infestations and control measures would be implemented that are consistent with ODA, OISC, and BLM noxious weed control plans and policies, as applicable.

4.4.1.7 Vegetative Pathogens

Port Orford cedar root rot disease is caused by the fungus *Phytophthora lateralis*. The disease was first discovered in Port Orford cedar's natural range in 1952 and since has spread throughout its range. Port Orford cedar root rot disease affects both seedlings and mature trees. The spores live in the soil and are spread through contact with contaminated soil or via free water. The disease is primarily spread through soil disturbance and moving water. Spread of the disease over long distances occurs from contaminated equipment and livestock.

Jordan Cove would take precautions during construction to reduce the introduction or spread of Port Orford cedar root rot disease from contaminated earth moving equipment. To ensure adequate conservation measures to address Port Orford cedar root rot disease are in place and implemented, Jordan Cove would follow the measures and recommendations found in the Forest Service and BLM's Final Supplemental EIS regarding the management of Port Orford cedar in southwest Oregon (Forest Service and BLM 2004).

4.4.2 Pacific Connector Pipeline Project

Vegetation types that would be crossed by the pipeline include forests and woodlands, shrublands, grasslands, wetland, and agricultural (see table 4.4.2-1). Wetland vegetation types found along the pipeline route are discussed in section 4.3.

TABLE 4.4.2-1

Vegetation Types Crossed by the Pacific Connector Pipeline Project a/

General Vegetation Type	**Mapped Vegetation Category**	**Late Successional or Old-Growth Forest Crossed (miles)**	**Mid-Seral Forest Crossed (miles)**	**Clearcut/ Regenerating Forest Crossed (miles)**	**Total Miles b/**	**Percent of Total Vegetation**
Forest-Woodland	Douglas-fir-W. Hemlock-W. Red-Cedar Forest	2.2	3.9	11.2	17.2	8.2
	Douglas-Fir-Mixed Deciduous Forest	5.4	13.9	8.5	27.9	13.3
	Alder-Cottonwood	0.0	<0.1	0.0	<0.1	<0.1
	Mixed Conifer/Mixed Deciduous Forest	1.8	4.5	9.2	15.5	7.4
	Shasta Red Fir – Mountain Hemlock Forest	1.5	0.9	3.8	6.1	2.9
	Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest	0.7	0.9	0.3	1.9	0.9
	Douglas-fir Dominant-Mixed Conifer Forest	21.5	8.1	18.0	47.6	22.7
	Ponderosa Pine/White Oak Forest and Woodland	3.2	2.3	1.9	7.4	3.5
	Ponderosa Pine Forest and Woodland	1.0	2.7	3.0	6.7	3.2
	Oregon White Oak Forest	2.2	2.1	0.0	4.4	2.1
	Western Juniper Woodland	0.2	2.9	0.0	3.1	1.5
	Ponderosa Pine/Western Juniper Woodland	0.0	1.4	3.7	5.1	2.4
	Forest-Woodland Subtotal	**39.6**	**43.6**	**59.7**	**142.8**	**68.2**
Shrubland	Sagebrush Steppe	n/a	n/a	n/a	7.0	3.3
	Shrublands	n/a	n/a	n/a	10.7	5.1
	Shrubland Subtotal	n/a	n/a	n/a	**17.7**	**8.5**
Grassland	Grasslands (West of Cascades)	n/a	n/a	n/a	11.8	5.6
	Grasslands (East of Cascades)	n/a	n/a	n/a	4.5	2.1
	Grassland Subtotal	**n/a**	**n/a**	**n/a**	**16.4**	**7.8**
Wetland	Wetland	0.0	0.1	0.1	6.0	2.9
	Wetland Subtotal	**0.0**	**0.1**	**0.1**	**6.0**	**2.9**
Agriculture	Agriculture	0.0	0.0	0.0	26.5	12.7
	Agriculture Subtotal	**0.0**	**0.0**	**0.0**	**26.5**	**12.7**
	Project Total	**39.6**	**43.7**	**59.7**	**209.4**	**100.0**
	Percent of Project Total	**18.9**	**20.9**	**28.5**		

General: Mileages may not sum correctly due to rounding. Mileages are rounded to nearest tenth of a mile; values less than 0.1 are shown as "<0.1".)

a/ Table does not include impacts on unvegetated areas (e.g., urban, industrial, beaches, roads, open water).

b/ Total miles crossed include the 0.9 mile of pipeline that would not disturb vegetation because of the HDD method and direct pipe method used to install pipeline below six waterbodies: Coos Estuary (2 crossings), Coos River, South Umpqua River, Rogue River, and Klamath River.

4.4.2.1 Forest and Woodland Vegetation

Forests vegetation found along the Pacific Connector pipeline route were assigned an age class using available GIS data (BLM 2016c; Moeur et al. 2005, 2006, and 2011; Davis et al. 2015).[111] Age classes were categorized within various age ranges: clearcut (0-5 years), regenerating (5-40 years), mid-seral (40-80 years), as well as LSOG (80+ years).

- Clearcut/Regenerating forest:
  - Clearcut forest includes areas that were harvested within the past five years but presently are non-stocked. This age class generally has a canopy cover of less than 10 percent (Moeur et al. 2005).
  - Regenerating forest generally includes areas with canopy cover greater than 10 percent and tree size less than 10 inches diameter at breast height (dbh; Moeur et al. 2005). This category was further refined to identify early regenerating forest (harvested within the last 10 to 15 years) and regenerating forest for interior forest analyses described later in this section.
- Mid-seral forest includes stands within the current harvest rotation and generally includes small single- and multi-storied trees with canopy cover greater than 10 percent and tree size between 10 and 20 inches dbh (Moeur et al. 2005).
- LSOG:
  - Late successional forest includes forest stands greater than 80 years old. This age range is consistent with definitions used in the NWFP and as described in Moeur et al. (2005) and Davis et al. (2015). This age class generally includes medium and large single- or multi-storied trees with canopy cover greater than 10 percent and average tree size between 20 and 30 inches dbh.
  - Old-growth forest includes forest stands greater than 175 years and dominated by coniferous forest. This correlates well with Moeur et al. (2005), Franklin et al. (1981, 1986), and Franklin and Spies (1991) descriptions that consider primary size and canopy structure characteristics of old-growth Douglas-fir to develop between 175 and 250. This age class generally includes large, multi-storied stands with canopy cover greater than 10 percent and average tree dbh greater than 30 inches (Moeur et al. 2005). Mature deciduous-dominated forests were also included in this forest age classification.

The following text describes dominant vegetation communities in the Project area, lists the common species, and discusses the general distribution:

The Douglas-fir–Western Hemlock–Western Redcedar Forest type occurs at low to middle elevations and has a multi-storied canopy dominated by Douglas-fir, with western hemlock, western redcedar (*Thuja plicata*), and grand fir (*Abies grandis*) as co-dominants. In addition, Pacific yew may be present in the subcanopy (Kagan et al. 1999). Port Orford cedar can also be a dominant tree species within Douglas-fir–Western hemlock–Western redcedar forest types within the pipeline Project area (Johnson and O'Neil 2001). Within riparian areas, and non-conifer dominated stands, bigleaf maple (*Acer macrophyllum*) and red alder are common. Large stature shrubs, such as vine maple, Pacific rhododendron, and evergreen and red huckleberry (*Vaccinium*

[111] Age class was also reviewed by BLM and Forest Service biologists on their respective lands between 2007 and 2008, with specific focus on verifying/classifying late seral forest stands, as well as by Siskiyou BioSurvey LLC.

ovatum and *V. parvifolium*), are frequently present. Ferns dominate the rich and diverse herbaceous layer. It is located within Coos and Douglas Counties.

The Douglas-Fir–Mixed Deciduous Forest type is a low to mid-elevation conifer and mixed deciduous forest found primarily in southwestern Oregon. The upper tree layer always contains Douglas-fir, with the sub-canopy consisting of a mix of shade tolerant conifers and deciduous trees including: tanoak (*Notholithocarpus densiflorus*), Pacific madrone, golden chinquapin (*Chrysolepis chrysophylla*), and Pacific dogwood (*Cornus nuttallii*). Indicative shrubs of this cover type include dwarf Oregon-grape (*Mahonia nervosa*), pacific blackberry (*Rubus ursinus*), oceanspray, California hazelnut, and others (Kagan et al. 1999). This forest type is found within Douglas, Jackson, and Klamath Counties.

The Alder–Cottonwood Forest type is found along the margin of flowing streams in the foothills and mountains throughout much of Oregon. It is prevalent along high gradient stream systems that flood frequently and deposit bed-load sand and gravel. Black cottonwood (*Populus balsamifera* ssp. *trichocarpa*) is always present in the overstory of this forest type. West of the Cascade crest, other dominant species in the overstory include red alder and big leaf maple, and conifers could include Douglas-fir, western hemlock, western redcedar, and Port Orford cedar. East of the Cascade crest, the other dominant species is typically white alder (*Alnus rhombifolia*), with other deciduous trees present including mountain alder (*Alnus incana* ssp. *tenuifolia*), Pacific willow (*Salix lucida* ssp. *lasiandra*), non-native black locust (*Robinia pseudoacacia*), and quaking aspen (*Populus tremuloides*). Associated conifers east of the Cascades include ponderosa pine (*Pinus ponderosa*), Douglas-fir, Engelmann spruce (*Picea engelmannii*), and lodgepole pine (Kagan et al. 1999). It is found within Coos, Douglas, Jackson, and Klamath Counties.

The Mixed Conifer/Mixed Deciduous Forest type is generally composed of co-dominant conifer (e.g., Douglas-fir) and deciduous (e.g., red alder and/or bigleaf maple) trees in a single-layered canopy forest (Kagan et al. 1999). Port Orford cedar may also be the dominant tree species within this forest type (Johnson and O'Neil 2001). This forest type is found in low- to mid-elevations (Kagan et al. 1999) within Coos County.

The Shasta Red Fir–Mountain Hemlock Forest type is a mid-to-upper elevation conifer forest mostly found above 4,000 feet. Overstory species generally include Shasta red fir (*Abies magnifica* var. *shastensis*), mountain hemlock (*Tsuga mertenxiana*), white fir (*Abies concolor*), and lodgepole pine. It often is a closed, multi-story canopy with dense understory of shrubs, forbs, and ferns, including dwarf bramble (*Rubus lasiococcus*), Oregon boxwood (*Paxistima myrsinites*), pinemat manzanita (*Arctostaphylos nevadensis*), and Sadler's oak (*Quercus sadleriana;* Kagan et al. 1999). It is found within Jackson and Klamath Counties.

The Douglas-fir–White Fir/Tanoak–Madrone Mixed Forest type is a multi-layered forest of mixed conifer and mixed deciduous species. It always contains Douglas-fir, with other co-dominants (e.g., white fir, incense cedar (*Calocedrus* [*Libocedrus*] *decurrens*), sugar pine [*Pinus lambertiana*] and western white pine [*Pinus monticola*]). Subcanopy layers contain shade-tolerant trees, including tanoak, Pacific madrone, golden chinquapin, Pacific dogwood, and California laurel (*Umbellularia californica*). Shrub and herb layers are generally well represented. This forest type is found at low to mid elevations (Kagan et al. 1999) within Jackson County.

The Douglas-fir Dominant-Mixed Conifer Forest type typically consists of a single-layer forest canopy, although stand structure can be diverse in undisturbed late seral stands. There is a wide range of canopy closure based on management practice, disturbance history, and microsite. Douglas-fir is dominant, with a variety of coniferous trees including, white fir, incense cedar, western white pine, ponderosa pine, and sugar pine. Understory vegetation is usually diverse and rich in species. This forest type is found at mid elevations (Kagan et al. 1999) within Coos, Douglas, Jackson, and Klamath Counties.

Ponderosa pine and white oak (*Quercus garryana*) are the dominant overstory species within the Ponderosa Pine/White Oak Forest and Woodland type. Shrub cover is typically sparse, but herbaceous and grass species tend to be abundant. This forest type is found at low elevations (Kagan et al. 1999) within Jackson and Klamath Counties.

Ponderosa pine is exclusively the overstory tree at low elevations within the Ponderosa Pine Forest and Woodland type. White fir, grand fir, western larch, incense cedar, Douglas-fir, subalpine fir, and Engelmann spruce are common at higher elevations. Understory and regeneration layers reflect similar composition as overstory. Lower elevations have fewer shrubs, with shrubs increasing in diversity and abundance with elevation and improved soil moisture conditions. This forest type is found at low to middle elevations (Kagan et al. 1999) within Jackson and Klamath Counties.

The Oregon White Oak Forest type contains deciduous woodland/forest dominated by Oregon white oak. Other canopy trees can be Douglas-fir and ponderosa pine in upland settings, and Oregon ash (*Fraxinus latifolia*), black cottonwood, and bigleaf maple on valley floors. The subcanopy often consists of California black oak (*Quercus kelloggii*). Understory typically contains tall deciduous shrubs and smaller stature deciduous trees. This forest type is a highly desirable wildlife habitat that has been decreasing as a result of fire suppression. It is found at low elevations (Kagan et al. 1999). This forest type can require more than 100 years to reach full productivity and function as wildlife habitat, and these types of wildlife habitats are limited within the region (see section 4.5). It is found within Douglas and Jackson \Counties.

The Grass-shrub-sapling or Regenerating Young Forest type is characteristic of successional conditions following timber harvest, which can include ground scarification and slash/large woody debris, a variety of shrubs and forbs typical of the area, and then conifer saplings which form a continuous canopy above the shrub layer (Kagan et al. 1999). It is found within Coos, Douglas, Jackson, and Klamath Counties.

The Western Juniper Woodland type is dominated by western juniper (*Juniperus occidentalis*) and has an open canopy (less than 30 percent crown closure) and single story, short stature (6 to 20 feet tall) trees. Understory vegetation is dominated by sagebrush species, such as big sagebrush (*Artemisia tridentata*), rigid sagebrush (*Artemisia rigida*), and low sagebrush (*Artemisia arbuscula*), as well as mountain mahogany (*Cercocarpus ledifolius*), bitterbrush (*Purshia tridentata*), and rabbitbrush (*Ericameria* ssp.; *Chrysothamnus* spp.). Grasses characterize the herbaceous layer. This woodland type is found at a wide range of elevations (Kagan et al. 1999) within Klamath County.

The Ponderosa Pine/Western Juniper and Woodland type is typically found in the foothill margins bordering upland conifer types and sagebrush dominant lowlands. This forest type has a two-story canopy with widely spaced overstory ponderosa pine and a subcanopy of western juniper. Canopy cover is generally between 10 and 50 percent. The understory is dominated by a shrub layer, including big sagebrush, low sagebrush, rabbitbrush, mountain mahogany, and bitterbrush, and is interspersed with non-native grasses (typically in areas that are overgrazed) and native bunchgrasses (Kagan et al. 1999). It is found within Klamath County.

Late Successional and Old-growth Forest

Many of the forested and woodland vegetation types discussed above include areas that contain late-successional and mature old-growth vegetation (i.e., old-growth forests). Historic logging practices within the Pacific Northwest have dramatically reduced the size and health of old-growth forests. There is no single definition of old growth and multiple definitions have been used, depending on the forest type (deciduous or evergreen) being considered and the agency/organization managing the land. The NWFP defines old growth as "(a) forest stand usually at least 180 to 220 years old with moderate to high canopy closure; a multilayered, multi species canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground" (FEMAT 1993). In addition, old-growth forests typically contain moderate-to-high accumulations of nonvascular vegetation such as fungi, lichens, and bryophytes (Forest Service and BLM 1994b).

LSOG forests west of the Cascade Range typically consist of old large overstory trees, such as Douglas-fir and western hemlock, multiple tree canopy levels, shade-tolerant tree species in the understory, large course woody debris and snags, a lush understory shrub layer, and infrequent stand replacement fire events (BLM 2008a, ODFW 2016a). The drier LSOG forests of eastern and southwest Oregon generally contain widely spaced or small groups of large overstory trees, such as ponderosa pine, with a more open grassy understory maintained by frequent low-intensity fire (BLM 2008a).

LSOG forests provide vital habitat for many native plant and animal species, including many federally-listed threatened or endangered species (Forest Service and BLM 1994b). Bird species that are obligates of old-growth forests include the federally threatened northern spotted owl and marbled murrelet (see section 4.6). LSOG forests have been greatly reduced in size and connectivity, which impacts plant and wildlife species adapted to LSOG conditions and/or wildlife species with limited ability to travel over long distances to find new suitable areas (ODFW 2016a). Additionally, many of the species supported by LSOG forests require large patches of older or mature forests to survive and may be sensitive to changes in the seral stage of the forest (ODFW 2016a). LSOG forests also provide a variety of other environmental services, including clean water, carbon sequestration, and a variety of recreational opportunities (BLM 2008a). Additionally, the complexity of LSOG forests increases the resiliency of these forest to disturbance (BLM 2008a). The loss of LSOG forests since 1850 in the Coast Range, West Cascades, and Klamath Mountains ecoregions of Oregon is estimated to be almost 90 percent (ODFW 2016a).

4.4.2.2 Shrubland Vegetation

The Sagebrush Steppe vegetation type is a mosaic of grasses (mostly introduced) and shrubs that include sagebrush subspecies, such as Wyoming (*Artemisia tridentata* ssp. *wyomingensis*), basin (*A. tridentata* ssp. *tridentata*), and mountain (*A. tridentata* ssp. *vaseyana*). Other shrubs include low, silver, and three-tip sagebrush, and rabbitbrush. A variety of bunchgrasses are scattered with the shrubs, although overgrazing has limited their presence (Kagan et al. 1999). Sagebrush steppe vegetation is a valuable natural resource and many species of wildlife (including ungulates, birds, reptiles, and invertebrates) rely on sagebrush steppe vegetation (Monsen and Shaw 2000; FWS 2014a). Vast areas of sagebrush steppe vegetation have been altered or lost through grazing, agriculture or other development, conversion to non-native annual or perennial grasslands through artificial seeding or invasion of annual grasses, and wildfire; and sagebrush steppe is now considered one of the most imperiled ecosystems in the United States (Monsen and Shaw 2000; FWS 2014a). Sagebrush steppe is found within Klamath County.

The Shrublands vegetation type consists of a mosaic of grasses and shrubs. It may include sagebrush but is not dominated by this species and species composition can vary greatly based on location along the pipeline. Common shrubs may include rabbitbrush (*Ericameria nauseosa* and *Chrysothamnus viscidiflorus*), bitterbrush, and manazanita (*Arctostaphylos* spp.) east of the Cascades. West of the Cascades native shrubs may include salmonberry, thimbleberry, as well as non-native shrubs including Scotch broom. It typically occurs within revegetated utility corridors and transitional areas, such as reclaimed industrial sites. It is located within Coos, Douglas, Jackson, and Klamath counties.

4.4.2.3 Herbaceous Vegetation

Grasslands (west of Cascades) are found at lower elevations and contain less than 30 percent tree or shrub cover and is generally used for livestock grazing. Native-dominated sites consist primarily of bunchgrasses, with mosses, lichens, and native forbs occurring throughout. Native westside grasslands (i.e., native prairie) have largely been disturbed through grazing activities and are typically vegetated with a mix of native and non-native perennial and annual grasses and forbs. Patches of native remnant prairie still occur, but their distribution is limited. It is found within Coos, Douglas, and Jackson Counties.

Grasslands (east of Cascades) contain a mosaic of various bunchgrasses, typically dominated by Idaho fescue (*Festuca idahoensis*). Other co-dominant grass species include bluebunch wheatgrass (*Pseudoroegneria spicata*), junegrass (*Koeleria* spp.), Sandberg bluegrass (*Poa secunda*), and western needlegrass (*Achnatherum occidentale*). In heavily grazed stands, cheatgrass (*Bromus tectorum*) and bottlebrush squirreltail (*Elymus elymoides* ssp. *elymoides*) can be dominant. This vegetation type is found at low to middle elevations (Kagan et al. 1999) within Klamath County.

Agricultural vegetation includes crop land, orchards, hay fields, and managed pastures. These areas consist of lands that have been cleared of native vegetation and modified for growing crops.

4.4.2.4 General Impacts on Vegetation

Constructing the pipeline would impact approximately 4,176 acres of vegetation (table 4.4.2.4-1). Operating the pipeline would permanently impact approximately 786 acres of vegetation (table 4.4.2.4-2). Permanent impacts would occur in association with aboveground facilities, new permanent access roads, and areas of road improvements. In these locations, vegetation would be removed during construction and the areas would not be revegetated during restoration. Permanent impacts would also occur within the 30-foot-wide operational right-of-way maintenance corridor. While this corridor would be revegetated following construction, it would be maintained in an herbaceous and/or low-growing shrub state during the life of the pipeline. Finally, the clearing of mature forested vegetation is also a permanent impact because restoration to preconstruction conditions would not happen during the life of the Project.

As indicated in tables 4.4.2.4-1 and 4.4.2.4-2, constructing and operating the pipeline would require the temporary and permanent clearing of vegetation, including clearing of unique or sensitive vegetation (i.e., LSOG forest, native prairie grasslands, and sagebrush steppe). Removal of vegetation would increase the potential for soil erosion, edge effects, and introduction and spread of noxious weeds and invasive species, and would reduce the amount of available wildlife habitat. The degree of impact depends on the type and amount of vegetation affected, the rate of vegetation regeneration following construction, and the frequency of vegetation maintenance conducted within the 30-foot-wide maintenance corridor within the operational pipeline easement. Additionally, site-specific conditions, such as grazing, precipitation, soil type, and presence of noxious weeds and invasive plants, would influence the length of time required to achieve successful revegetation. Clearing of agricultural and grassland areas would be considered a short-term impact because revegetation of these areas would typically occur within three growing seasons. Clearing of forested and shrubland areas would be considered a long-term impact because affected areas would not resemble adjacent undisturbed areas for many years to many decades; and, as stated above, clearing of mature forests (e.g., LSOG forest) would be considered a permanent impact.

Additional long-term impacts would include the cutting of danger trees or hazard trees, which are defined as trees located outside approved construction areas that are at risk of falling on workers or vehicles and thus would need to be removed. The removal of these trees would result in an additional long-term impact on adjacent vegetation. The extent or existence of danger trees would be identified, to the extent possible, following creation of the construction right-of-way, TEWAs, new access roads, and on roads that have not triggered land-managing agency danger tree removal due to limited road use. Pacific Connector would compensate the respective land manager/owner for any merchantable danger trees that are felled. Danger trees are discussed further in section 4.7.2.5 of this EIS.

