SECTION 3.4 PLANTS AND ANIMALS
(WAC 463-42-332)

This section presents information on existing conditions and impacts related to plants and animals, including the following sections:

- Upland Habitat (Section 3.4.1)
- Wetlands (Section 3.4.2)
- Habitat Types and Wildlife Use (Section 3.4.3)
- Fisheries and Aquatic Resources (Section 3.4.4)
- Unique Species (Section 3.4.5)
- Fish and Wildlife Migration Routes (Section 3.4.6)

The areas described below comprise the study area and the impact area applicable to the vegetation, wetlands, and wildlife studies conducted for the project.

- The **study area** is defined as a 2,640' (0.5 mile) corridor centered on the pipeline route. The study area provides a basis for describing existing conditions within a regional context.
- The **study corridor** is defined as a 200' wide corridor centered on the proposed pipeline route. Although the width of the actual construction corridor varies depending upon engineering design constraints, the 200' corridor allows for minor or localized route adjustments during final design.
- The **construction corridor** refers to the area which will be cleared and graded during pipeline construction. Along much of the pipeline route, the construction corridor will be 60' wide. At aquatic resource crossings, the construction corridor will be 30' in width. In some locations, the construction corridor will be narrower because the alignment will be placed in existing cleared corridors (such as railtrails and Forest Service roads).
- The **maintained right-of-way** refers to the area which will be kept clear of large, woody vegetation that would obscure aerial visibility. In most forested areas of the route, a 30' wide swath centered over the pipeline will be maintained as a permanent easement clear of trees and large shrubs in order to maintain the required clear area.

Dominant vegetation cover type and wetland boundaries were identified in the field and mapped on aerial photographs. Boundary information and type labels were transferred to orthophotographs for digitizing and Geographic Information System (GIS) maps were generated. These maps are found in Appendix A. The U.S. Fish and Wildlife Service and the Washington Department of Natural Resources were contacted for information on endangered, threatened, candidate, and sensitive plant species, high-quality native plant communities, and high quality undisturbed wetlands found in the general vicinity of the proposed pipeline route. The Washington Department of Fish and Wildlife (WDFW) was contacted for information on priority habitats and species. Information was supplied in form of maps (WDFW, 1997).

The results of these office and field investigations are presented below.

3.4.1 UPLAND VEGETATION

The vegetation mapping in Appendix A shows the dominant vegetation cover types occurring along the length of the pipeline route. Vegetation mapping was based on field work, aerial photograph interpretation, and agency GIS coverages (old-growth mapping in the study area relied heavily upon the Washington Department of Fish and Wildlife Priority Habitats and Species coverage). Information presented in this section is based on discussions with, and publications and information from, Washington Natural Heritage Program, U.S. Fish and Wildlife Service, U.S. Forest Service, U.S. Bureau of Reclamation, U.S. Bureau of Land Management, and Department of the Army (Yakima Training Center Staff). A vegetation report was prepared in June 1997 for this project (Dames & Moore 1997). The discussion in this section of the application updates the information provided in that report.

Vegetation studies were conducted in the field during spring and summer from 1995 to 1998. The following lists the segments of the route which have been included in the vegetation field studies: shrub-steppe habitats (vicinity of Yakima River to the end of the route); forest habitats on Bureau of Land Management and Forest Service (Mt. Baker-Snoqualmie National Forest and Wenatchee National Forest) land; and any other areas outside of existing easements or railtrails that consist of natural, non-weedy vegetation (these route segments are identified in Appendix A (Map Atlas) of the EFSEC application as "New Corridor"). Vegetation studies were not conducted along BPA easements or on agricultural land in the Puget lowlands because these areas are easily mapped by aerial photograph interpretation and are unlikely habitats for rare plants.

3.4.1.1 Existing Conditions

Regional Conditions

The proposed pipeline route traverses a landscape that is dramatically affected by a broad range of environmental factors, all of which influence vegetation patterns. The climate ranges from temperate regions that receive more than 90" of annual precipitation to areas that receive only 8" of precipitation; the soils range from mucks of high organic content found in wetlands to dry sandy and rocky soils in the Columbia Basin; the altitude ranges from near sea level to roughly 2,600' near Snoqualmie Pass. These conditions form a number of different habitats for a variety of plant communities.

The study area extends through the following vegetational areas (Franklin and Dyrness, 1988):

- western hemlock (*Tsuga heterophylla*) zone,

- subalpine forest -- includes silver fir (*Abies amabilis*) and mountain hemlock (*Tsuga mertensiana* zone,
- Douglas fir (*Pseudotsuga menziesii*) zone,
- ponderosa pine (*Pinus ponderosa*) zone,
- shrub-steppe - with big sagebrush (*Artemisia tridentata*) zone.

The western hemlock zone occurs in the greater Puget Sound region, while the subalpine forest zone occurs near the crest of the Cascades. The Douglas fir and ponderosa pine zones are present to the east of the Cascade crest. The shrub-steppe zone is in eastern Washington.

Corridor Conditions

Although upland vegetation covers over 90 percent of the study area, almost all of the construction corridor is located where the vegetation has been disturbed to varying degrees. As noted in Section 2.1 Site Description, these segments of the proposed pipeline route include existing transmission line or railroad rights-of-way, logging or USFS roads, agricultural areas, and landscaped areas.

Upland vegetation cover in the study area includes second-growth coniferous forest, regenerating coniferous forest (timber harvest areas), old-growth forest, deciduous forest, mixed forest, scrub-shrub, shrub-steppe, grasses and forbs, cropland, hay and pasture, orchards, and developed areas (such as residential tracts, parks, golf courses). All of these cover types occur along the proposed alignment in both eastern and western Washington, except orchards and shrub-steppe which occur only in eastern Washington. Cover types of interest include old-growth forests, aspen groves (*Populus tremuloides*), oak woodlands (*Quercus garryana*), and unique plant communities identified by the Natural Heritage Program (which are discussed in Section 3.4.5, Unique Habitats and Species). Old-growth has the potential to occur in both western and eastern Washington. Along the pipeline route, the aspen groves and oak woodlands occur only in eastern Washington.

<u>Forested Plant Communities</u>

Forested plant communities are extensive in the study area (nearly 30 percent) and include coniferous forest, regenerating coniferous forest (i.e., recently replanted clearcuts or burns), old-growth, deciduous forest, and mixed forest. Much of the study area from the Thrasher Pump Station to the Yakima River (about 95 miles) is forested. The construction corridor, however, will be located in existing corridors for most of the first 95 miles. Existing BPA easements, logging roads, and railbed trails will be used to minimize the amount of forested vegetation cleared for this project.

The pipeline crosses Forest Service designated Late-successional Reserves (LSRs) in two places, one of which is west of the crest of the Cascades and the other to the east. One of the LSRs occurs in Township 22 North, Range 10 East, Section 13 (near the Annette Lake trailhead and Humpback Creek). A small

Segment of new corridor is located in this area and the existing vegetation within a 30-foot-wide swath will be permanently cleared. The trees that will be cleared are young second-growth alders and conifers up to 10" dbh. The other LSR along the pipeline alignment occurs in Township 19 North, Range 14 East, Section 4. In this segment of the route, the pipeline is located in the cleared BPA powerline right-of-way. No trees will be affected by construction of the pipeline in this area. The pipeline crosses the Snoqualmie Pass Adaptive Management Area (AMA), where the pipe will be placed in an existing road. The Snoqualmie Pass AMA will not be affected by installation of the pipeline.

Coniferous Forests

Second-growth Coniferous Forests. The coniferous forests of the Puget lowlands (including the foothills west of the Cascade Mountains) are dominated by western hemlock and Douglas fir. Western red cedar occurs sporadically, and in some places is a dominant or co-dominant species. Big-leaf maple (*Acer macrophyllum*) and red alder (*Alnus rubra*) are intermittently interspersed within the coniferous forest, but account for less than 25 percent of the total forest cover. The understory varies along the route from no vegetation at all to areas that are very dense, although most of the route has some understory vegetation. Common understory plants include, but are not limited to, salmonberry and blackberries (*Rubus* spp.), salal (*Gaultheria shallon*), Oregon grape (*Mahonia* spp.), vine maple (*Acer circinatum*), wild roses (*Rosa* spp.), snowberry (*Symphoricarpos albus*), red elderberry (*Sambucus racemosa*), sword fern (*Polystichum munitum*), bleeding heart (*Dicentra formosa*), false lily-of-the-valley (*Maianthemum dilatatum*), and foamflower (*Tiarella trifoliata*). Segments of the route composed of this forested plant community are mapped as "WH" (western hemlock) in the Map Atlas.

Coniferous forests on the west slopes of the Cascade Mountains include western hemlock, Douglas fir, and Pacific silver fir in the overstory. Noble fir, big-leaf maple, and red alder occur to a limited extent. Dominant understory vegetation is similar to that listed above for the Puget lowlands. Segments of the route composed of this forested plant community are mapped as "SF" (silver fir) in the Map Atlas.

Over the crest of the Cascades, Pacific silver fir and mountain hemlock are dominant species, and they are joined by western hemlock, western red cedar, and subalpine fir (*Abies lasiocarpa*). Understory vegetation is dominated by huckleberry (*Vaccinium*) species in the shrub layer and ferns, grasses,and sedges along with broadleaf ground covers such as false lily-of-the-valley, blackberries, twinflower (*Linnea borealis*), and bunchberry (*Cornus canadensis*). Segments of the route composed of this forested plant community are mapped as "MH" (mountain hemlock) in the Map Atlas. The pipeline route crosses the Cascade Mountains through an existing tunnel near Snoqualmie Pass and no impacts to these forest types will occur.

On the east slope of the Cascade Mountains, much of the proposed pipeline route is coniferous forest dominated by Douglas fir or ponderosa pine. Toward the east, the rainfall decreases, and the forests are dominated by Douglas fir, grand fir, and ponderosa pine. In the driest forested sites, ponderosa pine tends to be a lone dominant. Along the proposed pipeline route, the eastern limits of the ponderosa pine is Swauk

Creek. In the vicinity of the Yakima River, shrub-steppe vegetation may be interspersed within the open ponderosa pine forest. Common understory shrubs include huckleberry, Oregon grape, snowberry, buckbrush (*Ceanothus velutinus* or *C. sanguineus*), and buffalo berry (*Shepherdia canadensis*), and in the drier areas, bitterbrush (*Purshia tridentata*) and big sagebrush may be dominant in the understory. Segments of the route composed of these plant communities are mapped as "DG" (Douglas fir) or "PP" (ponderosa pine) in the Map Atlas.

Regenerating Coniferous Forest. Regenerating coniferous forests, including tree farms, are dominated by planted species such as Douglas fir and western hemlock, although other young trees may be present. Understory vegetation may include young red alder, blackberry, salmonberry, salal, Oregon grape, sword fern, and bracken fern (*Pteridium aquilinum*).

Old-growth. Stands of old-growth occur in the study area, but none occur within the proposed construction corridor. Patches of old-growth occur in the western hemlock, silver fir, and mountain hemlock plant communities between mile post 13 and 58 (see the Map Atlas in the EFSEC application for milepost locations). Old-growth forest will not be affected by the project. All coniferous trees removed during construction will be second-growth or from regenerating coniferous forest.

Deciduous Forests

Deciduous forests occur on both sides of the Cascade Mountains, although along the proposed pipeline route, most of the deciduous forest occurs to the west of the mountains. West of the Cascades, deciduous forests occur, for the most part, in patches throughout the residential and commercial areas of Snohomish and King Counties and along riparian corridors. Big-leaf maple and red alder are the dominant species. While big-leaf maple usually occurs in the uplands, red alder may occur in the uplands or in wetlands (see the Wetlands Report prepared for this project for more information on forested wetlands). Other deciduous trees such as black cottonwood (*Populus trichocarpa*), cascara (*Rhamnus purshiana*) and willows (*Salix* spp.) as well as some of the coniferous trees listed in the above section occur in the deciduous forest plant communities to a limited extent. Understory vegetation in the deciduous forests of western Washington consists of salmonberry as well as many of those species listed in the section describing the understory vegetation of western Washington coniferous forests.

East of the Cascade Mountains, patches of quaking aspen (*Populus tremuloides*) are scattered in wet sites, and garry oak (*Quercus garryana*) occurs marginally in the study area, primarily in the vicinity of Swauk Creek. Much of the deciduous vegetation in eastern Washington occurs in the wetlands and riparian areas, and includes such species as willows and Russian olive (*Elaeagnus angustifolia*).

Mixed Forest

Most of the mixed forest plant communities occur west of the Cascades, and mixed forest stands are common along much of the segment of the route in western Washington. Dominant trees in this plant community include western hemlock, Douglas-fir, big-leaf maple, and red alder. Understory vegetation listed in the discussion of western Washington coniferous forest also occurs in mixed forest plant communities of western Washington.

Along the portion of the route east of the Cascades, patches of mixed forest occur in the vicinity of Cabin Creek and the City of Easton. Dominant vegetation includes western hemlock, Douglas fir, black cottonwood, and red alder.

<u>Shrub Plant Communities</u>

Shrub plant communities are also extensive within the study area, covering approximately 33 percent of the study area. Included in this category are the scrub-shrub plant communities and the shrub-steppe plant communities. These plant communities are dominated by shrubby vegetation, but herbaceous species are usually present as understory vegetation or interspersed in the shrubby areas.

Scrub-shrub Plant Communities. Scrub-shrub vegetation typically occurs in intensively-managed areas (such as BPA transmission line easements) in western Washington. Commonly occurring shrubs in western Washington include vine maple (*Acer circinatum*), young black cottonwood, Scot's broom, salal, blackberries, salmonberry, beaked hazelnut (*Corylus cornuta*), wild roses, snowberry, young red alder, and willows.

Shrub-steppe Plant Communities. Shrub-steppe plant communities are extensive in parts of eastern Washington and occupy most of the study area mapped as shrubland. The vegetation in the shrub-steppe plant communities is very diverse and is determined in part by a number of factors including location, substrate, elevation, and degree of disturbance. Along the proposed route, shrub-steppe vegetation occurs from the Yakima River to Pasco, which includes Kittitas, Grant, Adams, and Franklin Counties. Most of the shrub-steppe vegetation crossed by the proposed pipeline has been altered to varying extents for agricultural purposes, athough much of the relatively natural shrub-steppe habitats occur in Kittitas County.

Livestock grazing is common in Kittitas, Grant, and Adams Counties. Along the eastern portion of the alignment in Grant County, much of the shrub-steppe has been converted, or is in the process of being converted, to agricultural circles. In Franklin County, much of the remaining shrub-steppe habitat along the proposed route occurs in small patches between agricultural circles. Other signs of disturbed habitat occurring along the proposed route includes old road scars, evidence of fires, and signs of herbicides having been sprayed.

From the Yakima River east to the town of Kittitas along the proposed alignment, dominant shrub-steppe plant species include bitterbrush (*Purshia tridentata*), big sagebrush, Sandberg's bluegrass (*Poa sandbergii*), bluebunch wheatgrass (*Agropyron spicatum*), bulbous bluegrass (*Poa bulbosa*), balsamroot (*Balsamorhiza* spp.), long-leaf phlox (*Phlox longifolia*), buckwheat (*Eriogonum* spp.), desert-parsley (*Lomatium* spp.), alfilaria (*Erodium cicutarium*), and erigeron (*E. linearis* and *E. poliospermus*). Non-native and weedy species (including cheatgrass and knapweed species) are present in places, with habitat degradation resulting primarily from livestock grazing. The moss and lichen crust in the study corridor has been broken or eliminated, depending on the amount of grazing and off-road vehicle use. Often the crust is intact under shrubs, with the area between shrubs being most disturbed.

From Kittitas to the Columbia River, commonly-occurring shrubs and grasses include big sagebrush, stiff sagebrush (*Artemisia rigida*), gray rabbitbrush (*Chrysothamnus nauseosus*), green rabbitbrush (*Chrysothamnus viscidiflorus*), buckwheat, Sandberg's bluegrass, bluebunch wheatgrass, and cheatgrass (*Bromus tectorum*). Frequently found broadleafs include balsamroot, long-leaf phlox, milk-vetch, desert-parsley, erigeron (*Erigeron* spp.), milk-vetch (*Astragalus* spp.), and sagebrush violet (*Viola trinervata*). Other species that are common in this area include wild onion (*Allium* spp.), gold star (*Crocidium multicaule*), goldenweed (*Happlopappus* sp.), bluebell (*Mertensia longiflora*), phacelia (*Phacelia* sp.), and blue-eyed mary (*Collinsia sparsiflora*). Although the shrub-steppe communities along portions of this route segment contain a diversity of native plants and some areas of intact crust, evidence of previous and on-going disturbance is present. During one of the spring plant surveys, sheep two to three miles west of Vantage had grazed much of the grasses and forbs down to ground level. Dirt roads have been maintained near and along the pipeline route in the shrub-steppe. Invasive weeds are often prevalent near these areas of disturbed ground. Cheatgrass is found in most places along this route segment, and it is often the dominant grass on south facing slopes, especially near roads.

The dominant shrub and grass vegetation along the alternative routes to the west of the Columbia River (Kittitas County) are similar to many of the species listed above and includes big sagebrush, stiff sagebrush, buckwheat, Sandberg's bluegrass, bluebunch wheatgrass, and cheatgrass. Bitterbrush, purple sage (*Salvia dorrii*), and spiny hopsage (*Atriplex spinosa*) are interspersed along these alignments. Commonly-occurring grasses and broadleafs include Sandberg's bluegrass, bluebunch wheatgrass, cheatgrass, and Idaho fescue (*Festuca idahoensis*), balsamroot, erigeron, desert-parsley, milk-vetch, wild onion, gold star, long-leaf phlox, goldenweed, and sagebrush violet. Some portions of these route segments have relatively intact shrub-steppe habitats, although there is evidence of previous and on-going disturbance. Much of the alternative alignments have been grazed by livestock. There is often little or no crust remaining. On Yakima Training Center land, some of the existing dirt roads have been widened and swaths for new roads have been cleared.

Dominant shrubs and grasses along the proposed pipeline route in Grant County include big sagebrush, gray rabbitbrush, green rabbitbrush, cheatgrass, bluebunch wheatgrass, and Sandberg's bluegrass. Commonly-occurring species include spiny hopsage and wildrye (*Elymus* spp.). The shrub-steppe in Grant

County has generally been disturbed, with few small patches consisting entirely of native vegetation. Much of the shrub-steppe along the alignment has been converted for agricultural use. The alignment runs along the edge of numerous agricultural circles.

The dominant vegetation along the alternative routes to the east of the Columbia River (Grant County) is similar to that along the proposed pipeline route in Grant County. Vegetation in the vicinity of the sand dunes (located to the east of the Columbia River) includes the following shrub and grass species: big sagebrush, green rabbitbrush, gray rabbitbrush, cheatgrass, Indian rice grass (*Oryzopsis hymenoides*), and Sandberg's bluegrass. Commonly-occurring plants in the sand dunes include purple sage, primrose (*Oenothera* sp.), milk-vetch, and buckwheat.

In Adams County, the dominant shrubs and grasses are big sagebrush, cheatgrass, Sandberg's bluegrass, and bluebunch wheatgrass. Green rabbitbrush and gray rabbitbrush are common. Greasewood (*Sarcobatus vermiculatus*) and wildrye occur along portions of the alignment north of Highway 26. The shrub-steppe vegetation along the alignment in Adams County has been disturbed by grazing.

Much of the alignment in Franklin County crosses cropland. Very little native shrub steppe vegetation occurs along the alignment in this county. Where it does occur, dominant shrub and grass vegetation includes big sagebrush, gray rabbitbrush, green rabbitbrush, cheatgrass, and Sandberg's bluegrass. The shrub-steppe habitat in this county has been degraded by agricultural practices, development, and herbicide spraying.

Herbaceous Plant Communities

This plant community type represents approximately 1 percent of the study area and is composed of the grass/forb plant communities. These communities typically occur in disturbed areas such as roadsides, vacant lots that have been cleared, or fallow or abandoned pastures and farm fields. Herbaceous plants (graminoids and forbs) are dominant in these communities. To the west of the Cascade Mountains, dominant plant species in these plant communities include orchard grass (*Dactylis glomerata*), redtop and colonial bentgrass (*Agrostis alba* and *A. tenuis*), thistles (*Cirsium* spp.), sword fern, ox-eye daisy (*Chrysanthemum leucanthemum*), plantains (*Plantago* spp.), clovers (*Trifolium* spp.), and tall fescue (*Festuca arundinacea*).

The dominant weedy herbaceous plants east of the Cascades Mountains include cheatgrass, tumblemustard (*Sisymbrium altissimum*), alfilaria, fiddleneck (*Amsinckia lycopsoides*), and knapweed (*Centaurea* spp.). These species are typically found in previously disturbed areas such as roadsides, abandoned fields, or along irrigation canals.

Agricultural Plant Communities

Agricultural plant communities occur throughout the proposed corridor, with the general exception of the areas between North Bend and Easton, and cover approximately 29 percent of the study area. Along the proposed pipeline route, the majority of the agriculture west of the Columbia River is hay and pasture. The plant species that occur in pastures include tall fescue, redtop/colonial bentgrass, orchard grass, and soft rush (*Juncus effusus*). East of the Columbia, agricultural lands are covered with apple orchards, corn, oats, other row crops, and hay and pasture, all maintained by irrigation. See Section 5.1 Land and Shoreline Use for additional information on agricultural crops.

Developed Areas

Developed areas cover approximately 5 percent of the study area. Developed (barren) areas include land which is essentially cleared of all vegetation, such as roads, industrial parks, and other buildings and facilities. However, developed (vegetated) areas are landscaped, and include such areas as residential property, parks, and golf courses. These areas are typically dominated by lawns, shrubs, and/or trees that are relatively intensively managed, through mowing, pruning, cultivating, or fertilizing.

Kittitas Terminal and Pump Station Sites

Along the pipeline route, 6 pump stations are proposed, including a storage and distribution facility at Kittitas. The Kittitas Terminal and pump station is located at mile post 124.0. The other 5 pump stations will be located at Thrasher (mile post 0.0), North Bend (mile post 37.4), Stampede (mile post 67.1), Beverly-Burke (mile post 154.0), and Othello (mile post 189.5).

The site of the Kittitas Terminal is approximately 27 acres, and is currently used as cropland. The 5 pump station sites are each approximately 1-2 acres, with the exception of the Thrasher Pump Station which is on approximately 3.7 acres. The Thrasher Station site is dominated by grasses and forbs, Scot's broom, and a few Douglas fir trees. The North Bend site is presently unused, and is covered with grasses and forbs. The Stampede Station site is a disturbed site with grass/forb vegetation. The Beverly-Burke and Othello Station sites are cropland.

3.4.1.2 Impacts to Upland Vegetation

Project impacts to upland vegetation will result directly from the physical removal of vegetation for construction of the pipeline and associated facilities and indirectly from the compaction of soils and introduction of invasive species. Permanent impacts will occur in those areas currently composed of trees or large shrubs that will not be allowed to regrow over the maintained right-of-way and at the proposed facility locations. Because most of the pipeline is proposed to be constructed in existing corridors, impacts to forested and shrub plant communities will be moderate. Impacts to grass/forb, cropland, hay/pasture, orchard, and developed plant communities will be low or negligible.

Total construction impacts to upland vegetation are 1,348.3 acres, with the majority of the impacts associated with clearing and grading along the pipeline corridor (1,310.0 acres). Approximately 37.4 acres will be affected by construction of the facilities and about 0.9 acres will be affected by construction of the starting and ending sites for directional drilling at the Columbia River.

Pipeline Construction

Construction impacts to upland vegetation will occur during right-of-way preparation, equipment staging, construction, and installation in the construction corridor. Right-of-way preparation will include surveying, clearing, grading, and the installation of temporary fencing, siltation fences and the placement of straw bales and other erosion control structures. Construction and installation of the pipeline will generally include trenching, pipe stringing, moving trucks and other equipment along the corridor, bending, welding and x-raying the pipeline, joint coating, pipe laying, and backfilling. The following discussion is based on the proposed route unless noted otherwise.

The width of the construction corridor along most of the route will be 60' (in areas composed of upland vegetation except for stream and wetland buffers and on Forest Service land), and all vegetation within the construction corridor will be cleared. In some forested areas, however, the pipe will be placed in existing logging roads and rail-trails. In these areas, there will be no clearing of vegetation during construction because construction techniques will be used which will allow for conducting construction-related activities within a narrower construction corridor. However, some overhanging tree branches may be removed to provide for adequate overhead work area. Those segments of the route for which there will be no vegetation clearing include Cedar Falls Trail, Homestead Valley Road, John Wayne Trail, Tinkham Road, and Snoqualmie Pass Tunnel. Table 3.4-1 shows the impacts to upland vegetation from construction-related activities.

TABLE 3.4-1
TOTAL CONSTRUCTION IMPACT ACREAGES BY COVER TYPE

Cover Types	Impact Acreage
Western hemlock	38.6
Silver fir	1.0
Mountain hemlock	0.0
Douglas-fir	2.0
Ponderosa pine	2.2
Deciduous forest	4.9
Mixed forest	3.7
Young (regenerating) coniferous forest	51.9
Old-growth coniferous forest	0.0[a]
Scrub-shrub	207.6
Shrub-steppe	541.7
Grass/forb	10.6
Cropland	275.1
Hay/pasture	150.1
Orchard	6.8[b]
Developed (vegetated)	13.8
Total	1,310.0

(a) The route avoids impacts to old-growth forest.
(b) No orchard trees will be cut.

The pipeline will impact approximately 104.3 acres of forested upland vegetation. Of this, 43.8 acres are coniferous, 4.9 acres are deciduous, 3.7 acres are mixed forest, and 51.9 acres are regenerating coniferous forest. No old-growth vegetation will be impacted by the project. Forested impacts will occur primarily in western Washington. Some oak and aspen trees may be cleared for the project, most of which are near Swauk Creek (i.e., individual trees may be removed, but the pipeline will not cross stands of these trees). Approximately 14.7 acres of the forested vegetation will be affected due to construction in areas of new corridor (i.e., those areas where the alignment cannot follow existing easements). An additional 17.0 acres of the new corridor will be required through regenerating coniferous forest.

Along the proposed alignment, the pipeline will impact approximately 749.3 acres of shrub vegetation. Of this, 207.6 acres is scrub-shrub, while 541.7 acres of shrub-steppe will be affected. Much of the natural vegetation between the Yakima River and the end of the route is shrub-steppe. For this reason, the shrub-steppe plant communities will have the greatest total acreage impact of all the plant communities along the proposed corridor. Table 3.4-2 shows the impacts to the shrub-steppe habitats by dominant cover types. Most of the construction corridor crosses shrub-steppe habitat that has been degraded by grazing, vehicle use, fire, and herbicides. New corridor construction will be required in about 299.9 acres of shrubby habitats, of which 294.6 acres are in shrub-steppe.

TABLE 3.4-2
SHRUB-STEPPE IMPACTS

Cover Types	Impact Acreage
Sagebrush/rabbitbrush/cheatgrass	47.5
Sagebrush/native grass(es)	92.1
Buckwheat/grass(es)	10.8
Bitterbrush/sagebrush/grass(es)	28.8
Sagebrush/rabbitbrush/cheatgrass/native grass(es)	34.7
Bitterbrush/grass(es)	42.3
Sagebrush/cheatgrass/native grass(es)	81.3
Rabbitbrush/buckwheat/grass(es)	5.0
Cheatgrass	14.4
Elymus sp.	3.9
Sagebrush/cheatgrass	70.0
Rabbitbrush/cheatgrass	23.8
Sagebrush/rabbitbrush/native grass(es)	27.3
Bitterbrush/rabbitbrush/native grasses	2.8
Native grass(es)	15.1
Sagebrush/spiny hopsage/grass(es)	0.8
Sagebrush/buckwheat/grass(es)	25.5
Greasewood/cheatgrass	0.7
Greasewood/sagebrush/cheatgrass	7.1
Shrub-steppe type unknown[a]	5.8
Total Acreage	539.7

[a] Permission to access property denied.

Note that the total shrub-steppe impacts (Table 3.4-1) is somewhat greater than the total acreage for detailed shrub-steppe impacts (Table 3.4-2). This is due to slight differences in the minimum mapping units between the two GIS coverages, which result in a cumulative difference of 2.0 acres.

The pipeline will pass through approximately 10.6 acres of herbaceous grass and forb vegetation other than cultivated vegetation. These grass/forb plant communities consist primarily of weedy species.

The pipeline will cross through approximately 432.0 acres of agricultural land. Of this, 275.1 acres are cropland, 150.1 acres are hay/pasture, and 6.8 acres is orchard. Construction-related impacts are expected to be minimal for cropland and hay/pasture because of a relatively short revegetation time period (about one growing season). See Section 5.1.7.2 (Agricultural Crops/Animals Impacts) for more information on impacts to agricultural areas.

The pipeline will affect approximately 13.8 acres of developed (vegetated) land.

Alternative Columbia River Crossings

In addition to the proposed route, several alternative alignments have been identified for crossing the Columbia River. Figure 2.1-2 shows the alternative crossing locations and the all the potential route segments along the alternative alignments. Crossing methods include the northernmost alternative, which would use the wet trench crossing method. Three of the alternative crossings include installing the pipe on existing structures. These are the I-90 bridge, Wanapum Dam, and the Beverly Railroad Bridge. The original route, as shown in the EFSEC application dated February 1996, proposed to cross the Columbia River just downstream of the Wanapum Dam using directional drilling. The following addresses the impacts to vegetation for some of the possible alternative alignments and compares those impacts with the proposed route. Note that the proposed route consists of the following route segments: 1a, 2a, 9a, 14, 15, 17, 18, 21, and HDD (see Figure 2.1-2).

The total impacts to vegetation for the route segment as proposed in the EFSEC application dated February 1996 are 151.1 acres of shrub-steppe plant communities, 8.9 acres of hay/pasture, and 10.4 acres of cropland. The original route would affect an additional 3.9 acres of hay/pasture and 3.3 acres of cropland, but would reduce the impacts to shrub-steppe plant communities by 9.5 acres as compared to the proposed route.

The other alignment north of I-90 consists of segments 1, 2, 9, 14, 15, 17, 18, 21, and HDD. Total impacts to vegetation include 163.2 acres of shrub-steppe plant communities, 7.1 acres of cropland, and 3.7 acres of hay/pasture. This route would affect an additional 2.6 acres of shrub-steppe habitat and reduce the impacts to hay/pasture by 1.3 acres.

The northern wet trench alternative impact assessment was based on segments 1, 2, 3, WTC, and 24. Total impacts to vegetation include 175.5 acres of shrub-steppe plant communities, 12.4 acres of hay/pasture, 8.6 acres of cropland, and 2.7 acres of grass/forb plant communities. Compared to the proposed route, this alignment will affect an additional 14.9 acres of shrub-steppe, 7.4 acres of hay/pasture, 1.5 acres of cropland, and 2.7 acres of grass/forb plant communities.

The crossing along the I-90 bridge impact assessment was based on segments 1, 2, I90B, and 24. Total impacts to vegetation include 171.6 acres of shrub-steppe vegetation, 12.4 acres of hay/pasture, 8.6 acres of cropland, and 3.1 acres of grass/forb plant communities. Compared to the proposed route, this alignment will affect an additional 11.0 acres of shrub-steppe, 7.4 acres of hay/pasture, 1.5 acres of cropland, and 3.1 acres of grass/forb plant communities.

One of the alignments that could cross the Columbia River near the Wanapum Dam includes segments 1, 2, 3, 10, 16, 17, 18, 21, and DC. Total impacts to vegetation include 190.7 acres of shrub-steppe plant communities, 12.4 acres of hay/pasture, 10.3 acres of cropland, and 1.3 acres of grass/forb plant communities. Compared to the proposed route segment, this alignment would affect an additional 30.1 acres of shrub-steppe plant communities, 7.4 acres of hay/pasture, 1.3 acres of grass/forb, and 3.2 acres of cropland.

One of the alignments along the south side of I-90 that crosses near Wanapum Dam includes segments 4, 5, 6, 7, 11, 12, 14, 15, 17, 18, 21, and DC. This alignment would affect 175.9 acres of shrub-steppe vegetation, 16 acres of hay/pasture, and 10.4 acres of cropland. Compared to the proposed route, this alignment would affect an additional 15.3 acres of shrub-steppe plant communities, 11.0 acres of hay/pasture, and 3.3 acres of cropland.

The crossing along the Beverly Railroad Bridge impact assessment was based on segments 4, 5, 6, 7, 11, 12, 14, 15, 17, 19, 22, and BRB. Total impacts to vegetation include 204.5 acres of shrub-steppe vegetation, 16 acres of hay/pasture, and 10.4 acres of cropland. Compared to the proposed route, this alignment will affect an additional 43.9 acres of shrub-steppe plant communities, 11.0 acres of hay/pasture, and 3.3 acres of cropland.

Staging Areas

At all wetland and stream crossings (except the Columbia River crossing), the construction corridor in the adjacent uplands will be used as staging areas. In using the 60' wide construction corridor, additional work areas will not be needed at aquatic resource crossings.

Upland vegetation will be impacted at the Columbia River crossing, where horizontal directional drilling will be used to install the pipeline. Additional work areas will be needed for the launching and receiving sites. The launching site will be a maximum of 200' in length by 100' in width. The exit site will be a maximum of 175' in length by 100' in width. Work areas at the Columbia River crossing will affect about 0.86 acres of shrub-steppe vegetation. The shrub-steppe plant communities near the Columbia River have been degraded by previous development projects, including construction of the Wanapum Dam, installation of transmission lines, and roadways. Clearing and grading activities associated with construction of the work areas will not affect unique or high-quality plant communities.

Kittitas Terminal and Pump Station Construction

Clearing and grading will occur at the proposed pump station locations and at the storage and distribution facility in Kittitas. The vegetation on the proposed Kittitas Terminal and pump station sites will be permanently lost. Construction of these facilities will result in the loss of approximately seven acres of grass/forb vegetation, and a small number of second- or third-growth trees, as well as about 30 acres of cropland.

Pipeline Operation

Maintenance of the pipeline corridor will require the permanent removal of trees and shrubs for a 30' wide swath along the pipeline route. This will be necessary to allow inspection of the pipeline from the air. Right-of-way maintenance results in permanent impacts to areas covered with woody vegetation because trees and shrubs will be prevented either from becoming established or from growing to their full height.

Shrub-steppe and grass/forb vegetation will be replanted and/or reseeded and allowed to grow over the pipeline corridor, resulting in no operational impacts to these plant communities. Agricultural land, and developed areas are not included in the operational impact table because these areas will return to their previous use once the pipe has been installed. Table 3.4-2 shows the acreage of impacts to forested and shrub vegetation from maintaining the right-of-way. These impact calculations were based on a 30' wide corridor.

TABLE 3.4-2
TOTAL OPERATIONAL IMPACT ACREAGES BY COVER TYPE

Cover Type	Impact Acreage
Western hemlock	21.1
Silver fir	1.0
Mountain hemlock	0.0
Douglas-fir	1.2
Ponderosa pine	1.1
Deciduous forest	3.3
Mixed forest	3.7
Young (regenerating) coniferous forest	27.9
Old-growth forest[(a)]	0.0
Scrub-shrub	105.1
Shrub-steppe	0.0
Orchard	3.0
Developed (vegetated)	6.6
Total	174.0

[(a)] The route avoids potential impacts to old-growth forest.

Potential impacts from clearing forested cover are associated with the change in cover types. Since the right-of-way is to be maintained clear of trees and large shrubs for aerial inspection and maintenance access, the conversion from forested to non-forested habitat is a permanent change. As with construction impacts, when large areas of vegetation are maintained, there is a risk that opportunistic plant species and concurrent habitat degradation may occur in these disturbed plant communities.

3.4.1.3 Mitigation Measures

Mitigation strategies, in order of priority, are: (1) avoidance; (2) minimization; (3) restoration; and (4) compensation.

Avoidance

Avoidance of impacts to upland plant communities has been accomplished in a number of ways. Route alignment and engineering design have resulted in avoiding vegetation impacts along portions of the proposed corridor, most notably in forested plant communities.

Along some segments of the route that are forested, there are logging roads and rail-trails that can be used as a construction corridor. In the forested areas where existing roads and trails are available, specialized construction equipment will be used so that the adjacent forested vegetation will not be cleared (although some overhanging branches may need to be cleared to provide sufficient overhead work space). Given the amount of the route that is forested, this construction technique will significantly reduce the impacts to forested areas.

Construction equipment will use existing access roads to access the construction corridor. Therefore, vegetation will not be removed to access the work areas. By not constructing any new access roads, additional vegetation impacts have been avoided.

In some cases, impacts to priority vegetation habitats (such as oak woodlands and old-growth forest) has been avoided by carefully routing the pipeline around these plant communities.

Where avoidance of upland impacts is not feasible, the following mitigation measures will be used.

Minimization

Impact minimization includes measures taken to reduce the amount of vegetation affected by the construction of the pipeline as well as measures taken to prevent invasive plant species from becoming established in cleared areas. Impacts will be minimized by utilizing the narrowest construction corridor feasible. The construction corridor will be a maximum of 60' in width (and only 30' wide in stream and wetland buffers). To ensure that vegetation beyond the construction corridor is not unnecessarily removed or crushed by equipment, the pipeline alignment and construction corridor boundaries will be clearly staked and marked to minimize equipment impacts. Temporary fencing will be installed where needed to prevent unanticipated vegetation impacts. Stumps of trees and roots of shrubs will only be removed where absolutely necessary (e.g., where excavation and grading will occur).

Specific measures will be employed to minimize the invasion and spread of undesirable plant species. They include:

- Straw bales will be used instead of hay bales for erosion control to limit the number of weed seeds introduced to disturbed areas.
- Disturbed areas will be replanted with native species after the topsoil has been replaced.
- Trees and shrubs will be replanted in all appropriate disturbed areas outside the maintained corridor to shade out undesirable grasses and weeds.
- Recommendations from the State and County Noxious Weed Control Boards will be used.

In areas that are dominated by non-native and/or invasive species, those species have the potential to return once construction is complete. Measures implemented to reduce the potential for invasive and/or non-native species to become established will focus primarily on those areas that are composed of primarily native vegetation.

Petroleum products spill impacts will be minimized by employing the Spill Prevention Plan prepared for this project. For details on this plan, refer to Section 2.9 (Spill Prevention and Control) in the EFSEC document.

Recommendations from the County Noxious Weed Control Boards that will be implemented to minimize the spread of noxious weeds include re-vegetating the construction corridor with certified weed-free seeds, pressure washing construction equipment, and working with board representatives to control spread of weeds.

Restoration

Restoration will begin when construction is complete. Final grading will include construction of diversion levees across slopes and chiseling or discing compacted soils. Areas dominated by forested and scrub-shrub plant communities will be restored within the portion of the construction corridor not maintained as right-of-way. All vegetation planted or used in seed mixes will be native to the area. Shrub-steppe habitats will be restored along the entire width of the construction corridor with a mix of shrub and grass seeds that are native to the area. Areas currently composed of herbaceous vegetation will be restored with a seed mix native to the area. Cropland and hay/pasture plant communities will be restored; see section 5.1.7 of the EFSEC application for additional information. Plants will be installed in the ground and seed mixes spread in late summer before the rainy season begins.

Compensation

All on-site mitigation will occur as restoration of the construction corridor when construction is complete. No off-site compensation is proposed.

3.4.1.4 Monitoring

A five-year monitoring plan for upland vegetation, including contingency plans, will be developed and implemented. Parameters to be monitored will include the success of replanted vegetation, types and percentage cover of invasive species, damage to remaining vegetation along the corridor, such as blowdown or erosion of topsoil, and unanticipated impacts.

3.4.2 WETLANDS

This section describes the wetlands that occur in the vicinity of the proposed pipeline route. The wetland studies were conducted as described in the Wetlands Technical Report, May 28, 1997.

3.4.2.1 Existing Conditions

Wetland areas were identified primarily through the use of National Wetland Inventory maps and aerial photographs. Site visits were conducted for all wetlands, and they were subsequently rated according to the Washington State Department of Ecology wetland rating systems for western and eastern Washington (WDOE, 1991; WDOE, 1993). Wetland functions were also estimated in the field. Wetland boundaries were delineated and verified during 1996, 1997, and 1998.

A total of 137 wetlands were found to occur completely or partially within the 200' study corridor, of which 59 were in western Washington and 78 in eastern Washington. These wetlands total approximately 1000 acres in area, and range in size from less than 1 acre to over 100 acres. Approximate acreages for wetland classes are as follows: palustrine emergent, 350 acres; palustrine scrub-shrub, 300 acres; palustrine forested, 225 acres, palustrine open water, 100 acres; riverine, 25 acres. See section 3.4.2.2 for an evaluation of impacts to wetlands and see the Map Atlas for wetland locations.

The WDOE wetland rating systems place the wetlands in four categories. Category I wetlands are of the highest quality. These are wetlands that: 1) provide a documented life-support function for threatened or endangered species and are on file in databases maintained by state agencies; 2) represent a high quality example of a rare wetland type; 3) are rare within a given region; or, 4) are relatively undisturbed and contain ecological attributes that are impossible to replace within a human lifetime, if at all.

Category II wetlands are those which: 1) provide habitat for very sensitive or important wildlife or plants; 2) are difficult to replace; or 3) provide very high functions, particularly for wildlife habitat. These wetlands occur more commonly than Category I wetlands, but still warrant a high level of protection.

Category III wetlands also provide important functions and values. They provide habitat for a variety of wildlife species and occur more commonly throughout the state than either Category I or Category II wetlands. Generally, Category III wetlands are smaller, less diverse, and/or more isolated in the landscape than Category II wetlands. They occur more frequently, are somewhat difficult to replace, and warrant a moderate level of protection.

Category IV wetlands are the smallest, most isolated, and least diverse wetlands in terms of vegetation and habitat values. These are wetlands that could be easily reestablished and, in some cases, improved from a habitat or native vegetation standpoint. However, reestablishment, in any specific case, may not fully restore functions and values. These wetlands do provide important functions and values, and where possible, impacts should be avoided. Because the criteria for Category IV wetlands are narrowly drawn, these wetlands are not common in most regions of the state.

Within the study corridor, the most common category of wetlands found in western Washington was Category I; the most common found in eastern Washington was Category II. Because of the predominance of forested wetlands in the less developed areas of western Washington, these wetlands are considered to be of relatively high value based on functional value assessments and were usually rated Category I. In eastern Washington, there are no estuaries and very few mature forested wetlands or peat systems. Therefore, Category II wetlands may be considered to be of relatively high value in that part of the state.

The upland areas immediately adjacent to wetlands are called buffers, and they perform an important role in the landscape in protecting wetland functions and values. Buffers that are well vegetated provide the most protection to wetlands, by shading water to moderate temperature increases, by shielding wildlife from noise, predation, and other disturbances, and by filtering surface water and removing pollutants before they flow into wetlands. Areas adjacent to wetlands that are developed, such as roads, are not considered buffers (WDOE, 1993).

The following sections briefly discuss each of the wetland types occurring along the proposed pipeline route. Detailed descriptions, maps, data sheets, and assessments for each wetland are found in the Wetland Technical Report, May 28, 1997.

Palustrine Emergent Wetland

This wetland type is characterized by erect, rooted, herbaceous hydrophytes. In areas with relatively stable climatic conditions, emergent wetlands maintain the same appearance year after year. Emergent wetlands include marshes and wet meadows (Cowardin et al., 1979). Plant species which occur in emergent wetlands in the study area in western Washington include slough sedge, cattails, soft rush, creeping buttercup, small-fruited bulrush, skunk cabbage, piggy-back plant, and non-native species such as reed canary grass. In eastern Washington, plant species that occur in palustrine emergent wetlands in the study area include cattails, small-fruited bulrush, red top, horsetails, hairy willow-herb, and soft rushes and sedges, as well as non-native grasses and forbs such as reed canary grass and purple loosestrife.

Palustrine Scrub-shrub Wetland

This wetland type consists of areas dominated by woody vegetation less than 20' tall. This includes true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions. Scrub-shrub wetlands may represent a successional stage of forested wetland, or may be relatively stable communities (Cowardin et al., 1979). Plant species which occur in scrub-shrub wetlands in the study area in western Washington include salmonberry, red alder, black cottonwood, willow, hardhack, red-osier dogwood, and cascara. In eastern Washington, scrub-shrub species in the study area include red alder, willow, hardhack, salmonberry, and the non-native Russian olive.

Palustrine Forested Wetland

This type of wetland is characterized by woody vegetation that is 20' or taller. Forested wetlands usually also include an understory of young trees or shrubs and an herbaceous layer (Cowardin et al., 1979). Plant species that occur in the forested wetlands in the study area in western Washington include red alder, western red cedar, western hemlock, and black cottonwood. Along the pipeline route in eastern Washington, forested wetlands are limited, but may include black cottonwood, red alder, red cedar, and western hemlock.

Palustrine Open Water

The open water areas are unvegetated and are assumed to be less that 6.6' (2 meters) in depth. These open water areas are associated with forested, scrub-shrub, and/or emergent wetlands.

Riverine

Riverine indicates that the wetland is associated with a stream or river. These streams are usually unvegetated, and the associated riparian areas may or may not meet the definition of a jurisdictional wetland.

3.4.2.2 Impacts to Wetlands

Of the 137 wetlands within the 200' wide corridor, 59 will not be affected by construction-related activities. The other 78 wetlands, however, are partially or completely within the construction corridor, and would be affected to a varying extent by pipeline construction and operation. Approximately 17.07 acres of wetland occur directly within the construction corridor, which is approximately 1.5% of the total acreage of the wetlands that are within the study corridor of this project. For each individual wetland, the direct impact is only a fraction of an acre, with the exception of wetland 191401A, which would have 1.54 acres of impact.

