. Storage at Canadian projects can also be used to provide water at certain times of the year to enhance stream flows for migrating fish.

**The West-side Northern Intertie and Storage**. Energy storage transactions which involve transmission over the west-side Northern Intertie include Non-Treaty storage (NTS), Water Budget storage (WB), flow augmentation, and other storage transactions.

- Energy storage occurs when generation from water flows is delivered to a connected power system to displace generation from the receiving system's generators. This means that energy generated from one hydro plant might be stored in other hydro projects outside of the river system.
- Non-treaty storage is water storage that BC Hydro constructed at Columbia River Treaty projects, beyond what was required by the treaty. BC Hydro has guaranteed BPA access to 56 cubic meters per second (cms) (2 thousand cubic feet per second (kcfs)) of non-treaty storage during the period from September through April. BPA may use this NTS flow to meet non-power objectives as well as power needs.
- The Water Budget is a requirement of the Pacific Northwest Regional Power Planning Council (Council), under the Council's fish and wildlife program, for BPA to store 4.25 cubic kilometers ($km^3$) (3.45 million acre feet (maf)) of water for release on the

Columbia during the April 15 through June 15 period to aid migrating fish. Typically, BPA stores significant amounts of energy from Water Budget flows with BC Hydro.

- Flow augmentation, also a Council requirement, is similar to WB and requires BPA to store up to an additional 3.7 $km^3$ (3 maf) on the Columbia River for release in May and June (and in July 1993). The flows also generate energy which may be stored in Canada.

In addition, BPA has a long-term general storage contract with Canada for non-guaranteed storage in Canada: specifically, energy stored as water which the storage operator may release for other requirements, such as flood control at the storage projects. Other energy storage transactions occur from time to time, depending on the stream flows and loads in the Pacific Northwest and storage availability in Canada.

**Hydroelectric power systems**. One of the great advantages of the Columbia River hydroelectric power system is its storage capability. During heavy spring and summer snow melt periods, water can be held behind upstream storage dams and "stored" there to generate power during low streamflow seasons in fall and winter. In addition, the capability to hold some water from one year to the next helps to provide more power in years when the snowpack is low. This storage capability has helped the Pacific Northwest adjust to recent years of drought and low water conditions.

Electricity generated elsewhere can also in effect be stored as water. If the electric power systems of the northwestern United States and Canada were not interconnected, each system would only be able to generate as much power as consumers in its service territory were using. If fish flows or other non-power uses of the river system required more than enough water to generate power to meet those consumers' loads, the excess water would simply have to be "spilled," or released without generating power. Once water is spilled, its value for generating electricity is lost. However, interconnected systems have the potential to deliver power to each other to make use of river flows beyond their immediate generation requirements. For example, when flows required in the U.S. can generate more power than can be used or sold in the U.S., some of the power can be transmitted to Canada or the Pacific Southwest to serve loads there. Because power from the U.S. can serve Canadian electrical loads, less water is used to generate power in Canada, and more water stays behind the dams in Canada. The physical effect is that electric energy from one system can end up stored as water in another system. Energy storage transactions can provide for the system that receives the energy to return it at a later time.

**Canadian export policy.** A critical element of electric energy marketing between the United States and Canada is Canada's policy on power exports. On July 12, 1993, the Ministry of Energy, Mines and Petroleum Resources released the key features to the new policy governing long-term firm electricity exports from British Columbia. This policy will allow commercial export of electricity on a long-term firm basis, subject to conditions to protect British Columbia consumers and the environment. All types of power sources will be considered, including natural gas, hydro, coal, and wood waste. All proposals will be subject to a permitting process and reviewed on a case-by-case basis. Environmentally unacceptable projects will be ruled out, including large hydro storage dams for export. The length of each export contract must be justified to a maximum of 20 years, and will not be subsidized by domestic consumers. The general direction of the new policy is to protect British Columbia consumers from the financial and environmental risks of exports.

# APPENDIX B
# PUBLIC INVOLVEMENT

# APPENDIX B
# PUBLIC INVOLVEMENT

BPA is required to consult the public before making decisions on projects requiring an EIS (CEQ Regulations 40 CFR 1501.7). BPA places a high value on public involvement in decision making. This commitment is reflected in BPA's mission statement and management policies.

This section of the EIS briefly describes the public involvement program for the NW Washington Transmission Project and elaborates on issues raised by the public during the scoping process.

## STRATEGIES

The public involvement program has used several strategies.

1. **Joint agency meetings** to plan for public involvement throughout the NEPA process. Agency meetings were jointly conducted by BPA and Whatcom County (with SEPA authority), and sometimes the State Energy Office. The meetings often included Puget Power, at the utility's request.

2. **One-on-one contacts** with individuals and groups having a high interest and involvement in the project. Both BPA and Puget Power representatives made the contacts, with an emphasis on informing persons and organizations about the problems facing the local area and region, and how they could help to solve them. The contacts also sought advice on how to involve the public effectively.

   The contacts were made with major landowners, interest group leaders, elected officials, governmental agencies, customers, news media and others.

3. **Scoping meetings** were held, at Sedro Woolley and Bellingham on February 5 and 6, 1992, respectively. The meetings were designed to inform the public about the problem and BPA's proposed solution, and to get people's comments on the issues they felt needed to be addressed, as well as preliminary alternatives. To get the most public input, two meeting formats were used: an

informal open house, followed by a more traditional meeting with a facilitator. A court reporter produced transcripts.

The scoping meetings were held after publication of the Federal Register Notice of Intent, allowing at least 2 weeks for public notice of the meetings (ads were run in the local newspaper), and for completion of key agency meetings and contacts.

4. **Open houses/public meetings** will be held to present information and receive comments on the preferred alternatives and the environmental analysis of the Draft EIS. These meetings will be held at the same locations as the scoping meetings. The public will receive notice of these meetings, including ads and public service announcements on the radio.

5. **Fact Sheets** were issued every 2 or 3 months throughout the process to the entire mailing list. They were used to:

   - Tell about initiation of the project, describe the project need, and announce scoping meetings and the beginning of the NEPA process.

   - Describe issues and share comments and questions about the proposal.

   - Describe proposed and preferred alternatives; tell about the availability of the Draft EIS; announce open houses/public meetings; describe the review and comment opportunities available to the public and the deadlines.

   - Describe comments received during scoping and the review of the DEIS, and where to find BPA's responses to those comments.

   - Tell about the availability of the Final EIS and the ROD.

   - Describe the project's design and construction schedule after the ROD is published.

6. **Field Office** - BPA set up a field office in Bellingham, beginning in September 1992, at 1333 King Street. A field office manager was hired to respond to requests for assistance from the public and from the project team. The office was set up both as an "answer point" for questions/small group meetings and as a base for people working on the project.

7. **Public Record** - Transcripts for the public meetings and other public process documents are available for public viewing on request at the Public Involvement Office.

8. **BPA Journal** includes a Public Involvement page used to alert a broader audience to public process opportunities, the availability of NEPA process documents, and project fact sheets. Regional power and environmental interest groups receive this monthly publication.

9. **1-800 Numbers** - BPA has three 1-800 numbers that can be used to obtain various information. 1-800-622-4520 is for requesting documents; 1-800-622-4519 is the Public Involvement number for giving public comments on any project; and 1-800-662-6963 is the Project Management number for giving technical information on a project.

Other strategies may be used to meet special needs if they arise.

## SCOPING

The scoping period began November 15, 1991, with publication of the Notice of Intent in the Federal Register. The scoping period, originally scheduled to end February 29, 1992, was extended to March 31, 1992, upon request of the public.

Two public meetings were held: one in Sedro Woolley, WA (February 5), and one in Bellingham, WA (February 6). Both meetings began with open house sessions that provided information about the project under consideration. The open house was followed by a more formal presentation and comment period. Transcripts of the meetings were produced.

During the scoping period, BPA and Whatcom County received 300 comments, primarily from scoping meetings; a few comments were received in letters and phone conversations.

Most concern centered on environmental resources (such as visual effects, fish and wildlife, water resources, soil erosion, vegetation) and on possible effects from electric and magnetic fields (EMF) generated by the power lines. Commenters were also concerned about the design and siting of the line, future land use issues, and concern over noise from the existing and proposed line. Questions were raised about possible effects on property values or on BPA compensation for easements. Need for the project was questioned. And, finally, a number of comments was received about BPA maintenance practices and communications with the public.

Summarized below are the comments/questions received during scoping.

**Project Need**: Commenters wanted to know whether the project was truly needed for Whatcom County or out of the area.

**Project Alternatives/Design/Construction**: Commenters asked whether the line could be buried underground or located elsewhere, or whether conservation could address some or all of the need. Some recommended that the line be built to meet future needs or electric surge conditions; some were concerned about design to avoid potential shocks or interference with televisions, radios, and portable phones. Several questions focused on BPA practices during construction, asking for more information on site restoration, for instance. Some expressed interest in the design of the structures from which the lines are suspended: what they would look like, how big they would be compared to the existing towers, and how they would fit into the existing pattern of structures. Visual resources were part of this concern.

**EIS Process:** Commenters wanted assurance that BPA would pay attention to the comments made. Some wanted to know how to become involved in shaping the project or how to find out what was currently going on during the process. A request was made to extend the scoping period. (It was extended to March 31.)

Some commenters wanted BPA to pay for extra studies before the project started, or for independent consultants. A few asked whether BPA would file for locally required permits, such as hydrologic permits for stream crossings.

**Environmental Resources:** Concern was expressed for salmon spawning in local rivers; for eagles nesting along the corridor; for the many birds in the area and the possible effect

the upgraded line might have on them. Commenters were also concerned about preservation of existing wetlands in the area; construction in the Whatcom County watershed, especially near stream crossings; and added silt, sediment, and herbicides ending up in the lake. Commenters were concerned with BPA's tree-cutting and clearing practices and asked for more definite information on this in the EIS.

**Public Health:** Most of the concern centered on possible health effects caused by high-voltage power lines. Commenters wanted more research on electric and magnetic fields (EMF); they also want BPA to be cautious before exposing adults, children, or animals. Particular concern was expressed for proximity of schools to the power lines. Commenters made several suggestions for coverage of this issue in the EIS, including thorough literature research, risk exposure analysis, and use of an outside consultant.

**Noise:** Current line noise levels were cited, as commenters were concerned that the level might increase with the new line. Some concern was also expressed over helicopter noise during construction.

**Future Land Use:** Commenters wanted BPA to consider any future land use plans: additions to homes, a planned high school, future lot development.

**Property Values/Economics:** A number of commenters were concerned that their future security would be jeopardized because that they felt they would be unable to get a fair price for their property encumbered by power lines. Several felt that BPA's financial compensation for easements was not adequate in the long term. Other commenters wanted to ensure that environmental concerns would not be overlooked in favor of financial gain, and asked for detailed economic analysis in the EIS.

**BPA Practices:** Finally, commenters expressed concern over operations and maintenance of existing transmission lines, particularly the use of herbicides. They suggested that there should be a vegetation management plan to control herbicide use. Other focused on a recent cleanup of oil contamination at the BPA Bellingham Substation, and how it was handled. Some commenters were unhappy with BPA past commitments and practices on the existing line: tree-cutting, crew behavior, replacing too-small culverts, and other perceived failures.

**Communication:** Commenters asked for assurance that better notice would be received of meetings or other actions. Some felt that it was hard to get direct information from BPA and asked for a remedy. A number expressed doubts about BPA's general reputation with the public, and wanted BPA to establish a better track record in the community.

These issues have been addressed in the EIS or by the process used in producing it.

# APPENDIX C
# HEALTH AND SAFETY

# APPENDIX C: HEALTH AND SAFETY

## APPENDIX C-1

### A REVIEW OF BIOLOGICAL AND EPIDEMIOLOGICAL STUDIES RELATING TO EMF

A study in Denver, Colorado, (Wertheimer and Leeper, 1979) and one in Sweden (Tomenius, 1986) first reported that some cancer risks were about 2-3 times greater for children living near certain types of power lines assumed to be carrying high current. Those researchers suggested that the finding may be related to the magnetic fields of 2-3 milligauss (mG) and above produced in homes by such lines. The possibility could not be ruled out, however, that other factors, or chance, may be involved. If certain power lines actually do influence cancer rates, this would mean that 2 or 3 children out of 10,000 children exposed to such lines would develop cancer each year, compared to the average rate of 1 in 10,000 per year (Ahlbom et al., 1987).

A second study done in Denver (Savitz et al., 1988) found results that were generally consistent with the earlier work on childhood cancer by Wertheimer and Leeper (1979). However, the relative risk[1] in the new study (1.5) was smaller than that reported earlier (2-3). It was also on the borderline of statistical significance, which means that it could have been due to chance. Results of another study, from the Seattle area, found no association between power lines and leukemia in adults (Severson et al., 1988). An earlier power line study in Denver by Wertheimer and Leeper (1982) also found no increase in adult leukemia. However, the earlier Denver study did find an increased risk for some other types of adult cancers.

A study done in Los Angeles County California provided additional support for an association between childhood leukemia risk and high-current power lines (London et al., 1991). The odds ratio for very-high-current lines compared to very-low-current and underground lines was 2.15. Associations with actual measured electric and magnetic fields, however, were weaker and not statistically significant.

A new study done in Sweden found that the relative risk for leukemia in children living near transmission lines was 3.8 where magnetic fields were greater than 3 mG (Feychting and Ahlbom, 1992). Sweden's National Electrical Safety Board has issued a document entitled *Revised Assessment of Magnetic Fields and Health Hazards* (February 25, 1993). It states that the agency "has revised the previous assessment of health hazards to the extent that the

---

[1] Results of case control studies are given in terms of relative risk (or odds ratio). A relative risk of 1.0 means that exposure to some factor (assumed to be EMF in this case) is the same for people with a disease (cases) as for people without the disease (controls). A value of 2 means cases were exposed to the factor twice as often as the controls. This establishes a "statistical association" between the disease and the factor. This may not represent a cause-and-effect association, however.

Board in the future *will act on the assumption* that there is a connection between exposure to power-frequency magnetic fields from power lines and childhood cancer, when preparing regulations on electrical installations." The document also notes, "It should be stated that a connection between cancer and magnetic fields has not yet been scientifically proven..." (Revised *Assessment of Magnetic Fields and Health Hazards,* Swedish National Board for Electrical Safety, 1993.)

Preliminary information on a larger study done in Denmark indicates no increased risk of leukemia for children living near transmission lines in that country (Olsen, 1992). However, there was an elevated risk of lymphoma reported in the Danish study. A Danish blue-ribbon panel examining the EMF issue has recommended against government regulation: "[There is] no scientific reason for establishing standards with respect to high-current plants. New research results must be followed closely in the future." *(EMF Health and Safety Digest, June 1993)*

Earlier studies in Rhode Island (Fulton et al., 1980), in Taiwan (Lin and Lu, 1989) and in England (Myers et al., 1985) found no significant association between childhood cancer and power lines. Other community studies in England found no consistent evidence to support a power line-cancer association (Coleman et al., 1985; McDowall, 1986).

A study in Washington State first reported that men in various "electrical occupations" had died more frequently from leukemia than men in other occupations (Milham, 1982). Other studies reported similar findings, suggesting an increased risk of around 20 to 50 percent (Savitz and Calle, 1987; Coleman and Beral, 1988). However, the studies were primarily based on information only from death certificates (i.e., job title, and cause of death). It therefore was not possible to determine whether the preliminary findings were related to electric and magnetic fields, or to other exposures such as those from chemicals.

Research on electric and magnetic fields and cancer was reviewed in a draft report by the U.S. Environmental Protection Agency (EPA, 1990). The EPA concluded that magnetic fields are a possible but unproven cause of cancer in humans and that more research is needed. The EPA's Science Advisory Board (SAB) also reviewed the issue and reached a similar conclusion. The SAB, however, recommended that the EPA report should be rewritten to correct inconsistencies in the report (SAB, 1991).

In addition to research on humans and laboratory animals, several studies have investigated possible effects of transmission line electric and magnetic fields on plants, wildlife, and domestic animals (USDOE, 1993). Crop growth is not noticeably affected by even the largest transmission lines. Trees that are allowed to grow too close to transmission line conductors can be damaged by the strong electric fields near the conductors. Normally trees are not allowed close to conductors to prevent electrical flashover, i.e., spontaneous arcing of electrical current from lines to trees.

Studies have shown that honey bees in commercial hives can be adversely affected by strong transmission-line electric fields. Shocks received by bees while in the hive cause decreased

honey production and increased mortality. As a precaution, BPA recommends that bee hives not be placed directly on the transmission line right-of-way.

Wildlife do respond to effects (e.g., changes in food supply) of cleared rights-of-way. However, there is no evidence that their behavior is noticeably affected by the presence of electric and magnetic fields. Few studies have attempted to determine whether wildlife may be affected by long-term exposure to these fields. As noted above, some effects of electric and magnetic fields have been found in laboratory animal studies. It is not known whether such effects occur in wildlife similarly exposed to these fields.

Several studies have looked at the behavior and production of livestock raised near transmission lines. These studies found no indication that electric or magnetic fields have any major effects on livestock. Most of the studies were not designed to detect any subtle field effects; however, more detailed information on the potential health effects of electric and magnetic fields can be found in two free BPA publications (incorporated here by reference: "Electrical and Biological Effects of Transmission Lines: A Review (1993) and "Electric Power Lines: Questions and Answers on Research Into Health Effects" (1993)).

Because no hazardous effects of electric or magnetic fields have been confirmed, it is not possible to identify "unsafe" field levels. It is possible, however, to look at changes in potential human exposures to these fields. Because of scientific and public interest in this issue, it is BPA practice to consider potential electric and magnetic field exposure increases in the design and location of new transmission facilities. Increases in long-term, involuntary exposures to these fields are avoided if practical alternatives exist.