TABLE 4.4.2.4-1

Construction Impacts on Vegetation by the Pacific Connector Pipeline Project (acres)

General Vegetation Type	Mapped Vegetation Type	Forest Stand by Age a/	Pipeline Facilities: Construction ROW	Temporary Extra Work Areas	Uncleared Storage Areas	Rock Source/ Disposal	Access Roads (TARs/PARs/ Improvements) b/	Pipe Yards	Aboveground Facilities - Klamath Compressor Station c/	Subtotals: Subtotal Late Successional – Old Growth	Subtotal Mid-Seral	Subtotal Clearcut or Regenerating	Subtotal by Vegetation Type	*Percent of Total Vegetation Impacted*
Forest-Woodland	Douglas-fir-W. Hemlock-W. Redcedar Forest	L-O	25	2	5	1	0	0	0					
		M-S	47	14	8	1	0	0	0	33	70	216	318	*7.6*
		C-R	130	61	22	4	<1	0	0					
	Douglas-fir – Mixed Deciduous Forest	L-O	67	18	75	0	<1	0	0					
		M-S	157	37	93	0	<1	<1	0	160	287	255	701	*16.8*
		C-R	98	42	115	0	<1	0	0					
	Alder-Cottonwood	L-O	0	0	0	0	0	0	0					
		M-S	<1	<1	0	0	<1	0	0	0	<1	0	<1	*<0.1*
		C-R	0	0	0	0	0	0	0					
	Mixed Conifer/Mixed Deciduous Forest	L-O	21	5	9	0	0	0	0					
		M-S	52	13	12	0	0	0	0	35	77	167	279	*6.7*
		C-R	109	35	23	0	<1	0	0					
	Shasta Red Fir – Mountain Hemlock Forest	L-O	17	1	8	0	0	0	0					
		M-S	9	1	5	0	0	0	0	26	14	72	113	*2.7*
		C-R	41	16	15	0	<1	0	0					
	Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest	L-O	8	2	7	0	0	0	0					
		M-S	11	3	7	0	0	0	0	17	21	5	43	*0.9*
		C-R	4	<1	1	0	0	0	0					
	Douglas-fir Dominant-Mixed Conifer Forest	L-O	252	45	108	1	<1	0	0					
		M-S	92	32	25	<1	<1	0	0	405	149	349	904	*21.6*
		C-R	206	62	81	0	<1	0	0					
	Ponderosa Pine/White Oak Forest and Woodland	L-O	38	14	4	0	0	0	0					
		M-S	26	8	1	0	0	0	0	55	36	35	126	*3.0*
		C-R	21	6	8	0	0	0	0					
	Ponderosa Pine Forest and Woodland	L-O	11	2	0	0	0	0	0					
		M-S	32	2	0	<1	0	0	0	13	35	46	94	*2.3*
		C-R	36	9	<1	1	0	0	0					
	Oregon White Oak Forest	L-O	26	9	4	0	0	0	0					
		M-S	25	7	2	0	<1	0	0	39	34	0	73	*1.7*
		C-R	0	0	0	0	0	0	0					
	Western Juniper Woodland	L-O	2	<1	0	0	0	0	0					
		M-S	33	6	0	0	0	0	0	3	40	0	42	*1.0*
		C-R	0	0	0	0	0	0	0					

TABLE 4.4.2.4-1 (continued)

Summary of Construction-Related Disturbance to Vegetation by the Pacific Connector Pipeline Project (acres)

General Vegetation Type	Mapped Vegetation Type	Forest Stand by Age a/	Pipeline Facilities: Construction ROW	Pipeline Facilities: Temporary Extra Work Areas	Pipeline Facilities: Uncleared Storage Areas	Pipeline Facilities: Rock Source/ Disposal	Pipeline Facilities: Access Roads (TARs/PARs/ Improvements) b/	Pipeline Facilities: Pipe Yards	Pipeline Facilities: Aboveground Facilities - Klamath Compressor Station c/	Subtotals: Subtotal Late Successional – Old Growth	Subtotals: Subtotal Mid-Seral	Subtotals: Subtotal Clearcut or Regenerating	Subtotals: Subtotal by Vegetation Type	Subtotals: *Percent of Total Vegetation Impacted*
Forest - Woodland	Ponderosa Pine/Western Juniper Woodland	L-O	0	0	0	0	0	0	0	0	18	48	66	*1.6*
		M-S	16	2	0	0	0	0	0					
		C-R	42	6	0	0	0	0	0					
Subtotal Forest-Woodland by Age Class		***L-O***	***466***	***97***	***216***	***2***	***<1***	***0***	***0***	***782***	***780***	***1,193***	***2,755***	***66.0***
		M-S	***501***	***125***	***153***	***2***	***<1***	***<1***	***0***					
		C-R	***687***	***236***	***265***	***4***	***1***	***0***	***0***					
Subtotal Forest-Woodland			**1,654**	**458**	**634**	**8**	**1**	**<1**	**0**	**782 [d]**	**780**	**1,193**	**2,755**	
Percent of All Forest-Woodland			***60.0***	***16.6***	***23.0***	***0.3***	***<0.1***	***<0.1***	***0.0***	***28.4***	***28.3***	***43.3***	***100.0***	
Shrubland	Sagebrush Steppe	n/a	78	31	0	0	0	0	21	n/a	n/a	n/a	130	*3.1*
	Shrublands	n/a	123	41	11	0	<1	0	0	n/a	n/a	n/a	175	*4.2*
Subtotal Shrubland		n/a	**201**	**72**	**11**	**0**	**0**	**0**	**21**	**n/a**	**n/a**	**n/a**	**305**	***7.3***
Grassland	Grasslands (West of Cascades)	n/a	133	87	6	<1	2	148	0	n/a	n/a	n/a	377	*9.0*
	Grasslands (East of Cascades)	n/a	51	9	<1	1	0	108	0	n/a	n/a	n/a	170	*4.1*
Subtotal Grasslands			**185**	**96**	**6**	**2**	**2**	**256**	**0**	n/a	n/a	n/a	**546**	***13.1***
Wetland	Wetland	n/a	68	46	<1	0	1	1	0	n/a	n/a	n/a	115	*2.7*
Subtotal Wetland			**68**	**46**	**<1**	**0**	**1**	**1**	**0**	**n/a**	**n/a**	**n/a**	**115**	**2.7**
Agriculture	Agriculture	n/a	305	132	<1	3	1	14	0	n/a	n/a	n/a	456	*10.9*
Subtotal Agriculture			**305**	**132**	**<1**	**3**	**1**	**14**	**0**	n/a	n/a	n/a	**456**	***10.9***
Subtotal Non-Forest			**758**	**345**	**17**	**5**	**5**	**272**	**21**	**n/a**	**n/a**	**n/a**	**1,422**	***34.1***
Percent of All Non-Forest			***53.3***	***24.3***	***1.2***	***0.4***	***0.3***	***19.1***	***1.5***	***n/a***	***n/a***	***n/a***	***100.0***	
Project Total		n/a	**2,411**	**803**	**651**	**12**	**6**	**272**	**21**	**782 [d]**	**780**	**1,193**	**4,176**	
Percent of Pipeline Facilities		n/a	***57.7***	***19.2***	***15.6***	***0.3***	***0.1***	***6.5***	***0.5***	***18.7***	***18.7***	***28.6***		

General: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1").
a/ "L-O" = Late Successional and Old-Growth; "M-S" = Mid-Seral; "C-R" = Clearcut or Regenerating
b/ Road improvements will affect approximately 22.52 acres along the margins of existing access roads; all acres of disturbance have been included in vegetation type "roads."
c/ Construction disturbance associated with aboveground facilities (mainline block valves and meter stations) is included in construction ROW and/or TEWA acres of disturbance. Approximately 1.61 acres associated with communication towers is not included in this table (previously disturbed sites).
d/ Approximately 667 acres of construction-related disturbance to LSOG forests would occur on lands managed by the BLM and Forest Service.

TABLE 4.4.2.4-2

Operation Impacts on Vegetation by the Pacific Connector Pipeline Project

General Vegetation Type	Mapped Vegetation Type	Forest Stand by Age b/	Pipeline Facilities (acres a/): *30-foot-wide Maintenance Corridor*	Pipeline Facilities (acres a/): Permanent Access Roads	Pipeline Facilities (acres a/): Subtotal LSOG	Pipeline Facilities (acres a/): Subtotal Mid-Seral Forest	Pipeline Facilities (acres a/): Subtotal Clearcut / Regenerating Forest	Permanent Easement (50-foot) c/	Aboveground Facilities d/ (acres a/)	Total Operation Impacts by Vegetation Type e/
Forest-Woodland	Douglas-fir-W. Hemlock-W. Redcedar Forest	L-O	8	0				14		
		M-S	15	0	8	15	41	25	<1	**63**
		C-R	41	<1				68		
	Douglas-fir – Mixed Deciduous Forest	L-O	20	<1				34		
		M-S	50	<1	20	50	30	84	<1	**101**
		C-R	30	<1				52		
	Alder-Cottonwood	L-O	0	0				*0*		
		M-S	<1	0	0	<1	0	<1	0	**<1**
		C-R	0	0				*0*		
	Mixed Conifer/Mixed Deciduous Forest	L-O	6	0				11		
		M-S	16	0	6	16	34	27	<1	**57**
		C-R	34	<1				57		
	Shasta Red Fir – Mountain Hemlock Forest	L-O	5	0				9		
		M-S	3	0	5	3	14	5	<1	**23**
		C-R	14	<1				23		
	Douglas-fir-White Fir/Tanoak-Madrone Mixed Forest	L-O	3	0				4		
		M-S	3	0	3	3	1	6	0	**7**
		C-R	1	0				2		
	Douglas-fir Dominant-Mixed Conifer Forest	L-O	78	0				130		
		M-S	30	0	78	30	66	49	<1	**173**
		C-R	66	<1				110		
	Ponderosa Pine/White Oak Forest and Woodland	L-O	12	0				20		
		M-S	8	0	12	8	7	14	0	**27**
		C-R	7	0				11		
	Ponderosa Pine Forest and Woodland	L-O	4	0				6		
		M-S	10	0	4	10	11	17	0	**25**
		C-R	11	0				18		
	Oregon White Oak Forest	L-O	8	0				13		
		M-S	8	0	8	8	0	13	0	**16**
		C-R	0	0				0		
	Western Juniper Woodland	L-O	1	0				1		
		M-S	10	0	1	10	0	16	0	**11**
		C-R	0	0				0		
	Ponderosa Pine/Western Juniper Woodland	L-O	0	0				0		
		M-S	5	0	0	5	14	8	<1	**19**
		C-R	14	<1				23		
Subtotal Forest-Woodland by Age Class		***L-O***	**144**	**<1**				**242**	***<1***	***144***
		M-S	**158**	**<1**	**145**	**158**	**217**	**263**	***<1***	***158***
		C-R	**217**	**<1**				**364**	***1***	***218***
Subtotal Forest-Woodland			**519**	**1**	**145**	**158**	**217**	***868***	**1**	**520**

TABLE 4.4.2.4-2 (continued)

Operation Impacts on Vegetation by the Pacific Connector Pipeline Project

General Vegetation Type	Mapped Vegetation Type	Forest Stand by Age b/	Pipeline Facilities (acres a/): *30-foot-wide Maintenance Corridor*	Pipeline Facilities (acres a/): Permanent Access Roads	Pipeline Facilities (acres a/): Subtotal LSOG	Pipeline Facilities (acres a/): Subtotal Mid-Seral Forest	Pipeline Facilities (acres a/): Subtotal Clearcut / Regenerating Forest	Permanent Easement (50-foot) c/	Aboveground Facilities d/ (acres a/)	Total Operation Impacts by Vegetation Type e/
Shrubland	Sagebrush Steppe	n/a	26	0	n/a	n/a	n/a	44	21	**47**
	Shrublands	n/a	39	<1	n/a	n/a	n/a	64	<1	**39**
		Subtotal Shrubland	**65**	**<1**	n/a	n/a	n/a	***108***	**21**	**87**
Grassland	Grasslands (West of the Cascades)	n/a	43	1	n/a	n/a	n/a	72	1	**44**
	Grasslands (East of the Cascades)	n/a	16	0	n/a	n/a	n/a	27	0	**16**
		Subtotal Grassland	**59**	**1**	n/a	n/a	n/a	***99***	**1**	**61**
Wetland	Wetland	n/a	21	<1	0	<1	<1	36	0	**22**
		Subtotal Wetland	**21**	**<1**	0	**<1**	**<1**	***36***	**0**	**22**
Agriculture	Agriculture	n/a	97	<1	n/a	n/a	n/a	161	<1	**97**
		Subtotal Agriculture	**97**	**<1**	n/a	n/a	n/a	***161***	**<1**	**97**
		Subtotal Non-Forest	**241**	**2**	**n/a**	**n/a**	**n/a**	**404**	**23**	**266**
		Project Total	**760**	**2**	**145**	**160**	**218**	**1,272**	**25**	**786**

General: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as “<1”).

a/ Acres disturbed were evaluated using GIS; footprints for each component (aboveground facilities, 50-foot-wide permanent easement, and 30-foot-wide maintenance corridor) were overlaid on the digitized vegetation coverage.

b/ “L-O” = Late Successional and Old-Growth; “M-S” = Mid-Seral; “C-R” = Clearcut or Regenerating Young Forest.

c/ Shaded cells identify acres of vegetation type within the defined area but are not included in the overall Project total because: 1) only the 30-foot-wide Maintenance Corridor included within the 50-foot-wide Permanent Easement is expected to be affected during operations and maintenance activities, and 2) no additional maintenance would occur on access roads improved for construction of the Project.

d/ Aboveground facilities include block valve assemblies (BVAs), the Jordan Cove, Clarks Branch, and Klamath meter stations, and the Klamath Compressor Station.

e/ Total by Vegetation Type includes the 30-foot-wide maintenance corridor and permanent access roads, and only aboveground facilities with a meter station or compression station (mainline block valves are located within the 30-foot-wide maintenance corridor).

Acres of impacts only include impacts on vegetated areas; therefore, impacts in this table may not reflect impact values reported in other sections of this EIS. Shaded cells identify acres of vegetation type within the defined area but are not included in the overall Project total because: 1) only the 30-foot-wide Maintenance Corridor included within the 50-foot-wide Permanent Easement is expected to be affected during operations and maintenance activities, and 2) no additional maintenance would occur on access roads improved for construction of the Project.

The Pacific Connector Pipeline Project would impact approximately 130 acres of sagebrush steppe habitat. Impacts on sagebrush steppe would be long term because big sagebrush only regenerates from seed and may take 20 years or more to become reestablished (West 1988). Constructing and operating the pipeline would also impact approximately 782 acres of LSOG forests, 780 acres of mid-seral forest, and 1,193 acres of clearcut/regenerating forests.

Throughout our environmental review of this Project, we have received comments not only from the public, but from the tribes, and federal and state resource agencies expressing concern about impacts on forests, specifically “old-growth” forests. Since implementation of the NWFP in 1994, periodic monitoring of the amount, distribution, and spatial arrangement of LSOG forest within the range of the NWFP has been conducted. Based on monitoring conducted in 2012, there was approximately 6,460,900 acres of LSOG forests within the NWFP boundary in the four physiographic provinces in Oregon (Coast Range, Western Cascades, Eastern Cascades and Klamath) crossed by the pipeline (Davis et al. 2015). There have been numerous large fires in stands of LSOG forest in the Eastern Cascades and Klamath physiographic provinces since 2012; therefore, the acreage of LSOG forest within these four provinces is likely less than 6,460,900 acres. The impacts on 782 acres of LSOG forests from construction and operation of the Project would represents a loss of only 0.01 percent of the remaining LSOG forest in the four physiographic provinces crossed by the pipeline. As stated above, LSOG forests provide vital habitat for many native species of plants and wildlife, including many federally-listed threatened or endangered species, as well as providing a variety of environmental services (Forest Service and BLM 1994b; BLM 2008a). The loss of this forest vegetation would reduce the amount of habitat available to species dependent on LSOG vegetation and would potentially alter existing vegetation composition and soil and hydrologic characteristics and the ecosystem services provided by LSOG forests.

Additionally, constructing the pipeline would result in forest fragmentation and edge effects. The pipeline would fragment or “break-up” large tracts of contiguous forest and further the fragmentation of tracts broken up previously due to other forest practices (timber harvest, access roads), and other development (urban growth, agricultural development, utility corridors). Fragmentation reduces forest size and can reduce the size and increase the spatial isolation of local plant populations, including rare or endangered species (Jules et al. 1999). Fragmented forests also affect wildlife movement and its ability to successfully function as wildlife habitat (see section 4.5).

Fragmentation also results in new forest “edges” which play a crucial role in ecosystem interactions and landscape function, including the distribution of plants and animals, fire spread, vegetation structure, and wildlife habitat. New forest edges would affect microclimate factors such as wind, humidity, and light, and can lead to a change in species composition within the adjacent forest or increase invasion by invasive species. Compared to the forest interior, vegetation edges receive more direct solar radiation during the day, lose more light and heat at night, and experience less humidity. Increased solar radiation (e.g., light and heat) and wind can desiccate vegetation by increasing evapotranspiration, which can affect which species survive along the edge (typically favoring shade intolerant species) and can impact soil characteristics. The orientation of a fragment’s edge can affect the extent and magnitude of edge effects because the amount of solar radiation that falls on the newly created edge would depend on the direction it faces, its latitude, time of year and time of day, and height of trees in the area that would cast shadows on the new edge (Chen et al. 1995). Because these values constantly change temporally and spatially, the edge effects would also constantly change along the pipeline, as tree shadows would extend different distances across the right-of-way depending on the time of year or aspect of the edge. This would result as some areas would be in shade at one point in the year (reducing edge effects) and in sunlight during another portion of the year (increasing edge effects).[112]

Harper et al. (2005) reported that the mean distance of edge influence could occur up to 300 feet (approximately 100 meters); however, the study also found that the development of a sidewall of dense vegetation along the new edge can affect the overall mean distance of edge effects.. This may reduce the depth of penetration of energy and matter into the forest, shortening the length of the gradient (distance) while the magnitude of edge influence remains strong (Harper et al. 2005). In general, the greater distances were not found in the North American sites, where the influence associated with maintained clearings was less than 150 feet; however, these studies were done in boreal forests (Harper et al. 2015) which may not be directly applicable to the temperate old-growth forests in the Pacific Northwest. A study on edge influence in old-growth Douglas-fir forests in the Pacific Northwest found that the edge influence on microclimatic variables (air temperature, soil temperature, relative humidity, short-wave radiation, and wind speed) extended between 98 feet (30 meters) to more than 785 feet (240 meters) depending on the microclimatic variable (Chen et al. 1995). Additionally, Jules et al. (1999) found that the depth of edge influence on forest understory species in the Klamath ecoregion ranged from 0 feet to more than 197 feet (60 meters) depending on the species. In younger coniferous forests or mixed forests with deciduous species, edge effects compared to interior forests have been much less pronounced (Heithecker and Halpern 2007; Harper and Macdonald 2002).

Although any vegetation type can be fragmented, of the vegetation types crossed by the pipeline, forested and woodland vegetation and their associated species are likely the most sensitive to fragmentation. Existing patch size, patch isolation, and edge characteristic (i.e., the contrast or the relative difference among adjacent patches) of coniferous and/or mixed forest patches of different age classes were evaluated along the pipeline's centerline to determine the acreage of interior forests that would be fragmented and experience new edge effects. Based on this assessment, approximately 430 acres of interior forest would be affected by construction of the pipeline, while between 1,752 and 3,504 acres would be indirectly affected (i.e., would be within 50 to 100 meters of newly created edges). This includes effects on approximately 185 acres of LSOG forests, 126 acres of mid-seral forests, and 119 acres of regenerating forests, and indirect effects on approximately 1,449 acres of LSOG forest, 1,010 acres of mid-seral forests, and 1,046 acres of regenerating forests.

To reduce forest fragmentation and edge effects, Douglas-fir or western hemlock would be planted during restoration of temporary work areas, including TEWAs, in the pipeline right-of-way (except in the 30-foot-wide maintenance corridor centered on the pipe), where conifers would be removed during construction activities. By revegetating the area, the edge along the fragment would be reduced, thereby reducing the effects of fragmentation and edge effects. This reduction in edge

[112] For example, assume the 95-foot-wide pipeline construction corridor is oriented northwest to southeast at 135 degrees from north. At a location in the vicinity of the pipeline (longitude=123.0 degrees West, latitude=42.5 degrees North) on June 21, the sun would be shining from the east (azimuth ≈91.5 degrees) at 0815 (Pacific Standard Time [PST]) with solar altitude of ≈ 37.6 degrees. A tree 100 feet tall on the southwest-facing edge of the right-of-way would cast a shadow 130 feet which, given the angle and width of the right-of-way, would fall short of reaching the opposite side (northeast-facing edge) by about 5 feet. On May 21, however, the sun in the same position would have cast a shadow of about 170 feet at 0745 (PST) and on July 21 at 0800 (PST) the shadow would extend about 160 feet. In both instances, the edge opposite the eastern sun would be in shadow.

effect would take place over several decades. If 12-inch-tall Douglas-firs and western hemlocks are planted during restoration and they are not harvested later, trees of both species could, depending on site conditions, range between about 20 and 120 feet tall in 50 years. Douglas-fir and western hemlock planted adjacent to edges of clearcut and/or early regenerating stands (assuming conifers from 1 to 10 feet tall at the time of construction) would modify edges of the seral stands from hard, to soft, to no edge as they grow. As the replanted trees grow, edge contrasts would decrease, as would effects on forest interiors, because taller trees would reduce direct solar radiation and increase soil moisture and humidity along the edges of stand interiors (Chen et al. 1993; Heithecker and Halpern 2007).

The Project's proposed vegetation clearing in forested vegetation has the potential to exacerbate the rate of windthrow in adjacent forest stands. Long-term forest stand degradation due to windthrow could potentially occur in local areas along the proposed right-of-way where the route is exposed to strong winds, especially where it runs perpendicular to the direction of the prevailing wind.

UCSAs would not be cleared of vegetation during construction but would be located in areas of woodlands and dense, mature forest. Within UCSAs located in forests and woodlands, some damage to understory vegetation and minor damage to trees would occur. Trees that are damaged at the time of construction could die over time (e.g., from severed roots, damage to lateral or anchoring roots, broken tops, or damage to more than 50 percent of the circumference of the tree). In these cases, the impact would be long term, i.e., the death of a tree would be considered a long-term or permanent impact. Vegetation disturbance would generally depend on the site-specific vegetation characteristics, with younger regenerating forests being potentially more susceptible to damage such as limb breakage. To protect trees within UCSAs, Pacific Connector would implement the measures outlined in its *Leave Tree Protection Plan* (Appendix P to Pacific Connector's POD [appendix F.10 of this EIS]). After construction, Pacific Connector would assess potential tree damage within the UCSAs and would appropriately compensate the landowner for damage.

Pacific Connector would implement numerous measures to reduce impacts on vegetation and ensure successful revegetation of disturbed areas. These measures include those found in the ECRP, *Leave Tree Protection Plan*, *Integrated Pest Management Plan*, *Fire Prevention and Suppression Plan,* and the *SPCC Plan* (see the POD, appendix F.10). These measures would be applied to all lands crossed by the pipeline route. However, as part of their right-of-way grant, the Forest Service and BLM would require additional measures to reduce and mitigate impacts on vegetation, including LSOG forests, on federal lands. Measures specific to federally managed lands are addressed below in section 4.4.3.3, as well as in the *BLM and Forest Service Compensatory Mitigation Plan and Amendment* (appendix F.2) and *Late Successional Reserves Crossed by the PGCP Project* (appendix F.3).

4.4.2.5 Noxious Weeds and Invasive Species

Section 4.4.1.6 describes and defines what noxious weeds and other invasive plant species are, as well as the general effects that they can have to a system. List "T" (i.e., target species) noxious weeds that have the potential of occurring in the area of the pipeline are listed in table 4.4.2.5-1.