Wetland vegetation and the associated buffers will be impacted in numerous ways, both directly and indirectly, by both the construction and operation of the pipeline project. Impacts will be both temporary and permanent, and will include loss of vegetation and other habitat features, such as stumps, downed logs, and snags. Direct impacts include the removal of vegetation for pipeline construction. Indirect impacts may include damage to vegetation from temporary water quality degradation and sedimentation, introduction of invasive species, compaction and loss of topsoil, and changes to wetland hydrology. Project impacts to wetlands that are particularly susceptible or sensitive to disturbance of hydrology or vegetation will be moderate. Impacts to wetland buffers and more resilient wetlands will be low.

TABLE 3.4-3
ESTIMATED TOTAL ACREAGE OF WETLAND IMPACTS

Wetland Type	Temporary	Permanent[a]
Palustrine forested wetland	.54	0
Palustrine scrub-shrub wetland	10.97	0
Palustrine emergent wetland	4.86	0
Riverine	0.13	0
Palustrine aquatic bed	0	0
Palustrine open water	.57	0
Total	17.07	0

[a] Minimal tree removal will occur in wetland buffers.

Construction Impacts

The majority of impacts will occur during trenching activity because the existing vegetation and soils within the right-of-way will be disturbed. Impacts to wetland vegetation may be short-term or long-term. Impacts to wetland buffers would be considered indirect impacts to the wetlands. Most of the construction activity will result in short-term impacts to wetland functions and values. Short-term impacts associated with this project include temporary loss of herbaceous vegetation during grading activities, disruption of soil structure during pipeline installation, and similar impacts in buffers. A small amount of erosion and sedimentation may occur before vegetation is re-established.

Filling usually refers to a permanent wetland impact from placing fill materials in wetlands for such structures as buildings or roads. However, trenching and backfilling for pipelines is also defined as filling of wetlands. Trenching can usually be done so that wetlands can be restored. In some cases, there will be direct impacts to wetlands from excavation associated with jacking and boring under roads, such as the wetlands near Maltby Road, Highway 203, Lake Fontel Road, and Kelly Road. However, jacking and boring activities will not increase the footprint of construction impacts in wetlands.

Wetland Vegetation. Vegetation clearing occurs when woody vegetation (shrubs and trees) and herbaceous vegetation (grasses and forbs) are removed from the wetland. Vegetation clearing alone would not necessarily reduce the total wetland area, and for many impacted wetlands, it will be possible for the wetland to maintain most of its original functional values. The impact most likely to be permanent is the conversion of wetland areas currently covered with woody wetland vegetation to herbaceous wetland vegetation. Since woody vegetation takes longer to grow than herbaceous vegetation, clearing vegetation from forested and scrub-shrub wetlands will affect some wetland functions for a longer period of time (assuming the woody vegetation is re-planted and allowed to grow). Impacts to wetland buffers would be considered indirect impacts to the wetlands, but nevertheless may be long-term where trees are perennially removed from wetland buffers in the right-of-way. This will only occur in 5 wetlands that presently have forested buffers.

Wetland hydrology. Wetland hydrology may be impacted by installing the pipeline. Perched wetlands lying over impermeable layers, such as hardpan, may be impacted by the reduction in water levels that could occur when these impermeable layers are penetrated. Wetland hydrology could also be negatively impacted by draining of the wetlands through the pipeline trench, both during and after construction. A third type of alteration of wetland hydrology could be caused by changes in the subbasin that drains to each of the wetlands. The compaction of soils in the subbasin during the construction process could result in an increase in runoff and a decrease in baseflow to wetlands. In addition, changes to the grade of the subbasins may alter their size.

Changes in wetland hydrologic regimes can directly impact the plant communities and wildlife habitat of the wetlands (Azous, 1991). Increases in the average monthly water level fluctuation during the growing season or either an increase or a decrease in the average water level beyond the range of tolerance in a wetland during the growing season may change the habitat value for vegetation. Wetlands with altered hydrologic regimes may become dominated by relatively tolerant plants, such as hardhack, reed canary grass, and cattail (*Spirea douglasii, Phalaris arundinacea,* and *Typha latifolia*). Plant species that are less tolerant of changes in wetland hydrology often have greater habitat value. Wildlife habitat may also be compromised by changes in hydrology, especially for amphibians and ground-nesting birds (Taylor, 1993). Impacts to wetlands hydrology and soils would be long-term. Wetland hydrology could be impacted by trenching and by installing the pipeline or by jack and bore pits, and therefore site-specific mitigative measures will be implemented to address these concerns.

Baseline information on the hydrology of each of the 78 wetlands that may be crossed by the Cross Cascade pipeline by trenching has been developed to determine which of these wetlands may be at risk of hydrologic change by the construction of the pipeline. In most cases, crossing the wetlands will be accomplished by installing the pipeline in a trench approximately 6 feet deep and then replacing the subsoil and soil.

Three types of risks of substantially altering wetland hydrology have been identified. The first type would be draining a wetland by allowing the water to flow out of the wetland along the pipeline trench, presumably in material with greater hydraulic conductivity than the native material. This could occur when a wetland is located on a slope. When a wetland is located in a topographic depression or river valley, it could not be drained through the trench because the trench in the wetland is at the lowest point. The only wetlands subject to this risk are those that are crossed by the pipeline on a slope where the pipeline continues downgradient of the wetland.

The second type of risk would be the case of a wetland situated on a shallow impermeable layer that may be drained by puncturing the impermeable layer with the pipeline trench. If the impermeable layer is more than 8 or 10 feet below the surface, it would not be penetrated by the trench and the wetland would not be drained.

The third type of alteration of wetland hydrology could be caused by changing the subbasin that drains to a particular wetland by diverting subsurface flows through the pipeline trench. This could only occur where the pipeline trench is located on a slope above a wetland that is fed by shallow subsurface flow. A review of the topography along the pipeline route shows that this could potentially occur at three sites.
These are Sec. 13, T 22 N, R 10 E and Sec. 18, T 22 N, R 11 E, (between Tinkham Road and the JW Trail), Sec. 10, T 20 N, R 13 E (south of Lake Easton), and Sec 4, T 19 N, R 15 E (north of Peoh Point). This potential alteration of wetland hydrology will be prevented by the use of concrete trench plugs in those areas along the pipeline route where the gradient of the trench and the hydraulic conductivity of the backfill could divert the shallow subsurface flow.

Each of the 78 wetlands has been categorized in terms of hydrologic input, shape, size, surficial geology, soils, and the risk of either draining through the trench or draining through the subsoil. Categories of hydrologic inputs are either a surface connection to a stream, river, or lake, groundwater discharge, surface runoff, or any combination of these, along with the direct precipitation that all wetlands receive. There are no estuaries along the Cross Cascade pipeline route.

The shape categories are surface depressional, floodplain, slope, or other. A depressional wetland is located in a topographic depression in the landscape. A floodplain wetland is located on a floodplain and is hydrologically connected to the river or stream by either surface or subsurface flows, or both. A slope wetland is located on a slope, and may either be a small depression fed by surface flows or an area of shallow groundwater discharge. Other wetlands are those that do not fit into any of these shape categories.

The geology and soils are based on interpretation of aerial photographs and soil surveys, respectively, and are used to determine whether or not there is a possibility of a shallow impermeable layer occurring under the wetland.

The rationale for evaluating the risk of changes in wetland hydrology by categorizing all of the wetlands is based on logic and the process of elimination. Water cannot flow out of a wetland through the pipeline trench if it would have to run uphill. Only those wetlands located on slopes that are also crossed by the pipeline in a direction other than parallel to the contour line are at risk of being drained in this manner. All wetlands located at the lowest point in the subbasin are eliminated from this risk category. Through this process, only 5 wetlands are considered to be at risk of being drained through the pipeline trench. In these cases, trench plugs will be installed to prevent this from occurring.

Likewise, water cannot flow out of a wetland through the subsoil if the impermeable layer extends to a depth greater than the depth of the pipeline trench. Only those wetlands located on thin layers of low permeability material such as caliche or clay are at risk of being drained in this manner. All wetlands located on basal till or in alluvium associated with a river or stream or those that are fed by groundwater discharge are eliminated from this risk category. Twenty-five wetlands are considered to be potentially subject to this risk. This will be prevented by inspecting the trench at these wetlands to determine if such a layer has been penetrated. If so, an impermeable layer will be installed in the pipeline trench prior to backfilling in these wetland areas. Additional details on the hydrogeomorphology of each wetland are found in the Wetland Technical Report.

Surface Water Hydrology. An analysis of the unique features of this project leads to the conclusion that altering the surface water hydrology either upstream or downstream of wetlands is not a substantial risk. Typical construction projects result in the creation of large areas of impervious surfaces and/or the filling and permanent destruction of wetland areas. Creation of impervious surfaces alters the hydrograph of the subbasin, increasing peak flows and decreasing low flows and groundwater recharge. The filling and permanent destruction of wetlands results in a loss of detention capacity in the landscape. These activities increase the risk of downstream flooding. Construction and operation of the Cross Cascade pipeline, however, will not substantially alter surface water hydrology nor will it result in increased risks of downstream flooding. This is for two reasons.

For the most part, construction of this project will not create impervious surfaces. The only locations of impervious surface creation are the pump station and block valve sites. The block valve sites will be approximately 30' by 40' and the pump stations will be located on 1-2 acres of land. The Kittitas Terminal will occupy 27 acres. All pump station and block valve sites will have adequate retention/detention facilities to prevent any exacerbation of downstream flooding. The largest area of impervious surface to be created, the Kittitas terminal, will have retention facilities and no surface water will be discharged off site.

The second reason that this project will not contribute to downstream flooding is that no wetlands will be permanently destroyed nor will their topographic contours be altered. None of the block valve and pump station sites are located in wetlands. Although backfilling will occur in the pipeline trenches, including those that are located in wetlands, no other filling of wetlands will occur. The detention/retention capacity of the wetlands will not be substantially altered. The volume of the pipeline trench will typically be 4% or less of the volume of the wetland, and often much less. More importantly, the volume of the pipeline trench will be such a small fraction of the detention capacity of the watershed in which it is found that it would be difficult to calculate. Moreover, construction in wetlands will not occur during the flood season and wetland soils will be immediately replaced.

Water quality degradation results primarily from erosion and sedimentation during construction, although chemicals and other toxic substances can degrade the wetland water quality if a spill occurs. Impact from erosion has the potential to occur along most of the corridor. Runoff from construction-related activities can carry sediments into wetlands. While working in wet sections of trenches, stream crossings, and jack-and-bore pits, the trenches or pits will be de-watered, and the water will not be discharged into streams or wetlands without first controlling the sediments.

Mitigation measures, including the requirement that refueling occur more than 100' from wetlands, will minimize the potential for chemicals and toxic substances from construction equipment to enter wetlands. However, OPL's spill prevention and control plan will be followed during and after construction of the pipeline to minimize the potential of chemical degradation of wetlands.

Operational Impacts

Operational impacts will be avoided by not maintaining the 30' right-of-way through wetlands or most wetland buffers. Emergent wetlands within the right-of-way will, in all likelihood, re-vegetate, but the intrusion of invasive plants is a distinct possibility and could result in a long-term impact. A limited number of trees will be removed from five wetland buffers. No pipeline access roads will be constructed through wetlands.

Summary

Approximately 17.07 acres of wetland will be affected by construction-related activities, based on a 30-foot construction width and the total length of wetlands crossed. Table 3.4-4 presents the number of acres impacted by wetland type, or USFWS classification, for each wetland directly impacted. The impacts are summarized for each county and for the entire project.

All impacted wetlands will be restored and no wetland area will be lost. About half an acre of palustrine forested wetland will be converted to scrub-shrub or emergent wetland. Impacts to palustrine forested wetlands will be compensated by the enhancement and conversion of disturbed emergent wetland to forested wetland in an amount equal to twice the disturbed area. Impacts to disturbed scrub/shrub wetlands will be compensated by enhancement of disturbed emergent wetland to scrub/shrub wetland in an amount equal to the disturbed area. Impacts to disturbed emergent, riverine, or open water wetlands will be compensated by enhancement of emergent wetlands in an amount equal to one-half the disturbed area.

TABLE 3.4-4
ACREAGE OF WETLAND IMPACTS, BY TYPE

Wetland	Palustrine Forested	Palustrine Scrub-shrub	Palustrine Emergent	Riverine	Palustrine Open Water	Total Impact	Total Restoration	Enhancement*
Total	.54	10.97	4.86	.13	.57	17.07	17.07	14.70
Snohomish								
County Total	.03	3.88	1.31	.02	.03	4.37	4.37	3.74
270522A	0	.32	0	0	0	.32	.32	.32
270522B	0	.88	0	0	0	.88	.88	.88
270522C	0	.02	0	0	0	.02	.02	.02
270522D	0	0	.72	0	0	.72	.72	.36
270523	0	.65	0	0	0	.65	.65	.65
270523A	0	.15	0	0	0	.15	.15	.15
270524B	0	0	.11	0	0	.11	.11	.06
270619A	0	.02	0	0	0	.02	.02	.02
270619C	0	.10	0	0	0	.10	.10	.10
270619B	0	.65	0	0	0	.65	.65	.65
270620E	0	.11	.04	0	0	.15	.15	.13
270628	0	.26	.17	0	0	.43	.43	.35
270621A	0	0	.10	0	0	.10	.10	.05

TABLE 3.4-4 (CONTINUED)
ACREAGE OF WETLAND IMPACTS, BY TYPE

Wetland	Palustrine Forested	Palustrine Scrub-shrub	Palustrine Emergent	Riverine	Palustrine Open Water	Total Impact	Total Restoration	Enhancement*
270621C	0	.09	0	0	.09	.18	.18	.18
270621B	0	0	0	.02	0	.02	.02	.01
270627	0	0	.14	0	.03	.17	.17	.09
270626B	0	0	.03	0	0	.03	.03	.02
270626C	0	.03	0	0	0	.03	.03	.03
270625B	0	.03	0	0	0	.03	.03	.03
270730	0	.26	0	0	0	.26	.26	.26
270720	0	.03	0	0	0	.03	.03	.03
270729	.03	0	0	0	0	.03	.03	.06
270732B	0	.28	0	0	0	.28	.28	.28
King County								
County Total	.51	5.02	.09	.03	0	5.65	5.65	6.31
260709	0	.52	.09	0	0	.61	.61	.57
260716	0	.18	0	0	0	.18	.18	.18
260717	0	.28	0	0	0	.28	.28	.28
260727A	0	.34	0	0	0	.34	.34	.34
260734	0	.05	0	0	0	.05	.05	.05
260735	0	.46	0	0	0	.46	.46	.46
260735A	0	.53	0	0	0	.53	.53	.53
250702C	0	.12	0	0	0	.12	.12	.12
250702B	0	.15	0	0	0	.15	.15	.15
250702A	0	.34	0	0	0	.34	.34	.34
250711	0	.01	0	0	0	.01	.01	.01
250714	.17	.05	0	.03	0	.25	.25	.41
250714A	0	.03	0	0	0	.03	.03	.03
250725C	0	.14	0	0	0	.14	.14	.14
250725D	0	.34	0	0	0	.34	.34	.34
250725E	0	.53	0	0	0	.53	.53	.53
250736	0	.15	0	0	0	.15	.15	.15

TABLE 3.4-4 (CONTINUED)
ACREAGE OF WETLAND IMPACTS, BY TYPE

Wetland	Palustrine Forested	Palustrine Scrub-shrub	Palustrine Emergent	Riverine	Palustrine Open Water	Total Impact	Total Restoration	Enhancement*
250736A	0	.20	0	0	0	.20	.20	.20
240806	.15	0	0	0	0	.15	.15	.30
240807	.19	0	0	0	0	.19	.19	.38
221016	0	.01	0	0	0	.01	.01	.01
221013	0	.59	0	0	0	.59	.59	.59

TABLE 3.4-4 (CONTINUED)
ACREAGE OF WETLAND IMPACTS, BY TYPE

Kittitas County								
County Total	0	1.36	1.96	.02	0	3.42	3.42	2.46
201309	0	.07	0	0	0	.07	.07	.07
191403	0	0	.08	0	0	.08	.08	.04
191401A	0	.81	.73	0	0	1.54	1.54	1.18
191504	0	0	.29	0	0	.29	.29	.15
191608	0	0	.08	0	0	.08	.08	.04
191611A	0	0	.08	0	0	.08	.08	.04
191611B	0	0	.02	0	0	.02	.02	.01
191723	0	.05	0	0	0	.05	.05	.05
191821A	0	.09	.32	.01	0	.42	.42	.26
191835	0	.24	.09	0	0	.33	.33	.29
181918	0	.02	0	0	0	.02	.02	.02
181919	0	0	.23	0	0	.23	.23	.12
171904	0	.04	0	0	0	.04	.04	.04
172008A	0	.04	0	0	0	.04	.04	.04
172008B	0	0	0	.01	0	.01	.01	.01
172016	0	0	.04	0	0	.04	.04	.02
Grant County								
County Total	0.00	0.00	1.13	0.03	0.24	1.40	1.40	0.73
162419	0	0	.14	0	0	.14	.14	.07
162416	0	0	.17	0	0	.17	.17	.09
162415	0	0	.03	0	0	.03	.03	.02
162413	0	0	.03	0	0	.03	.03	.02
162412	0	0	.07	0	0	.07	.07	.04
162614	0	0	.14	0	0	.14	.14	.07
162735A	0	0	.17	0	0	.17	.17	.09
162735B	0	0	.38	.03	0	.41	.41	.21
162736	0	0	0	0	.24	.24	.24	.12

TABLE 3.4-4 (CONTINUED)
ACREAGE OF WETLAND IMPACTS, BY TYPE

Adams County								
County Total	0	0	.07	0	.21	.28	.28	.16
152806A	0	0	.07	0	0	.07	.07	.04
152806B	0	0	0	0	.21	.21	.21	.12
Franklin County								
County Total	0	.71	.30	.03	0	1.04	1.04	.89
142812	0	.66	0	0	0	.66	.66	.66
132911A	0	0	.02	.02	0	.04	.04	.02
132925D	0	0	.13	0	0	.13	.13	.07
132925B	0	0	.05	0	0	.05	.05	.03
112901	0	0	.10	0	0	.10	.10	.05
102924	0	0.5	0	.01	0	.06	.06	.06

* It is proposed to enhance wetlands as compensation for temporary wetland impacts.

3.4.2.3 Mitigation Measures

Mitigation measures for wetland impacts are prioritized in the following order: (1) Avoidance, (2) Minimization, (3) Restoration, and (4) Compensation. Current federal and state regulations require that impacts to wetland communities be avoided whenever practicable. Where avoidance of wetlands is not possible, impacts are to be minimized or the wetlands restored over time, and where partial or total loss of wetland communities is unavoidable, compensation is required to offset the wetland loss. Compensation with the same type of wetlands as those lost (in-kind replacement) is preferred to out-of-kind replacement, and on-site replacement is preferred to off-site replacement.

For each wetland impacted, specific mitigation measures will be evaluated and developed based on the functions and values of that wetland. These mitigation measures will follow the prioritization of avoidance, minimization, restoration, and compensation described above under the upland vegetation section. Details on mitigation are found in the Cross Cascade Pipeline Wetland Mitigation Plan (Dames & Moore, in progress).

Avoidance

As with other critical habitat areas, such as streams and oak woodlands, wetlands will be avoided where possible along the pipeline route. In particular, high value wetlands that are difficult to replicate will be avoided wherever practicable. Nevertheless, not all wetlands can be avoided, and a total of 17.07 acres of wetlands will be directly impacted by trenching or open cutting. Approximately 1,000 acres of wetlands may be indirectly impacted by the pipeline passing through a portion of the wetland or its associated buffer.

Avoidance of impacts to wetlands and wetland functional values occurs by physically avoiding contact with the wetlands and their buffers. OPL has included wetland avoidance in their route selection criteria, avoiding river and stream valleys and their associated wetlands to the extent possible and placing nearly 80 percent of the route in or adjacent to existing trails, transmission line, and road corridors. Although it is not possible to avoid all of the wetlands within the pipeline corridor, wetlands will be further avoided during final alignment whenever feasible.

Avoidance has been emphasized for high-quality wetlands (e.g., Category I wetlands) and wetland types which are difficult to replicate (e.g., forested wetlands). For example, forested wetlands are avoided to the extent that only 0.54 acres of forested wetlands are directly impacted along the 231 mile pipeline route. No estuaries, alpine wetlands, or bogs are impacted by this project.

Although many of the wetlands crossed by the pipeline are high quality, the pipeline construction corridor is located in a previously impacted plant community within the wetland so that intact plant communities are avoided in almost every case. The plant communities in these wetland areas have been altered by the removal of trees and/or agricultural practices in 75 of the 78 wetlands. The three remaining wetlands, (270729, 250714 Tolt River, and 250736 Griffin Creek) have been impacted somewhat from road construction perpendicular to the pipeline route. No feasible alternatives to crossing these three wetlands are known to exist. Details of the alternatives considered in the route selection process are described under in Section 9.1 of this application.

Other than the construction right-of-way, the only access roads which will be used in wetlands are those existing roads that can be used with no modification and no impact on the wetland. All construction equipment will be refueled at least 100' from water bodies or wetland boundaries. All equipment will be cleaned and inspected prior to entering a wetland. Equipment leaking oil or other fluids will not be allowed to enter a wetland.

Following are the wetland mitigation strategies that will be employed if avoidance is not feasible.

Minimization

Minimization of wetland area and functional value impacts and impacts to wetland buffers include measures taken to reduce the extent or severity of unavoidable impacts. For those wetlands that cannot be avoided, OPL will use the following construction techniques to minimize impacts (subject to evaluations to minimize overall impacts):

Access, Staging, and Ancillary Areas

- Wetland boundaries in the construction corridor will be staked and flagged.
- Where wetlands must be crossed, the pipeline will be routed through less sensitive portions of the wetland if it is feasible.
- Pipeline construction impacts to wetlands will be minimized by using the narrowest possible corridor (30') and by constructing during a time of year when the resources (i.e., nesting or migrating waterfowl, water quality sensitive fish) are either not present or less vulnerable.
- The only access roads, other than the construction right of way, which will be used in wetlands are those existing roads that can be used with no modification and no impact on the wetland.
- All construction equipment will be refueled at least 100' from water bodies or wetland boundaries.
- All equipment will be cleaned and inspected prior to entering a wetland. Equipment leaking oil or other fluids will not be allowed to enter a wetland.

Spoil Pile Placement and Control

- The upper 6 to 12" of topsoil will be removed and protected throughout construction. This material may be stockpiled in adjacent upland areas.
- All spoil material from water body crossings must be placed in the right of way at least 10' away from the ordinary high water line. At a minimum, all spoil shall be contained within sediment filter devices.
- The materials removed from the trench below the topsoil level may also be stockpiled in adjacent upland areas. However, it will not be placed on top of, or mixed with, the topsoil material previously removed.
- Along with other temporary erosion and sedimentation controls, filter fencing and straw bales will be used during construction to minimize sedimentation in wetlands and to deter construction equipment operators from venturing further than absolutely necessary into sensitive areas.

General Construction Procedures

- All activities within the wetland will be kept to the minimum disturbance area possible.
- Construction techniques that minimize the compaction and mixing of wetland soils will be utilized.
- In wetlands and riparian areas, vegetation that must be removed will be cut at ground level, leaving existing root systems intact. The pulling of tree stumps and grading activities will be limited to those that would directly interfere with trenching, pipe installation and backfill.
- Trench plugs will be used as necessary to prevent diversion of water into upland portions of the pipeline trench.
- Grading will not take place within the boundaries of any wetland, and disturbance will be kept to the minimum necessary to safely construct the pipeline.
- Pipe sufficient to cross the wetland will be welded on the right-of-way and radiographed before being carried or pulled into the wetland and lowered into the trench. In long wetland stretches, it may be more feasible to weld up several joints of pipe, carry them into the trench leaving one end at the welding location, weld on additional lengths, pull them into the trench, and repeat this process until the entire wetland length has been crossed.
- If standing water or saturated soils are present, low ground weight construction equipment will be used, or construction will be done using prefabricated equipment mats.
- In the event that matting is necessary, all construction activities will be carried out from the matting. Equipment will not be allowed in the wetland off the mats, at any time. The mats will be inspected prior to placing in the wetland and mats with foreign material will not be used.
- Once the pipe has been laid in the trench, the subsoil will be replaced, followed by the topsoil. Excess material will be spread on the right-of-way outside the wetland boundaries.

Restoration

Restoration of wetlands and buffers over time re-establishes a wetland area, including the associated functions and values. This type of mitigation is used when a wetland has been adversely affected during construction and is then restored when the construction is complete. Most of the wetlands and buffers crossed by the proposed pipeline can be restored or partially restored in terms of acreage, functions, and values.

Of the 78 wetlands, 73 of them have buffers that are not forested within the construction corridor. These wetland buffers will be restored after construction by replanting vegetation similar to that found at the time of construction. For example, wetland buffers with shrubs will be replanted in shrubs, buffers that are in crops or pasture will likewise be replanted, and those buffers that are unvegetated at the time of 4construction (such as roads, unplanted cropland, or the rail trail) will not be replanted. As in all upland areas of the pipeline construction corridor, mitigative measures to control erosion and to control invasive plant species will be implemented in wetland buffers. Therefore, the impacts to these buffers will not be substantial, but marginal.

The remaining 5 wetlands have forest cover in all or part of their buffers within the construction corridor. These five wetlands are 270729, 250714, 250736, 240806, and 240807. Impacts to these buffers will be mitigated by replanting the impacted portion of the buffers with trees and shrubs. In order to maintain a corridor along the pipeline that is visible from the air, it will be necessary to maintain a cover of low shrubs and not trees for a width of 30' along the pipeline route. Since the width of the construction corridor in upland areas is a maximum of 60', half of the forested wetland buffers will be reforested and half will be revegetated with native shrubs, grasses and forbs.

The permanent loss of forest cover in the buffer around wetlands 270729 and 250714 will be less than 3% of the total buffer area in each case. These buffers lie between the wetlands and commercial forest land. In the case of wetland 250714, the buffer on the south side of the wetland was clearcut in 1996.

The permanent loss of forest cover in the buffer around wetland 250736 is less than 1% of the total buffer area. The buffer to the south lies between the wetland and commercial forest land and to the north lies between the wetland and a logging road.

In wetlands 240806 and 240807, the pipeline route follows a logging road through a private tree farm. The permanent loss of forest cover in the buffers around these wetlands is less than 1%, and the buffers lie between the wetlands and commercial forest land.

The most important wetland buffer with forested cover that will be impacted is the buffer to the north of wetland 250736. This buffer lies between the wetland associated with Griffin Creek and the logging road. The most valuable function that this buffer provides is the improvement of the quality of the surface water that runs off the road and into Griffin Creek. This function of water quality improvement can be performed as well by a buffer with shrubs, grasses, and forbs.

The land use adjacent to the buffers in the other four wetlands is of low intensity. For this reason, and because only a small percentage of the wetland buffers will be permanently altered, the impacts will not be substantial.

Restoration of wetland hydrology is essential to the maintenance of wetland functions and values. Restoration measures to be included in the Cross Cascade pipeline project consist of the following:

- Where trenching occurs through open water, aquatic bed, emergent, and scrub-shrub wetlands, soils and vegetation will be replaced.
- Where trenching through a wetland may alter the hydroperiod (i.e., excavating through a layer of till, or altering the topography, soil or sub-basin which supports wetland hydrology), soil, subsoil and/or topographic conditions will be recreated as nearly as possible to restore the existing wetland hydrology.
- Restoration of wetland, buffer, and riparian vegetation presently vegetated with native species is considered successful if the native herbaceous and/or woody cover comprises at least 80 percent of the total cover, and native species diversity is at least 50 percent of the diversity originally found in the wetlands. If revegetation is not successful at the end of the 5-year post-construction monitoring period, the applicant will (in consultation with a professional wetlands ecologist, EFSEC, WDFW, and DOE) develop and implement a plan to actively revegetate the wetland with native wetland herbaceous and woody plant species.

Compensation

Impacts to water quality and disruption of wildlife habitat during construction will be, for the most part, temporary in nature. Removal of forested wetland and buffer vegetation will have long term impacts, as will the permanent loss of any other wetland functions and values. These permanent losses of functions will be small relative to the scope of the project due to the implementation of avoidance and minimization strategies.

OPL proposes to provide compensation for wetland impacts by enhancing existing degraded or low-value wetlands at four selected sites near the pipeline route. These four sites are located in Grant, Kittitas, King, and Snohomish counties.

The rationale for providing compensation in this manner is as follows:

A. Wetland impacts related to this project are, for the most part, temporary in nature.

B. Because of the geography of the project, a large number of wetlands are impacted over a 200 mile range. However, the area of impact in each wetland is typically only a few hundred or a few thousand square feet. Consolidating the proposed compensation (mitigation) into four sites increases the likelihood that the compensation will provide benefits to the environment. It also simplifies other tasks, such as management and monitoring of the compensation sites.

C. Enhancement of existing wetlands is more likely to succeed than creating wetlands from upland sites.

D. The goals of the mitigation plan are focused on addressing the impacts of the project. The impacts of the project will result in a temporary and, in some cases, permanent loss of functions and values, but not in a loss of wetland acreage. Therefore, the goals of the compensation are oriented towards wetland functions and values, not acreage.

For wetlands that are disturbed but not lost, the following shall apply:

- Forested wetlands. Disturbance impacts to forested wetlands will be mitigated by both: restoration of the disturbed area to either forested wetland or scrub/shrub wetland; and enhancement of disturbed emergent herbaceous wetland to forested wetland in an amount equal to twice the disturbed area.
- Scrub/shrub wetlands. Disturbance impacts to scrub/shrub wetlands will be mitigated by both: restoration of the disturbed area to scrub/shrub wetland; and enhancement of disturbed emergent wetland to scrub/shrub wetland in an amount equal to the disturbed area.
- Emergent wetlands. Disturbance impacts to emergent herbaceous wetlands will be mitigated by restoration of the disturbed areas to native emergent herbaceous wetland and enhancement of disturbed wetland in an amount equal to one-half the disturbed area.
- For those restoration, creation or enhancement areas that do not meet the success standards provided above after 5 years, additional replacement will be provided as follows: an amount of forested wetland equal to the unsuccessful portion of the restored forested wetland areas; and an amount of scrub/shrub or emergent wetland equal to the unsuccessful portion of the mitigation scrub/shrub or emergent wetland areas.
- Wetland restoration, creation, and enhancement will be designed to meet the goal of no net loss of wetland acreage and functions. In-kind replacement of functions and values will be preferred over out-of-kind replacement.

3.4.2.4 Monitoring

- A five-year post-construction monitoring plan will be developed and implemented to assess mitigation success or failure.

- Wetlands and other sensitive habitats will be monitored during construction to provide oversight to ensure the implementation of Best Management Practices and for onsite adjustments to construction practices.

- Restoration of wetland, buffer, and riparian vegetation presently vegetated with native species is considered successful if the native herbaceous and/or woody cover is at least 80 percent of the total cover, and native species diversity is at least 50 percent of the diversity originally found in the wetlands. If revegetation is not successful at the end of the 5 year post-construction monitoring period, the applicant will develop and implement (in consultation with a professional wetlands ecologist, EFSEC, WDFW, and WDOE) a plan to actively revegetate the wetland with native wetland herbaceous and woody plant species.

3.4.2.5 Right-of-Way Maintenance

- Herbicides and pesticides will not be used.
- No management of vegetation will occur over the right-of-way in wetlands, wetland buffers, and riparian areas.

3.4.3 HABITAT TYPES AND WILDLIFE USE

Wildlife species records and distributions along the pipeline route were gathered from publications and inventory information from the Washington Natural Heritage Program, U.S. Fish and Wildlife Service, U.S. Forest Service, and Department of the Army (Yakima Training Center Staff). Field work provided some site specific information, and published field guides and related studies provided additional background information. Vegetation mapping was based on aerial photograph interpretation, and agency GIS coverages (old-growth mapping in the study area relied heavily upon the Washington Department of Fish and Wildlife Priority Habitats and Species coverage) with field verification.

The habitat types and wildlife use study area for this project is defined as a 0.5-mile-wide corridor centered along the proposed pipeline route. This area was selected to: 1) encompass the actual construction impact area (60' wide strip at its maximum); 2) allow for minor adjustments in the pipeline route; 3) encompass areas that may be converted to edge habitat by the construction of a new right-of-way; and 4) allow investigation of habitat fragmentation and the spatial context by studying impacts at a larger scale.

WAC 463-42-332 requires that the assessment of habitat types, vegetation, wetlands, animal life and aquatic life include information on species density and distribution. Since linear projects such as the Cross Cascade Pipeline affect only a narrow slice of many habitats and populations, we address density and distribution with reference to the larger habitats and populations. Habitats are mapped and described and specific distributions of special status species are addressed. Densities of populations are discussed in terms of published information and limited field observations.

3.4.3.1 Affected Environment

Wildlife Species Along Pipeline Corridor

Over an entire year, approximately 320 species of wildlife are likely to occur in habitats traversed by the pipeline corridor (see Appendix B for species list). Sixteen species of amphibians potentially occur in aquatic, riparian, wetland, and upland habitats in the study area. Fifteen species of reptiles potentially occur in aquatic and terrestrial habitats within the corridor. There are 224 species of birds that may occur within habitats in the study area as permanent year-round residents, breeding season residents, spring/fall migrants, and/or winter residents. A total of 32 species of mammals may occur in habitats traversed by the project. Small mammals, including rodents, shrews, bats, and rabbits are the most numerous, although they are not readily observed. Large mammals include deer, elk, coyotes, and black bears.

Habitat Types Along Pipeline Corridor

Habitat types were identified in the study area along the proposed pipeline corridor, based on vegetation types described in Section 3.4.1. The acreage of each habitat type within the study area is shown in Table 3.4-5. Because the delineation of the study area is drawn with an artificial line (i.e., no specific biological distinction), impacts may be better evaluated by total acreage rather than percentage of the entire study area. However, both values are given. Each habitat type is described below in terms of wildlife use and habitat values. Vegetation types are mapped in Appendix A.

TABLE 3.4-5
HABITAT TYPES IN THE STUDY AREA[a]

Habitat Type	Acreage	Percent of Total
Old-growth forest	427.0	.6
Coniferous forest	16,765.9	23.3
western hemlock	5,877.2	8.2
silver fir	230.9	.3
mountain hemlock	650.0	.9
Douglas fir	3,674.8	5.1
ponderosa pine	1,793.5	2.5
regenerating conifer	4,539.5	6.3
Deciduous forest	531.7	.7
oak woodland	50.3	.07

TABLE 3.4-5 (CONTINUED)
HABITAT TYPES IN THE STUDY AREA[(a)]

Habitat Type	Acreage	Percent of Total
Mixed forest	3,308.9	4.6
Scrub-shrub	2,497.0	3.5
Shrub steppe	21,000.8	29.1
Grass/forb	398.4	.6
Cropland	13,571.3	18.8
Hay/pasture	7361.6	10.2
Orchard	796.1	1.1
Developed vegetated	1494.9	2.1
Developed barren	966.0	1.3
Lakes and ponds	671.2	.9
Rivers and streams	413.5	.5
Wetlands	1,965.2	2.7
Palustrine forested	416.8	.6
Palustrine scrub-shrub	602.1	.8
Palustrine emergent	685.0	1.0
Palustrine open water	131.4	.2
Palustrine aquatic bed	28.6	.04
Palustrine unconsolidated bed	1.62	.002
Riverine	113.2	.2
Total	72182.8	100

(a) The ***study area*** is defined as a 0.5-mile-wide corridor centered on the pipeline route.

Forest: Forest habitat consists of areas dominated by coniferous and/or deciduous tree cover, and associated forest understory vegetation. Coniferous forest is the predominant habitat type, comprising 23 percent of the study area (16,765.9 acres). Deciduous and mixed forest occur in smaller patches, mostly in riparian and wetland areas, and comprise an estimated 0.7 and 4.6 percent (531.7 and 3,308.9 acres) of the study area, respectively.

Forest habitat for wildlife in general varies depending on the age or successional stage of the stand, the presence of several vegetative layers (i.e., shrub/midstory and herbaceous/understory vegetation), the presence of snags and downed logs, the size of the stand, the plant community type (ie. western hemlock or ponderosa pine), and topographic features. Large tracts of forest habitat are located on the Mount Baker-

Snoqualmie National Forest, Wenatchee National Forest, and privately-owned forest lands along the route. On privately owned tree farms the land is being managed primarily for timber production; these stands generally consist of younger second-growth with closed canopies, sparse understory vegetation, and few snags. In the two National Forests, the forested stands are generally characterized as older second-growth with well-developed shrub and understory layers and numerous snags.

The coniferous forests of the Puget lowlands and western Cascades are dominated by western hemlock and Douglas fir, while closer to the Cascade crest Pacific silver fir and mountain hemlock are also dominant trees. On the eastern slopes of the Cascades the forests are dominated by more open stands of Douglas fir and ponderosa pine. Along the proposed pipeline route, the eastern limits of ponderosa pine forest is Swauk Creek. Although many wildlife species can utilize a variety of forest types, some have special requirements limiting them to certain forest types (ie. deciduous, moist western hemlock, dry ponderosa pine). Examples of specialist species are found in the unique species section 3.4.5

Common wildlife species in forest habitat in the study area are typical of those found in second-growth forest stands throughout Washington. Forest songbirds in the study area include Pacific slope flycatchers, Steller's jays, chestnut-backed chickadees, red-breasted nuthatches, brown creepers, winter wrens, golden-crowned kinglets, varied thrushes, solitary vireos, Townsend's warblers, Wilson's warblers, western tanagers, and black-headed grosbeaks. Other common birds include Cooper's hawks, grouse, great horned owls, barred owls, and red-tailed hawks. Large mammals include deer, mountain beaver, black bear, coyotes, bobcats, raccoon, and opossums. Many small mammal species as well as several amphibians and reptiles also utilize forest habitats.

Regenerating Coniferous Forest: Regenerating coniferous forests, including tree farms, in the study area include Douglas fir and western hemlock forests that were clearcut up to 20 years ago. For the first few years after clearcutting, these stands are dominated by a mix of forbs, ferns, and shrubs, such as salal, Oregon grape, trailing blackberry, vine maple, sword fern, bracken fern, and red alder. Within 5 to 10 years after clearcutting, the conifer seedlings (primarily Douglas fir) become the dominant vegetation, often with a dense understory of herbs, ferns, and shrubs. By age 20, the stands are classified as forest habitat with closed canopies and less prevalent understory vegetation.

Regenerating forest comprises an estimated 6.4 percent (4,539.5 acres) of the study area. Regenerating forest is interspersed with forest habitat in the study area. Large tracts of regenerating forest are located on the Mount Baker-Snoqualmie National Forest, Wenatchee National Forest, and on private timber land.

Many wildlife species are found in regenerating forest stands because the variety of plants and seeds provides an abundance and diversity of food. The young plants are palatable to browsers and grazers like deer and elk, and provide hiding cover for songbirds and other wildlife. Birds common in regenerating coniferous forest includes ruffed grouse, mourning doves, rufous hummingbirds, Swainson's thrushes, orange-crowned warblers, MacGillivray's warblers, Wilson's warblers, rufous-sided towhees, song sparrows, white-crowned sparrows, dark-eyed juncos, American goldfinches, and red-tailed hawks. Coyotes, deer, elk, bear and bobcats are also found within regenerating forest habitat and often use logging roads through the regenerating stands.

Old-Growth Forest: Old-growth forests are defined as a priority habitat by the Washington Department of Fish and Wildlife because they have high wildlife density, high wildlife species diversity, and provide important breeding habitat and seasonal ranges (WDFW 1996). Old-growth forest habitat is critical for several species, including the northern spotted owl and marbled murrelet. This habitat is also limited in availability and highly vulnerable to habitat alteration.

Old-growth forest habitat was delineated based on the Washington Department of Fish and Wildlife's 1988/1989 Old-growth Database. In this database, old-growth forest is defined as coniferous forest stands where the dominant trees are 30" or more in diameter and the codominant trees are 16" or more in diameter. Stands have a deep multi-layered canopy, with incomplete canopy closure. Stands also contain several large (>=20" DBH), upright snags per acre and many downed logs greater than 24" DBH (WDW, 1990). There are 427 acres (0.6 percent) of old-growth forest in the study area; however, the selected route avoids all old-growth stands.

Oak Woodlands: Oak woodlands consisting of pure or mixed stands of Garry oak are a notable feature in the region. There is one stand of oak woodland in the study area located where the pipeline crosses Swauk Creek, as well as scattered oaks in the surrounding area. Oak woodlands comprise approximately 0.07 percent (50.3 acres) of the study area. Oak woodlands are classified as a priority habitat by the Washington Department of Fish and Wildlife because they support comparatively high wildlife density and species diversity, are limited and declining in availability, and are highly vulnerable to habitat alteration (WDFW 1996). Species inhabiting oak woodlands in eastern Washington include the western gray squirrel, Lewis' woodpecker, acorn woodpecker, and ash-throated flycatcher.

Scrub-Shrub: Scrub-shrub habitat is the primary habitat type in existing rights-of-way and may also occur in recent clearcuts prior to tree regeneration. It comprises 2,497 acres or 3.5 percent of the study area. Scrub-shrub habitat is often dominated by Scot's broom, but also includes trailing blackberry, Himalayan blackberry, salmonberry, thimbleberry, and young red alder. These shrub-scrub habitats in existing rights-of ways may serve as a travel corridor for some species, and provide forage for elk, deer, black bears, and other animals which otherwise remain close to the forest habitat for cover. Birds of prey, coyotes, and other predators may be attracted to these shrubby corridors by increased densities of small mammals and birds.

Shrub-Steppe: Shrub-steppe habitat covers much of central and southeastern Washington in areas typified as arid to semiarid with low precipitation (Franklin and Dyrness 1988). This habitat is composed primarily of bunchgrass and sagebrush communities, most of which have been altered by fire and grazing. Shrub-steppe comprises 29.1 percent (21,000.8 acres) of the study area and provides valuable habitat for many bird species including white-crowned sparrows, sage sparrows, sage thrashers, sage grouse, burrowing owls, and ferruginous hawks. Mammals in the shrub-steppe include pocket mice, deer mice, pocket gophers, badgers, coyotes, and mule deer (winter range). In a relatively undisturbed condition, shrub-steppe is classified as a priority habitat by the Washington Department of Fish and Wildlife. However, most of the shrub-steppe habitat occurring in the study area has previously been disturbed by various human activities (Section 3.4.1.1).

Grass/Forb: Grass/forb habitats make up 0.6 percent (398.4 acres) of the study area and are typically disturbed areas dominated by herbaceous vegetation. These habitats provide foraging areas for deer and elk, as well as hunting grounds for raptors and other predators that prey upon small mammals.

Agricultural: Agricultural areas include pastures (7,361.6 acres, 10.2 percent), croplands (13,571.3 acres, 18.8 percent), and orchards (796.1 acres, 1.1 percent). Some of these low-lying fields become flooded during winter and many provide temporary winter habitat for numerous species of waterfowl where they rest and feed on grains. These species include trumpeter swans, Canada geese, mallards, northern pintails, American widgeons, green-winged teal, and common goldeneyes. Killdeer and common snipe are examples of other water birds that may use fields for foraging habitat. Open areas also provide foraging habitat for raptors. Red-tailed hawks, American kestrels and northern harriers occur year-round in open agricultural areas. Songbirds occurring in this habitat type include violet-green swallows, savannah sparrows, and American robins.

Wetlands: Wetland habitats are interspersed among terrestrial habitats and comprise approximately 1,965.2 acres (2.7 percent) of the half mile study area. Wetland types include palustrine emergent, palustrine scrub-shrub, and palustrine forested wetlands, described in Section 3.4.2. Emergent wetlands provide habitat for waterfowl, shorebirds and a variety of songbirds including common yellowthroats, marsh wrens, and red-winged blackbirds. Several amphibians and reptiles inhabit emergent wetlands including roughskin newts, red-legged frogs, and garter snakes. Scrub-shrub wetlands provide habitat for shrub-nesting songbirds, such as willow flycatchers, Hutton's vireos, MacGillivray's warblers, and song sparrows. Forested wetlands with dead standing trees (snags) provide habitat for cavity-nesting wildlife such as wood ducks, common goldeneyes, pileated woodpeckers, and red-breasted sapsuckers.

Lakes and Ponds: Lakes and ponds comprise 0.9 percent (671.2 acres) of the habitat in the study area. Lakes and ponds are important habitat for the loons, grebes, herons, waterfowl, and shorebirds that potentially occur in the study area and are also used by a variety of other birds. Several mammal species, most amphibians, and some reptiles also use lake and pond habitat.

Rivers and Streams: The proposed pipeline route crosses 293 waterways including rivers, streams, canals, and wasteways. Waterways comprise approximately 413.5 acres or .5 percent of the pipeline study area. River and stream habitats provide important habitat for numerous species of birds, mammals, reptiles, amphibians, and invertebrates.

Developed: Developed barren areas consist of roads, highways, buildings, and other unvegetated areas. Developed vegetated areas include residential areas with greater than 25 percent vegetative cover, parks, golf courses, and other landscaped areas. Developed barren and developed vegetated areas comprise an estimated 1.3 and 2.1 percent (966 and 1,494.9 acres) of the study area, respectively. Although there are varying levels of development, these areas generally provide low-quality habitat because of the lack of native vegetation and the level of human disturbance. Species common to developed areas include European starlings, rock doves, American crows, house sparrows, and opossums, all of which are well adapted to human-modified environments.