# APPENDIX C-2

## EXPOSURE TABLES

**Table C-1**
**Numbers of Homes Expected to Experience**
**Increases in Magnetic Field Exposure**
**More Than 1 mG**
**Estimated Annual Average Magnetic Field Level in Milligauss (mG)**

## Option 1

| Segment* | >1 to 2 | >2 to 3 | >3 to 4 | > 4 to 5 | > 5 to 6 | > 6 |
|---|---|---|---|---|---|---|
| A | 0 | 0 | 0 | 1 | 0 | 0 |
| B** | 11 | 8 | 3 | 6 | 0 | 0 |
| C | 2 | 1 | 0 | 1 | 0 | 0 |
| D*** | 3 | 0 | 0 | 0 | 0 | 1 |
| E | 0 | 0 | 0 | 0 | 0 | 0 |
| H | 0 | 0 | 0 | 0 | 0 | 0 |
| I | 0 | 0 | 0 | 1 | 0 | 0 |
| J | 0 | 1 | 0 | 0 | 0 | 0 |
| K | 6 | 0 | 0 | 0 | 0 | 0 |
| L | 1 | 0 | 0 | 1 | 0 | 0 |
| M | 1 | 0 | 0 | 1 | 0 | 0 |
| N | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 24 | 10 | 3 | 11 | 0 | 1 |

* There are no buildings in Segments F and G
** Includes 9 commercial buildings
*** Includes 2 commercial buildings

**Table C-2**
**Numbers of Homes Expected to Experience**
**Increases in Magnetic Field Exposure**
**More Than 1 mG**
**Estimated Annual Average Magnetic Field Level in Milligauss (mG)**

## Option 2

| Segment* | >1 to 2 | >2 to 3 | >3 to 4 | >4 to 5 | >5 to 6 | > 6 |
|---|---|---|---|---|---|---|
| A | 2 | 0 | 0 | 0 | 1 | 0 |
| B** | 11 | 10 | 0 | 6 | 0 | 0 |
| C | 2 | 1 | 0 | 1 | 0 | 0 |
| D*** | 2 | 0 | 0 | 0 | 0 | 1 |
| E | 0 | 0 | 0 | 0 | 0 | 0 |
| H | 0 | 0 | 0 | 0 | 0 | 0 |
| I | 0 | 0 | 0 | 1 | 0 | 0 |
| J | 0 | 1 | 0 | 0 | 0 | 0 |
| K | 6 | 0 | 0 | 0 | 0 | 0 |
| L | 1 | 0 | 0 | 1 | 0 | 0 |
| M | 1 | 0 | 0 | 2 | 0 | 0 |
| N | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 25 | 12 | 0 | 11 | 1 | 1 |

* There are no buildings in Segments F and G
** Includes 9 commercial buildings
*** Includes 2 commercial buildings

**Table C-3**
**Numbers of Homes Expected to Experience**
**Increases in Magnetic Field Exposure**
**More Than 1 mG**
**Estimated Annual Average Magnetic Field Level in Milligauss (mG)**

## Option 3

| Segment | >1 to 2 | >2 to 3 | >3 to 4 | >4 to 5 | >5 to 6 |
|---|---|---|---|---|---|
| A | NA | NA | NA | NA | NA |
| B | 0 | 0 | 0 | 0 | 0 |
| C | 0 | 0 | 0 | 0 | 0 |
| D | 0 | 0 | 0 | 0 | 0 |
| E | 0 | 0 | 0 | 0 | 0 |
| H | 0 | 2 | 0 | 0 | 0 |
| I | 0 | 0 | 0 | 0 | 0 |
| J | 1 | 1 | 0 | 0 | 0 |
| K | 0 | 0 | 0 | 0 | 0 |
| L | 0 | 0 | 0 | 0 | 0 |
| M | 0 | 0 | 0 | 0 | 0 |
| N | 0 | 0 | 0 | 0 | 0 |
| TOTALS | 1 | 2 | 0 | 0 | 0 |

* There are no buildings in Segments F and G

# APPENDIX C-3

## COMPUTER-GENERATED MAGNETIC FIELD ANALYSIS

To estimate levels of magnetic fields for each of the project alternatives (existing and proposed), the transmission line corridor was broken into segments where significant differences in field levels might be expected. These differences occur because the number and type of transmission lines vary considerably along the corridor. For each segment of each alternative, field profiles were calculated on both sides of the corridor. These segments are described later in Appendix C.

Direct comparisons between the existing and proposed alternatives must be made in the future to establish properly the relative effect of the proposed lines. Thus, for existing and proposed alternatives, all calculations were based on estimated annual average current loading (electricity usage) for the year 2000, and under the assumption that the transmission system would be operating normally. Estimated annual peak loads would be about twice the annual average levels. This loading data was obtained from the same power-flow computer simulations used to determine the need for the proposed project. Note: For unusual operating situations, the transmission lines could operate under an emergency condition that would temporarily increase magnetic field levels. However, these conditions are usually rare and of short duration.

All magnetic field calculations were made using industry-accepted computer modeling techniques. Graphical representations of the magnetic field profiles, for each segment of each alternative, are illustrated later in Appendix C.

It is important to note that the calculated field levels used in the exposure assessment represent typical levels obtained using BPA's best estimates for key factors such as line loading and line design. Future changes in the assumptions used for making these calculations could, therefore, result in changes in the predicted field levels. However, it is not expected that such changes would have any significant impact on the relative exposure comparisons of alternatives made in this document (which is the primary purpose of these analyses).

## Using the Geographic Information System for Data Gathering and Analysis

The Geographic Information System (GIS) is a set of computer hardware and software that links graphical map data with descriptive attributes about the map features. This system was used to integrate and analyze data sets to quantify changes in magnetic field exposures to homes and buildings near high-voltage power lines between Sedro Woolley, Washington and BPA's Custer Substation about 19 kilometers (12 miles) north of Bellingham, Washington.

Four types of information were used in the analysis:

1. Building location and type
2. Tower and line locations
3. Buffer zones created by the GIS
4. Magnetic field strength estimates

### *Building Locations*

Aerial photographs taken in March 1992 and May 1992 were used to locate and identify building locations and types. The building outlines were traced into computer files using an analytical stereoplotter, an electronic-optical machine that enables viewing of aerial photographs in three dimensions. The stereoplotter also corrects for distortion caused by the camera lens and uneven terrain on the ground. The results are accurate ground locations of buildings near the power lines. The buildings were also tagged with an identifier code which can be used to group the buildings by type such as house, barn, mobile home, etc.

Since magnetic field levels decrease as distance from the line increases, the highest magnetic fields will be found in parts of a building nearest the line. The nearest corner of the building to the line was selected and used as the distance value for that building. In subsequently relating these distances to estimated magnetic fields, the highest magnetic field occurring at that building would be selected, representing a worst-case scenario at each location.

### *Transmission Conductor (Line) Locations*

The x, y coordinate locations of transmission line towers were taken from survey and input into Arc/Info (a software program) as point locations. Lines representing the transmission

conductors were created by generating lines between each tower point, creating an accurate location for the centerline of each transmission line in the right-of-way.

### *Buffer Zones in the GIS*

The centerline of the Monroe-Custer No. 2 line was used as the zero reference point for calculations of magnetic field strength levels. This line was used to create buffer zones (areas of equal distance from the line) in 6-m (20-ft.) increments, from 0 to + 183 m (0 to + 600 ft.) out from the Monroe-Custer No. 2 line. These buffer zones were separated into left (-) and right (+) sides and divided by segments A - N, which corresponded to changes in the configuration of the transmission lines in the right-of-way.

## Putting Magnetic Field Calculations and the GIS Together

Calculations based on loading, line configuration, and other factors were run, providing estimated magnetic field levels at 1.5-m (5-ft.) intervals from the zero reference point of the Monroe-Custer No. 2 line. Data for the current line configurations as well as for each of the three alternatives were provided.

The field strength data for each segment was determined by distance from the zero-reference point of the Monroe-Custer No. 2 line. There were four files of magnetic field levels: existing configuration, and proposed Options 1, 2 and 3, each based on existing or proposed line configurations. Each of these files has a distance value and a corresponding magnetic field at that distance from the zero-reference point. Using standard relational database techniques, the magnetic field strength at each building location was linked to the appropriate value in each file. Increases in magnetic field strength at a building could then be calculated by subtracting field strength estimates for each option from the estimates of current field strengths.

The final result is a table of field strengths at each identified building location for present and possible future estimates of EMF at those locations. These were summarized by segment and then averaged, giving average field strength increases by segment for each option. This allows specialists to look at the individual sites to find buildings that may be experiencing an increase in magnetic field levels as a result of this project.

# APPENDIX C-4

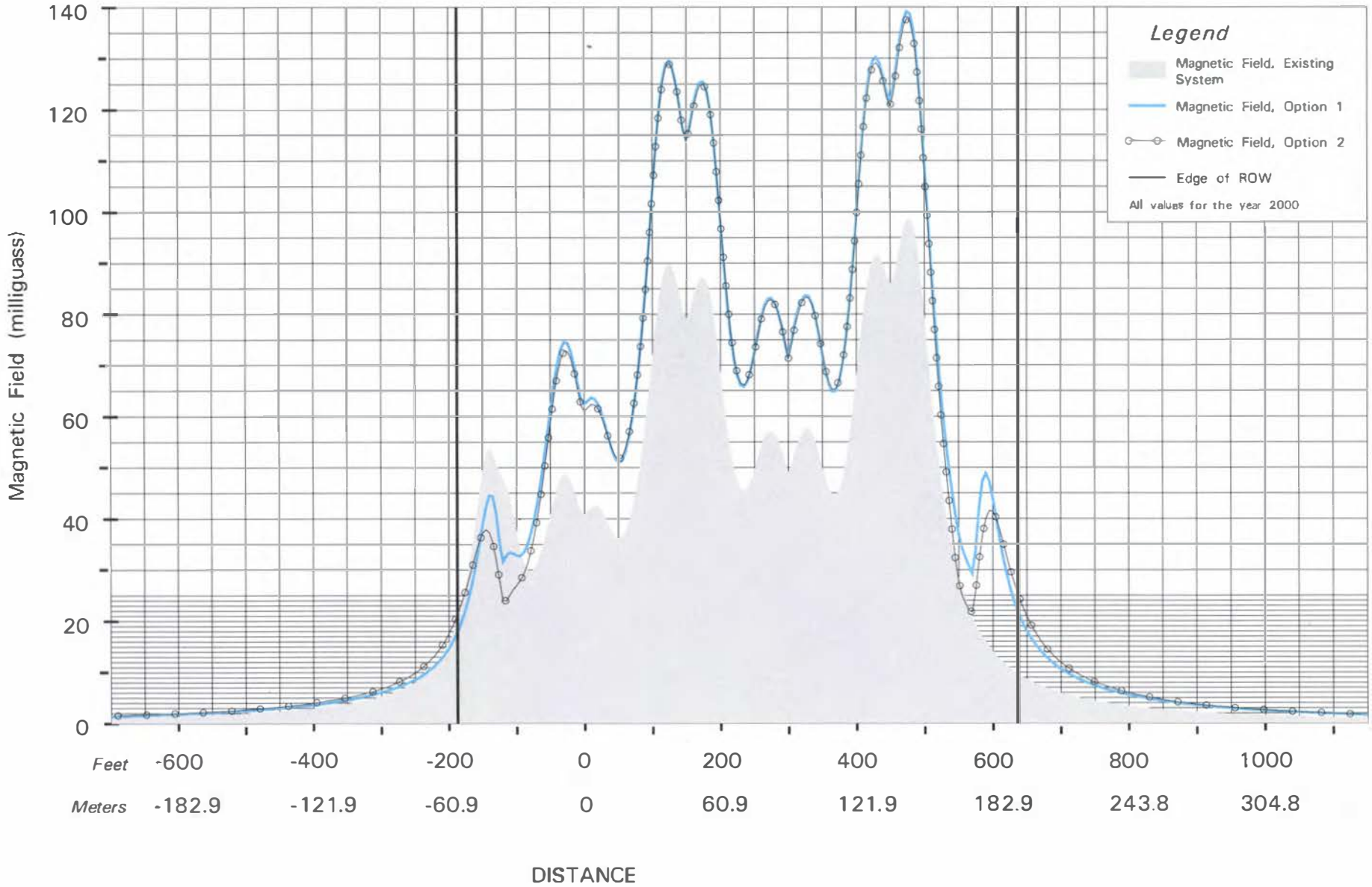
## MAGNETIC FIELD PROFILE GRAPHS, BY SEGMENT

**Table C-4. BPA Corridor Segments**

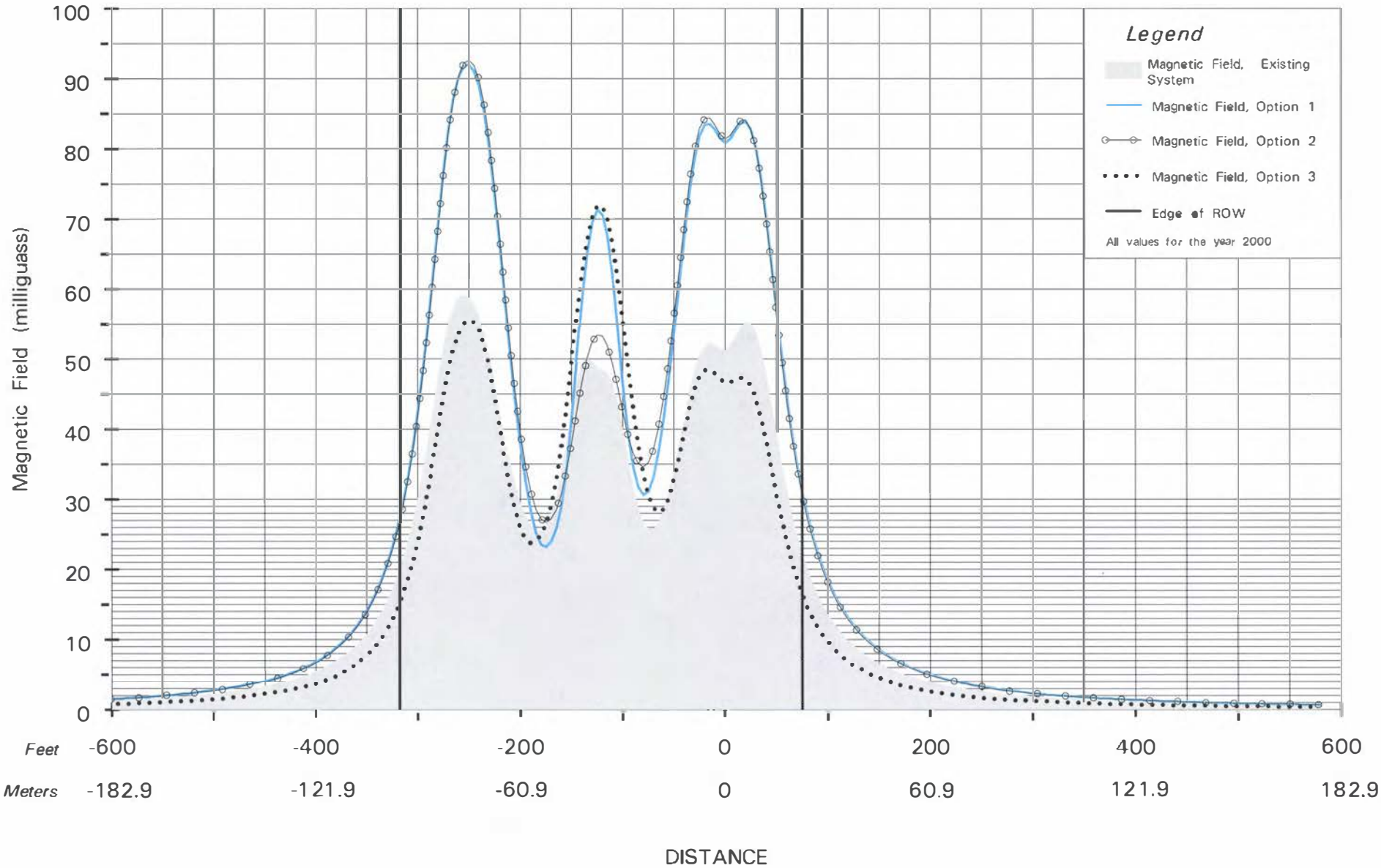
| SEGMENT | ENDING TOWER # ON MONROE-CUSTER # 2[a] | LANDMARK |
|---|---|---|
| A | 87/1 | Intersects main corridor after crossing I-5 |
| B | 77/1 | Between Kelly and Kline Rds |
| C | 75/1 | BPA's Bellingham Substation at Dewey Rd. |
| D | 73/5 | At Britton Rd. & Emerald Lake Way |
| E | 66/3 | East of Lake Whatcom |
| F | 65/1 | East of Lake Whatcom |
| G | 60/2 | Just north of County line |
| H | 58/2 | Highway 9 crosses under lines |
| H1 | [rejoins at 56/4] | [Leaves main corridor at 60/2] |
| I | 57/4 | Just south of Samish River |
| J | 56/4 | Near Upper Samish Rd |
| K | 54/4 | Near Fruitdale Rd |
| L | 51/2 | Southwest of Northern State Hospital |
| M | 50/1 | South of Minkler Rd |
| N | 49/3 | At Puget Power's Sedro Woolley Substation |

a BPA's portion of the project has been divided up into segments. They start at the BPA Custer Substation and continue to the Puget Power Sedro Woolley Substation. The Monroe-Custer # 2 500-kV line was used to reference tower numbers, since it is the constant through the main corridor. (Monroe-Custer No. 1 creates the **H1** route.) The segments were identified to mark places where the transmission lines arrangement in the corridor changes. Some landmarks have been provided to help the reader locate these transition points.