TABLE 4.4.2.5-1

Oregon Target Weeds (List T) Suspected within or Near the Proposed Pacific Connector Pipeline Work Area a/

Noxious Weed Common and Scientific Name	Known or Suspected Occurrences: County b/	Known or Suspected Occurrences: Forest Service Region 6 c/	Known or Suspected Occurrences: BLM Districts c/	ODA Noxious Weed Class d/
Garlic mustard *Alliaria petiolata*	Jackson (L)		MD - D	B
Plumeless thistle *Carduus acanthoides*	Douglas e/ Klamath (L)		LV – D, RO – D	A
Woolly distaff thistle *Carthamus lanatus*	Douglas (L) Jackson e/		MD – D, RO - D	A
Spotted knapweed *Centaurea stoebe* (*C. maculosa*)	Coos (L) Douglas (L) Jackson (L) Klamath (W)	UMP - D	LV – D MD - D	B
Squarrose knapweed *Centaurea virgata*	Klamath e/		LV MD - D	A
Rush skeletonweed *Chondrilla juncea*	Douglas (W) Jackson (W) Klamath (L)	FW – D RRS – D UMP - D	LV MD - D RO - D	B
Field bindweed *Convolvulus arvensis*	Coos (W) Douglas (W) Jackson (W) Klamath (W)	FW – D	CB – D, MD – D, LV – D, RO - D	B
Portuguese broom *Cytisus striatus*	Douglas (L)	UMP – D	MD – D, RO - D	B
Paterson's curse *Echium plantagineum*	Douglas (L)			A
Leafy spurge *Euphorbia esula*	Coos e/ Jackson (L) Klamath (L)	FW - D	CB – D, LV – D, MD - D	B
Orange hawkweed *Hieracium aurantiacum*	Coos (L) Klamath (L)			A
Perennial pepperweed *Lepidium latifolium*	Jackson (L) Klamath (W)	FW – D	LV - D	B
Dalmatian Toadflax *Linaria dalmatica* (*L. genista*)	Coos (L) Douglas (L) Jackson (L) Klamath (W)	FW – D UMP – D	LV – D MD - D	B
Waterprimrose *Ludwigia grandiflora* ssp. *hexapetala; L. peploides*	Jackson (L)		MD - D	B
Matgrass *Nardus stricta*	Klamath (L)		CB	A
Yellow floating heart (*Nymphoides peltata*)	Douglas (L) Jackson (L)	RRS – D UMP - D		A
Taurian thistle *Onopordum tauricum*	Klamath (L)			A
Tansy ragwort *Senecio jacobaea*	Coos (W) Douglas (W) Jackson (L) Klamath (H)	FW – D	CB – D, LV – D, MD - D, RO - D	B
Smooth cordgrass *Spartina alterniflora*	Coos (H)			A
Dense-flowered cordgrass *Spartina densiflora*	Coos (L)			A
Saltcedar *Tamarix ramosissima*	Jackson (L) Klamath (L)		LV - D	B
Gorse *Ulex europaeus*	Coos (W) Douglas (L)	RRS – D UMP – D	CB – D, MD – D, RO - D	B

a/ Source: ODA 2018a; Forest Service 2005b and 2017b; BLM 2017

b/ Letter in parenthesis indicates distribution within the county, if provided (ODA 2018a). L = Limited, W = Widespread, and H = Historic. No letter indicates county not listed on the ODA (2018a) species fact sheet

c/ Forest Service and BLM District Codes: UPM = Umpqua NF, RRS = Rogue River Siskiyou NF, FW = Fremont-Winema NF, CB =Coos Bay BLM, LV = Lakeview BLM, MD = Medford BLM, RO = Roseburg BLM. "D" indicates that it is documented in National Forest Service or BLM District but not necessarily within county crossed by the Pacific Connector pipeline.

d/ Oregon Noxious Weed List: List "A" weeds occur in small enough infestations to make eradication or containment possible or is not known to occur in Oregon but is present in neighboring states making occurrence in Oregon seem imminent. List "B" weeds are regionally abundant but may have limited distribution in some counties. List "T" weeds are selected from the "A" or "B" lists and are designated as a target species

e/ BLM District indicated that this species is found in the listed county (BLM 2017a).

In addition to the List T weeds, other weed species (e.g., non-List T species) that are also of concern could occur along the pipeline route.[113]

All Oregon State-listed noxious weeds (List A, B, and T species) documented along the pipeline route are listed in table 4.4.2.5-2. Five List T weeds, spotted knapweed, rush skeletonweed, Dalmatian toadflax, tansy ragwort, and gorse, were documented.

TABLE 4.4.2.5-2

Summary of Noxious Weeds found within the Vicinity of the Pacific Connector Pipeline Route during Surveys a/

Common Name *Scientific Name*	ODA Noxious Weed Class	ODA Target "T" Weed
Velvetleaf *Abutilon theophrasti*	B	No
Biddy-biddy *Acaena novae-zelandiae*	B	No
False brome *Brachypodium sylvaticum*	B	No
Butterfly bush *Buddleja davidii*	B	No
Musk thistle *Carduus nutans*	B	No
Meadow knapweed *Centaurea moncktonii*	B	No
Yellow starthistle *Centaurea solstitialis*	B	No
Spotted knapweed *Centaurea stoebe* (*C. maculosa*)	B	Yes
Rush skeletonweed *Chondrilla juncea*	B	Yes
Canada thistle *Cirsium arvense*	B	No
Bull thistle *Cirsium vulgare*	B	No
Houndstongue *Cynoglossum officinale*	B	No
Scotch broom *Cytisus scoparius*	B	No
Cutleaf teasel *Dipsacus laciniatus*	B	No
French broom *Genista monspessulana*	B	No
English ivy *Hedera helix*	B	No
St. Johnswort *Hypericum perforatum*	B	No
Perennial peavine *Lathyrus latifolius*	B	No
Dalmation toadflax *Linaria dalmatica (L. genista)*	B	Yes
Purple loosestrife *Lythrum salicaria*	B	No
Scotch thistle *Onopordum acanthium*	B	No
Japanese knotweed *Polygonum cuspidatum* (*Fallopia japonica*)	B	No
Sulphur cinquefoil *Potentilla recta*	B	No
Himalayan blackberry *Rubus armeniacus (R. discolor, R. procerus, R. fruticosa)*	B	No
Tansy ragwort *Senecio jacobaea*	B	Yes
Medusahead rye *Tainiatherum caput-medusae*	B	No
Gorse *Ulex europaeus*	B	Yes

a/ Documented within 100 feet of the pipeline project route.

Pacific Connector's ECRP includes measures to control noxious weeds, soil pests, and forest pathogens. In addition, Pacific Connector developed an *Integrated Pest Management Plan* (Appendix N to the POD [appendix F.10 of this EIS]), in consultation with the ODA (Butler 2017), BLM, and the Forest Service, to reduce the potential spread and infestation of weeds. This plan, applicable to all land ownerships, includes requirements for surveys to be conducted prior to construction to determine the presence of noxious weeds; determining where management or pretreatment may be necessary prior to construction to prevent the spread of noxious weeds; cleaning of construction equipment prior to moving it onto the construction right-of-way; and cleaning of vegetation clearing and grading equipment if it passes through areas where weeds have been identified. Additionally, disturbed areas would be replanted with appropriate seed mixes to

[113] All Oregon State noxious weeds that could potentially occur along the pipeline project (including List A and B species) are included in Table C.3-4 of Appendix C.3 in Resource Report 3 in Pacific Connector's September 2017 application to the FERC.

help reduce noxious weed germination. After construction, the right-of-way would be monitored and any noxious weed infestations would be controlled. Pacific Connector would also investigate noxious weed issues raised by landowners during operation of the pipeline.

To reduce the spread of noxious weeds, construction equipment would be power washed, if necessary, as determined by the EI. In addition, initial inspections of all company and construction contractor vehicles would be performed prior to being allowed on the construction right-of-way. The EI or Pacific Connector's authorized representative would be responsible for performing inspections and registering or tagging the equipment prior to being transported or moved to the right-of-way. Any equipment used within areas where noxious weeds are present (specifically those that are classified as priority A and T as well as selected B listed weeds) would be cleaned by hand, blown down with air, or pressure washed prior to leaving the site. Equipment cleaning on the right-of-way would occur in a cleaning station approved by the EI. Infested areas and cleaning stations would be mapped to ensure that these areas are monitored during construction and to ensure that weeds at these areas are controlled and not spread.

After construction, Pacific Connector would monitor the right-of-way for infestations of noxious weeds, in compliance with its *Integrated Pest Management Plan*. Targeted weed monitoring would occur in the areas where noxious weeds were identified prior to construction and were previously mapped to ensure that potential infestations do not reestablish and/or spread. Monitoring would also occur in areas along the right-of-way where equipment cleaning stations, hydrostatic dewatering sites, and other temporary project disturbances were located to ensure that infestation at these locations do not occur. If infestations occur along the right-of-way, Pacific Connector would make an assessment of the source of the infestation, the potential for the infestation to spread, and develop a treatment plan to control the infestation. Where infestations occur on federal lands, this assessment and treatment plan would be developed cooperatively with these agencies. The treatment plan would be developed using integrated weed management principles, and if herbicides are used, all applicable approvals would be obtained prior to their use including landowner approvals. Only herbicides that are approved for use on the affected lands (private, state, or federal) would be used. Herbicide treatments would not be conducted during precipitation events or when precipitation is expected within 24 hours to reduce the risk of these chemicals moving beyond the treated areas or into waterbodies. If weeds targeted for herbicide treatments are in the vicinity of sensitive sites, proper buffers would be used in order to prevent the spread of herbicides to these areas. Pacific Connector would consult with the ODA Noxious Weed Control Program or local County Weed Programs for additional support regarding noxious weed control issues that may occur during the pipeline operations. Pacific Connector would conduct follow-up inspections of all disturbed areas until revegetation is successful. If additional infestations or other invasive/noxious weed species are found, then these would be controlled and monitored as well.

4.4.2.6 Vegetation Pathogens

In Oregon, the Forest Service and ODF conduct annual aerial surveys of all forested land to determine insect and disease activity status. These surveys indicated the following insect and/or disease activity within 0.5 mile of the pipeline route: Douglas-fir beetle, fir engraver, flatheaded borer, mountain pine beetle (ponderosa and sugar pine), western pine beetle, needle cast (lodgepole pine, ponderosa pine, and Swiss), and Port Orford cedar root disease.[114] Within the pipeline Project area, the flatheaded borer, western pine beetle, and fir engraver are most prevalent. Other diseases that may occur or have potential to occur are annosus root and butt rot, laminated root rot, dwarf mistletoe, sudden oak death, and the black stain root disease. As indicated in table 4.4.2.6-1, multiple infestations of insect parasites and tree pathogens already exist along the pipeline route.

TABLE 4.4.2.6-1

Summary of Known Infestations of Insect Parasites and Tree Diseases Along the Pacific Connector Pipeline Route a/

Tree Insect or Disease	Land Ownership	Number of Incidences Along Pipeline Route	Approximate Mileposts (MP) of ROW Affected
Douglas-fir Beetle	BLM/Private/Forest Service	7	MP 32.1-32.2; MP 48.0; MP 98.4 – 102.2
Fir Engraver	BLM/Private/Forest Service	18	MP 48.3; MP 82.0 – 84.5; MP 103.9 – 113.7; MP 152.3-177.7
Flatheaded Borer	BLM/Private/Forest Service	27	MP 30.5 – 40.9; MP 50.8 – 51.1; MP 104.4 – 158.1
Laminated Root Rot	Forest Service	1	MP 154.2 – 154.5
Mountain Pine Beetle	BLM/Private/Forest Service	9	MP 112.3; MP 159.5 – 173.8; MP 224.2 – 224.9
Needle Cast	BLM/Private/Forest Service	7	MP 6.7R – 22.0; MP 161.5 – 168.7
Pine Engraver	Private	1	126.8
Port Orford Cedar Root Disease	Private	4	MP 23.1; MP 30.4 – 30.9; MP 39.65
Western Pine Beetle	BLM/Private/Forest Service	13	MP 96.9 – 97.0; MP 116.6 – 127.1; MP 139.9 – 154.0

Mileages rounded to nearest tenth of a mile.
a/ Summarized from Table 1-2 in the *Integrated Pest Management Plan* (Appendix N to the POD).
Source Data: ODF 2004 through 2017 aerial GIS data.

The introduction and/or spread of insects and diseases from construction equipment, activities, and personnel can adversely affect vegetation. Impacts include loss, reduced species fitness and diversity, and changes to habitat characteristics and subsequent wildlife use. To reduce the introduction and spread of insects and disease, Pacific Connector would implement measures described in its *Integrated Pest Management Plan*. Pacific Connector would identify/verify areas infested with forest pathogens during timber cruises prior to construction and implement minimization measures, including but not limited to cleaning equipment and vehicles upon entering/departing infested areas, applying sporax/borax on freshly cut stumps and wounds to reduce spread of root rot, and utilizing standard logging practices that reduce or prevent damage to standing trees adjacent to the pipeline.

4.4.2.7 Fire Regimes and Emergency Fire Response

Fires play a substantial role in shaping the composition and structure of vegetative communities. The pipeline would pass through numerous fire regimes. Table 4.4.2.7-1 lists the mean fire return interval (i.e., mean fire frequency in the area) as well as the total acres that have burned between 2000 and 2015 (based on existing fire data) for the fifth field watersheds crossed by the pipeline. The most notable recent fire event in the region is the Stouts Creek fire, which burned 26,452 acres in and around the pipeline project area in 2015 in the Days Creek-South Umpqua River and Elk Creek watersheds (Northwest Interagency Coordination Center 2015). Approximately 10.7 miles

[114] Table C.3-3 in Appendix C.3 of Pacific Connector's Resource Report 3 lists the location (by MP when known) of each identified pathogen near the pipeline route.

(227 acres) of the pipeline crosses the area burned by the Stouts Creek fire, generally between MP 95.5 through MP 108.8.

TABLE 4.4.2.7-1

Historic Average Fire Frequency and Extent of Acreage Burned in Watersheds Crossed by the Proposed Pacific Connector Pipeline

Ecoregion	HUC – Fifth-Field Watershed	Mean Fire Return Interval a/	Total Acres Burned (2000–2015) b/
Coast Range	Coos Bay-Frontal Pacific Ocean	126-150 Years	0
	Coquille River	81-90 Years	0
	North Fork Coquille River	151-200 Years	0
	East Fork Coquille River	126-150 Years	0
	Middle Fork Coquille River	61-70 Years	827
Klamath Mountains	Olalla Creek-Lookingglass Creek	21-25 Years	0
	Clark Branch-South Umpqua River	26-30 Years	56
	Myrtle Creek	61-70 Years	0
	Days Creek-South Umpqua River	46-50 Years	17,753
	Lower Cow Creek	41-45 Years	11,551
	Upper Cow Creek	41-45 Years	897
	Elk Creek	36-40 Years	13,504
	Trail Creek	26-30 Years	835
	Shady Cove-Rogue River	21-25 Years	48,677
	Bear Creek	21-25 Years	2,379
	Gold Hill-Rogue River	21-25 Years	1,870
	Big Butte Creek	26-30 Years	986
	Little Butte Creek	26-30 Years	3,644
Eastern Cascades Slopes and Foothills	Spencer Creek	31-35 Years	0
	John C Boyle Reservoir-Klamath River	26-30 Years	5,529
	Lake Ewauna-Klamath River	61-70 Years	26
	Mills Creek-Lost River	91-100 Years	13

a/ Data from LANDFIRE (2017).
b/ Data from BLM_Fire_History shapefile (BLM 2017b). Acres rounded to nearest whole acre.

The use of heavy equipment to construct the pipeline would increase the potential for a wildfire. Specifically, prescribed burning of slash, mowing, welding, refueling with flammable liquids, and parking vehicles with hot mufflers or tailpipes on tall dry grass would increase the risk of wildfires. A wildfire would result in additional loss of vegetation.

Certain activities associated with construction and operation of the Pacific Connector project (such as prescribed burning of slash, mowing, welding, refueling with flammable liquids, and parking vehicles with hot mufflers or tailpipes on tall dry grass) could increase the risk of wildland fires, especially if these activities occur within the fire season. Even small fires, created during these activities, could have far-reaching consequences on vegetative communities. For example, large forest fires could occur if small, low-intensity surface fires, ignited within the herbaceous or low-shrub cover maintained along the permanent right-of-way, spread to ladder fuels near forest edges, allowing access to the forest's canopy. This could trigger a high intensity crown fire that could spread to adjacent areas, away from the pipeline's route. If fire frequencies were to increase due to Project activities, vegetative communities could shift over time to a species composition more adapted to higher fire frequencies. It is also possible that the cleared right-of-way could serve as a fire break for large crown fires, thereby reducing the extent of a fire's spread; however, as discussed above, the presence of the cleared right-of-way could also increase the risk of crown fires occurring in the first place. Implementation of measures outlined in the *Fire Prevention and Suppression Plan* (Appendix K of the POD [appendix F.10 of this EIS]) would reduce the risk of fires associated with construction and operation of the Project. Additionally, this plan includes fire response procedures to be implemented in the event of a fire.

4.4.3 Environmental Consequences on Federal Lands

The Pacific Connector pipeline route would cross lands managed by federal agencies including the Forest Service, BLM, and Reclamation. The pipeline would pass through portions of federal land designations that are intended to protect vegetation or habitats: such as Riparian Reserves and LSRs. These federal land designations, as well as the effects that the pipeline would have on these areas, are addressed in section 4.7.

4.4.3.1 BLM – Forest Operations Inventory

The BLM tracks vegetation, land management treatments, and disturbance within each district during operations inventories. These data and/or attributes are then transferred to a GIS coverage called the FOI. The FOI describes and classifies forest cover (vegetation), site class, denudation cause, dominant species, understory species, treatments, age class, and stand condition (BLM 2016c).

Table I-6 in appendix I lists the acres of impact that would occur to FOIs from both construction and operation of the pipeline. As shown in table I-6, there would be approximately 893 acres of impact during construction of the pipeline to FOIs, which includes about 285 acres on the Coos Bay District (approximately 238 acres of conifer forest, 7 acres of hardwood forest, 31 acres of mixed conifer and hardwood forest, and 9 acres of non-forest/other), 316 acres on the Roseburg District (approximately 273 acres of conifer forest, 37 acres of mixed conifer and hardwood forest, and 7 acres of non-forest/other), 274 acres on the Medford District (approximately 107 acres of conifer forest, 34 acres of hardwood forest, 83 acres of mixed conifer and hardwood forest, and 50 acres of non-forest/other), and 18 acres on the Lakeview District (all conifer forest).

4.4.3.2 Forest Service – Plant Series and Plant Association Groups

The Forest Service classifies potential vegetation based on plant series, and plant association groups (PAGs). Plant series are based on the climax dominant trees of a stand (e.g., the Douglas-fir series). Plant series can be subdivided into PAGs, which are described primarily by the presence or absence of plant species, as well as the abundance of a species based on environmental variables, including soil, aspect, slope, slope position, and moisture. Not all of the three National Forests crossed by the Pacific Connector pipeline route have identified PAGs or plant series, and these unidentified areas are noted as “not in series” (Forest Service 1996a). Table I-7 lists the acres of impact that would occur on PAGs and plant series from both construction and operation of the pipeline. As shown in table I-7, there would be approximately 585 acres of impacts during construction of the pipeline on PAGs and plant series, which includes about 211 acres on the Umpqua National Forest, 276 acres on the Rogue River-Siskiyou National Forest, and 98 acres on the Fremont-Winema National Forest. White fir and Douglas-fir series would be the most heavily affected PAGs.

The following describes the seven plant series that would be crossed by the pipeline, based on GIS coverage.

Douglas-Fir Series

Douglas-fir occurs in all PAG series within elevations ranging from sea level to 5,600 feet. Usually overstory presence of Douglas-fir indicates recent ground disturbance while presence and dominance in the understory can indicate hot, dry conditions, which is characteristic of the Douglas-fir Series. Many other tree species may be present that are also tolerant of drought-like conditions, such as ponderosa pine, incense cedar, and canyon live oak (*Quercus chrysolepis*). Within Umpqua National Forest, the following shrubs/plant associations may occur within the Douglas-fir Series: poison oak (*Toxicodendron diversilobum*), canyon live oak, chinquapin, salal, and species associated with ultramafic parent materials. Potentially canyon live oak and Douglas-fir may occur on the Rogue River-Siskiyou National Forest.

Mountain Hemlock Series

In Southwest Oregon, mountain hemlock occurs at high elevations, ranging from approximately 3,950 feet to 6,690 feet in the Cascades, with cold temperatures and moderate precipitation. Associated parent material is highly variable, although pumice, andesite, and basalt are the most common. Mountain hemlock and Shasta red fir are dominant tree species in the overstory, with western white pine and Douglas-fir occasionally occurring. Within the Rogue River-Siskiyou National Forest, the Mountain Hemlock Series may be associated with grouse huckleberry (*Vacccinium scoparium*) in deep soils at higher elevations, Pacific rhododendron at lower elevations and warmer conditions, and/or with the wildflower sidebells pyrola (*Pyrola secunda*). Mountain Hemlock Series has also been documented in the Fremont-Winema National Forest.

Shasta Red Fir Series

The Shasta Red Fir Series is representative of a variety of California red fir found in southwest Oregon and northern California generally at higher elevations (4,000 to 6,900 feet) where the climate is cool and moist. Shasta red fir is typically the dominant tree in the overstory, although on warmer sites, white fir is present and, on cooler sites, mountain hemlock is present. Within the Rogue River-Siskiyou National Forest, the mountain sweet-root (*Osmorhiza berteroi*)/Shasta Red Fir Series association, which is typically located at sites with lower precipitation, may potentially be found. In the Winema National Forest, the Shasta Red Fir series is found within the Cascade Province of Southwest Oregon.

White Fir Series

This species is most abundant in southwest Oregon and will occur on a variety of sites and therefore is not specific to slope, aspect, soil type, or elevation. White Fir Series generally occurs on cool sites, with an average rainfall varying between 45 inches in drier areas of the Cascades to 102 inches near the coast. As a result of frequent disturbances, other early seral species become the dominant overstory tree in the White Fir Series, such as Douglas-fir and Shasta red fir, which are present within the Rogue River-Siskiyou National Forest. Also, dwarf Oregon-grape is common and widespread within the Series and may occur within the area crossed by the pipeline. Based on GIS coverage, white fir-Shasta red fir is crossed on the Winema National Forest.

Grand Fir Series

No specific description has been created for this series. However, based on GIS coverage, grand fir trees may be dominant within stands located in the Umpqua National Forest, with a canyon live oak association.

Jeffrey Pine Series

This species is scattered throughout Jackson and Douglas Counties and usually occurs on dry, ultramafic parent material, mainly serpentine and peridotite with high exposed gravel, surface rock, and bedrock components. As a result of the serpentine/periodotite parent material, this series is associated with many unique and rare species. This series is found within a wide elevational range, from 1,200 feet to 6,000 feet; however, most occurrences are concentrated near 2,000 feet. It can occur on all aspects and slope positions although it is most common on the southerly aspect and mid-slope position. Often Douglas-fir and incense cedar are associated with the Jeffrey Pine Series, which has an open canopy characteristic. Within the Umpqua National Forest, Jeffrey pine has the potential to occur with high grass understory coverage.

Western Hemlock Series

This plant series is known to occur in drier conditions on Umpqua National Forest, and the associations crossed by the pipeline are salal, Oregon-grape, and rhododendron. The series is associated with low to moderate elevations. Because of the frequent disturbances in southwest Oregon, the overstory of this series is generally dominated by Douglas-fir with the understory predominately western hemlock; however, within the western hemlock/salal-dwarf Oregon-grape association, both western hemlock and Douglas-fir are present in the overstory.

Lodgepole Pine Series

This plant series is widely distributed throughout forested areas of eastern Oregon, where distribution is apparently tied directly to ash and pumice deposits, mostly from Mt. Mazama. Within the area crossed by the pipeline, this series occurs within the Fremont-Winema National Forest and is associated with huckleberry and forbs within elevations between 5,000 and 5,700 feet on lower slopes and bottoms, and shrub (cool-xeric zone) at upper elevations in well-drained soils. This series tends to dominate sites that are too wet or too dry for its competitors (ponderosa pine, white fir-grand fir, Shasta red fir, or mountain hemlock).

4.4.3.3 Measures Implemented on Federally Managed Lands

Listed below are the avoidance and minimization measures that would be implemented on federally managed lands, in addition to those described above:

- Disturbed areas would be replanted to prevent noxious weed germination, and disturbed areas would be revegetated with seed mixes described in the ECRP.
- The authorized officer for the BLM or Forest Service may inspect and approve straw material used on federal lands to verify that it is certified noxious weed free. Gravel/rock used on federal lands would be from weed-free sources as well, and approved by the agencies' authorized representative.
- Pacific Connector has agreed to plant the easement with native trees/shrubs described in the ECRP. Affected riparian areas would be replanted extending 100 feet from the

streambanks on federal lands. All plantings proposed for federally administered lands must be approved by each agency's authorized representative.