Habitat Types at Kittitas Terminal and Pump Stations

Habitat types at the Kittitas Terminal, and at the North Bend, Beverly-Burke, and Othello Station sites are primarily crop lands and pastures. The Kittitas Terminal is the largest of the facility sites and this 26-acre site is located entirely within an existing agricultural area. The Thrasher Station is dominated by grasses and forbs, Scot's broom, and a few Douglas fir trees, and is located near a rural residential and commercially-developed area. The Stampede Station is located in disturbed grass/forb habitat. Wildlife species at these sites are typical of those found in agricultural and grass/forb habitats.

3.4.3.2 Potential Impacts to Habitat Types and Wildlife Use

Several types of impacts could occur from construction of the proposed pipeline. Direct impacts are caused by the action and occur at the same time and place and are considered primary effects. Direct impacts could occur from surface disturbance at construction sites where new corridors are constructed, in existing powerline corridors, or where new pump stations or terminals are located. Indirect impacts caused by the action are considered secondary effects. These impacts occur later in time or some distance away from the action. Indirect impacts may include urban development and other impacts related to induced changes in the pattern of land use, human population density or growth rate, and related impacts on air and water and other natural systems, including ecosystems (40 CFR 1508.8 [a]).

Duration of effects can be temporary and short-term or extended and long-term. Mitigation and conservation measures discussed are intended to reduce impacts and include pre-construction, construction, and post-construction mitigation measures.

Direct impacts from surface disturbance related to construction activities include direct mortality (e.g., equipment crushing an individual organism), temporary and/or permanent displacement of the species from the disturbed area, or removal of their habitat or food organisms. The pipeline project will have very little permanent disturbance in the way of buildings or paved area, but maintaining a 10 to 30' wide visual corridor for aerial inspections will require impacts in forested areas that would persist for the life of the project. Areas of permanent disturbance include block valve sites, the Kittitas terminal, and pump stations. Temporary surface disturbing effects will occur on the part of the construction corridor that can be returned to the type of vegetative cover formerly there. Areas where construction occurs in existing roads will have no direct impacts on wildlife.

Indirect impacts could include such things as new forest edges attracting species such as jays that increase the level of egg predation on forest bird species such as northern goshawks. The pipeline project will create no new corridor through interior forest situations (more than 600' from an existing opening), so this potential impact will not result. Fragmentation of habitat and interruption of wildlife travel corridors could be other potential indirect impacts. Fragmentation can be important if the habitat structure is substantially changed, such as cutting and maintaining a new corridor through a forest. With the cover removed, some species may be more vulnerable to predation as they cross the opening. This situation does not pertain to the pipeline project because the route will be constructed in existing roads, former railroad grades, or in already-cleared transmission corridors through forested areas. In non-forested areas, the habitat structure will be essentially unchanged, since shrubs can be allowed to grow in the corridor, and the corridor will be revegetated except for where it coincides with existing roads or trails. Interruption of travel corridors will not occur (except for the very brief period when the trench is open during construction) because the pipeline corridor will have no new barriers to wildlife travel. Over most of the route, the pipeline will be in or adjacent to existing roads that are existing physical or hazard barriers to wildlife travel.

Project Construction Impacts

Direct Effects

In general, vegetation within the construction corridor will be disturbed by trenching, stockpiling of topsoil and overburden, machinery and vehicle access and movement, and backfilling. The maximum width of the construction corridor will be 60'. In existing powerline corridors where tall trees are periodically removed, construction activities will only disturb shrub, grass, or herb dominated vegetation. Where the pipeline corridor uses existing roadways, trails, or railbeds, construction will be kept within existing cleared areas and limited vegetation will be lost. Additional tree and tall shrub removal will continue to occur only within the 30' maintenance corridor.

Habitat Areas Affected

Table 3.4-6 shows estimated acreages of vegetation types impacted by pipeline construction and maintenance. The construction corridor will be restricted to 30' wide or less in riparian areas and in the Cascade Mountain construction spread. The pipeline will be placed within existing roads and trails in forested areas along the Cedar Falls Trail, Homestead Valley Road, John Wayne Trail, Tinkham Road, and Snoqualmie Pass Tunnel. Vegetation clearing along these roads and trails will be limited to some overhead branches and to a few stream sites where trenching is required.

Native grasses and shrubs will be restored in wetlands, shrub steppe, and in other areas by seeding and/or planting of native vegetation. The pipeline corridor through shrub steppe habitat represents a fraction of a percent of the total acreage of this contiguous habitat. The operational impact to shrub steppe will be very low because it will be seeded with native grasses, and native grasses and shrubs will be allowed to recolonize the corridor. Agricultural use will continue on all agricultural areas impacted by construction.

TABLE 3.4-6
ESTIMATED ACREAGE OF CONSTRUCTION AND OPERATIONAL IMPACT BY VEGETATION COVER TYPE

Vegetation Cover Type	Acreage of Impact	
	Construction	Operation
Old-growth forest	0.0[a]	0.0
Coniferous forest	95.7	52.3
western hemlock	38.6	21.1
silver fir	1.0	1.0
mountain hemlock	0.0	0.0
Douglas fir	2.0	1.2
ponderosa pine	2.2	1.1
regenerating conifer	51.9	27.9
Deciduous forest	4.9	3.3
oak woodland	0.0[b]	0.0
Mixed forest	3.7	3.7
Scrub-shrub	207.6	105.1
Shrub steppe	541.7	0.0
Sagebrush	410.9	0.0
Grass/forb	10.6	0.0
Cropland	275.1	0.0
Hay/pasture	150.1	0.0
Orchard	6.8	3.0
Developed vegetated	13.8	6.6
Total upland habitat	1310.0	174.0
Palustrine forested wetland	0.54	0.54
Palustrine scrub-shrub wetland	10.97	0.0
Palustrine emergent wetland	4.86	0.0
Palustrine open water wetland	0.57	0.0
Riverine wetland	0.13	0.0
Total wetland habitat	17.07	0.54

(a) The route avoids impacts to old-growth forest.
(b) Although the construction corridor passes through oak woodland, no oak trees will be removed.

Sequence of Habitat Effects Along Pipeline Route

From the western terminus of the pipeline to the Cascade Crest, direct impacts will occur to forested, shrub, herbaceous, and agricultural plant communities. Most of this section of the route occurs in a fragmented landscape with construction occurring on roads, trails, or in powerline corridors. Two important river crossings with riparian areas will be affected in this area, but only short sections of forested habitat will be impacted by the construction of new corridors. A variety of habitats occur within this section including aquatic communities in wetlands and streams, and terrestrial communities in riparian areas, forested habitat, and open areas such as grass/forb and hay/pasture habitats. Potential special status species that could occur in those habitats include bald eagle, northern goshawk, Pacific fisher, pileated woodpecker, and Van Dyke's salamander.

From the Cascade Crest to the Columbia River most direct impacts will be to shrub-steppe, grassland, and agricultural habitats. The pipeline route through shrub-steppe vegetation will be placed in powerline corridors, in new corridors, in or adjacent to existing roads, or through private land. Most of the shrub-steppe areas have had a long history of grazing impacts. Little impact will occur in forested habitat since existing trails and roads will be used extensively in forested areas. One stream crossing (Swauk Creek) has forest habitat, but most if not all trees will be avoided, and cattle grazing is currently impacting the area. Very little additional impact will occur. Additional agricultural land will be affected, but effects on habitat or special status species will be insignificant since the agricultural lands along the route provide limited habitat to special status species and agricultural land use will continue after construction. Along this section, many stream crossings will occur, but those crossings will be minimally impacted due to the route being located on roads, trails, and existing powerline corridors. Special status wildlife species that could occur along this section include species utilizing aquatic habitats (i.e., bald eagle, spotted frog), species from forested habitats (i.e., Larch Mountain salamander, northern goshawk, spotted owl, Townsend's big-eared bat, Vaux's swift), and species of open grasslands and shrub-steppe habitats (i.e., burrowing owl, loggerhead shrike, sage thrasher, sage sparrow, sage grouse).

From the Columbia River to Pasco, Washington, a variety of habitats will be affected including wetlands, shrub-steppe, grasslands, and agricultural types. Impacts to wetland-dependent wildlife species will be temporary and very short term. Special status species that could occur there include American peregrine falcon, ferruginous hawk, burrowing owl, and loggerhead shrike.

Mortality Effects

Construction vehicle movement may result in a certain amount of direct mortality of animals. Small animals that are hidden in the path of the excavators and other equipment may be crushed by the equipment. Moving animals crossing the path of operating equipment and vehicles can be hit and killed, just as they do crossing highways, but less so because vehicle speeds will be lower. The amount of this kind of direct effect is expected to be an extremely small percentage of any species' population, and therefore not a significant effect. No threatened or endangered species is expected to be affected in this way.

Noise and Disturbance

Human activity and noise generated from construction of the pipeline can result in temporary disturbance of some wildlife species in surrounding habitat. Pipeline construction noise will emanate from trenching activities and from blasting. Areas where special-status species sensitive to noise in part of their life cycle, such as spotted owls or marbled murrelets, will have construction delayed until after the sensitive season. Crews will place mats over any area to be blasted in order to decrease noise and limit the amount of outward explosion. Potential noise impacts from operation of the project do not exceed the threshold established noise guidelines presented in WAC 176-60-020(2) given in Section 4.1 Environmental Health of the EFSEC Application, and no significant effects on wildlife are expected.

Block Valves and Pump Stations

Direct impacts will occur at block valves along the pipeline route. Block valves will be constructed at pump stations and at all major stream and river crossings. Construction sites will include a fenced area approximately 30' x 40' within the pipeline construction corridor, a 8' x 8' valve vault, a 10' x 10' control building, and a power pole. Disturbance impacts will include clearing of vegetation and construction work. The sites will not be permanently attended, therefore, human activity will occur primarily during initial construction. Impacts to wildlife could include disturbance and temporary displacement at the construction site and some direct mortality (e.g., ground dwelling species). Impacts at block valves will be localized to a small area.

The site of the Kittitas Terminal is approximately 27 acres, and is currently used as cropland. The five pump station sites are each approximately two acres. The Thrasher Station site is dominated by grasses and forbs, Scot's broom, and a few Douglas fir trees. The North Bend site is presently being used as pasture, and is covered with grasses and forbs. The Stampede Station site is disturbed site with grass/forb vegetation. The Beverly-Burke and Othello Station sites are cropland. Wildlife (primarily species found in agricultural areas and in "edge" habitats) at these sites will be displaced. Mortality may occur during construction, and when animals move to adjacent habitat.

Indirect Effects

Potential indirect impacts from project construction are related to increased access to the public, additional fragmentation of habitat, and changes in site characteristics (physical and ecological) that can influence habitat availability and value in areas adjacent to the pipeline corridor.

Habitat Value

Potential habitat value reductions could result from increased exposure of wildlife to public use (e.g., hunters, poachers) or alterations to microclimate along edges of the right-of-way, which could favor different species. Indirect impacts to vegetation and wildlife species occurs from public access associated with site construction areas and new road construction; this can impact vegetation by prohibiting re-establishment of native vegetation in continually disturbed areas. However, if new access roads are built, they will be revegetated and ownership and management of the land will not change as a result of the pipeline project. Therefore, these impacts will not occur.

Indirect impacts to habitat will also result from clearing forest vegetation in new construction corridors. Although the area outside of the maintenance right-of-way will be revegetated with grasses and forbs immediately following construction, the change in microclimate and edge could affect vegetation or wildlife species in those areas.

Public Harassment of Wildlife

Wildlife can be adversely affected by increased public access that results in harassment of wildlife, legal and non-legal take of wildlife species not previously accessible, and wildlife take from vehicles on roads or off roads accessed by construction sites.

Impacts from public access are expected to be low for several reasons. Forested areas are currently fragmented and construction will occur primarily on roads, trails, or in powerline corridors within forested areas. Corridors in eastern Washington will be within existing powerline rights-of-way or on private land, which can be restricted by fencing closure if the owners desire. The potential for impact due to increased public access is expected to be insignificant.

Habitat Fragmentation

Species that could be affected by fragmentation are usually species with low dispersal capability and mammals with large home ranges that are dependent on connected habitats. All of the forested landscape that is being traversed by the pipeline is already highly fragmented. Placement of the pipeline on roads, trails, and powerline corridors has mostly precluded the need to build new corridors through forested habitats. All new corridors will be short ones connecting roads, trails, and powerline corridors with each other. High road densities south of I-90 and the matrix of private and public forest sections has made the South Fork Snoqualmie Watershed the most fragmented watershed in the basin (SFSWA 1995). Impacts from additional fragmentation will be insignificant.

The Forest Service considers the Snoqualmie Pass area as an important corridor in the north-south and east-west movement of species (SPAMAP 1995). Since the pipeline will be placed along the JWPT through the Snoqualmie Pass Tunnel, this project will not cause disturbance to species moving over Snoqualmie Pass.

Operation and Maintenance

Direct Effects

A maintenance corridor will be maintained to facilitate periodic pipeline monitoring and inspection, including overflights and ground patrols. The corridor will be 30' wide, centered on the pipeline route in segments that are not within an existing road, railroad, or powerline right-of-way. Maintenance along the corridor will include control or removal of trees and large shrubs.

Operation and maintenance will result in noise from biweekly overflights of the pipeline route. Overflights could periodically disturb wildlife that return to the pipeline corridor and adjacent habitat after construction. These effects are expected to be minor and insignificant.

Noise will result from operation of the Kittitas Terminal and pump stations. Activity will be greatest at Kittitas Terminal, but due to existing noise levels at the site near Interstate 90 and at a neighboring gas station, noise impacts to wildlife will be insignificant. The Thrasher, North Bend, and Stampede Stations will be enclosed to limit noise impacts. The Beverly-Burke and Othello Stations are located in agricultural areas that are currently farmed. Impacts to special status wildlife from operation of pump stations and Kittitas Terminal will be very small and insignificant.

Indirect Effects

Loss of forested habitat or fragmentation of the landscape could affect adjacent vegetation types by changing moisture regimes, temperature, or soil conditions. Those areas along the pipeline route where forested areas currently exist will be revegetated with grasses and forbs. Loss of trees could influence wildlife in the corridor or in adjacent forested areas. Small species such as salamanders and small mammals will be affected most. Species that cannot adjust to a change from forested to herbaceous vegetation cover will be forced to move.

Mortality could occur to species that invade other species' territories, to species that can not locate suitable habitat, or to species which are preyed upon while searching for new habitat. This is in keeping with the commonly accepted assumption that existing habitats are at carrying capacity for a given species.

Indirect impacts from disturbances at pump stations and Kittitas Terminal could include establishment of invasive species. The effect of invasive species on wildlife will vary; some wildlife will find cover or forage where invasive species become established while others will not. Some of the special status species could become opportunistic foragers around newly cleared sites (e.g., at pump stations or along newly revegetated grassland corridors). Bird species, such as the ferruginous hawk and the loggerhead shrike, which forage on small mammals and insects, respectively, could take advantage of newly created clearing and habitat change.

Emergency Activities

Direct Effects

Direct impacts could occur from emergency activities anywhere and at any time along the pipeline route, although the likelihood is very low. Emergency situations could arise from a natural disaster, accident, or other events, which could cause rupture of the pipeline, fire, or explosion. To address these issues, Section 2.9, Spill Prevention and Control and Section 7.2, Emergency Plans were formulated pursuant to State of Washington Code and are given in the EFSEC Application.

Emergency activities require an immediate response to ensure safety and damage control. Repair crews would use existing access roads, but as emergency situations could occur anywhere along the pipeline, additional ground disturbance could occur along with increased human activity, both of which could cause mortality to special status species or their prey, and effects on habitat. Since extent of disturbance caused by emergency activities is unknown, the potential for impacts from those activities are also unknown; generally, emergency activities are of short duration and are localized. The Product Spill Analysis Report for the pipeline project examined a number of scenarios.

Indirect Effects

Indirect effects arising from emergency situations can contribute to habitat alteration or loss, increased fragmentation of adjacent habitats, or changes in micro-climate along affected areas of the pipeline corridor or pump station. Indirect impacts from emergency activities, depending on the extent of the emergency, would be similar to indirect impacts from initial construction of the pipeline route or from maintenance activities.

Cessation of Operations

Direct Effects

Cessation of the pipeline would result in disturbance similar to those under construction, however, a smaller area of disturbance would generally be involved. Stopping of operations would entail removal of block valves at stream crossings, which would require removal of fencing around the valves, excavation of valves, and backfilling of the site. Those impacts would be temporary and the sites would be revegetated and returned to pre-construction conditions. Pump stations would also be dismantled and sites returned to pre-construction conditions. The Kittitas Terminal would be shut down, dismantled, and prepared for further industrial use by leveling and covering with gravel.

Where removal of pipe is required, additional surface disturbance and human activity similar in scope to project construction activities would occur. Some direct mortality of wildlife is possible in those areas. Potential for impacts will be reduced substantially if the pipeline is left in place.

Indirect Effects

Indirect impacts could occur on those species that had become re-established along the pipeline route and adjacent areas. Some species along the route could become established and habituated to the presence of the pipeline route; the longer the period between pipeline construction and cessation, the more species would become re-established. Indirect effects of cessation would be similar to those during construction.

CUMULATIVE EFFECTS

Cumulative effects under the Endangered Species Act regulations are defined as those of future non-federal (i.e., state, local government, private) activities that are reasonably certain to occur during the course of project activity. Future federal actions are subject to consultation requirements established in Section 7 of the Endangered Species Act and, therefore, are not considered cumulative to the proposed action. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time (40 CFR 1508.7).

Cumulative impacts could occur in the vicinity of the Kittitas Terminal if new development takes place. The primary impacts resulting from development would be additional disturbance of agricultural lands and potential habitat loss adjacent to those lands, however, cumulative impacts are likely to be minor due to the high level of disturbance associated with the gas stations and adjacent Interstate 90.

Actions on private and other public lands could include timber harvesting, agricultural, recreational, and industrial. It is anticipated that such activities will continue to occur, although the rate and frequency cannot be predicted.

3.4.3.3 Mitigation Measures

Mitigation measures are designed to reduce impacts of the proposed project. Mitigation measures have been applied to various stages of the project, including pre-construction, construction, and post-construction; these can lessen potential for impacts on species and habitats of concern. Mitigation measures described were initiated in an attempt to avoid, minimize, restore, and compensate for impacts. Mitigation measures include route changes and timing restrictions to avoid or minimize most effects along the route. Route changes were made to avoid priority habitats and special status species nesting or foraging areas. In areas where the project location could not be rerouted to avoid sensitive habitat or species, restrictions on timing of construction will be implemented where appropriate.

Impacts can be minimized for four key reasons:

- Underground Location: As the pipeline will be located underground, impacts on most land uses will be temporary.

- Short Construction Period: A pipeline is constructed in sections, thereby minimizing the time during which any particular area is under construction. For the most sensitive sections along the pipeline route, such as stream crossings, it is expected that construction will be completed within 48 hours. The length of time construction activities will take place in any given location will depend on the location, topography, soils, etc. West of

Snoqualmie Pass, construction is expected to move approximately 1.5 to 2.3 miles per day while east of the pass it is expected to move approximately 1.9 to 2.7 miles per day. In the pass area and narrow sections of the route, such as along the JWPT or in BPA corridors, construction time will be approximately 0.3 to 0.5 mile per day.

- Sensitive Areas Avoided: The proposed pipeline route has been adjusted to take into consideration sensitive areas and to avoid them as much as possible. In its 231-mile length, over 99 percent of the corridor has been routed to avoid wetlands. The 17.07 acres that cannot be avoided will be restored or replaced. In addition, by placing the pipeline in existing right-of-way corridors, pipeline impacts are generally confined to areas that already have been disturbed.

- Rivers, Streams, and Canals: The proposed pipeline will cross 294 waterways, most of which are small streams, many of them intermittent. Wherever practicable, existing bridges will be used to cross wetlands and streams.

Preconstruction Mitigation

Mitigation measures applied prior to construction activities include measures intended to lessen impacts to species and habitat in the project area. Specific mitigation measures were formulated for vegetation and wildlife species, although many of these measures apply to both species and habitats. Mitigation measures developed for certain special status species or priority habitats are covered in 3.4.5.2.

Preconstruction mitigation measures include:

- Consolidated the pipeline route to a single corridor along roads, railroads, and in existing rights-of-way to lessen impact from habitat fragmentation.

- New corridors were located along the periphery of forested areas whenever possible to lessen impacts to interior forest species and reduce impacts from edge effects.

- New corridors through forested areas will be restricted to 30' wide or less in the Alice Creek and Humpback Creek areas.

- The new corridor from Tinkham Road to the upper trail road near the Annette lake Trailhead area will be curved to limit straight line-of-sight.

- State and federal wildlife agencies will be contacted periodically for possible additions of any endangered, threatened, or sensitive wildlife species, or priority habitats of statewide significance in the vicinity of the proposed project. If any are identified, coordination for any possible mitigation measures will occur with the appropriate agency.

Construction Mitigation

Construction activities will generally occur from June to October in critical wildlife areas. More specific timing restrictions will occur along the route where any special status species occur within the project area.

Mitigation measures to further reduce impacts will include the following:

- Full-time Environmental Inspector: In order to minimize impacts during construction, and to ensure that environmental protection is given a high priority, OPL will have a full-time environmental compliance coordinator during project construction. This coordinator will oversee qualified personnel working with construction crews to ensure environmental "best management practices" are carried out.

- Directional drilling will be used for crossing the Columbia River. Directional drilling is a method by which the pipeline is buried far beneath the river bottom. By using this method, neither the drill, nor the pipe itself, comes into contact with the river water.

- Other major river crossings will use an open-cut dry method which diverts the water flow in sections of the river for placement of pipe sections. This method can be accomplished in a very short period of time and eliminates the need for a large drilling equipment staging area.

- Confining Pipeline to Existing Corridors Minimizes Impact on Wildlife and Plants: The pipeline will use existing right-of-way corridors whenever possible. These corridors already have experienced significant alterations to vegetation and habitat. Edge and corridor habitat have been created over the years, meaning that wildlife have adjusted to altered habitat conditions.

- Any habitat disruption will occur on a temporary basis during construction. Concentrated construction activity will take place for up to a two-week period in any given location. Disturbed areas will be restored.

- Construction of the pipeline in some limited areas will require the minimal cutting of trees. However, no old-growth trees have been identified in areas needing clearing. New rights-of-way will be created in areas where the proposed route must cross from one existing right-of-way to another. It will also be created where power lines in the existing right-of-way are strung from one slope to another, where shrub vegetation below the power line is currently re-established.

- Following construction, a 30' wide corridor is normally desired for long-term right-of-way maintenance. Thirty feet of the construction easement will be restored and revegetated with native plant species favorable to wildlife immediately following construction, consistent with a site-specific vegetation plan and landowners agreements, as appropriate.

- No access roads will be constructed through sensitive wetland areas and there will be no long-term maintenance right-of-way corridor through wetlands, wetland buffers, and riparian areas, with the exception of limited removal of trees in the wetland buffer.

- Erosion and Sediment Control: Construction contractors will implement an erosion and sediment control plan to include Best Management Practices. These plans and practices will minimize or eliminate potential impacts such as water quality degradation through sedimentation, erosion, and removal of vegetation, and effects on fisheries and aquatic resources.

- Little or No Long-term Noise Impacts: Temporary increases in noise will result from construction of the pipeline. However, most construction will be limited to daytime hours and most areas will experience no more than two weeks of construction activity at any given time.

- Restrictions on blasting will coincide with general timing restrictions for construction.

Noise from operation of the pipeline will be minor. The equipment at the Thrasher, North Bend and Stampede pump stations will be enclosed in buildings to minimize noise. The Kittitas Terminal is adjacent to I-90, where noise levels are already high due to traffic. There are gasoline service stations in the immediate vicinity, but no residences.

- Native vegetation will be retained as much as possible in the impact area to preserve wildlife habitat. Shrub habitat will be maintained at low to medium vegetation heights in the rights-of-way buffers.

- The normal corridor needed during construction will be 60' wide. When a new right-of-way is created in sensitive areas, special construction techniques will be used to restrict it to the smallest area possible.

- In upland forested and riparian areas where new corridors are cut through forest, downed logs will be moved and replaced after construction if the logs and debris are substantial enough to allow replacement.

Wetlands

The following mitigation measures will be implemented specifically to address potential for impacts to wetlands.

- Pipeline construction impacts to wetlands will be minimized by using the narrowest possible corridor (30') and by constructing during a time of year when the resources (i.e., nesting or migrating waterfowl or amphibians) are either not present or less vulnerable.

- Where wetlands must be crossed, the pipeline has been routed through less sensitive portions of the wetland where feasible.

- All activities within the wetland and buffer will be kept to the minimum disturbance area possible.

- Along with other temporary erosion and sedimentation controls, filter fencing and straw bales will be used during construction to minimize sedimentation in wetlands and to deter construction equipment operators from venturing further than absolutely necessary into sensitive areas.

- To the extent possible, construction through wetlands will occur when water levels are low.

- Trench plugs will be used, as necessary, to prevent diversion of water from wetlands to restrict the loss of water and control the loss of wildlife from dehydration.

- In wetlands and riparian areas, vegetation that must be removed will be cut at ground level, leaving existing root systems intact. Pulling of tree stumps and grading activities will be limited to those that would directly interfere with trenching, pipe installation and backfill.

- Matting will be used to support construction equipment when the water level is within 18 inches of the soil surface.

- In the event that matting is necessary, all construction activities will be carried out from the matting. Equipment will not be allowed in the wetland off the mats, at any time. The mats will be inspected prior to placing in the wetland and mats with foreign material (mud and weed seeds from elsewhere) will not be used.

- No herbicides and pesticides will be used.

- All construction equipment used in wetlands will be refueled at least 100' from water bodies or wetland boundaries. All equipment will be inspected and cleaned prior to entering a wetland.

- The scrub-shrub and forested portions of wetlands will be avoided to the greatest extent possible.

- Where trenching has occurred through open water, aquatic bed, emergent, and scrub-shrub wetlands, soils and vegetation will be maintained.

- Where trenching through a wetland has altered the hydroperiod (i.e., excavation through a hardpan layer, or altering the topography, soil or sub-basin which supports wetland hydrology), characteristics of soil, subsoil and/or topographic conditions will be recreated as nearly as possible to restore existing wetland hydrology. During excavation in wetlands, a soil scientist will determine if mitigation measures are needed to address potential impacts from changes in wetland hydrology. If the determination is made that mitigation is needed, measures will then be implemented at that site.

Post Construction Mitigation

The following will be implemented:

- Manage corridors to create vegetation structure changing from grasses and forbs in the center of the maintenance corridor to shrubs and trees on the outside of the construction corridor to lessen impacts from a created edge where the surrounding areas are composed of shrub and tree communities.

- Reseeding and planting of forest and shrub habitats impacted by ground disturbance in western Washington, and reseeding of shrub-steppe habitats with grasses and shrubs in eastern Washington.

- Seasonal restrictions will apply to corridor maintenance. For example, maintenance work, such as vegetation clearing, will be done during summer months to avoid the spring breeding season for most species.

- At block valves, pump stations, and Kittitas Terminal, a noxious weed eradication effort will be implemented to eliminate invasive species that become established at disturbed areas.

- Compensation for permanent impacts to native plant communities and fish and wildlife habitat values will be negotiated with natural resource agencies.

- Specific mitigation plans, including monitoring, will be developed for wetland compensation, with the goal of no net loss of wetland acreage and functions.

- Disturbance to forested wetlands will be mitigated by both: restoration of the disturbed area to either forested wetland or scrub/shrub wetland, and enhancement of disturbed emergent wetland to forested wetland in an amount equal to twice the total impacted forested wetland area.

- Disturbance impacts to scrub/shrub wetlands will be mitigated by both: restoration of the disturbed area to scrub/shrub wetland, and enhancement of disturbed emergent wetland to scrub/shrub wetland in an amount equal to the total impacted scrub/shrub wetland area.

- Disturbance to emergent, riverine, and open water wetlands will be mitigated by both: restoration of the disturbed areas to emergent, riverine, or open water wetland, and enhancement of disturbed emergent wetland in an amount equal to one-half the total impacted emergent, riverine, and open water wetland areas.

- Wetlands will be monitored during construction to provide oversight to ensure the implementation of Best Management Practices and for on-site adjustments to construction practices.

- A five year post-construction monitoring plan will be developed and implemented to assess mitigation success or failure.

- Restoration of wetland, buffer, and riparian vegetation presently vegetated with native species is considered successful if the native herbaceous and/or woody cover is at least 80 percent of the total cover, and native species diversity is at least 50 percent of the diversity originally found in the wetlands. If vegetation is not successful at the end of the 5 year post-construction monitoring period, the applicant will develop and implement (in consultation with a professional wetlands ecologist, EFSEC, WDFW, and WDOE) a plan to actively revegetate the wetland with native wetland herbaceous and woody plant species.

3.4.3.4 Coordination

- The U.S. Fish and Wildlife Service will be contacted prior to implementation of the project to update the list of endangered, threatened, and candidate species. If any new species are listed, impacts to these species will be assessed and appropriate mitigation measures will be presented to the appropriate federal agency.
- In consultation with state and federal wildlife agencies, pipeline construction will be scheduled to avoid critical periods for wildlife, such as spotted owl nesting periods.
- The Washington Department of Fish and Wildlife will be contacted prior to construction for updated information from the Natural Heritage Data System.
- The United States Forest Service will be contacted prior to construction for updated information from their inventories.

3.4.4 FISHERIES AND AQUATIC RESOURCES

The fisheries and aquatic resources study area is defined as the streams, rivers, lakes, and creeks potentially affected by the construction and operation of the pipeline and associated facilities. The pipeline crossings and the water bodies are shown in Appendix A. Fish, other aquatic organisms, and aquatic habitat are addressed, but the focus of this section is on salmonids (salmon and trout) because of their economic, cultural, and biological importance. These species have a well-documented sensitivity to a wide range of environmental stresses and are located near the top of the aquatic food chain. Streams which support anadromous salmon or trout species are further emphasized in this subsection.

Numerous data sources were reviewed for fisheries information to prepare this section. Information from the United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (WDNR) was reviewed. Databases from the old Washington Department of Fisheries (WDF) stream catalog (Williams et al., 1975), the Washington Rivers Information System (WARIS: WDFW, 1995a), the Washington Department of Natural Resources (Data96: WDNR, 1996) and the Pacific States Marine Fisheries Association (PSMFA, 1995) were also analyzed to obtain information on fish utilization, distribution, and other data. A total number of 285 pipeline waterway crossings and an additional 40 on alternate routes were identified from databases. Eighteen streams not on databases were found on the preferred route during field surveys, resulting in a total of 303 crossings. Seven of these stream crossings were avoided and 9 crossings identified as stream crossings were actually wetlands with no defined channels, reducing the number of waterway crossings on the preferred route to 287. Alternate route 1 was resurveyed after the pipeline alignment was rerouted and 10 additional stream crossings were found for a total of 50 waterway crossings on alternate routes. Crossings 208 through 222 and 244 through 251 (a total of 23 crossings) were removed from the preferred route and 29 waterway crossings from the alternative routes were added for a final total of 293 waterway crossings on the preferred route and 44 crossings on alternative routes. One hundred and ninety-eight of these crossings were jurisdictional streams. Of the remaining 95 non-jurisdictional waterways, 61 were canals or irrigation ditches and 34 had no defined channel.

Initial field surveys were performed during August, 1995, and focused primarily on the potential crossing locations to determine the presence and types of fisheries habitat areas. Additional field surveys were conducted from March to July 1996, to inventory more waterways. Most irrigation canal crossings and many small waterways along the pipeline route were surveyed. Crossings 44 through 117 were surveyed again during August 1997 and crossings 162 through 228 were resurveyed during April 1998 to obtain additional information on fish presence and sedimentation impacts. Alternate route 1 was resurveyed during April 1998.

The proposed pipeline route was chosen to minimize the total linear length and to avoid critical habitat and stream crossings where practicable. Even though there are many stream crossings, the route follows existing transmission line corridors, roads, and railroad grades where riparian areas have been previously impacted. These corridors are ideal for constructing the pipeline because impacts can be avoided or confined in already affected areas. The transmission line corridors have been cleared of large trees and few mature trees would be damaged at the stream crossings. Moreover, these areas also have good heavy equipment access via the numerous roads that follow the corridor.

Many pipeline crossings will occur at existing road or railroad grade crossings and these crossings currently have bridges or culverts which will ease construction. The fill on top of the culverts is often deep and will allow pipeline placement without disturbance of the stream channel.

Existing bridges will also be utilized at eleven stream crossings (including crossings of four large streams) to minimize project impacts. The Snoqualmie River near Duvall and Snoqualmie, Washington (Tables 3.4-8 and 3.4-9; crossing Numbers 11 and 38), and the South Fork (S.F.) Snoqualmie River near North Bend, Washington (crossing Numbers 42 and 43), would be crossed with bridges. No instream habitat would be affected at those locations.

The pipeline route begins near Maltby and generally follows existing power line corridors east across the Snoqualmie River valley. After heading east for about 12 miles, the route goes south, generally following power line corridors or logging roads. The route continues along an abandoned railroad bed near the towns of Snoqualmie and North Bend. The route again heads east towards Snoqualmie Pass.

Near Snoqualmie Pass, the pipeline will follow the John Wayne Trail and Tinkham Road for the most part.

The majority of waterway crossings along the trail have culverts and deep road fills above the culverts. Trenching will occur in the fill and the channels will not be impacted. The majority of stream crossings in Tinkham Road will be under existing culverts. Some of the stream crossings along the corridor near Snoqualmie Pass will be in vegetated areas, such as adjacent to or along narrow roads or abandoned railbeds.

Between Snoqualmie Pass and Easton, the pipeline route will be located in or adjacent to the John Wayne Trail. From Easton to just north of Ellensburg, the route follows power line corridors. Between Kittitas/Ellensburg and Pasco, Washington, the pipeline route frequently follows named roads and crosses mainly range, pasture, and agricultural land.

East of the Columbia River, the route follows roads and crosses range and crop land. Near Royal City, the route follows Highway 26 to the east-southeast. East of the Adams/Grant County line, the route heads south following roads and power line corridors. The eastern terminus is at the existing tank farm in Pasco, near the Snake River.

3.4.4.1 Existing Environment

The study area lies mainly within the Snoqualmie, S.F. Snoqualmie, Yakima, and middle Columbia River Basins. Some project streams in the western portion of the pipeline alignment are in the Sammamish and Snohomish River Basins.

Construction of the Cross Cascade Pipeline would result in approximately 293 crossings of rivers, streams, stream/wetland complexes, and irrigation canals identified from the DNR database and field work. The largest water bodies in the corridor are the Snoqualmie River, Tolt River, S.F. Snoqualmie River, Yakima River, and the Columbia River. The pipeline would also cross many smaller streams that have important fisheries values. These streams are listed in Table 3.4-8.

Many of the streams, rivers, and canals that would be crossed by the pipeline support anadromous and resident salmonids, warmwater game fish, and nongame species. Important salmon species found in the project area include chinook, coho, pink, chum, and sockeye salmon. Table 3.4-7 lists all of the fish species that are likely to utilize the habitat of the water bodies at the pipeline crossings, and consequently may be affected by the project (WDFW, 1995a, WDF, 1985, and Wydoski and Whitney, 1979).

TABLE 3.4-7
FISH THAT OCCUR IN THE STUDY AREA[a]

Common Name	Scientific Name
Anadromous Fish	

TABLE 3.4-7 (CONTINUED)
FISH THAT OCCUR IN THE STUDY AREA[(a)]

Common Name	Scientific Name
Chinook Salmon	*Oncorhynchus tshawytscha*
Chum Salmon	*Oncorhynchus keta*
Coho Salmon	*Oncorhynchus kisutch*
Pink Salmon	*Oncorhynchus gorbuscha*
Sockeye Salmon	*Oncorhynchus nerka*
Coastal Cutthroat Trout (Sea-run)	*Oncorhynchus clarki*
Steelhead Trout	*Oncorhynchus mykiss*
Dolly Varden	*Salvelinus malma*
Bull Trout	*Salvelinus confluentis*
White Sturgeon	*Acipenser transmontanus*
Green Sturgeon	*Acipenser medirostris*
River Lamprey	*Lampetra ayresi*
Pacific Lamprey	*Lampetra tridentata*
Resident Salmonids	
Rainbow Trout	*Oncorhynchus mykiss*
"Redband Trout" (Interior Rainbow trout)	*Oncorhynchus mykiss gairdneri*
Coastal Cutthroat Trout (Resident)	*Oncorhynchus clarki*
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*
Bull Trout	*Salvelinus confluentis*
Eastern Brook Trout	*Salvelinus fontinalis*
Brown Trout	*Salmo trutta*
Kokanee Salmon	*Oncorhynchus nerka*
Other Species	
Mountain Whitefish	*Prosopium williamsoni*
Largescale Sucker	*Catostomus macrocheilus*
Sculpins (General)	*Cottus sp.*
Northern Squawfish	*Ptychocheilus oregonensis*
Speckled Dace	*Rhinichthys osculus*
Longnose Dace	*Rhinichthys cataractae*
Bridgelip Sucker	*Catostomus columbianus*
Yellow Perch	*Perca flavescens*
Walleye	*Stizostedion vitreum*
Largemouth Bass	*Micropterus salmoides*
Smallmouth Bass	*Micropterus dolomieui*
Brown Bullhead	*Ictalurus nebulosus*

TABLE 3.4-7 (CONTINUED)
FISH THAT OCCUR IN THE STUDY AREA[a]

Common Name	Scientific Name
Pumpkinseed	*Lepomis gibbosus*
Pygmy Whitefish	*Coregonus clupeaformis*
Carp	*Cyprinus carpio*
Black Crappie	*Pomoxis nigromaculatus*
Western Brook Lamprey	*Lampetra richardsoni*
Bluegill	*Lepomis macrochirus*
Burbot	*Lota lota*
Three Spined Stickleback	*Gasterosteus aculeatus*
Goldfish	*Carassius auratus*
Redside Shiner	*Richardsonius balteatus*
Leopard Dace	*Rhinichthys falcatus*
Mountain Sucker	*Catostomus platyrhynchus*
Longnose Sucker	*Catostomus catostomus*
Peamouth	*Mylocheilus caurinus*
Lake Chub	*Couesius plumbeus*
Chiselmouth	*Acrocheilus alutaceus*
Channel Catfish	*Ictalurus punctatus*
Sandroller	*Percopsis transmontana*
White Crappie	*Pomoxis annularis*

(a) From WARIS (WDFW, 1995a), Fishery Management Report 85-2 (WDF, 1985), and Inland Fishes of Washington (Wydoski and Whitney, 1979).

Salmonid Stocks and Migrations

Migration routes and salmonid stocks are discussed in Subsection 3.4.6, Fish or Wildlife Migration Route Impacts.

Fish Habitats and Utilization

For simplicity, the fisheries resources are discussed by stream basin or subbasin and presented following the pipeline from west (near Woodinville) to east (Pasco, Washington). The fisheries resources and aquatic habitat are summarized for the project streams. A description of the area of the pipeline crossings is provided, since those areas potentially would be impacted by the construction of the pipeline. The habitat characteristics of the project streams were developed from the field survey information (August 1995). Information on current fish utilization is primarily from WDFW (1995a), and supplemented by field observation data. The stream channel characteristics are frequently summarized by Rosgen channel types

(Rosgen, 1993). Generalized stream type categories are described using broad descriptions of longitudinal profiles, valley and channel cross-sections, and plan-view patterns. Type A streams are steep (4 to 10 percent slope), with step, cascading, step/pool bed features. Type B streams are riffle-dominated types with "rapids" and infrequently spaced scour-pools at bends or areas of constriction. The C, DA, E and F streams are gentle-gradient riffle/pool types.

Sammamish River Basin: Little Bear Creek is the only project stream that would be crossed by the pipeline that drains into the Sammamish River (crossing 1, see Tables 3.4-8 & 3.4-9). The proposed stream crossing site is under transmission lines and the stream is bordered by wetlands. The stream has a stable, low gradient B-channel and is dominated by cobble and rubble substrate. The dense riparian vegetation of alder, shrubs, and conifers have produced stable streambanks and the stream is in very good condition.

Little Bear Creek near the pipeline crossing is utilized by coho and sockeye salmon, cutthroat trout and sculpins (WDFW, 1995). The stream crossing site has spawning and summer rearing habitat for several of those species. This crossing will be by diverting the stream flow and trenching. Construction will be performed to avoid periods of spawning or rearing.

An unnamed tributary to Little Bear Creek (crossing 4) would be crossed next to Highway 9. The crossing site is in the BPA transmission line corridor and has a failing culvert. The streambanks are dominated by blackberry, and recently several large cedars along the streambanks have been cut down. The small stream is utilized by coho salmon for spawning.

Snohomish River Basin: The headwaters of mainstem Anderson Creek and a tributary to Anderson Creek would be crossed by the proposed pipeline. The pipeline crossing site on Anderson Creek is located on the Echo Falls Golf Course and is heavily channelized (crossing 7). Further downstream, the channel has many culverts and small waterfalls that were created when the golf course was built. During the survey, the creek was dry at the site and had no fisheries value.

Snoqualmie River Basin: For this report, the Snoqualmie Basin includes the area drained by the mainstem Snoqualmie River (and its tributaries) from its confluence with the Snohomish River to the S.F. Snoqualmie River. Within this basin, the Snoqualmie River and its tributaries can be divided into sections as discussed in the WDF stream catalog (Williams et al., 1975). They are described below.

Lower Mainstem Snoqualmie River: This section includes the lower 12 miles of the Snoqualmie River and it tributaries, from a few kilometers above Duvall downstream to the confluence with the Skykomish River. The lower Snoqualmie River is a migration corridor for chinook, coho, pink, and chum salmon and steelhead trout (Williams et al., 1975). Only limited spawning habitat is available; however, Cherry and Peoples Creeks support good to excellent spawning populations in their lower reaches.

The lower Snoqualmie River meanders through a broad valley floor that is bordered by small thickets of deciduous trees and shrubs. At crossing location 11, land use along the river is almost exclusively agricultural pasture land and the gradient is low (0.5 percent). This C-type channel has a bankfull discharge width of approximately 200 feet and the stream substrate is all sand/silt. The lower river provides adult holding water and a transportation corridor for salmon and trout and has very little spawning habitat. The lower Snoqualmie is used for rearing by chinook salmon, steelhead trout and to a lesser extent, coho salmon (Nelson, 1997). Largescale suckers and sculpins have also been observed in the area. The slow-moving river lacks overhead or instream cover for salmonids and is warm during the summer months. The crossing area of the Snoqualmie River only provides rearing habitat for nongame species which provide a food source for salmonid species (Williams et al., 1975).

The pipeline would also cross the headwaters of Ricci (crossing 9) and Peoples (crossing 14) creeks. These small first and second order streams are characterized by small, incised B-type channels, moderate gradients, boulder and cobble substrates, and dense stands of riparian vegetation. These stable streams are lacking winter habitat for salmonids, but do have some summer rearing and patches of spawning gravel. The crossing sites for these streams are not accessible to anadromous salmonids.

In this subbasin, the pipeline would also cross three streams in the Cherry Creek Basin. The unnamed tributary to North Fork Cherry Creek would be crossed twice (crossings 17 & 18). The stream at the upstream crossing (crossing 17) is a moderately steep A/B-type channel with a baseflow of approximately 1 cfs. The small, stable stream is dominated by boulders and large rubble substrates and would favor resident salmonid usage. The dense vegetative canopy shades approximately 80 percent of the stream and is dominated by alder and various shrubs. The channel at the downstream crossing site (crossing 18) is a much lower gradient (1.5 percent) B-type channel that is dominated by rubble and gravel substrates. This well-shaded stream segment has a bankfull width of approximately 10 feet and does support anadromous salmonids. Juvenile coho salmon were observed during the site visit.

N.F. Cherry Creek was dry at the crossing site (crossing 19) and has no fisheries values during the summer low flow period. Coho and pink salmon do utilize the lower portion of the creek. The crossing area is wetland and may provide some wintering habitat for salmonids during high precipitation months.

The mainstem Cherry Creek is an excellent stream with a good balance of pool-riffle-run habitat types. The B-type channel has a moderate gradient (2 percent) and overhead cover is provided primarily by mature alder trees in the fairly wide riparian zone. There is a good mixture of stream substrate sizes. Suitable spawning gravels were located high on dewatered gravel bars, which would favor winter-run steelhead trout usage. Other species which utilize the area include coho, pink and chinook salmon, Pacific lamprey, and western brook lamprey. At crossing site 20, summer rearing habitat for anadromous salmonids was observed.

Middle Mainstem Snoqualmie River: This reach of the Snoqualmie River is transportation and rearing habitat for anadromous fish. It also provides adult holding water. Chinook, coho, chum, and pink salmon spawn and rear in the mainstem Snoqualmie near Carnation, Washington. The section of the Snoqualmie River at the mouth of the Tolt is a primary spawning area for chinook and pink salmon, and steelhead trout (Nelson, 1997). Coho and chum salmon also utilize Harris Creek, with chum salmon spawning in the lower 0.6 mile (Williams et al., 1975). Harris, Cherry and Griffin Creeks are highly productive coho salmon streams. Chinook, coho, chum and pink salmon utilize the lower Tolt River, with chinook salmon, steelhead trout and coho salmon ascending higher in the watershed.

Harris Creek and the Tolt River are the largest tributaries to the mainstem Snoqualmie River between Duvall and Carnation that will be crossed by the proposed pipeline.

At pipeline crossing location 22, Harris Creek is a low-gradient, meadow stream with a C-type channel. The stream is almost completely shaded by alder, dogwood, grasses, and shrubs and meanders through wetland area. The stream substrate is almost entirely sand/silt and summer base flow was approximately 1.5 cfs. This small stream has summer and winter rearing habitat and is utilized by coho salmon, cutthroat trout, and western brook lamprey.