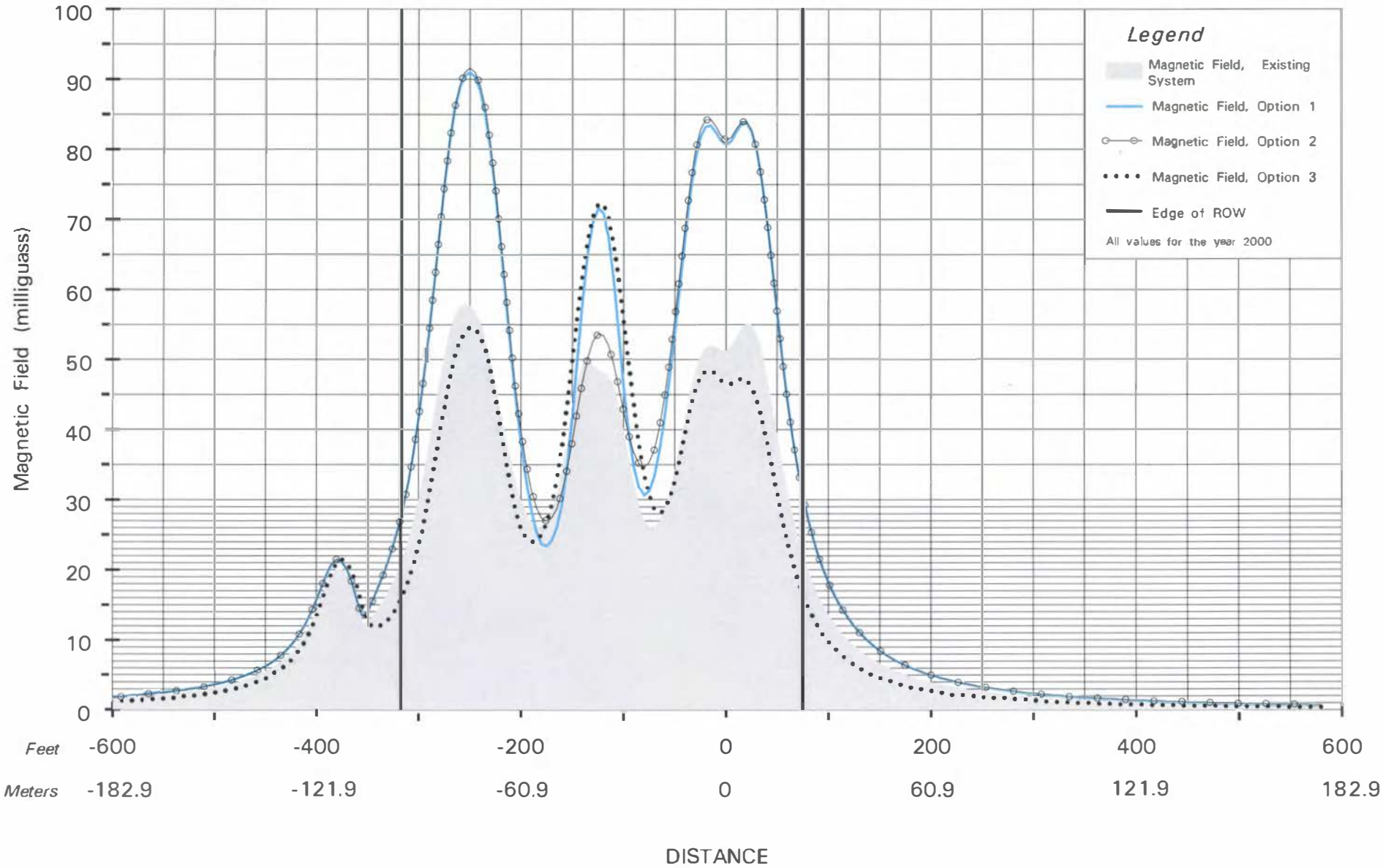
# Segment A Magnetic Field Profile



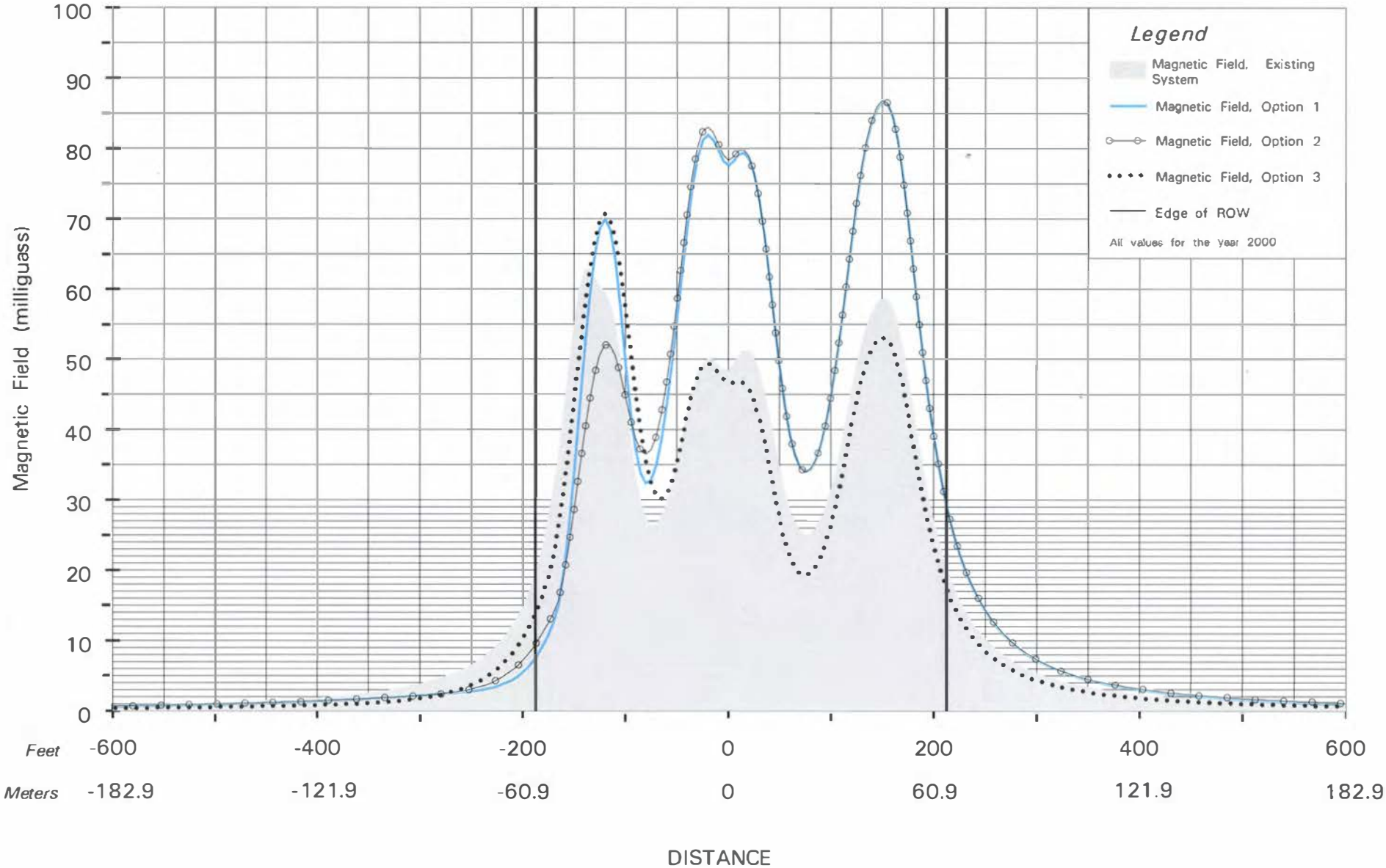
# Segment B Magnetic Field Profile



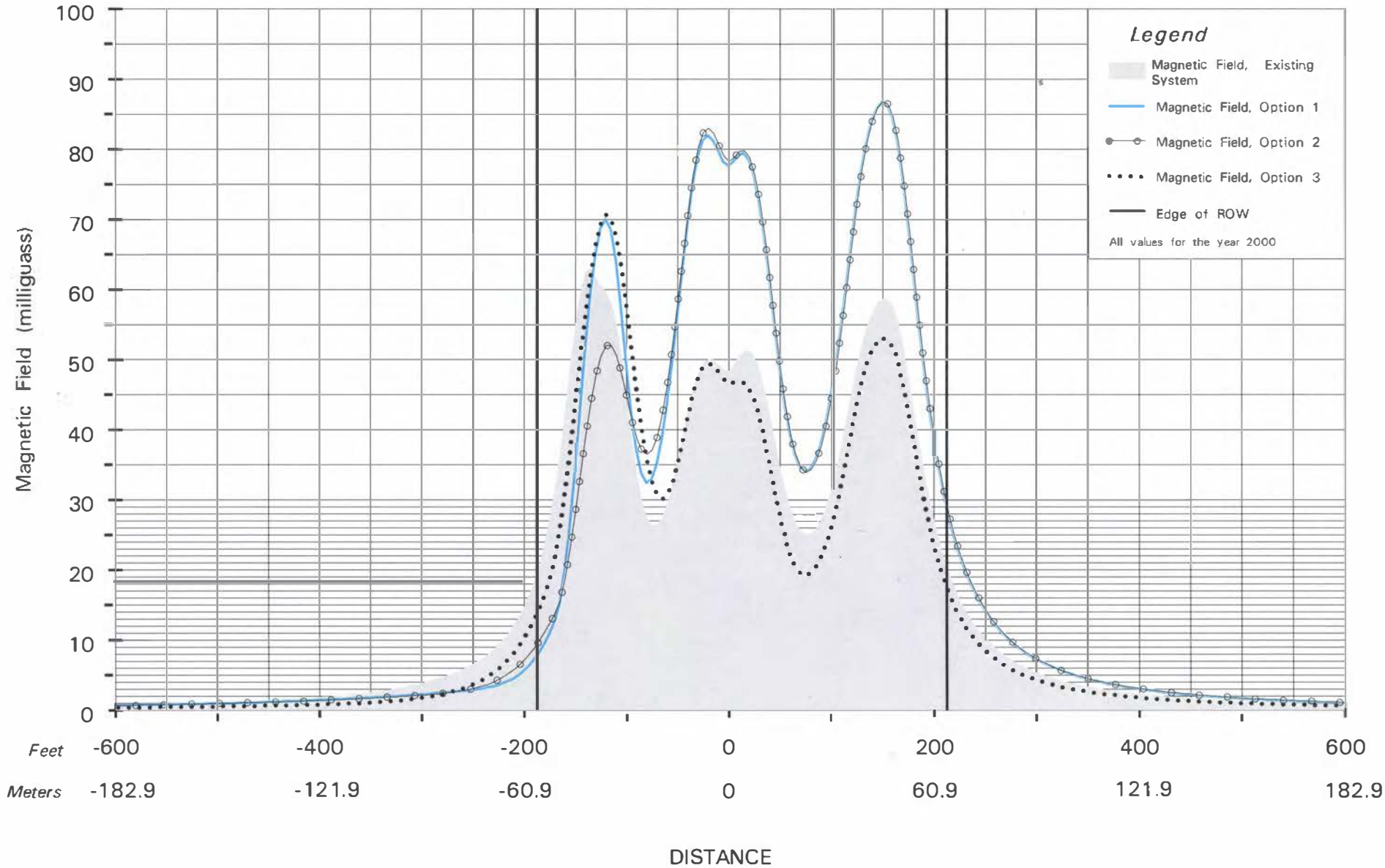
# Segment C Magnetic Field Profile



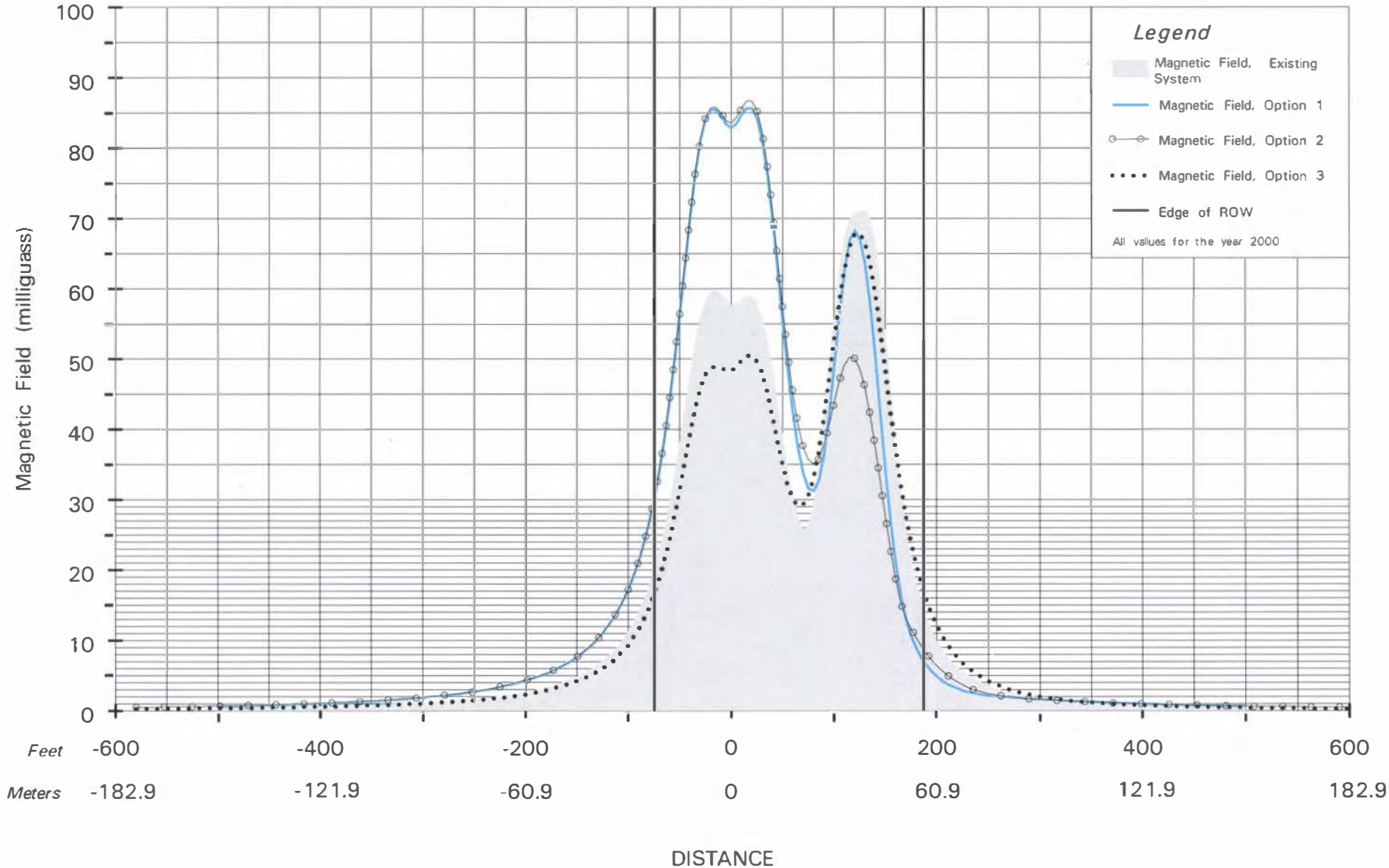
# Segment D Magnetic Field Profile



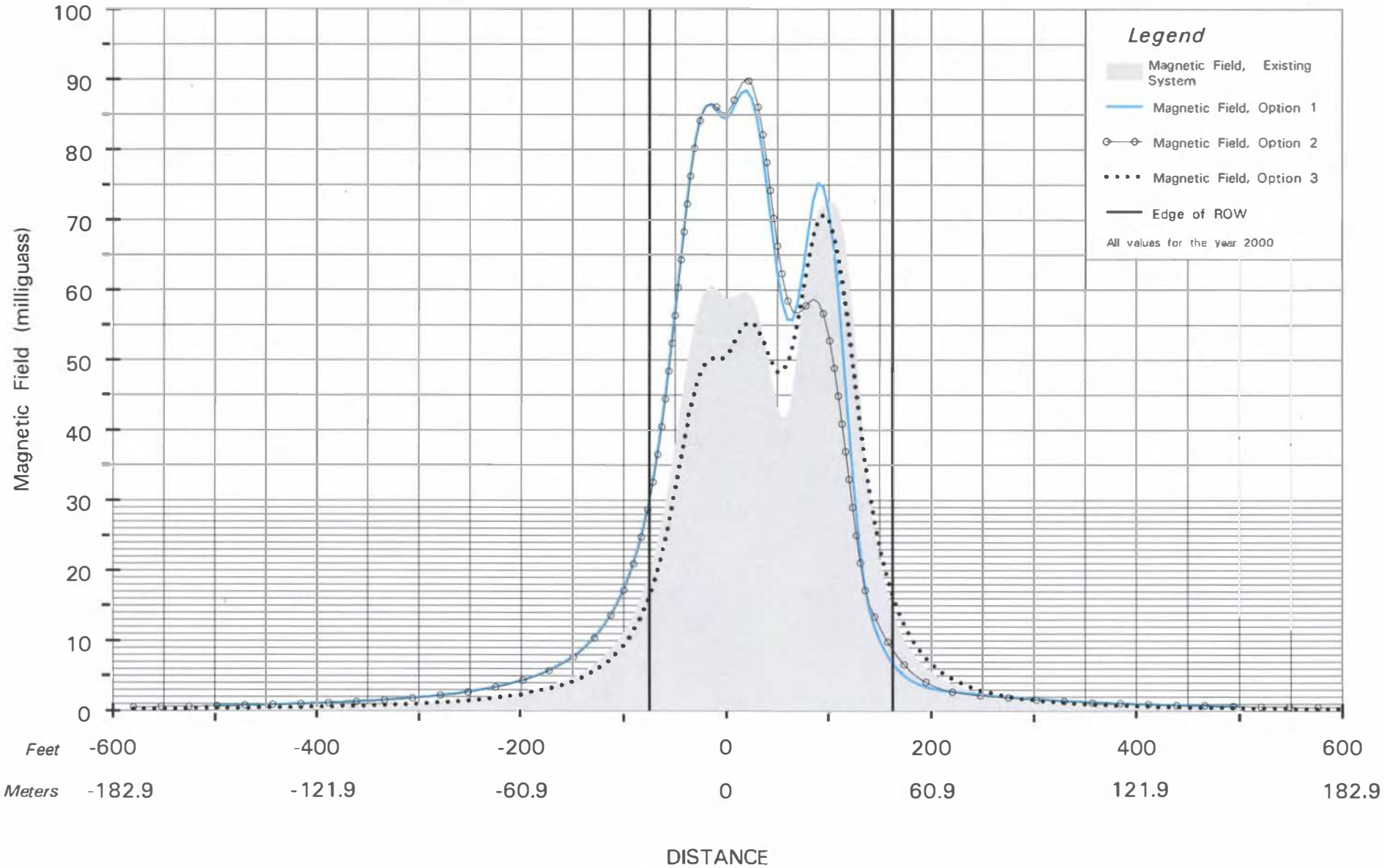
# Segment E Magnetic Field Profile



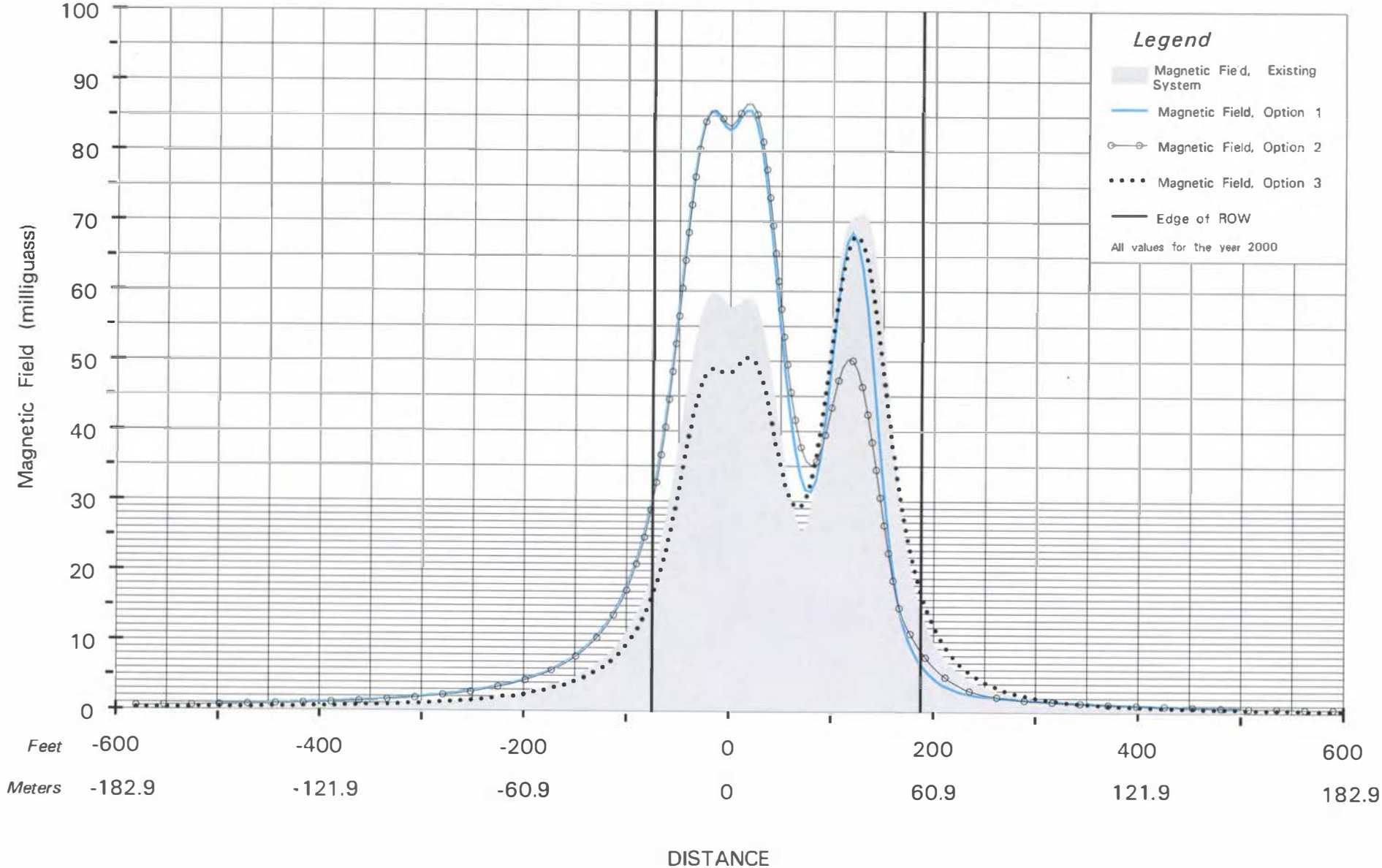
# Segment H Magnetic Field Profile



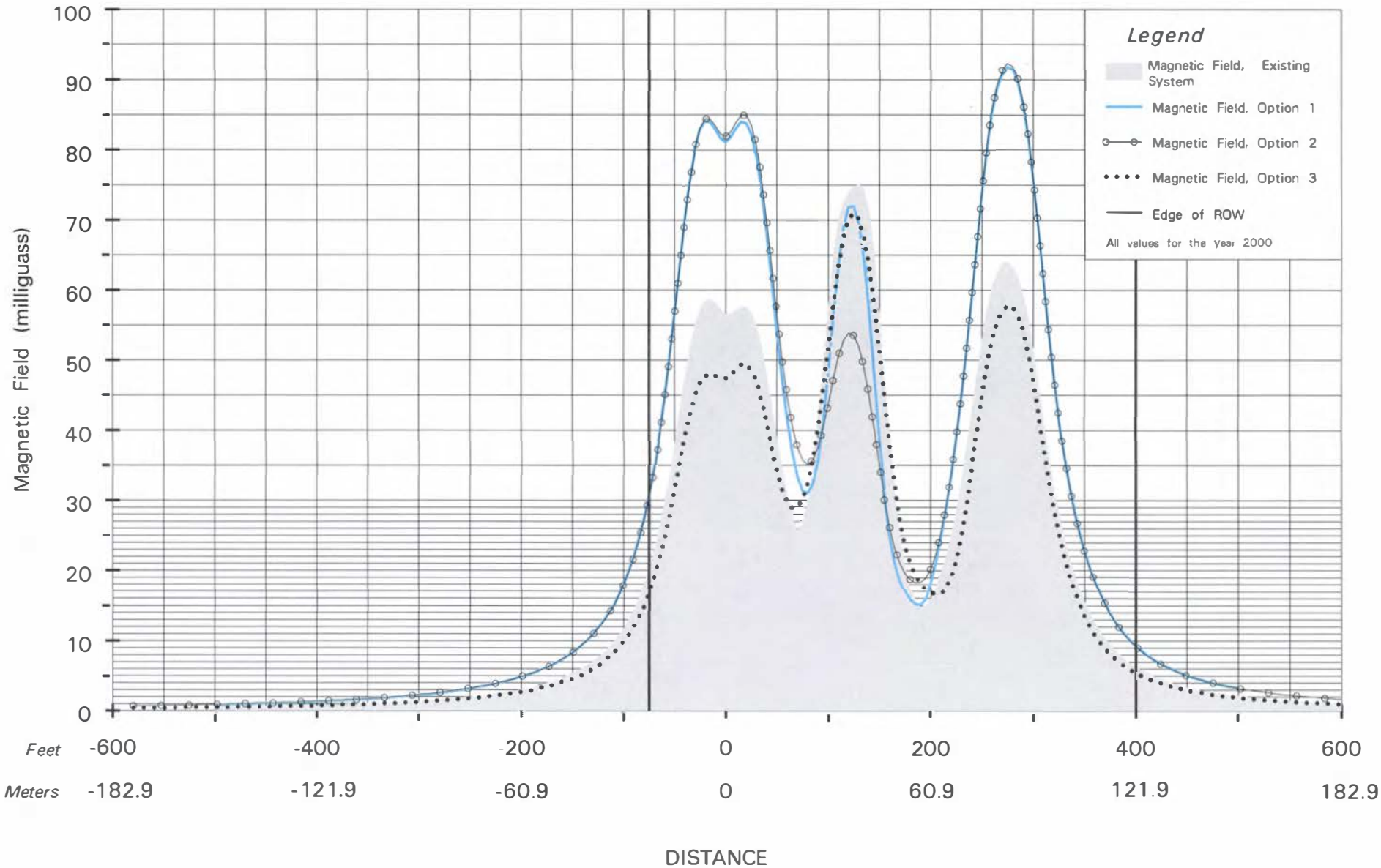
# Segment I Magnetic Field Profile



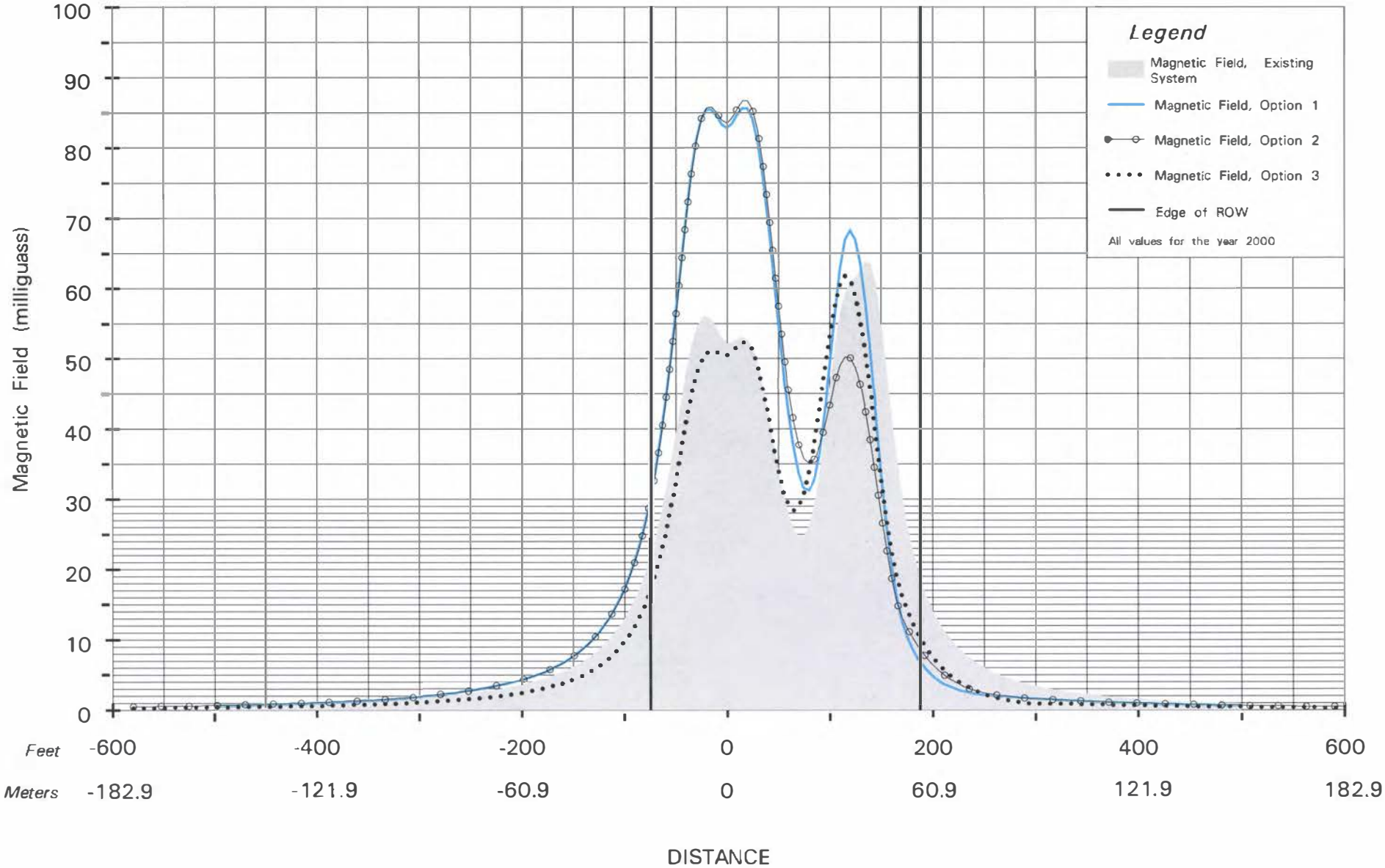
# Segment J Magnetic Field Profile



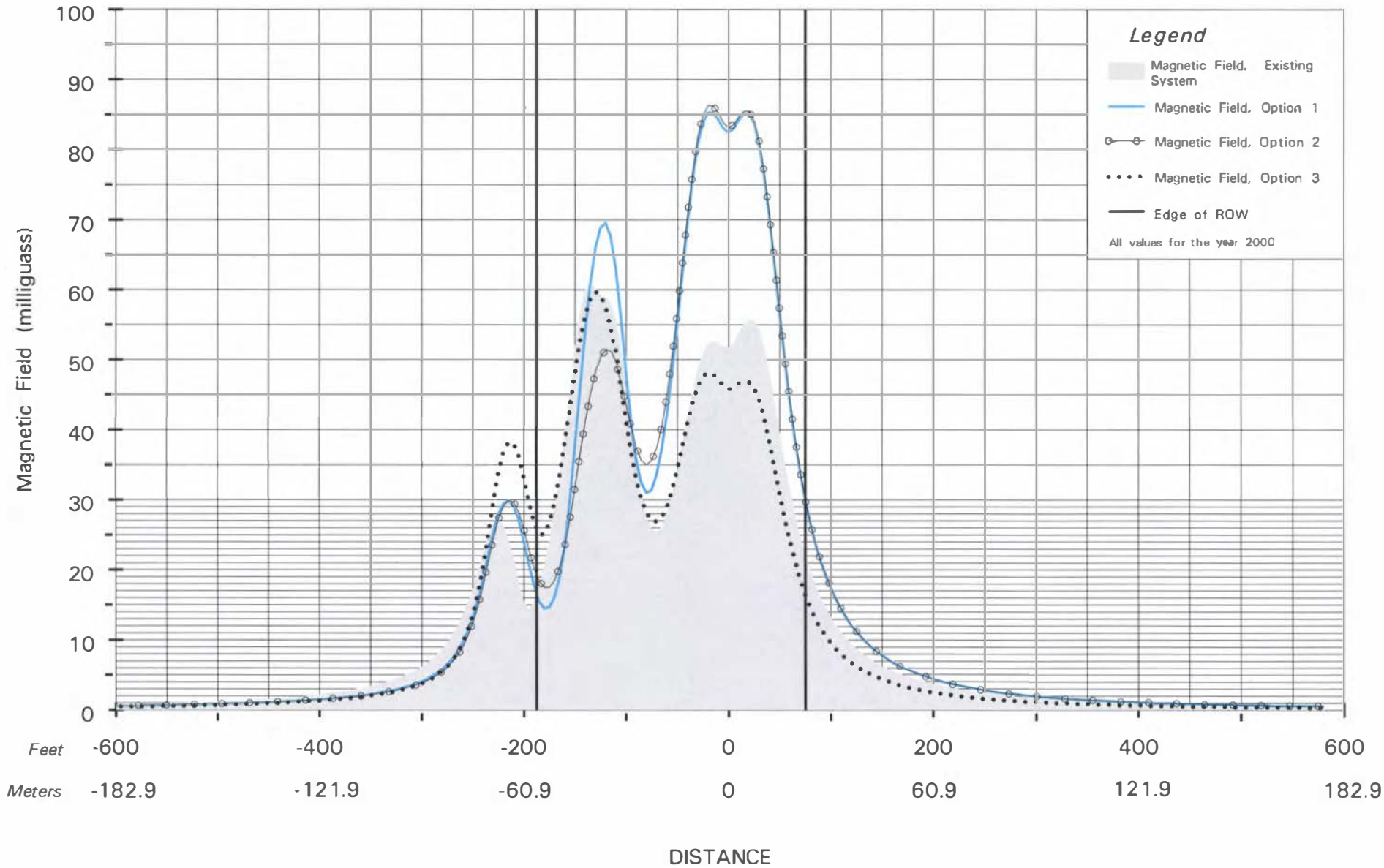
# Segment K Magnetic Field Profile



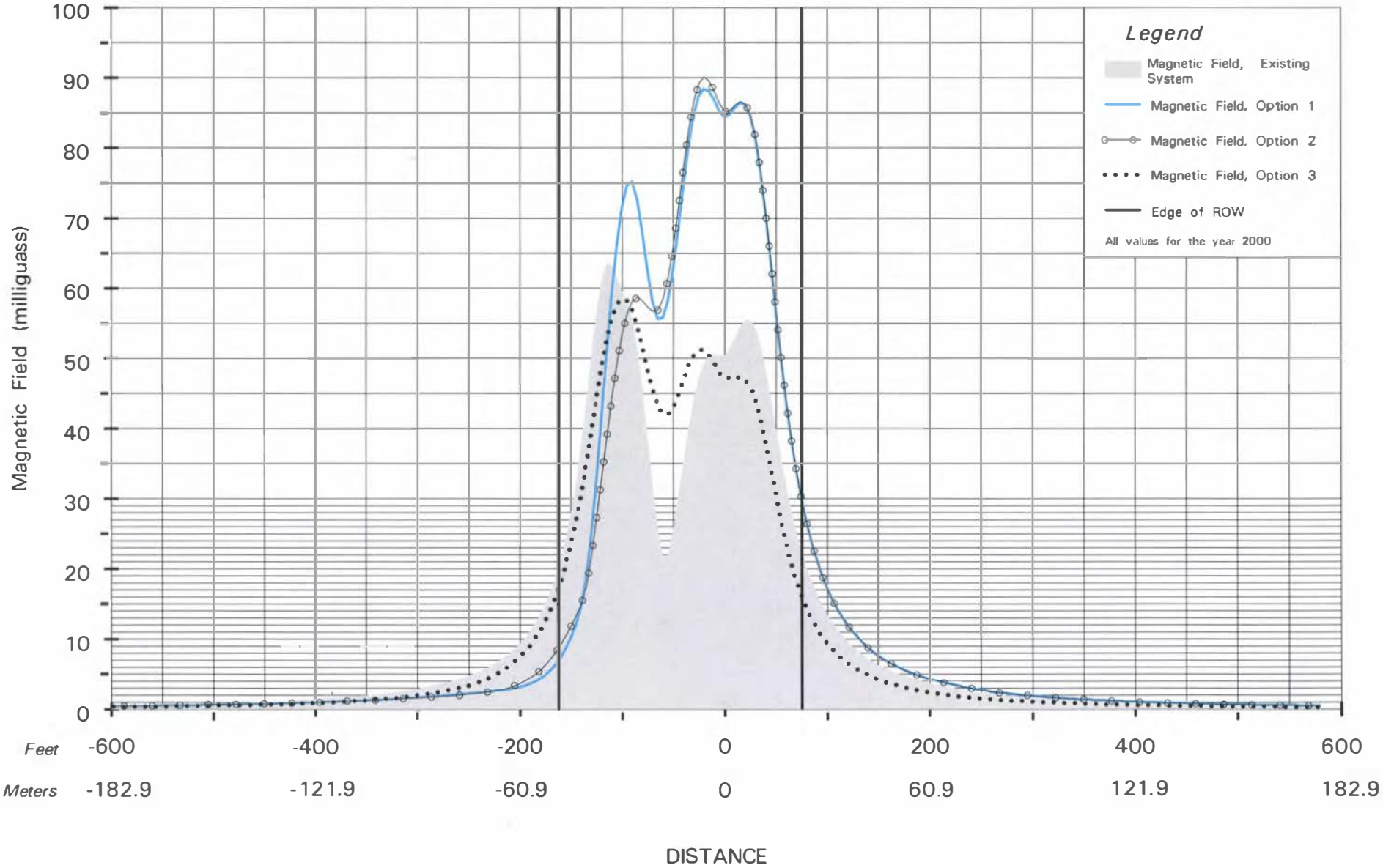
# Segment L Magnetic Field Profile



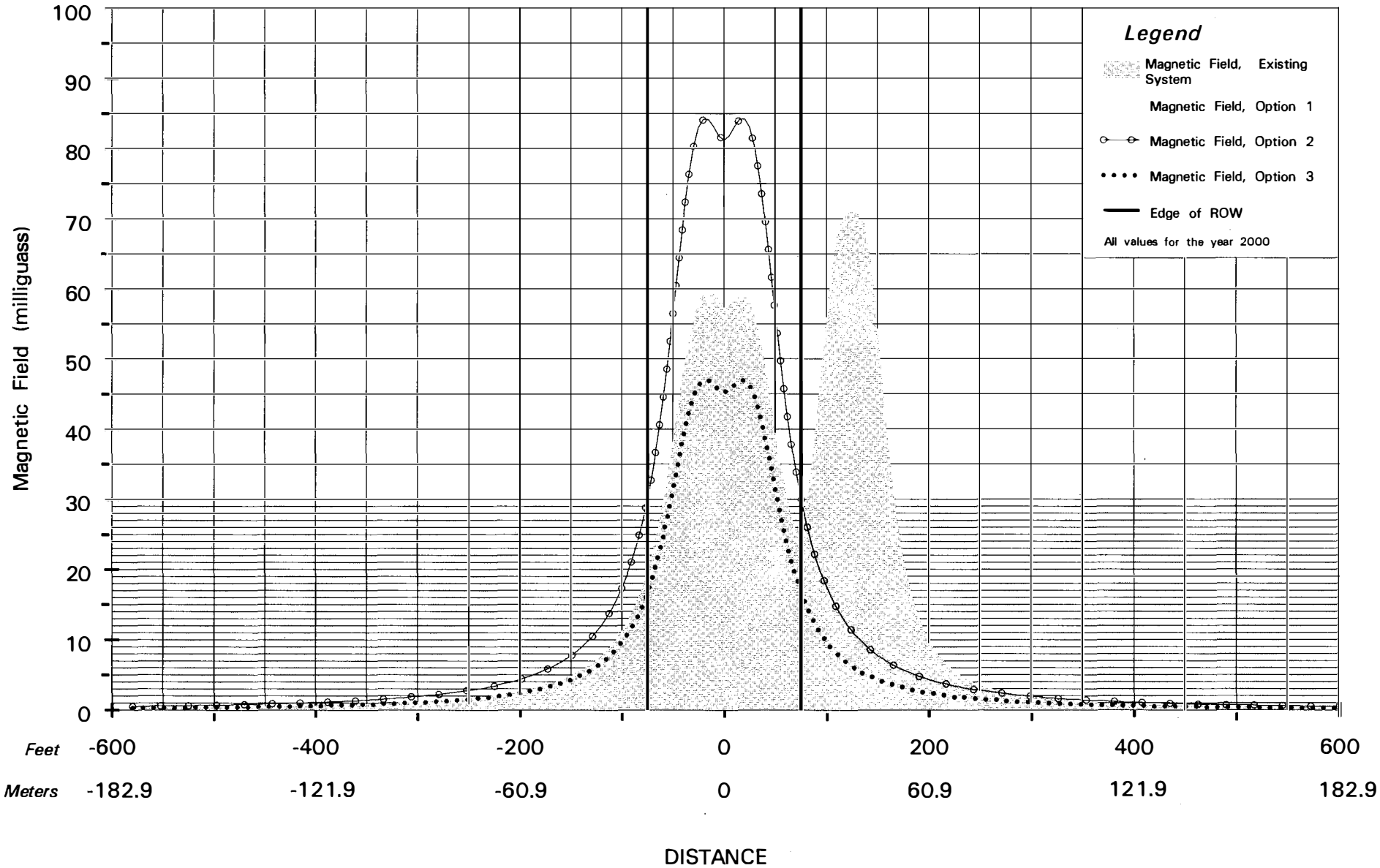
# Segment M Magnetic Field Profile



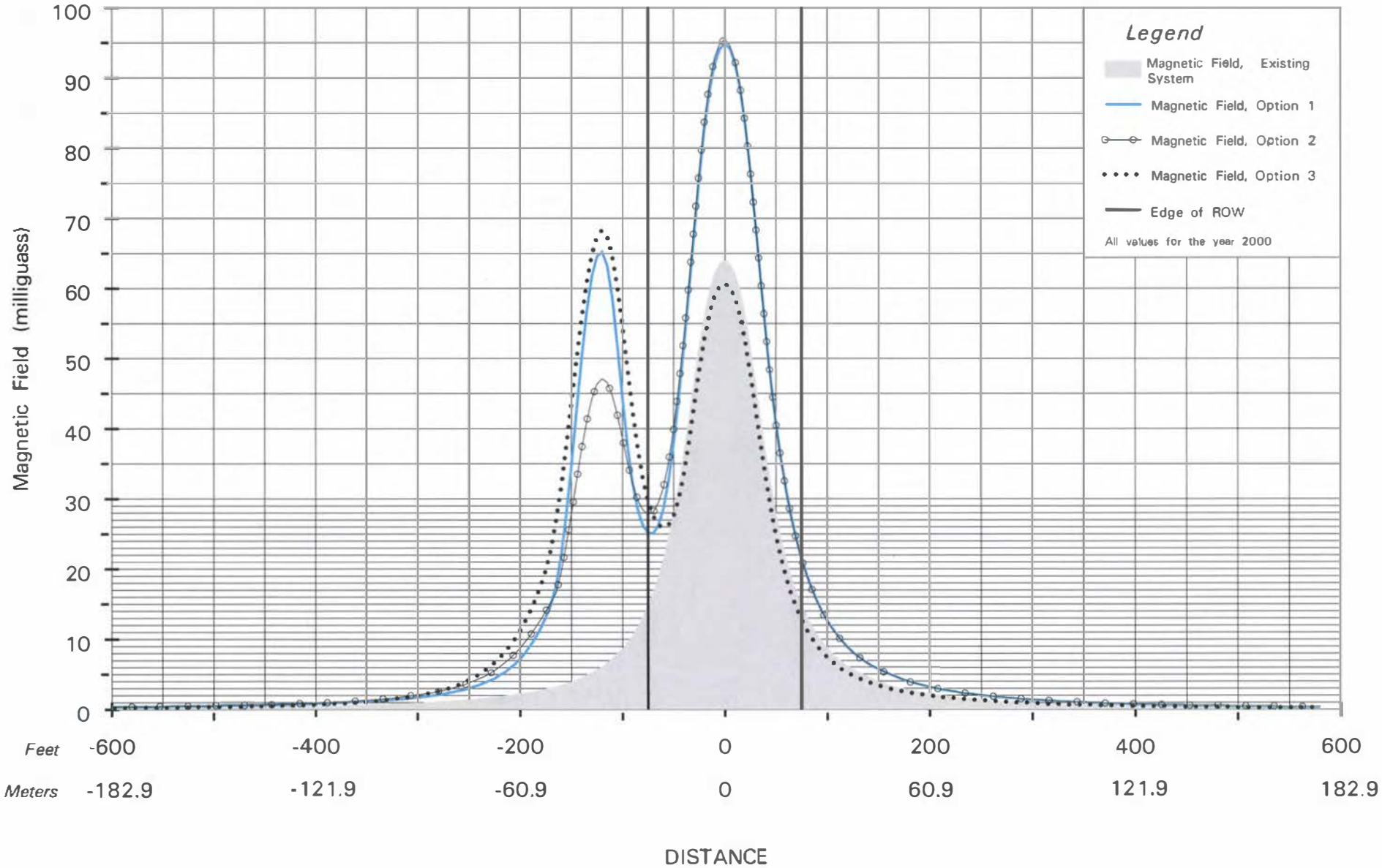
# Segment N Magnetic Field Profile



# Segment H-I-J Magnetic Field Profile



# Segment H1 Magnetic Field Profile



# APPENDIX C-5

**MAGNETIC FIELD LEVELS**
(Average annual loading conditions)
Year 2000

| BPA - BELLINGHAM #2 115 KV TRANSMISSION REBUILD LINE | |
|---|---|
| **Distance from Pole (in meters)** | **Magnetic Field Level (in mG)** |
| 15.2 (50 ft. field side of pole) | 1.3 |
| 7.6 (25 ft.) | 2.3 |
| 0 | 3.3 |
| 7.6 (25 ft.) | 2.8 |
| 15.2 (50 ft. road side of pole) | 1.7 |

| BPA - BELLINGHAM #3 115 KV TRANSMISSION LINE | |
|---|---|
| **Distance from Pole (in meters)** | **Magnetic Field Level (in mG)** |
| 15.2 (50 ft. field side of pole) | 1.0 |
| 7.6 (25 ft.) | 1.7 |
| 0 | 2.4 |
| 7.6 (25 ft.) | 1.9 |
| 15.2 (50 ft. road side of pole) | 1.1 |

| BPA - BELLINGHAM - KENDALL 115 KV TRANSMISSION LINE | |
|---|---|
| **Distance from Pole (in meters)** | **Magnetic Field Level (in mG)** |
| 15.2 (50 ft. field side of pole) | 0.5 |
| 7.6 (25 ft.) | 0.8 |
| 0 | 1.1 |
| 7.6 (25 ft.) | 0.9 |
| 15.2 (50 ft. road side of pole) | 0.5 |

# 1992 BONNEVILLE INTERIM GUIDELINES ON ELECTRIC AND MAGNETIC FIELDS

Recognizing

- that public concern is increasing over potential health effects of electric and magnetic fields, and that this concern is important to BPA,
- that a clear course of action cannot be determined from present scientific evidence, and
- that defining and addressing any risks associated with EMF is the responsibility of the entire society, which values both the availability of energy and the well-being of its citizens,

Bonneville Power Administration (BPA) adopts the following revised interim guidelines governing its practices with regard to electric and magnetic fields. As new information becomes available, these guidelines will be reexamined. Such reexamination will occur at least every 2 years.

1. Because it appears that it will take several more years before sufficient scientific data is available to establish whether EMF are a threat to public or worker health, it does not appear prudent at this time for BPA to modify existing electrical field standards or establish numerical field strength standards for magnetic fields produced by BPA facilities.

   As States in the Region review the issue of EMF and consider limits on these fields, BPA will participate in the process. BPA will adopt practices consistent with EMF standards in such States, to the maximum extent practicable.

2. BPA will continue to support R&D efforts dealing with EMF issues.

3. In arriving at design and location choices for new transmission facilities:

   EMF exposure shall be a major decision factor to be balanced with other major decision factors (such as reliability).

   Accordingly, BPA shall seek to keep EMF exposures as low as are reasonably achievable, considering social, economic, and environmental factors.