- The Forest Service, BLM, and Pacific Connector are currently working together to develop projects that could be implemented in order to provide compensatory mitigation for environmental impacts on federally managed lands, as well as ensure that the Pacific Connector pipeline is consistent with the objectives of LMPs.

4.4.3.4 Noxious Weeds

Pacific Connector developed an *Integrated Pest Management Plan*, in consultation with the ODA (Butler 2017), BLM, and Forest Service, to reduce the potential spread and infestation of weeds. This plan, applicable to both public and private lands, includes requirements for surveys to be conducted prior to construction to determine the presence of noxious weeds; determining where management or pretreatment may be necessary prior to construction to prevent the spread of noxious weeds; cleaning of construction equipment prior to moving it onto the construction right-of-way; and cleaning of vegetation clearing and grading equipment if it passes through areas where weeds have been identified.

The BLM objective for weeds is Early Detection Rapid Response in order to avoid introduction or spread of noxious weeds, and to contain and/or reduce noxious weed infestations using an integrated pest management approach (e.g., chemical, mechanical, manual, and/or biological), as outlined in the BLM's multi-state Northwest Area Noxious Weed Control Program EIS (BLM 1985) and its supplements, as well as the BLM's (2010a) *Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in Oregon*. The BLM is concerned with the impacts of weeds on special areas, including LSRs (see section 4.7), and seeks to remove or control weeds that adversely affect those areas. The BLM surveys for noxious weed infestations, reports them to the ODA, and coordinates with them to reduce infestations while using methods that do not conflict with the objectives of each BLM District's RMP.

The Forest Service's objective for invasive plants and noxious weeds is similar to BLM's objectives (described above). Control of noxious weeds by the Forest Service is coordinated with state, county, and private organizations through weed control districts or coordinated resource management agreements. On NFS lands, preventive management is critical to an effective control program. The agency utilizes management direction provided in the *Pacific Northwest Region Invasive Plant Program: Preventing and Managing Invasive Plants Final Environmental Impact Statement* (Forest Service 2005b). Noxious weeds classified as target species that occur on federally managed lands are listed in table 4.4.1.6-1.

In order to prevent or limit the spread of invasive species and noxious weeds, all construction equipment would be inspected to ensure that it is clean and free of potential weed seed or propagules, prior to transporting equipment to the construction right-of-way. In addition, equipment used in areas of priority A and T listed weeds, as well as selected B listed weeds, would be cleaned by hand, blown down with air, or pressure washed prior to leaving the site, as determined necessary by the EI based on the specific weed infestation, level of infestation, and stage of growth of the weed. Because of the contiguous pattern of NFS lands crossed by the pipeline, equipment that could serve as a vector for invasive species would be inspected and cleaned at cleaning stations located at the borders of each National Forest, prior to clearing and grading activities. Because the BLM lands crossed by the Project are not contiguous and are spread out in a checkerboard pattern, it is not practical to set up inspection and cleaning stations at each entry point. However, where BLM lands are contiguous to NFS lands, cleaning stations would be located to include the adjacent BLM lands. Additionally, equipment would be inspected and cleaned at cleaning stations located adjacent to mapped noxious weed infestation areas that were identified during preconstruction surveys on federal lands and where a treatment plan has been developed in consultation with the agency authorized representative.

Additionally, equipment would be inspected and cleaned at stations located adjacent to mapped noxious weed infestation areas that were identified during pre-construction surveys on federally-managed lands. The cleaning stations would be located and approved by the EIs and authorized agency representative; these locations would also be mapped for future monitoring efforts to determine if potential infestations occur at these sites and, if they do, to ensure that appropriate control treatments are applied. The BLM has indicated that cleaning of equipment should occur when leaving noxious weed sites prior to entering BLM-managed lands regardless of land continuity. Also, monitoring efforts for weed species would be similar to those described above (for all lands), except that Pacific Connector has proposed to conduct monitoring on federally managed lands annually for a period of at least three to five years. However, the BLM and Forest Service have indicated that they would require that monitoring on federally managed lands be conducted every three to five years for the life of the Project, and that this would be a condition of the Right-of-Way Grant. Therefore, **we recommend that:**

- **<u>Prior to construction</u>, Pacific Connector should file with the Secretary a revised *Integrated Pest Management Plan*, for review and written approval by the Director of the OEP, that specifies that construction equipment would be cleaned after leaving areas of noxious weed infestations and pathogens and prior to entering BLM-managed lands regardless of contiguous land owner. The revised plan should also address BLM and Forest Service requirements related to monitoring of invasive plant species and pathogens on federally managed lands, and documentation that the revised plan was found acceptable by the BLM and Forest Service.**

4.4.3.5 Vegetative Pathogens

The existing conditions related to known occurrences of insects or pathogens are identical to the discussion presented in section 4.4.2. Insects or pathogens that have the potential to occur within the area that would be affected by the Project include Douglas-fir beetle, fir engraver, flatheaded borer, mountain pine beetle (ponderosa and sugar pine), western pine beetle, needle cast (lodgepole pine, ponderosa pine, and Swiss), Port Orford cedar root disease, annosus root and butt rot, laminated root rot, dwarf mistletoe, sudden oak death, and the black stain root disease (see section 4.4.2). The effects that could occur as well as the measures that would be implemented for the prevention of infestation by insects or pathogens on federally managed lands would be similar to those discussed in section 4.4.2, with the addition of the following:

- *Douglas-fir beetle*—No Douglas-fir down wood, 12 inches or larger in diameter, would be left in areas on NFS lands where there are known infestations of Douglas-fir beetle.
- *Port Orford cedar root disease*—All equipment entering NFS lands would comply with all Forest Service *P. lateralis* mitigation requirements. The Forest Service (Region 6) and BLM prepared management objectives for affected federally managed lands in 2004 to help control the spread of the fungus. The objectives focus on maintaining disease-

free watersheds, preventing spread through sanitation, seasonal restrictions for activities, and reestablishing Port Orford cedar using resistant and non-resistant seedlings.

- *All pathogens*—Directional tree falling would be required on all NFS lands, including areas with no known insect/disease occurrence, to prevent residual tree damage/injury and disease infection.

4.4.3.6 Wild-Harvesting of Non-Timber Forest Products

Wild-harvesting is the act of gathering food, decorative, or medicinal botanical products that grow naturally on lands not normally associated with agriculture. The non-timber forest products harvested near the pipeline route are of three categories: floral greens, edibles, and medicinals. Some of the more common of these are salal, evergreen huckleberry, swordfern (*Polystichum munitum*), and pinemat manzanita (Forest Service 2017b). This harvesting of non-timber forest products is widespread on public lands in the Pacific Northwest and can occur year-round (OPB 2006).

The Forest Service and BLM grant permits to wild-harvest for both recreational and commercial uses. Some recreational and commercial harvesters could be temporarily displaced during pipeline construction. Additionally, some of the forest products typically harvested would be removed during vegetation clearing for the Pacific Connector pipeline. However, the pipeline right-of-way and roads would also create new access into forested areas. As a result, it is possible that wild harvesting could increase as a result of the operation of the pipeline project. See section 4.9 of the EIS for a discussion of the effects of the Project on tribal wild harvests and supplemental subsistence.

4.4.4 Conclusion

Constructing the Jordan Cove LNG Project would result in about 499 acres of impacts on vegetation, including 168 acres of permanent vegetation loss. Constructing the Pacific Connector Pipeline Project would impact approximately 4,186 acres of vegetation; this amount includes a total of approximately 133 acres of sagebrush steppe and 2,750 acres of forested lands, including 773 acres of LSOG forests.

Most of the vegetation types affected by the Project are common and widespread in the vicinity of the Project. Although constructing and operating the Project would result in the loss of 773 acres of LSOG forests, this represents only a small percentage of remaining LSOG forests in Oregon. Additionally, measures listed in section 4.4.3.3, as well as in the *BLM and Forest Service Compensatory Mitigation Plan and Amendment* (appendix F.2) and *Late Successional Reserves Crossed by the PGCP Project* (appendix F.3) would reduce or mitigate impacts on LSOG forests. Therefore, based on the types and amounts of vegetation that would be affected by the Project, the measures that would be implemented to avoid, reduce, and mitigate the resulting impacts, and the presence of similar vegetation in the affected watersheds, we conclude that constructing and operating the Project would not significantly affect vegetation.

4.5 WILDLIFE AND AQUATIC RESOURCES

4.5.1 Terrestrial Wildlife

The Project would affect suitable habitat for a number of wildlife species associated with the coastal, mid-coastal, interior foothills, and mountain terrains in southern Oregon. The types of wildlife habitat affected by the Project and the wildlife species potentially located in those habitats are described below. Endangered and threatened species and other special status species are addressed in section 4.6.

4.5.1.1 Jordan Cove LNG Project

Wildlife Habitats

Characterizations of wildlife habitats potentially affected by construction of the Project are based on resource agency consultations, on-the-ground surveys, and published reports. In accordance with its Fish and Wildlife Habitat Mitigation Policy, the ODFW has established the following six classifications for habitats, based on dominant plant, soil, and water associations of value to the support and use of fish and wildlife:

- Category 1 – irreplaceable[115], essential habitat[116] that is limited;[117]
- Category 2 – essential habitat that is limited;
- Category 3 – essential habitat, or important[118] habitat that is limited;
- Category 4 – important habitat;
- Category 5 – habitat having a high potential to become essential or important habitat; and
- Category 6 – habitat that has a low potential to become essential or important habitat.

Below we discuss the habitats found in the Jordan Cove terminal tract, their vegetation cover, representative wildlife species that potentially occur, and ODFW habitat categories.

<u>Upland Habitats</u>

Uplands on the North Spit contain coastal dune forest, riparian forest, shrubs, grasslands (herbaceous), and unvegetated sand dunes (see section 4.4 for more details and descriptions). Dominant overstory for coastal dune forest include Douglas-fir, western hemlock, shore pine, Sitka spruce, and Port Orford cedar, with an understory including evergreen huckleberry, salal, bearberry, rhododendron, California wax myrtle, and manzanita. Shore pine and Sitka spruce forests constitute the habitat with the greatest structural complexity on the North Spit and support the greatest diversity of wildlife species. The trees, snags, and downed logs in coastal dune forests

[115] "Irreplaceable" means that successful in-kind habitat mitigation to replace lost habitat quantity and/or quality is not feasible within an acceptable period of time or location, or involves an unacceptable level of risk or uncertainty, depending on the habitat under consideration and the fish and wildlife species or populations that are affected. "Acceptable," for the purpose of this definition, means in a reasonable time frame to benefit the affected fish and wildlife species (OAR 635-415-0025).

[116] "Essential Habitat" means any habitat condition or set of habitat conditions that, if diminished in quality or quantity, would result in depletion of a fish or wildlife species (OAR 635-415-0025).

[117] "Limited habitat" means an amount insufficient or barely sufficient to sustain fish and wildlife populations over time (OAR 635-415-0025).

[118] "Important Habitat" means any habitat recognized as a contributor to sustaining fish and wildlife populations on a physiographic province basis over time (OAR 635-415-0025).

provide important breeding, foraging, and cover habitat for a variety of wildlife species: upland amphibians seek cover in downed logs, and many bird species, including raptors, woodpeckers, and songbirds, nest and forage in these habitats.

Coastal dune forest and riparian forest habitats are classified as Category 3 because they are "essential to wildlife" but are "not limited" (as defined by Oregon under OAR 635-415-0025). Species that depend on these habitat types include the Pacific marten (*Martes caurina*) (or coastal marten, addressed in section 4.6), bats, and some songbirds.

Herbaceous, herbaceous shrub, and shrub upland habitat types are all classified as Category 4 because they are not essential or limited, but they are still important to wildlife. The vast majority of these habitats lie on dredge spoils covered by weedy herbaceous and shrub species. Shrub species present within these habitats include young shore pine and invasive species such as Scotch broom and Himalayan blackberry. Herbaceous vegetation in these habitat types includes native species such as seashore lupine, small-head clover, and beach strawberry, together with invasive species such as European beachgrass, colonial bentgrass, and sweet vernal grass. These habitats have been extensively degraded historically, and only provide habitat for generalist species such as deer, small mammals, and a limited suite of songbirds (DEA 2014).

Open Water/ Wetland Habitats

Open water and wetland habitats on the LNG terminal site are composed of several freshwater lakes, ponds, forested and shrub wetlands, and emergent wetlands and marshes, together with the Coos Bay estuary and its associated shoreline, including mudflats. Habitats found in this environment support a rich terrestrial wildlife community, including mammals, birds, reptiles, and invertebrates; aquatic species found in these habitats are discussed below in section 4.5.2. Terrestrial wildlife species that use open water and wetland habitats (inland, estuarine, or marine) on the North Spit are generally specialized or are strongly associated with one habitat type. However, there are dozens of species that may occur in the area affected by the Project that are very well adapted to utilizing one, two, or all three of these open water and wetland habitats, as seasonal conditions warrant. Resident and migrant shorebirds congregate on the tidally inundated mudflats along the shore of Coos Bay, to forage on the invertebrates in the shallow waters and exposed mudflats, especially during low tides. Raptors known to use open water and shoreline habitats include the bald eagle (*Haliaeetus leucocephalus*), osprey (*Pandion haliaetus*), northern harrier (*Circus cyaneus*), and peregrine falcon (*Falco peregrinus*). Mammals that also forage in wetlands and near shore environments include, but are not limited to, raccoon (*Procyon lotor*), mink (*Neovison vison*), and striped skunk (*Mephitis mephitis)*.

Forested, scrub-shrub, and emergent wetlands are classified as Category 2, because they are essential for wildlife, and limited, but not irreplaceable. The access channel contains open water habitat in Coos Bay (see figure 4.5-2 in section 4.5.2). This area consists of salt marsh, eelgrass, intertidal, and subtidal habitats. Open water habitat contains both Category 2 and Category 3 habitat classifications.

Developed Habitat

Developed areas include portions of the LNG terminal site that have been substantially disturbed by previous development and industrial use, including land use activities such as demolished mill foundations/concrete pads, unvegetated cut slopes, rocked yards, paved roads, parking lots, gravel roads, concrete laydown areas, log deck storage areas, and sandy roadside areas. Developed lands have limited potential to become important or essential wildlife habitat, and therefore are classified as Category 6.

Terrestrial Animals in the Project Area

Terrestrial wildlife that may occupy the area affected by the Jordan Cove LNG Project includes mammals, birds, amphibians, reptiles, and invertebrates. Approximately 178 species of amphibians, reptiles, birds, and mammals were recorded in uplands on or adjacent to the Jordan Cove Project site (i.e., the LNG terminal facility) during surveys conducted from 2005 to 2017 in support of the Project.

Mammals

Fifty-eight mammal species are known to occur on the North Spit (BLM 2005). This includes large mammals, such as mountain lion (*Puma concolor*), Roosevelt elk (*Cervus elaphus roosevelti*), American black bear (*Ursus americanus*), and black-tailed deer (*Odocoileus hemionus*). Wildlife surveys conducted for Jordan Cove in 2005, 2006, and 2012 documented 11 mammal species in the terminal tract (LBJ 2006; SHN 2013b): American beaver (*Castor canadensis*), Roosevelt elk, Virginia opossum (*Didelphis virginiana*), North American porcupine (*Erethizon dorsatum*), mountain lion, Townsend's chipmunk (*Neotamias townsendi*), black-tailed deer, harbor seal (*Phoca vitulina*), raccoon, Douglas' squirrel (*Tamiasciurus douglasii*), and American black bear. Nine species of bats are known to occur on the North Spit (BLM 2005). While bat-specific surveys were not completed by Jordan Cove, the mosaic of habitat types in the area suggests bat presence is potentially high. Unidentified bats were observed in one of the buildings on the Roseburg Forest Products property on July 21, 2005.

Birds

Migratory birds, which include all native birds in the U.S., with the exception of upland game birds, are protected under the MBTA, as described in section 1.5.1.10. Additionally, EO 13186 was enacted, in part, to ensure that the environmental analysis of a federal action evaluates the effects of that action on migratory birds, and the federal agency and its project proponents avoid, minimize effects, conserve species, and restore and enhance migratory bird habitat. EO 13186 states that emphasis should be placed on species of concern, priority habitat, and key risk factors. In March 2011, FERC and FWS finalized an MOU to implement EO 13186. Conservation of migratory bird habitats, avoiding or minimizing take of migratory birds, and developing effective mitigation measures to restore or enhance habitats on lands affected by energy projects are included as obligatory elements in the MOU. The MOU also places emphasis on, but is not exclusive to, birds of conservation concern (BCC; FWS 2008).

The Jordan Cove LNG Project is located in the Pacific Flyway path for migratory birds and is in Bird Conservation Region (BCR) 5 as defined by FWS (2008) (note that the Pacific Connector Pipeline Project is also in BCR 9 as well, as discussed in section 4.5.1.2). Birds that are known or that likely occur along the waterway and in the LNG terminal site include seabirds, shorebirds, waterfowl, passerines (songbirds), wading birds, and raptors. The number of bird species documented on or near the North Spit of Coos Bay is 277: the BLM has documented 275 avian species in this area (BLM 2005), while LBJ Enterprises (2006) documented 151 avian species during surveys of the LNG terminal tract, including two additional species not documented by the BLM. BCC that potentially occur in the area affected by the Project are listed in table 4.5.1.1-1.

Federally- or state-listed species that are also BCC are not included below, as they are discussed in more detail in sections 4.6.1 and 4.6.2.

TABLE 4.5.1.1-1

Birds of Conservation Concern in the Project Area, Timing of Potential Occurrence, and Expected Habitat

Common Name	Scientific Name	Timing of Potential Occurrence	Expected Habitat
Allen's hummingbird	*Selasphorus sasin*	Summer	Chaparral, thickets, brushy hillsides, open coniferous woodlands, and gardens near coast
Bald eagle	*Haliaeetus leucocephalus*	year-round	Near large bodies of water
Black oystercatcher	*Haematopus bachmani*	year round	Coastal beaches, bays, and estuaries
Black swift	*Cypseloides niger*	Migration	Forages over forests and open areas
Caspian tern	*Sterna caspia*	Migration	Coastal areas
Hudsonian godwit	*Limosa haemastica*	Rare	Marshes, beaches, flooded fields, and tidal mudflats
Lesser yellowlegs	*Tringa flavipes*	Migration	Marshes, ponds, wet meadows, lakes and mudflats
Long-billed curlew	*Numenius americanus*	Winter	Fields, dry prairies, mudflats
Little willow flycatcher	*Empidonax traillii brewsteri*	Summer	Low brushy vegetation in wet areas
Marbled godwit	*Limosa fedoa* (ssp. *beringiae* only)	Winter	Beaches, mudflats, shallow pools
Olive-sided flycatcher	*Contopus cooperi*	Summer	Coniferous forests
Oregon vesper sparrow	*Pooecetes gramineus* (ssp. *affinis* only)	Very unlikely to occur in vicinity of Project	Open fields and pastures
Peregrine falcon	*Falco peregrinus*	winter/year-round	Open habitats, nests on cliffs
Purple finch	*Carpodacus purpureus*	Year-round	Wooded areas
Red knot	*Calidris canutus*	Migration	Beaches and mudflats
Rufous hummingbird	*Selasphorus rufus*	summer/migration	Coniferous forests
Short-billed dowitcher	*Limnodromus griseus*	Winter	Beaches, mudflats, shallow ponds
Western grebe	*Aechmophorus occidentalis*	Winter	Marshes, lakes, and bays
Whimbrel	*Numenius phaeopus*	Migration	Coastal marshes, beaches, rocky shores

Sources: FWS (2008); Sibley (2000); NatureServe (2009, 2013)

Seabirds

Fifteen seabird species (e.g., consisting of auklets, murres, guillemots, gulls, terns, petrels, and cormorant groups) breed along Oregon's coast (Naughton et al. 2007), with offshore rocks and islands providing critical nesting habitat and important rest-over locations. The most abundant breeding seabird in the Coos Bay region is the common murre (*Uria aalge*) followed by species from the cormorant and gull groups (Naughton et al. 2007). Seabirds depend on relatively undisturbed coastal nesting habitats and on the rich coastal waters for food (Oregon Ocean Resources Management Task Force 1991). Non-breeding seabirds also utilize the Oregon coast for resting and foraging during migration. Foraging habitat can differ by species; some species such as the sooty shearwater (*Puffinus griseus*) and the northern fulmar (*Fulmarus glacialis*) are non-breeding seabirds found primarily along the mid and outer shelf, while California gull (*Larus californicus*) and western gull (*Larus occidentalis*) are breeding seabirds that occur only in the nearshore (Oregon Ocean Resources Management Task

Force 1991). Foraging seabirds can be encountered along the LNG carrier transit route, at the terminal site, and in adjacent Coos Bay water.

Shorebirds

Coos Bay is an important area for shorebirds between San Francisco Bay and British Columbia. Key areas for migrating shorebirds include Coos Bay and the beaches and deflation plains in the Oregon Dunes National Recreation Area (ODNRA). Coos Bay's extensive eelgrass beds, productive sloughs, intertidal algal flats, and substantial tidal marshes provide valuable habitat for thousands of shorebirds. Foraging habitat for shorebirds includes inter-tidal mudflats, rocky inter-tidal areas, estuaries, salt marshes, and beaches; salt marshes are used for resting and preening. The vast majority of shorebirds are migratory and non-breeders in Coos Bay. An important exception is the western snowy plover (*Charadrius alexandrinus nivosus*), which nests on the North Spit (this species is discussed in more detail in section 4.6). Shorebirds are most likely to be encountered along the beaches of the North Spit, and in the bay along tidal mudflats, salt marshes, and other exposed estuarine habitat.

Waterfowl

Waterfowl habitat varies from ocean surf to fields and open meadows to upland streams (FWS 2007a). The southern Oregon coast provides wintering and migratory habitat for waterfowl of the Pacific Flyway. Coos Bay is recognized as an important migration and wintering waterfowl location. Waterfowl are most likely to be encountered in Coos Bay and the immediate near shore habitat. Some waterfowl such as wood duck (*Aix sponsa*) and ring-necked duck (*Aythya collaris*) may breed at or near the Project (LBJ 2006).

Passerines (Songbirds)

Breeding and foraging habitat for both migratory and resident passerines is associated with terrestrial and wetland habitat in Coos Bay. Important habitat includes coastal scrub-shrub, coastal dune forest and palustrine wetlands. In the case of swallows, human-made structures can be important structures for nesting colonies. Passerines are likely to occur in all habitats at the terminal site.

Passerines were observed during surveys of the waterway and LNG terminal. These are largely forest-nesting species. Examples of passerines detected at the LNG terminal site include olive-sided flycatcher (*Contopus cooperi*), Wilson's warbler (*Wilsonia pusilla*), orange-crowned warbler (*Vermivora celata*), and Swainson's thrush (*Catharus ustulatus*).

Wading Birds

Several wading bird species are resident in the Coos Bay area and the North Spit. Wading birds are typically colonial when nesting and therefore are sensitive to anthropogenic disturbance at breeding sites. Wading birds hunt in a variety of habitat types from fields and meadows to palustrine and estuarine wetlands. Wading birds are likely to occur in the shoreline habitats at the terminal site.

At least two historic great blue heron (*Ardea herodias*) rookeries occur close to the Jordan Cove LNG terminal site area. One rookery is located about 2,000 feet to the east of the LNG terminal site and about 300 feet from Jordan Cove Road (on both sides of Trans-Pacific Parkway) (LBJ

2006). The other historical rookery is located adjacent to the LNG terminal site on the south side of Henderson Marsh (BLM 2006a). No evidence of great blue heron breeding in the area was observed during the 2005, 2006, 2012, or 2013 surveys.