The lower Tolt River is utilized by chinook, coho, chum, and pink salmon. Chum and pink salmon are attracted to the channel splits and overflow channels in the lower river. Steelhead trout and western brook lamprey also utilize the area. At the proposed pipeline crossing locations 26 & 27, there are two distinct channels separated by an island. The RB (right bank facing downstream) has been riprapped to protect the county road and private residences during frequent flooding. The B-type channel is dominated by boulders and cobbles, but spawning gravel was observed on mid-stream bars. The river also has summer rearing habitat.

Upper Snoqualmie River: This section includes the mainstem Snoqualmie River and its tributaries from Carnation, Washington, to its confluence with S.F. Snoqualmie River. Several streams in the Griffin Creek subbasin, Tokul Creek, and the mainstem Snoqualmie River would be crossed by the proposed pipeline.

Chinook, coho, chum and pink salmon utilize the mainstem Snoqualmie within this section for transportation, spawning, and rearing (Williams et al., 1975). Chinook salmon spawning is intense downstream of Fall City, Washington, and some pink and chum salmon utilize this same area. Coho salmon utilize mainly the tributaries, especially Griffin Creek. In Griffin Creek, the main spawning occurs between river miles 3.0 and 5.0.

Griffin Creek is a large tributary to the Snoqualmie River. The pipeline would cross the creek (crossing 28), where the main coho salmon spawning in the stream occurs (river mile 4.3). The stream is a B-type channel with a moderate gradient. Stream substrate is predominantly gravel and rubble, and summer base flow was approximately 1.5 cfs. The stream had a bankfull width of about 15.5 feet. Unlike most project streams, Griffin Creek has a good amount of large woody debris (LWD) that provides excellent winter habitat for coho salmon and cutthroat trout. The good mixture of pool-riffle-run stream habitats also provides excellent summer and winter rearing habitat for fish.

The proposed pipeline would also cross the headwaters of several small tributaries to Griffin Creek and Tokul Creek. At the crossing sites in these tributary drainages summer baseflow was less than 0.2 cfs. Two of the Griffin Creek tributaries are fishless and the unnamed Tokul Creek tributaries are very steep and also do not contain fish.

At pipeline crossing location 34, Tokul Creek is a large stream with highly fluctuating flows and heavy bedload movement. The proposed crossing method is to use an existing bridge. The river has a moderate gradient, good pool-riffle-run balance, and suitable substrates for anadromous fish. However, a falls a short distance downstream of the stream crossing location blocks fish migrations, and the habitat above the falls is utilized by resident cutthroat trout. Streambanks are moderately unstable and mature trees are falling into the stream channel. The riparian corridor overstory is dominated by alder and cedar trees. Stream substrate is primarily rubble and cobble, but some spawning habitat was observed. The stream also has summer and winter rearing habitat for resident salmonids. WDFW manages a fish hatchery near the mouth of Tokul Creek and their water intake is very vulnerable to water quality degradation.

The Snoqualmie River, approximately 1.2 miles above Snoqualmie Falls, would be crossed by the pipeline (crossing 38). The low gradient (0.5 percent) C-type channel floods frequently. The stream substrate is entirely sand/silt and pool is the sole habitat type. The confined channel is riprapped on the left bank (LB) and bankfull width is approximately 132 feet. The stream provides limited summer rearing habitat for resident fish, primarily rainbow and cutthroat trout, and western brook lamprey.

The pipeline would follow the existing railroad grade across Meadowbrook Slough and two unnamed tributaries to the upper Snoqualmie River. The slough is an old, shallow oxbow of the Snoqualmie River and may support warmwater fish populations. The tributaries are very confined, channelized streams that had summer base flows of approximately 1 cfs. The streams were almost completely choked with grasses and alders and support a few cutthroat trout and sculpins.

South Fork Snoqualmie River: This section covers the entire S.F. Snoqualmie River and its tributaries that may be affected by the pipeline. There is no natural utilization of anadromous salmonids above Snoqualmie Falls, which is over 2.8 miles downstream from the South Fork.

The channel at the pipeline crossing of the lower mainstem S.F. Snoqualmie River (crossing 42) has a low gradient (0.5 percent). The relatively confined channel has been riprapped on the left bank (LB-facing downstream), and follows a road prism on RB. Bankfull width is approximately 215 feet. The stream habitat is primarily pool. Gravel and sand/silt dominate the bottom substrates, with suitable patches of spawning gravel for resident salmonids located at the stream margins. Stream cover is low and consists mainly of intermittent stands of deciduous trees and underbrush. The small amount of instream cover is provided by the large riprap boulders. Resident trout were observed at the crossing site (August 28, 1995). Overall, the stream had a little spawning and summer rearing habitat for salmonids.

At the second crossing of S.F. Snoqualmie River (crossing 43), the B-type channel is well confined by streambanks that are approximately 26 feet high. Bankfull width is about 110 feet. Stream gradient is 3.5 percent and the moderately steep channel is dominated by large boulders. This area has extremely high water velocities and the habitat is primarily riffle and run. The river has a little summer rearing habitat for resident salmonids.

After crossing the S.F. Snoqualmie River, the proposed pipeline route would follow the LB of the river and cross several named and unnamed tributaries. The following discussion of the existing conditions of the streams at the pipeline crossings is presented as the route goes upstream (easterly) toward Snoqualmie Pass.

Boxley Creek would be crossed approximately 0.8 mile upstream from the confluence with the S.F. Snoqualmie River (crossing 44). The crossing site was relocated to avoid a small unnamed tributary with unstable streambanks. Boxley Creek is an excellent stream for resident salmonids. Stream habitat types are well-balanced and LWD has created good summer and winter rearing habitat for cutthroat trout. Stream substrate is predominantly gravel, but large amounts of sand/silt were also observed. This may be due to an unstable LB slide which would be a source of fine sediment.

Upstream of Boxley Creek, the pipeline route crosses several first and second order streams (named and unnamed) that drain generally northward to S.F. Snoqualmie River. These streams have very similar habitat characteristics at the proposed crossing locations.

Most of the unnamed tributaries are extremely small (less than 1 cfs). They are very steep drainages (7-10 percent) that provide little fisheries value. The named tributaries to the upper S.F. Snoqualmie River include Change, Hall, Mine, Alice, Carter, Hansen, Humpback, Olallie, and Rockdale Creeks. These streams were quite similar in habitat characteristics and factors limiting to fish production. Generally, the streams have steep (5 to 10 percent) A-type channels that are very unstable. Much of the upslope areas of these stream have experienced extensive logging that has resulted in high bedload movement and unstable streambanks. Bankfull width ranges from 20 to 30 feet, and the streams are usually highly aggraded where the pipeline would cross. Stream substrate is dominated by large boulders and cobbles, and the summer base flows are very low or subsurface. Riffle is the dominant habitat type. During past surveys, only a few of the tributaries to upper S.F. Snoqualmie River had fish (WDFW, 1995). Several of the tributaries were dry during our survey and others provided little summer rearing habitat for salmonids. Winter rearing conditions (high streamflows) would be very restrictive to salmonids in these drainages. Crossings 51, 54, 55, 73, 73A and 74 occur at small fishless streams that drain into the South Fork of the Snoqualmie River. The crossings occur very close to the river which contains naturally reproducing populations of cutthroat and rainbow trout and sedimentation from construction related activities could silt spawning beds in the Snoqualmie River.

Crossing methodologies used at these crossings (placing the pipeline under or over existing culverts) will eliminate the possibility of sedimentation in the mainstem river. Crossings 50, 52, 53, 55, 57, 72, 75, and 77 occur at fish bearing streams close to where they drain into the South Fork of the Snoqualmie River. Crossing methodologies used at crossings 50, 52 and 55 will eliminate the release of sedimentation into the mainstem river. Crossing 77 may be either flumed and trenched or an under culvert crossing. The unnamed tributary stream at crossing 77 has a very low flow and should not release much sediment into the mainstem river. Crossings 72 and 75 (Carter, and Hansen Creeks) are divert and flume crossings and crossings 53 and 57 will be wet trenched. These are medium sized tributaries and a small release of sediment can be expected (see Table 3.4-9 for the impact potential of these stream crossings). There are a total of 14 tributaries of the South Fork of the Snoqualmie River with crossings close enough to contribute sediment to the mainstem river. Of these, 4 have the potential to contribute significant amounts of sediment. Despite the extensive logging and road building activities that have occurred near this section of the river, the spawning gravels and bed sediments show little indication of embedded sediments. It is doubtful that the quantity of sediment released from this project will cause a deterioration of spawning or rearing habitat in the mainstem river. The primary factor impacting this section of the mainstem river has been the intentional removal of large woody debris (LWD) from the river, reducing the buffering of sediment transport and creation of pools and holding water (Pfeiffer, 1997). None of the activities related to pipeline construction will change the recruitment of LWD in the system, except at the locations where trees will be removed.

Yakima River Basin: For the purposes of discussion, the Yakima River Basin is divided into upper Yakima River and middle Yakima River. The creeks in the Kittitas/Ellensburg area (middle Yakima River) drain irrigated pasturelands and are mixed with numerous irrigation canals and ditches. The creeks draining into the upper Yakima River, including those tributaries to Keechelus Lake, are more typical of channels draining forested hillsides.

Prior to Euro-American development in the Yakima Basin, anadromous salmonid returns are estimated to have approached 1 million adults annually. By 1905, the returns had decreased to an estimated 50,000 adults annually. Although logging, grazing, mining, and other development activities bear some of the responsibility for this decline, it was the development of irrigated agriculture that was the primary cause of this decline. Traditional water management practices in the Yakima Basin produce extreme low flows in the lower 100 miles of the Yakima River. Combined with the elevation of instream temperatures and the loss of juveniles and adults in a poorly screened system of irrigation canals and ditches (the screens are currently being upgraded), the impacts of irrigated agriculture have almost completely eliminated the river's anadromous fisheries and continue to impede restoration efforts. Today, the anadromous salmonid runs total less than 5,000 adults returning annually. Sockeye, summer-run chinook, and coho salmon are extinct in the Yakima Basin (Tuck, 1994).

Upper Yakima River: After crossing Snoqualmie Pass via the railroad tunnel, the proposed pipeline follows an existing railroad grade that crosses several tributaries on the west side of Keechelus Lake. Mill and Cold Creek have similar habitat characteristics. Both streams have concrete arch culverts that are passage barriers for resident fish. There is approximately 13 feet of fill on top of the culverts. The streams are B-type channels with a 2.5 percent gradient. Stream substrate is predominantly cobble, rubble, and boulder, with small patches of suitable spawning gravel for fish. Both streams have fairly heavy bedload movement under higher flows. Riffle is the dominant habitat type and the crossing areas have summer rearing habitat for salmonids. Under higher flows, fish would not be able to utilize these areas because of high water velocities and the lack of LWD which would create lower velocity winter habitat.

Roaring and Meadow Creeks are also tributaries to Keechelus Lake, and they provide more fish habitat than Mill and Cold Creeks. Their A/B-type channels have a good mix of habitat types, with riffle being dominant. Stream substrate favors rubble and cobble, but suitable spawning gravel is also present.

Cold, Mill, Roaring and Meadow Creeks are accessible from Keechelus Lake, and stream-spawning fish could utilize them. The streams are known to contain westslope cutthroat trout and bull trout were sampled in Roaring and Mill Creeks during 1997 surveys. Keechelus Lake contains westslope cutthroat trout that utilize these streams for spawning. It is not known if adfluvial bull trout populations in Keechelus Lake use these streams as spawning habitat. The bull trout population in the lake is considered depleted. Additionally, the lake contains kokanee salmon and a relict population of pygmy whitefish. Both of these fish could use the creeks for spawning. Pygmy whitefish are listed as a priority 1 & 2 species by Washington state. There is no evidence that the pygmy whitefish population in the lake is currently threatened, but the population is isolated. Overall, the stream crossing sites have summer and winter rearing habitat and fall and spring spawning habitat.

Several unnamed tributaries between Stampede and Cabin Creeks have little fish habitat at the proposed pipeline crossings. Rainbow trout were observed in Mosquito Creek and although it appears to have little spawning habitat, it provides both rearing and winter refuge for salmonids. Upstream of the railroad grade, Stampede Creek is mostly a marshy wetland near the railroad grade. The culvert is approximately 12 feet lower than the top of the grade and passes water only at high flows. The creek provides considerable spawning and rearing habitat for salmonids below this marshy area and provides good habitat for rainbow trout. There are three unnamed tributaries located well below the railroad grade that average 5 feet wide. They will not be crossed and have little fisheries habitat.

The pipeline will cross Cabin Creek adjacent to the railroad grade. At crossing location 117, Cabin Creek is a moderately stable low gradient B-type channel and is dominated by cobble/rubble substrates. The creek is downcutting and has a heavy bedload movement during high flows. The creek lacks woody debris and overhead cover. The streambanks are sparsely vegetated by cottonwood and alders, and most vegetation is above the average bankfull width. Cobble/rubble substrates dominate the stream bottom. The mainstem of Cabin Creek has summer rearing and marginal spawning habitat for resident and anadromous salmonids at and downstream of the proposed pipeline crossing. Cabin Creek also has extensive upstream spawning habitat and provides valuable winter refuge for salmonids.

An unnamed tributary to Cabin Creek flows out of an old beaver dam pond that is adjacent to the railroad grade, which is adjacent to the pipeline crossing location. The pond contains excellent habitat for fish. Floating and submerged woody debris, standing snags, and floating and emergent aquatic vegetation provide cover habitat for adult trout. The pond is surrounded by alder and conifer trees. The pond outlet follows the railroad grade, turns downstream under the Cabin Creek bridge, and enters Cabin Creek 200 feet downstream. The pond and outlet creek provide summer and winter rearing habitat. The outlet creek would not be crossed by the pipeline.

At least four unnamed tributaries to the upper Yakima River between Cabin and Tucker Creeks will be crossed by the pipeline. These small first order streams have little fisheries value, but are contributors of high quality water to the Yakima River and provide winter refuge for salmonids.

The pipeline will cross Tucker Creek (crossing 124) in a powerline corridor. The creek is a moderately stable low gradient B-type channel and is dominated by gravel substrate. The creek is actively downcutting due to removal of woody debris and riparian vegetation. The stream flows through residential property that has been recently cleared. The water temperature was warm (63°F, August 1995). During normal years an upstream water user diverts the entire flow of the creek (per personal communication with landowner during field survey). There is spring spawning and limited summer rearing habitat at the crossing site.

The pipeline will also cross Main Canal twice (crossings 123 and 125), on either side of Tucker Creek. The large canal is straight and part of it is concrete lined. Although it contains a few salmonids that enter through poorly screened irrigation diversions, no spawning or rearing habitat exists and fry that enter the canal are usually lost to the fishery. Most irrigation canals are dry part of the year. Any fish that enter the canals during the irrigation season are usually lost at the end of the crop growing season. The Main Canal and other irrigation canals in the Yakima Basin have little fisheries value.

Big (crossing 127) and Little (crossing 129) Creeks will be crossed in a powerline corridor. At the crossing locations, both stream channels have been affected by the clearing of vegetation under the power transmission lines and the channels are actively moving laterally and downcutting. Big Creek has a larger basin and is characterized as a moderately stable low gradient B-channel that is dominated by rubble/cobble substrates. Little Creek is also moderately stable but has a flatter C-type channel. The streambanks are dominated by small alders, cottonwoods, willow and vine maples. Both streams are lacking large woody debris and instream cover is low. Young-of-year and juvenile salmonids were observed in both streams (August 30, 1995). Both creeks had spawning and summer rearing habitat. Spring-run chinook salmon and summer-run steelhead trout have been observed in both streams.

Downstream of Little Creek, the proposed pipeline will cross several small tributaries under the transmission line corridor before it crosses the mainstem Yakima River. They are Granite (crossing 131), Spec Arth (crossing 132), Tillman (crossing 133), and Thornton Creeks (crossing 143). These small creeks are first and second order streams and their streambeds are dominated by sand. Streambank vegetation is primarily grasses and emergent aquatic plants, with some small trees and shrubs. During the surveys, they either had low baseflow (< 1 cfs) or were dry. They had limited fisheries value but Granite, Spec Arth, Tillman and Thornton Creeks contain resident trout and provide winter refuge for salmonids.

Where the pipeline will cross the Yakima River (crossing 147), the bankfull width is approximately 200 feet. The well-confined channel was near bankfull during the field surveys. The B-type channel has a good mixture of stream substrates and is predominantly riffle habitat. Boulder, cobble and rubble substrates dominate the center of the channel. The stream margins have mainly rubble, gravel, and sand substrates. Streambanks are lined with willow, alder, and cottonwood. The upper Yakima River is an important spawning and rearing area for anadromous salmonids. Spring-run chinook salmon, summer-run steelhead trout and bull trout (a resident salmonid) are present in the upper Yakima River. Bull trout are listed as threatened or endangered and the chinook salmon and steelhead trout will probably soon be federal candidates for listing as threatened or endangered. Bull trout are known to spawn in Cabin and Swauk Creeks.

Middle Yakima River: The creeks in central Kittitas County drain flood-irrigated pasturelands and are intermingled with numerous irrigation canals/ditches. Parke Creek (crossings 201, 205, 206, 208, 209, 211 and 1-A), Coleman Creek (crossing 196), Currier Creek (crossing 180), and Reecer Creek (crossing 166) have very poor habitat for salmonids in the project area. These creeks are heavily channelized, frequently culverted, regularly excavated, and generally were filled with turbid water. The riparian areas are very narrow to nonexistent with little overhead cover. The warm water runs turbid and near bankfull with irrigation water. These creeks are managed primarily for water conveyance. Some of the creeks to be crossed have some fisheries value, despite the limitations noted. The areas above the pipeline crossings and the irrigation diversions usually contain good populations of resident westslope cutthroat trout and the lower stretches near the Yakima River contain fishable populations of rainbow trout with limited trout spawning occurring. Although these streams often contain healthy populations of resident salmonids in their higher elevations and serve as salmonid habitat during the winter months in their lower-reaches, only a few fish are found in their mid-sections where they are crossed by the pipeline.

Sixteen of the canals in this area contain a small number of salmonids that enter through poorly screened stream diversions. Salmonid reproduction does not occur in the canals and most of the fry that enter the canals are lost when the canals are dewatered. Some of these streams and canals do currently support fish resources, but most have low fisheries production and are extremely turbid with little spawning gravel or habitat. Therefore, fisheries impacts of the project will be minimal for these waterways. Chinook salmon fry utilize the lower stretches below the pipeline as winter habitat. Because the streams are primarily used for irrigation near the pipeline route and little riparian habitat exists due to overgrazing and farming activities and the streams are heavily sedimented and turbid in these locations, damage to fishery resources will be minimized either by boring under the canals for nine of the crossings or by timing the construction of crossings at periods of low flow and diverting water around the construction sites to prevent sedimentation.

Swauk Creek (crossing 151) is a low gradient B-type channel dominated by gravel substrates. The valley bottom width is greater than 500 feet. The channel is unstable and shows signs of channel shifts and downcutting. The streambanks are heavily grazed by livestock. The channel lacks LWD and overhead cover. Sideslopes are steep, composed of sand/silt sediments, and sparsely vegetated. Numerous Cyprinids (unknown species) were observed at the crossing site.

The pipeline will cross Dry Creek four times at Crossings 156, 157, 160 and 161. Dry Creek has a moderately unstable B-type channel. The substrate is dominated by cobble/rubble particles. Willows and grasses dot the stream bank. The creek was dry during the survey, contains no fish and provides no summer fish habitat. This watershed is subject to winter flooding and probably contributes heavy loads of sediment to the Yakima River. It is possible that during the winter months, the lower reaches of Dry Creek provide winter refuge for salmonids.

Wilson (crossing 187) and Naneum Creeks (crossings 190 and 193) are in the best condition in this section of the pipeline route in the Yakima River basin. Wilson Creek has a stable C-type channel. The substrate is cobble/rubble dominated. Grasses, cottonwoods, and willows provide relatively wide, stable riparian area in places. Grasses line moderately stable streambanks. One adult trout was observed at the crossing site. Naneum Creek and the unnamed tributary to Naneum Creek (192) are cobble/rubble dominated, B-type channels. The grass lined streambanks are moderately stable and less impacted by excavation activities. The creek is lined by intermittently spaced willows and cottonwoods. Both streams have high water temperatures and limited summer rearing and spawning habitat for salmonids and serve as winter refuge for chinook salmon juveniles and other salmonids..

Columbia River Basin: Johnson Creek, the mainstem Columbia River, Lower Crab Creek, and an unnamed tributary to lower Crab Creek are streams in this basin that drain into the Columbia River and would be crossed by the pipeline. The pipeline also crosses numerous irrigation canals and ditches (lined and unlined), two coulees, and a wasteway. Lower Johnson Creek and Crab Creek provide winter refuge areas for chinook salmon juveniles and other salmonids.

Johnson Creek drains arid grassland foothills and empties into the Columbia River through a private campground. Johnson Creek (crossings 222 and 20-A) was dry at the survey site and construction during the low flow period would have little impacts to aquatic habitat. Within the campground the creek is heavily channelized and rip-rapped, is dominated by sand substrates, but does provide a winter refuge for Columbia River salmonids.

The Columbia River will be crossed just downstream of Wanapum Dam (crossing 223). This area is influenced by dam discharges and the backwatering effects of Priest Rapids Lake. The streambanks are composed of rubble, cobble and gravel substrates and have little vegetation. Because of dam discharges, the stream habitat is primarily run and riffle. The crossing site probably provides spawning and summer rearing habitat for anadromous salmonids, especially fall-run chinook salmon. Other species of anadromous salmonids migrate past the crossing site. The directionally drilled crossing should have no impacts on stream of fish habitats.

Lower Crab Creek: The crossing sites on Lower Crab Creek (crossing 244) and its unnamed tributaries are near the Columbia National Wildlife Refuge. The streams drain adjacent crop/rangeland and are managed for water conveyance. The channels are low gradient C types, dominated by sand substrate (assumed from streambank composition), and have little habitat diversity. The streambanks are dominated by grasses and are stable. The creek does not provide habitat for salmonids in this area, but provides a winter refuge for salmonids downstream near its confluence with the Columbia River. Historically, Lower Crab Creek provided habitat for interior rainbow and steelhead trout, but it is doubtful if any native fish still exist in the watershed. At various times, hatchery steelhead trout have been planted in Crab Creek. A trout hatchery exists on Rocky Ford Creek in the headwaters of Crab Creek above Moses Lake and Rocky Ford Creek at one time had a variety of cutthroat trout that is now extinct. Rocky Ford and Crab Creek below Potholes Reservoir has spawning populations of introduced rainbow and brown trout, but these fish do not migrate as far downstream as crossing 244. Crossings H26-C, H26-D, and H26-E of Lower Crab Creek occur farther upstream and are close enough to Marsh Units 1 and 2 in the Columbia National Wildlife Refuge that rainbow and brown trout stocked in the units find their way down to the creek in the vicinity of the pipeline crossing.

Irrigation Canals/Ditches: The pipeline route would cross many large and small irrigation canals. Some of the large waterways include Main, North Branch, Cascade, Highline, Royal Branch, Wahluke Branch, Eltopia Branch, and Esquatzel Diversion canals. Some of the canals are lined with concrete, especially when the crossing is near an existing road.

Approximately 61 irrigation canals/ditches will be crossed in the Columbia River Basin by the proposed pipeline and these waterways have limited salmonid value. The various canals, ditches, and coulees have supported yellow perch, black crappie, pumpkinseed, brown bullhead, largemouth bass, sculpin and bluegill. An occasional stocked trout finds it way into the canals from pothole lakes, but reproducing populations of trout do not exist in any of the canals or streams outside of the mainstem Columbia and Snake Rivers and a few streams outside of the project area. Sport fishing primarily occurs in small lakes and overflow ponds that are connected to the canals. With the exception of a few major canals, the irrigation canals and ditches primarily serve as sources of fry from warm-water species that serve to restock the lakes and ponds after they are drawn down during periods of high water demand. The straight, featureless channels have smooth bottoms and elevated water temperatures. Riparian vegetation along the canals is usually sparse or non-existent. Canal maintenance generally prohibits the growth of significant riparian vegetation. The lack of structure and riparian vegetation combined with the effects of frequent incidental sprayings of chemicals used to control riparian vegetation growth yield a poor habitat in most cases for any kind of fish.

Eagle Lake and Esquatzel Coulee have other species of fish, but no salmonids. Eagle lake drains into the Columbia and the Ringold hatchery is located at the confluence. Most of the flow of Esquatzel Coulee is diverted into the Esquatzel Diversion Channel upstream of the proposed pipeline crossing location.

Riparian Areas

Riparian areas may provide numerous functions in the landscape. These include shading streams to attenuate water temperatures, providing cover and trophic inputs to the stream, large woody debris recruitment, providing wildlife habitat in the form of corridors and sources of food and cover, and diversity of vegetation and plant communities. The recruitment of large woody debris is particularly important in buffering the transport of bedload sediments; maintaining a proper mix of pools, riffles, spawning gravels and shelter. Riparian areas also provide aesthetic value.

At the locations of stream and river crossings along the pipeline route, the majority in western Washington are either located in a power line corridor where trees are regularly removed or in an existing road or rail trail where vegetation does not exist. In eastern Washington, the stream and river crossings are usually located at a road or rail trail crossing or in an agricultural area where vegetation has either been removed or otherwise disturbed.

Dominant vegetation can be an indicator of riparian zone function. For example, riparian zones dominated by trees provide more function in terms of fish and wildlife habitat than riparian zones dominated by grasses and forbs. Because few trees exist along the route east of the Yakima River, riparian zones in that portion of the pipeline route that are dominated by shrubs are relatively more valuable than riparian zones dominated by shrubs in the western half of the route.

The crossing locations of all the canals and 32 streams are dominated by grasses and forbs. Of the crossing locations at the other streams, 55 are dominated by shrubs, as are the crossings along route alternatives #20 and #23. Only 21 of the stream crossing locations are dominated by trees. These crossings are #26 and #27 (Tolt River), #28 (Griffin Creek), #34 (Tokul Creek), #36, #36A, #37, #44 (Boxley Creek), #57 (Mine Creek), #70, #71, #72 (Carter Creek), #73, #74, #76, #77, #78 (Humpback Creek), #147 (Yakima River), #186, #196 (Coleman Creek), and #262 (Eagle Lakes). Four crossings dominated by trees occur within USFS riparian reserves (crossings 57, 72, 73, and 78).

3.4.4.2 Fisheries and Aquatic Resources Impacts

In general, the primary potential impacts to fishery resources from pipeline installation and associated construction are from water quality degradation and physical alteration of instream and stream-adjacent habitat. Operation and maintenance activities should have no impacts on aquatic resources given the mitigation measures that will be incorporated into the operation phase of the project (see Subsection 3.4.4.3 Mitigation Measures). A combination of factors (species present, life history, riparian vegetation, hydrological, and geological) are used to estimate sensitivity to impact of the stream at each crossing in Table 3.4-9. Table 3.4-9 also assigns a mitigation factor to the different crossing methodologies and uses this figure to determine an impact potential for each crossing.

The potential impacts from the discharge of hydrostatic test water are discussed in Section 2.5 Water Supply and 2.7 Characteristics of Aquatic Discharge Systems. The entire pipeline will be hydrostatically tested as mandated in 49 CFR Chapter 1 Part 195, "Transportation of Hazardous Liquids by Pipeline". A four hour test is required for visual inspection and an eight hour test is required for sections which cannot be visually inspected. The water supply sources for hydrostatic testing will be the Snoqualmie River, the Cities of North Bend and Carnation and the Port of Royal Slope. Approximately 1.3 million gallons of water will be used for hydrostatic testing of the pipeline. Discharge of the water will be kept at a minimum. It is anticipated that in most areas the water will be allowed to evaporate and/or percolate into the soils, and that discharge into receiving waters may not be necessary. The test water will be analyzed and treated, if necessary, to ensure compliance with temporary water quality modification permits for the project. If the test water is discharged into an infiltration basin on site, a preliminary investigation will be performed to determine soil suitability and infiltration capacity.

During directional drilling, sump areas are required to contain the drilling fluids used during the drilling process and to capture the fluid once the initial hole is completed. The drilling fluid is normally a bentonite mud mixture which is used to flow cuttings from the drill bit back to the drill rig. It also lubricates the hole during drilling and maintains positive pressure in the hole so the hole does not collapse before the pipe is installed. Because of the pressure used to force drilling muds into the bore hole, there is a danger of the muds fracturing out through the ground surface or streambed. The potential hazards of bentonite seepage are discussed in Section 2.14 Construction Methodology. Although drilling muds are inert and do not contain hazardous material, they can have a negative impact. The bentonite clay mixture is extremely fine and can result in excessive turbidity in an affected stream or wetland. The bentonite clay can cause excessive turbidity for long periods of time in downstream reservoirs or lakes if little turnover occurs in the lake or reservoir's water volume. A high polymer concrete coated piping will be used for crossing under sensitive areas. After the completion of drilling, the drilling fluid will be transported to an approved disposal site.

During construction, physical alterations may eliminate fish habitat and increase sedimentation and scouring of the streams. Project streams have a variety of habitats (summer rearing and winter rearing, spawning, and adult holding) for fish. Disturbance of the riparian vegetation adjacent to streams could increase suspended solids, turbidity and organic matter downstream from the construction areas. Shading and trophic inputs may be decreased. Stream crossings that require blasting can cause harm to fish due to acoustic shock or damage to their air bladders if blasting occurs in the water.

Impacts on fish habitat will be minimized by avoiding wet trenching at all fish-bearing streams (with the exception of crossings 53, 57, 78, and 199 where no reasonable alternatives exist). Where possible, existing bridges will be used or the pipeline will be laid under or over existing culverts. Trench cuts will be used at crossings where staging the necessary equipment for other methodologies would impact a larger habitat area or other methods are technically infeasible. Many stream crossings occur near wetlands or other sensitive habitat areas which could be impacted by large staging areas. An alternatives analysis for each crossing will be provided in a separate document. Water will be flumed or diverted around most open trench cuts and filtration methods used to avoid downstream sedimentation. Wherever possible, biotechnical methods of erosion control will be implemented. The erosion and sediment control methodologies are described in detail in Section 2.10 Surface-water Runoff. The trenches will be dug during low water flows with the only impact occurring in the 30 foot wide construction corridor across the streambed. After trenching, the streambed will be reshaped to its original contours and spawning gravel replaced. Wherever possible, an attempt will be made to site crossings to avoid removing any streamside trees. Most trenched crossings should be completed within 1-2 days with longer periods possibly required for large streams.

The short term impacts will be limited to the duration of, and immediately following, construction and will be minimized due to the incorporation of Best Management Practices for construction, operation, and maintenance of the pipeline. As described in Section 2.10 Surface Water Runoff, the construction contractors will implement an erosion and sediment control plan that includes Best Management Practice's environmental criteria to minimize environmental impacts. As noted in Section 3.3 Water, state water quality regulations will be complied with during construction and operation of the pipeline.

On the preferred route, of the 137 proposed crossing of streams containing significant fisheries resources, trenching will be used at 66 crossings. Of these 66 crossings, 55 will use flumes or diversions, 4 will be wet trenches, 6 may be dry trenches, and one crossing may be bored. The remaining 71 crossings will avoid disturbances to streambeds by using existing bridges, culverts, drilling, etc.

The impact analysis on fishery and aquatic resources considered the potential for sedimentation and erosion, potential removal of vegetation, and the stream crossing methodologies, including whether blasting was likely to be needed.

Stream Crossing Methodologies

The actual impacts to the fish and aquatic habitat and resources will depend on the methodology selected for crossing the streams, the timing of construction, and the protective measures applied. The types of proposed crossing methods are flume and trench, divert and trench, dry trench, wet trench, existing fill crossing above or below a culvert, horizontal directional drilling, and using existing bridges to span the streams. Lined canals will generally be crossed by boring under them. Unlined canals will be trenched. The crossing methodologies are described in detail in Section 2.14 Construction Methodology.

The level of impacts is directly correlated to these crossing methods and other environmental variables (i.e., width of channel, angle of adjacent streambanks, presence of bedrock, access to sites, etc.). The level of impact is also related to the sensitivity of the aquatic resources and the effectiveness of mitigation measures. Table 3.4-8 lists major and minor project streams and the proposed crossing method for each.

The methods and mitigation measures for this project are similar to the guidelines established at a national workshop to develop guidelines for the design and construction of pipeline waterway crossings (Tera Environmental Consultants and Beak Consultants, 1993). The standard methods proposed were designed to first avoid, and then minimize, environmental impacts. Open cut trenching is proposed for crossing most streams because overall there would be minimal impacts to surrounding streamside habitat and it is the least expensive construction method. For streams that have significant fishery resources or environmental impacts, more expensive construction techniques (i.e., directional drilling) are proposed to avoid impacts. Where the potential environmental impact appeared to be the same with two crossing techniques, the less expensive method was chosen. An alternatives analysis for each crossing will be provided in a separate document.

TABLE 3.4-8
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
SNOHOMISH COUNTY Sammamish Basin															
Little Bear Creek (y)	Sammamish River	1	1	2, 3	3	X		X	X	X	609	H	X	X95	D
Unnamed (y)	Little Bear Creek	2	1				X				90	N	X	95	F
Unnamed (y)	Little Bear Creek	3	1				X				180	N	X	95	F
Unnamed (y)	Little Bear Creek	4	1	2, 3	3	X		X	X	X	NI	H	X	95	UC
Unnamed (y)	Little Bear Creek	5	2				X				99	N	X	95	D
Unnamed (n) (w)	Little Bear Creek	6	3				X				W	N	X	W	WETLAND
Snohomish Basin															
Anderson Creek (y)	Snohomish River	7	3				X				NI	N	X	X95	UC
Unnamed (n) (w)	Anderson Creek	8	4				X				W	N	X	W	WETLAND
Snoqualmie Basin															
Ricci Creek (y)	Snoqualmie River	9	4		3	X		X	X		690	M	X	95	D
Unnamed (n) (d)	Snoqualmie River	10	4				X				NC	N	X	95	DRY
Unnamed (y)	Snoqualmie River	10A	5				X				NI	N	X	95	UC
Snoqualmie River (y)	Snohomish River	11	5	2, 3, PT	3	2, 3		X	X		NI	H	X	X95	BRIDGE
Unnamed (n) (d)	Snoqualmie River	12	5				X				NI	N	X	95	Avoided
Unnamed (y)	Snoqualmie River	13	5				X				198	N	X	95	F
Peoples Creek (y)	Snoqualmie River	14	6	2, 3	3	X		X			NI	H	X	X95	OC
Unnamed (y)	Peoples Creek	14A	6				X				99	N	X	95	D
Peoples Creek (y)	Snoqualmie River	15	6		3	X		X			294	M	X	95	F

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Unnamed (y)	Peoples Creek	16	6				X				NI	N	X	95	OC
KING COUNTY Snoqualmie Basin															
Unnamed (y)	N.F. Cherry Creek	17	7		3	X		X			NI	M	X	X95	OC
Unnamed (y)	N.F. Cherry Creek	18	7	2, 3	3	X		X			345	H	X	X95	F
N.F. Cherry Creek (y)	Cherry Creek	19	8	2, 3	3	X			X		345	M	X	X95	F or D
Cherry Creek (y)	Snoqualmie River	20	8	2, 3, PT	3	X		X	X	X	1575	H	X	95	D or F
Unnamed (n) (w)	Cherry Creek	21	8				X				W	N	X	W	WETLAND
Harris Creek (y)	Snoqualmie River	22	9	2, 3	3	X		X	X		768	H	X	95	D
Unnamed (y)	Harris Creek	23	9		3	X		X	X		198	M	X	95	F
Unnamed (y)	Harris Creek	24	9				X				120	N	X	NS	F
Unnamed (n) (w)	Harris Creek	25	10				X				W	N	X	W	WETLAND
Unnamed (y)	Tolt River	25A	11				X				90	N	N	98	F
Tolt River (y)	Snoqualmie River	26	11	2, 3, PT	3	X		X		X	7872	H	N	X95	D
Tolt River (side channel) (y)	Snoqualmie River	27	11	2, 3, PT	3	X		X		X	984	H	N	95	D
Griffin Creek (y)	Snoqualmie River	28	12	2, 3	3	X		X	X	X	471	H	X	X95	D
Unnamed (y)	Griffin Creek	29	12	D	D	D	X				NI	H	X	NS	OC
Unnamed (n) (w)	Griffin Creek	30	12				X				W	N	X	W	WETLAND
Unnamed (y)	Griffin Creek	31	12	D	D	D	X				NI	H	X	NS	OC
Unnamed (y)	Tokul Creek	32	13				X				NI	N	X	95	OC
Unnamed (n) (a)	Tokul Creek	33	14				X				NI	N	X	NS	Avoided

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Tokul Creek (y)	Snoqualmie River	34	14		3	X		X	X	X	NI	M	N	X95	Bridge
Unnamed (y)	Mill Pond	35	14		3	X		X	X		NI	M	X	X96	OC
Unnamed (y)	Mill Pond	36	14				X				48	N	X	NS	F
Unnamed (y)	Pond	36A	14				X				NI	N	X	95	OC
Unnamed (y)	Pond	37	14				X				NI	N	X	NS	OC
Snoqualmie River (y)	Snohomish River	38	14		3	X		X	X	X	NI	M	X	X95	BRIDGE
Meadowbrook Slough (y)	Snoqualmie River	39	15		3	X		X	X		NI	M	X	95	BRIDGE
Meadowbrook Slough (y)	Snoqualmie River	39A	15		3	X		X	X		NI	M	X	98	BRIDGE
Unnamed (y)	S.F. Snoqualmie R.	40	15				X				NI	N	X	95	BRIDGE
Unnamed (y)	S.F. Snoqualmie R.	41	15		3	X			X		NI	M	X	95	BRIDGE
S.F. Snoqualmie R. (y)	Snoqualmie River	42	15		3			X			NI	M	X	X95	BRIDGE
S.F. Snoqualmie R. (y)	Snoqualmie River	43	17		3			X			NI	M	X	X95	BRIDGE
Boxley Creek (y)	S.F. Snoqualmie R.	44	17		3			X	X	X	1770	M	X	X95	F or D
Unnamed (y)	S.F. Snoqualmie R.	44A	17				X				NI	N	X	95	UC
Unnamed (y)	S.F. Snoqualmie R.	45	18				X				NI	N	X	95	OC
Unnamed (y)	S.F. Snoqualmie R.	46	18				X				NI	N	X	95	OC
Unnamed (y)	S.F. Snoqualmie R.	47	18				X				NI	N	X	97	OC

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Unnamed (y)	S.F. Snoqualmie R.	48	18				X				NI	N	X	97	OC
Unnamed (y)	S.F. Snoqualmie R.	49	18				X				NI	N	X	97	OC
Unnamed (y)	S.F. Snoqualmie R.	50	19		3	X	D	X		X	NI	M	X	97	OC
Unnamed (y)	S.F. Snoqualmie R.	51	19				D				NI	L	X	97	OC
Change Creek (y)	S.F. Snoqualmie R.	52	19		3	X	D	X	X	X	NI	M	X	X96	BRIDGE
Hall Creek (y)	S.F. Snoqualmie R.	53	19		3	X	D	X	X		480	M	X	X96	WET
Unnamed (y)	S.F. Snoqualmie R.	54	19				D				NI	L	X	95	OC
Unnamed (y)	S.F. Snoqualmie R.	55	19		3	X	D	X		X	NI	M	X	95	OC
Unnamed (y)	S.F. Snoqualmie R.	56	19				D				NI	N	X	95	OC
Mine Creek (y)	S.F. Snoqualmie R.	57	19		3	X	D	X	X	X	540	M	X	X96	WET
Unnamed (y)	S.F. Snoqualmie R.	58	20				X				NI	N	X	95	OC
Wood Creek (y)	S.F. Snoqualmie R.	59	20		D	D					NI	M	X	96	OC
Alice Creek (y)	S.F. Snoqualmie R.	60	20		D	D					NI	M	X	X96	OC
Unnamed (y)	Unnamed Tributary	61	20				X				NI	N	X	95	UC

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Unnamed (y)	S.F. Snoqualmie R.	62	20				X				NI	N	X	95	OC
Unnamed (y)	S.F. Snoqualmie R	62A	20				X				NI	N	X	95	OC
Unnamed (y)	S.F. Snoqualmie R	62B	20				X				NI	N	X	95	OC
Unnamed (y)	S.F. Snoqualmie R	62C	20				X				NI	N	X	95	OC
Unnamed (y)	Unnamed Tributary	63	20				X				NI	N	X	95	OC
Unnamed (y)	S.F. Snoqualmie R.	64	21				X				NI	N	X	95	UC
Unnamed (y)	S.F. Snoqualmie R.	65	21				X				NI	N	X	95	OC
Rock Creek (y)	S.F. Snoqualmie R.	66	21				X				450	N	X	96	D
Unnamed (y)	S.F. Snoqualmie R.	66A	21				X				NI	N	X	97	OC
Harris Creek (y)	S.F. Snoqualmie R.	67	21				X				450	N	X	X96	D
Unnamed (y)	S.F. Snoqualmie R.	67A	21				X				NI	N	X	95	OC
Unnamed (y)	S.F. Snoqualmie R.	68	21				X				NI	N	X	95	OC
Unnamed (n) (d)	S.F. Snoqualmie R.	69	21				X				NC	N	X	95	DRY
Unnamed (y)	S.F. Snoqualmie R.	70	21				X				NI	N	X	95	UC
Unnamed (y)	S.F. Snoqualmie R.	71	21				X				NI	N	X	95	UC

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Carter Creek (y)	S.F. Snoqualmie R.	72	22		3	X	D		X		768	M	X	X96	F or D
Unnamed (y)	S.F. Snoqualmie R.	73	22				D				NI	L	X	95	UC
Unnamed (y)	S.F. Snoqualmie R.	73A	22				D				NI	L	X	95	UC
Unnamed (y)	Hansen Creek	74	22				D				NI	L	X	95	UC
Hansen Creek (y)	S.F. Snoqualmie R.	75	22		3	X	D	X			1182	M	X	X95	F or D
Unnamed (y)	Pond	76	22				X				NI	N	X	95	UC
Unnamed (y)	S.F. Snoqualmie R.	77	22		3	X	D				NI	M	X	95	UC
Humpback Creek (y)	S.F. Snoqualmie R.	78	23		3	D					1119	M	X	X95	WET
Unnamed (n) (w)	S.F. Snoqualmie R.	79	23				X				W	N	X	W	WETLAND
Unnamed (n) (w)	S.F. Snoqualmie R.	80	23				X				W	N	X	W	WETLAND
Unnamed (n) (w)	S.F. Snoqualmie R.	81	23				X				W	N	X	W	WETLAND
Unnamed (y)	S.F. Snoqualmie R.	82	24				X				240	N	X	95	D
Olallie Creek (y)	S.F. Snoqualmie R.	83	24		D	D					414	M	X	X95	D
Rockdale Creek (y)	S.F. Snoqualmie R.	84	24		D	D					NI	M	X	X95	Avoided
KITTITAS COUNTY															

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Yakima Basin															
Unnamed (y)	Keechelus Lake	85	25				X				NI	N	X	95	OC
Mill Creek (y)	Keechelus Lake	86	26		1, 3, PT	1, 2		X		X	NI	H	X	X95	OC
Unnamed (y)	Keechelus Lake	87	26				X				NI	N	X	95	OC
Cold Creek (y)	Keechelus Lake	88	26		1, 3, PT	1, 2	X	X		X	NI	H	X	X95	OC
Unnamed (y)	Keechelus Lake	89	26				X				NI	N	X	95	OC or UC
Unnamed (y)	Keechelus Lake	90	26				X				NI	N	X	95	OC or UC
Unnamed (y)	Keechelus Lake	91	26				X				NI	N	X	95	OC or UC
Unnamed (y)	Keechelus Lake	92	26				X				NI	N	X	95	OC or UC
Unnamed (y)	Keechelus Lake	93	26				X				NI	N	X	95	OC or UC
Unnamed (y)	Keechelus Lake	94	26				X				NI	N	X	95	OC or UC
Unnamed (y)	Keechelus Lake	95	26				X				NI	N	X	95	OC or UC
Unnamed (y)	Keechelus Lake	96	27				X				NI	N	X	95	OC or UC
Roaring Creek (y)	Keechelus Lake	97	27		1, 3, PT	1, 2	X	X	X	X	846	H	X	X95	D
Unnamed (y)	Keechelus Lake	98	27				X				NI	N	X	95	OC or UC
Meadow Creek (y)	Keechelus Lake	99	27		1, 3, PT	1, 2	X	X	X	X	1200	H	X	X95	D
Unnamed (y)	Pond	100	27				X				NI	N	X	95	OC or UC
Unnamed (y)	Yakima River	101	28				X				NI	N	X	95	OC or UC
Unnamed (y)	Yakima River	102	28				X				NI	N	X	95	OC or UC
Mosquito Creek (y)	Yakima River	103	28		3	X		X	X	X	471	M	X	95	D

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Stampede Creek (y)	Yakima River	104	28		3	X		X	X	X	NI	M	X	95	OC or UC
Unnamed (y)	Yakima River	105	29				X				NI	N	X	X95	OC
Unnamed (y)	Yakima River	106	29				X				NI	N	X	X95	OC
Unnamed (y)	Yakima River	107	29				X				NI	N	X	95	OC
Unnamed (y)	Yakima River	108	30				X				NI	N	X	X95	OC
Unnamed (y)	Yakima River	109	30				X				NI	N	X	95	OC
Unnamed (y)	Yakima River	110	30				X				NI	N	X	95	OC
Unnamed (y)	Yakima River	111	30				X				NI	N	X	95	OC
Unnamed (y)	Yakima River	112	30				X				NI	N	X	95	OC
Unnamed (n) (d)		113	30				X				NC	N	X	95	DRY
Unnamed (y)		114	30				X				NI	N	X	95	OC
Unnamed (y)	Yakima River	115	31				X				NI	N	X	95	OC
Unnamed (y)	Yakima River	116	31				X				NI	N	X	95	OC
Cabin Creek (y)	Yakima River	117	31	2, 3, PT	3, PT	X		X		X	984	H	X	X95	D
Unnamed (n) (d)	Pond	118	31				X				NC	N	X	95	DRY
Unnamed (n) (d)	Pond	119	31				X				NI	N	X	95	OC
Unnamed (n) (d)		120	31				X				NC	N	X	95	DRY
Unnamed (n) (d)	Lake Easton	121	32				X				NC	N	N	95	DRY
Unnamed (y)	Yakima River	122	32				X				492	N	X	95	D or F
Main Canal (n) (c)		123	32		3	X					NI	L	X	96	B