   BPA will consider both existing mitigation techniques (such as developing alternative facility locations; increasing right-of-way widths; altering line or tower geometry; using higher voltages to reduce current levels; and undergrounding) and developing technology. The practicability of these options will be determined on a case-by-case basis.

4. Where practical alternatives exist, public and employee exposure to EMF should not be increased by any BPA operation, practices, or action.

5. BPA employees will be kept informed on current research and information.

6. BPA will explore, in conjunction with its employees, ways to reduce exposures in carrying out their jobs.

7. BPA will actively seek to inform and involve affected customers and the public in BPA project development, including evaluation of siting factors such as EMF. BPA will continue to develop appropriate educational materials and to respond to requests from the public for information or measurement of EMF associated with the BPA transmission system.

8. BPA will involve its utility customers and the public in its policy deliberations on EMF.

# APPENDIX D
# WETLANDS DELINEATION REPORT

WETLAND DELINEATION REPORT
FOR BONNEVILLE POWER

Bellingham Substation

## INTRODUCTION

This delineation report was completed for Bonneville Power Administration's Bellingham Substation in Whatcom County, Washington, shown in Figure 1. Construction next to the substation would alter an existing palustrine, emergent wetland

## METHODOLOGY

The aquatic systems intended to be protected under the Federal Clean Water Act in general are rivers, streams, lakes, estuaries and special aquatic sites, including wetlands. Delineation criteria used by the Corps to determine the extent of jurisdictional wetlands are published in the Environmental Laboratory, 1987, *Corps of Engineers Wetlands Delineation Manual*, Tech. Report Y-87-1. The criteria are based on identifying the presence of positive indicators for three parameters; 1) wetland hydrology, 2) wetland vegetation, and 3) hydric soils. A walking survey was conducted (February 1992) on the BPA fee-owned property adjoining the substation prior to the field investigation noting local-terrain, stream-channel, and wetland characteristics. Recorded data were studied before the field investigation. The National Wetlands Inventory Map (base map from USGS topographic sheet, 7.5 series, Bellingham East, 1954, photo-revised 1980) was consulted for drainage patterns and general identification of wet areas. Site-specific information came from black-and-white aerial photos flown in 1980 and 1992 (at 1 in. to 400 ft.) and color infra-red photography flown in March 1992 (at 1 in. to 750 ft.). The Soil Conservation Service Soil Survey for Whatcom County (May 1992) was consulted for general soils information and growing season.

Two site visits were completed just before the growing season (as estimated by the Soil Conservation Survey for Whatcom County): one in April 1992 and a second in March 1993. Evidence of biological activity was noted in the field by new growth in grasses and trees. Soil temperature at 51 cm (20 in.) deep was 5 C (41 F) degrees.

Normal circumstances occur at the site (no recent alteration of site's hydrology or vegetation). Representative vegetation units were identified and sampled following the Routine Determination Method. Field observations of vegetation and hydrology and some soils during the April 1992 visit were recorded on data forms. During the March 1993 visit, field observations of vegetation, hydrology and soils were restricted to the Construction Area (see Figure 2) and are recorded on field data forms. Vegetation dominance within a 5 m (15 ft) radius of the sample pit was visually estimated and determined using the 50/20 rule within the identified plant communities. Taxonomy follows Hitchcock and Cronquist, 1973. Sample pits, 46 cm (18 in.) deep were dug within the representative plant communities for soils and hydrology information.