Raptors

Raptors are abundant year-round residents in Coos Bay. Fourteen species of raptor are known to occur on the North Spit (BLM 2005), and surveys conducted by LBJ (2006) detected both peregrine falcons and bald eagles near the Jordan Cove site. Coos Bay and the North Spit provide a mosaic of terrestrial, coastal, and nearshore habitat types with abundant prey for raptors. White-tailed kites (*Elanus leucurus*) were observed during 2005 surveys near Henderson Marsh. Osprey, falcons, and eagles may occur in the nearshore habitats along the waterway for LNG carrier transit and at the terminal site. Ospreys are relatively common near river estuaries and bays and nest on human-made structures including the Roseburg Forest Products facility lights. Falcons are likely to be associated with salt marsh and tidal mudflats where shorebirds are abundant.

Amphibians and Reptiles

Eleven species of amphibians (8 salamanders, 3 frogs) are known to occur on the North Spit (BLM 2005). Despite the presence of invasive non-native bullfrogs (*Lithobates catesbeianus*), two native amphibian species were observed in suitable habitat during the wildlife surveys conducted in 2005, 2006, and 2012 for the LNG terminal (LBJ 2006; SHN 2013b). The northern red-legged frog (*Rana aurora*) and northwestern salamander (*Ambystoma gracile*) are present in some wetlands within the terminal tract.

Ten species of reptiles are known to occur on the North Spit (BLM 2005), including the western pond turtle (*Actinemys marmorata*). However, the western pond turtle was not observed during wildlife surveys of the Jordan Cove LNG terminal area (LBJ 2006; SHN 2013b). Reptiles observed during Project surveys in 2005, 2006 and 2012 included the northern alligator lizard (*Elgaria coerulea*) and northwestern garter snake (*Thamnophis ordinoides*) (LBJ 2006; SHN 2013b).

Invertebrates

Inland sand dunes at the North Spit are used extensively by certain species of terrestrial insects, primarily beetles, centipedes, and millipedes. Flying insects are also common throughout the site and are fed upon heavily by barn swallows (*Hirundo rustica*) (BLM 2005).

Effects on Wildlife Habitat and Terrestrial Wildlife Species from Construction and Operation of the Jordan Cove LNG Project

Effects on Habitats

The area affected by the construction of the LNG terminal and associated facilities (including the Workforce Housing Facility, Ingram Yard, laydown areas, etc.) is presented by temporary and permanent acres of disturbance by habitat type in table 4.5.1.1-2. Temporary disturbances to upland habitat would be restored in consultation with landowners and to the extent possible using non-invasive plant species, although it could take years to many decades for shrub and forested habitats to regenerate. Other habitats, such as grassland (herbaceous) habitats, temporarily disturbed during construction would typically be restored within three years. Permanent disturbance to habitat results in these areas being converted to a developed habitat type that would be occupied by Project facilities during operations.

TABLE 4.5.1.1-2

Acres of Wildlife Habitat Types Affected by Construction and Operation of the Jordan Cove LNG Project

Area	Acres of Disturbance		Grand Total
	Temporary	Permanent	
Access and Utility Corridor a/	**5.8**	**20.9**	**26.7**
Coastal Dune Forest (Category 3)	2.7	6.9	9.6
Developed (Category 6)	0.1	4.0	4.1
Herbaceous (Category 4)	0.1	0.2	0.3
Herbaceous Shrub (Category 4)	1.0	2.9	4.0
Riparian Forest (Category 3)	<0.1	0.1	0.1
Unvegetated Sand Upland (Category 3)	1.6	6.2	7.7
Emergent Wetland (Category 2)	0.2	0.6	0.8
Scrub-Shrub Wetland (Category 2)	<0.1	<0.1	0.1
Access Channel/Pile Dike Rock Apron/Slip/MOF	**21.4**	**57.8**	**79.2**
Algae/Mud/Sand (Category 2)	0.2	5.9	6.1
Deep Subtidal (Category 3)	17.9	--	17.9
Eelgrass (Category 2)	0.1	2.1	2.2
Intertidal Unvegetated Sand (Category 2)	0.5	6.1	6.6
Salt Marsh (Category 2)	--	0.1	0.1
Shallow Subtidal (Category 3)	0.3	4.1	4.4
Coastal Dune Forest (Category 3)	--	16.8	16.8
Developed (Category 6)	0.1	2.2	2.4
Herbaceous (Category 4)	1.8	19.9	21.7
Shrub (Category 4)	0.4	0.6	1.0
APCO Sites 1 and 2 b/	**40.7**	**0.0**	**40.7**
Algae/Mud/Sand (Category 2)	0.2	--	0.2
Deep Subtidal (Category 3)	0.9	--	0.9
Eelgrass (Category 2)	<0.1	--	<0.1
Salt Marsh (Category 2)	0.1	--	0.1
Shallow Subtidal (Category 3)	<0.1	--	<0.1
Developed (Category 6)	12.2	--	12.2
Herbaceous (Category 4)	14.9	--	14.9
Herbaceous Shrub (Category 4)	9.0	--	9.0
Shrub (Category 4)	3.3	--	3.3
Ingram Yard c/	**35.3**	**82.8**	**118.1**
Coastal Dune Forest (Category 3)	27.0	45.9	72.9
Developed (Category 6)	1.5	2.8	4.4
Herbaceous (Category 4)	6.7	34.0	40.7
Shrub (Category 4)	0.1	--	0.1
IWWP/Water Utility Easements	**15.2**	**0.0**	**15.2**
Coastal Dune Forest (Category 3)	0.2	--	0.2
Developed (Category 6)	8.3	--	8.3
Herbaceous (Category 4)	6.1	--	6.1
Herbaceous Shrub (Category 4)	0.3	--	0.3
Shrub (Category 4)	0.2	--	0.2
Scrub-Shrub Wetland (Category 2)	0.1	--	0.1
Meteorological Station d/	**1.5**	**0.0**	**1.5**
Developed (Category 6)	0.6	<0.1	0.6
Herbaceous (Category 4)	0.1	<0.1	0.1
Herbaceous Shrub (Category 4)	0.7	--	0.7
Marine Waterway Modification Areas and Temporary Dredge Pipeline	**39.7**	**0.0**	**39.7**
Algae/Mud/Sand (Category 2)	<0.1	--	<0.1
Deep Subtidal (Category 3)	39.5	--	39.5
Eelgrass (Category 2)	<0.1	--	<0.1
Shallow Subtidal (Category 3)	<0.1	--	<0.1
Herbaceous (Category 4)	<0.1	--	<0.1
South Dunes Site e/	68.6	24.2	92.9
Algae/Mud/Sand (Category 2)	0.1	--	0.1
Salt Marsh (Category 2)	<0.1	--	<0.1
Coastal Dune Forest (Category 3)	2.2	0.8	3.0
Developed (Category 6)	21.2	13.8	35.0
Herbaceous (Category 4)	5.2	3.8	9.0

TABLE 4.5.1.1-2 (continued)

Acres of Wildlife Habitat Types Affected by Construction and Operation of the Jordan Cove LNG Project

Area	Acres of Disturbance		Grand Total
	Temporary	Permanent	
Herbaceous Shrub (Category 4)	35.7	3.4	39.1
Riparian Forest (Category 3)	0.9	1.4	2.4
Shrub (Category 4)	1.1	<0.1	1.3
Emergent Wetland (Category 2)	1.4	0.4	1.8
Forested Wetland (Category 2)	0.1	0.2	0.3
Scrub-Shrub Wetland (Category 2)	<0.1	--	<0.1
Open Water (Category 2)	0.7	0.2	0.9
Temporary Construction Areas f/	**157.8**	**0.0**	**157.8**
Algae/Mud/Sand (Category 2)	<0.1	--	<0.1
Intertidal Unvegetated Sand (Category 2)	<0.1	--	<0.1
Shallow Subtidal (Category 3)	<0.1	--	<0.1
Coastal Dune Forest (Category 3)	24.3	--	24.3
Developed (Category 6)	59.4	--	59.4
Herbaceous (Category 4)	46.3	--	46.3
Herbaceous Shrub (Category 4)	11.8	--	11.8
Riparian Forest (Category 3)	0.1	--	0.1
Shrub (Category 4)	3.8	--	3.8
Unvegetated Sand Upland (Category 3)	11.4	--	11.4
Emergent Wetland (Category 2)	0.5	--	0.5
Scrub-Shrub Wetland (Category 2)	0.2	--	0.2
Trans Pacific Pkwy/US 101 Intersection Widening	**5.1**	**0.0**	**5.1**
Algae/Mud/Sand (Category 2)	1.4	--	1.4
Developed (Category 6)	3.7	--	3.7
GRAND TOTAL g/	**391.1**	**185.7**	**576.9**

Note: Rows/columns may not sum correctly due to rounding.

a/ Access and Utility Corridor includes all temporary construction and permanent access roads and facilities and utilities, as well as the Fire Department (non-jurisdictional).
b/ APCO Sites 1 and 2 includes off-loading transfer platform and temporary dredge pipeline option.
c/ Ingram Yard Site includes all permanent LNG Terminal facilities. e.g., LNG tanks and liquefaction equipment, compressors, etc., and any other temporary construction facilities located on Ingram Yard.
d/ Meteorological Station includes access road.
e/ South Dunes Site includes Workforce Housing Facility, metering station, administrative building, and SORSC (non-jurisdictional), and temporary areas around the border.
f/ Temporary Construction Sites includes construction laydown/staging and off-site park & rides, i.e. Roseburg laydown site, Port laydown site, Boxcar Hill site, and Myrtlewood and Hydraulic Dredge Pipeline/Access Road from Jordan Cove Road to MOF.
g/ The acres disturbed as listed in this table includes vegetated and unvegetated upland and wetland habitats (excluding mitigation sites) and thus may differ from the total acreage disturbed as listed in other sections of this EIS, such as the vegetation section.

The primary effect on wildlife from construction and operation of the LNG terminal would be habitat modification or habitat loss. The natural habitats most important to wildlife that would be affected include forested dunes and open water/wetlands. Jordan Cove has indicated that upland habitat values lost to the construction of the LNG terminal and related facilities would be mitigated through the Panhandle, Lagoon, and North Bank mitigation sites. More details on these upland mitigation sites are provided in the *Terminal Upland Mitigation Plan* attached to the *Comprehensive Mitigation Plan*.[119] Jordan Cove has indicated that estuarine habitat values lost to the construction of the LNG terminal and related facilities would be replaced in-kind at the eelgrass and Kentuck mitigation sites. These upland and estuarine mitigation sites include:

- The Panhandle site is approximately 133 acres and is located north of Trans-Pacific Parkway. The Panhandle site is part of a larger natural area that extends north into the

[119] Attachment 27 of the *Comprehensive Mitigation Plan* filed with the FERC on August 30, 2019.

ODNRA. It contains coastal dune forest, herbaceous, shrub, unvegetated sand, wetlands, and open water habitat types. The site is in proximity to a known population of the proposed threatened coastal DPS of Pacific marten and contains habitat important to this species. The Panhandle site is home to known populations of northern red-legged frog and unique wetland types. Proposed ecological uplift includes the following actions the removal of Scotch broom from selected portions of the parcel and provide stewardship (conservation easement and management) of the entire parcel for the life of the Project.

- Approximately 113 acres of the 320-acre Lagoon site is proposed as mitigation. The Lagoon site is located adjacent to the meteorological station and contains shrub, herbaceous shrub, herbaceous, emergent wetland, and scrub-shrub wetland habitat types. The proposed ecological uplift would include burying power lines within the existing road prism and reseeding with native vegetation, and providing stewardship of the entire parcel for the life of the Project.
- The North Bank site is approximately 156 acres and is located on the north bank of the Coquille River adjacent to the Bandon Marsh National Wildlife Refuge (NWR). It contains conifer forest, stabilized sand dunes, and scrub-shrub wetland habitat types. It consists primarily of industrially logged forests providing little habitat diversity. Proposed uplift would be to implement forestry activities that provide diversity at the site and that promote progress towards a mature forest setting. Silviculture activities may include targeted thinning, snag retention and/or creation, and placement of LWD. Thinned areas would be seeded with a wildlife-friendly forage mix. During forestry activities, removal of weeds, including Scotch broom, gorse, English ivy, and blackberry, would occur to the extent practicable. The Applicant would also provide stewardship of the parcel in perpetuity.
- Eelgrass (Habitat Category 2) would be replaced by constructing an eelgrass mitigation site across the bay from the LNG terminal site, south of the runway for the Southwest Oregon Regional Airport;
- Estuarine resources (Habitat Category 2), including intertidal sand/mudflats, salt marsh, and shallow subtidal, would be mitigated by the construction of mudflat estuarine wetlands in the Kentuck project site; and
- Additional freshwater wetland resources (Habitat Category 2) disturbed by the construction of the LNG terminal would be mitigated out-of-kind at the Kentuck project site and in accordance with ODSL wetland mitigation requirements (OAR Chapter 141, Division 85 and Division 90) on neighboring North Spit property owned by Jordan Cove.

Activities associated with the ecological uplift described above could disturb wildlife. If heavy equipment is needed for silvicultural treatments, weed removal, and/or burying of power lines, wildlife could be displaced temporarily due to noise, and/or permanently due to habitat modification. However, the proposed ecological uplift is anticipated to improve habitat quality for wildlife overall and in the long term. Standard measures to avoid or minimize effects on wildlife, such as those presented in the *Comprehensive Mitigation Plan*, would also apply to actions taken at mitigation sites.

Effects on Terrestrial Wildlife Species

General Effects Applicable to All Terrestrial Wildlife

Constructing the project would temporarily and permanently affect wildlife. Impacts would include mortality if less mobile individuals are unable to avoid equipment or vehicles or cannot flee away from an oil or fuel spill. More mobile species would likely be displaced from the terminal area during active construction to adjacent similar habitats. Wildlife near the LNG terminal would also be disturbed by construction activities and noise and may move farther away.

An increased human presence and the resulting trash/waste could attract predators. However, the Project site would be kept clear of construction debris and food wastes. Covered, animal-proof receptacles would be provided in eating and break areas, parking lots, and at appropriate locations around the construction site. During construction, the site would be cleaned on a daily basis to remove any food or other debris left by construction workers. During operations, the Project site would be regularly inspected to ensure that no garbage is allowed to accumulate.

Noise associated with construction of the Project could also affect wildlife. Construction-related noise could affect animal behavior, foraging, or breeding patterns, and cause wildlife species to move away from the noise or relocate in order to avoid the disturbance. Noise from construction of the LNG terminal should be similar to typical commercial construction programs, which have noise levels averaging between 47 to 57 A-weighted decibels (dBA) when measured 2,000 feet away (H&K 1994), although pile-driving noise levels are anticipated to be greater than this at approximately 75 to 80 dBA maximum sound level (L_{max}) at 2,000 feet. Noise from construction of the terminal is discussed in detail in section 4.12.2.4. Construction of the terminal would occur over a period of about five years. Noise associated with construction would be intermittent and may be operated on two 10-hour shifts, 6 days per week, with the potential to increase to a 24/7 schedule if required. We conclude that construction noise from the terminal including pile driving may adversely affect some wildlife depending on their proximity to the terminal and each species' tolerance for increased noise; however, we are recommending that noise-related mitigation be implemented, which would reduce these noise effects (see section 4.12 of this EIS).

We received comments from the Forest Service regarding the potential for soil vibrations resulting from vibratory pile driving to adversely affect wildlife. However, vibration levels from vibratory pile drivers decrease to imperceptible levels within about 300 feet of the source, and are considered disturbing only within about 50 feet of the source (Wiss 1967). Therefore, potential soil vibrations resulting from pile driving would only affect wildlife located in direct proximity to pile driving. Species located this close to the pile-driving activities would be expected to be displaced by other construction disturbances (e.g., human presence, noise, visual disturbance as described above) before experiencing vibration disturbances.

Operating the Project would also affect wildlife. For example, an LNG carrier in transit in the waterway could strike seabirds or shorebirds, an oil or fuel leak from a ship could affect both aquatic wildlife and terrestrial wildlife near the surface of the water and along the shorelines of the navigation channel, or vessel traffic may cause shoreline erosion. Jordan Cove would encourage LNG carrier operators to implement measures that would reduce the potential for oil or fuel spills. LNG carriers have a double hull that would keep fuel and oil onboard, thereby reducing the potential for a spill. Furthermore, each LNG carrier would maintain a Shipboard Oil Pollution Emergency Plan. Further details on the potential effects of a spill are discussed in section 4.5.2.1.

Studies conducted by Jordan Cove have shown that LNG carriers transiting at slow speeds in the Coos Bay navigation channel suggests that waves created by the vessels would be within the normal magnitude of waves that naturally occur in the bay and that any increase in shoreline erosion would be minor (section 4.5.2.1).[120]

Light being emitted from the LNG terminal facility could cause wildlife to alter their behavior to either avoid areas of artificial light or be attracted to those areas. Lighting at the LNG terminal would likely include a mixture of low-power fluorescent lighting and higher intensity security lighting that would primarily be located on shore, in and adjacent to the slip. When an LNG carrier is not in the berth, the lighting would be reduced to that required for security. Other industrial facilities on the North Spit (Roseburg, Southport, DB Western) already have night lighting. Jordan Cove has proposed including hooded or cut-off fixtures in its lighting plan to reduce glare and reduce light pollution to night skies. Because Jordan Cove has not prepared and filed a lighting plan, **we recommend that:**

- **<u>Prior to construction</u>, Jordan Cove should file with the Secretary, for review and written approval by the Director of OEP, its lighting plan. The plan should include measures that will reduce lighting to the minimal levels necessary to ensure safe operation of the LNG facilities and any other measures that will be implemented to minimize lighting impacts on fish and wildlife. Along with its lighting plan, Jordan Cove should file documentation that the plan was developed in consultation with the FWS, NMFS, and ODFW. This lighting plan should also be in compliance with the lighting recommendations found in section 4.13.**

Operational noise from the Jordan Cove Project could have long-term effects on wildlife on the North Spit. We predict that operational noise from the LNG terminal would have an equivalent sound level (L_{eq}) of 49 dBA and day-night sound level (L_{dn}) of 55 dBA when measured about 0.7 miles away, at the nearby ODNRA. This compares to current ambient L_{dn} noise levels of about 55 dBA at this location (see section 4.12.2.4 of this EIS). During operation, the ODNRA would experience a noise level of 58 dBA L_{dn} (a 3 dB increase). A small portion of the ODNRA would be subjected to day-night sound levels as high as 65 dBA. The Jordan Cove Project would result in a 3 decibel (dB) or greater increase over ambient at this recreation area. We conclude that operational noise from the terminal may affect some wildlife depending on their proximity to the terminal and each species' tolerance for increased noise.

Special status species that could be affected by the Jordan Cove Project, and relevant mitigation of those effects, are discussed in section 4.6.

Effects on Mammals

The construction and operation of the LNG terminal would reduce the amount of habitat available for big game species, and vehicle traffic related to the Project would increase the potential for collisions. However, due to the amount of previous disturbance at the site, and existing industrial

[120] See *Technical Report – Draft, Volume 2 – Jordan Cove Energy Project and Pacific Connector Gas Pipeline, Coastal Engineering Modeling and Analysis*, filed by Jordan Cove as Appendix I.2 in Resource Report 2 included with its September 2017 application to the FERC.

activities in the area, we conclude that the Project would not significantly affect mammal species that currently occupy the North Spit.

Breeding and roosting sites for bats at the LNG terminal tract are limited due to the absence of typical bat habitat such as cliffs, rock outcrops, bridges, caves, and mines. Dune forest habitat is available on the LNG terminal site for those bat species that roost under bark. Removal of dune forest habitat would remove bat roosting habitat and likely displace individuals into nearby dune forest habitat (such as the ODNRA immediately north of the LNG terminal site). As described below under Effects on Birds, vegetation clearing at the LNG terminal would be conducted prior to March 1 or after August 31 where possible to minimize effects to nesting birds, which would also minimize effects to roosting bats during the pupping season, if present. A meteorological station on the North Spit would pose a collision risk for bats, especially if guy-lines are required for operation. As with other mammals, we conclude that the Project would not significantly affect bat species.

Effects on Birds

Migratory bird species would likely experience disturbance due to the construction and operation of the Jordan Cove Project. Effects on birds would most likely be related to modification of habitat. However, areas affected by the Jordan Cove Project are relatively small in comparison to the total habitat available in Coos Bay, and in the larger BCR 5. Effects on migratory birds from both jurisdictional and non-jurisdictional facilities are included in this analysis.

Nesting habitat for migratory birds occurs in areas that would be cleared for the LNG terminal and related facilities. The Project would alter and disturb breeding and non-breeding habitat and could affect prey species. The removal of coastal dune forest, grasslands (herbaceous), and shrublands (herbaceous shrubs and shrubs) could affect nesting and foraging opportunities for songbirds and raptors that occupy upland habitats. The effect of the construction of the slip and access channel, pile dike rock apron, and MOF on wetlands would be the permanent loss of intertidal, shallow subtidal, and eelgrass. These are all habitats utilized by seabirds, waterfowl, wading birds, and shorebirds. The loss of wetland habitat would be offset by the creation of in-kind mitigation areas proposed by Jordan Cove at the Kentuck project and Eelgrass Mitigation site.

The Eelgrass Mitigation site could attract birds to the area, including species groups identified as potentially hazardous to aircraft such as ducks, geese, herons, and gulls (FAA 2007). The use of this site by birds could affect operations at the Southwest Oregon Regional Airport. However, Coos Bay currently contains extensive eelgrass beds (approximately 1,400 acres), and the Eelgrass Mitigation site and airport are currently surrounded by existing eelgrass beds. Therefore, it is not expected that these mitigation efforts would substantially alter the composition of wildlife in the area or affect airport operations. Similarly, placement of dredge material at the APCO Site could attract birds to the area, especially those associated with sand dunes. However, sand dunes are not limited on the landscape and the APCO Site would be stabilized using American dune grass or other appropriate measures in consultation with the FWS. As described in section 4.4, the APCO Site is currently dominated by European beachgrass and disturbed vegetation types. Therefore, dredge disposal at the APCO Site would not substantially alter the composition of wildlife in the area or affect airport operations. Table 4.5.1.1-2 presents the acreage of upland and wetland habitat disturbed during construction.

The great blue heron rookery located 2,000 feet east of the LNG terminal site and 300 feet from the Jordan Cove Road would be subject to potential disturbance from construction noise from pile driving at the LNG terminal, as well as noise from construction traffic using Jordan Cove Road. Pile-driving noise levels at the LNG terminal are anticipated to be approximately 75-80 dBA L_{max} at 2,000 feet, and could occur during any time of year. The rookery is currently subject to noise from truck traffic delivering chips to the Roseburg wood chip export facility. Similarly, the historic rookery on the south side of Henderson Marsh could be affected by construction noise if the rookery was active during site construction. Jordan Cove would conduct spring status assessments annually of both great blue heron rookeries, as reuse by this species could occur. If biologists from other agencies (such as ODFW and BLM) conduct rookery surveys on the North Spit, Jordan Cove may use the results of these agency surveys. If either rookery becomes active, Jordan Cove, in consultation with ODFW, would develop an appropriate mitigation plan.

During operation of the Project, birds would be at risk of colliding with terminal facilities, including the LNG storage tanks and meteorological station. This risk is expected to be low given the visibility of most facilities, but could increase during storms, dense fog, at night, or at other times with reduced visibility. The meteorological station would be less visible than the terminal facilities and storage tanks and would likely pose a greater collision risk for birds that utilize beach and dunes habitat than the other facilities. If guy-lines would be required for operation of the meteorological station, they would be outfitted with bird deterrent measures to reduce the likelihood of bird strikes.