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Tucker Creek (y)	Yakima River	124	33		3	X				X	345	M	X	X95	F
Main Canal (n) (c)		125	33		3	X					NI	L	X	96	B
Unnamed (y)	Big Creek	126	33				X				NI	N	X	97	UC
Big Creek (y)	Yakima River	127	34	2, 3, PT	3	X		X		X	885	H	X	X95	D or F
Unnamed (n) (d)	Yakima River	128	34				X				NC	N	X	95	DRY
Little Creek (y)	Yakima River	129	34	2, 3, PT	3	X		X		X	1182	H	X	X95	D or F
Peterson Creek (y)	Granite Creek	130	35				X				294	N	X	95	D or F
Granite Creek (y)	Yakima River	131	35		3	X		X		X	60	M	X	95	F
Spex Arth Creek (y)	Yakima River	132	36		3	X		X			NI	M	X	X95	UC
Tillman Creek (y)	Yakima River	133	37		3	X		X	X		99	M	X	95	F
Unnamed (y)	Tillman Creek	134	37				X				99	N	X	95	F
Unnamed (y)		135	38				X				198	N	X	95	F
Unnamed (n) (d)		136	38				X				NC	N	X	95	DRY
Unnamed (y)		137	39				X				78	N	X	95	F
Unnamed (n) (d)		138	39				X				NC	N	X	95	DRY
Unnamed (n) (d)		139	39				X				NC	N	X	95	DRY
Unnamed (n) (d)		140	39				X				NC	N	X	95	DRY
Unnamed (y)		141	40				X				99	N	X	95	F
Unnamed (y)		142	40				X				294	N	X	95	F
Thornton Creek (y)	Yakima River	143	40		3	X		X	X		147	M	X	95	D

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Unnamed (n) (d)		144	40				X				NC	N	X	95	DRY
Unnamed (n) (d)		145	41				X				NC	N	X	95	DRY
Main Canal (n) (c)		146	41		3	X					NI	L	X	96	B
Yakima River (y)	Columbia River	147	41	2, 3, PT	3, PT	2		X		X	2166	H	X	X95	D
Unnamed (n) (w)	Yakima River	148	42				X				W	N	X	95	WETLAND
Unnamed (n) (d)	Pond	149	42				X				NC	N	X	95	DRY
Unnamed (y)	Swauk Creek	150	43				X				198	N	X	95	DRY
Swauk Creek (y)	Yakima River	151	43	2, 3, PT	3, PT	X		X			1476	H	N	X95	F
Unnamed (n) (d)	Swauk Creek	152	43				X				NC	N	N	95	DRY
Unnamed (n) (d)	Swauk Creek	153	43				X				NC	N	X	95	DRY
Unnamed (n) (d)	Dry	154	44				X				NC	N	X	95	DRY
Unnamed (n) (d)		155	44				X				NC	N	X	95	DRY
Dry Creek (y)	Yakima River	156	44				X				393	N	X	95	DRY
Dry Creek (y)	Yakima River	157	45				X				294	N	X	95	F or D
Unnamed (y)	Dry Creek	158	45				X				99	N	X	95	F or D
Unnamed (y)	Dry Creek	159	45				X				294	N	X	95	D or F
Dry Creek (n) (d)	Yakima River	160	45				X				NC	N	X	95	DRY
Dry Creek (y)	Yakima River	161	45				X				492	N	X	95	D or F
Unnamed (y)	Yakima River	162	45				X				90	N	X	95	F
Unnamed (y)	Yakima River	163	46				X				165	N	X	95	F

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Unnamed (y)	Yakima River	163A	46				X				90	N	X	98	DRY
Unnamed (y)	Yakima River	163B	46				X				60	N	X	98	DRY
Unnamed (y)	Yakima River	163C	46				X				60	N	X	98	DRY
Unnamed (y)	Yakima River	164	46				X				NC	N	X	95	F
Unnamed (y)	Yakima River	165	46				X				60	N	X	96	F
Unnamed (y)	Yakima River	165A	46				X				60	N	X	98	F
Reecer Creek (y)	Yakima River	166	46		3	X			X	X	90	M	X	X96	D
Unnamed (y)	Yakima River	166A	46				X				90	N	X	98	DRY
Unnamed (y)	Yakima River	167	46				X				90	N	X	95	F
Jones Creek (y)	Yakima River	168	46		3	X		X			108	M	N	95	D
Jones Creek (y)	Yakima River	169	46		3	X		X			108	M	N	95	F
Jones Creek (y)	Yakima River	170	47		3	X		X			150	M	N	95	F
Unnamed (y)	Pond	171	47				X				30	N	N	95	F or DRY
Unnamed (y)	Currier Creek	172	47				X				120	N	X	95	F or DRY
Unnamed (y)	Currier Creek	173	47				X				90	N	N	95	F
North Branch Canal (n) (c)	Yakima River	174	47		3	X					NI	L	X	96	B
Unnamed (y)	Currier Creek	175	47				X				246	N	N	95	D or F
Unnamed (n) (c)	Currier Creek	176	47		3	X		X			C	L	X	95	F
Currier Creek (y)	Yakima River	177	47		3	X				X	609	M	X	X95	F
Unnamed (y)	Currier Creek	178	47				X				90	N	N	95	F

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed (y)	Currier Creek	179	48				X				60	N	N	95	F
Currier Creek (y)	Yakima River	180	48				X				90	N	N	96	F
Unnamed (n) (c)	Yakima River	181	48		3	X					C	L	X	96	D or F
Unnamed (n) (c)	Yakima River	182	48		3	X					C	L	X	96	F
Unnamed (n) (c)		183	49		3	X					C	L	X	96	F
Unnamed (y)	Yakima River	184	49				X				207	N	N	X95	D or F
Unnnamed (n) (c)	Yakima River	185	49		3	X					C	L	X	X95	F
Mercer Creek (y)	Yakima River	186	49				X				690	N	N	X96	D or F
Wilson Creek (y)	Yakima River	187	49		3	X		X			690	M	N	X95	D or F
Canal (n) (c)		188	50		3	X					NI	L	X	95	B
Canal (n) (c)		189	50		3	X					NI	L	X	95	B
Naneum Creek (y)	Yakima River	190	50		3	X		X			393	M	X	X95	D or F
Unnamed (n) (a)	Naneum Creek	191	50				X				NI	N	X	95	Avoided
Unnamed (n) (a)	Naneum Creek	192	50				X				NI	N	X	95	Avoided
Naneum Creek (y)	Yakima River	193	50		3	X		X			393	M	X	96	D or F
Cascade Canal (n) (c)		194	51		3	X					NI	L	X	95	B
Unnamed (n) (c)	Coleman Creek	195	51		3	X					C	L	N	95	F
Coleman Creek (y)	Yakima River	196	51		3	X		X			492	M	N	95	D or F
Unnamed (y)	Coleman creek	197	51				X				N/A	N	X	95	D or F
Canal (n) (c)		198	51		3	X					NI	L	X	95	B

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Cooke Creek (y)	Cherry Creek	199	52		3	X					N/A	M	X	95	WET
Caribou Creek (y)	Cherry Creek	200	52				X				NI	N	X	95	Bridge
Parke (n) (d)	Cherry Creek	201	52				X				NC	N	X	95	DRY
Unnamed (n) (d)	Parke Creek	202	52				X				NC	N	X	95	DRY
Cascade Canal (n) (c)		203	53		3	X					NI	L	N	96	B
Unnamed (y)	Parke Creek	204	53				X				NC	N	N	96	D or F
Parke Creek (y)	Cherry Creek	205	53		3	X		X			180	M	N	96	D or F
Unnamed (y)	Cherry Creek	205A	54				X				90	N	N	98	DRY
Parke Creek (y)	Cherry Creek	206	54		3	X		X			180	M	N	X96	D or F
Highline Canal (n) (c)		207	55		3	X					NI	L	N	96	B
Unnamed (n) (d)	Parke Creek	1-F	55				X				NC	N	N	98	F or D
Unnamed (y)	Parke Creek	1-E	55				X				60	N	N	98	DRY
Parke Creek (y)	Cherry Creek	1-A	55				X				45	N	N	96	DRY
Canal (n) (c)		1-I	55				X				C	N	N	98	F
Canal (n) (c)		1-J	55				X				C	L	N	98	D or F
Unnamed (y)	Parke Creek	1-G	56				X				450	N	N	98	DRY or F
Unnamed (y)	Parke Creek	1-B	56				X				450	N	N	96	DRY or F
Unnamed (y)	Parke Creek	1-C	56				X				300	N	N	96	DRY
Unnamed (y)	Parke Creek	1-K	56				X				120	N	N	98	DRY
Columbia Basin															

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f]	Species Utiliz.	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed (n) (d)	Ryegrass Coulee	1-D	57				X				90	N	N	96	DRY
Unnamed (n) (d)	Ryegrass Coulee	1-L	57				X				120	N	N	98	DRY
Unnamed (y)	Rocky Coulee	1-H	58				X				90	N	N	98	DRY or F
Unnamed (y)	Rocky Coulee	1-M	59				X				90	N	N	98	DRY
Unnamed (y)	Royegrass Coulee	9-B	61				X				90	N	N	98	DRY
Ryegrass Coulee (y)	Columbia River	9-A	61				X				360	N	N	96	DRY
Unnamed (y)	Ryegrass Coulee	14-A	61a				X				360	N	N	98	DRY
Unnamed (n) (d)	Columbia River	16-L	62a				X				NC	N	N	96	DRY
Getty's Cove (y)	Columbia River	18-A	63	2,3,E, PT	3, PT	2,3					15000	H	X	96	D
Unnamed (y)	Columbia River	23-A	63				X				150	N	N	98	DRY
Columbia River (y)	Pacific Ocean	223	64	2, 3, E, PT	3, PT	2, 3		X	X		NI	H	N	X95	HDD
GRANT COUNTY **Columbia Basin**															
Unnamed (n) (d)	Columbia River	224	65				X				NC	N	X	96	DRY
Unnamed (y)	Nunnally Lakes	225	66				X				90	N	X	96	F
Unnamed (n) (d)	Nunnally Lakes	226	67				X				NC	N	X	98	DRY
Unnamed (y)	Nunnally Lakes	227	67				X				75	N	X	98	F
Unnamed (y)	Nunnally Lakes	228	67				X				120	N	X	96	F
Unnamed (n) (d)	Nunnally Lakes	229	68				X				NC	N	X	96	DRY
Unnamed (y)	Lower Crab Creek	230	69				X				198	N	X	X96	F

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f]	Species Utiliz.	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Unnamed (y)	Lower Crab Creek	231	69				X				99	N	X	96	F
Unnamed (n) (c) (a)	Lower Crab Creek	232	69			3					NI	L	X	96	Avoided
Royal Branch Canal (n) (c)	Lower Crab Creek	233	69			3					NI	L	N	96	B
Canal (n) (c)	Lower Crab Creek	234	69			3					NI	L	N	96	B
Royal Branch Canal (n) (c)	Lower Crab Creek	235	70			3					NI	L	N	96	B
Canal (n) (c)	Lower Crab Creek	236	71			3					NI	L	X	96	B
Crab Creek Lateral (n) (c)	Lower Crab Creek	237	71			3					NI	L	X	96	B
Unnamed (n) (d)	Lower Crab Creek	238	73				X				NC	N	X	96	F or Dry
Unnamed (y)	Lower Crab Creek	239	74				X				225	N	X	96	F
Unnamed (n) (c)	Lower Crab Creek	240	75			3					C	L	X	X95	F
Canal (n) (c)		241	75			3					NI	L	X	96	B
Canal (n) (c)		242	76			3					NI	L	X	96	B
Unnamed (n) (c)	Lower Crab Creek	243	77			3					NI	L	X	96	Avoided
Canal (n) (c)	Lower Crab Creek	H26-A	78			3					C	L	N	96	DRY or F
Canal (n) (c)	Lower Crab Creek	H26-B	78			3					C	L	N	96	DRY or F
Lower Crab Creek (y)	Columbia River	H26-C	78		3	3					600	M	N	96	D
Lower Crab Creek (y)	Columbia River	H26-D	78		3	3					600	M	N	96	D
Lower Crab Creek (y)	Columbia River	H26-E	79		3	3					1500	M	N	96	F or D
Canal (n) (c)		H26-F	79			3					C	L	N	96	DRY or F
Canal (n) (c)		H26-G	79			3					C	L	N	96	DRY or F

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f]	Species Utiliz.	Corr.[h]	Sur. Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
Canal (n) (c)		H26-H	79			3					C	L	N	96	DRY or B
Unnamed (n) (d)		H26-I	79				X				NC	N	X	96	DRY
Canal (n) (c)		H26-J	79			3					C	L	N	96	DRY or F
Unnamed (n) (d)		252	80				X				NC	N	X	96	DRY
Unnamed (n) (d)		253	80				X				NC	N	X	96	DRY
Unnamed (n) (d)		254	80				X				NC	N	X	96	DRY
ADAMS COUNTY Columbia Basin															
Canal (n) (c)		255	82			3					NI	L	X	96	B
Canal (n) (c)		256	82			3					NI	L	X	96	B

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat[e] at Crossing			Pot. Impact[f]	Species Utiliz.	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.	(Sq. ft.)	Index[g]			
FRANKLIN COUNTY Columbia Basin															
Canal (n) (c)		257	83			3					NI	L	X	96	B
Wahluke Branch Canal (n) (c)		258	84			3					NI	L	X	96	B
Unnamed (n) (c)		259	85			3					C	L	X	96	F or DRY
Canal (n) (c)		260	85			3					NI	L	X	96	B
Canal (n) (c)		261	86			3					NI	L	N	96	B
Unnamed (y)	Eagle Lake Wetland	262	87			3					780	L	N	96	F or D
Unnamed (y)		263	87			3					120	L	N	96	F or OC
Canal (n) (c)		264	88			3					NI	L	N	96	B
Canal (n) (c)		265	88			3					NI	L	X	96	F or B
Canal (n) (c)		266	89			3					NI	L	X	96	F or B
Canal (n) (c)		267	89			3					NI	L	X	96	F or B
Unnamed (n) (c)		268	89			3					NI	L	X	96	B
Canal (n) (c)		269	89			3					NI	L	X	96	B
Potholes Canal (n) (c)		270	90			3					NI	L	X	95	B
Canal (n) (c)		271	90			3					NI	L	X	95	B
Canal (n) (c)		272	91			3					NI	L	X	95	B
Canal (n) (c)		273	91			3					NI	L	X	95	B
Eltopia Branch Canal (n) (c)		274	91			3					NI	L	X	95	B

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Canal (n) (c)		275	92			3					NI	L	N	95	B
Canal (n) (c)		276	92			3					NI	L	N	96	B
Canal (n) (c)		277	93			3					NI	L	N	96	B
Canal (n) (c)		278	93			3					NI	L	X	96	B
Canal (n) (c)		279	94			3					NI	L	X	96	B
Canal (n) (c)		280	94			3					NI	L	X	96	B
Canal (n) (c)		281	95			3					NI	L	X	96	B
Canal (n) (c)		282	95			3					NI	L	X	96	B
Esquatzel Diversion Canal (n) (c)		283	96			3					NI	L	X	X96	Bridge
Esquatzel Coulee (y)		284	96			3					630	L	X	X95	F
Canal (n) (c)		285	99			3					NI	L	X	96	B
KITTITAS COUNTY Yakima Basin															
Alternate Route (Originally on Preferred Alignment)															
Parke Creek (y)	Cherry Creek	208	55		3	X		X			513	M	N	X95	D or F
Parke Creek (y)	Cherry Creek	209	55		3	X		X			240	M	N	X96	F or DRY
Unnamed (y)	Parke Creek	210	55				X				90	N	N	95	F or DRY
Parke Creek (y)	Cherry Creek	211	55		3	X		X			300	M	N	X95	F or DRY
Unnamed (n) (d)	Parke Creek	212	56				X				NC	N	N	95	F or DRY
Unnamed (n) (d)	Parke Creek	213	56				X				NC	N	N	95	F or DRY

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Waterway[a]	Tributary to	Crossing Number[b]	Atlas Page[c]	Fisheries Utilization[d]				Salmonid Habitat at Crossing[e]			Pot. Impact[f] (Sq. ft.)	Species Utiliz. Index[g]	Corr.[h]	Sur Date[i]	Crossing Type[j]
				Anad. Sal.	Res. Sal.	Other sp.	No Fish	Resident Habitat	Winter Refuge	Spawn Hab.					
Unnamed (n) (d)	Parke Creek	214	56				X				NC	N	N	95	F or DRY
Unnamed (n) (d)	Parke Creek	215	57				X				NC	N	N	95	F or DRY
Columbia Basin															
Unnamed (y)	Sagebrush Spring	216	61				X				444	N	X	96	F or DRY
Unnamed (y)	Sagebrush Spring	217	61				X				300	N	X	95	F or DRY
Unnamed (y)	Canyon Creek	218	61				X				360	N	N	96	F or DRY
Unnamed (y)	Canyon Creek	219	63				X				450	N	X	95	F or DRY
Middle Canyon Creek (y)	Johnson Creek	220	63				X				600	N	X	96	F or D
Middle Canyon Creek (y)	Johnson Creek	221	63				X				600	N	N	96	F or D
Johnson Creek (y)	Columbia River	222	63				X				690	N	N	X96	F

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Alternate Route #8															
Ryegrass Coulee (y)	Columbia River	8-A	60				X				720	N	N	96	D
Alternate Route #12															
Unnamed (y)	Columbia River	12-A	61				X				300	N	N	NS	DRY
Alternate Route #16															
Unnamed (y)	Columbia River	16-A	61a				X				180	N	N	96	DRY
Unnamed (y)	Columbia River	16-B	61a				X				300	N	N	96	DRY
Unnamed (n) (d)	Columbia River	16-C	61a				X				NC	N	N	96	DRY
Unnamed (y)	Columbia River	16-D	62a				X				150	N	N	96	DRY
Unnamed (y)	Columbia River	16-E	62a				X				450	N	N	96	DRY
Unnamed (y)	Columbia River	16-F	62a				X				150	N	N	96	DRY
Unnamed (y)	Columbia River	16-G	62a				X				180	N	N	96	DRY
Unnamed (y)	Columbia River	16-H	62a				X				180	N	N	96	DRY
Unnamed (n) (d)	Columbia River	16-I	62a				X				NC	N	N	96	DRY
Unnamed (y)	Columbia River	16-J	62a				X				180	N	N	96	DRY
Unnamed (y)	Columbia River	16-K	62a				X				90	N	N	96	DRY
Alternate Route #19															
Canyon Creek (y)	Columbia River	19-A	63				X				600	N	N	96	F or D
Alternate Route #20															
Johnson Creek (y)	Columbia River	20-A	63				X				690	N	N	96	F

TABLE 3.4-8 (CONTINUED)
PIPELINE STREAM CROSSINGS, FISHERIES UTILIZATION, SALMONID HABITAT, POTENTIAL IMPACT AREA, SENSITIVITY INDEX, AND PROPOSED CROSSING METHODS

Alternate Route #22															
Unnamed (y)	Columbia River	22-A	63				X				900	N	N	96	DRY
Unnamed (y)	Columbia River	22-B	63				X				450	N	N	96	DRY
Alternate Route #23															
Unnamed (y)	Columbia River	23-B	63				X				90	N	N	NS	DRY
Alternate Route #24															
Sand Hollow (y)	Columbia River	24-A	63a				X				NI	N	N	96	B
Canal (n) (c)		24-B	64b				X				C	N	N	96	D or F
Unnamed (y)		24-C	65				X				210	N	N	96	DRY
GRANT COUNTY **Columbia Basin**															
Alternative Route (Originally on Preferred Alignment)															
Lower Crab Creek (y)	Columbia River	244	77			3					1674	L	X	X95	D
Unnamed (y)	Lower Crab Creek	245	77				X				900	N	X	96	F
Unnamed (y)	Lower Crab Creek	246	78			X					984	L	X	X95	F
Unnamed (n) (d)		247	78				X				NC	N	X	96	DRY
Unnamed (n) (d)		248	79				X				NC	N	X	96	DRY
Unnamed (n) (d)		249	79				X				NC	N	X	96	DRY
Unnamed (y)		250	79				X				198	N	X	96	D or F
Unnamed (y)		251	80				X				198	N	X	96	D or F

(a) Symbol (y) indicates that the waterway is under the jurisdiction of the Army Corps of Engineers (ACOE) pursuant to Section 404 of the Clean Water Act. Symbol (n) indicates that the waterway is not an ACOE jurisdictional stream. Symbol (u) indicates that the ACOE jurisdictionality of the waterway is unknown at this time, additional field surveys will be completed to determine ACOE jurisdictionality. Symbol (w) indicates that the waterway is actually a wetland at the pipeline crossing point. Symbol (d) indicates that at the pipeline crossing point there is no defined channel. Symbol (c) indicates that the waterway is an irrigation canal with little or no fisheries value.

(b) Dames and Moore's waterway crossing number. Crossing number increases as you follow the pipeline west to east.

(c) Map Atlas (see Dames & Moore, 1996a) page number for the waterway crossing.

(d) Fisheries utilization: ANAD- anadromous fish; RES SAL-resident salmonids; OTHER SPECIES-other fish species; NO FISH- no known fisheries utiliza indicated by a "D". A "D" in the "NO FISH" column indicates that sediment transport at the crossing has the potential of impacting fisheries resources in Data from Washington Rivers Information System (WARIS) (WDFW, 1995a). If Washington State Priority species are present, the priority criteria are li as threatened within the next year, it is noted by the symbol 'PT' and if a species present is listed as endangered, it is noted by the symbol 'E.'

(e) Salmonid habitat types present at specific or general pipeline crossing locations.

(f) POT IMPACT - Potential impacted area for stream crossings. The area in square feet is calculated by multiplying the distance across a full stream cha impact because no physical disturbance to stream channel occurs, NA=No information available, NC=No defined channel, C=Canal or irrigation ditch, and

(g) Criteria for Sensitivity Index ratings are: HIGH (H)-stream contains anadromous fish, Washington state priority species (priority level 1 or 2) or a spe listing as threatened or endangered within the next 2 years; MODERATE (M)-stream contains resident salmonids and is not an irrigation canal: LOW (L)- priority level 3 fish species or is an irrigation canal that contains incidental resident salmonids. A sensitivity index of LOW is also applied to pipeline streams in locations where sedimentation from construction will affect a fish bearing stream; NO FISH (N)-no fish are present and sedimentation from cons

(h) Corridors: Pipeline waterway crossings that occur at established road, rail or powerline right-of-ways are marked with an X to represent an established co crossing is marked with an N.

(i) Field Surveys: The date that a pipeline waterway crossing was surveyed in the field is recorded as 95 or 96. An X preceding the date indicates that a surv B. Wetlands were not surveyed for fisheries resources and are indicated by a W. NS indicates that a stream was not surveyed in the field.

(j) Crossing types: HDD - Horizontal Directional Drill; F - Flume; D - Divert; DRY - Dry Trench; WET - Wet Trench; B - Bore; BRIDGE - Bridge; OC - Over

Open Cut Trenching: Most of the project streams would be crossed by open-cut trenching (using flumes or diversion of stream flow). This crossing procedure was selected because it is a traditional pipeline construction technique, and the cheapest method. All trenching and other construction activities would occur during construction windows that have been established by WDFW to protect salmonids. The general construction windows are specified by county, with some special construction timing considerations for important project streams. The general construction windows are listed below:

County	Construction Window
King	June 15 - October 15
Snohomish	June 15 - September 30
Kittitas	June 15 - September 30
Grant	July 1 - September 30
Franklin	July 1 - September 30
Adams	July 1 - September 30

Special Timing Requirements

Little Bear Creek	June 15 - September 30
Columbia R.	October 16 - March 31
Roaring and Meadow Creeks	Aug 1 - Aug 15
Yakima R., Swauk Creek	Sept 1 - Sept 30 (Sept 15 - Sept 30 preferred)
Cabin, Big and Little Creeks	July 1 - Aug 31

Open-cut trenching is proposed for installing pipeline and crossing many streams. When utilized, it can be very cost-effective and allow better control of some potential construction impacts than drilling or jack/bore methods. Where streambanks are steep, heavily wooded, or inaccessible from roads, the environmental impacts of open cut crossing can be less than those of directional drilling due to the need to get equipment (several trucks) to the drilling site. Crossings only take a few days or less to finish and sedimentation impacts will be brief. Short-term turbidity increases will be minimal in project streams with rocky bottoms. Trenching would generally be completed with the use of water diversions to prevent erosion and sedimentation through the use of diversion flumes and coffer dams. The pipes which are installed in and adjacent to the open cuts will be coated with concrete to provide negative buoyancy and additional mechanical strength. Only four streams in the project area will be wet trenched without diverting water around the construction area. Diverting or fluming water around these stream crossings would be impractical because the streambeds of hall, Mine, Humpback, and Cooke Creeks (crossings 53, 57, 78, and 199) are composed of large or porous substrates.

Physical Disturbance of Instream Habitat: The fish habitat at approximately 65 pipeline crossings would be temporarily eliminated by open cut trenching. For construction, a trenching machine would work across the active stream channel perpendicular to streamflow. The process would disturb an area approximately 30 feet wide. In riffle areas, or crossings with mostly spawning gravel, the impacts would be minimal. After excavation, the trench would be filled with suitable new spawning gravel and the habitat would be returned to its original structure. Clean gravel will be used to replace the sediments excavated from the trench to prevent the release of any fine sediments existing in the original substrate. The replacement gravel will be selected to match as closely as possible the original size distribution and form factor of the material removed. Spawning habitat would return to its original condition or be improved by the removal of fine sediments, immediately after construction activities. For streams that have summer or winter rearing habitat, the streambed would be re-contoured to match preconstruction conditions. If large substrate material and LWD (large woody debris) exists at the crossing, attempts will be made to replace it or similar objects. However, even with contouring efforts some of the habitat value would be temporarily lost. The rearing habitat and the hydraulic conditions at the crossings would be disturbed. It could take two years (or a bank full flow event) to redistribute the streambed gravels and cover in the trenched streambed and form new habitat elements that are usable by fish. Recolonization by aquatic macroinvertebrates should occur rapidly.

A number of open-cut trench crossings occur in streams with significant salmonid spawning habitat or channels which have the potential to release sediments to significant downstream habitat. Trenching methodologies were selected for these crossings after an alternatives analysis determined that other methodologies were impractical.

Jack-and-Bore: Jack-and-boring will be used on 41 waterway crossings, primarily the lined irrigation canals/ditches along the eastern part of the pipeline route. Boring is an alternate methodology for an additional four crossing locations. The method requires a starting and ending pit. The pits are excavated to a desired depth that will allow horizontal movement of the pipe under the canal. No instream habitat would be affected by boring activities. If riparian vegetation occurs adjacent to the canals and near the pit sites, the areas would be cleared of all vegetation. The bore pit will require an area 10-15 feet wide and 50 feet long. Receive pits will be approximately 10 by 10 feet. Some of the advantages of guided boring over directional drilling include lower installation costs and no drilling muds to disperse. Also, most canal banks are higher than the surrounding land. For those waterways, there is a low potential for sediment to enter the canal during or after construction.

Directional Drilling: Directional drilling would occur under the Columbia River (crossing 223) and will only affect vegetation well away from the active stream channel. Each starting drill and receiving pad will require the removal of a minimum of approximately .7 acres of upland or riparian vegetation on each side for a total of 1.5 acres. The working areas around the pad will also be approximately 150-200 feet long by 100 feet wide for the drill pad and 100-175 feet long by 50-100 feet wide around the receiving pad. Drilling muds from the pilot hole and the reamed hole will also be collected at the drilling side and spread over appropriate upland areas or otherwise properly disposed of.

The other potential environmental impacts from directional drilling involve direct sedimentation. Rarely, the drilling activity "fractures" the substrate in the stream channel. Fine sediment from the drilling mud could leach into the active channel and be carried downstream by streamflow. This fine material could settle in low gradient depositional reaches and degrade spawning and rearing habitat. To minimize the potential for fracturing, the drilling will be well below the stream channels (see Section 2.14 Construction Methodology).

Utilization of Bridges: Twelve stream crossings currently have bridges that will be used for the pipeline. Impacts to the stream habitat and fisheries resources at these locations will be minimal because construction pits or pads would not be created. Existing riparian vegetation would be removed up to the bridges (a maximum of 30 feet wide on both streambanks) and no in-channel impacts would occur.

Types of Aquatic Habitat Impacts

Deterioration of Water Quality: The construction, operation, and maintenance of the pipeline may affect the aquatic habitat. The turbidity of the streams may increase due to suspended sediment from physical habitat disturbance during construction and from unstable streambanks. The potential water quality impacts resulting from hydrostatic test water discharges, bentonite seepage at drilled crossings, and hazardous material spills are addressed in Sections 2.5 Water Supply (WAC 463-42-165), 2.7 Characteristics of Aquatic Discharge Systems (WAC 463-42-185), 2.9 Spill Protection and Control (WAC 463-42-205), and 7.2 Emergency Plans (WAC 463-42-525).

Sedimentation: Two modes of sediment transport are typically delineated in streams: (1) suspended load transport: the turbulence of flowing water is sufficient to entrain and maintain particles in suspension (typically clay and silt sizes <0.83 mm in diameter), and (2) bedload transport. During freshets, bedload generally consists of particles >1 mm in diameter, which roll, slide, or saltate downstream close to the bed. Although fine to coarse sand-size particles (0.1-1.0 mm in diameter) are usually transported as bedload, these particles can also be carried as suspended sediment depending on local hydraulic condition.

The transport of suspended sediment can occur over a wide range of flow conditions. Because the hydraulic forces required to keep these particles in suspension are relatively low, once entrained they are rapidly moved downstream. Most of the suspended sediment carried by mountain streams is transported during periods of high streamflow (Everest et al, 1987).

Construction methodologies used for the Cross Cascade Pipeline Project should produce no increases in bedload transport, but will release varying amounts of suspended sediment. With the exception of a wet trench, most of the sediment will be released when stream water is allowed to refill a diverted streambed.

Additionally, in some cases where terrain prevents the construction of a settling basin, water from the construction site will have to be pumped through a filtration system and some fine particles of sediment will enter the stream. However, these particles will be < 100 microns and should, for the most part, be kept in suspension and not be deposited in spawning gravels.

If not mitigated, adverse impacts from suspended sediments could include but are not limited to:

- Fish mortality or injury due to damaged gill tissues. This may lead to asphyxiation or increased susceptibility to disease. However, this is unusual. An extreme concentration (>20,000 mg/l) is required for direct mortality to occur in salmonids. This is rarely found in nature (or during any of the construction methodologies to be used). The tolerance of salmonids to suspended sediments varies seasonally with the highest tolerance in the fall (Noggle, 1978). The highest levels of suspended sediment (2,000 to 3,000 mg/l) that may occur during periods of construction would produce an initial mild stress response, but the fish will adapt quickly and the event will be short-term.
- Reduced fish feeding efficiency. Reduced visibility due to water turbidity could impact feeding efficiency. The levels from construction are within the range of natural variation.
- Destruction of food production areas. The stream substrate could fill with fine sediment.
- Mortality of aquatic invertebrates and their habitat. A reduction in macroinvertebrate biomass has been shown to occur after siltation of streambeds, but the population quickly rebounds to pre-siltation event levels within 2-3 months (Tebo, 1954). Because of the mitigation measures, sediment carried along by streamflow is expected to have no or minor effects on aquatic organisms, depending on the quantity of material and the duration of suspended sediment exposure.
- Reduced spawning success. Filling of spawning gravel with fine sediment could "armor" spawning substrates and reduce or eliminate spawning activity.
- Mortality of eggs, fry, and juvenile fish. Gravels impacted with fine sediment would have reduced streamflow and oxygen. Emerging fish could be trapped by fine sediment in the gravel interstices.
- Reduction of available summer rearing and winter holding habitat for fish. This would occur from the entry of excessive amounts of large sediment (an unlikely occurrence from a point source unless it involves a large mass wasting event).
- Delay migration of adult spawners. This can be mitigated by proper timing of construction activities.

Sedimentation may occur during and after pipeline construction activities are completed. Sediment released at the waterway crossing sites may affect various types of instream habitat, especially spawning habitat in low gradient areas downstream of the crossings. Potential sources of sediment include the stream channel that is disturbed for trenching and the exposed streambanks that have been stripped of vegetation.

Excavated sediments will be removed to an area far enough from the stream to prevent their release into the watercourse and disposed of in an upland fill. When diverting or fluming water, sediment will be filtered from water that is pumped out of the construction area where it is impossible to construct a settling pond adequately isolated from the stream. A small amount of sediment would be released immediately from the channels that will be trenched. Bare streambanks could also release sediments until the crossings have been completely revegetated. Those impacts would be short-term, and banks typically will be stabilized within the 1-2 growing seasons it takes for planted shrubs and vegetation to develop a sufficient root structure. Some crossing sites present a challenge to the growth of shrubs because of localized unfavorable environmental conditions. Where it is appropriate, biotechnical methods of erosion control will be used to stabilize slopes. At some sites, it may be necessary to use physical rather than biological methods of slope stabilization. Existing statutory or policy requirements for fish habitat protection will be met or exceeded (WA State Forest Practices, U.S. Forest Service Best Management Practices). The appropriate mitigation measures are summarized in Section 3.3 Water (WAC 463-42-322). Erosion and sediment control are addressed in Subsection 3.4.4.3 and in Section 2.10 Surface Water Runoff (WAC 463-42-215).

Where the pipeline route closely parallels a waterway, such as the South Fork of the Snoqualmie River or Keechelus Lake, sediment will be released from the road surface and wash into the stream with storm runoff. Run-off of fine sediments from road surfaces decrease with the age of the road and are directly proportional to the amount of vehicle traffic (Cederholm et al, 1981) (Reid & Dunne, 1984). In the case of the John Wayne trail, there is no public access by motor vehicle; greatly reducing the opportunity for the release of fine sediment where the pipeline route passes close to Keechelus Lake.

The potential downstream impacts of sedimentation based on stream hydrological and fisheries information is addressed in Table 3.4-9. The sensitivity of the stream to physical disturbances at the crossing site are computed and an impact potential is calculated using this factor (adjusted for crossing methods that involve excavation in the stream channel (trenching) vs non-invasive methods (drilling, boring, and over/under culvert methodologies) and a mitigation factor assigned to each crossing methodology.

Impacts of sediment entry into a stream will be kept to a minimum by timing construction streambank stabilization procedures during the summer months to avoid the large scale mobilization of sediments that occur during storms. The effects of “off cycle” sedimentation is minor, because only a small area is affected and the sediment source is ephemeral.

Although cases of heavy chronic sedimentation by suspended sediments have been documented to adversely affect the reproductive success of salmonids, sediment releases from sources created by pipeline crossings should be short term because BMP’s will be followed to stabilize streambanks. There should be a 2 year period of slightly elevated release of fine sediments, followed by a return to the original baseline level of fine sediments (Reid and Dunne, 1984). Fine sediments released into the stream during this time should be removed from spawning gravel by winter and spring freshets (Dietrich and Smith, 1981). Salmonids have been demonstrated to use avoidance behavior to adjust to limited amounts of sedimentation in spawning gravels. The act of digging a redd removes fine sediments and areas that are heavily used by spawning salmonids experience a reduction in fine sediments. Fish will abandon redds if they cannot be cleaned sufficiently of fine sediments during digging and select cleaner patches of gravel (Everest et al, 1987). By properly timing construction to avoid the period between redd building and the escape of fry from the gravel, the release of fine sediments will not reduce reproductive success during the construction year. Winter and spring freshets and redd construction during the following year should remove any remaining fine sediments and return the streambed to pre-construction levels of sediment load.

Petroleum Product Releases

The possibility of a petroleum product release from the pipeline is addressed in Section 2.9, and in the separate technical report entitled Cross Cascade Pipeline Project/Product Spill Analysis (Feb. 28, 1997).

A product release, if it occurred, would likely be either short in duration, small in volume, or both. A release of a significant volume of product would be detected quickly by monitoring or the computerized leak detection system. Response time would usually be swift, and product isolation, containment, recovery and cleanup/disposal would occur quickly, Most of the product would be removed from the environment, the area of impact would be relatively small and the time of exposure would be limited. The biological effects of such a short-term release would, therefore, be limited. Moreover, the likelihood that such a release would have any impact on aquatic environments is diminished farther by the fact that most of the pipeline route is located in upland areas.

A release of a smaller volume of product may be more difficult to detect. The exposure time may, therefore, be greater, but the area of impact would be smaller due to the small volume of product released. OPL will conduct careful and frequent monitoring in order to detect any such releases. Once detected, isolation, containment, recovery and cleanup would occur quickly.

Relatively little data exists concerning the long term toxicity effects of petroleum products on aquatic organisms. Most of the existing data have been gathered from laboratory experiments, and, although valuable for determining the lethal doses of fish toxicants, do not address the effects of long-term exposure to low-level doses.

In contrast, considerable data has been gathered concerning the effects of crude oil spills on aquatic organisms. Much of this work has been performed in the wake of the Exxon Valdez and Gulf of Persia oil spills. Crude oil spills would be expected to have more significant effects on the environment that petroleum product spills because crude oil does not volatize nearly as quickly as refined petroleum products. Nonetheless, studies of Alaska pink salmon (Oncorhychus gorbuscha) in Prince William Sound following the Valdez spill have not demonstrated any long-term impacts attributable to crude oil spill. In particular, mean sediment concentrations of polycyclic aromatic hydrocarbons (PAH) up to 300 ppb were measured in oiled streams in 1989 (following the oil spill) and generally followed a downward trend toward background in 1990 and 1991 to background levels. These PAH concentrations were then used in regression analyses of potential effects on key early life stages of pink salmon. Conclusions of the study indicated that measures of early life stages were largely indistinguishable between oiled and unoiled streams (Brannon, 1995). Studies of postspill returns of adult salmon returning to oiled and unoiled streams concluded that no differences could be found that could be attributed to the oil spill (Maki, 1995). Although these studies concerned a crude oil spill in a marine environment, they suggest that spills of refined petroleum products would also be unlikely to result in significant long-term effects on aquatic organisms.

Removal of Vegetation: The removal of riparian vegetation for any type of stream crossing will result in short-term impacts to the fisheries resources. Thirty linear feet of both streambanks will have all vegetation removed during construction activities. Overhead cover for fish would be removed for some streams. The permanent construction impact will be the removal of large trees at the crossing locations. These trees will not be replanted in the pipeline right-of-way because the corridor will have to remain visible from the air during future inspection flights. The streambanks would be revegetated with just shrubs (e.g. willows). The removal of trees adjacent to the streams may result in a minor increase in local runoff because precipitation interception would be reduced. This may cause a small increase in erosion, turbidity, and suspended solids in the streams. Until the banks are revegetated (typically within 1-2 growing seasons), the exposed streambanks would also be susceptible to erosion and sedimentation of the habitat. The loss of streambank vegetation, large woody debris, and other instream cover will also result in a temporary decrease in fish cover.

The removal of streamside vegetation could slightly increase the water temperature at the stream crossing sites by reducing the shading. This potential impact is important for streams that have summer rearing habitat for fish, especially those in eastern Washington. However, it is not expected that water temperatures would change significantly. Many project streams have already been affected by construction activities (roads, bridges, culverts, railroad, and transmission lines) at the proposed crossing sites and their riparian areas are not intact. A relatively small linear distance of streambank will be affected at each stream crossing and there would be insignificant impacts due to temperature increases.

Six of the streams and rivers that will be crossed by the pipeline presently fail to meet the temperature criteria for their water quality classifications. These are Tokul Creek, Big Creek, the Yakima River, Swauk Creek, Cooke Creek, and Lower Crab Creek. Trees will be removed from the riparian zones of two of these streams, Tokul Creek and the Yakima River. Loss of these trees will result in less shading of the streams and may cause a slight increase in ambient temperatures. Shrubs removed from these six crossings and the other crossings dominated by shrubs will be replanted to restore as much shading at the crossing locations as possible.

Where the pipeline route passes through USFS or BLM lands it will enter Riparian Reserves at stream crossings or where it parallels the South Fork of the Snoqualmie or Keechelus Lake. Riparian Reserve Buffers are based on stream type and distance from the stream. Type 1 (containing anadromous fish) and 2 (Containing resident fish) streams are buffered to 300 feet on both sides (total 600 feet). Type 3 (perennial with no fish) streams are buffered to 150 feet on both sides and Type 4 (intermittent) and type 5 (ephemeral) streams are buffered to 100 feet on both sides. Natural lakes and ponds are buffered with 300 foot reserve widths and man-made lakes and ponds have 150 foot reserve widths. Wherever possible, the pipeline has been or will be routed to avoid the removal of mature trees. Most of the pipeline route is along existing roads and should not require tree removal. BMP's will be met or exceeded during construction and impacted areas will be stabilized before and after construction and revegetated with native perennials and shrubs. The removal of Riparian Reserve trees within thirty linear feet of the pipeline will be necessary at some points along the pipeline route. This will usually occur at stream crossings. Crossings 57, 72, 73, and 78 are the only ones located within Riparian Reserves that will involve the removal of trees. In each case, all BMP's will be met or exceeded and streambanks will be stabilized before and after construction. All of these streams are extensively forested and tree removal at these crossings should not create any significant loss in the recruitment of large woody debris in the stream channels.

Acoustic Shock: OPL is not proposing to use in-water blasting as part of construction. Blasting can be harmful or fatal to fish due to acoustic shock or damage to their air bladders. Laterally compressed fish (i.e., largemouth bass) are the most sensitive to blast related acoustic shock, while the more fusiform body types (i.e., trout and salmon) are the least affected. If the specific geologic circumstances (i.e., bedrock) were to require the use of controlled blasting at an individual crossing, the effects of these explosions will be mitigated by several factors. Active construction in the stream will probably scare most fish out of the construction areas prior to detonation. A small scare charge or air bubble curtains will also be used to minimize this impact. Fish will also be collected within the area of blasting and held until construction is complete then released to the same general area. The area will be netted off to avoid migration of other fish into the area during construction. If blasting is necessary, the blasting and construction activities will occur during low flow periods, to ensure the maintenance of instream nets.

Estimates of Impacted Habitat

The amount of impacted aquatic habitat is directly correlated to the types of crossing methods and other environmental variables. Streams crossed by the preferred pipeline route with significant fisheries and aquatic resources will be trenched at approximately 50 crossings and the amount of impacted habitat is in Table 3.4-8. Some waterways will not have impacted aquatic habitat. They have deep road fills above culverts that can be trenched without disturbing the stream channel. Other waterways will be crossed by bridges, or the pipeline will be drilled under the stream channel. Refer to the impacts column and the legend for Table 3.4-8 for each waterway.

We did not estimate the amount of impacted habitat for 200 waterway crossings in Table 3.4-8. One hundred and thirty-six of these streams are crossed by non-invasive methods or avoided and do not impact the streambeds. Of the remaining 64 crossings, 42 occur at small intermittent streams which probably do not support fish based on their size and pipeline crossing location, 17 were canals, 2 were not measured, and 3 were likely to be crossed by a non-invasive method (jack-and-bore). The intermittent streams could, however, be important contributors of high-quality water to downstream reaches. All of these small streams, except one, are first and second order streams and they have very small channels. The pipeline would cross them near their headwaters in most cases. Several of the channels do not appear to drain into another stream or waterbody. Although the 17 canals crossed by invasive methods do contain fish, due to a lack of bottom structure, riparian vegetation, frequent dewatering, and high levels of siltation and turbidity, they provide no significant habitat or spawning areas. These waterways are primarily used for water conveyance and do not represent a significant fisheries resource. They do have some value as a source of fry of warmwater species to restock ponds and lakes connected to the waterways.

For boring and directional drilling crossings, none of the aquatic habitat in the active channel will be disturbed when placing the pipeline under the stream. Only working areas around the pits or pads and the streambanks will be cleared of vegetation, which would affect primarily overhead cover for fish. These impacts to vegetation are noted in Subsection 3.4.2.2.

The pipeline will be installed on existing bridges for several stream crossings. There will be no channel impacts at those locations. Vegetation adjacent to the stream channel may be impacted and those impacts are noted in Subsection 3.4.2.2.

The majority of the streams will be crossed by open-cut trenching. The trenching machine will disturb an area approximately 30 feet wide or less across the channel. To determine the total surface area of the active channel that may be disturbed for each stream crossing, the average bankfull width of the stream was multiplied by the construction corridor width. These estimates are very conservative since bankfull width is only realized approximately every 2 years, and the area of wetted channel is usually less. The estimates of potential impact do not include the riparian zone area that may be disturbed during construction.