Wetland areas and classification are shown on Figure 2. The wetland boundary of the construction area was based on vegetation in conjunction with two soil sample points. During the March 1993 site visit, the wetland boundary in the Construction Area was confirmed and flagged.

Mapped wetland boundaries for the Reference Area, the Disturbed Area, and the Pasture Area have not been confirmed and are intended to show approximate areas only.

An upland area in the north corner of the site was assessed in April 1992 (no field data forms recorded) and determined to be upland by all three parameters. The locations of a series of drain pipes and culverts were identified. It was determined that these effectively drain this corner.

## LANDSCAPE SETTING

The substation is located on 8.6 ha (21.6 ac.) of land in section 9 of T38N-R3E, 5.6 km (3.5 mi.) northeast of Bellingham. The most prominent landform feature in the area is the glacial outwash channel in which the substation is located. Squalicum Creek is a geologically recent development within the outwash channel. It flows from north to south, eventually emptying into Bellingham Bay in the city of Bellingham. Squalicum Creek is listed in the Washington State Shoreline Management Act as a Shoreline of the State. At the substation location in the outwash channel, the valley is about 610 m (2,000 ft.) wide, with steep side walls. Dewey Road runs north and south along the east side of the valley. The substation is between Dewey Road and the eastern wall, which rises 17 m (55 ft.) in elevation with a nearly vertical slope.

The 1954 USGS Bellingham North topographic sheet indicates a stream entering the substation property from the east valley wall. This creek has been diverted. The substation site was altered during the 1950's, with the construction of the substation and a railroad spur. A 1953 BPA geological report refers to the presence of "hollows, ponds, and swamps" on the site before construction. Although hydrology has been altered on this site, wetland conditions remain in some portions. A cement ditch diverts the creek around the existing capacitor yard. This unnamed creek flows along the southern boundary of the property, parallels Dewey Road and flows west through a culvert underneath an agricultural area, before entering Squalicum Creek south of its historic confluence.

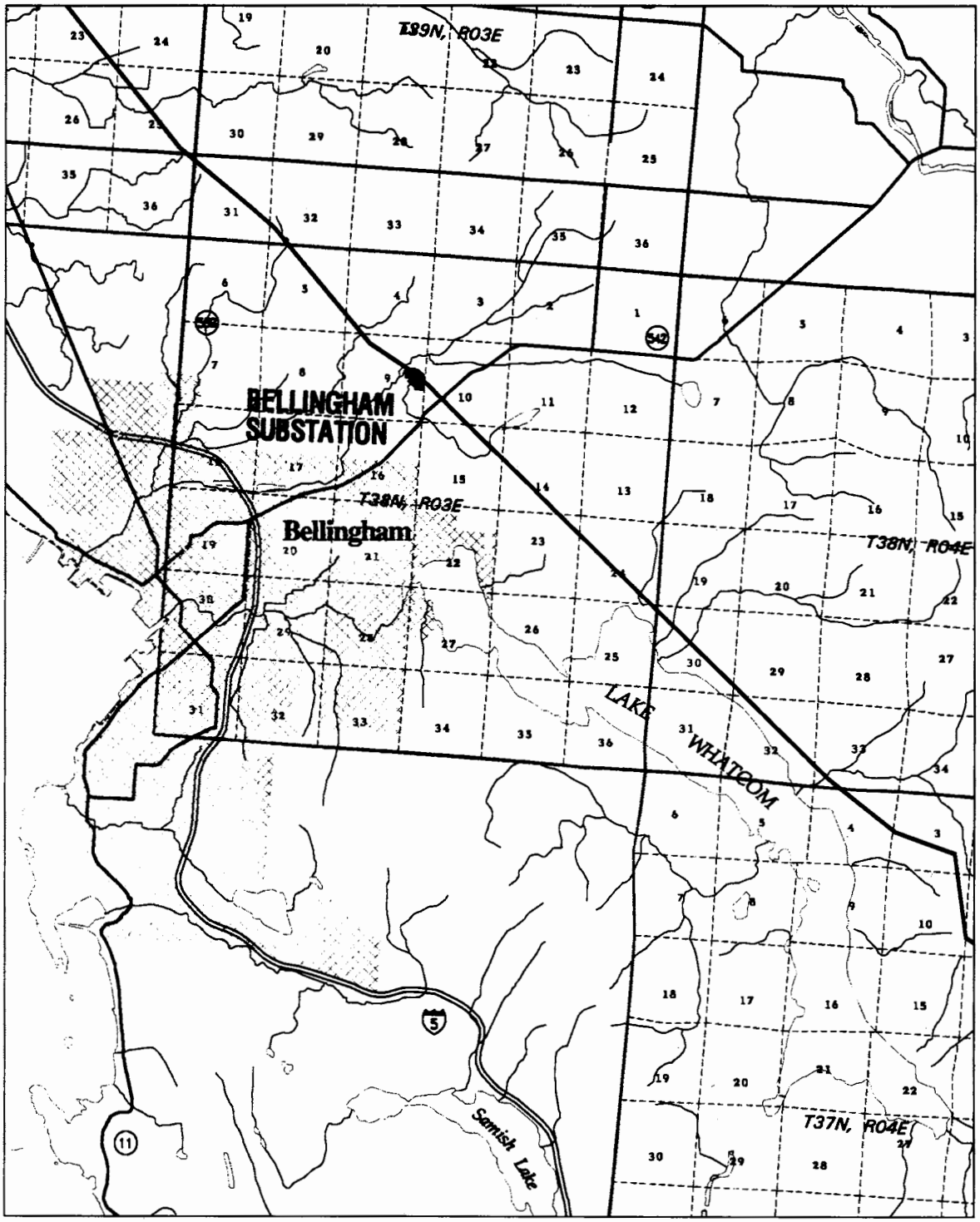
## WETLAND UNITS IDENTIFIED

Four wetland units were identified within BPA fee-owned property adjoining the substation. They are referred to in the report as: 1) the Construction Area, 2) the Reference Area, 3) the Disturbed Area, and 4) the Pasture Area (Figure 2).

## OBSERVATIONS

### CONSTRUCTION AREA

This wetland area is between the substation on the northeast and the existing capacitor yard on the southwest. A gravel maintenance road between the substation yard and the capacitor yard borders the northwest, and the valley wall borders the east side of the wetland. Vegetation at the base of the wall is Himalayan blackberry, intergrading with grasses, rushes and sedges, and sparse shrubs. This is mapped as Fill Area with sample points B-4/92-6, B-3/93-1 and B-3/93-2. This site was visited first in April 1992; at that time, generalized sampling points were located and information on vegetation and hydrology was recorded. The site was visited again in March 1993. Sampling points were located; data on vegetation, hydrology and soils were recorded; and the wetland boundary was determined and flagged.