The facilities would be well lit at night, which could attract birds. There is some evidence that high intensity continuous anti-collision lights on structures may result in an increased number of bird strikes, especially at night or during fog and overcast conditions. The number of strikes can apparently be reduced by strobe or blinking the anti-collision lights. The LNG storage tanks would not be illuminated with high-intensity lighting. The intensity and number of lights would be limited to what is required for security and operations. Use of low-intensity lighting should reduce the likelihood of adverse effects on birds from collision with the LNG storage tanks compared to use of high intensity lighting. Jordan Cove would also implement measures through a lighting plan that would minimize effects on birds from terminal lighting. However, Jordan Cove has not developed its final lighting plan. Therefore, we are recommending that Jordan Cove produce a final lighting plan prior to construction, for our review and approval that outlines measures to be implemented to ensure that facility lighting would not have major effects on birds and other wildlife.

Similar to lighting, birds can be drawn to the terminal flares. For example, some 7,500 songbirds were killed in September 2013 when they flew into the 30-meter-tall flare at the Canaport LNG import terminal in Saint John, New Brunswick, Canada (CBC News 2013). The flares at the LNG terminal are unlikely to have a similar adverse effect on birds due to design features. These flares would be lower in height and only be used for temporary periods, such as during start-up and shutdown, maintenance, and in response to unplanned pressure changes in the system to maintain safe operations. We received a comment on the draft EIS requesting that we identify additional measures that would be implemented to limit effects of flares on birds. We considered potential minimization measures that have been applied in other areas (e.g., audible warning systems); however, it was determined that additional measures would not be necessary because of the nature of the ground flaring system proposed for the Project and the limited effects that this system has on avian species.

Birds would also be at risk of colliding with LNG carriers in the waterway during operation of the terminal. Although the annual ship traffic would increase due to the Project, LNG carriers in the navigation channel would be traveling slowly and escorted by tugboats, and operate in compliance with Coast Guard as well as Oregon State requirements. Therefore, we conclude that LNG carrier marine traffic in the waterway would not significantly affect birds.

Jordan Cove proposes to implement various measures to avoid, minimize, and in some instances mitigate, effects on birds and their local habitats. All vegetation clearing at the LNG terminal would be conducted prior to March 1 or after August 31 to ensure most nesting birds have fledged. If construction activities must occur during the nesting season, Jordan Cove would conduct focused pre-construction surveys to determine if there are active migratory bird nests present that need to be avoided. The surveys would be conducted within the construction limits and within 100 feet (200 feet for raptors) of the construction limits. If active nests are encountered within the limits of the survey, construction and vegetation removal activities would be halted in the immediate vicinity (to approximately 20 feet away) until a qualified biologist has determined that the individuals have fledged from the nest (evacuated) or that the nest has failed from natural causes. If no active nests are encountered within the limits of the survey, construction and vegetation removal would proceed. Empty or abandoned nests would be removed; permits are not required (except for eagles and listed species) to remove an empty or abandoned nest or to remove or alter the structure the nest is built in or on (FWS 2003a, 2013a). Jordan Cove would coordinate with the FWS prior to proceeding with construction, and any consultation exchange with the FWS would be provided to the FERC. Further description of avoidance, minimization, and mitigation measures is provided in the draft *Migratory Bird Conservation Plan* filed with FERC on August 31, 2018.

Structures associated with the Project would be monitored to discourage use by avian predator species. Frequent inspections would ensure that nests are not being constructed and all nests found would be removed immediately, before birds could lay eggs. It is anticipated that there would be sufficient inspections and other activities mandated by safety and security requirements to keep the structures nest free. However, in the unlikely event that a nest becomes established and it is not discovered until eggs or young birds are present, the disposition of the nest would be handled in accordance with the provisions of the MBTA in consultation with the FWS. The FWS would require a special use permit if an active nest is encountered that would need to be removed, relocated, or transferred to a rehabilitation center. The Commission requires that all necessary permits be obtained prior to construction, including a Migratory Bird Special Use permit under 50 CFR section 21.27 if needed.

Additionally, in August 2018 both Jordan Cove and Pacific Connector jointly filed a draft *Migratory Bird Conservation Plan*. Both companies continue to consult with the FWS to finalize the plan and to prioritize conservation of migratory birds during construction and operation of all facilities. Therefore, we conclude that the Project would not significantly affect birds.

Effects on Amphibians and Reptiles

Potential Project-related effects on amphibians and reptiles would include mortality from construction if they were not able to avoid equipment or traffic, and habitat loss. Fill activity in wetlands would reduce available habitat for some amphibians and reptiles. Removal of dune forest for the Project would reduce habitat for the clouded salamander (*Aneides ferreus*), should this species occur in these areas. Jordan Lake and nearby wetlands on the east side of the terminal tract may offer suitable breeding habitat for the western toad (*Anaxyrus boreas*), although the species was not found during surveys of the site.

Jordan Cove proposed to mitigate potential effects on amphibians by conducting pre-construction surveys for the western pond turtle, northern red-legged frog, and clouded salamander. Individuals located in the construction area would be captured and transported to suitable nearby habitats, as agreed to by the ODFW.

4.5.1.2 Pacific Connector Pipeline

Wildlife Habitats

Wildlife associations with habitats in the area that would be affected by the Pacific Connector Pipeline Project include the following (adapted from Johnson and O'Neil 2001):

- close association: a species is known to depend on a specific habitat for part or all of its life history requirements (feeding and reproduction) implying that the species has an essential need for a particular habitat for its maintenance and viability;
- general association: a highly adaptable species that is supported by a number of habitats that provide for its maintenance and viability; and
- present: a species that occasionally uses a habitat that provides marginal support for its maintenance and viability.

Sixteen wildlife habitat types (Johnson and O'Neil 2001) coincide with one or more of the vegetation types described for the Pacific Connector pipeline area in section 4.4.1.2. Wildlife species associations with these habitat types provide a basis for evaluating Project effects on biodiversity and in some cases, on individual species. Two additional wildlife habitat types are not specifically addressed in Johnson and O'Neil (2001) but are well represented in the area affected by the Project: Grass-Shrub-Sapling or Regenerating Young Forest and Roads. Table 4.5.1.2-1 lists the miles of each of these habitat types crossed. Westside Lowland Conifer-Hardwood Forest and Southwest Oregon Mixed Conifer-Hardwood Forest are the most abundant habitats crossed, with 60.1 and 47.1 miles crossed, respectively.

Specialized habitat features also occur within the area affected by the pipeline project. Such features include cliffs that provide nesting for peregrine falcons and possibly other raptors. Snags provide roosting locations for several bat species, and nesting locations for cavity-nesting birds. LWD is present, which could be used by reptiles and amphibians.

Grasslands and/or meadows provide habitats for animals that are adapted to areas dominated with perennial bunchgrasses and forbs. A wide variety of species use grasslands and meadows, including songbirds, amphibians, and reptiles. We estimate that the pipeline route would cross about 16.3 miles of grasslands (see table 4.5.1.2-1). Wetlands provide habitat for migrating and breeding waterfowl, shorebirds, waterbirds, songbirds, mammals, amphibians, and reptiles (ODFW 2006b). Riparian zones (including forested wetlands) support high species diversity (Johnson and O'Neil 2001). In total, the pipeline route would cross about 6 miles of wetlands and riparian habitats.[121]

[121] Following wetland regulation protocols, construction of the pipeline would initially impact 112.2 acres of wetlands. See section 4.3 for results of jurisdictional wetland delineation and discussion of Project effects on wetlands.

TABLE 4.5.1.2-1

Wildlife Habitat Types Crossed by the Pacific Connector Pipeline and Wildlife Species Associated with Habitats

General Habitat Type	Mapped Habitat Type	Late Successional or Old-Growth Forest Crossed a/,f/ (miles)	Mid-Seral Forest Crossed b/,f/ (miles)	Clearcut/ Regenerating Forest Crossed c/,f/ (miles)	Total Miles	Percent of Total Project Mileage per Habitat Type	Number of Species Associated d/
Forest-Woodland	Westside Lowland Conifer-Hardwood Forest	9.3	22.4	28.9	60.6	26.4	32 – Herpetofauna 115 – Birds 66 – Mammals
	Montane Mixed Conifer Forest	1.5	0.9	3.8	6.1	2.7	22 – Herpetofauna 95 – Birds 64 – Mammals
	Southwest Oregon Mixed Conifer-Hardwood Forest g/	22.2 (1.6)	9.0 (0.4)	18.3 (0.2)	49.5 (2.2)	21.6 (1.0)	36 – Herpetofauna 127 – Birds 65 – Mammals
	Ponderosa Pine Forest and Woodlands	4.2	5.0	4.9	14.1	6.1	31 – Herpetofauna 128 – Birds 60 – Mammals
	Westside Oak and Dry Douglas-fir Forest and Woodlands	2.2	2.1	0.0	4.4	1.9	33 - Herpetofauna 116 – Birds 65 – Mammals
	Western Juniper and Mountain Mahogany Woodlands	0.2	4.2	3.7	8.1	3.5	19 - Herpetofauna 93 – Birds 40 – Mammals
	Subtotal	**39.6**	**43.6**	**59.7**	**142.8**	**62.2**	
Grasslands Shrubland	Shrub-steppe	–	–	–	17.7	7.7	23 – Herpetofauna 76 – Birds 47 – Mammals
	Westside Grasslands	–	–	–	11.8	5.1	26 – Herpetofauna 82 – Birds 38 – Mammals
	Eastside Grasslands	–	–	–	4.5	2.0	21 – Herpetofauna 80 – Birds 47 - Mammals
	Subtotal	–	–	–	**34.1**	**14.9**	
Wetland/ Riparian e/	Westside Riparian-Wetlands/Eastside Riparian-Wetlands	–	0.1	0.1	0.3	0.1	38 – Herpetofauna 156 – Birds 78 – Mammals
	Herbaceous Wetlands	–	–	–	5.7	2.5	18 – Herpetofauna 134 – Birds 44 – Mammals
	Subtotal	–	–	–	**6.0**	**2.6**	
Agriculture	Agriculture, Pastures, and Mixed Environs	–	–	–	26.5	11.6	34 – Herpetofauna 181 – Birds 78 – Mammals
	Subtotal	–	–	–	**26.5**	**11.6**	

TABLE 4.5.1.2-1 (continued)

Wildlife Habitat Types Crossed by the Pacific Connector Pipeline and Wildlife Species Associated with Habitats

General Habitat Type	Mapped Habitat Type	Late Successional or Old-Growth Forest Crossed a/,f/ (miles)	Mid-Seral Forest Crossed b/,f/ (miles)	Clearcut/ Regenerating Forest Crossed c/,f/ (miles)	Total Miles	Percent of Total Project Mileage per Habitat Type	Number of Species Associated d/
Developed/ Altered	Urban and Mixed Environs	–	–	–	2.2	1.0	37 – Herpetofauna 133 – Birds 64 – Mammals
	Roads				14.5	6.3	
	Subtotal				**16.7**	**7.3**	
Barren	Coastal Dunes and Beaches	–	–	–	<0.1	<0.1	8 – Herpetofauna 103 – Birds 26 – Mammals
	Subtotal	–	–	–	**<0.1**	**<0.1**	
Open Water	Open Water - Lakes, Rivers, and Streams	–	–	–	0.9	0.4	17 – Herpetofauna 95 – Birds 20 – Mammals
	Bays and Estuaries	–	–	–	2.4	1.0	1 – Herpetofauna 132 – Birds 12 – Mammals
	Subtotal	–	–	–	**3.3**	**1.4**	
	Project Total	**39.6**	**43.7**	**59.7**	**229.4**	**100.0**	

Note: Mileages rounded to nearest tenth of a mile; values less than 0.1 miles shown as "<0.1". Rows/columns may not sum correctly due to rounding.

a/ Late Successional (80 to 175 years) and Old-Growth Forest (175 + years).
b/ Mid-Seral Forest (40 to 80 years).
c/ Clearcut (0 to 5 years) and Regenerating Forest (5 to 40 years).
d/ Numbers of species associated with each habitat type crossed by the Pacific Connector Project were summarized from Pacific Connector's Environmental Resource Report 3, Appendix 3D, Table 3D-1.
e/ Following wetland regulation protocols, construction of the pipeline would initially affect 114.1 acres of wetlands. See section 4.3 for results of jurisdictional wetland delineation and discussion of Project effects on wetlands.
f/ Cells with no data result from the fact that non-forested habitat types did not identify seral stage; thus, miles are identified only in the "total miles" column.
g/ Distances in parentheses indicate crossing through recently burned Southwest Oregon Mixed Conifer-Hardwood Forest.

The pipeline route would cross about 142 miles of woodlands and forest habitats. Deciduous hardwood species, such as oak and tanoak, occur in the area affected by the pipeline project. Mixed coniferous and deciduous forests, deciduous-dominated riparian areas, and oak woodlands are found most often in Douglas and Jackson Counties. In Coos County, many of the historical deciduous woodlands have been reduced as a result of conifer plantings and changes in fire frequency and intensity, as well as conversion to agricultural and residential uses. A wide variety of species use deciduous and young conifer forest habitats, including songbirds, reptiles, and small mammals.

Mid-seral (greater than 40 years old), late successional (80 to 175 years old), and old-growth (greater than 175 years old) forests are unique, important habitat elements. Tree species common in mid-seral to old-growth forests are western hemlock, Douglas-fir, western redcedar, Sitka spruce, red alder, and bigleaf maple (Chappell et al. 2001). Bird species that are obligates of old-growth forests include the federally threatened NSO and MAMU (further discussed in section 4.6).

Terrestrial Animals in the Project Area

The areas crossed by the Pacific Connector pipeline route provide diverse habitats for wildlife, including forests, shrublands, and grasslands. These habitats support an array of wildlife species. Overall, 47 amphibian and reptile, 281 bird, and 108 mammal species are known or suspected to occur in the area affected by the Project.

Mammals

Based on their distributions in southwestern Oregon and habitat associations described by Johnson and O'Neil (2001), 108 species of mammals may be present in habitats that coincide with and/or are adjacent to the Pacific Connector pipeline. The most numerous groups likely to occur are rodents (46 species, such as Baird's shrew [*Sorex bairdi*], coast mole [*Scapanus orarius*], least chipmunk [*Tamias minimus*], and Douglas' squirrel), carnivores (19 species, such as coyote [*Canis latrans*], gray fox [*Urocyon cinereoargenteus*], black bear, and mink), and bats (13 species; see subsection below). Mammal species with special state or federal status are discussed in section 4.6.

The highest diversity of mammals can be expected in the Johnson and O'Neil (2001) Agriculture, Pastures, and Mixed Environs habitat and Eastside and Westside Riparian-Wetlands habitat (78 species, respectively). Mammalian species diversity is also relatively high in Westside Lowland Conifer-Hardwood-Forest (66 species), Southwest Oregon Mixed Conifer-Hardwood Forest (65species), Westside Oak and Dry Douglas-Fir Forest and Woodlands (65), Montane Mixed Conifer Forest (64 species), as well as in Developed-Urban and Mixed Environs (64 species). The lowest species diversity of mammals is expected in Bays and Estuaries (12).

Wild Horses

The BLM and the Forest Service manage wild horses to ensure healthy herds and healthy rangelands in Oregon. The Pokegama Herd Management Area (HMA) is in the southwestern corner of Klamath County and the southeast corner of Jackson County, on both private and BLM lands in the Lakeview District. While the pipeline does not cross it, the HMA is in the general vicinity of the Project. From 1972 to 2002, the average number of horses in the HMA was 42.7, but the population has ranged from 23 to 55 horses over that time. Relative to other wild horse herds (which increase about 22 percent per year), the Pokegama herd has a low yearly increase of 4 to 5 percent. This may be due to illegal removal or mountain lion predation (BLM 2002).

Bats

A total of 15 species of bat occur in Oregon; 13 of the species potentially occur in the area affected by the Project. All of the species except for little brown myotis, big brown bat, and Brazilian free-tailed bat have some special status, whether identified by the State as sensitive, the FWS as a Species of Concern, or by the BLM or the Forest Service as a Sensitive Species. Special status species are discussed in section 4.6; special status bats are listed in table I-3 of appendix I. Uses of different habitats that may occur along the pipeline route vary between little brown myotis, big brown bat, and Brazilian free-tailed bat (table 4.5.1.2-2).

TABLE 4.5.1.2-2

Non-Special Status Bat Species and Associated Habitats Likely to Occur In the Project Area

Species	Distribution in Southern Oregon	Habitat Types	Foraging Habitat
Little brown myotis *Myotis lucifugus carissima*	Yearlong throughout Oregon	Associated with all habitats described in table 4.5.1.2-1	Forages for insects in scattered trees, along edges of dense timber, near water in shrub-grassland
Big brown bat *Eptesicus fuscus*	Yearlong throughout Oregon	Associated with all habitats described in table 4.5.1.2-1	Forages for insects over forest canopy, along roads/edges through trees, forest clearing
Brazilian free-tailed bat *Tadarida brasiliensis mexicana*	Non-migratory southern Oregon only	Westside Lowland Conifer-Hardwood Forest, Southwest Oregon Mixed Conifer-Hardwood Forest, Ponderosa Pine Forest and Woodlands, Westside Oak and Dry Douglas-fir Forest and Woodlands, Western Juniper and Mountain Mahogany Woodlands, Shrub-steppe, Westside Grasslands, Westside Riparian-Wetlands, Herbaceous Wetlands, Agriculture, Pastures, and Mixed Environs, Urban and Mixed Environs, Open Water - Lakes, Rivers, and Streams	Forages for insects in heated buildings or outside during warm spells during winter. During other periods, will forage almost anywhere from valley bottoms to Cascade / Siskiyou Mtn. crest, foraging long distances, e.g., 30+ miles round trip per night

Sources: Maser and Cross (1981), Verts and Carraway (1998), Johnson and O'Neil (2001), Weller (2008), ODFW (2013a)

All of the bat species consume insects, and most are associated with tree-dominated habitats that occur in the area affected by the pipeline project. Bats have roosts used by nursing females and young, roosts used during daylight, and hibernacula that are used to survive during winter while hibernating or in torpor. White-nose syndrome is a disease of hibernating bats, caused by a fungus that affects skin for the nose, ears, and wings of hibernating bats (USGS 2013b).

White-nose syndrome has spread from the northeastern United States to 28 states and has most recently been identified in the state of Washington in 2016; since 2006 over 6 million insect-eating bats have died from the effects of this disease. ODFW, along with other federal agencies, has been surveying caves for the disease with no positive indications that the disease is presently in Oregon bat populations (ODFW 2017b).

Birds

Based on their distributions in southwestern Oregon, 281 bird species may be present in habitats that would be crossed by the Pacific Connector pipeline (Johnson and O'Neil 2001). The highest diversity of bird species can be expected in habitats associated with agriculture, pastures, and mixed environs (181 species). Many species are also associated with riparian-wetland habitats (156 species), herbaceous wetlands (134 species), bays and estuaries (132 species), and developed-urban and mixed environs (133 species; table 4.5.1.2-1). The fewest number of bird species are associated with sagebrush shrub-steppe (76) and eastside grasslands (80).

Annual breeding bird survey (BBS) counts were used to determine additional potential bird species presence in habitats crossed by the Pacific Connector pipeline. Fewer species have been documented on BBS routes (241 species observed) than the number of species associations of wildlife habitats coinciding with the Pacific Connector Project (281 species expected). The disparity is likely due to several factors: the BBS does not usually document all of the species possibly present at the time of the survey (i.e., nocturnal owls and birds that do not sing or call regularly); species reported are present only during the season of the survey; and survey routes may not include or be representative of all habitat types crossed by the pipeline. Regardless, the BBS survey counts can be used as an index of some species' population trends over time.

The Pacific Connector pipeline crosses two BCRs: (1) BCR 5 – Northern Pacific Rainforest, from MP 0.0 to MP 168.15; and (2) BCR 9 – Great Basin, from MP 168.15 to MP 228.81. Bird species diversity and population trends in the region surrounding the Project were evaluated from data collected on 33 BBS routes that have been surveyed within 50 miles of the Project (17 routes in BCR 5, 16 routes in BCR 9). Of the 238 species observed on the BBS routes, 11 species are BCC in BCR 5 (excluding the MAMU, discussed in section 4.6) and 21 species are BCC in BCR 9. BCC in the area affected by the Pacific Connector pipeline are listed in table 4.5.1.2-3.

TABLE 4.5.1.2-3

Birds of Conservation Concern in BCR 5 and BCR 9 that Have Been Observed on BBS Routes within 50 Miles of the Pacific Connector Pipeline Project with Regional and Local Population Trends, and Breeding Dates, if Known

Common Name a/ *Scientific Name*	**Regional BCR Trend 2005 to 2015 b/**	**Local Trend 1997 to 2016 c/**	**Confirmed Breeding Dates d/**	
			Earliest	**Latest**
BCR 5, Northern Pacific Rainforest				
Pelagic cormorant *Phalacrocorax pelagicus*	No Trend	Insufficient Data	22 Mar	26 Jul
Bald eagle *Haliaeetus leucocephalus*	No Trend	Insufficient Data	8 Mar	9 Aug
Northern goshawk *Accipiter gentilis*	No Trend	Insufficient Data	10 May	9 Aug
Peregrine falcon *Falco peregrinus*	No Trend	Insufficient Data	26 Apr	26 Jul
Caspian tern *Sterna caspia*	No Trend	Insufficient Data	14 Jun	19 Jul
Rufous hummingbird *Selasphorus rufus*	Decreasing ($p<0.05$)	Increasing ($p<0.01$)	22 Mar	2 Aug
Olive-sided flycatcher *Contopus cooperi*	Decreasing ($p<0.05$)	No Trend	14 Jun	30 Aug
Willow flycatcher *Empidonax traillii*	Decreasing ($p<0.05$)	Increasing ($p<0.10$)	7 Jun	9 Aug
Horned lark e/ *Eremophila alpestris*	Decreasing ($p<0.05$)	No Data	3 May	26 Jul
Vesper sparrow f/ *Pooecetes gramineus*	No Trend	Insufficient Data	26 Apr	16 Aug
Purple finch *Carpodacus purpureus*	No Trend	Increasing ($p<0.01$)	10 May	19 Jul

TABLE 4.5.1.2-3 (continued)

Birds of Conservation Concern in BCR 5 and BCR 9 that Have Been Observed on BBS Routes within 50 Miles of the Pacific Connector Pipeline Project with Regional and Local Population Trends, and Breeding Dates, if Known

Common Name a/ *Scientific Name*	**Regional BCR Trend 2005 to 2015 b/**	**Local Trend 1997 to 2016 c/**	**Confirmed Breeding Dates d/**	
			Earliest	**Latest**
BCR 9, Great Basin				
Eared grebe *Podiceps nigricollis*	No Trend	Insufficient Data	31 May	23 Aug
Bald eagle *Haliaeetus leucocephalus*	Increasing ($p<0.05$)	No Trend	8 Mar	9 Aug
Ferruginous hawk *Buteo regalis*	No Trend	No Data	29 Mar	19 Jul
Golden eagle *Aquila chrysaetos*	No Trend	Insufficient Data	22 Feb	19 Jul
Peregrine falcon *Falco peregrinus*	No Trend	Insufficient Data	26 Apr	26 Jul
Yellow rail *Coturnicops noveboracensis*	No Analysis	Insufficient Data	7 Jun	5 Jul
Snowy plover *Charadrius alexandrinus*	No Analysis	Insufficient Data	17 May	5 Jul
Long-billed curlew *Numenius americanus*	No Trend	Insufficient Data	19 April	12 Jul
Calliope hummingbird *Stellula calliope*	No Trend	No Trend	31 May	26 Jul
Lewis's woodpecker *Melanerpes lewis*	No Trend	No Trend	24 May	23 Aug
Williamson's sapsucker *Sphyrapicus thyroideus*	No Trend	Insufficient Data	17 May	26 Jul
White-headed woodpecker *Picoides albolarvatus*	No Trend	Insufficient Data	24 May	26 Jul
Willow flycatcher *Empidonax traillii*	No Trend	Increasing ($p<0.05$)	7 Jun	9 Aug
Loggerhead shrike *Lanius ludovicianus*	No Trend	Insufficient Data	10 May	19 Jul
Pinyon jay *Gymnorhinus cyanocephalus*	No Trend	Insufficient Data	7 Jun	19 Jul
Sage thrasher *Oreoscoptes montanus*	No Trend	Insufficient Data	10 May	26 Jul
Green-tailed towhee *Pipilo chlorurus*	No Trend	No Trend	17 May	9 Aug
Brewer's sparrow *Spizella breweri*	Decreasing ($p<0.05$)	No Trend	3 May	9 Aug
Black-chinned sparrow *Spizella atrogularis*	No Analysis	No Data	No Data	No Data
Sagebrush sparrow g/ *Artemisiospiza nevadensis*	No Trend	Insufficient Data	10 May	9 Aug
Tricolored blackbird *Agelaius tricolor*	No Trend	No Trend	12 Apr	9 Aug

a/ BCC species listed by BCR in FWS (2008).
b/ Regional trend analyses available at https://www.mbr-pwrc.usgs.gov/bbs/bbs.html (Sauer et al. 2017).
c/ BBS data retrieved from https://www.pwrc.usgs.gov/bbs/RawData/ (Pardieck et al. 2017). Local population trends in each BCR were estimated from average number observed per BBS route if data were sufficient (average occurrence per route per year ≥1, average number of routes per year with species counted ≥5).
d/ Confirmed breeding dates from Oregon Breeding Bird Atlas (Adamus et al. 2001).
e/ Only applies to streaked horned lark (*Eremophila alpestris strigata)* subspecies not differentiated in data sources.
f/ Only applies to Oregon vesper sparrow (*Pooecetes gramineus affinis)* subspecies not differentiated in data sources.
g/ Sage sparrow was recently split into two species: Bell's sparrow (*Artemisiospiza belli*) and sagebrush sparrow (*Artemisiospiza nevadensis*). Sagebrush sparrows were observed within 50 miles of the pipeline in BCR 9 and are assumed to be BCC in that region.