One of the primary stream crossing design considerations for the pipeline is depth of scour and width of scour. Adequate design of each crossing will require burying the pipeline below the maximum scour depth across the active channel scour width such that the pipeline does not become exposed during large erosion events. Exposure can lead to physical damage of the pipe with an increased risk of spills and leaks. Maximum scour was evaluated for each waterway crossing. The pipe will be buried a minimum of 2 feet below the maximum scour depth. Some of the high gradient streams tributary to the South Fork of the

Snoqualmie will also have large debris released during high-water events. The debris will include large tree trunks and boulders capable of damaging the pipe. However, these streams have been heavily scoured by high-water events and only large cobbles and boulders remain in their streambeds. The size of the bed materials in these streams is expected to prevent their being dislodged by debris and exposing the pipe to damage.

Aquatic Conservation Strategy: Construction at waterway crossings within the National Forests must comply with the Aquatic Conservation Strategy developed to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within them on public lands. This strategy protects salmon and steelhead trout habitat on federal lands managed by the Forest Service and Bureau of Land Management within the range of Pacific Ocean Anadromy. As such, it would apply to all drainages west of the Cascade Mountains within the project area with the exception of the Snoqualmie Basin above Snoqualmie Falls and to the Yakima River Basin below Keechelus Lake.

The Aquatic Conservation Strategy has the following nine objectives.

- Maintain and restore the distribution, diversity and complexity of watershed and landscape-scale features.
- Maintain and restore spatial and temporal connectivity within and between watersheds.
- Maintain and restore the physical integrity of the aquatic system, including shorelines, banks and bottom configurations.
- Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems.
- Maintain and restore the sediment regime under the aquatic ecosystems evolved.
- Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing.
- Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.
- Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration and to supply amounts and distributions of coarse woody debris sufficient to sustain physical complexity and stability.
- Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

The four components of the Aquatic Conservation Strategy are as follows:

- **Riparian Reserves**: Lands along streams and unstable and potentially unstable areas where special standards and guidelines direct land use.

- **Key Watersheds**: A system of large refugia comprising watersheds that are crucial to at-risk fish species and stocks and provide high quality water.
- **Watershed Analysis**: Procedures for conducting analyses that evaluate geomorphic and ecological processes operating in the specific watersheds
- **Watershed Restoration**: A comprehensive, long-term program of watershed restoration to restore watershed health and aquatic ecosystems, including the habitats supporting fish and other aquatic and riparian-dependent organisms.

The strategy outlined in the Aquatic Conservation Strategy's objectives and components applies to land along streams accessible to anadromous fish administered by the USFS, BLM, and two sections along the route owned by Plum Creek Timber Company that may be traded to the USFS. This would appear to apply to crossings 100 through 116 and 129 in the Yakima Basin. If the definition of Pacific Ocean Anadromy is also applied to the Snoqualmie River Basin above Snoqualmie Falls, then crossings 46, 47, 61 through 78 and 82 through 99 would also be covered. Clearing for staging areas for pipeline construction at these sites will be confined to the minimum area necessary and generally confined to the construction corridor or to existing cleared areas away from the streams.

Crossing methods that would affect the instream habitat of these crossings occur at crossings 66-67 (diversion and trench cut); crossings 70-72 and 75-77 (Flume and trench cut); and crossings 78, 82-84, 88, 97, 99, 103 and 129 (diversion and trench cut). Crossing 69 will be a dry trench cut. Sedimentation in these cuts will be minimized through the use of flumes or diversions around the construction sites and filtering. Only the 30 feet wide section of streambed at the crossing will be affected and it will be recontoured and returned to its previous state before returning water to the channel. There should be no downstream siltation of the area and the trenched streambed will return to previous conditions after the high-water events of the first winter and spring. It is important that erosion control and bank stabilization procedures detailed in Subsection 3.4.4.3 be strictly followed to prevent damage to the streambed during high-water events and OPL has agreed to do so.

Stream crossings have been sited to avoid any unnecessary removal of trees or large shrubs. The Riparian Area discussion in Subsection 3.4.4.1 describes crossings that occur where trees form the dominate vegetation. The removal of trees within Riparian Reserves will be further detailed in a separate report. The pipeline has been routed to avoid Late Successional Reserves.

Stream Crossing Sensitivity: To simplify the discussion of the potential fisheries and aquatic impacts from the project, each stream and its crossing method was considered. An impact sensitivity assigning a quantitative total sensitivity to physical disturbance at each crossing was developed along with an inherent impact factor representing the relative effect of each crossing method. Impact potential for each crossing was calculated by multiplying the crossing's impact sensitivity by its inherent impact factor. Impact sensitivity was calculated using the following variables:

Impact Sensitivity (Table 3.4-9): An impact sensitivity index was developed to assign a quantitative total sensitivity to physical disturbance at each crossing, based on the geological factors present at the site, stream hydrograph, riparian vegetation and fish species present. Impact sensitivities are based on the following factors:

Species Utilization: The Fisheries Utilization Sensitivity Index listed in Table 3.4-8 with NO FISH=0, LOW=1, MOD=2, and HIGH=3. Higher ratings indicate the presence of fish

HIGH: Stream contains anadromous fish, Washington state priority species (priority level 1 or 2) or a species expected to be federally listed under the Endangered Species Act within the next 2 years.

MODERATE: Stream contains resident salmonids and is not an irrigation canal.

LOW: Stream contains non-salmonid Washington state priority level 3 fish species or is an irrigation canal that contains incidental resident salmonids. A sensitivity index of low is also applied to pipeline stream crossings occurring on non-fish bearing streams and in locations where sedimentation from construction would affect a fish bearing stream.

NO FISH: No fish are present and sedimentation from construction will not affect a fish bearing stream. This rating only applies to the presence of fish and the effects of sedimentation on downstream watercourses. Any stream (including intermittent and ephemeral) provides water, nutrients and organic debris to downstream fisheries.

The project streams that support sensitive and/or anadromous fish at the pipeline types and are assumed to support salmonids. The "low" rating was assigned to small streams with other fisheries values, or those creeks that had limited fisheries values.

Hydrology: Streams with a winter rain hydrograph are assigned a rating=1 and streams with a summer rain, winter snow hydrograph are assigned a rating=2. Higher ratings indicate higher levels of stream scour.

Stream Gradient: High gradient streams (>5%) are assigned a rating=1, moderate gradient streams (1-5%) are assigned a rating=2, and low gradient streams are assigned a rating=3. Higher ratings indicate a higher depositional rate of fine sediments.

Stream Geometry: Narrow and deep stream channels are assigned a rating=1, channels with a medium width and depth are assigned a rating=2, and wide and shallow channels are assigned a rating=3. Higher ratings indicate lower bank stability. Weak banks are usually associated with wide, shallow channels and cohesive banks tend to form deep, narrow channels.

Side Slope: Streambank slope <90% and no significant cutbank=1; streambank slope >90% or significant cutbank=2. Higher ratings indicate a higher risk of sediment release from construction activities.

Riparian Vegetation: 0=In roadbed, 1=grasses and forbs, 2=trees or shrubs. Higher ratings indicate higher levels of bank stability reduction caused by vegetation removal. If construction takes place within the roadbed, no vegetation is removed and no streambed disturbance occurs. Grasses and forbs strengthen banks by dense root systems. Trees and shrubs provide large woody debris, streamside shade, and cover in addition to bank strengthening root systems.

Life History: The length of residence time in the stream: 1=resident trout, charr, or resident non-salmonid species; 2=coho, Spring and summer-run chinook salmon; 3=Fall-run chinook and sockeye salmon; and 4=pink and chum salmon. Higher ratings indicate species are present that have a short residence time in fresh water. The shorter the residence time before a salmonid smolts and migrates to salt-water, the higher the impact of fine sediments on spawning gravels (Everest, 1987).

Soils: Soils not highly erodible=1, moderately erodible soils=2, and highly erodible soils=3. Higher ratings indicate a higher risk of sediment release from construction activities.

Higher numbers indicate a greater sensitivity of the stream crossing to physical impact. The values of the above factors used to calculate impact sensitivity in Table 3.4-9 can be found in Table 6 of the Fisheries and Aquatic Resources Technical Report (Dames & Moore, 1997). Impact sensitivity is computed on a scale 0-10 with the lowest possible value assigned to a stream crossing being 3.18. The total impact sensitivity of each crossing was calculated with the following formula:

Impact sensitivity = 10(Species utilization index+hydrology+stream gradient+stream geometry+side

Total impact sensitivities ranged from 4.09 to 8.64. High impact sensitivities can be mitigated by selecting low impact methods of crossing as shown below.

The impact sensitivity listed above and in Table 3.4-9 is for an invasive (involving excavation of the streambank and streambed) methodology. When computing the impact potential value of a stream crossing, the impact sensitivity value is calculated differently for invasive (involving excavation of the streambank and streambed) and non-invasive (requiring no disturbance of the streambank or streambed) methodologies. Impact sensitivity (invasive) is calculated using the equation above used to calculate "total" impact sensitivity, while a separate equation is used to calculate impact sensitivity (non-invasive). The equation used for calculating the sensitivity index for non-invasive crossings is as follows:

Impact sensitivity(non-invasive)= 10(Species utilization index+hydrology+stream gradient+stream

Invasive and non-invasive crossing methodologies are:

Invasive crossing methodologies	**Non-invasive crossing methodologies**
Dry Trench	Bridge
Flume and Trench	Over Culvert
Divert and Trench	Under Culvert
Wet Trench	Horizontal Directional Drill
	Bore

Impact Potential of Crossing (Table 3.4-9): Impact potential represents the potential for a crossing method to impact a specific crossing site. The inherent impact of the crossing methodology is factored into the impact sensitivity for each crossing site. Impact sensitivity is differentiated into a figure for total or invasive impact sensitivity (involving excavation of the streambank and streambed) as given above and non-invasive impact sensitivity (requiring no disturbance of the streambank or streambed). The calculations for determining a crossing's impact potential are as follows:

An **inherent impact factor** representing the relative effect of a crossing methodology was assigned with avoiding=0 and a wet trench=1. Inherent impact factors assigned to the crossing methodologies are as follows: Bridge=0, Bore=0, Horizontal Directional Drill=0 (0.3 if drilling mud leakage occurs), Over Culvert=0, Under Culvert=0 (0.4 if culvert is replaced and 1.0 if culvert cannot be flumed before replacing), Dry Trench=0.25, Flume or Divert and Trench=0.4, and Wet Trench=1.0.

The **impact potential** of a crossing is derived by multiplying the impact sensitivity, invasive or non-invasive, of a stream crossing by the inherent impact factor of the crossing methodology.

The lowest impact potential (0) listed in Table 3.4-9 is for non-invasive crossing methods (bridge, culvert, drill, or bore) and the highest (7.73) is for a wet trench across Getty's Cove. Because of its unique situation, the figure for Getty's Cove is probably not a good indicator of impact potential. This is a wet trench across a wide shallow cove with very little water flow. With the exception of the finest particles of suspended sediment, most of the substrate disturbed by the crossing will probably settle out within the cove. Any other sediment will settle in the pool behind Priest Rapids Dam. Most high-impact crossings (trenched) had impact potentials between 2.18 and 3.45.

Conclusions (impact sensitivity and impact potential)

Most of the impacts to stream habitat from pipeline crossings will be caused by the release of fine sediments into the stream channel. The impact potential scores listed in Table 3.4-9 are conservative, with trenched crossings using a diversion or flume assigned 40 percent of the value of a wet trench. The actual amount of sediment released from a trench cut using some form of water diversion is probably considerably less than 10 percent of the sediment released from a wet trench. A "worse case" example of sedimentation from trench cutting a streambed would be if all of the fine sediment in the substrate removed during the cut was washed downstream.

Assuming a 10 foot deep trench is dug at a crossing, the base of the trench will be approximately 4 feet across and the slope of the trench will be 50%. For each foot of trench dug, the following amount of substrate will be removed:

One foot of trench = (4 feet x 10 feet) + (10 feet x 10 feet) = 140 cubic feet of substrate removed

Fine sediment <1 mm in diameter in the substrate of Cascade Mountain streams varies between 10-30 % of the total substrate (Everest et al., 1997). With one exception (crossing 18A at Getty's Cove on alternate route 18), trenches will be dug after the stream flow has been diverted and little of the substrate removed will be released into the diverted water flow. Although only a small amount of the substrate removed during trenching will be released into a stream, we will assume that 30% of the substrate removed is fine sediment and that all of it is released into the stream below the crossing. In this scenario, 0.3 X 140 = 42 cubic feet of fine sediment that will be released into the stream below the crossing. This sediment will settle-out from the water column over a span of several stream miles, but we will assume for these calculations that all of the sediment settles out within 1000 feet of the crossing and that the width of the stream remains relatively constant. Each foot of trench should yield 42 cubic feet of fine sediment deposited over an average one foot wide and 1000 foot long section of streambed. This will yield an average depth of 0.5 inches of fine sediment deposited on the surface of the stream bed. If spawning gravels are 12 inches deep, the percent of fine sediment particles in the gravel will increase by four percent of the total volume.

The actual amount of fine sediment released from a trench cut into a diverted or flumed stream should be several orders of magnitude less than the above scenario, leading to considerably less than a one-percent-by-volume average increase of fine sediments in spawning gravels below a pipeline crossing. In addition, sediments will not be evenly deposited. Fine sediments will primarily settle-out in low velocity sections of the stream as sand and silt bars. Spawning gravels are found in higher velocity riffle sections of streams and will have a far lower percentage of fine sediments deposited. This slight increase in fine sediments should result in no significant loss in spawning success unless they occur while eggs are in the gravel (coating the eggs and suffocating the embryos). Construction will only occur before spawning or after fry have hatched and left their redds. Silt deposited before spawning will be removed during the construction of redds. A short-term decrease in macroinvertebrates can be expected, followed by a rapid recovery (Tebo, 1955).

Relatively large quantities (500 to 1,000 ppm) of suspended water-borne material can be carried for short periods of time without detriment to fish. Natural levels of suspended sediment concentrations in Cascade Mountain streams vary between 5 to 1000 ppm (highest concentrations occur during the spring run-off of glacial rivers). Construction activities should not cause suspended sediment concentration over 500 ppm (during a "wet" trench cut) and these concentrations will only occur for a few hours at most. The impact potentials between 2.18 and 3.45 that are listed in Table 3.4-9 represent a suspended sediment concentration of approximately 75-200 ppm. Suspended sediment levels will only approach these concentrations during the removal of flumes or diversions and the initial flooding of the crossing after trenching and infilling is completed. Bridge building, boring, drilling, or laying the pipeline over or under a culvert will not cause increases in suspended sediment (unless a leakage of drilling mud occurs or if a culvert has to be replaced or cannot be flumed before replacing). A leakage of drilling mud will be of short duration and has a low probability of occurrence. Replacement of culverts in established roadbeds constitutes an improvement to existing infrastructure and will prevent future wash-outs. The brief duration of construction related increases in turbidity should have no significant effects on primary production or feeding activities of aquatic organisms other than the temporary decrease in macroinvertebrates stated above.

In summary, the "worse case" scenario of a wet trench cut that releases all of the fine sediment present in the removed substrate into the stream below the crossing would result in a 4% increase of fine sediments in spawning gravels below the stream crossing. These sediments would be deposited in a construction "window" after fry have left their redds or before spawning has occurred. The deposits would have short-term impacts and would be removed during the construction of redds or during winter and spring freshets. The potential impacts for trench cut crossings utilizing water diversions listed in Table 3.4-9 are 28 to 45 percent of the potential impact listed for a wet trench (Getty's Cove). This is based on using an inherent impact factor that is 40 percent of that of a wet trench. Considering that the actual amount of sediment released is probably considerably less than 10 percent of the sediment of a wet trench (the trench is cut in a dry channel and little fine sediment is released into the stream), the 40 percent factor is a very conservative estimate of inherent impact. Since the estimated release of fine sediment from wet trenching as described would have no significant impact on fish reproduction and no impacts on primary production or feeding activities of aquatic organisms, a trench cut utilizing water diversions will surely have no significant impact on aquatic organisms.

TABLE 3.4-9
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
Little Bear Creek	1	1	D	CT, SS, RS	COT, TS, WL, SD	0.4	6.82	2.73
Unknown	4	1	UC[(k)]	**CT, SS**	COT	0 0.4 1.0	6.82 6.82 6.82	0 2.00 5.00
Ricci Creek	9	4	D	**CT**	COT	0.4	5.91	2.36
Snoqualmie River	11	5	Bridge	**CT, RB, BC, DV, SCT, SHW, SHS, CF, SS, CH, PS**	COT, WF, LRS, TS, PL, WL, RL, NSF, **GS**, **WS**, LND, SD, RS, PM	0	7.73	0
Peoples Creek	14	6	OC	**CT, SS**	COT, WL	0	7.27	0
Peoples Creek	15	6	F	**CT**	COT, WL	0.4	5.91	2.36
Unnamed	17	7	OC	**CT**	COT, WL	0	6.82	0
Unnamed	18	7	F	**CT, SS**	COT, WL	0.4	8.18	3.27
N.F. Cherry Creek	19	8	F or D	**CT, SS**	COT	0.4	6.82	2.73
Cherry Creek	20	8	D or F	**CT, RB, SCT, SHW, SS, CH, PS, CF**	COT, WL, PL	0.4	8.64	3.45
Harris Creek	22	9	D	**CT, SCT, SS, CH**	COT, WL	0.4	7.73	3.09
Unnamed	23	9	F	**CT**	COT	0.4	5.91	2.36
Tolt River	26	11	D	**CT, RB, SHW, SHS, SS, CH, CF, PS**	COT, WL, WF	0.4	8.64	3.45
Tolt River (side channel)	27	11	D	**CT, RB, SHW, SHS, SS, CH, CF, PS**	COT, WL, WF	0.4	8.64	3.45
Griffin Creek	28	12	D	**CT, SS**	WL, COT	0.4	6.82	2.73
Unnamed	29	12	OC	D	D	0	6.82	0
Unnamed	31	12	OC	D	D	0	6.82	0
Tokul Creek	34	14	Bridge	**CT,** EB	WL, COT	0	5.45	0

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
Unnamed	35	14	OC	**CT**	COT	0	5.45	0
Snoqualmie River	38	14	Bridge	**CT, RB**	COT, WF, WL, LRS	0	5.45	0
Meadowbrook Slough	39	15	Bridge	**CT**	COT	0	5.45	0
Meadowbrook Slough	39A	15	Bridge	**CT**	COT	0	5.45	0
Unnamed	41	15	Bridge	**CT**	COT	0	5.45	0
S.F. Snoqualmie R.	42	15	Bridge	**CT. RB**	COT, WF, WL, LRS, LND	0	5.91	0
S.F. Snoqualmie R.	43	17	Bridge	**CT. RB**	CPT. WF, WL, LRS, LND	0	5.45	0
Boxley Creek	44	17	F or D	**CT. RB**	COT	0.4	5.91	2.36
Unnamed	50	19	OC	**CT. RB**	COT	0	5.00	0
Unnamed	51	19	OC	NF	NF	0	4.55	0
Change Creek	52	19	Bridge	**CT. RB**	COT	0	6.36	0
Hall Creek	53	19	WET	**CT. RB**	COT	1.0	5.45	5.45
Unnamed	54	19	OC	NF	NF	0	5.45	0
Unnamed	55	19	OC	**CT. RB**	COT	0	5.45	0
Unnamed	56	19	OC	NF	NF	0	4.55	0
Mine Creek	57	19	WET	**CT. RB**	COT	1.0	5.91	5.91
Wood creek	59	20	OC	D	D	0	6.36	0
Alice Creek	60	20	OC	D	D	0	6.36	0
Carter Creek	72	20	F or D	**CT. RB**	COT	0.4	6.82	2.73
Unnamed	73	22	UC[(k)]	NF	NF	0 0.4 1.0	5.91 5.91 5.91	0 1.45 3.64

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
Unnamed	73A	22	UC[(k)]	NF	NF	0 0.4 1.0	5.45 5.45 5.45	0 1.27 3.18
Unnamed	74	22	UC[(k)]	NF	NF	0 0.4 1.0	5.45 5.45 5.45	0 1.27 3.18
Hansen Creek	75	22	F or D	**CT**	COT	0.4	7.73	3.09
Unnamed	77	22	UC[(k)]	**CT. RB**	COT	0 0.4 1.0	6.36 6.36 6.36	0 1.64 4.09
Humpback creek	78	23	WET	**CT**	COT	1.0	6.82	6.82
Olallie Creek	82	24	D	D	D	0.4	6.82	2.73
Rockdale Creek	84	24	Avoided	D	D	0	6.82	0
Mill Creek	86	26	OC	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**	0	6.36	0
Cold Creek	88	26	OC	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**	0	6.82	0
Roaring Creek	97	27	D	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**, BR	0.4	7.73	3.09
Meadow Creek	99	27	D	**RB, WCT, BC,** EB, **K**	COT, MS, **PW**, BR	0.4	7.27	2.91
Mosquito Creek	103	28	D	**RB**	COT, MS	0.4	5.91	2.36
Stampede Creek	104	28	OC	**RB**	COT, MS	0	5.00	0
Stampede Creek	104	28	UC[(k)]	**RB**	COT, MS	0 .4 1.0	5.00 5.00 5.00	0 1.45 3.64
Cabin Creek	117	32	D	**RB, WCT, BC,** EB**, SHS, CSP**	COT, MS, LND, SD, LD, WF	0.4	8.64	3.45
Main Canal	123	32	B	**RB**	COT, MS, LND, SD, LD, WF	0	4.55	0
Tucker Creek	124	33	F	**RB**	COT, MS, LND, SD, LD	0.4	6.82	2.73

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
Main Canal	125	33	B	**RB**	COT, MS, LND, SD, LD, WF	0	4.09	0
Big Creek	127	34	D or F	**RB, WCT, <u>SHS</u>, <u>CSP</u>**	COT, MS, LND, SD, LD, RS	0.4	7.73	3.09
Little Creek	129	34	D or F	**RB, WCT, <u>SHS</u>, <u>CSP</u>**	COT, MS, LND, SD, LD, RS	0.4	8.64	3.45
Granite Creek	131	35	F	**RB**	COT	0.4	6.36	2.55
Spex Arth Creek	132	35	UC[(k)]	**RB**	COT	0 .4 1.0	6.82 6.82 6.82	0 1.64 4.09
Tillman Creek	133	37	F	**RB,** EB	COT, MS, LND, SD, LD	0.4	5.91	2.36
Thornton Creek	143	40	D	**RB**	COT, LND, SD, LD	0.4	6.82	2.73
Main Canal	146	41	B	**RB**	COT, LND, SD, LD, WF, LRS	0	4.09	0
Yakima River	147	41	D	**RB, WCT, BC,** BT, EB**, <u>SHS</u>, <u>CSP</u>**	WF, **SR**, NSF, SD, LND, LRS, BRS, COT, LD, RS, MS, <u>PL</u>, PM, TS	0.4	6.82	2.73
Swauk Creek	151	43	F	**RB, WCT, BC,** EB**, <u>SHS</u>, <u>CSP</u>**	COT, WF, TS, LRS, MS, LND, SD, RS, LD	0.4	8.18	3.27
Reecer Creek	166	46	D	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	6.36	2.55
Jones Creek	168	46	D	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	7.27	2.91
Jones Creek	169	46	F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	5.91	2.36
Jones Creek	170	47	F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	5.91	2.36
North Branch Canal	174	47	B	**RB**	COT, LND, SD, LD, WF, LRS	0	5.00	0
Unnamed	176	47	F	**RB**	COT, LND, SD, LD, WF, LRS	0.4	5.45	2.18
Currier Creek	177	47	F	**RB**	COT, LND, SD, LD, WF, LRS	0.4	7.27	2.91
Unnamed	181	48	D or F	**RB**	COT, LND, SD, LD, WF, LRS	0.4	5.91	2.36
Unnamed	182	48	F	**RB**	COT, LND, SD, LD, WF, LRS	0.4	5.91	2.36

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[a]

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[e]	Non-Salmonids[f]	Inherent Factor[g]	Impact[h] Sensitivity	Impact Potential of Crossing[i]
Unnamed	183	49	F	**RB**	COT, LND, SD, LD, WF, LRS	0.4	5.45	2.18
Unnamed	185	49	F	**RB**	COT, LND, SD, LD, WF, LRS	0.4	6.36	2.55
Wilson Creek	187	49	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	7.27	2.91
Canal	188	50	B	**RB**	COT, LND, SD, LD, WF, LRS	0	4.09	0
Canal	189	50	B	**RB**	COT, LND, SD, LD, WF, LRS	0	4.09	0
Naneum Creek	190	50	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	6.82	2.73
Naneum Creek	193	50	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	5.45	2.18
Cascade Canal	194	51	B	**RB**	COT, LND, SD, LD, WF, LRS	0	4.09	0
Unnamed	195	51	F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	4.55	1.82
Coleman Creek	196	51	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	6.36	2.55
Canal	198	51	B	**RB**	COT, LND, SD, LD, WF, LRS	0	4.09	0
Cooke Creek	199	52	WET	**RB**	COT, WF, LRS, LND, SD, RS, LD	1.0	5.91	5.91
Cascade Canal	203	53	B	**RB**	COT, LND, SD, LD, WF, LRS	0	5.91	0
Parke Creek	205	53	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	7.27	2.91
Parke Creek	206	54	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	6.82	2.73
Highline Canal	207	55	B	**RB**	COT, LND, SD, LD, WF, LRS	0	4.09	0
Getty's Cove	18A	63	D	**RB, BC, SHS, CSP, CF, CS**	**LMB**, **SMB**, **WAL**, **CC**, **WS**, PL, WC, **SR**, CM, BRS, LSS, LNS, NSF, SD, LND, LD, RS, GF, PM, LC, BC, YP, PS, COT, CP, BBH, WF	0.4	7.73	3.09
Columbia River	223	64	HDD[j]	**RB, BC, SHS, CSP, CF, CS**	**LMB**, **SMB**, **WAL**, **CC**, **WS**, PL, WC, **SR**, CM, BRS, LSS, LNS, NSF, SD, LND, LD, RS, GF, PM, LC, BC, YP, PS, COT, CP, BBH, WF	0 0.3	8.18 8.18	0 1.50

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
Unnamed	232	69	Avoided		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Royal Branch Canal	233	69	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	234	69	B		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG	0	5.00	0.32
Royal Branch Canal	235	70	B		**LMB**, CP, YP, BC, PS, BBH	0	4.09	00
Canal	236	71	B		CP, YP, PS, **LMB**, COT, BG, BC	0	6.36	0
Crab Creek Lateral	237	71	B		**LMB**, COT, CP, YP, PS	0	5.91	0
Unnamed	240	75	F		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0.4	4.09	1.64
Canal	241	75	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	242	76	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Unnamed	243	77	Avoided		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	H26-A	78	DRY		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.25	4.09	1.02
Canal	H26-A	78	F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	4.09	1.64
Canal	H26-B	78	DRY		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.25	4.09	1.02
Canal	H26-B	78	F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	4.09	1.64
Lower Crab Creek	H26-C	78	D	**RB,** BT	**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	6.82	2.73

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
Lower Crab Creek	H26-D	78	D	**RB,** BT	**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	6.82	2.73
Lower Crab Creek	H26-E	79	D or F	**RB,** BT	**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	6.82	2.73
Canal	H26-F	79	DRY		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.25	4.09	1.02
Canal	H26-F	79	D or F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	4.09	1.64
Canal	H26-G	79	DRY		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.25	4.09	1.02
Canal	H26-G	79	F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	4.09	1.64
Canal	H26-H	79	DRY		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.25	4.09	1.02
Canal	H26-H	79	B		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0	4.09	0
Canal	H26-J	79	DRY		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.25	4.09	1.02
Canal	H26-J	79	F		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG, LND, RS, SD	0.4	4.09	1.64
Canal	255	82	B		CP, YP, PS, **LMB**, COT, BG, BC	0	6.36	0
Canal	256	82	B		**LMB**, COT, CP, YP, PS	0	4.09	0
Canal	257	83	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Wahluke Branch Canal	258	84	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Unnamed	259	85	F		**LMB**, YYP, BG, BBH, PS, COT, CP,	0.4	4.55	1.82

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[a]

Waterway	Crossing Number[b]	Atlas Page[c]	Crossing Type[d]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[e]	Non-Salmonids[f]	Inherent Factor[g]	Impact[h] Sensitivity	Impact Potential of Crossing[i]
					LRS, BC, SD, LND, RS			
Unnamed	259	85	DRY		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0.25	4.55	1.14
Canal	260	85	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	261	86	B		**LMB**, COT, PS, YP, CP	0	4.09	0
Unnamed	262	87	F or D		**LMB**, CP, YP, PS, COT, BG, BC	0.4	7.27	2.91
Unnamed	263	87	F		**LMB**, CP, YP, PS, COT	0.4	6.36	2.55
Unnamed	263	87	OC		**LMB**, CP, YP, PS, COT	0	6.36	0
Canal	264	88	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	265	88	F		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0.4	4.09	1.64
Canal	265	88	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	266	89	F		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0.4	4.09	1.64
Canal	266	89	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	267	89	F		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0.4	4.09	1.64
Canal	267	89	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Unnamed	268	89	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	269	89	B		**LMB**, YYP, BG, BBH, PS, COT, CP,	0	4.55	0

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
					LRS, BC, SD, LND, RS			
Potholes Canal	270	90	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	271	90	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	272	91	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	273	91	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Eltopia Branch Canal	274	91	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	275	92	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	276	92	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	277	93	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	278	93	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	279	94	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	280	94	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.55	0
Canal	281	95	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Canal	282	95	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0

TABLE 3.4-9 (CONTINUED)
FISH THAT OCCUR AT PIPELINE WATERWAY CROSSINGS AND IMPACT POTENTIAL OF WATERWAY CROSSINGS ON FISH HABITAT[(a)]

Waterway	Crossing Number[(b)]	Atlas Page[(c)]	Crossing Type[(d)]	Fish That Occur at Pipeline Waterway Crossings		Crossing Sensitivity/Imp. Potential		
				Salmonids[(e)]	Non-Salmonids[(f)]	Inherent Factor[(g)]	Impact[(h)] Sensitivity	Impact Potential of Crossing[(i)]
Esquatzel Diversion Canal	283	96	Bridge		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Esquatzel Coulee	284	96	F		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0.4	6.36	2.55
Canal	285	99	B		**LMB**, YYP, BG, BBH, PS, COT, CP, LRS, BC, SD, LND, RS	0	4.09	0
Alternate Route (Originally on Preferred Alignment)								
Parke Creek	208	55	D or F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	6.36	2.55
Parke Creek	209	55	F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	6.82	2.73
Parke Creek	209	55	DRY	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.25	6.82	1.7
Parke Creek	211	55	F	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.4	6.36	2.55
Parke Creek	211	55	DRY	**RB**	COT, WF, LRS, LND, SD, RS, LD	0.25	6.36	1.59
Lower Crab Creek	244	77	D		**LMB**, **SMB**, BC, YP, PS, CP, COT, BG	0.4	6.36	2.55
Unnamed	246	78	F		CP, YP, BC, PS, BBH	0.4	5.91	2.36

(a) Table lists only streams with potential fisheries values.

(b) Dames and Moore's waterway crossing number. Crossing number increases as you follow the pipeline west to east.

(c) Map Atlas (see Dames & Moore, 1996a) page number for the waterway crossing.

(d) Crossing types: HDD - Horizontal Directional Drill; F - Flume; D - Divert; DRY - Dry Trench; WET - Wet Trench; B - Bore; Bridge - Bridge; OC - Over Culvert; UC - Under Culvert

(e) Fish presence at a downstream location is indicated by a "D." If fish are Abbreviations for salmonid names are as follows (Underlined abbreviations represent anadromous species and abbreviations in bold represent Washington State Priority Species):

BC or **BC**=Bull Trout	**CH**=Chum Salmon	**CT**=Cutthroat Trout	**K**=Kokanee	**RS**=Sockeye Salmon	**SHW**=Steelhead Trout (Winter-run)
Bt=Brown Trout	**CS**=Chinook Salmon(Summer-	**DV**=Dolly Varden	**PS**=Pink Salmon	**SCT**=Sea-run Cutthroat Trout	**SS**=Silver Salmon

	run)	Trout			
<u>CF</u>=Chinook (Fall-run)	**<u>CSP</u>**=Chinook Salmon (Spring-run)	EB=Eastern Brook Trout	**RB**=Rainbow Trout	**<u>SHS</u>**=Steelhead Trout (Summer-run)	**WCT**=Westslope Cutthroat Trout

(f) Fish presence at a downstream location is indicated by a "D." Abbreviations for non-salmonid fish names are as follows (Underlined abbreviations represent anadromous species and abbreviations in bold represent Washington State Priority Species)(Whitefish species are listed with non-salmonid species):

BBH=Brown Bullhead	COT=Sculpin	**LMB**=Largemouth Bass	<u>PL</u>=Pacific Lamprey	SD=Speckled Dace	WL=Western Brook Lamprey
BC=Black Crappie	CP=Carp	LND=Longnose Dace	PM=Peamouth	**SMB**=Smallmouth Bass	**<u>WS</u>**=White Sturgeon
BG=Bluegill	GF=Goldfish	LNS=Longnose Sucker	PS=Pumpkinseed	**SR**=Sandroller	YP=Yellow Perch
BTS=Bridgelip Sucker	**<u>GS</u>**=Green Sturgeon	LRS=Largescale Sucker	**PW**=Pygmy Whitefish	TS=Three Spined Stickleback	BR=Burbot
CC=Channel Catfish	LC=Lake Chub	MS=Mountain Sucker	<u>RL</u>=River Lamprey	**WAL**=Walleye	WF=Mountain Whitefish
CM=Chiselmouth	LD=Leopard Dace	NSF=Northern Squawfish	RS=Redside Shiner	WC=White Crappie	

(g) INHERENT IMPACT FACTOR: Relative effect, on a scale of 0-1, of a crossing methodology with avoiding=0 and a wet trench=1. Inherent impact factors assigned to the crossing methodologies are as follows: Bridge=0, Bore=0, Horizontal Directional Drill=0 (0.3 if drilling mud leakage occurs), Over Culvert=0, Under Culvert=0 (0.4 if culvert is replaced and 1.0 if culvert cannot be flumed before replacing), Dry Trench=0.25, Flume or Divert and Trench=0.4, and Wet Trench=1.0.

(h) IMPACT SENSITIVITY: The total sensitivity of a stream crossing to disturbance based on the geological factors present at the site, stream hydrograph, riparian vegetation and fish species present. Sensitivity is computed on a scale of 0-10 with the lowest value assigned to a stream crossing being 3.18. Impact sensitivity does not take into account which kind of crossing methodology is used or if the methodology is invasive (involving excavation of the streambank and streambed) or non-invasive (requiring no disturbance of the streambank or streambed). The formula used to compute impact sensitivity is as follows:
Impact sensitivity=10 (species utilization index+hydrology+stream gradient+stream geometry+side slope+riparian vegetation+life history+soils)/22

(i) IMPACT POTENTIAL OF CROSSING: Impact potential of a crossing is derived by multiplying the impact sensitivity of a stream crossing by the mitigation factor of the crossing methodology. When computing the impact potential value of a stream crossing, the impact sensitivity value is calculated differently for invasive (involving excavation of the streambank and streambed) and non-invasive (requiring no disturbance of the streambank or streambed) methodologies. Impact sensitivity (invasive) is calculated using the same equation given in the above footnote, [n] , used to calculate total impact sensitivity, while a separate equation is used to calculate impact sensitivity (non-invasive). The equations used for calculating the sensitivity index for invasive and non-invasive crossings are as follows:
Impact sensitivity(invasive)=10 (species utilization index+hydrology+stream gradient+stream geometry+side slope+riparian vegetation+life history+soils)/22

Impact sensitivity(non-invasive)=10 (species utilization index+hydrology+stream gradient+stream geometry+life history)/22

Invasive and non-invasive crossing methodologies are listed below:

<u>Invasive crossing methodologies</u>	**<u>Non-invasive crossing methodologies</u>**
Dry Trench	Bridge
Flume and Trench	Over Culvert

Divert and Trench	Under Culvert
Wet Trench	Horizontal Directional Drill
	Bore

The formulas for invasive and non-invasive impact potential of crossings are as follows:

Impact potential for invasive crossing=crossing methodology mitigation factor (invasive crossing impact sensitivity)
Impact potential for non-invasive crossing=crossing methodology mitigation fact (non-invasive crossing impact sensitivity)

(j) HDD MITIGATION FACTOR: Two mitigation factors are used for computing the impact potential of crossings using horizontal directional drilling (HDD). The first mitigation factor (0) is used to compute the standard impact potential of HDD methodology and the second mitigation factor (0.3) represents the impact if a fracture and leakage of drilling mud occurs.

(k) UC MITIGATION FACTORS: Three mitigation Factors are used for computing the impact potential of crossing a stream under a culvert (UC). The first mitigation factor (0) is used to compute the standard impact potential of UC crossings; the second mitigation factor (0.4) represents the impact of fluming the stream and replacing the culvert that the pipeline is buried beneath; and the third mitigation factor (1.0) represents the impact of replacing the culvert without fluming the stream.

Maintenance, Spill Prevention and Operational Impacts: Pipeline maintenance is described in Sections 7.2 Emergency Plans (WAC 463-42-525) and 2.9 Spill Prevention and Control (WAC 463-42-205).

Maintenance

In accordance with the Oil Pollution Act of 1990, the Olympic Pipe Line Company (OPL) will be required to prepare a detailed, comprehensive oil spill response plan (OSRP) for the pipeline and the Kittitas Terminal. The OSRP will also satisfy Research and Special Programs Administration requirements of the United States Department of Transportation found within 49 CFR Part 194 and Facility Contingency Plan and Response Contractor Standards of the State of Washington WDOE found in WAC 173-181. OPL will also be required to comply with Environmental Protection Agency requirements under 40 CFR 112, Spill Prevention, Control, and Countermeasures (SPCC) Plan.

OPL has an excellent record of maintaining and operating the existing system that minimizes the occurrence of spills along the pipeline system. Table 2.9-1 in Section 2.9 (Spill Prevention and Control (WAC 463-42-205) summarizes OPL's product releases and recoveries for the operational period of the existing mainline petroleum pipeline.

Spill Prevention:

The Spill Prevention, Control and Countermeasure (SPCC) Plan outlines the following spill detection measures:

<u>Countinuous Monitoring</u>

- OPL personnel will continuously (24 hours per day) monitor operational performance and integrity throughout pipeline operations and terminal transfers
- Monitoring will be performed through visual inspections and analysis of pipeline operational conditions such as line pressures, flow volumes, and pump and valve actuation.
- Tank levels and operation conditions at the Kittitas Terminal will also be continuously monitored remotely from the Renton Control Center and visually by facility personnel during normal operating hours. The Renton Control Center will have the capability of remotely controlling pumps and valves.
- If abnormal operating conditions occur during pipeline operation, audible and visual alarms will activate, and an investigation will be initiated by system controllers.
- Pipeline pressures, flow rates and line balances will also be monitored at the Renton Control Center.
- Methods used for determining leaks will include:

- Pressure drops
- Shortage trends evident on product delivery
- Significant shortage without a pressure drop
- Computer comparison with pipeline operating history
- Pipeline aerial surveillance
- Land owner, third party, civil authorities or company personnel reports.

Emergency Plans

After detection of a spill, the following emergency plan is acted upon.

- Complete initial notification of authorities
  - Field personnel are immediately dispatched to the reported site for an initial assessment.
  - Local emergency response authorities and the OPL Incident Commander are notified.
  - Notification is made to the National Response Center and federal, state and local agencies.
- Activate the response organization
  - Local and regional response contractors and mutual aid cooperatives are notified. and depending upon the magnitude of the spill, the Texaco Western Regional Oil Spill Response Team may be requested to respond to the incident.
- Assess the situation
- Collect and manage information
- Identify spill trajectories and initial impact areas
- Site Isolation
  - Pipeline facility Evacuation if necessary
  - Public evacuation where necessary
- Secure the source of the spill
- Spill Volume Determination
- Spill Containment
  - Temporary Dikes, Dams and Berms
  - Sorbent Barriers
  - Culvert and/or Storm Drain Blockage
  - Containment Booming
- Product Recovery
- Cleanup and Disposal of Contaminated Materials

Operation Impacts

The technical report entitled Cross Cascade Project/Product Spill Analysis (Feb. 28, 1997) addresses the likelihood of petroleum product releases of greater than 50 barrels occurring from operating the proposed pipeline. Based on national statistics from the United States Department of Transportation, OPL's actual operating experience in Washington, and other recent pipeline studies, the report calculates the likelihood of such a spill of 50 barrels or more to be:

- First 5 years of operation: 0.0466 spills/year (or 1 spill every 21 years)
- Years 5-15: 0.093 spills/year (or 1 spill every 11 years)
- Years 15-20: 0.1118 spills/year (1 spill every 8 years)

The likelihood of a spill occurring at any particular location along the pipeline route approaches zero. The report also concludes that, by reducing the amount of petroleum products transported via barges and tanker trucks, the proposed Cross Cascade Pipeline will reduce the number of barges and tanker spills by three to six spills per year.

In addition to addressing the probability of petroleum product spills from pipelines, barges and trucks, the Product Spill Analysis considers several hypothetical "worst case" spill scenarios, and it examines the potential impacts that might result if the hypothesized worst case spills occurred. Several of these hypothetical scenarios concerned spill events at or near waterways.

Spill scenarios for spill events at waterway crossings were defined in the Cross Cascade Pipeline Project/Product Spill Analysis and an assessment of impact made using the following five factors:

- The types of products spilled.
- The size of the spill.
- The local conditions at the time and place of the spill.
- The receptors of the impact and their characteristics.
- The specific emergency response and cleanup activities used.

Scenarios were used at Little Bear Creek, Harris Creek, Ollalie Creek, Keechelus Lake, Yakima River, Columbia River and Crab Creek. Spills of a wide range of sizes were evaluated. Biological impacts of a spill include direct impacts of the spilled product on the organisms (toxic effects, smothering, or modification of features like insulation layers that allow death from low temperature, or death from fire, if that occurs). A low-level, undetected spill could produce a chronic exposure to hydrocarbon compounds in the environment. Other important impacts include modification of habitat by killing vegetation directly or through the cleanup efforts, such as removing contaminated soil or building access roads or fire breaks. Loss of organisms that serve as food for other species can also have a major effect.

If a spill occured on waterways, vegetation, resident fish, and avifauna will experience significant short term impacts. In the dynamic environment of streams and rivers, impacts can be extended to a significant area, but the dynamic nature of the environment also tends to dilute and reduce impacts with time. Long term chronic impacts were determined to be potentially less significant due to naturally occurring mechanisms in the environment that buffer, disperse, absorb or degrade material introduced to the environment by an accidental release. The scenario of a slow leak at the Columbia River illustrated that a leak could persist for a lengthy period of time without detection. However, due to the extremely large dilution of such a release, acute effects on fish would be confined to a small area, and chronic effects would not be expected. In the case of gasoline spills in particular, there is a tendency for a significant portion of the released product to evaporate. Finally, spills from tankers and barges often occur near river mouths or estuaries and pose a threat to migrating fish where fish are more concentrated than upriver migrants.

3.4.4.3 Mitigation Measures

Potential impacts to aquatic resources would be limited to the construction phase of the project. As such, the following mitigation measures pertain to construction. The pipeline will be routed, subject to engineering restraints, to avoid the removal of trees along the 30 foot construction corridor. At stream crossings through riparian stream vegetation, the crossing will be situated to pass between trees or large shrubs wherever possible. Trees will be removed in the 30 foot construction corridor only when no other alternatives exist. When an impact due to tree removal and loss of canopy and shading occurs at specific crossings, such as the removal of cottonwood trees near the Yakima, new trees will be planted on sections of stream which lack canopy cover to prevent the elevation of water temperatures. The removal of most trees will occur in areas where there is extensive canopy cover and recruitment of large woody debris into the stream. In these situations, no other mitigation measures are proposed relative to effects on shading and large woody debris.

Operational impacts include the continual removal of trees from crossing locations (to allow inspection over-flights), and the potential for impacts from a spill.

General Construction Procedures

- The WDFW will be notified at least 48 hours prior to the commencement of pipe installation activities or blasting within each water body.

Erosion Control

Site specific biotechnical methods of erosion control will be implemented at each waterway crossing. These erosion control methods will include:

- Construction of stream crossings will be limited, to the extent feasible, to the low flow period, which on sensitive crossings will occur between approximately June 15 and September 15, to minimize sedimentation and turbidity induced by high water flow.
- Erosion control measures will be used while constructing pipeline trenches and staging areas, particularly erosion that could lead to increased sediment loads or turbidity in nearby waterbodies. The specific methods used will depend on site conditions such as slope, soil type, and downstream receptors.
- Only straw certified as weed free will be used for mulch and site-specific biotechnical methods of erosion control will be used wherever appropriate. Disturbance of the soil and vegetation will be minimized.
- Vegetative components, alone or in combination with structural and/or mechanical components will be used to stabilize soil. The use of rip-rap to stabilize streambanks will be kept to a minimum and only used in site-specific situations where biotechnical methods of erosion control are not effective. After stabilizing soils with mulch or biotechnical methods of soil and slope stabilization, native vegetation will be planted in denuded areas. Appropriate native perennial plants with strong root structures appropriate for stabilizing streambanks will be selected for this purpose.
- Temporary and permanent runoff diversion structures will be utilized after careful placement planning to minimize runoff to denuded slopes or critical areas. Prompt grading, mulching, armoring, and revegetation will be used to minimize erosion. Sediment retention ponds will be used where sediment-laden runoff is greater than the capacity that can be controlled by more traditional means (i.e., straw bales and silt fences). Sediment retention devices will be used to filter water pumped from the pipeline trench.
- Slope steepness and slope length will be minimized through the construction of benches, terraces, contour furrows, or diversion ditches.
- Stable road fill will be used to minimize erosion.
- Crossing construction sites will be frequently monitored and inspected to insure that problems will be corrected promptly.