# LOCATION OF BELLINGHAM SUBSTATION

BPA Transmission Line

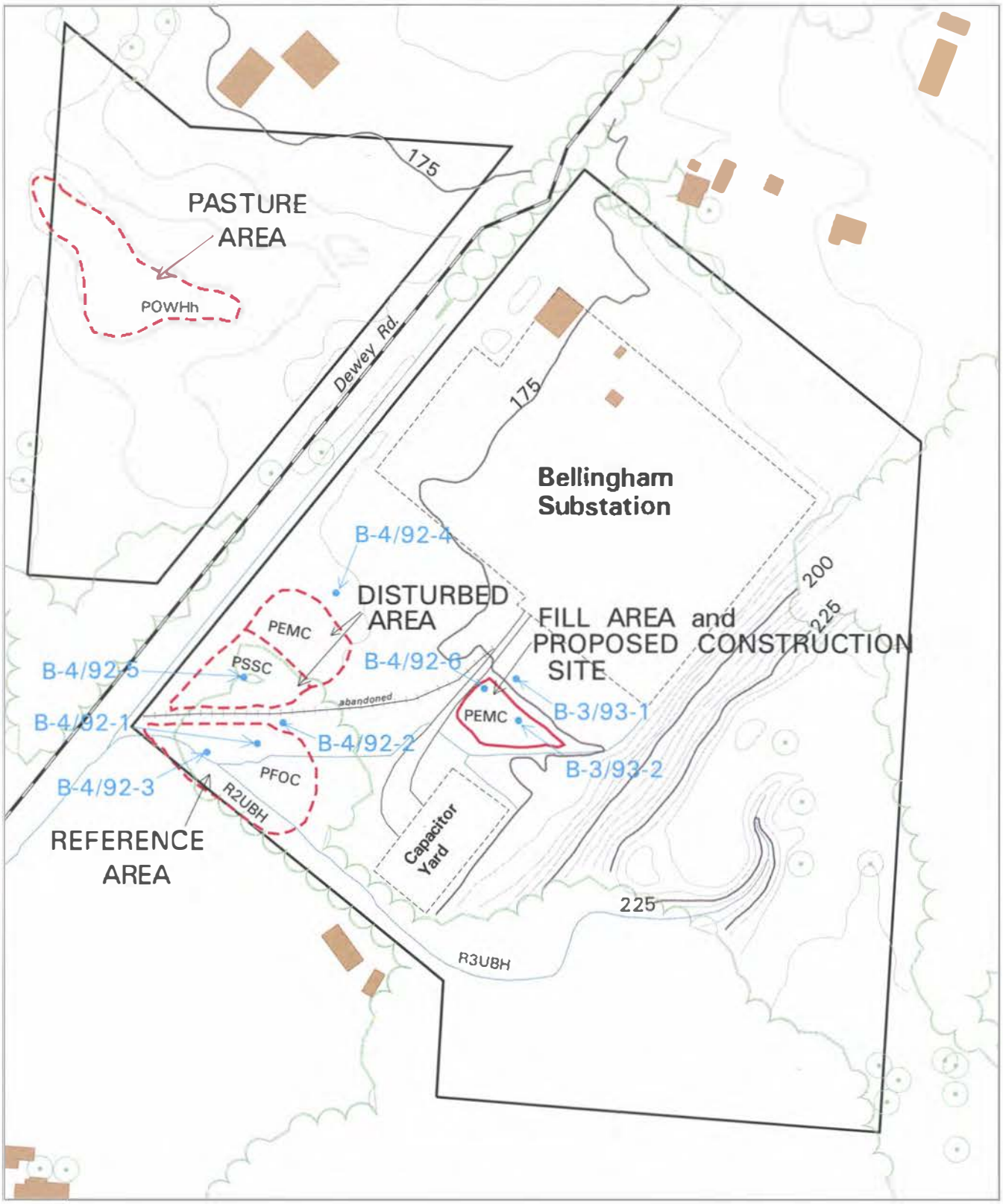
Bellingham Substation Site

Source: BPA Regional Geographic Database, Division of Facilities Engineering.

KILOMETERS 0 1 2 3

MILES 0 1 2 3

Figure 1




## BELLINGHAM SUBSTATION - WETLANDS

*Sample location*
*Wetland Boundary*
*Estimated Wetland*
*Treeline*
*Substation Pad and Capacitor Yard*
*Single Tree*
*Building*

SCALE 1:2400
One inch = 200 feet
One cm = 24 meters
Contour Interval 5 ft. (1.5 m)

Source: BPA Regional Geographic Database
Division of Facilities Engineering.

Figure 2

**Vegetation**

Vegetation here is dominated by grasses and forbs with sparse clumps of shrubs and sapling black cottonwoods. The placement of fill and subsequent ditching has shaped the terrain and vegetation. The northeast fork of the drainage ditch is lined with soft rush. The southeast fork of the ditch is covered with sapling black cottonwood (*Populus trichocarpa*, FAC) and represents less than 2% of the total vegetation cover in this area. These drainage forks join near the western edge of the wetland and continue to flow toward the lower western corner of the property. The ditch is the boundary between the upland community to the south and the wetland community to the north. The upland community is represented by quakegrass (*Agropyron repens* FACU) and colonial bentgrass (*Agrostis tenuis* FAC), and Canada thistle (*Cirsium arvense* FACU). The wetland community is represented by velvet grass (*Holcus lanatus* FAC), soft rush (*Juncus effusus* FACW), and other sedges: pointed broom (*Carex scoparia* FACW) and dense sedge (*Carex densa [sp]* OBL). These rushes and sedges are growing in about 8 to 15 cm (3 to 6-in.) of standing water. Sample point B-3/93-1 is in the upland community; sample points B-4/92-6 and B-3/93-2 are in the wetland community. On the northern edge of the wetland area, a 3-m (10-ft.) diameter mound contains upland shrubs, snowberry (*Symphoricarpos albus* FACU) and osoberry (*Oemlaria cerasiformis* NOL). These upland species represent less than 7% of the vegetation cover in the wetland area.

**Hydrology**

Hydrology is influenced by three systems: 1) precipitation and surface runoff, 2) de-watering at the base of the eastern slope and 3) remnant flow of the diverted stream. The forked drainage ditch in the Construction Area flows generally from east to west. Storm water runoff from the substation yard and the capacitor yard flows into the ditch. De-watering at the base of the slope, as well as surface flow not confined in the channelized stream from the south, also enter the ditch. The water then flows through a culvert beneath the maintenance road into the forested wetland of the Reference Area. Standing water 8 to 15 cm (3 to 6-in.) deep was observed near sampling point B-4/92-6 in April 1992 and in March 1993.

**Soils**

Soils with low chromas (10YR 3/2) and mottling (10YR 5/8) were observed in pit B-4/92-6. At sampling point B-3/93-2, silty clay sampled immediately below the A horizon at 18 cm (7 in.) has a chroma of 2.5YR 2/0. At upland sampling point B-3/93-1, gravely silt sampled at 25 cm (10 in.) has a chroma of 10YR 4/3.

**Determination**

This wetland area is generally defined by the drainage ditch, the embankment and the maintenance road. The wetland boundary has been determined and flagged and equals 0.10 ha (0.24 ac.); Cowardin Classification is PEMC.

**REFERENCE AREA**

A forested wetland was observed in the west corner of the property. Because tree sizes here appear to be 30 to 50 years old, this area is mapped as the Reference Area (soil sample pits B-4/92-1, B-4/92-2 , B-4/92-3). Vegetation is primarily black cottonwoods, western red cedar, black twinberry, creeping buttercup, and grasses. This site was visited in April 1992, when

sampling points were chosen. The site was visited again in March 1993; no new sampling was undertaken.

**Vegetation**

The wetland plant community is dominated by species with an indicator status of FACW to FAC in three strata. The dominate species in the tree layer, which covers approximately 60% of the surface, are black cottonwood (*Populus trichocarpa*, FAC), red alder (*Alnus rubra* FAC) and western red cedar (*Thuja plicata* FAC). Some of the cottonwoods are 51 cm + (20 in.) dbh which may indicate an age of 30 to 50 years. The red alders are generally 13-20 cm (5-8 in.) dbh. and the western red cedar are 15-25 cm (6-10 in.) dbh. The sapling layer which covers about 40% of the surface, is dominated by salmonberry (*Rubus spectabilis* FAC), Douglas spiraea (*Spiraea douglasii* FACW) and black twinberry (*Lonicera involucrata* FAC). The herb layer covers about 75% of the surface and is dominated by reed canary grass (*Phalaris arundinacea* FACW), creeping buttercup (*Ranunculus repens* FACW), and velvet grass (*Holcus lanatus* FAC). This wetland vegetation is generally defined by the intergrading of upland vegetation that parallels the railroad spur: primarily osoberry (*Oemlaria cerasiformis* NOL), sword fern (*Polystichum munitum* NOL), and vine maple (*Acer circinatum* FACU). Dominant vegetation in the Reference Area is characteristic of a forested wetland.

**Hydrology**

Surface hydrology to this area is a combination of a low gradient stream flowing along the south boundary of the substation property and the drainage ditch from the substation and capacitor yard. The stream begins above the east valley wall of the outwash channel. It flows along the south side of the property where the gradient is reduced. The stream bed widens and joins a forested wetland area. This wetland is in the west corner of the property adjacent to stream. Two pits (B-4/92-1 and B-4/92-3) in the wetland area showed that free water was at 20 and 10 cm (8 and 4 in.) below the surface. Inundation, as well as surface saturation occur in this corner.

**Soils**

Whatcom silt loam is mapped for this area. It is not on the hydric soils list; however, soils with low chromas (10YR 3/1) were observed in two pits B-4/92-1 and B-4/92-3, with free water encountered at 20 and 10 cm (8 and 4 in.) depth. Upland soil horizons were indistinct and had a surface duff layer of 5 cm (2 in.). No colors were noted.

**Determination**

The initial site visit indicates that wetland criteria are satisfied in this area and if delineated may be equal to 0.3 ha (0.8 ac.); Cowardin Classification-PFOF/R3UBH.

**DISTURBED AREA**

A third area was identified immediately north of the Reference Area and across the railroad spur. This wetland area is generally defined by the railroad spur to the south, edge of the fill to the north, and Dewey Road to the west. Vegetation here is composed of Douglas' spiraea, snowberry, soft rush, and reed canary grass. This is mapped as the Disturbed Area. Sample points are B-4/92-4 and B-4/92-5. Casual observations were made at this site in April 1992,and again in March 1993.

**Vegetation**

Two plant communities are present. A dense shrub area adjacent to Dewey Rd., covering 40% of the total area, is dominated by Douglas spiraea (*Spiraea douglasii* FACW) and black twinberry (*Lonicera involucrata* FAC), with some trees dominated by black cottonwood.An adjacent herb layer occupying 60% of the total cover is dominated by reed canary grass (*Phalaris arundinacea* FACW) and soft rush (*Juncus effusus* FACW).

**Hydrology**

Hydrology appears to be connected to the hydrology of the Reference Area to the south. In one location (B-4/92-5), rounded gravels and cobbles near the surface may indicate the prior position of the now diverted stream channel. Saturation in the upper 31 cm (12 in.) was observed in both sampling areas, with free water at a depth of 15 cm (6 in.) (B-4/92-5) and 31 cm (12 in.) (B-4/92-4).

**Soils**

Sampling points in this area are B-4/92-4 and B-4/92-5. Soil samples with low chromas (10YR 3/1 and 5YR 5/1) were observed in these pits. Sampling point B-4/92-5 also exhibited a faint sulfur odor. Both low soil chromas and sulfidic odor are hydric soil indicators.

**Determination**

This area was altered during the construction of both the railroad spur and the substation in the early 50's. The site apparently continues to be influenced by the hydrology of the Reference Area to the south. It is at the same topographic elevation and landscape position as the Reference Area. Casual observation indicates that the wetland criteria are satisfied and if delineated may equal 0.3 ha (0.8 ac.) (0.2 ha (0.5 ac.) PSSC, and 0.1 ha (0.3 ac.) PEMC).

**PASTURE AREA**

West of Dewey Road, on property owned by BPA, a fourth wetland area was identified from aerial photos and nearby observations. A water-filled, closed depression in the pasture that outlines the location of the previously mapped tributary to Squalicum Creek was observed. This area is inundated, and it is mapped on the NWI as POWHh. Most of the adjacent vegetation has been removed by grazing except for some clumps of soft rush. If delineated it may equal 0.6 ha (1.4 ac.); Cowardin Classification-PEMC.

## CONCLUSION

Four wetland areas in the valley portion of this BPA site were identified, they are: 1)Construction Area with 0 10 ha (0.24 ac.) PEMC, 2)Reference Area with 0.3 ha (0.8 ac.) PFOF, 3)Disturbed Area with 0.3 ha (0.8 ac.) PEMC, 4)Pasture Area with 0.6 (1.4 ac.) PEMC.

Staff includes Chris Thoms, Phil Smith, Nancy Weintraub
Report submitted by Chris Thoms, Wetland Specialist, US&A Contract to BPA

## REFERENCES


Cowardin, Lewis M. 1979, US Fish and Wildlife, Classification of Wetlands and Deepwater Habitats of the United States, FWS/OBS-79/31.

Dennis, Helen M., Gilkey, LaRea J., 1980, Handbook of Northwestern Plants, Oregon State University Bookstores, Inc.

Detling, LeRoy R., 1968, Historical Background of the Flora of the Pacific Northwest, Bulletin #13, Museum of Natural History, University of Oregon.

Environmental Laboratory, 1987, Corps of Engineers Wetlands Delineation Manual, Tech. Report Y-87-1.

Federal Interagency Committee for Wetland Delineation, 1989, Federal Manual for Identifying and Delineating Jurisdictional Wetlands, US Army Corps of Engineers, US Environmental Protection Agency, US Fish and Wildlife Service, and USDA Soil Conservation Service,.

Franklin, Jerry K., Dyrness, C.T., 1969, Vegetation of Oregon and Washington, USDA Forest Service Research Paper PNW-80.

Hitchcock, A.S., Chase, Agnes, 1971, Manual of the Grasses of the United States, Dover Publications.

Hitchcock C. Leo, Cronquist, Arthur, 1973, Flora of the Pacific Northwest, University of Washington Press.

Reed, Porter B. Jr., May 1988, National List of Plants Species that Occur in Wetlands: Northwest (Region 9), Fish and Wildlife Service, Biological Report 88(26.9).

Sudworth, George B., 1967, Forest Trees of the Pacific Slope, Dover Publications.

US Fish and Wildlife Service, National Wetland Inventory quadrangle, Bellingham North. 1980.

USDA Soil Conservation Service, May 1992, Soil Survey of Whatcom County, Washington

USGS 7.5 min. quad., Bellingham North, Wash., 1954, photorevised 1972.

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

| | |
|---|---|
| Project/Site: Bellingham Substation<br>Applicant/Owner: BPA<br>Investigator: Chris Thoms / Phil Smith | Date: 3/30/93<br>County: Whatcom<br>State: WA |
| Do Normal Circumstances exist on the site? (Yes) No<br>Is the site significantly disturbed (Atypical Situation)? Yes (No)<br>Is the area a potential Problem Area? (Yes) No<br>(If needed, explain on reverse.) Seasonal | Community ID: B-393-2<br>~~Transect ID:~~ FILL<br>~~Plot ID:~~ WL |

## VEGETATION

| Dominant Plant Species (15 diam) | Stratum | Indicator | Dominant Plant Species | Stratum | Indicator |
|---|---|---|---|---|---|
| 1. Juncus effusus (30%) | H | FACW | 9. | | |
| 2. Carex scoparia (15%) | H | FACW | 10. | | |
| 3. Agrostis tenuis (10%) | H | FAC | 11. | | |
| 4. Spiraea douglasii (10%) | S | FACW | 12. | | |
| 5. | | | 13. | | |
| 6. | | | 14. | | |
| 7. | | | 15. | | |
| 8. | | | 16. | | |

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks:
More than 50% dominant spec are FAC to FACW.

## HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other

✓ No Recorded Data Available

Field Observations:

Depth of Surface Water: 2-3 (in.)

Depth to Free Water in Pit: ___ (in.)

Depth to Saturated Soil: ___ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: historic data, aerial photos indicate ponding and vegetation

## SOILS

Map Unit Name (Series and Phase): Whatcom silt loam 3-8% slope

Drainage Class: MW

Field Observations Confirm Mapped Type? Yes (No)

Taxonomy (Subgroup): Aquolfic Haplorthod

Profile Description:

| Depth (inches) | Horizon | Matrix Color (Munsell Moist) | Mottle Colors (Munsell Moist) | Mottle Abundance/Contrast | Texture, Concretions, Structure, etc. |
|---|---|---|---|---|---|
| 0-7 | A | 5Y 2.5/2 | | | SICL - SIL, SAB |
| 7-12 | Bt | 2.5Y 2/0 | | | SICL, SAB |
| 12-13 | Bt2 | 2.5Y 2/0 | | | SICL |
| 13-18 | Bt3 | 2.5Y 2/0 | 7.5YR 5/8 | common, fine, distinct | SIC |
| | | | | | |
| | | | | | |

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- X Sulfidic Odor
- X Aquic Moisture Regime
- ___ Reducing Conditions
- X Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks:

## WETLAND DETERMINATION

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | (Yes) No | (Circle) |
| Wetland Hydrology Present? | (Yes) No | |
| Hydric Soils Present? | (Yes) No | |

(Circle)

Is this Sampling Point Within a Wetland? (Yes) No

Remarks: All three parameters have positive indicators..

Approved by HQUSACE 3/92

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

| | |
|---|---|
| Project/Site: Bellinghan Substation<br>Applicant/Owner: BPA<br>Investigator: Chris Thoms / Phil Smith | Date: 3/30/93<br>County: Whatcom Co<br>State: WA |
| Do Normal Circumstances exist on the site? (Yes) No<br>Is the site significantly disturbed (Atypical Situation)? Yes (No)<br>Is the area a potential Problem Area? (Seasonal) (Yes) ~~No~~<br>(If needed, explain on reverse.) | Community ID: 3/93-1<br>Transect ID: FILL<br>Plot ID: UPLAND |

## VEGETATION

| Dominant Plant Species (15 dom) | Stratum | Indicator | Dominant Plant Species | Stratum | Indicator |
|---|---|---|---|---|---|
| 1. Agropyron repens (30%) | H | FACU | 9. | | |
| 2. Cirsium arvense (17%) | H | FACU | 10. | | |
| 3. Tanacetum vulgare (15%) | H | NOL | 11. | | |
| 4. Holcus lanatus (25%) | H | FAC | 12. | | |
| 5. Agrostis tenuis (20%) | H | FAC | 13. | | |
| 6. | | | 14. | | |
| 7. | | | 15. | | |
| 8. | | | 16. | | |

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 40%

Remarks: Dominant species are not hydrophytic. less than 50% FAC-OBL

## HYDROLOGY

✓ Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ___ Aerial Photographs
- ___ Other
- ___ No Recorded Data Available

Field Observations:

Depth of Surface Water: _____ (in.)