Regional trends of BCC species in the Oregon portion of BCR 5 show that rufous hummingbird (*Selasphorus rufus*), olive-sided flycatcher, willow flycatcher (*Empidonax traillii*), and horned lark (*Eremophila alpestris*) are apparently decreasing, but local trends indicate that rufous hummingbird, willow flycatcher, and purple finch (*Carpodacus purpureus*) populations are increasing. The remaining species in BCR 5 have insufficient data or show no trend. Regional trends of BCC species in the Oregon portion of BCR 9 show bald eagle and willow flycatcher are apparently increasing and Brewer's sparrow (*Spizella breweri*) is decreasing. There are no significant trends for local populations of any BCC in BCR 9. The remaining species in BCR 9 have insufficient data or show no trend.

Many migratory bird species have been observed during the annual Christmas Bird Count (CBC), sponsored by the Audubon Society in the vicinity of the Project. At least 272 bird species (common names are reported and have not been standardized) have been counted at eight locations proximate to the area affected by the Pacific Connector Pipeline Project. While 152 bird species have been reported by both BBS and CBC, 91 species have only been reported by the CBC. The species include various seabirds (auklets, murres, guillemots, jaegers, gulls, albatrosses, shearwaters, and cormorants), waterfowl (scoters, geese, swans), and shorebirds (dowitchers, sandpipers, plovers, turnstones). The local population of common ravens (*Corvus corax*) has been increasing during the breeding period in BCR 9 and during winter on CBC count circles near the Pacific Connector pipeline.

Several raptor species are known or suspected to nest, migrate, and seasonally reside in the general vicinity of the pipeline route. Those reported for BBS routes in the region include turkey vulture (*Cathartes aura*), osprey, white-tailed kite, bald eagle, northern harrier, sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), northern goshawk (*Accipiter gentilis*), red-shouldered hawk (*Buteo lineatus*), Swainson's hawk (*Buteo swainsoni*), red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), American kestrel (*Falco sparvarius*), American peregrine falcon, and prairie falcon (*Falco mexicanus*). Several additional raptor species have only been observed during CBC surveys. Those include rough-legged hawk (*Buteo lagopus*), gyrfalcon (*Falco rusticolus*), and merlin (*Falco columbarius*). Bald eagles, northern goshawks, and peregrine falcons have nest sites within 3 miles, some much closer to the Project (data from ORBIC 2012 and 2017a; BLM 2017a; Forest Service 2017c; and pipeline surveys for the northern goshawk on Rogue River-Siskiyou National Forest). Other raptor species have been observed, some nesting, along the Project route during surveys focusing on other rare species. Bald eagles, ospreys, sharp-shinned hawks, Cooper' hawks, goshawks, golden eagles, red-shouldered hawks, red-tailed hawks, peregrine falcons, and turkey vultures have been reported during surveys in 2007 and 2008 but nest sites were not included in the documentation. Some of these raptor species have probably nested in the Project vicinity in the past.

There are also several species of owls that have been documented on BBS routes and are likely to occur in the areas crossed by the pipeline. They include barn owl (*Tyto alba*), western screech owl (*Otus kennicottii*), great horned owl (*Bubo virginianus*), northern pygmy-owl (*Glaucidium gnoma*), barred owl (*Strix varia*), great gray owl (*Strix nebulosa*), short-eared owl (*Asio flammeus*), and NSO. Owls seen only during the winter CBC surveys include northern saw-whet owls (*Aegolius acadicus*) and burrowing owls (*Athene cunicularia*). Additionally, boreal owl (*Aegolius funereus*), flammulated owl (*Otus flammeolus*), and long-eared owl (*Asio otus*) are expected to occur in habitats crossed by the Pacific Connector pipeline route. The burrowing owl, flammulated owl, and great gray owl have special state or federal status and more information on their occurrence is included in appendix I. The NSO has threatened state and federal status and is discussed in more detail in section 4.6. Great horned owls, western screech owls, NSOs, barred owls, northern pygmy owls, and great gray owls have been reported during surveys in 2007 and 2008 but nest sites were not included in the documentation.

Game Animals

Several species of mammals and birds are considered game animals and are harvested through recreational and/or subsistence hunting. Except for wildlife harvest administered and managed under tribal authorities, hunting is regulated by the ODFW in defined Wildlife Management Units. Big game species that may occur in the areas crossed by the Pacific Connector pipeline route include black-tailed deer, mule deer (*Odocoileus hemionus*), Roosevelt elk, Rocky Mountain elk (*Cervus elaphus nelsoni*), black bear, and cougar (*Puma concolor*). Demographic data and harvest data for game animals are compiled by ODFW and are available in online reports, listed by animals taken by each hunt unit.

Two subspecies of mule deer occur in the Pacific Connector pipeline area: the larger Rocky Mountain mule deer (*Odocoileus hemionus hemionus*), usually found east of the Cascade Mountain crest, and the black-tailed deer (*O. hemionus columbianus*), generally found west of the Cascades (ODFW 2008). A second species, Columbian white-tailed deer (*O. virginianus leucurus*), was state and federally delisted in 2003 and may occur between MPs 56.0 and 61.0, and MPs 65.5 and 66.2, in an area mapped by ODFW as "peripheral big game range" and "impacted habitat" (ODFW 2017c, 2017d). Black-tailed deer are considered management indicator species (MIS) for both the Umpqua and Rogue River National Forests (Forest Service 1990a, 1990b).

In eastern Oregon, mule deer are mainly confined to open woods or isolated mountain ranges, although they once ranged into sagebrush plains in canyons or rimrock. During the winter, a period considered critical for the mule deer, they descend to lower elevations to browse sagebrush, bitterbrush, rabbitbrush, juniper, and mountain-mahogany, which are high in fats (ODFW 2003a, 2011; Csuti et al. 2001). In western Oregon, black-tailed deer are found in forested areas and heavy brush areas at the edges of forests and chaparral thickets. Black-tailed deer prefer early successional stages created by clear-cuts or burns, providing grasses, forbs, and shrubs (ODFW 2008; Csuti et al. 2001). Most black-tailed deer that summer in the high Cascades winter at lower elevations on the west slope, although some wintering may occur east of the Cascade crest (ODFW 2008). Winter loss of black-tailed deer is generally far less than for mule deer, because the snow does not remain on the valley floors for extended periods and a crust does not form on the surface as it does on the east side of the Cascades (ODFW 2008). In Jackson County, black-tailed deer are highly migratory and often move along well-defined migration trails at night during the months between October and March (ODFW 2007a). In Douglas County, Columbian white-tailed deer are most often associated with riparian habitats, although they are known to use a variety of lower elevation habitat types, such as grasslands, grass shrub, oak woodlands, coniferous woodlands, and mixed deciduous and coniferous woodlands (FWS 2003b).

Rocky Mountain elk inhabit most of eastern Oregon and Roosevelt elk occupy most of western Oregon with concentrations in the Cascades and Coast ranges. They are known to make significant movements in response to disturbances from humans and predators, as well as seasonal weather patterns. Rocky Mountain elk is considered an MIS for both the Umpqua and Rogue River National Forests (Forest Service 1990a, 1990b). Note that MIS species are addressed in more detail in section 4.5.1.3

Several herds of elk are known to winter on the western slopes of the Cascades (ODFW 2003b). Summer elk forage consists of a combination of lush forbs, grasses, and shrubs, which is usually attained at higher elevations in wet meadows, springs, and riparian areas in close proximity to forested stands. Forage becomes less abundant and accessible in winter and the nutritional quality declines. Winter range is usually in forested sites, which provide protection against weather as well as lichens and other plants used as forage (ODFW 2003b); however, in Jackson County, winter range also consists of other habitat types such as grassy meadows, recent clearcuts, industrial forestlands, agricultural fields, orchards and urban edges. Most elk range is on BLM and NFS lands (ODFW 2003b); however, in the Pacific Connector pipeline area, most winter range occurs on private lands (table 4.5.1.2-4). Jackson County has the most winter range affected by the Project, followed by Klamath County, then Douglas County.

TABLE 4.5.1.2-4

Designated Big Game Winter Range Crossed by the Pacific Connector Pipeline

	Miles Crossed Per Landowner			
Winter Range or Management Area	**BLM**	**Forest Service**	**Other a/, b/**	**Total**
Douglas County				
Big Game Winter Range – Umpqua National Forest	0.0	0.6	0.0	0.6
Douglas County Total	**0.0**	**0.6**	**0.0**	**0.6**
Jackson County				
Sensitive Wildlife Area c/	2.3	0.0	2.3	4.6
Very Sensitive Wildlife Area d/	11.1	1.4	19.7	32.3
Jackson County Total	**13.5**	**1.4**	**22.0**	**36.9**
Klamath County				
Deer Low/Medium Density Winter Range e/	0.0	0.0	4.4	4.4
Deer Low/Medium Density Winter Range f/	0.3	0.0	14.2	14.5
Elk Winter Range g/	0.0	0.0	1.2	1.2
Klamath County Total	**0.3**	**0.0**	**19.8**	**20.1**
Overall County	**13.7**	**2.1**	**41.9**	**57.7**

Note: Rows/columns may not sum correctly due to rounding. Mileages rounded to the nearest tenth of a mile (values below 0.1 are shown as “<0.1”).
a/ Other includes non-federal lands, such as private, county, and state.
b/ Seasonal restrictions are specific to landownership. "Other" designation is stipulated by ODFW.
c/ Sensitive Wildlife Areas coverage (ODFW 2017c) also incorporates Forest Service Deer Winter Range coverage (Trail Creek, Big Butte Creek, and Lake Creek). Occurs in Evans Creek and Rogue ODFW big game management units.
d/ Very Sensitive Wildlife Area coverage (ODFW 2017c) also incorporates BLM Deer (Camel Hump, BFRA Salt Creek, Little Butte Creek South) and Elk (Camel Hump, BFRA Salt Creek) Winter Management Area coverages, as well as Forest Service Deer Winter Range coverages (Big Butte Creek, Lake Creek). Occurs in Rogue ODFW big game management units.
e/ Deer Low/Medium Density Winter Range coverage (ODFW 2012b) includes the ODFW Keno big game management unit.
f/ Deer Low/Medium Density Winter Range (ODFW 2012a) incorporates BLM Deer Winter Management coverages (Stukel, South Bryant). Occurs in Klamath Falls big game management unit.
g/ Elk Winter Range for Eastern Oregon (ODFW 2012c).

ODFW delineated digital GIS coverage of deer and elk habitat in Oregon, which include big-game winter management areas in Jackson and Klamath Counties in the vicinity of the pipeline (ODFW 2012b, 2012c, and 2017d). The delineated areas do not necessarily represent complete deer and elk winter ranges in each county, but designate areas that provide some level of protection for big-game winter range while allowing development to occur (Milburn 2007). Additionally, our analysis incorporates GIS coverage of big-game winter range on NFS lands, which also includes a few delineated areas in the Umpqua National Forest in Douglas County (Forest Service 2006). BLM Districts defer to winter range delineated by ODFW (Waddell 2017) Harvested small game and furbearer species that occur are beaver, bobcat (*Lynx rufus*), gray fox, red fox (*Vulpes vulpes*), American marten (*Martes americana*), mink, muskrat (*Ondatra zibethicus*), otter (*Lontra canadensis*), raccoon, badger (*Taxidea taxus*), coyote, nutria (*Myocastor coypus*), opossum, spotted skunk (*Spilogale gracilis*), striped skunk, and weasel (*Mustela frenata*; Hiller 2011).

Amphibians and Reptiles

Based on their distributions in southwestern Oregon, 23 amphibian species and 24 reptile species may be present in habitats that would be crossed by the Pacific Connector pipeline route (Leonard et al.

1993; Nussbaum et al. 1983). Habitats in the area of the pipeline that support the highest diversity of reptiles and amphibians include Wetlands/Eastside Riparian-Wetlands (38 species), Developed, Urban, and Mixed Environments (37 species), and Mixed Conifer-Hardwood Forest (36 species). One reptile species (western terrestrial garter snake) is potentially found in bays and estuarine habitats. Amphibian and reptile species that could potentially occur near the Project include, but are not limited to, clouded salamander (*Aneides ferreus*), tailed frog (*Ascaphus truei*), western toad (*Bufo boreas*), western pond turtle (*Actinemys marmorata*), sagebrush lizard (*Sceloporus graciosus*), rattlesnake (*Crotalus oreganus*), king snake (*Lampropeltis* sp.), western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis catenifer*), and rubber boa (*Charina bottae*).

Some amphibian species potentially occurring in the area affected by the pipeline project are associated with a variety of habitats and thus are common and widespread with healthy populations, such as the Pacific tree frog (*Pseudacris regilla*) and rough-skinned newt (*Taricha granulosa*). Other species that have been documented, such as the foothill yellow-legged frog (*Rana boylii*; a federal species of concern, state sensitive, BLM and Forest Service sensitive species), are declining (ODFW 2006b; Oregon Conservation Strategy 2016). Amphibians demonstrate close associations with aquatic and riparian habitats, though they may occur in other habitat types if not too distant from water, for example, the ensatina (a lungless salamander), which is found in forests. Amphibians with extremely limited distributions and relatively specific ecological requirements may be more at risk of further population declines (Walls et al. 1992).

Reptiles present along the pipeline project are also associated with a variety of habitats crossed, although not all are as closely associated with water and/or water-dominated features as amphibians.

<u>Invertebrates</u>

Terrestrial invertebrates occur along the Pacific Connector pipeline. Arthropods occur in all habitat types crossed by the pipeline, though terrestrial mollusks (gastropods) are considerably more restricted. With few exceptions, terrestrial mollusks are generally found in moist habitats associated with springs, seeps, decaying wood, moist mature forests, and habitats maintained in the coastal "fog" zone near the ocean. Other invertebrate species would likely be widespread and abundant throughout the area affected by the Project; some examples include *Peromyscopsylla selenis*, earthworm (*Lumbricus variegatus),* orb weaver spider (family *Araneidae)*, and grass spiders (*Agelenopsis* spp*.)*. Some invertebrates, such as bees (from families such as *Apidae*, *Halictidae*, *Andrenidae*, *Megachilidae*, and *Colletidae*), play an important role in pollination of native plants in the area affected by the Project.

<u>Upland Wildlife of Concern to Native Americans</u>

The Coquille Indian Tribe listed the following birds of concern: eagles, hawks, owls, cormorant, kingfisher, herons, osprey, flicker, woodpeckers (particularly pileated), grebe, cormorant, crows and ravens, and colorful neo-tropical species. The Tribe mentioned deer, elk, coyote, cougar, bear, bobcat, raccoon, beaver, and squirrel as important upland mammals. The Grand Ronde Community expressed concerns about specific upland wildlife species that play a role in their subsistence patterns and culture; birds of concern include federally listed marbled murrelet and northern spotted owl, and state-sensitive common nighthawk, flammulated owl, great gray owl, Lewis's woodpecker, purple martin, white-headed woodpecker, and yellow breasted chat. Other upland mammals important to the tribes include American marten, fisher, California myotis, fringed myotis, hoary bat, red tree vole, ringtail, and Sierra Nevada red fox. Reptiles of interest include the federally listed Oregon spotted frog, and state-listed Del Norte salamander, northern red-legged frog, southern torrent salamander, California mountain kingsnake, and western pond turtle.

Effects on Wildlife Habitat and Terrestrial Wildlife Species from Construction and Operation of the Pacific Connector Gas Pipeline Facilities

Effects on Habitats

The acres of wildlife habitat types (from Johnson and O'Neil 2001) that would be affected by construction of the Pacific Connector pipeline are listed in table 4.5.1.2-5. Westside Lowland Conifer Forest, Southwest Oregon Mixed Conifer-Hardwood Forest, Shrublands and Grasslands, Agriculture, Pastures, and Mixed Environs, and Urban and Mixed Environs would be the wildlife habitats most affected by construction.

At aboveground facilities, native habitats would be cleared, and on private lands the area would be permanently converted into developed-industrial land. During pipeline operation, a 30-foot-wide corridor, centered over the pipe, would be kept clear of trees. As a result, areas cleared of forest during pipeline construction would be maintained in a shrub/herbaceous state within this 30-foot-wide corridor. The remainder of the temporary pipeline construction right-of-way would be revegetated with native species, although it would take years to many decades for forested and shrub-steppe habitat to regenerate. Other habitats, such as grasslands, within the temporary construction right-of-way would typically be restored within three years. A 10-foot-wide corridor centered on the pipeline may be mowed annually and maintained in an herbaceous state. The remainder of the 30-foot-wide corridor within the permanent easement may be subject to vegetation clearing every three years. The acres of wildlife habitat that would be affected by operation of the Pacific Connector Project are listed in table 4.5.1.2-6.

During construction and restoration, Pacific Connector would implement numerous measures to minimize impacts on vegetation and ensure successful revegetation of disturbed areas (see section 4.4). These measures include those found in the ECRP, *Leave Tree Protection Plan*, *Integrated Pest Management Plan*, *Fire Prevention and Suppression Plan*, and the *SPCC Plan*. These measures would be applied to all lands crossed by the pipeline route; however, federal land-managing agencies may impose additional measures on federal lands. Measures specific to federally managed lands are addressed in the upland vegetation section 4.4.1.3.

TABLE 4.5.1.2-5

Summary of Construction-Related Effects on Habitat by the Pacific Connector Pipeline (acres a/)

General Habitat Type	Mapped Habitat Type	Forest Stand by Age	Pipeline Facilities								Subtotals	
			Construction Right-of-Way	**Temporary Extra Work Areas**	**Uncleared Storage Areas**	**Rock Source/Disposal**	**Access Roads (TARs/PARs/ Improvements)**	**Pipe Yards**	**Aboveground Facilities - Klamath Compressor Station**	**Subtotal by Age Class**	**Subtotal by Habitat Type**	**Percent of Total Habitat**
Forest-Woodland	Westside Lowland Conifer-Hardwood Forest	L-O b/	112	24	89	1	<1	0	0	226	1,298	26.3
		M-S c/	256	64	113	1	<1	<1	0	434		
		C-R d/	337	137	160	4	<1	0	0	638		
	Montane Mixed Conifer Forest	L-O b/	17	1	8	0	0	0	0	26	113	*2.3*
		M-S c/	9	<1	5	0	0	0	0	14		
		C-R d/	41	16	15	0	<1	0	0	72		
	Southwest Oregon Mixed Conifer-Hardwood Forest	L-O b/	259	46	112	1	<1	0	0	419	943	19.1
		M-S c/	103	35	31	<1	<1	0	0	170		
		C-R d/	209	63	82	0	<1	0	0	354		
	Ponderosa Pine Forest and Woodlands	L-O b/	49	16	4	0	0	0	0	69	220	4.5
		M-S c/	59	10	1	<1	0	0	0	71		
		C-R d/	57	15	9	<1	0	0	0	81		
	Westside Oak and Dry Douglas-fir Forest and Woodlands	L-O b/	26	9	4	0	0	0	0	39	73	*1.5*
		M-S c/	25.0	7	2	0	<1	0	0	34		
		C-R d/	0	0	0	0	0	0	0	0		
	Western Juniper and Mountain Mahogany Woodlands	L-O b/	2.3	<1	0	0	0	0	0	3	108	2.2
		M-S c/	49	8	0	0	<1	0	0	57		
		C-R d/	42	6	0	0	<1	0	0	48		
	Subtotal Forest-Woodland		**1,654**	**458**	**634**	**8**	**1**	**<1**	**0**	**2,755**	**2,755**	***55.8***
	Percent of All Forest-Woodland		***60.0***	***16.6***	***23.0***	***0.3***	**<1**	**<1**	**0.0**	***100.0***	***100.0***	
Grasslands -Shrubland	Sagebrush Steppe	n/a	78	30.6	0	0	0	0	21.4	n/a	130	*2.6*
	Shrublands	n/a	123	41.1	10.9	0	<1	0	0	n/a	175	*3.5*
	Westside Grasslands	n/a	133	87.0	5.7	<1	1.9	148.3	0	n/a	377	*7.6*
	Eastside Grasslands	n/a	51	8.9	<1	1.4	0	107.9	0	n/a	170	*3.4*
	Subtotal Grasslands-Shrubland		**385**	**168**	**17**	**2**	**2**	**256**	**21**	**n/a**	**851**	***17.2***
Wetland / Riparian	Westside Riparian-Wetlands/Eastside Riparian-Wetlands	L-O b/	0	0	0	0	0	0	0	0	2	*0.0*
		M-S c/	<1	<1	0	0	0	0	0	1		
		C-R d/	<1	<1	0	0	0	0	0	1		
		Shrub	1	<1	<1	0	0	<1	0.4	n/a	2	*0.0*
	Herbaceous Wetlands	n/a	65	45	<1	0	1	<1	0	n/a	111	*2.2*
	Subtotal Wetland / Riparian		**68**	**46**	**<1**	**0**	**1**	**1**	**0**	**n/a**	**115**	**2.3**
Agriculture	Agriculture, Pastures, and Mixed Environs		305	132	<1	3	1	14	0	n/a	456	*9.2*
	Subtotal Agriculture		**305**	**132**	**<1**	**3**	**1**	**14**	**0**	**n/a**	**456**	**9.2**

TABLE 4.5.1.2-5 (continued)

Summary of Construction-Related Effects on Habitat by the Pacific Connector Pipeline (acres a/)

General Habitat Type	Mapped Habitat Type	Forest Stand by Age	Pipeline Facilities: Construction Right-of-Way	Temporary Extra Work Areas	Uncleared Storage Areas	Rock Source/Disposal	Access Roads (TARs/PARs/ Improvements)	Pipe Yards	Aboveground Facilities - Klamath Compressor Station	Subtotal by Age Class e/	Subtotals: Subtotal by Habitat Type	Percent of Total Habitat
Developed / Barren	Urban and Mixed Environs	n/a	22	55	<1	26	<1	339	2	n/a	444	9.0
	Roads	n/a	143	60	20	3	23	47	<1	n/a	295	*6.0*
	Beaches	n/a	<1	3	0	0	0	0	0	n/a	3	*0.1*
	Subtotal Developed / Barren		**166**	**118**	**20**	**29**	**23**	**385**	**2**	**n/a**	**742**	***15.0***
Open Water	Open Water - Lakes, Rivers, Streams	n/a	9	5	<1	0	<1	<1	0	n/a	14	0.3
	Bays and Estuaries	n/a	0	<1	0	0	0	4	0	n/a	5	*0.1*
	Subtotal Open Water		**9**	**5**	**1**	**0**	**<1**	**5**	**0**	**n/a**	**18**	***0.4***
	Subtotal Non-Forest		**932**	**468**	**38**	**33**	**28**	**661**	**23**		**2,182**	***44.2***
	Percent of All Non-Forest		***42.7***	***21.4***	***1.7***	***1.5***	***1.2***	***30.7***	***1.1***		***100.0***	
Project Total		n/a	**2,586**	**926**	**671**	**41**	**29**	**661**	**23**		**4,936**	
Percent of Pipeline Facilities		n/a	***52.4***	***18.8***	***13.6***	***0.8***	***0.6***	***13.4***	***0.5***		***100.0***	

General: Columns and rows do not necessarily sum correctly due to rounding. Acres rounded to nearest whole acre. Values less than 1 acre shown as "<1". Acres of disturbance to non-vegetated areas are included in this table for consistency in values reported in this document.

a/ Acres disturbed were evaluated using GIS; footprints for each component (aboveground facilities, permanent easement, and 30-foot maintenance corridor) were overlaid on the digitized vegetation coverage.

b/ The "Late Successional and Old-Growth" category (L-O) describes those forest areas with a majority of trees over 80 years of age. Forests with stands greater than 175 years are considered to have old-growth characteristics.

c/ The "Mid-Seral" category (M-S) describes those forest areas with a majority of trees over 40 years of age but less than 80 years of age.

d/ The "Grass-shrub-sapling or Regenerating Young Forest" category (C-R) describes those forest areas that are either clear-cut (tree age 0-5 years) or regenerating (tree age 5 to 40 years). Forest areas in this category are divided into forest vegetation types based on their potential to become those types of forests.