Refueling of Equipment

- All construction equipment will be refueled at least 100 feet from water bodies.
- Equipment refueling or repair will not be allowed in or near the floodplain without adequate provisions to prevent the escape of petroleum products.
- Storing hazardous materials, chemicals, fuels, and lubricating oils, activities will be performed outside the floodplain (at least 100 feet from bank).
- Waste lubricants and solids will be removed from construction sites and be disposed of using Department of Ecology and EPA-approved procedures.

Stream Crossings

- The timing of all construction will consider the migrational periods and rearing conditions of the salmonids. The construction windows establish by WDFW for each county, or special project stream, will be followed.
- Where feasible, the pipeline will be attached to existing bridges at crossing sites to avoid impacts.
- The use of riprap will be minimized to areas where flow conditions preempt vegetative stabilization.
- EFSEC and WDFW will be notified at least 48 hours prior to proposed construction activities within streambeds.
- Crossings will be constructed perpendicular to the axis of the stream channel as engineering and routing conditions permit.
- Downstream flow rates will be maintained at all times.
- Equipment pads, clean rockfill and culverts, or a portable bridge will be used for equipment crossing sensitive perennial streams.
- Instream construction in minor streams will be completed within 24 hours.
- Sediment filter devices will be installed and maintained at all streambanks. The devices will be inspected on a daily basis and repaired as needed.
- Resident fish will be removed from stream crossing areas when blasting is necessary.
- Where possible, existing culverts will not be disturbed. The pipeline will be placed in fill above existing culverts to prevent construction impacts. Undersized culverts could be blocked by debris flows during winter storms, causing extensive erosion, sediment release into the water channel, and possible damage to the pipeline. Undersized culverts represent a pre-existing risk of sediment release into stream channels. As such, undersized culverts that are identified will be replaced as a pipeline construction mitigation measure.
- Where pre-existing blockages to migration of existing fish populations occurs, modifications to the culverts may be made as a mitigation measure.

Hydrostatic Testing

- The entire pipeline will be hydrostatically tested in accordance with DOT regulations and in compliance with the stipulations of EFSEC regulations regarding water withdrawal and discharge. Pipe installed in rivers will be hydrostatically tested prior to installation. If leaks are detected, they will be repaired or the pipeline section replaced and the section retested.
- All welds to be installed under water bodies or wetlands will receive a 100 percent radiographic inspection.
- At least thirty (30) days prior to use, EFSEC will be provided with a list of specific

locations for withdrawals and discharge of hydrostatic test water.

- EFSEC will be notified of the intent to begin using specific sources at least 48 hours prior to testing.
- The intake hose for the hydrostatic test water will be screened (1/8" mesh) to prevent entrainment of fish. The maximum approach velocity will not exceed 12 cm per second.
- Adequate flow rates will be maintained at all times to protect aquatic life and to provide for all other water body uses, including downstream withdrawals.
- When hydrostatic testing is complete, the test water will be analyzed and treated if necessary to make it suitable for discharge in compliance with the water withdrawal and discharge permits issued for the project.
- The water will be detained in ponds or holding areas and discharged to the ground or through filtering media before it enters any watercourse. Erosion protection measures will be incorporated into the water discharge procedures. Final discharge plans will be developed in consultation with EFSEC.
- The water discharge rate will be regulated and energy dissipation devices will be used in order to prevent erosion of upland areas, stream bottom scour, suspension of sediments, or excessive stream flow.

Clearing, Restoration, Stabilization, and Revegetation

- All staging areas, access roads, and temporary access roads will be located at least 100 feet back from the streambank where topographic conditions permit to reduce loss of riparian vegetation and limit the probability that these additional cleared areas will erode.
- Clearing for staging areas for pipeline construction will be confined to the minimum area necessary, and generally are confined to the construction corridor or existing cleared areas away from streams.
- All spoil material from water body crossings will be placed in the right-of-way at least 10 feet away from the riparian zone, or in other EFSEC-approved trenched material storage areas. All sediment will be contained within sediment filter devices.
- Disposal sites that contain cleared slash and overburden will be located in upland areas away from water bodies and will entail the use of runoff control structures.
- Streambanks will be stabilized prior to and after construction by replanting riparian vegetation.
- Clean gravel will be used for the upper one foot of fill over trenches (excavations) in streams.
- Revegetation will be performed immediately after construction using vegetation that is quickly established and native trees for long-term stabilization.
- Black cottonwood (*Populus trichocarpa*) will be planted in locations along the Yakima River, selected with the advice of WDFW biologists, to increase the shade and cover of

the middle reaches of this river.

- In rangeland, where heavy grazing by livestock has denuded riparian vegetation and destablized streambanks and channels, revegetated areas will be protected by fencing to permit quick regrowth. Where permitted by landowners, sensitive areas of streambank vegetation can be fenced to restrict livestock access and encourage the regrowth of riparian areas in mitigation for the removal of riparian shrubs and trees at pipeline crossings.
- Log deflectors will be used that create sediment deposition and vegetation establishment to stabilize banks where possible.

3.4.5 UNIQUE SPECIES

Federally listed threatened and endangered species are those plant and animal species formally listed by the U.S. Fish and Wildlife Service (USFWS) under authority of the Endangered Species Act of 1973, as amended. An endangered species is defined as one in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as one likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Candidate species are those being considered for listing as threatened or endangered by the USFWS.

In amending the ESA in 1982, Congress allowed the process of developing habitat conservation plans (HCPs) to reduce conflicts between land use and endangered species. This amendment allows the U.S. Fish and Wildlife Service to permit "taking" of endangered or threatened species incidental to otherwise lawful activities, provided that the taking is mitigated by the implementation of conservation measures outlined in the HCP (USFWS, 1995).

State listed endangered plant species are those that are in danger of becoming extinct or extirpated in Washington within the near future if factors contributing to their decline continue. State listed threatened species are likely to become endangered in Washington within the near future if factors contributing to their population decline or habitat degradation or loss continue. State listed sensitive species are vulnerable or declining and could become endangered or threatened in the state without active management or removal of threats (DNR, 1994).

The U.S. Fish and Wildlife Service and the Washington Departments of Fish and Wildlife and of Natural Resources were contacted for information on threatened and endangered species potentially occurring in the study area. Correspondence from the U.S. Fish and Wildlife Service is included in Appendix E of this report. The Natural Heritage Data Systems were searched for documented occurrences of species of concern in the study area. Local biologists with the Washington Department of Fish and Wildlife were contacted to confirm specific information on species of concern in the study area.

3.4.5.1 Threatened, Endangered and Sensitive Plant Species

Agency Responses

The U.S. Fish and Wildlife Service was contacted for information on the potential occurrence of threatened, endangered, and candidate plant species in or adjacent to the study area. The Washington Natural Heritage Program was also contacted for information on endangered, threatened, and sensitive plants; high quality native plant communities; and high quality natural areas and wetlands occurring in the vicinity of the study area.

The Washington Department of Natural Resources Natural Heritage Information System indicates that the following 12 plant species occur in the general vicinity if the pipeline route: southern mudwort (*Limosella acaulis*), Columbia milk-vetch (*Astragalus columbianus*), white eatonella (*Eatonella nivea*), desert evening-primrose (*Oenothera cespitosa*), dwarf evening-primrose (*Oenothera pygmaea*), Paiute suncup (*Camisssonia scapoidea*), Hoover's desert-parsley (*Lomatium tuberosum*), gray cryptantha (*Cryptantha leucophaea*), Buxbaum's sedge (*Carex buxbaumii*), Snake Canyon desert-parsely (*Lomatium serpentinum*), coyote tabacco (*Nicotiana attenuata*), and Hoover's tauschia (*Tauschia hooveri*). In addition, six high quality native plant communities were listed in the vicinity of the pipeline route: tall gray rabbitbrush-bitterbrush/Indian ricegrass (*Chrysothamnus nauseosus-Purshia tridentata/Oryzopsis hymenoides)* association, western hemlock/swordfern-three-leaved foamflower (*Tsuga heterophylla/Polystichum munitum-Tiarella trifoliata*) association, big sagebrush/needle-and-thread (*Aremisia tridentata/Stipa comata*) association, big sagebrush/bluebunch wheatgrass (*Artemisia tridentata/Agropyron spicatum*) association, stiff sagebrush/Sandberg's bluegrass (*Artemisia rigida/Poa sandbergii*) association, and red alder (*Alnus rubra*) cover type.

The U.S. Fish and Wildlife Service has identified the following plants as having the potential to occur in the vicinity of the pipeline route: Hoover's desert-parsley, Hoover's tauschia, Columbia milk-vetch, and northern wormwood (*Artemisia campestris* spp. *borealis* var. *wormskioldii*). These species were previously listed as federal Candidate species, but are now listed as federal species of concern.

The Yakima Training Center has information pertaining to rare plants on YTC land. Based on information in that report, *Taushia hooveri*, *Eatonella nivea*, and *Astragalus columbianus* occur along or in the vicinity of the proposed pipeline alternative alignments.

The Forest Service provided rare plant lists for the Mt. Baker-Snoqualmie National Forest and the Wenatchee National Forest. These lists are included in Appendix B. This agency also provided a list of 11 survey and manage plant species for which field surveys are required. They are: *Allotropa virgata*(vascular), *Botrychium minganense* (vascular), *Botrychium montanum* (vascular), *Coptis* *aspleniifolia* (vascular), Cypripedium montanum (vascular), *Galium kamtschaticum* (vascular), *Platanthera orbiculata* (vascular), *Oxyporus nobilissimus* (fungi), *Hypogymnia duplicata* (lichen), *Lobaria linita* (lichen), *Pseudocyphellaria rainierensis* (lichen).

The Forest Service also provided a GIS coverage showing known locations of the survey and manage species. Based on this coverage, two species of fungi that are not listed above are known to be in the study area. These two species are *Collybia bakerensis* (occurs about 300 feet from the pipeline alignment) and *Paxina compressa* Snyder (about 2,670 feet from the pipeline alignment).

Oxyporus nobilissimus and *Lobaria linita*, two species on the survey and manage list, occur in the vicinity of the study area. The proposed pipeline route is 340' from the *Oxyporus nobilissimus* site. Near this site, the proposed project will be placed in an existing road or trail where no trees will be cut, with the exception of a short corridor (about 200' x 30') between Tinkham Road and a transmission access road where some second-growth trees will be removed. This stand does not provide habitat for this species. Given the distance of the project from the noble polypore site and the type of impact, the project will have no effect, direct or indirect, on the mushroom.

Lobaria linita is usually closely associated with old-growth forests, and it occurs in the Mt. Baker-Snoqualmie National Forest. It has also been found on rock outcrops and boulders in moist conifer forests. Based on the GIS coverage, there is only one *Lobaria linita* location within one mile of the proposed pipeline, and it occurs about 50' from the proposed route where it follows the John Wayne Trail. This location is in an area composed primarily of second-growth coniferous forest. This entire area has been previously affected by development, including logging. *Lobaria linita* is not expected to be effected by the project as the pipeline follows existing roads, trails, and BPA corridor through areas of potential habitat and near the known site.

Field Survey

Five rare plant species were found in the shrub-steppe habitat. They are: *Tauschia hooveri*, *Erigeron piperianus*, *Astragalus columbianus*, *Astragalus misellus* var. *pauper*, and *Oenothera caespitosa*. Hoover's tauschia and Columbia milk-vetch are listed as federal species of concern and are state listed as threatened. Piper's daisy, pauper milk-vetch, and desert evening primrose are state sensitive plant species (no federal listing). Small populations, or individual plants within affected populations may be destroyed during construction, but none of these species will be significantly impacted by the project as many other populations exist at other locations.

High quality habitats occur on steep slopes to the east of the Columbia River (steep slopes in the vicinity of mile post 149. This applies only to the proposed route; the alternative alignments along the steep slopes to the east of the Columbia River are not high-quality (the alternative alignments have either cheatgrass as a dominant grass or are adjacent to roads and other development).

Impacts

Priority plant species may be directly impacted during the construction process by physical crushing. In addition, the seeds and root structures could become buried too deeply to be viable. Accidental fire in the range of these species could be devastating. Indirect impacts could occur through the increase of invasive species in the general area or soil compaction in the plant species' respective habitats.

None of the unique habitats identified by NHP will be affected by the project. An area of high quality native habitat occurs on the steep slopes just east of the Columbia River (approximate mile post is 149 of the proposed route).

Mitigation Measures

Mitigation measures proposed for priority plant species and plant communities are:

- Avoid or minimize direct impacts to known areas of occurrence or habitats that may support these species, including soils compaction.
- Implement fire prevention and abatement procedures during construction and maintenance of the pipeline.
- Implement and monitor a plan to control invasive species that may out-compete the vegetation of concern.

3.4.5.2 Threatened, Endangered and Sensitive Wildlife Species

Information on U.S. Fish and Wildlife Service, U.S. Forest Service (USFS), and Washington State status species was gathered from database records and inventories and from discussions with the Washington Department of Fish and Wildlife (WDFW) and USFS, and from field work and habitat assessments of the pipeline route. Spotted owl information was obtained from the Washington Department of Fish and Wildlife database and the U.S. Forest Service. All activity centers whose associated conservation circles may be intersected by the pipeline (i.e., within 1.8 miles of the construction corridor) were mapped by Dames & Moore, but are not shown in public record maps.

A biological assessment addresses any listed and proposed species which are likely to be affected by the proposed project. The biological assessment was prepared in compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, and is included in separate documentation for this project.

Federally Listed Threatened and Endangered Species

Threatened, endangered, and candidate wildlife species identified by the U.S. Fish and Wildlife Service that may be present in the study area are listed in Table 3.4-10. Records of their occurrence and critical habitat along the pipeline route are discussed below.

TABLE 3.4-10
FEDERALLY LISTED WILDLIFE SPECIES

Common Name	Scientific Name	Federal Status[1]	State Status[2]	Forest Service Status[3]	Habitat Type
American Peregrine Falcon	*Falco peregrinus anatum*	E	E		Open country with cliffs overlooking rivers or lakes
Bald Eagle	*Haliaeetus leucocephalus*	T	T	S	Lakes, large rivers, coastal areas with large trees
Gray Wolf	*Canis lupus*	E	E		Forests, tundras
Grizzly Bear	*Ursus arctos*	T	E		Forests, tundras
Marbled Murrelet	*Brachyramphus marmoratus*	T, CH	T	S	Mature, and old-growth forests
Northern Spotted Owl	*Strix occidentalis caurina*	T, CH	E		
Oregon Spotted Frog	*Rana pretiosa*	C	C		Marshy edges of lakes, springs, ponds, or streams

Federal Status[1]
- E = Endangered: A species that is in danger of extinction throughout all or a significant portion of its range.
- T = Threatened: Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.
- C = Candidate: Species that could become listed during project planning.
- CH = Critical Habitat: For listed species critical habitat is designated on the basis of the best scientific information available and consideration of economic and other relevant impacts including particular areas in the designation.

State Status[2]
- E = Endangered: Wildlife species native to Washington State that are seriously threatened with extinction throughout all or a significant portion of is range in the state.
- T = Threatened: Wildlife species native to the Washington State that are likely to become endangered within the foreseeable future throughout significant portions of their ranges in the state without cooperative management or the removal of threats.
- S = Sensitive: Wildlife species native to Washington State that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their ranges in the state without cooperative management or the removal of threats.
- C = Candidate: Wildlife species that will be reviewed by the department (WDFW) for possible listing as endangered, threatened, or sensitive.

Forest Service[3]
- S = Sensitive: Those species of plants and animals that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species.

Survey & Manage Strategy 2: Species requiring land managers to take certain actions relative to rare species which include surveys for the presence of rare organisms prior to ground-disturbing activities.

Peregrine falcons could be found migrating through or foraging in the project area. However, there are no documented nest sites in the project study area. The USFS has documented potential nesting cliff habitat in the Snoqualmie Pass Adaptive Management Area Plan (SPAMAP 1995). Cliff habitat is also found along the Columbia River and Swauk Creek. None have been observed during field surveys of the Cross Cascades Pipeline route.

Wintering bald eagles occur in the vicinity of the project area from about October 31 through March 31. One communal night roost is known adjacent to the Snoqualmie River east of Maltby, Washington, but this site is over 0.5 mile from the project area, and over 4,000' from the maintenance right-of-way. Eagles occasionally are found wintering along the South Fork Snoqualmie River (SFSWA 1995), and the USFS lists available winter roosting and nesting habitat within the South Fork Snoqualmie Watershed.

A bald eagle nest is located approximately 9,500' west of the proposed pipeline near the Snoqualmie River north of Carnation, Washington. Breeding surveys conducted by the WDFW indicated that this nest site in a large cottonwood tree has been active for the past few years including 1997 (Pers. Comm. with Steve Negri, WDFW). Another nest site is located a few miles north of the project area near Lake Cle Elum within the Snoqualmie Pass Adaptive Management Area (SPAMA 1995). No bald eagle nests have been reported for the North Bend Ranger District. No roosts or nests have been observed within sight of the pipeline route during field surveys for the Cross Cascade Pipeline project.

The USFS considers suitable gray wolf habitat as areas at high elevation with broad valley bottoms, little human disturbance, and a good supply of prey. The USFS has delineated potential suitable habitat in the Snoqualmie Pass Adaptive Management Area (SPAMA 1995). Suitable denning and rendezvous habitat (1631 acres) is available in the South Fork Snoqualmie Watershed, with a substantial prey base of elk using the area year-round (SFSWA 1995). Recorded sightings of gray wolves in forested areas surrounding the pipeline area are rare. Two records on the North Bend Ranger District are 0.5 mile from the pipeline route east of North Bend, and within 0.5 mile of the route near Alice Creek. The Priority Habitat and Species Database has one 1993 record of a live adult within 0.25 mile of the pipeline route east of Cle Elum near elk winter range (T19N R15E S6). An additional occurrence record is located east of I-90 near Easton, outside the project area. The presence of this species in the study area is rare.

Available grizzly bear habitat in the South Fork Snoqualmie Watershed and along the pipeline route in general has limited security cover and summer foraging areas due to prevalent road and trail networks and other human disturbances. The pipeline route is not within the North Cascades Grizzly Bear Recovery Zone located north of I-90. Two unconfirmed records of a grizzly bear track (1990) and a sighting (1995) were located within a mile of the pipeline in the North Bend Ranger District. There are no confirmed sightings of grizzly bears in the Snoqualmie Pass Adaptive Management Area (AMA) but there are many unconfirmed sightings and two confirmed sightings just north of the AMA (SPAMAP 1995). There are confirmed sightings in the Cle Elum Ranger District in the Wenatchee National Forest (SFSWA 1995). The occurrence of this species in the project study area would be very rare.

A marbled murrelet was observed 2 miles east of the Cascade Crest (about 43 miles from saltwater) within the Snoqualmie Pass Adaptive Management Area (SPAMAP 1995), but no sightings have been documented within the project study area. One marbled murrelet occurrence was reported in the vicinity of the pipeline near Snoqualmie Pass on the east side of I-90. This observation, over 4,000' from the proposed pipeline route, did not confirm nesting activity near the project. Since the Cross Cascade Pipeline will remove no trees suitable for murrelet nesting and construction will occur after the nesting season, no surveys for murrelets have been conducted for the project.

Critical habitat for marbled murrelets in the vicinity of the pipeline includes only Federal lands designated as Late Successional Reserves (LSRs) (61 FR 26256). Approximately one mile of pipeline crosses critical habitat on Forest Service land where it crosses Humpback Creek and the Ashael Curtis Recreation Area.

The WDFW spotted owl database was searched for any activity centers along the pipeline route. Nine mapped, 1.8 mile radius, spotted owl circles intersect the project area. Only one of the activity centers is currently mapped as being within .25 mile of the pipeline route (T19N R14E S11).

Potential habitat for spotted owls along the pipeline route include western hemlock, silver fir, ponderosa pine, and douglas fir forest types. Potential habitat and spotted owl circles intersect the proposed route where it will remain within existing roads, trails, and transmission line corridors with the exception of only two short (about 200' by 30') connecting corridors. These corridors connect the John Wayne Trail with a forest service road east of Alice Creek near the McClellan Butte trailhead, and Tinkam Road to an access road near the Annette Lake Trailhead parking area. Dominant forest types in these corridors are western hemlock and silver fir. No potential habitat trees are found in these stands which are made up of second growth trees up to 10" dbh.

The USFS conducts yearly demographic surveys for spotted owls which include critical habitat and activity circles near the pipeline route. The North Bend Ranger District recorded spotted owl occurrences in 1983 and 1988 about 0.75 mile from the route along Tinkham Road. The Washington Department of Natural Resources (WDNR) has records of occurrence on Department Land southeast of Easton, Washington where the proposed pipeline route is within a BPA corridor. Spotted owl circles in the Cle Elum area and east and west of the Yakima River Crossing in the Yakima River Valley also intersect the proposed pipeline route where it follows a BPA corridor.

Critical habitat for spotted owls is designated along the proposed pipeline route in critical habitat units (CHUs) WA-33 (T22N R10E S13,14; T22N R11E S18, 27, 34) and WA-14 (T20N R14E S4, 10, 11, 12, 30, 32). However, no old growth or habitat trees will be removed in these CHUs, and the pipeline in these areas follows existing road, trail, or transmission line corridors except where the line leaves Tinkham Road to follow a forest service road as described above near the Annette Lake Trailhead.

The Oregon spotted frog (*Rana pretiosa*), considered a federal candidate species, was historically found in ponds, lakes, and wetland areas in Snohomish and King Counties. However, the only known population in Washington occurs in Thurston County.

Forest Service Status Wildlife Species

Forest Service sensitive species are those species that have appeared in the federal register as proposed for classification and are under consideration for official listing as endangered or threatened species. Survey and Manage species are species that are addressed in the Record of Decision (ROD) (USDA and USDI 1994) and which require land managers to take certain actions relative to rare species. Survey and Manage Strategy 2 species are those which require surveys prior to ground disturbing activities that will be implemented in 1997 or later.

U.S. Forest Service status wildlife species, excluding those covered under the federally listed species section, are listed in Tables 3.4-11a and 3.4-11b. Records of their occurrence and potential habitat along the pipeline route are discussed below.

TABLE 3.4-11a
U.S. FOREST SERVICE SENSITIVE AND SURVEY AND MANAGE STRATEGY 2 BIRD, MAMMAL, AND AMPHIBIAN SPECIES

Common Name	Scientific Name	State Status[1]	Forest Service Status[2]	Habitat Type
Common Loon	*Gavia immer*	C	S	Lakes, and ponds with fish populations
Ferruginous Hawk	*Buteo regalis*	T	S	Shrub steppe, grasslands, open plains
Larch Mountain Salamander	*Plethodon larselli*	S	S, Strategy 2	Talus slopes in old-growth forested areas
Townsend's Big-eared Bat	*Plecotus townsendii*	C	S	Coniferous and deciduous forests, found in caves, mines, and under bark on trees
Van Dyke's Salamander	*Plethodon vandykei*	C	Strategy 2	Aquatic woodlands near seeps, springs, and streams; talus and old-growth forested areas
Wolverine	*Gulo gulo*		S	Forests, tundras

State Status[1]

T = Threatened: Wildlife species native to the Washington State that are likely to become endangered within the foreseeable future throughout significant portions of their ranges in the state without cooperative management or the removal of threats.

S = Sensitive: Wildlife species native to Washington State that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their ranges in the state without cooperative management or the removal of threats.

C = Candidate: Wildlife species that will be reviewed by the department (WDFW) for possible listing as endangered, threatened, or sensitive.

Forest Service[2]

S = Sensitive: Those species of plants and animals that have appeared in the Federal Register as proposed for classification and are under consideration for official listing as endangered or threatened species.

Survey & Manage Strategy 2: Species requiring land managers to take certain actions relative to rare species which include surveys for the presence of rare organisms prior to ground-disturbing activities.

TABLE 3.4-11b
U.S. FOREST SERVICE SURVEY & MANAGE STRATEGY 2 MOLLUSK SPECIES

TABLE 11b (CONTINUED)
US FOREST SERVICE SURVEY & MANAGE STRATEGY 2 MOLLUSC SPECIES CONSIDERED IN THIS BIOLOGICAL EVALUATION

Common Name	Scientific Name
Blue-grey Tail-dropper	*Prophysaon coeruleum*
Evening Field Slug	*Deroceras hesperium*
Malone Jumping Slug	*Hemphillia malonei*
Oregon Megomphix	*Megomphix hemphilli*
Puget Oregonian	*Cryptomastix devia*
Panther Jumping Slug	*Hemphillia pantherina*
Papillose Tail-dropper	*Prophysaon dubium*
Warty Jumping Slug	*Hemphillia glandulosa*
Washington Duskysnail	*Lyogyrus n. sp. 2*

All recorded observations of common loons have occurred over 0.5 mile from the project area, and the route does not intersect any priority habitat for common loons (WDFW 1997).

Ferruginous hawks could be found foraging in the project area, especially in central or eastern Washington. However, no nests have been documented in the project area, and none were seen during field reconnaissance of the route. Several ferruginous hawk nest locations were recorded in 1995 and 1996 over 1 mile south of the proposed Beverly-Burke Pump Station. These nests were not active in 1997 (WDFW 1997). A nest was located in 1988 in the Columbia National Wildlife Refuge one mile from the project area. Red-tailed hawks used this nest in 1992.

No Larch Mountain salamanders were found during surveys in potential habitat along the route during fall 1996 or spring 1997 surveys (Appendix B). A population of this species was found in the AMA approximately 5 miles to the east of Snoqualmie Pass. That population was found at 3,700' elevation in a talus slope adjacent to old-growth western hemlock, Pacific silver fir, and Douglas-fir (SPAMAP 1995).
Only one known winter hibernaculum of Townsend's big-eared bats is known on the Mount Baker Snoqualmie and Wenatchee National Forests; this is located over 20 miles south of the project area (SPAMAP 1995). No individuals of the species have been recorded in the pipeline study area (SFSWA 1995). Biologists from the WDFW and Washington State Parks conducted a winter hibernacula survey in the Snoqualmie Pass Tunnel in March 1998 and found no sign of winter bat use of the tunnel (Appendix B).

No Van Dykes' salamanders were found during fall 1996 and spring 1997 surveys conducted in potential habitat along the pipeline route (Appendix B). Van Dyke's salamanders are not known to exist near the proposed pipeline route, although localized populations could potentially occur along streams in forested communities in the Central Cascades.

The wolverine is known from the Wenatchee National Forest but it is not known whether it occurs in the project area. Its occurrence in the project area is unlikely.

All survey and manage mollusk species potentially found in habitats along the pipeline, with the exception of the Washington duskysnail, are identified as old growth associates, and all are riparian associates. Six are slugs, two are land snails, and one is a freshwater snail. The freshwater snail is not likely to occur along the proposed pipeline. In general, the land species require some deciduous leaf litter, although many are found in old coniferous forests.

Opportunistic searches for mollusks were conducted during the salamander surveys in spring 1997. Several representative specimens (jumping slugs) were collected for expert identification. None of the species observed were on the survey and manage list. Survey and manage mollusk species are unlikely to be found within the project area as they are all considered old growth associates, and the pipeline does not cross any old growth stands.

State-Listed Wildlife Species and Habitats

State-listed wildlife species and habitats are managed by the Washington Department of Fish and Wildlife Nongame and Priority Habitats and Species (PHS) programs. The goal of the Nongame Program is to recover endangered and threatened species so that they may be delisted and to prevent sensitive and monitor species from becoming threatened or endangered. Candidate species are under review for being listed as endangered, threatened, or sensitive. The PHS program designates and manages habitats and species to help prevent species from becoming threatened or endangered. The category of priority species includes all species that are presently state or federal endangered, threatened, sensitive, or candidate because these species require special attention. Priority species also includes species that the Washington Department of Fish and Wildlife believes are vulnerable to future listing and species with recreational importance that are vulnerable to impacts because of lost or degraded habitat. A priority habitat supports unique wildlife or a wide diversity of wildlife, and must be protected to prevent further species losses.

Washington state endangered, threatened, and candidate species not covered previously in the federally listed or USFS status species lists are shown in Table 3.4-12. Records of their occurrence and potential habitat along the pipeline route are discussed below.

TABLE 3.4-12
WASHINGTON STATE STATUS WILDLIFE SPECIES

Common Name	Scientific Name	State Status[1]	Habitat Type
Black-backed Woodpecker	*Picoides arcticus*	C	Coniferous forests with windfalls or burned areas and standing dead trees
Columbia Spotted Frog	*Rana luteiventris*	C	Marshy edges of lakes, springs, ponds, or streams
Flammulated Owl	*Otus flammeolus*	C	Ponderosa pine, grand fir, Douglas fir mature and old growth forests above 3,000 feet elevation
Golden Eagle	*Aquila chrysaetos*	C	Open areas of eastern Washington with cliffs, large trees, or sagebrush habitat with cliffs
Johnson's Hairstreak	*Mitoura johnsoni*	C	Lowland mature and old growth coniferous forests with dwarf mistletoe
Lewis Woodpecker	*Melanerpes lewis*	C	Logged or burned open forest and woodlands, including oak, coniferous, and riparian woodlands
Loggerhead Shrike	*Lanius ludovicianus*	C	Open country with scattered trees and small shrubs, shrub steppe
Long-horned Leaf Beetle	*Donacia idola*	C	Lowland sphagnum bogs in western Snohomish County
Northern Goshawk	*Accipiter gentilis*	C	Mature, old-growth forests near water
Northern Leopard Frog	*Rana pipiens*	C	Wet meadows, potholes, and riparian areas in eastern Washington
Pacific Fisher	*Martes pennanti*	C	Dense, spruce-fir mature forests, and lowland forests
Pileated Woodpecker	*Dryopterus pileatus*	C	Forested areas with large trees, snags, and fallen trees
Sage Grouse	*Centrocercus urophasianus*	C	Sagebrush plains and foothills
Sage Sparrow	*Amphispiza belli*	C	Sagebrush communities
Sage Thrasher	*Oreoscoptes montanus*	C	Shrub steppe including sagebrush, rabbitbrush, and greasewood communities
Sandhill Crane	*Grus canadensis*	E	Prairies, marshes, margins of lakes, and large rivers with open expanses separating from heavy cover
Vaux's Swift	*Chaetura vauxi*	C	Douglas fir and hemlock forests
Washington Ground Squirrel	*Spermophilus washingtoni*	C	Open areas, grasslands, low sagebrush communities, cultivated fields, and hillsides
Western Burrowing Owl	*Athene cunicularia hypugea*	C	Shrub steppe, nonforested plains, and grasslands

TABLE 3.4-12 (CONTINUED)
WASHINGTON STATE STATUS WILDLIFE SPECIES

Common Name	Scientific Name	State Status[1]	Habitat Type
Western Pond Turtle	*Clemmys marmorata*	E	Ponds, marshes, slow moving rivers, streams, and creeks
White-headed Woodpecker	*Picoides albolarvatus*	C	Mature ponderosa pine forests with snags

State Status[1]

E = Endangered: Wildlife species native to Washington State that are seriously threatened with extinction throughout all or a significant portion of is range in the state.

T = Threatened: Wildlife species native to the Washington State that are likely to become endangered within the foreseeable future throughout significant portions of their ranges in the state without cooperative management or the removal of threats.

S = Sensitive: Wildlife species native to Washington State that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their ranges in the state without cooperative management or the removal of threats.

C = Candidate: Wildlife species that will be reviewed by the department (WDFW) for possible listing as endangered, threatened, or sensitive.

Black-backed woodpeckers are uncommon in the project area where they could be found in coniferous forest in the Cascades east of the crest and in ponderosa pine habitat in Kittitas County (Smith et al. 1997). No confirmed nest sites are located in the project area.

Columbia spotted frogs have been observed in the South Fork Snoqualmie Watershed, and in the Wenatchee National Forest (SFSWA 1995). Along the study corridor they are most likely to be found in wetland or stream habitats in Kittitas County (Leonard et al. 1993). Large numbers of spotted frogs and their egg masses were observed during a stream survey in April 1998 at stream crossings 175 and 176, an irrigation ditch near Church Road (Ellensburg area) which contains water year round. One adult frog was observed at stream crossing 205.

Flammulated owls are uncommon along the pipeline route where they would be limited to lower elevation ponderosa pine and Douglas fir forests along the lower slopes of the eastern Cascades. No confirmed nest sites are located in the project area (Smith et al. 1997).

Golden eagles are common in open, dry ponderosa pine and Douglas fir forests with nearby cliff habitat in Kittitas County (Smith et al. 1997). One occurrence is reported for the Kittitas Valley in the vicinity of the project, but no nests are known along the route. In the sagebrush habitats along the route they are most likely to occur near the basalt cliffs bordering the Columbia River.

Johnson's hairstreak butterflies could occur in lowland western hemlock and fir forests along the pipeline route in King and Snohomish Counties. However, they are most often found in old growth forests (Larsen et al. 1995). The pipeline route does not intersect any old growth stands.

Lewis woodpeckers occur where the pipeline route intersects ponderosa pine forests, oak woodlands, and other riparian woodlands in central Kittitas County (Smith et al. 1997).

Loggerhead shrikes are common nesters in shrub steppe of the Yakima Training Center and Grant County in the vicinity of the pipeline route. They prefer a mosaic of shrub-steppe and grassy areas more than homogeneous shrub steppe habitat (Smith et al. 1997). In the Lower Crab Creek area, loggerhead shrikes have been recorded as occurring more than 0.75 mile from the project area. Occurrences also exist for the Saddle Mountains area over 1.5 miles from the project area.

The long-horned leaf beetle is found in sphagnum bogs in western Snohomish County near the northern end of the project in the Woodinville area. However, the project does not cross any bog habitat.

Along the pipeline alignment, northern goshawks occur and breed in forested areas in the Cascades in King and Kittitas Counties (Smith et al. 1997). The AMA lists approximately 30 sites with goshawk detections and 8 confirmed nest sites (SPAMAP 1995). Suitable habitat has been delineated for this species in both the Snoqualmie Pass Adaptive Management Area and the South Fork Snoqualmie Watershed Analysis. Northern goshawks are known from the Wenatchee National Forest and several occurrences have been reported in the Cle Elum Area.

Two occurrence records for the northern goshawk are in the vicinity of the project area. Both were visual sightings near Snoqualmie Pass within 0.25 mile of the pipeline route. One was a response to a calling survey in 1994 (WDFW 1997). The nesting status of these birds is unknown.

Northern leopard frogs are not likely to be found along the pipeline route, except possibly in Crab Creek. Recent sightings of northern leopard frogs in Washington are limited to the Potholes Reservoir and Moses Lake (Pers. Comm. with Peggy Bartels, WDFW, 1997).

The Pacific fisher is not likely to be present in the project area due to the lack of available mature and old-growth habitat. If present, they would probably be found ranging from small patches of mature forest adjacent to the project area. Documented cases of Pacific fishers near the pipeline route in forested areas in the Cascades are rare. The North Bend Ranger District has a record of occurrence near the pipeline route, but it is approximately 0.5 mile from the project area and 0.75 mile from the construction corridor. One fisher was sighted near Lake Keechelus in 1986 and there are other sightings on both sides of the Cascade Crest (SPAMAP 1995). Suitable habitat has been delineated in the Snoqualmie Pass Adaptive Management Area and the South Fork Snoqualmie Watershed Analysis, however, habitat south of I-90 is highly fragmented, decreasing the likelihood of the watershed to support fishers (SFSWA 1995).

Pileated woodpeckers have been observed in forested habitat in several places along the proposed pipeline route in Snohomish, King, and Kittitas Counties. They nest in large snags which will not be affected by pipeline construction. The North Bend Ranger District has recorded a number of occurrences along the route. Several pileated woodpeckers were also observed by biologists in a large wetland complex east of Maltby in 1995. Another sighting was recorded in the Cherry Creek area east of Duvall. Many more records of occurrence for this species were outside of the project area.

Sage grouse are uncommon and limited to sagebrush habitat in Kittitas County along the pipeline route (Smith et al. 1997). No breeding grounds have been identified along the pipeline route, but one recorded lek is located about two miles south of the proposed pipeline route (T17N R21E S32) in the Boylston area. This lek was last active in 1983. An adult with young was recorded about two miles north of the proposed route in this same region (T17N R21E S11).

The sage sparrow is uncommon and declining in sagebrush dominated communities along the pipeline route. Sage sparrows were observed during spring plant and stream surveys in sagebrush along the pipeline route in Kittitas County (T19N R18E S26 and T17N R21N S24).

The sage thrasher is a common breeder in sagebrush communities along the pipeline route in eastern Kittitas County. Breeding habitat is also found, but breeding is less common along the pipeline route in Grant, Adams, and Franklin Counties (Smith et al. 1997). Sage thrashers were observed during spring plant surveys in dense sagebrush along the pipeline route near the Vantage Highway in Kittitas County (T17N R21N S24, T17N R22N S19, S20).

Large flocks of migrating sandhill cranes congregate just south of Highway 26 in the Crab Creek area where the pipeline route follows the highway, and they occur on WDNR land southeast of Royal City where the route is adjacent to North Glade Road. Sandhill crane concentrations occur to the northwest of Ginkgo State Park, but the area is over 2.25 miles north of the project area. There are no records of sandhill cranes breeding in the project area (Smith et al. 1997).

Vaux's swifts are common breeders in forested areas along the pipeline route in Snohomish, King, and Kittitas Counties (Smith et al. 1997). However, no nest sites have been documented in the project study area.

Washington ground squirrels are rare and patchily distributed in shrub steppe, grasslands, and cultivated areas in central and eastern Washington, except in sandy areas. However, their presence has not been documented in the pipeline study area.

Four burrowing owl nest sites were identified by the Priority Habitat and Species Database near the pipeline route. All of these sites were active in 1987. The nest sites were in good condition in the spring of 1997, but owls were not observed using these sites (Pers. Comm. with Peggy Bartels, WDFW). Two nest sites are located in Grant County along the north side of Highway 26 east of Royal City within 150' of the proposed Cross Cascade Pipeline maintenance corridor. However, the pipeline alignment here is located south of Highway 26. Two other sites are located south of Basin City in Franklin County. The nest site near Glade North Road (T12N R29E S36) is located close to but on the other side of the road from the pipeline alignment. The other site along Garfield Road is located about 1000' from the proposed pipeline route (WDFW 1997).

Western pond turtles have been observed in the Puget Sound region and along the Columbia River. However, they are rare in Washington state, and are unlikely to be found in the project area. None are reported along the route, and none have been observed during wetland field work.

White-headed woodpecker habitat in the pipeline study area is limited to the ponderosa pine forests and oak woodlands of the eastern Cascades in Kittitas County. No confirmed breeding areas have been documented within or in the vicinity of the project study area (Smith et al. 1997).

The osprey, a state monitor species not listed in the state species table, has nest sites at three locations along the pipeline route: at milepost 4.2 Echo Lake Road wetland, mp 5.9 Anderson Creek, and mp 16.2 Cherry Creek.

State Priority Habitats and Species

Washington state priority habitats within the pipeline study area include oak woodlands, riparian, wetlands, and urban and rural natural open space (Figure 3.4-1(a-h)). Species priority habitats found in the project study area include range for several big game mammals (elk, black-tailed deer, mule deer), game birds (waterfowl, ring-necked pheasant), and migration habitat for a state endangered bird (sandhill crane). Species priority habitats located in the vicinity, but not within the project study area include common loon, mountain goat, and cavity nesting ducks. Cliff habitat may be within the study area, but not within the construction corridor, depending upon the Columbia River alternative selected.

FIGURE 3.4-1a - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

FIGURE 3.4-1b - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

FIGURE 3.4-1c - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

FIGURE 3.4-1d - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

FIGURE 3.4-1e - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

FIGURE 3.4-1f - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

FIGURE 3.4-1g - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

FIGURE 3.4-1h - PRIORITY HABITATS AND SPECIES WITHIN THE HALF-MILE PIPELINE STUDY AREA

Oak woodlands are classified as a priority habitat by WDFW because they support comparatively high wildlife density and species diversity, are limited and declining in availability, and are highly vulnerable to habitat alteration. Species that inhabit these oak woodlands include the western gray squirrel, Lewis' woodpecker, acorn woodpecker, and ash-throated flycatcher.

Priority riparian habitats support high wildlife density and species diversity, as well as providing important breeding habitat and movement corridors. Special status species in the project area that utilize priority riparian habitats include: bald eagle, Lewis' woodpecker, northern goshawk, northern leopard frog, spotted frog, Van Dyke's salamander, and western pond turtle. Priority riparian areas are crossed at various locations along the route, most often in the Puget Lowlands and western Cascade foothills.

Wetlands are considered priority habitat in Washington due to their high fish and wildlife density and species diversity, their important breeding habitat and seasonal ranges for fish and wildlife, their limited availability, and high vulnerability to alteration. Seventy-eight wetlands will be crossed along the pipeline route and a total of 16.87 acres of wetlands will be directly affected. Special status species that rely on wetland habitat for part or all of their needs include: common loon, long-horned leaf beetle, northern leopard frog, sandhill crane, spotted frog, and western pond turtle.

Cliff priority habitat includes those cliffs that are greater than 25' in height and occur below 5,000' elevation. These areas are important because they provide significant wildlife breeding habitat (ie. cliff nesting birds) and they often contain unique species assemblages. Several special status species addressed for this project use cliff habitat, primarily as nesting sites; these species include the American peregrine falcon and golden eagle. Cliff habitat occurs near the study area at Snoqualmie Pass, along Swauk Creek, and in places along the Columbia River, but will not be crossed by the pipeline construction corridor. Cliff habitat may occur in the study area depending upon the alternative route chosen for the Columbia River crossing.

Rural natural open space (RNOS) and urban natural open space (UNOS) are designated as priority habitats because a priority species resides in them or adjacent to them, they connect other priority habitats, or they are a remnant of natural habitat. RNOS will be crossed immediately east of the Columbia River and will include a new corridor through this area described as a unique complex of basalt cliffs, sand dunes, shrub steppe, and small wetlands. The UNOS crossed near Carnation includes a forested hillside near the Tolt River crossing.

Priority habitat for black-tailed deer, mule deer, and for elk includes regular and large concentrations in winter, breeding areas, and migration corridors. Winter range for these species occurs in the project area between Cle Elum and Vantage, Washington.

Priority habitat for ring-necked pheasants occurs along the project east of the Columbia River crossing. Priority habitat includes self-sustaining bird habitat for regular or large concentrations during winter. Habitat in these areas generally consists of dense growth of greasewood, cattails, and shrubs adjacent to agricultural lands (WDFW 1997).

Priority habitat for sandhill crane includes regular and large concentrations, migration staging areas, and breeding areas. Sandhill cranes using the Columbia Basin are migrants traveling north to breeding grounds. New corridors will be constructed in designated sandhill crane priority habitat areas near existing highways.

Areas with concentrations of waterfowl, including Canada geese, mallards, gadwalls, pintails, wigeons, shovelers, and teal, are defined as state priority habitat. This includes areas of regular and large concentrations in winter and significant breeding areas. Seasonally flooded fields across much of eastern Washington provide wintering habitat for waterfowl. Most of the priority habitat area crossed by the pipeline is a winter wheat feeding area near Pasco. Only a small section of a waterfowl rearing area along the Potholes Canal is crossed adjacent to Glade North Road.

Potential Impacts to Status Wildlife Species and Conservation Measures

Federally Listed Wildlife Species

No federally listed species are likely to be adversely affected by pipeline construction or maintenance.

Peregrine falcons foraging in the project area vicinity will be able to move away from the area during the brief construction period. Construction scheduled for late summer will prevent disturbances during the nesting season at Snoqualmie Pass. Avoidance or timing restrictions (construction window: August 15 - March 15 for raptor nests) will be applied during the construction phase if new nests are found at other locations near the proposed route.

Bald eagles foraging in the project area vicinity will be able to move away from the area during the brief construction period. No nests have been found within the project study area and any new nests detected before construction will be protected with timing restrictions, rerouting, or other conservation measures which are approved by the USFWS. Concentrations of wintering birds will be avoided from Nov 1 to April 1, and no important perching or potential nesting trees will be removed.

Portions of the pipeline route represent potential habitat for gray wolf, however, their occurrence in the study area is considered very rare. Pipeline project construction will only disrupt foraging terrain for a brief period of time (several weeks). No significant changes in prey density are likely.

Habitat for grizzly bears exists adjacent to and north of the study area, however, grizzly occurrence is rare in the region. Potential for direct impacts is considered minimal. Conflicts with construction crews and operational maintenance and inspection crews are extremely unlikely. Impacts to foraging habitat along the pipeline route will be temporary. The environmental inspector for the project will keep in contact with USFS staff regarding grizzly sightings that have been reported near the pipeline route. Any potential for conflict will immediately be reported to construction crew supervisors and to USFS staff; revisions to the construction schedule at identified potential conflict zones will be agreed upon at this time.

There is no documentation of marbled murrelets nesting within the project study area (WDFW 1997) (SPAMA 1995). No habitat trees will be removed during project construction or maintenance. Timing restrictions in place for spotted owl habitat circles will also prevent potential impacts to marbled murrelets during their nesting season, in the unlikely event that a new nesting territory is established near the pipeline route during the construction year. In addition, construction will be limited to between September 15 and April 1, or between August 6 and April 1 two hours after sunrise to two hours before sunset, along the section of pipeline crossing critical habitat for marbled murrelet.

The proposed route will follow existing roads, trails, or transmission line corridors through the majority of the spotted owl CHUs and activity circle areas. In addition, no old growth or habitat trees will be removed by construction or maintenance. Timing restrictions (construction window: September 1 - March 15) will apply in areas designated as spotted owl CHUs and where the route intersects 1.8 mile radius activity circles. The only exceptions to this are where the route crosses critical spawning habitat for fish at Meadow, Big, and Little Creeks where construction will occur in July or August depending upon stream conditions (Section 3.4.4). The construction window will be more restrictive (September 30 - March 15) where the route is within .25 mile of an activity center which is active the year of or year before construction. It is unlikely that this will occur as most of the activity centers are not currently active, and the only activity center .25 mile from the route is currently classed as historic. The latest survey information from the USFS and WDFW will be used to make this determination before construction begins.