Depth to Free Water in Pit: >21 feet ~~(in.)~~

Depth to Saturated Soil: _____ (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: No primary indicator of wetland hydrology. Historical Recorded data indicates prior location of wetlands near this site. Aerial photos indicate ditches and vegetation

## SOILS

Map Unit Name (Series and Phase): Watcom silt loam 3-8% slope Drainage Class: MW

Taxonomy (Subgroup): Aqualfic Haplorthod Field Observations Confirm Mapped Type? Yes (No)

Profile Description:

| Depth (inches) | Horizon | Matrix Color (Munsell Moist) | Mottle Colors (Munsell Moist) | Mottle Abundance/Contrast | Texture, Concretions, Structure, etc. |
|---|---|---|---|---|---|
| 0-17 | A | 10YR 4/4 | | | gsil, SAB |
| 17-24 | C | 10YR 4/3 | | | sil, sicl, SAB |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Site is on fill w/ little development evident.

## WETLAND DETERMINATION

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes (No) (Circle) | |
| Wetland Hydrology Present? | Yes (No) | |
| Hydric Soils Present? | Yes (No) | |
| Is this Sampling Point Within a Wetland? | (Circle) Yes (No) | |

Remarks:

All parameters not met. ~~[illegible]~~ Plant communities not wetland

Approved by HQUSACE 3/92

# APPENDIX E
# BIOLOGICAL ASSESSMENT AND CONCURRENCE

# BIOLOGICAL ASSESSMENT

## THREATENED AND ENDANGERED SPECIES

POTENTIAL IMPACTS OF THE NORTHWEST WASHINGTON TRANSMISSION PROJECT
WHATCOM AND SKAGIT COUNTIES, WASHINGTON

Prepared for:

Bonneville Power Administration
P.O. Box 3621 - EFBG
Portland, Oregon 97208-3621

Prepared by:

Rodney W. Krahmer
Wildlife Biologist
Utility Systems and Applications, Inc.
4160 SE International Way, Suite D-107
Portland, Oregon 97222

## 1.0 INTRODUCTION

Federal agencies, in consultation with the U.S. Fish and Wildlife Service (USFWS), are required to ensure that any action they authorize, fund, or carry out will not adversely affect a Federally listed threatened or endangered species. A Biological Assessment is required if Federal actions of major construction activities potentially may affect Federally listed species or critical habitat. In a letter dated 26 June 1992, the USFWS listed the bald eagle (*Haliaeetus leucocephalus*) and marbled murrelet (*Brachyramphus marmoratus*) as threatened or endangered species that may occur in the proposed project area. At the time of this letter, the marbled murrelet was identified as a proposed threatened or endangered species that may occur in the vicinity of the project. The USFWS was petitioned in 1988 to list the marbled murrelet as threatened in California, Oregon, and Washington. An official decision to list the marbled murrelet as "threatened" in these states was issued by the USFWS in September 1992.

This Biological Assessment has been prepared to determine potential impacts on the threatened bald eagle and marbled murrelet, and to assist the Bonneville Power Administration (BPA) in complying with Section 7 of the Endangered Species Act of 1973 (as amended). Section 7 requires consultation by an agency with the USFWS to ensure that a Federal action "is not likely to jeopardize the continued existence of an threatened or endangered species or result in destruction or adverse modification of habitat of such species which is determined to be critical."

## 2.0 PROJECT DESCRIPTION

The BPA and Puget Sound Power & Light (Puget Power) are proposing a joint project to reinforce the existing electric transmission system in northwest Washington, primarily near the towns of Bellingham and Sedro Woolley (Figure 4 in the EIS). The project is proposed to improve the reliability of the service to the local area, and increase to greater potential capacity the nearby existing Canadian-United States Intertie line, so that more power can be available in the future.

The BPA would rebuild its existing 21-kilometer (km) (13-mile) line between the BPA Bellingham Substation on Dewey Road and its Custer Substation northwest of the City of Bellingham. Instead of being single-circuit (three-wire) 230,000-volt (230-kV), the line would be rebuilt as either a double-circuit (six-wire) 230-kV line or a double-circuit 500-kV line (to be operated at 230-kV or 500-kV). The BPA would likewise rebuild its existing 40-km (25-mile) single-circuit line between Bellingham and Puget Power's Sedro Woolley Substation to the south. There is a route alternative on this section of the rebuild. In section 31, T37N, R5E, BPA could have the new line follow the H1 dogleg to the east created by one of the existing 500-kV lines. The H1 alternative rejoins the main corridor in section 19, T36N, R5E. For this route alternative, BPA would need to acquire more right-of-way adjacent to the existing line. For the other parts of this rebuild, the

actions would take place primarily within the existing corridor, with only very small pieces of parcels needed at two or three locations for Option 3.

The existing lines are presently suspended from H-frame wood poles which are 20-26 meters (m) (65-85 feet) tall. The rebuilt lines would be suspended from lattice steel structures about 38 m (125 feet) tall for 230-kV construction or 55 m (180 feet) tall for 500-kV construction. The distance between structures (the "span") now is between 137-213 m (450 and 700 feet). The distance between the new structures would average about 350 m (1150 feet), and for most of the project would be lined up with existing steel lattice structures already on the right-of-way. The BPA would also expand its Bellingham Substation to add new equipment, and would add 230-kV line terminals at its Custer Substation. Construction is anticipated to begin in Spring 1996, with energization occurring in October 1996.

Puget Power is proposing to rebuild their existing 115-kV line between their Bellingham Substation on Virginia Street and the BPA Bellingham Substation on Dewey Road, a distance of about 6.9 km (4.3 miles) (Figure 7 in the EIS). This rebuild has a route alternative starting at the intersection of Sunset Drive and St. Clair Street. From this point, the line could be relocated to continue in a northerly direction from St. Clair Street, intersecting with the abandoned Chicago Milwaukee Railroad right-of-way and following that to the northeast until it rejoins the existing transmission line corridor at Dewey Road. Puget Power would replace existing conductors (wires) with higher-capacity wires and replace poles and insulators. The line would still operate at 115 kV. The insulators would be longer. The wood poles would be up to 4.5 m (15 feet) taller, and would be placed almost exactly where the old ones are taken out.

Puget Power is also proposing to build about 2 km (1.3 miles) of new 115-kV line southeast from the BPA Bellingham Substation. This new construction would loop an existing line into and out of the substation. Finally, Puget Power would add 115-kV line terminals at its existing Bellingham Substation, and 230-kV line terminals (dead-end line structure plus equipment to receive the line and the power it carries) at its Sedro Woolley Substation (Figure 11 in the EIS). Construction of Puget Power's project is also anticipated to begin in Spring 1996, with energization occurring in October 1996.

## 3.0 METHODS

The methods used to conduct this assessment consisted of literature review, consultations with Federal and State Biologists (USFWS, Washington Department of Wildlife [WDW]), site visits, and review of maps and aerial photographs. The WDW's Nongame Data Systems was also consulted to identify the locations of priority habitats and species that occurred within the Northwest Washington Transmission Project study area. Detailed and/or systematic surveys of the proposed project area were not completed. Because exact design specifications for the proposed Northwest Washington Transmission Project have not been finalized, a worst-case analysis was used for this assessment.

## 4.0 SPECIES ACCOUNTS

### 4.1 BALD EAGLE

**STATUS.** The bald eagle is Federally listed as endangered in 43 of the 48 conterminous United States. The species is Federally listed as threatened within the states of Washington, Oregon, Minnesota, Wisconsin, and Michigan. In addition to the listing under the Endangered Species Act, bald eagles are also protected under the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act in all states, including Alaska.

Bald eagles are scavengers and predators that are primarily adapted to aquatic habitats, usually near sea coasts, lakes, reservoirs, or large streams (Stalmaster et al. 1985). Bald eagles are highly opportunistic, and feed on a great variety of fish, waterfowl, seabirds, and mammals taken alive or as carrion (Stalmaster et al. 1985).

The bald eagle's breeding range formerly included most of the continent. However, during the 19th and 20th centuries, the bald eagle breeding range diminished, and the species disappeared from many parts of its range. These declines were attributed to loss of habitat; human disturbance of nests, roosts, and perches; pesticide and lead contamination of prey, resulting in thinning egg shells and reduced reproductive success; illegal shooting, poisoning, and trapping; and electrocution (USFWS 1986).

**PRESENCE IN THE STUDY AREA.** The largest nesting population of bald eagles in the seven-state Pacific recovery area is in Washington (USFWS 1986). The bald eagle population in Washington continues to improve. The number of occupied breeding territories has increased approximately 288% from 1975 to 1989 (Bald Eagle Working Team for Oregon and Washington 1990), and surveys conducted in 1991 revealed a total of 444 occupied nests in the State (WDW 1991). Most nesting habitat in Washington is located in the San Juan Islands and on the Olympic Peninsula coastline (Grubb 1976). Fewer nesting territories are found along Hood Canal, on the Katsop Peninsula, in Island County, and in southwestern Washington (USFWS 1986). Washington also consistently has the most wintering eagles in the recovery area, with 1126 to 1624 individuals counted in the early- to mid-1980's (Knight et al. 1980, Dobler and Dobler 1982, McAllister 1984). Most eagles wintering in Washington are found along the Skagit, Nooksack, and Sauk River systems, in the Puget Trough, on the Olympic Peninsula, and in the Columbia Basin (USFWS 1986).

Breeding/nesting and wintering bald eagles are known to occur in the project area (USFWS 1992, Stendel 1992). Three bald eagle nest sites are located on the southeast shore of Lake Whatcom (Stendel 1992). All of these nests were documented as active in 1991 (Stendel 1992). The closest nest would be about 800 m (0.5 miles) from the proposed project; the other two are located about 1.6 km (1.0 miles) from the proposed project, respectively. None of the nests would have line-of-sight vision to the proposed project. Nesting activities in the area typically occur from 1 January through 15 August

(USFWS 1992). Wintering bald eagles may also occur in the vicinity of the project from about 31 October through 31 March (USFWS 1992). Wintering concentrations of eagles are known to occur in the Nooksack and Skagit River systems; however, none of these concentration areas are expected to be affected by the proposed project. The closest wintering bald eagle concentration areas are located about 5.6 km (3.5 miles) and 7.4 km (4.6 miles) from the proposed project (WDW Nongame Data Systems 1992). No communal roosts would be affected (WDW Nongame Data Systems 1992).

**IMPACT ANALYSIS.** The potential for impact was considered in four areas: 1) habitat alteration; 2) potential for disturbance of breeding/nesting individuals and wintering populations; 3) collision potential with the conducting wires and overhead groundwires; and 4) electrocution potential.

Habitat Alteration

Suitable nesting habitat is essential for successful reproduction in bald eagle populations. Extensive research has been conducted to determine elements of eagle nesting habitat (Anthony et al. 1982, Grubb 1980). This research has shown that nesting eagles exhibit a strong preference for large, dominant or co-dominant trees in a heterogeneous stand of mature or old-growth coniferous timber. Eagles also spend a large portion of the day perching in trees. Studies have shown that wintering eagles perch more than 90% of the daylight hours (Stalmaster 1981). Perching sites are typically closely associated with water and local food sources. On the Skagit River in Washington, 87% of all wintering eagles were observed to perch within 25 m (82 feet) of the river (Hunt et al. 1980). Eagles usually perch in the tallest trees or snags on the edge of forest stands and select strong, lateral branches high in the crown (Stalmaster and Newman 1979).

The proposed project would not significantly affect any important habitats used by nesting or wintering eagles. Most of the construction activities associated with the proposed project would be restricted to existing electric transmission line rights-of-way. Vegetation occurring within much of the existing right-of-way is dominated by regenerating trees and shrubs, and other common "weedy" species such as Himalayan blackberry (*Rubus discolor*), thistle (*Cirsium* sp.), common mullein (*Verbascum thapsus*), fireweed (*Epilobium angustifolium*), mustards (*Brassica* sp.), ragworts (*Senecio* sp.), asters (*Compositae* sp.), and various grasses (*Graminae* sp.). These areas would not be considered essential perching, roosting, foraging, and/or nesting habitats.

Additional clearing of forest lands adjacent to the existing transmission line corridor would be required in selected locations to provide adequate electrical clearance for operation, and to keep the "new" line in good running order. Collectively, over the entire 61-km (38-mile) length of the proposed project, about 49 hectares (ha) (122 acres) of forest lands would be affected. About 5.7 km (3.5 miles) of new right-of-way might also be required to complete the proposed project if the **H1** route alternative were selected (see Figure 4). The proposed **H1** corridor would be about 34 m (112 feet) wide, and would cross forest lands influenced to varying degrees by previous timber harvesting activities. About 34 ha

(84 acres) of forest land would be affected by the H1 alsternative. All of these forest lands are characterized by trees of similar age and size classes characteristic of second- and third-growth timber. The mean diameter breast height (DBH) of these stands is probably less than 38 cm (15 inches). Habitat structure and function associated with these second- and third-growth timber stands is typically homogeneous, often lacking the large, dominant or co-dominant trees and/or snags characteristic of more heterogeneous stands of mature or old-growth coniferous timber which are preferred by nesting, roosting, and perching eagles (Anthony et al. 1982, Grubb 1980).

Potential foraging areas are associated with the Nooksack River, Samish River, Skagit River, and Lake Whatcom; all of these waterways provide opportunities for preying upon fish. Construction activities associated with the proposed project would not adversely affect primary food stocks (fish) of eagles in the area. Habitat alterations associated with construction activities would not replace any permanent open-water fish habitats, and sedimentation into existing waterways is expected to be minimal. Erosion and sediment control measures would be implemented at all creek and/or river crossings.

Disturbance

Steenhoff (1978) provided a literature review of human disturbance of bald eagles. Stalmaster (1976) and Stalmaster and Newman (1978) quantified disturbance factors for wintering bald eagles. These reports indicate that human activity can cause eagles to abandon favorable use areas; in some cases, such activity can also cause reproductive failure. In spite of this, many eagles nest and winter near human population centers. Many types of human disturbances, at the right distances, are compatible with eagles (USFWS 1986).

Disturbance will not be a factor affecting nesting or wintering bald eagles in the proposed project area. Although construction activities would be scheduled to occur between spring and fall (considered part of the critical nesting period), all such activities would occur between 800-1600 m (0.5-1.0 miles) from any known bald eagle nest site in the area. These distances are significantly greater than protection zone requirements recommended by the USFWS for restricting human disturbance at eagle use areas. The USFWS (1986) recommends that logging, construction, habitat improvement, and other activities should not be allowed within 400 m (about 0.25 miles) of nests and roosts during periods of eagle use, and that these activities should be further regulated up to 800 m (about 0.5 miles) from nests and roosts where eagles have line-of-sight vision to these activities. None of the eagle nests known to occur in the proposed project area would have line-of-sight vision to construction activities. Because all activities associated with construction of the proposed project would occur between spring and fall, disturbance-related impacts to wintering bald eagles in the project area would be eliminated.

Collision Potential

Bald eagles, like any bird, are susceptible to collisions with transmission lines. However, there are a number of reasons why raptors are not likely to collide with power lines (Kroodsma 1978, Olendorff and Lehman 1986):

- Raptors have keen eyesight.
- Many raptors soar or use relatively slow flapping flight.
- Raptors, in general, are maneuverable while in flight.
- Raptors learn to use utility poles and structures as hunting perches and as nest sites, and certainly must, as a result, become conditioned to the presence of the lines.
- Raptors, unlike waterfowl, do not fly in V-formation when in groups, with their position and altitude determined by other birds of the flock.

A report prepared for the Northern States Power Company concluded there was no apparent evidence that power lines pose a collision hazard to bald eagles (Pinkowski 1977). The report was based on literature review and personal interviews. Olendorff and Lehman (1986) state that it is unlikely that bald eagle populations would be affected by collisions with any transmission line because all available data indicate that transmission lines have no discernible effect on the population dynamics of raptors, including bald eagles. Steenhoff (1978) indicated that collision potential would be greatest near roost sites. She believed that transmission lines should not be constructed within 1.6 km (1.0 mile) of communal roosts because eagles use these areas during strong winds and poor light conditions, when the potential for impacts is high. There is no evidence of communal roost sites located within 1.6 km of the proposed project (WDW Nongame Data Systems 1992). Data on mortality of other bird species (primarily waterfowl) from collision with transmission lines also indicates that collision mortality is relatively small (Meyer 1978, James and Haak 1979).

Based upon the evidence above, collision potential with the transmission lines/structures in the proposed project is believed to be low. Nevertheless, the BPA would place visual marker balls on wires and overhead ground wires which cross the Nooksack River and Samish River wetland/riparian area to reduce potential collision hazards further.

Electrocution Potential

Electrocution of eagles can be a problem on distribution lines where the wing can contact two conductors or a conductor and a groundwire (Miller et al. 1975, Nelson and Nelson 1976). However, it is not a problem on high-voltage transmission lines with more widely spaced conductors. Olendorff et al. (1981) stated that a separation of about 1.5 meters (5 feet) between transmission line wires will protect raptors (including bald eagles) from

electrocution. The separation of greater than 4.6 meters (15 feet) between wires would protect bald eagles from electrocution from proposed project facilities.

### 4.2 MARBLED MURRELET

**STATUS.** The USFWS was petitioned in 1988 to list the marbled murrelet as threatened in California, Oregon, and Washington. A final decision to list the marbled murrelet as "threatened" in these states was made by the USFWS in 1992.

The marbled murrelet is a small, robin-sized seabird inhabiting shallow coastal areas from the Aleutian Islands of Alaska, south to central California. The marbled murrelet typically occurs within 2 km (1.3 miles) of shore (Marshall 1988), but may range as far as 75 km (49 miles) inland (Carter 1984, Sealy and Carter 1984, Hamer and Cummins 1991). At sea, the marbled murrelet dives for food and consumes mostly small fish and various crustaceans (DeGraaf et al. 1991). Recently, an increasing amount of information has indicated that these marine birds are strongly associated with mature and old growth coniferous forest during their breeding season for nesting and, to some extent, for possible roosting during summer and winter in forested portions of their range (Sander and Carter 1988, Marshall 1988, Nelson and Meslow 1989, Hamer and Cummins 1991). To date, the marbled murrelet's breeding ecology and inland habitat requirements are among the most poorly understood of any bird.

The North American subspecies of the marbled murrelet occurs in summer from Alaska's Kenai Peninsula and Aleutian Islands, south along the coast of North America to south-central California (Marshall 1988). It winters mostly within the same general area, except that it tends to vacate the most northern sections of its range (Marshall 1988). Even before the first tree nest of the marbled murrelet became known to North American researchers in 1974, ornithologists expressed concern for this species' welfare. The focus of concern for the species is loss of their breeding habitat by the logging of old growth, and its replacement by young forest stands (Pacific Seabird Group 1987, Marshall 1988). Mortality from gill-net fisheries has also been significant at least in some parts of the birds range, and the marbled murrelet has a very high oil pollution susceptibility rating (Pacific Seabird Group 1987). Because of these concerns, there has been an accelerated research and survey effort. Alaska is the major center of marbled murrelet populations in North America (Mendenhall and McAllister 1988), with significantly lesser populations occurring in British Columbia (Sealy and Carter 1984), Washington (Manual et al. 1979; Wahl and Speich 1984), Oregon (Nelson et al. 1988, Varoujean and Williams 1989), and California (Sowls et al. 1980).