Forest Service Sensitive and Survey and Manage Wildlife Species

No Forest Service sensitive or survey and manage species are likely to be adversely affected by pipeline construction or maintenance.

No priority habitat for common loons will be impacted, and no nesting loons have been documented in the project area. Construction impacts to open water habitats which may occasionally attract loons are temporary.

There are no documented ferruginous hawk nest sites in the project study area (WDFW 1997).

Construction will cause only temporary changes to prey densities in a small proportion of the ferruginous hawk's foraging habitat. Individuals will be able to avoid the area during construction. Conservation measures are not planned unless a new nest is documented along the proposed pipeline route. In this case, WDFW will be consulted, and a plan will be made to prevent nest disturbances, most likely by physical avoidance or timing restrictions.

No Larch Mountain salamanders have been found along the pipeline route during fall and spring surveys in potential habitat. Impacts to stream, talus, and upland forested habitats will be temporary, and will, in most cases, occur where habitat has already been impacted by construction and maintenance of road, trail, or BPA corridors. Stream impacts will be temporary and minimized according to best management practices described in section 3.4.3.2.

Townsend's big-eared bats have not been documented in the study area, and have not been found to inhabit the Snoqualmie Pass tunnel, both during summer and during winter (hibernation). This species is particularly sensitive to disturbance. If bats occur in the Snoqualmie Pass tunnel, they will likely leave during summer construction and then return after construction is finished (Steve West, Univ. of Washington, pers. comm.). Timing of construction during the late summer (after nursing colonies have dispersed, but before winter hibernation) will minimize impacts to bats that may utilize the Snoqualmie Pass tunnel. If hibernating bats are present in the tunnel (they were not found during a winter survey of the tunnel) and construction occurs in the winter months, hibernating bats are likely to be disturbed, and some mortality may occur due to their winter metabolic constraints or if they fail to find alternative roost sites nearby. Maintenance inspections will not impact hibernating bats as the tunnel is closed during the winter months.

No Van Dyke's salamanders have been found along the pipeline route during fall and spring surveys in potential habitat. Impacts to stream habitats will be temporary, and will, in most cases, occur where streams have already been impacted by construction and maintenance of road, trail, or BPA corridors. Stream impacts will be temporary and minimized according to best management practices described in section 3.4.3.2.

Wolverines occur in remote, mountainous habitat and at very low densities. Their occurrence in the project area is unlikely, due to past alteration of habitat, fragmentation of habitat, and land use. Direct impact on individuals is considered unlikely. Effects on potential foraging terrain for wolverines is unlikely to be significant.

Survey and manage mollusk species are unlikely to be affected by the ground disturbing activities of pipeline construction, or from any secondary effects of microclimate change due to tree removal. With the exception of a few short corridors connecting existing corridors, the pipeline route follows existing trails, roads, and transmission line corridors where limited or no tree removal will occur. In addition, these species are unlikely to be found within or near the pipeline corridor as they are considered to be old growth associates and the pipeline does not cross any old growth stands. None of these species were found during salamander surveys in new proposed corridors and riparian areas on Forest Service land.

State Endangered, Threatened, and Candidate Species

No state status species are likely to be adversely affected by pipeline construction or maintenance. The Federal and Forest Service status species potentially found along the pipeline corridor are predominantly found in forest and wetland habitats. However, state status species include a substantial number of species which inhabit the shrub steppe portions of the pipeline, as well as forest and wetland related species.

Forest Species

The proposed pipeline route will follow existing roads, trails, or transmission line corridors through forested areas with the exception of a few short corridors which serve to connect existing corridors. No old growth or status species habitat trees will be removed by construction or maintenance at any locations. Forest bordering the pipeline corridor is generally made up of patches of second growth forest, regenerating forest, and cleared areas.

Two state status forest species are extremely unlikely to be found in the project area because one is largely limited to old growth and mature tree stands (Johnson's mistletoe hairstreak), and the other is rare in fragmented forest habitats (Pacific fisher). Johnson's hairstreak butterflies are not likely to be affected by the project as no old growth trees will be lost due to construction or maintenance. Occurrence of Pacific fisher in the project area and vicinity is considered rare, due to fragmentation of habitat and lack of mature old-growth forest stands. Even if they occur nearby, no impacts are anticipated because no forested habitat will be lost or further fragmented.

Many state status species are cavity nesting species including pileated woodpeckers, black-backed woodpeckers, white-headed woodpeckers, Lewis woodpeckers, flammulated owls, and Vaux's swifts. These species are not likely to be adversely affected as their prime habitat trees (large mature trees and upright snags) will not be lost during pipeline construction or maintenance. Cavity nesting birds foraging in the project area vicinity will be able to move away from the area during the brief construction period (no more than a few days at a given point). In most of the forested areas along the pipeline route, timing restrictions for the spotted owl will prevent disturbances to other nesting birds. No nests have been documented in the project area for any of these cavity nesting species.

Two birds of prey, the northern goshawk and golden eagle, are not likely to be adversely affected by construction or maintenance. Northern goshawks and golden eagles foraging in the project vicinity will be able to move away from the area during construction, and changes in prey densities within the 60' construction corridor will be minimal and temporary. No potential nesting or perching habitat or trees will be affected during construction or maintenance. Northern goshawks potentially nesting near Snoqualmie Pass are unlikely to be affected as construction in the mountains is scheduled for the late summer months. No golden eagle nests have been documented in the project study area.

The osprey, a state monitor species, has nest sites at three locations along the pipeline route. If these sites are active during the construction year then timing restrictions will limit construction to between August 15 and March 31 in these areas within .25 mile of the nest site.

Wetland Species

The proposed pipeline corridor will be limited to a 30' corridor through wetlands, best management practices will be followed, and all wetlands will be restored after construction.

Two wetland species, the long-horned leaf beetle and the western pond turtle are highly unlikely to be found in wetlands along the pipeline route. The pipeline does not cross bog habitat inhabited by long-horned leaf beetles. Western pond turtles are not likely to occur along the proposed pipeline route as the route only borders the edge of their dramatically declining range. Therefore, it is very unlikely that even a single nest will be destroyed by construction. Adults will be able to move away from the construction corridor.

Sandhill cranes will not be adversely affected by the project because construction is not likely to take place during migration periods, the construction corridor is adjacent to highways where sandhill crane habitat occurs, and all wetland habitat will be restored after construction. Even if migrating sandhill cranes are present, and this is unlikely with construction beginning in June in Franklin County, they can move to nearby habitat during the brief construction period.

Northern leopard frogs are not likely to be affected by the project because they have not been documented in the project area, and impacts to spotted frogs will be temporary and limited to a few crossings. Individual and egg mortality will be minimal with erosion control techniques. Impacts to stream and wetland habitats are temporary. Impacts to riparian and wetland areas where frogs may be found will be temporary and minimized with best management practices and by replanting with native vegetation after construction.

Shrub Steppe Species

Temporary loss of shrub steppe and grassland habitats will occur during and immediately after construction in the 60' corridor. Shrub steppe and grasslands will be reseeded with native grasses, and shrubs will recolonize shrub steppe in the construction zone to result in no loss of habitat. Direct mortality to young animals in nests or burrows, if it occurs, will affect only a small proportion of a total species population. Direct or indirect mortality of adult individuals is very unlikely as adults are able to temporarily move away from the construction corridor. Impacts to foraging opportunities within the construction corridor will be temporary, and similar opportunities exist in adjacent habitat.

A number of state candidate bird species occur in shrub steppe habitats. Species such as the sage grouse, sage sparrow, and sage thrasher are found mostly in sagebrush, while others like the loggerhead shrike and western burrowing owl can also be found along the borders of agricultural areas. The nests, eggs, and young of these species are most vulnerable to construction as these species' nests are generally built on the ground or in shrubs. Sage grouse are limited in distribution, and are most likely to be found on Yakima Training Center land which is not along the proposed route. There are no records of active sage grouse leks along the pipeline route or any pipeline alternative routes. Sage thrashers, sage sparrows, and loggerhead shrikes are more common in shrub steppe habitats along the route, but the percentage of available habitat affected will be extremely small.

Burrowing owl nests, as they are easy to observe (the adult birds spend hours sitting by their burrows), are more closely tracked by WDFW and by birding societies. Although four past nest sites are located in the pipeline vicinity, none are close enough to be affected by construction. WDFW will be consulted for current information on the location of active burrowing owl nests before construction. If a nest has become active near the pipeline route then WDFW will be consulted to determine appropriate conservation measures which may include timing restrictions.

Washington ground squirrels are unlikely to be found along the pipeline route as there are no records of them in the project study area, and they were not seen during field work. Washington ground squirrels are relatively large animals and populations have been documented at other locations. Even if some animals are inhabiting the construction corridor, individual burrows will likely be destroyed, but direct mortality will probably not occur to young animals as they are born in March and half grown by mid-April (Whitaker 1980). Adults and young able to move or be moved by their mother will relocate during construction as adjacent habitat is available.

State Priority Habitats and Species

Impacts to priority habitats and species will be temporary because the vegetation in the construction corridor is comprised primarily of non-woody vegetation.

Impacts to priority habitats were evaluated using GIS. The Washington State PHS information was input to the GIS and the pipeline route was overlain onto PHS polygons. The potential impact area for most priority habitats and species was calculated to include the 60' construction corridor. Construction corridors through riparian and wetland areas will be 30' wide and impacts were calculated using that width. Wetland values are from extensive field work conducted for the project. Impacts to forested and scrub-shrub riparian areas were calculated by estimating the riparian area based on aerial photographs and topography.

Oak Woodlands

Oak woodlands near Swauk Creek are in the construction corridor; however, no loss of oak trees will occur in this priority habitat area.

Riparian

The construction impact to forested and scrub-shrub riparian areas is an estimated 9.4 acres. Most of these impacts are to mixed (3.7 acres) and deciduous (1.7 acres) forest types and scrub-shrub vegetation (2.1 acres). Direct impacts from construction activity will be short-term since most stream crossings will take place within 48 hours. Protection measures for riparian habitat will be implemented as part of construction to minimize impacts. Operational impacts will likely affect less area than construction impacts because only a 30' wide clear area above the pipeline is required for aerial inspections. However, operational impacts were calculated in Table 3.4-6 using a 30' corridor width.

Wetlands

Seventy-eight wetlands will be crossed along the pipeline route and a total of 17.07 acres will be affected. Direct impacts to wetland vegetation will occur from trenching and backfilling. Most of the losses will be temporary because impacted wetlands will be restored after construction (Section 3.4.2). Limited woody vegetation will be lost and will be replaced by emergent or shrub vegetation. Impacts to wetlands such as a decrease in water quality caused by sedimentation, erosion, chemical and toxic substances from construction equipment, or a change in wetland hydrology will temporarily affect wetland vegetation and wildlife species dependent on aquatic environments.

Natural Open Space

Urban natural open space (UNOS) will be crossed near Carnation and near the Columbia River crossing, and rural natural open space (RNOS) will be crossed immediately east of the Columbia River crossing. The final acreage affected will depend upon the Columbia River crossing alternative chosen. The Tolt River crossing near Carnation will include a new corridor, however, impacts to riparian vegetation will be minimized by limiting disturbance to a 30' wide corridor. A new corridor will also be temporarily created through UNOS and RNOS east of the Columbia River. Impacts to all UNOS and RNOS will be temporary as all of these areas will be restored by reseeding (shrub steppe), replanting (wetlands and riparian), or natural revegetation depending upon the habitat type.

Cliff

Cliff habitat occurs within the vicinity of the project area near Snoqualmie Pass, along Swauk Creek, and near the Columbia River crossing. However, this habitat will not actually be crossed by the pipeline within the 60' construction corridor, even when all of the Columbia River crossings are considered. Therefore, impacts are not expected in this habitat.

Black-tailed Deer, Mule Deer, Elk

Although up to 113 acres of winter range for big game ungulates will be crossed by the construction corridor, new corridor outside of the existing BPA corridor will only be created on a few of these acres. Total elk winter range within the 60' corridor is .57 acres, black-tailed deer and mule deer winter range is 30.3 acres, and mule deer winter range is 82.3 acres. Deer and elk herds are unlikely to be affected by the project because most construction is planned from June to October, which is outside of the critical winter period (December 1 to April 1), and foraging grounds will be reseeded with native grasses. Agricultural areas will be cultivated again after pipeline construction.

Ring-necked Pheasant

Approximately 7.9 acres of priority habitat for ring-necked pheasant are within the 60' construction corridor. New corridors will be constructed in designated priority habitat areas, however, they include areas adjacent to existing highways or roads. Impacts to pheasants will be avoided by not constructing during the winter when regular or large concentrations of pheasants are more likely to occur in the priority habitat. Priority habitat and wetlands will be restored after construction. Cattails and shrubs will likely recolonize areas previously vegetated with these species.

Waterfowl

The construction corridor includes 28.6 acres of waterfowl priority habitat that will be affected by project activities. However, only a small portion of this area is waterfowl rearing area along the Potholes Canal, which will be crossed adjacent to Glade North Road where effects on waterfowl will be minimal. The rest of the area is a winter wheat feeding area which will continue to be wheat fields after construction.

Sandhill Crane

The construction corridor includes 11.3 acres of habitat utilized by sandhill cranes in the Crab Creek area and in wetlands near Glade North Road. Sandhill cranes are discussed in the State species impact section.

Kittitas Terminal and Pump Station Impacts to Threatened, Endangered and Sensitive Wildlife Species.

The proposed Stampede Station site is within a 1.8 mile radius spotted owl circle. Timing of construction activities will exclude activities during critical periods and will minimize the potential for impact. No spotted owl habitat will be affected as the site is composed of grasses and forbs and portions of it have previously been cleared. The Stampede Station will also be located approximately 2,000' from an inactive goshawk nest. This nest was last used in 1987. The Stampede Station will not be constructed as part of the initial construction.

3.4.5.3 Threatened, Endangered and Sensitive Fish Species

The U.S. Department of Fish and Wildlife, National Marine Fisheries Service, and Washington Department of Fish and Wildlife were contacted for information on threatened and endangered fish species that occur in the study area. Correspondence from those agencies is included in Appendix E of this report.

With the exception of upper Columbia Basin steelhead trout populations above the Yakima River on the Columbia River, there are no federal or state listed threatened or endangered species that utilize the streams and rivers of the project area. The above mentioned population of steelhead trout is federally listed as endangered. Columbia Basin bull trout were proposed for federal listing as threatened in June 1997, and middle Columbia Basin steelhead trout and were proposed for federal listing as candidate in August 1997. After a one year period for additional comments, bull trout will probably become officially listed as threatened in 1998. All wild stocks of Puget Sound chinook salmon, and upper Columbia Basin (above Priest Rapids Dam) spring-run (stream-type) chinook salmon were proposed for federal listing as threatened on January of 1998 with a one year period of comment before becoming officially listed as threatened. Other species of concern may be present in some of the project streams crossed by the proposed pipeline. These species are listed in Table 3.4-13. The occurrence of listed or sensitive species at waterway crossings is noted in Tables 3.4-8 and 3.4-9.

TABLE 3.4-13
SENSITIVE FISH SPECIES LIKELY TO OCCUR IN THE STUDY AREA

Common Name	Scientific Name	Priority Criteria[(a)]
Chinook Salmon (all stocks)	*Oncorhynchus tshawytscha*	2, 3
Chinook Salmon (Spring-run) (Upper Columbia Basin)	*Oncorhynchus tshawytscha*	PT
Chinook Salmon (all interior Columbia Basin stocks)	*Oncorhynchus tshawytscha*	K
Chinook Salmon (Wild Puget Sound Stocks)	*Oncorhynchus tshawytscha*	PT
Coho Salmon (all stocks)	*Oncorhynchus kisutch*	2, 3
Pink Salmon (all stocks)	*Oncorhynchus gorbuscha*	2, 3
Chum Salmon (all stocks)	*Oncorhynchus keta*	2, 3
Sockeye Salmon (all stocks)	*Oncorhynchus nerka*	2, 3, R
Kokanee Salmon	*Oncorhynchus nerka*	3, R
Steelhead Trout (all stocks)	*Oncorhynchus mykiss*	3
Steelhead Trout (Upper Columbia Basin)	*Oncorhynchus mykiss*	E
Steelhead Trout (Middle Columbia Basin)	*Oncorhynchus mykiss*	PC
Steelhead Trout (all interior Columbia Basin stocks)	*Oncorhynchus mykiss*	K
Rainbow Trout (all stocks)	*Oncorhynchus mykiss*	3
"Redband Trout" (Interior Rainbow Trout)	*Oncorhynchus mykiss gairdneri*	K
Sea-run Cutthroat Trout (all stocks)	*Oncorhynchus clarki*	3
Coastal Cutthroat Trout	*Oncorhynchus clarki*	3
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi*	3, K
Bull Trout (all stocks)	*Salvelinus confluentas*	3
Bull Trout (Columbia Basin)	*Salvelinus confluentas*	PT
Dolly Varden	*Salvelinus malma*	3
Pygmy Whitefish	*Prosopium coulteri*	1, 2, R
Burbot	*Lota lota*	R
Largemouth Bass	*Micropterus salmoides*	3
Smallmouth Bass	*Micropterus dolomieui*	3
Walleye	*Stizostedion vitreum*	3
Channel Catfish	*Ictalurus punctatus*	3
Sandroller	*Percopsis transmontana*	2, R
River Lamprey	*Lampetra ayresi*	R

TABLE 3.4-13 (CONTINUED)
SENSITIVE FISH SPECIES LIKELY TO OCCUR IN THE STUDY AREA

Pacific Lamprey	*Lampetra tridentata*	R
Shorthead Sculpin	*Cottus rhotheus*	R
Torrent Sculpin	*Cottus confusus*	R
White Sturgeon	*Acipsenser transmontanus*	2, 3, R
Green Sturgeon	*Acipenser medirostris*	2, 3

[a] Federal status under the Endangered Species Act:
E Listed as endangered.
PT Proposed for listing as threatened within the next year.
PC Proposed for listing as a candidate species.
State status as priority species
The Washington Department of Fish and Wildlife criteria for designating a species as priority are:
1 Criterion 1: Listed and candidate species (Pygmy whitefish are a candidate species).
2 Criterion 2: Species that forms vulnerable aggregations.
3 Criterion 3: Species of recreational, commercial , and/or tribal importance.

U.S. Forest Service and Bureau of Land Management special status species in the Interior Columbia Basin:
K Listed as a key salmonid (K) by the Interior Columbia Basin Ecosystem Management Project.
R Listed as a narrow endemic or special status fish (R) by the Interior Columbia Basin Ecosystem Management Project.

The majority of Washington state priority species that utilize the project area are game or commercial species that have healthy populations within the project area. The sandroller, sturgeons and pygmy whitefish may form vulnerable aggregations during spawning activity. Green sturgeon are unlikely to form these aggregations in the project area. Additionally, pygmy whitefish are a relict species found in a few deep glacial lakes in the state and are protected because of their spotty distribution.

The Interior Columbia Basin Ecosystem Management Project (U.S. Department of Agriculture, Forest Service and U.S. Department of the Interior, Bureau of Land Management) lists all interior Columbia Basin stocks of chinook salmon, rainbow and steelhead trout, bull trout and westslope cutthroat trout as Key salmonids in the Eastside Draft Environmental Impact Statement (ICBEMP, 1997). This document also lists a number of species found in streams along the pipeline route as narrow endemic and special status fish species. Key salmonids, narrow endemic and special status fish are listed in Table 3.4-12.

Three stocks of salmonids have been proposed for federal listing as threatened . All wild chinook salmon stocks in the Puget Sound Basin are severely depleted, as are spring-run chinook salmon in the upper Columbia Basin (including the Yakima River Basin). Although Oregon populations of middle Columbia Basin steelhead trout are healthy, the weak escapements in Washington streams have led to this stock of steelhead trout being proposed for federal listing as a candidate species. Bull trout in the Columbia Basin (including the Yakima River Basin) are proposed for listed as threatened. The Washington Department of Fish and Wildlife lists the status of the upper Yakima Basin stocks of bull trout as critical in its bull trout/dolly varden management and recovery plan.

Impacts to Threatened or Endangered Species

Bull Trout: The bull trout populations of Keechelus Lake and its tributary streams are listed as critical species in the Bull Trout/Dolly Varden Management and Recovery Plan (WDFW, 1993). Mainstem Yakima River populations are also listed as critical (high risk). All Columbia River populations of bull trout were proposed for federal listing as threatened in June, 1997. Management objectives for high risk populations of bull trout listed in the management and recovery plan are as follows:

Management objectives for high risk populations of bull trout: Management of high risk bull trout stocks will work toward an objective of no detrimental change in any requisite water and habitat component necessary to sustain critical life stages. In the case of spawning and rearing substrates, "no detrimental change" shall be interpreted as no increase in sediments, fine particles, or of mean particle size, and no loss or decrease in channel complexity.

The minimum standard for spawning and incubation substrates in bull trout streams subject to developmental activities should be 15 percent or less fine sediments (less than 1.0 mm), 35 percent or less of materials less than 6.35 mm, and a geometric mean particle size of at least 10.0 mm, as determined by McNeil core sampling. The minimum standard for bull trout rearing areas shall be a mean substrate score of at least 10.0 (a qualitative measure of channel substrate imbeddedness). Summer maximum temperatures should not exceed 15 C^o or 59 F^o by mid-September in bull trout spawning and rearing streams. Where normal background levels equal or exceed the above standards, there should be no development or other disturbances in the watershed which could exacerbate conditions affecting reproduction and rearing. Where any of the standards are exceeded in developed basins, immediate reparations to facilitate the recovery of the affected habitat component (s) should be started.

Existing statutory or policy requirements for fish habitat protection are considered absolute minimum protective measures, and land management activities must meet or exceed such standards (WA State Forest Practices, U.S. Forest Service Best Management Practices). Existing roads and trails will have restricted access during spawning and staging times of the year and the construction of new roads, trails and campgrounds near spawning and staging areas will be discouraged. Follow-up investigations of Hydraulic Project Approvals and Forest Practice Permits are required to assure timely compliance with the terms and conditions of permitted activities. Instream structures, such as bridges, piers, boat ramps, or culverts must not impede the natural movements of bull trout and dolly varden. Wherever habitat monitoring indicates critical threshold levels of spawning gravel sediments or of rearing area imbeddedness have been reached or exceeded, there should be no further developmental activity in the basin, and remedial measures should be undertaken to correct identified contributing problems. The WDFW will further restrict or condition other development activities as necessary and within legal authority through implementation of the Hydraulic Project Laws and regulations (RCW 75.20.100 and related RCW's and WAC's) to protect and preserve the habitat of native charrs.

All existing populations will be managed to ensure their continued existence, enhance their numbers, and preserve their intrinsic genetic and ecosystem values. The various populations and ecotypes will be managed as evolutionarily significant units. Basins where bull trout have apparently been extirpated will have specific actions proposed for reestablishing native charr populations.

Impacts and Mitigation Measures: Along the Cross Cascade pipeline route, populations of bull trout are found in the Keechelus Lake Basin and the mainstem of the Yakima River. These fish are listed as critical (high risk of extirpation). Bull trout have been reported in Roaring, Mill, Swauk and Cabin Creeks. The Washington Department of Fish and Wildlife is currently surveying the Yakima Basin for bull trout populations and may find additional populations.

The Keechelus Lake bull trout are an adfluvial population with their only known spawning population occurring in Gold Creek (Wissmar and Craig, 1997). Bull trout have been sampled in 1997 surveys in Roaring, Mill and Rocky Run Creeks (Wolf, 1997). It is not known at present what ecotype these populations have. It is highly unlikely that any adfluvial populations can cross through the Mill Creek culvert at the John Wayne Trail and the only suitable habitat for bull trout in Mill Creek is above the roadbed, so it is reasonable to assume that these fish exhibit the stream ecotype. Both Mill and Cold Creeks in the Keechelus Lake Basin are cut off from adfluvial populations by culverts under the John Wayne trail, with the Cold Creek culvert suspended over 6 feet above its plunge pool. Additionally, the channel from the Mill creek culvert to Keechelus Lake is extremely difficult for spawning fish to navigate during the spawning migration due to the exposure of the stream's alluvial fan during the lake's draw-down period. Roaring and Meadow Creeks are the only other creeks in the Keechelus Lake Basin crossed by the pipeline that have suitable spawning and rearing habitat for bull trout.

The Cross Cascade Pipeline route will cross four potential bull trout streams in the Keechelus Lake Basin. The Mill (crossing 86) and Cold (crossing 88) Creek Crossings will be "over culvert" crossings with the pipe buried in an existing road bed. No disturbance of the stream will occur and public access to the road is restricted to foot and bicycle traffic, minimizing release of fine sediments from the roadbed's surface. The crossing methodology proposed for Roaring (crossing 97) and Meadow (crossing 99) Creeks is to divert and trench. All existing statutory or policy requirements for fish habitat protection (WA State Forest Practices, U.S. Forest Service Best Management Practices) will be met or exceeded. Boring or directional drilling below the streambed are not practical at these crossings due to subsurface rock, and the existing bridges are inadequate for supporting the pipeline. The high water mark of the lake comes close to both crossings, but several hundred feet of stream channel below the crossing are exposed during summer and winter. Roaring Creek's exposed channel provides bull trout spawning habitat and the exposed channel of Meadow Creek provides both spawning and rearing habitat. Substrate data from the channels of Roaring and Meadow Creek below the crossings have not been gathered at this time. Construction of crossings will occur during the construction window of July 1 - Aug 31 (with July the preferred month) between the emergence of spring spawning salmonid fry and bull trout spawning activity. The pipe will be buried 2 feet below the maximum scour depth. The streambanks will be stabilized prior and after construction using biotechnical methods of erosion control and by replanting riparian vegetation. All erosion control mitigation measures listed in Subsection 3.4.4.3 will be followed. Construction of these crossings will not affect any known staging or spawning areas for adfluvial bull trout populations.

A special opportunity for increasing the availability of spawning and rearing areas to the reintroduction of adfluvial bull trout in Keechelus Lake exists at the Mill and Cold Creek crossings. The existing culverts block fish passage from the lake into the stream above the John Wayne Trail where most of the available bull trout spawning habitat in these stream basins occurs. These culverts could be replaced or modified to allow easy fish passage as mitigation for possible sediment releases at other stream crossings within the Yakima Basin.

Other crossings of known bull trout habitat by trenching methodologies in the Yakima Basin occur at Cabin Creek (Crossing 117), the Yakima River (Crossing 147), and Swauk Creek (Crossing 151). Alternative crossing technologies were considered for these crossings. Boring or drilling was not practical at Cabin Creek due to subsurface rock, and the existing bridge is inadequate for supporting the pipeline. Boring was not practical at the Yakima River due to a shallow water table, the site is too constricted for drilling and no access is available on the west side, and obtaining permits for the construction of a bridge would not be likely. Finally, boring was not feasible at the Swauk Creek crossing due to the required depth of launch and receive pits, drilling was not practical due to subsurface rock and steep slopes and bridge construction is technically infeasible.

It is possible that bull trout populations may utilize other streams in the Yakima Basin crossed by the pipeline route. All existing statutory or policy requirements for fish habitat protection (WA State Forest Practices, U.S. Forest Service Best Management Practices) will be met or exceeded at these stream crossings and in many cases, the crossing methodology will be non-invasive with no measurable release of sediment.

A summary of the recommended protective measures for bull trout populations in the project area follows:

(1) Maintain annual recruitment to the population.
(2) Maintain multiple age spawning populations.
(3) Maintain habitat necessary for sustaining critical life history stages (ie: spawning, hatching, rearing).
(4) Maintain current distribution of populations.
(5) Increase numbers of fish within current distribution.
(6) Reestablish populations in historically inhabited areas.

(7) Close trails and roads during critical spawning and staging times of the year.

(8) Prohibit construction of new roads, trails, and campgrounds near spawning and staging areas.

(9) Restrict or condition other development activities as necessary.

(10) Promote adherence to the minimum road-related "Management Recommendations for Priority Species" included in the WDFW's Priority Species and Habitats (PHS) document.

Pygmy Whitefish: A relict population of pygmy whitefish (Washington state priority 1) exists in Keechelus Lake and may use streams crossed by the pipeline for spawning (Mongillo, 1997). Pygmy whitefish also are a major forage fish for the adfluvial bull trout population in Keechelus Lake. The pygmy whitefish spawning streams affected are Cold, Mill, Roaring and Meadow Creeks; the same streams described above as bull trout habitat. Impacts and mitigation are the same as listed above under bull trout.

Columbia and Yakima Basin Steelhead Trout and Spring-run Chinook Salmon: The middle Columbia Basin population of steelhead trout has been proposed for federal listing as a candidate species and the upper Columbia Basin population of spring-run (stream-type) chinook salmon is expected to be proposed for federal listing as threatened in early 1998. All steelhead trout populations in the upper Columbia Basin above the Yakima River are now listed as endangered.

The construction of waterway crossings of anadromous streams in the Yakima River Basin will be confined to a window of time between September 1 and September 30, in the Yakima River and Swauk Creek, and July 1 to August 31 in Cabin, Big, and Little Creeks to avoid any disturbance of spawning or rearing fish and eggs or fry that are still in the gravel. Methods proposed for crossing the Columbia River are non-invasive and should have no effect on upstream stocks of anadromous salmonids.

Finally, all wild chinook salmon in the Puget Sound Basin are expected to be proposed for federal listing as threatened. Populations of wild chinook salmon occur in the Snohomish/Snoqualmie River Basin. Populations of wild chinook salmon are found in the Snoqualmie River, Cherry Creek, and the Tolt River. None of the stream crossings in the project area present any impact to spawning areas used by wild Puget Sound chinook salmon populations. Wild populations of chinook salmon in these streams spawn above the crossing sites. Timing of construction or crossing methodology used at these sites will allow the upstream migration of spawning fish.

3.4.6 FISH OR WILDLIFE MIGRATION ROUTES

3.4.6.1 Wildlife

Wildlife species migrating through the pipeline study area are unlikely to be affected by pipeline construction or maintenance, as construction is not scheduled to occur during critical migratory periods for species known to occur along the route, and the pipeline itself will not physically disrupt migration routes after the brief construction period (a few days at any given point). Even during construction, the pipeline project will present no physical barriers to migrating birds.

In the Northwest Forest Plan Record of Decision (USDA and USDI 1994, D-16) the Snoqualmie Pass Adaptive Management Area is considered critical to the movement of wildlife in the Cascades. The project presents no new barriers to wildlife movement here as the underground pipeline will be located in the Snoqualmie Pass tunnel and the John Wayne Trail through this area. Disturbance from construction activities along the trail and in the tunnel will be temporary, lasting only a few days at any given point.

Winter range for black-tailed deer, mule deer, and elk is found in the project area between Cle Elum and Vantage, Washington. Although up to 113 acres of winter range for big game ungulates will be crossed by the construction corridor, new corridor outside of the existing BPA corridor will only be created on a few of these acres. Total elk winter range within the 60' corridor is 0.57 acres, black-tailed deer and mule deer winter range is 30.3 acres, and mule deer winter range is 82.3 acres. Deer and elk herds are unlikely to be affected by the project because most construction is planned from June to October, which is outside of the critical winter period (December 1 to April 1), and foraging grounds will be reseeded with native grasses. Agricultural areas will return to cultivation after construction. Construction activities will only be present at a given location for no more than a few days. These activities are not expected to block any deer or elk movement as their range along the pipeline route is a large, contiguous area.

Priority habitat for waterfowl includes regular and large concentrations in winter and significant breeding areas. Seasonally flooded fields across much of eastern Washington provide wintering habitat for many waterfowl species. Most of the priority habitat area crossed by the pipeline is a winter wheat feeding area near Pasco. Many other agricultural areas are available for winter feeding in this region. Agricultural fields will be cultivated again after pipeline construction. Where the pipeline crosses duck brooding areas, it is adjacent to existing roads, which already act as a barrier to duck movement. The pipeline will present no additional barriers to moving ducks as all wetlands and adjacent uplands will be restored after pipeline construction.

Priority habitat for ring-necked pheasants occurs along the project east of the Columbia River crossing. Priority habitat includes areas with self-sustaining bird populations in regular or large concentrations during winter. Habitat in these areas generally consists of dense growth of greasewood, cattails, and shrubs adjacent to agricultural lands (WDFW 1997). Approximately 7.9 acres of priority habitat for ring-necked pheasant are within the 60' construction corridor. New corridors will be constructed in designated priority habitat areas, however, they include areas adjacent to existing highways or roads. Impacts to pheasants will be avoided by not constructing during the winter when regular or large concentrations of pheasants are more likely to occur in the priority habitat. Priority habitat and wetlands will be restored after construction. Cattails and shrubs will likely recolonize areas previously vegetated with these species.

Priority habitat for sandhill cranes includes areas of regular and large concentrations, migration staging areas, and breeding areas. Sandhill cranes using the Columbia Basin are migrants traveling north to breeding grounds. New corridors will be constructed in designated sandhill crane priority habitat areas near existing highways. The construction corridor includes 11.3 acres of habitat utilized by sandhill cranes in the Crab Creek area and in wetlands near Glade North Road. Even if migrating sandhill cranes are present, and this is unlikely with construction beginning in June in Franklin County, they can move to nearby habitat during the brief construction period. Wetland habitat loss will be temporary.

3.4.6.2 Salmonid Stocks and Migrations

Chinook Salmon

Two runs of chinook salmon have formerly used the Snoqualmie River Basin. The current status of spring-run chinook salmon remains disputed, however, and agencies are trying to re-establish the runs of the Snohomish River Basin (WDF et al., 1992a). The fall-run chinook salmon's geographical distribution includes the Snoqualmie River and its tributaries. They spawn from mid-September through October. Adult escapement in the Snohomish Basin ranged from 900 to 2,600 from 1979-1991, and averaged 1,700 adults (Puget, 1994). The chinook salmon are a depressed native stock (WDF et al., 1993). Even though summer/fall-run chinook salmon stocks in Puget Sound are stronger than spring-run stocks, escapements have fallen drastically in several rivers. All wild chinook salmon stocks in Puget Sound are expected to be proposed for listing as threatened within the next year as are upper Columbia Basin spring-run chinook salmon.

The upper Yakima Basin has a depressed native stock of spring-run chinook salmon. The majority of spawning occurs in the mainstem Yakima River from Ellensburg to Easton Dam (WDF et al., 1993). Spawning occurs between late August and October. Escapement is low and redd counts have ranged from 2 to 35 redds/mile (1967-1991) (WDF et al., 1993).

Coho Salmon

Coho salmon use virtually every accessible stream in the Snoqualmie Basin but escapement is unknown.

Coho salmon spawn from early November through late January or mid-February. The stock is considered healthy (WDF et al., 1993) and is comprised of hatchery and wild fish. Juvenile coho salmon characteristically stay in freshwater more than a year and migrate seaward from mid-April to mid-July.

Chum Salmon

Chum salmon escapement in the Skykomish Basin was 3,600 to 44,000 for odd-year fish (1969-1991) and 10,000 to 67,000 for even-year fish (1968-1990) (WDF et al., 1993). Specific escapement information is lacking for the Snohomish River Basin. Adult chum salmon have been observed in a side channel of the Snoqualmie River near Fall City, and in the Tolt River (WDF et al., 1992b). Chum salmon have also been observed spawning in lower Cherry Creek (Nelson, 1997). The spawning period is from mid-November through December. Relatively little spawning activity occurs in tributaries to the Snoqualmie River. Fry emerge from redds in March and April and quickly begin their seaward migration. The majority of each year-class leave freshwater by mid-June (Williams et al., 1975).

Pink Salmon

The odd-year escapement of pink salmon in the Snohomish Basin is large and has ranged from 70,000 to 302,000 (1967-1991) (WDF et al., 1993). Escapement of even-year fish ranged from 140 to 2,200 fish (1980-1990) (WDF et al., 1993). Both stocks are considered healthy. The Snoqualmie River supports an odd-year run of pink salmon, and mainstem spawning of even-year fish is suspected (WDF et al., 1993). Juvenile salmon begin migrating seaward quickly and complete their migration by late May (Williams et al., 1975).

Sockeye Salmon

Sockeye salmon are known to spawn in the Little Bear Creek watershed of the Sammamish Basin. These fish rear in Lake Washington and are probably originated from plants of Baker River stock. Sockeye salmon are a popular sport fish in Lake Washington and support tribal fisheries. Adult sockeye salmon arrive in Lake Washington in late June and July. The fish remain in the lake until late August and migrate into spawning streams over a period that lasts from September to early December and peaks in about mid-October. Most of the fry migrate into the lake in March. The fry stay in Lake Washington for 12-15 months until they become smolts and migrate to sea. Lake Washington sockeye salmon return to spawn after 1 to 3 years of ocean life (Wydoski and Whitney, 1979).

Steelhead Trout

Steelhead trout are a highly prized sport fish in Washington. The Snoqualmie Basin supports summer-run and winter-run steelhead trout. A summer run utilizes the Tolt River but this stock is depressed (WDF et al., 1993). Snorkel counts have observed 20 to 30 wild adults (WDF et al., 1993). A healthy winter-run steelhead trout stock exists in the Snoqualmie River, Tolt River, and other basin tributaries. Winter-steelhead trout escapement ranged from 1,303 to 2,536 from 1982 through 1992 (Puget, 1994). Summer-run steelhead trout in the interior Columbia Basin spawn from May through September (Withler, 1966). Summer-run steelhead trout in coastal streams spawn between February and April and winter-run spawning occurs from November through early June with most native fish spawning after February. Steelhead trout juveniles will remain in freshwater 1 to 3 years before migrating to the sea. The majority of steelhead trout juveniles in Washington reside in freshwater for 2 years (Puget, 1994).

The Yakima River has a native, wild stock of summer-run steelhead trout that is depressed due to irrigation diversions, drought conditions, habitat degradation, and juvenile and adult mortality associated with passage at four Columbia River hydroelectric dams (WDF et al., 1993). The Yakima River escapement has ranged from 64 to 2,198 fish (1980-1991) (WDF et al., 1991). Spawning occurs from mid-February to late May.

Sea-Run Cutthroat Trout

Even though less abundant than steelhead trout, sea-run cutthroat trout are a major sport species in Washington. Spawning usually occurs from December to March, and most often in small tributaries. Fry emerge from redds between March and June, and smolts migrate between the second and sixth year of life. Peak outmigration is from March to May. Adults in the marine environment remain nearshore, often within 30 miles of their natal stream. Sea-run cutthroat trout have declined throughout their range.

Dolly Varden/Bull Trout

Historically, coastal native charr were called dolly varden and inland native charr were called bull trout. Current sampling by Washington Department of Fish and Wildlife biologists indicate that 80-90% of charr sampled in the Puget Sound and its tributary streams are actually bull trout. Additionally, the remaining charr that key-out as dolly varden are usually females. Since female salmonids have shorter jaw lengths than males and this characteristic is the primary method of telling the two species apart, it is possible almost all of the native charr in the Puget Sound are actually anadromous and resident populations of bull trout. Dolly varden migrate from the sea upriver (e.g., the Snohomish system) between May and December with spawning activity for both species in the late fall to mid-winter (October) (Scott and Crossman, 1973). Fry emerge in April and May and migrate to sea at age 3 or 4 in the spring. When in the salt water, Dolly varden only migrate a short distance from their natal river.

Slow juvenile growth of native charr delays maturation until age five or older, and reproduction may only occur in alternate years. Native charr will live for twelve or more years in Washington. Mature native charr invariably penetrate farther upstream than any other salmonids present in the watershed.

Bull trout spawn in gravel riffles in small streams with cold water. There is a long in-gravel development period compared with other salmonids and juveniles are closely associated with the stream bed. Bull trout tend to be more piscivorous than other trout and salmon. An adfluvial population in Keechelus Lake feeds primarily on juvenile kokanee salmon and pygmy whitefish. Juvenile and stream-resident bull trout exhibit a more "trout-like" feeding pattern dependent on insects the majority of time.

Washington's native charr exhibit four basic life history ecotypes; anadromous, adfluvial, fluvial and resident. Anadromous populations make frequent migrations into and out of lower mainstem rivers and estuaries. Adfluvial stocks spawn and rear in streams, but most growth and maturation occurs in lakes or reservoirs. Major growth and maturation of fluvial populations occurs in mainstem rivers with migrations to smaller streams for spawning and early rearing . All life stages of stream-resident charr occur in small headwater streams, often upstream of impassable barriers. The Snohomish and Snoqualmie River Basin populations are anadromous with spawning occurring in the Skykomish River Basin. Keechelus Lake populations are adfluvial, but some stream-resident populations may occur in tributaries. Fluvial populations are found in the Yakima and Columbia River below Keechelus Lake. There is a possibility that some of the mainstem Yakima and Columbia River population is anadromous.

Bull trout stocks in Washington state have been reviewed recently and the Columbia Basin stocks have been found to be depressed. Bull trout in the Columbia Basin are listed as threatened or endangered. A Bull trout/Dolly Varden Management and recovery plan has been prepared by the Washington Department of Wildlife-Fisheries Management Division (WDFW, 1993). On the west side of the Cascades, the Skykomish River stock, which is the only one found in the Snohomish and Snoqualmie systems has been assigned a low risk level of extirpation. Management recommendations for this level of risk are to allow minimal restrictive trophy fisheries and to protect from negative habitat perturbations. Bull trout populations within the project area on the east side of the Cascades have been assigned a high risk level. Management recommendations for high risk populations are to protect bull trout from targeted or incidental harvest, manage habitat to protect from perturbations and to restore lost spawning and rearing areas, and to manage stocks to elevate to a low risk level.

Rainbow Trout

Rainbow trout are an important species in Washington and a principal sportfish above Snoqualmie Falls in the Snoqualmie River Watershed. Although rainbow trout are an introduced species above Snoqualmie Falls, they have become well established with reproducing populations in the North and South Forks and mainstem Snoqualmie River. Rainbow trout have a similar life history to steelhead trout. Spawning in the Snoqualmie Basin occurs from April to June with fry emerging in early to mid-summer. The principal sportfish in the Yakima Drainage, rainbow trout generally spawn between February and June in the Yakima and tributary streams (Pearsons et al., 1992).

Redband trout (Interior rainbow trout): The Forest Service and the Bureau of Land Management classify all rainbow and steelhead trout native to the interior Columbia Basin and upper Klamath Basin as "redband trout." They divide "redband trout" into two management groups based on their life histories, anadromous (interior steelhead trout) and non-anadromous (freshwater resident). The non-anadromous "redband trout" are further divided into resident-interior and resident "redband trout." The "resident-interior" subdivision encompasses native non-anadromous "redband trout" outside the native range of interior steelhead trout, whereas the "resident" form encompasses populations that exist within the range of interior steelhead trout(ICBEMP, 1997).

Phylogenetic studies have shown that the "redband group" consists of at least five genetically distinct populations that are no more closely taxonomically related among themselves than to coastal rainbow trout populations (Wishard et al, 1984). It has been suggested that the term "redband trout" be used to describe non-anadromous populations of rainbow trout adapted to harsh, arid environments, but that the term not necessarily infer taxonomic relationships among such populations. At the moment, some ichthyologists recognize the upper Fraser and Columbia River rainbow trout as a subspecies of rainbow trout, the interior rainbow or "redband trout" (*O. m. gairdneri*) and rainbow trout native to coastal streams of North America as the coastal rainbow trout (*O. m. irideus*) (Smith, 1991).

In the region crossed by the Cross Cascade Pipeline, the Forest Service and the Bureau of Land Management identify all population of rainbow trout found east of the Cascade mountain crest as "redband trout." With the exception of the interior steelhead trout, most of these trout are probably either hatchery rainbow trout (primarily descended from coastal rainbow trout), naturalized populations of hatchery rainbow trout or hybrid populations of native and hatchery fish (Campton, 1985). Although there is a possibility that non-hybridized populations of "redband trout" exist in streams along the pipeline route, there is no easy way to distinguish them from the majority population of hybridized fish.

Because of these considerations, no attempt has been made to differentiate between "redband" and rainbow trout in this report. However, any successful, rainbow trout reproducing in streams crossed by the pipeline must be regarded as representatives of a well adapted population of a highly popular game fish and will be treated as priority level 3 species for the purpose of this report.

Coastal Cutthroat Trout

Coastal cutthroat trout are abundant above Snoqualmie Falls in the upper Snoqualmie Basin. Coastal cutthroat trout density was estimated at approximately 1,600 fish per mile in 1985 (Puget, 1991). A self-sustaining population occurs in the S.F. Snoqualmie River (Puget, 1994). Coastal cutthroat trout populations are generally found in the headwaters of all Puget Sound streams in the project area.

Westslope Cutthroat Trout

With the exception of the Snake River drainage above Shoshone Falls (and possible relict populations of Yellowstone cutthroat trout in Washington state's Crab Creek and Idaho's Waha lake that were exterminated during the last century), westslope cutthroat trout are the native cutthroat trout of the Columbia River Basin, east of the Cascade Mountains. Despite their presence on the eastslopes of the Cascade Mountains, this trout received it's common name due to it being the native cutthroat trout of the westslopes of the Rocky Mountains in Montana. Oddly enough, it is also native to most eastslope Rocky Mountain streams in Montana. Most streams tributary to the Yakima River have healthy native populations of westslope cutthroat trout in their upper reaches which are gradually replaced in their lower reaches by hatchery rainbow trout/native interior rainbow trout hybrids. These headwater populations are isolated and susceptible to both habitat degradation and hybridization with non-native cutthroat and rainbow trout. Both coastal and westslope cutthroat trout prefer to utilize spawning areas in small tributary streams upstream from rainbow trout spawning areas.

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