**PRESENCE IN THE STUDY AREA.** Broad-scale at-sea censuses were first conducted in the late 1970's and early 1980's (Manual et al. 1979; Wahl and Speich 1983). Analysis of these surveys estimated Washington's marbled murrelet breeding population at 1,900-3,500 pairs. Although the USFWS (1992) has found that nesting murrelets may occur in the vicinity of the project, the WDW has no documented evidence of murrelets occurring within the proposed project study area (Stendel 1992, WDW Nongame Data Systems

1992). The closest known marbled murrelet nesting areas are located near the town of Verlot about 50 km (31 miles) southeast of the proposed project, and in the Olympic National Forest located about 115 km (72 miles) southwest (Hamer and Cummins 1991).

**IMPACT ANALYSIS.** The potential for impact was considered in four areas: 1) habitat alteration; 2) potential for disturbance to marbled murrelet breeding and foraging areas; 3) collision potential with the conducting wires and overhead groundwires; and 4) electrocution potential.

Habitat Alteration

Marbled murrelet nesting habitat is largely associated with mature, old growth coniferous forests located within about 60 km (73.5 miles) of the Pacific coast (Marshall 1988; Hamer and Cummins 1991). In general, an old-growth stand receiving high use by murrelets in the North Cascades of western Washington may be characterized by having at least a 73% composition of Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*), and western red cedar (*Thuja plicata*) with a DBH of 134 cm (about 53 inches), and an abundance of large limbs and platforms (Hamer and Cummins 1991). These stands are typically located less than 900 m (about 2,953 feet) in elevation and occur on slopes with an east or northeast aspect (Cummins and Hamer 1991).

The proposed project would not significantly affect any important habitats used by marbled murrelets. Most of the construction activities associated with the proposed project would be restricted to existing right-of-way. Vegetation occurring within much of this area is dominated by regenerating trees and shrubs, and other common "weedy" species such as Himalayan blackberry, common mullein, fireweed, thistle, mustards, ragworts, asters, and various grasses. None of these areas would be considered essential perching, roosting, foraging, and/or nesting habitats for marbled murrelets. Furthermore, no old-growth forest habitats which could be potential marbled murrelet nesting areas have been identified in the vicinity of the proposed project (WDW Nongame Data Systems 1992).

Additional clearing of forest lands next to the existing corridor would be required in selected locations to provide adequate electrical clearance for operation, and to keep the "new" line in good running order. Collectively, over the entire 61-km (38-mile) length of the proposed project, about 49 ha (122 acres) of forest lands would be affected. For the $H_1$ route alternative, about 5.7 km (3.5 miles) of new right-of-way may also be required to complete the proposed project. The proposed H1 corridor would be about 34 m (112 feet) wide, and would cross forest lands influenced to varying degrees by previous timber harvesting activities. About 34 ha (84 acres) of forest land would be affected by the $H_1$ corridor. All of these forest lands are characterized by trees of similar age and size classes representative of second- and third-growth timber. The average DBH of these stands is probably less than 38 cm (15 inches). Habitat structure and function associated with these second- and third-growth timber stands is typically homogeneous, often lacking large trees

with large limbs and platforms typically associated with mature or old-growth coniferous forests which are preferred by nesting marbled murrelets (Hamer and Cummins 1991).

No potential foraging areas would be affected by the proposed project because no saltwater habitats would be affected. Marbled murrelets typically forage upon small fish and invertebrates in saltwater habitats (Marshall 1988).

Disturbance

Because marbled murrelets spend most of their life cycle at sea, disturbance-related impacts of the proposed project would be primarily restricted to the critical nesting period when the birds search out and make use of mature, old-growth forest habitats. However, no marbled murrelets are known to nest within the proposed project study area (Stendel 1992), and no old growth forest habitats which could be potential marbled murrelet nesting areas have been identified in the vicinity of the proposed project study area (Stendel 1992, WDW Nongame Data Systems 1992). The closest documented nesting areas are located near the town of Verlot about 50 km (31 miles) southeast of the proposed project, and in the Olympic National Forest located about 115 km (72 miles) southwest (Hamer and Cummins 1991).

Furthermore, while investigating murrelet use of inland sites in northwestern Washingont, Hamer and Cummins (1991) reported that 70% of all marbled murrelet detections were recorded between 45 minutes before sunrise and 25 minutes after sunrise. Most activities associated with construction of the proposed project would occur after 7 A.M., which during the proposed construction season (spring-early fall 1996) would be more than 25 minutes after sunrise. Therefore, disturbance-related impacts on marbled murrelets associated with construction, operation, and maintenance of the proposed project are anticipated to be minimal.

Collision Potential

Marbled murrelets, like any bird, are susceptible to collision hazards. However, the actual significance of these collisions to the mortality rate of the population in the Pacific states has not been assessed. Several researchers have presented data on mortality of other bird species (primarily waterfowl) from collision with transmission lines, indicating that collision mortality is a relatively small percentage of total non-hunting mortality (Arend 1970, Stout and Cornwell 1976, Meyer 1978, James and Haak 1979). Olendorff and Lehman (1986) also presented findings indicating that transmission lines have no discernible effect on the population dynamics of raptors.

The flight behavior of marbled murrelets to inland sites may further reduce collision potential with the proposed project (Hamer and Cummins 1990). In order to examine the distribution and abundance of marbled murrelets, Hamer and Cummins (1990) divided their northwestern Washington study area up into four equal parts from west to east, and surveyed each region using observation stations. Each division was 21.3 km (13.25 miles)

wide, starting from the Puget Sound coastline and ending at the Pacific Crest about 85 km (about 54 miles) inland from the Puget Sound coastline. The highest detection rates were found for murrelets in Regions 3 and 4 (the easternmost Regions). These higher-altitude flights were not detected at lowland stations, but observers at higher elevation inland stations began to detect these birds as they flew to forest stands as potential nesting areas (Hamer and Cummins 1990). It was assumed that birds must fly over Regions 1 and 2 to reach these areas. Hamer and Cummins (1990) suspected that murrelets may gain altitude quickly upon leaving the Puget Sound in order to fly into areas in the North Cascades that were several thousand feet above sea level. The proposed project is located about 7-16 km (4.4-10 miles) inland from Bellingham Bay, which, when applying Hamer and Cummins (1990) landscape classification, would be located in a Region 1 type situation.

Collision potential with the transmission line wires of the proposed project is believed to be low. Nevertheless, the BPA would place visual marker balls on wires and overhead ground wires which cross the Nooksack River and Samish River wetland/riparian area to further reduce collision hazards in these potential flight corridors.

Electrocution Potential

The electrocution potential of the proposed project for marbled murrelets is expected to be minimal. Because bald eagles are also known to occur in this area, the proposed transmission line will be designed to protect eagles from electrocution. Bald eagles have a significantly larger wingspan than marbled murrelets, therefore, design specifications implemented to protect eagles from electrocution would more than adequately protect marbled murrelets from electrocution. A separation of more than 4.6 m (15 feet) between wires would protect marbled murrelets from electrocution in the proposed project area.

## 5.0 LITERATURE CITED

Anthony, R.G., R.L. Knight, G.T. Allen, B.R. McClelland, and J.I. Hodges. 1982. Habitat use by nesting and roosting bald eagles in the Pacific Northwest. Trans. N. Amer. Wildl. Nat. Resour. Conf. 47:332-342.

Arend, P.H. 1970. The ecological impact of transmission lines on the wildlife of San Francisco Bay. Report prepared for Pacific Gas and Electric Co. by Wildlife Associates.

Bald Eagle Working Team of Oregon and Washington. 1990. Working implementation plan for bald eagle recovery in Oregon and Washington. Oregon-Washington Interagency Wildlife Committee, WA. Dep. Wildl., Olympia, WA. 72 pp.

Carter, H.R. 1984. At-sea biology of the marbled murrelet (*Brachyramphus marmoratus*) in Barkley Sound, British Columbia. M.S. Thesis, Univ. Manitoba, Winnipeg.

DeGraaf, R.M, V.E. Scott, R.H. Hamre, L. Ernst, and S.H. Anderson. 1991. Forest and rangeland birds of the United States: natural history and habitat use. U.S. For. Serv., Agri. Handbook 688. 625 pp.

Dobler, F.C., and M.E. Dobler. 1982. The National Wildlife Federation midwinter bald eagle survey for Washington, 1982. WA. Dep. Game, Olympia.

Grubb, T.G. 1976. A survey and analysis of bald eagle nesting in western Washington. M.S. Thesis. Univ. of Washington, Seattle. 87 pp.

Grubb, T.G. 1980. An evaluation of bald eagle nesting in western Washington. Pages 87-103 in R.L Knight, G.T. Allen, M.V. Stalmaster, and C.W. Servheen, eds. Proc. Washington. Bald Eagle Symp. The Nature Conservancy, Seattle, WA.

Hamer, T.E., and E.B. Cummins. 1990. Forest habitat relationships of marbled murrelets in northwestern Washington. WA. Dep. Wildl., Wildl. Manage. Div., Nongame Program, Olympia. 54 pp.

Hamer, T.E., and E.B. Cummins. 1991. Relationship between forest characteristics and use of inland sites by marbled murrelets in northwestern Washington. WA. Dep. Wildl., Wildl. Manage. Div., Nongame Program, Olympia. 47 pp.

Hunt, W.G., B.S. Johnson, J.B. Bulger, and C.G. Thelander. 1980. Impacts of a proposed Copper Creek Dam on bald eagles. Biosystems Analysis Rep., San Francisco, Ca. 143 pp.

James, B.W., and B.A. Haak. 1979. Factors affecting avian flight behavior and collision mortality at transmission lines. Report prepared for Bonneville Power Administration by Western Interstate Commission for Higher Education. Bonneville Power Administration, Portland, Or. 109 pp.

Knight, R.L., R.C. Friesz, T.P. D'Acci, K.E. Taylor, and J.W. Vandon Bos. 1980. A summary of the mid-winter bald eagle survey in Washington, 1980. WA. Dep. Game, Olympia.

Kroodsma, R.L. 1978. Evaluation of a proposed transmissions line's impacts on waterfowl and eagles: Pages 69-76 *in* M.L. Avery, ed. Impacts of transmission lines on birds in flight. U.S. Fish Wildl. Serv., Biol. Serv. Program, Washington, D.C.

Manual, D.A., T.R. Wahl, and S.M. Speich. 1979. The seasonal distribution and abundance of marine bird populations in the Straight of Juan de Fuca and northern Puget Sound in 1978. U.S. Dep. Commerce, National Oceanic and Atmospheric

Administration, Environmental Res. Lab. Marine Ecosystems Analysis Prog. Tech. Mem. 44.

Marshall, D.B. 1988. Status of the marbled murrelet in North America: with special emphasis on populations in California, Oregon, and Washington. U.S. Fish. Wildl. Serv., Biol. Rep. 88(30). 19 pp.

McAllister, K.R. 1984. A summary of the 1984 midwinter bald eagle survey in Washington. WA. Dep. Game, Olympia.

Mendenhall, V.M., and M.L. McAllister. 1988. Current status and potential threats to the marbled murrelet in Alaska. Pac. Seabird Group Bull. 15:33.

Meyer, J.R. 1978. Effects on transmission lines on bird flight behavior and collision mortality. Report prepared for Bonneville Power Administration by Western Interstate Commission for Higher Education. Bonneville Power Administration, Portland, Or. 200 pp.

Miller, D., E.L. Boeker, R.S. Thorsell, and R.R. Olendorff. 1975. Suggested practices for raptor protection on powerlines. Raptor Res. Foundation, Provo, UT. 21 pp.

Nelson, M.W., and P. Nelson. 1976. Powerlines and birds of prey. Idaho Wildl. Rev. 28:3-7.

Nelson, S.K., M.L. McAllister, M.A. Steam, and D.H. Varoujean. 1988. Status of marbled murrelets in Oregon. Pac. Seabird Group Bull. 15:32.

Nelson, S.K., and E.C. Meslow. 1989. Distribution of marbled murrelet in western Oregon. Or. Coop. Wildl. Res. Unit, Corvallis. Progress Rep. 13 pp.

Olendorff, R.R., A.D. Miller, and R.N. Lehman. 1981. Suggested practices for raptor protection on power lines: the state of the art in 1981. Raptor Research Foundation Inc., Raptor Res. Rep. No. 4, St. Paul, MN. 111 pp.

Olendorff, R.R., and R.H. Lehman. 1986. Raptor collisions with utility lines: an analysis using subjective field observations. Final report submitted to PGE by U.S Dep. Inter., Bur. Land Manage., Sacramento, Ca.

Pacific Seabird Group. 1987. Marbled murrelet resolutions. Pac. Seabird Group Bull. 14:19-20.

Pinkowski, B.C. 1977. Powerline and bald eagle interactions in the upper Mississippi River Valley. Report prepared for Northern States Power Company by NUS Corporation, Ecological Sciences Division, Pittsburgh, Pennsylvania. 20 pp.

Sander, T.C., and H.R. Carter. 1988. Fixed-point detection for measuring marbled murrelet activity at inland locations. Pac. Seabird Group Bull. 15:36.

Sealy, S.G., and H.R. Carter. 1984. At-sea distribution and nesting habitat of marbled murrelet in British Columbia: problems in the conservation of a solitary nesting seabird. Pages 737-756 *in* J.P. Croxall, P.G.H. Evans, R.W. Schrieber, eds. Status and conservation of the world's seabirds. International Committee Bird Protection Tech. Publ. No. 2.

Sowls, A.L., A.R. DeGrange, J.W. Nelson, and G.S. Lester. 1980. Catalog of California seabird colonies. U.S. Fish Wildl. Serv., Office Biol. Serv., Washington, D.C. FWS/OBS-80/37.

Stalmaster, M.V. 1976. Winter ecology and effects of human activity on bald eagles in the Nooksack River Valley, Washington. M.S. Thesis, Western Washington State College, Bellingham. 100 pp.

Stalmaster, M.V. 1981. Ecological energetics and foraging behavior of wintering bald eagles. Ph.D. Thesis. Utah State University, Logan. 157 pp.

Stalmaster, M.V., and J.R. Newman. 1978. Behavioral responses of wintering bald eagles to human activity. J. Wildl. Manage. 42:506-513.

Stalmaster, M.V., and J.R. Newman. 1979. Perch site preferences of wintering bald eagles in northwest Washington. J. Wildl. Manage. 43:221-224.

Stalmaster, M.V., R.L. Knight, B.L. Holder, and R.J. Anderson 1985. Bald eagles. Pages 269-290 *in* E. R. Brown, ed. Management of wildlife and fish habitats in forests of western Oregon and Washington. U.S. For. Serv., Pacific NW Reg., Portland, Or. Publ. No. R6-F&WL-192-1985.

Steenhoff, K. 1978. Management of wintering bald eagles. U.S. Fish Wild. Serv., Washington, D.C. FWS-OBS/78-79. 59 pp.

Stendel, A. Wildlife Biologist. Washington Department of Wildlife, Mill Creek, WA.. Personal communication. August and November 1992.

Stout, I.J., and G.W. Cornwell. 1976. Nonhunting mortality of fledged North American waterfowl. J. Wildl. Manage. 40:681-693.

U.S. Fish and Wildlife Service. 1986. Recovery plan for the Pacific bald eagle. U.S. Fish Wildl. Serv., Portland, Or. 160 pp.

U.S. Fish and Wildlife Service. 1992. Personal communication - official letter: listed and proposed endangered and threatened species and candidate species which may

occur within the area of the proposed NW Washington Transmission Project, Whatcom and Skagit Counties, WA. U.S. Fish Wild. Serv., Fish and Wildl. Enhancement Office, Olympia, WA. 3 pp.

Varoujean, D.H., W.A. Williams, D.R. Warrick 1989. Nest locations and nesting habitat of the marbled murrelet (*Brachyramphus marmoratus*) in coastal Oregon. Or. Dep. Fish Wildl., Nongame Wildl. Program, Tech. Rep. 88-6-02. 48 pp.

Wahl, T.R., and S.M. Speich. 1983. First winter survey of marine birds in Puget Sound and Hood Canal, December 1982 and February 1983. WA. Dep. Wildl. Rep., Olympia. 35 pp.

Wahl, T.R., and S.M. Speich. 1984. Survey of marine birds in Puget Sound, Hood Canal, and waters east of Whidbey Island, Washington, in summer 1982. Western Birds 15:1-14.

Washington Department of Wildlife. 1991. Threatened and endangered: 1991 status report. WA. Dep. Wildl., Olympia, WA. 13 pp.

Washington Department of Wildlife Nongame Data Systems. 1992. Priority Habitats and species guide to digital data. WA. Dep. Wildl., Nongame Data Systems Program, Olympia. WA.

# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**
Ecological Services
3704 Griffin Lane SE, Suite 102
Olympia, Washington 98501-2192
(206) 753-9440 FAX: (206) 753-9008


September 10, 1993

Phillip D. Havens
Wildlife Biologist
Department of Energy
Bonneville Power Administration
P.O. Box 3621
Portland, Oregon 97208-3621

FWS Reference: 1-3-93-I-809

Dear Mr. Havens:

This letter is in response to the Biological Assessment (BA) and your cover letter, dated July 1, 1993, of the proposed Northwest Washington Transmission Project. The U.S. Fish and Wildlife Service (Service) received your letter on July 6, 1993.

The proposed project is to upgrade electricity potential on 38 miles of transmission line by reconstructing the carrying line and power poles. Approximately 122 acres of scrub growth would be affected. If alternative H1, a dogleg in the line, were to be chosen, you would affect an additional 84 acres of second- and third-growth forest. Because you have not chosen the preferred alternative, you have analyzed the project as a worst-case scenario.

The Service concurs that the proposed project, as described in the BA, in not likely to adversely affect the bald eagle if you maintain proper spacing of lines to prevent electrocuting birds. The Service also concurs that the proposed project is not likely to adversely affect the marbled murrelet.

This concludes informal consultation pursuant to Section 7(a)(2) of the Endangered Species Act of 1973, as amended. The project should be re-analyzed if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered in this consultation; if the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this consultation; and/or, if a new species is listed or critical habitat is designated that may be affected by this project.

If you have any questions about this letter or your responsibilities under the Act, please contact Michelle Eames at the letterhead phone/address.

Sincerely,

Carla H. Mundy

For David C. Frederick
State Supervisor

cl/pjs
c: WDW, Region 4 (Muller)
USAI, Portland (Krahmer)