TABLE 4.5.1.2-6

Summary of Operation-Related Effects on Habitat by the Pacific Connector Pipeline (acres a/)

General Habitat Type	Mapped Habitat Type	Forest Stand by Age	Pipeline Facilities: *30-foot Maintenance Corridor*	Pipeline Facilities: Permanent Access Roads	Pipeline Facilities: Subtotal Late Successional Old-Growth Forest	Pipeline Facilities: Subtotal Mid-Seral Forest	Pipeline Facilities: Subtotal Clearcut / Regenerating Forest	Pipeline Facilities: Subtotal By Habitat Type e/	Permanent Easement (50-foot)	Aboveground Facilities	Total Operation Disturbance by Habitat Type
Forest-Woodland	Westside Lowland Conifer-Hardwood Forest	L-O b/	35	<1					58		
		M-S c/	81	<1	35	81	105	221	136	<0	**221**
		C-R d/	105	<1					177		
	Montane Mixed Conifer Forest	L-O b/	5	0					9		
		M-S c/	3	0	5	3	14	22	5	0	**22**
		C-R d/	14	<1					23		
	Southwest Oregon Mixed Conifer-Hardwood Forest	L-O b/	80	<1					134		
		M-S c/	33	<1	80	33	67	180	55	0	**181**
		C-R d/	67	<1					112		
	Ponderosa Pine Forest and Woodlands	L-O b/	15	0					26		
		M-S c/	18	0	15	18	18	51	31	0	**51**
		C-R d/	18	0					30		
	Westside Oak and Dry Douglas-fir Forest and Woodlands	L-O b/	8	0					13		
		M-S c/	8	<1	8	8	0	16	13	0	**16**
		C-R d/	0	0					0		
	Western Juniper and Mountain Mahogany Woodlands	L-O b/	1	0					1		
		M-S c/	15	0	1	15	14	29	24	0	**29**
		C-R d/	14	0					23		
	Subtotal Forest-Woodland		**519**	<1	**145**	**158**	**217**	**520**	**868**	**0**	**520**
Grasslands-Shrubland	Sagebrush Steppe	n/a	26	0	n/a	n/a	n/a	26	44	21	**47**
	Shrublands	n/a	39	<1	n/a	n/a	n/a	39	64	0	**39**
	Westside Grasslands	n/a	43	2	n/a	n/a	n/a	44	72	0	**44**
	Eastside Grasslands	n/a	16	0	n/a	n/a	n/a	16	27	0	**16**
	Subtotal Grasslands-Shrubland		**123**	**2**	**n/a**	**n/a**	**n/a**	**126**	***207***	**21**	**147**
Wetland/ Riparian	Westside Riparian-Wetlands/Eastside Riparian-Wetlands	L-O b/	0	0					*0*		
		M-S c/	<1	0	0	<1	<1	1	<1	0	**1**
		C-R d/	<1	0					<1		
		Shrub	<1	0	n/a	n/a	n/a	<1	1	0	**<1**
	Herbaceous Wetlands f/	n/a	21	<1	n/a	n/a	n/a	21	34	0	**21**
	Subtotal Wetland/Riparian		**22**	**<1**	**n/a**	**n/a**	**n/a**	**22**	***36***	**0**	**22**
Agriculture	Agriculture, Pastures, and Mixed Environs	n/a	97	1	n/a	n/a	n/a	98	161	0	**98**
	Subtotal Agriculture		**97**	**1**	**n/a**	**n/a**	**n/a**	**98**	***161***	**0**	**98**

TABLE 4.5.1.2-6 (continued)

Summary of Operation-Related Effects on Habitat by the Pacific Connector Pipeline (acres a/)

General Habitat Type	Mapped Habitat Type	Forest Stand by Age	Pipeline Facilities: *30-foot Maintenance Corridor*	Pipeline Facilities: Permanent Access Roads	Pipeline Facilities: Subtotal Late Successional Old-Growth Forest	Pipeline Facilities: Subtotal Mid-Seral Forest	Pipeline Facilities: Subtotal Clearcut / Regenerating Forest	Pipeline Facilities: Subtotal By Habitat Type e/	Permanent Easement (50-foot)	Aboveground Facilities	Total Operation Disturbance by Habitat Type
Developed / Barren	Urban and Mixed Environs	n/a	8	<1	n/a	n/a	n/a	8	13	4	**10**
	Roads	n/a	51	<1	n/a	n/a	n/a	52	83	0	**52**
	Beaches	n/a	<1	0	n/a	n/a	n/a	<1	<1	0	**<1**
	Subtotal Developed / Barren		**59**	**<1**	**n/a**	**n/a**	**n/a**	**59**	***96***	**2**	**61**
Open Water	Open Water - Lakes, Rivers, and Streams	n/a	3	<1	n/a	n/a	n/a	3	5	0	**3**
	Bays and Estuaries	n/a	<1	0	n/a	n/a	n/a	<1	3	0	**<1**
	Subtotal Open Water		**3**	**<1**	**n/a**	**n/a**	**n/a**	**3**	***8***	**0**	**3**
	Subtotal Non-Forest		**303**	**3**	**0**	**<1**	**<1**	**307**	**508**	**25**	**330**
	Project Total		**822**	**3**	**145**	**158**	**218**	**827**	**1,376**	**25**	**850**

General: Columns and rows do not necessarily sum correctly due to rounding. Acres rounded to nearest whole acre. Values less than 1 acre shown as "<1".
Acres of disturbance to non-vegetated areas are included in this table for consistency in values reported in this document.

a/ Acres disturbed were evaluated using GIS; footprints for each component (aboveground facilities, permanent easement, and 30-foot maintenance corridor) were overlaid on the digitized vegetation coverage.

b/ The "Late Successional and Old-Growth" category (L-O) describes those forest areas with a majority of trees over 80 years of age. Forests with stands greater than 175 years are considered to have old-growth characteristics.

c/ The "Mid-Seral" category (M-S) describes those forest areas with a majority of trees over 40 years of age but less than 80 years of age.

d/ The "Grass-shrub-sapling or Regenerating Young Forest" category (C-R) describes those forest areas that are either clear-cut (tree age 0-5 years) or regenerating (tree age 5 to 40 years). Forest areas in this category are divided into forest vegetation types based on their potential to become those types of forests.

e/ Subtotal by Habitat Type includes the 30-foot maintenance corridor, permanent access roads, and only aboveground facilities with a meter station or compressor station (mainline block valves located within the 30-foot maintenance corridor).

f/ Acres of herbaceous wetlands within the 30-foot maintenance corridor are reported as an effect on wildlife habitat due to human and mechanical disturbance that may be present during maintenance. However, maintenance activities would not affect the herbaceous wetland functionality and are therefore not reported as an effect in section 4.3.

Effects on Terrestrial Wildlife Species

General Effects Applicable to All Terrestrial Wildlife

Many species have very specific habitat requirements that may or may not be present in the area affected by the Project and would not be described in the relatively broad habitat types used in this section (habitat types described by Johnson and O'Neil 2001). Consequently, the assumption has been made that if a species' occupied range is known or likely to coincide with the area affected by the Project, and if general habitat types that would be affected by the Pacific Connector pipeline could include more specific habitat components required by that species, then the species could occur and be affected in some way by the Project.

Constructing and operating the Project could cause habitat degradation by human presence, habitat removal or modification associated with vegetation clearing, spreading noxious weeds, herbicide use, noise, and habitat fragmentation. Wildlife may be affected by construction vehicles traveling to and from construction sites. Species most susceptible to vehicle-related injury and mortality include those that are inconspicuous (salamanders, frogs, snakes, small mammals), those with limited mobility (amphibians), burrowing species (mice and voles, weasels, beaver, frogs and toads, snakes, subterranean mollusks), and wildlife with behavioral activity patterns making them vulnerable, such as deer that are more active at dusk and dawn, and wildlife that may scavenge roadside carrion (Leedy 1975; Bennett 1991; Forman and Alexander 1998; Trombulak and Frissell 2000). Similarly, species that do not or cannot avoid construction activities could be subjected to blasting, which can cause injury, mortality, or affect normal behavior due to noise disturbance. Noise effects are discussed in more detail below.

Other species are likely to be displaced from habitats that are cleared of vegetation and from areas adjacent to construction sites. Species may also be negatively affected if individuals emigrate from habitats affected by project-related disturbances. Displacement of mobile wildlife would most likely be a short-term effect. Once construction and restoration of the right-of-way is complete, displaced individuals are expected to return to the original area they occupied, with the exception of habitats that are no longer suitable due to habitat conversion or edge effects. If adjacent habitats are at carrying capacity for the species, displaced individuals would cause increased competition for resources, increased susceptibility to predation, or promote disease that may be facilitated by crowding.

Activities associated with constructing the pipeline could decrease individuals' reproductive success by increasing neonate or nest abandonment and possibly by interfering with breeding behaviors, sustenance, and growth of fetuses and/or young, conception rates, and fetal survival. These impacts may affect population growth through diminished rates of survivorship and fecundity.

Both long-term and short-term effects could occur to amphibians and reptiles associated with waterbodies and the riparian areas. Removal of riparian vegetation along stream edges that are crossed by the Project could increase sedimentation input into the waterbody and/or increase water temperatures. Changes in hydrology could also occur in wetlands and waterbodies used for breeding, limiting dispersal or reducing breeding habitat (ODFW 2006b).

Construction of the pipeline through upland forests would require removal of deciduous and coniferous trees and would remove those habitat features over the long-term. It would take decades for trees to grow to their original size in temporary workspaces in cleared forested areas that are restored and revegetated after construction. Former forested habitats in Pacific Connector's 30-foot-wide operational right-of-way would be converted to shrub-sapling dominated or herbaceous cover for an extended period of time (50 years or more). This conversion could benefit some wildlife species that characteristically inhabit shrub or grassland habitats but would be detrimental to wildlife species adapted to forest interiors. Construction through forested areas would also result in the removal of snags and LWD that are used by a variety of wildlife, including cavity nesters and bats.

Construction through existing shrub-dominated areas would mostly result in short-term habitat loss. After restoration and revegetation, grasses and shrubs would be allowed to regenerate across the entire right-of-way. There would be long-term habitat loss in some areas, where shrubs, such as species of sagebrush, would require longer than 5 years to become reestablished. Loss of this habitat type could potentially affect certain species of birds, mammals, reptiles, amphibians, and invertebrates that utilize shrubs, by reducing forage, nesting, and cover/refuge opportunities.

Noxious Weeds and Invasive Species

Short- or long-term effects on wildlife habitat would also occur if the pipeline causes the establishment and spread of noxious weeds, as well as other invasive species (animals and microbes) not native to a region. In general, habitats with more bare ground, such as grasslands, riparian areas, relatively dry, open forests, and disturbed areas such as roads are more susceptible to invasive species establishment than are dense, moist forests, high mountain areas, and serpentine areas that have relatively closed plant cover or have extreme climate or soils.

Noxious weeds often out-compete native vegetation. They displace native species by spreading rapidly and utilizing resources (nutrients, water, sunlight) that can eventually lead to a weed-dominated monoculture. Such transformed habitat can be unsuitable to former wildlife inhabitants. Often, as habitat quality degenerates, wildlife diversity declines. For example, purple loosestrife forms dense monocultures that inhibit native vegetation, causing decreasing species' diversity, limit water flows and wildlife access to water, and in some instances can make waterfowl nesting areas unsuitable (Whitson 1996). A summary of noxious weed species found along the pipeline route is provided in table 4.4.1.2-4.

Clearing of vegetation from the linear right-of-way and soil disturbance from right-of-way grading would increase the chance of spreading noxious weeds through the removal of native, established species and soil disturbance, which could encourage the establishment of invasive plants. Equipment moving along the right-of-way could also bring seeds from one place to the next, aiding the spread of these species. Pacific Connector has measures in place to help prevent this as described in the ECRP.[123] Weed surveys would take place prior to vegetation removal, and infested areas would be pretreated through mechanical methods and herbicide spot treatment to minimize the spread of invasive plants. Equipment would also be inspected and cleaned of any potential weed seed or propagules (i.e., soil roots or rhizomes). During restoration, disturbed areas would be revegetated with native seed mixtures. Monitoring would typically occur for a period of three to five years (as described in the *Integrated Pest Management Plan* and ECRP) to ensure that no non-native plants establish themselves in lands disturbed by pipeline activities. Due to

[123] See Appendix I to the POD, which was included in Pacific Connector's application to the FERC.

measures that would be employed before, during, and after construction, the risk of the pipeline causing noxious weeds to spread in the area of the pipeline should be low.

Pacific Connector would mitigate for the spread of noxious weeds, forest pathogens, and soil pests by following the measures outlined in its *Integrated Pest Management Plan*.[124] Further measures for controlling the spread of noxious weeds are contained in its ECRP. See section 4.4.1.2 for more details on invasive plants and mitigation measures.

Invasive insects, mites (e.g., spruce spider mite), and terrestrial mollusks (e.g., the predatory spotted leopard slug) can similarly disperse along a newly created corridor where native vegetation formerly presented barriers to dispersion. In general, invasive exotic wildlife species can adversely affect native species and their populations through various pathways, singly or in combination that include:

- introduction of disease or parasites to native wildlife;
- interbreeding (hybridization) with native wildlife;
- competition for habitat with native wildlife;
- degradation of habitat of native wildlife; and/or
- predation on native wildlife.

The measures outlined in the *Integrated Pest Management Plan* would help decrease the adverse effects of invasive insects.

Invasive animals such as introduced bullfrogs have adversely affected various native frog populations through predation (Hayes and Jennings 1986), including populations of Oregon spotted frogs in Washington (Watson et al. 2000). Bullfrogs prey on and out-compete native frog species. They spread very quickly due to their prolific nature, lack of predators, ability to travel long distances over dry land, and wide habitat and diet preferences. Pacific Connector has developed BMPs to avoid the potential spread of the aquatic invasive species and pathogens of concern during Project hydrostatic testing operations (see the *Hydrostatic Test Plan*[125]). While bullfrogs are not specifically addressed in the *Hydrostatic Testing Plan*, it is anticipated that the screening/filtering, chlorine treatment, and upland dewatering BMPs would be effective at eliminating the potential spread of bullfrogs and their eggs or tadpoles.

The range of the barred owl has expanded into NSO habitat, and this species competes with NSO for resources and has been known to displace NSO from suitable habitat (Kelley et al. 2003; Kelley and Forsman 2004). Barred owls negatively affect NSO populations, primarily by reducing survival and increasing local territory extinctions (Dugger et al. 2016).

Herbicides

Herbicides could affect native plant species, thereby affecting wildlife habitat and potentially the animals themselves. While adverse effects on wildlife tend to be low, some symptoms include breakdown of vital organs, reduction in numbers of healthy offspring, decreased fitness, and direct mortality (Forest Service 2005b). Amphibians can be deformed or killed by some herbicides if these chemicals get into the water. Herbicides tend to form residue on grasses more readily than other

[124] See Appendix N to the POD, which was included in Pacific Connector's application to the FERC.
[125] See Appendix M to the POD, which was included in Pacific Connector's application to the FERC.

vegetation; therefore, wildlife that eats grass, as well as those species above them on the food chain, tend to be most susceptible to the effects of herbicides (Forest Service 2005b).

Pacific Connector would control all ODA A- and T-listed weeds, along with some B-listed weeds (ODA 2017b). To determine if an herbicide is to be used over hand and mechanical weed control methods, Pacific Connector would implement integrated weed management principles following BLM (2010b) and Forest Service (2005c) guidelines (see section 4.4 for more details).

In accordance with Pacific Connector's *Integrated Pest Management Plan*, only specific spots would be treated with herbicides to control noxious weeds. Because agency-approved herbicides are generally of low toxicity to animals when applied per label instructions, adverse effects on wildlife should be low.

Noise

Noise from construction and operation of the Pacific Connector Pipeline Project is discussed in detail in section 4.12.2.2 of this EIS. We estimate that noise from general construction of the pipeline would range from the L_{eq} of about 93 dBA at 50 feet, to 85 dBA at 100 feet, and 72 dBA at 300 feet. Ambient sound levels in much of the Pacific Connector pipeline route area probably would be similar to the Arcata Fish and Wildlife Office's projections (FWS 2006a). Ambient sound is defined as the sound qualities as they might exist currently and might include human-generated sources over the long term. The typical ambient sound level for forest habitats ranges from 25 dB to 44 dB. Considering ambient sound as a base, noise levels associated with some common machines and activities that would be present during pipeline construction are included in table 4.5.1.2-7. Noise from HDD drilling would range from L_{dn} of about 35 to 79 dBA at NSAs, with no noise mitigation. This compares to current ambient L_{dn} levels at these NSAs ranging from about 42 to 66 dBA. Double rotor helicopters may be used for timber clearing along a portion (15.4 miles) of the Pacific Connector pipeline route. This type of helicopter generates noise of about 92 dBA within 700 feet of its area of use.

TABLE 4.5.1.2-7

Common Sound Levels for Equipment/Activities Potentially Associated with the Pacific Connector Pipeline

Measured Sound Source	Range of Reported dB Values (at Distance Measured 50 feet)	Relative Sound Level a/
Forest Habitats	25 – 44	Ambient
Yelling	70	Low
Chain Saw (various types/conditions)	61 – 93	Low – Very High
Pickup Truck (idle to driving)	55 – 71	Very Low – Moderate
Mowers	68 – 85	Low – High
Log Truck	77 – 97	Moderate - Very High
Dump Truck	84 – 98	High - Very High
Rock Drills	82 – 98	High - Very High
Pumps, Generators, Compressors	87	High
Drill Rig	88	High
General Construction	84 – 96	High – Very High
Track Hoe	91 – 106	Very High – Extreme
Helicopter or Airplane (various types/conditions)	96 – 112	Very High – Extreme
Rock Blast	112 b/	Extreme
Logging Helicopter (Columbia double rotor)	108 – 123	Extreme

Source: FWS 2006a

a/ A general, subjective ranking of noise levels created by the sources considered when used for analysis of relative noise effects on species.

b/ Blasting required for the Pacific Connector pipeline would be underground and muffled, which should result in a lower dB value at 50 feet.

Noise could potentially affect wildlife in localized areas for a short duration during pipeline construction activities, including clearing and grading the right-of-way, and HDD operations. The average time a given point along the pipeline would be disturbed by construction noise is approximately 8 weeks. This would vary, as the speed at which a crew would be able to work would be affected by terrain, construction methods, weather, and environmental windows. HDD operations may occur 24 hours per day, seven days a week. HDD operations are estimated to last from 20 to 100 days depending on the location.

Distances at which noise would attenuate to ambient levels would depend on local conditions such as tree cover and density, topography, weather (humidity), and wind, all of which can alter background noise conditions. Consequently, short-term effects on wildlife by construction noise would vary along the length of the pipeline route.

Noise would most likely displace wildlife some distance away from noise sources especially if wildlife species are nearby. However, any short-term effects on wildlife by noise would occur simultaneously with human presence and the presence of heavy machinery normally required for pipeline construction. Most likely, any effects on wildlife due to noise could not be separated from those due to all other construction-related activities occurring concurrently. Noise and human presence would move along the construction right-of-way, albeit at a rather slow pace. Therefore, effects on wildlife because of noise would be of short duration and spatially localized.

Research has demonstrated varying short-term reactions of wildlife to noise. Most research has focused on wildlife reaction to more constant noise generated by roads and high-volume traffic (e.g., Forman and Alexander 1998). Some research has recorded wildlife reaction to airplanes, sonic booms, helicopters, artillery, and blasting that could produce similar reactions from noises associated with construction activities for the Pacific Connector Pipeline Project. For example, Golden et al. (1980) provided the following behavioral and physiological reactions of animals to known noise levels ranging between 75 and 105 dB from various disturbances, including aircraft:

- ungulates become nervous and/or run (82 to 95 dB) or panic (95 to 105 dB);
- waterfowl flock (80 to 85 dB), move and/or become nervous (85 to 95 dB), or startle (95 to 105 dB); and
- birds scare (85 dB).

Raptors and other forest-dwelling bird species have demonstrated more adverse effects on project-generated sound during nesting and breeding when levels substantially exceed ambient conditions existing prior to a project. For instance, the FWS has determined that sound exceeding ambient nesting conditions by 20 to 25 dB or exceeding 90 dB when added to ambient conditions may be considered take under ESA when evaluating effects on NSO and MAMU (FWS 2006a). Such sound levels could potentially result in egg failure or reduced juvenile survival, malnutrition or starvation of the young, or reducing the growth or likelihood of survival of young. However, these effects may be minimal; Awbrey and Bowles (1990) found that raptors flushed from their nests while incubating did not leave the eggs exposed for more than 10 minutes and concluded that multiple, closely spaced disturbances would be required to cause lethal egg exposure. Some raptors, for example osprey, refuse to be flushed from their nest despite closely approaching helicopters (Poole 1989). Based on the anticipated noise levels, birds may experience masking (i.e., interference with the detection of one sound due to the presence of other sounds) of important communications between individuals (e.g., a nestling and the adult) and/or other behavioral and/or physiological effects (Dooling and Popper 2007).

Specific studies to determine effects on wildlife from noise generated from construction of a pipeline have not been conducted. However, it is expected that construction noise in remote areas that are relatively free from noise would have a greater potential to disrupt wildlife. Potential effects on wildlife from some noises generated from construction activities can be evaluated to an extent, such as noise from vehicles and/or increased road traffic, blasting, helicopter timber harvest or pipeline delivery, and aerial fly-overs.

Animals could flee the area because of helicopter disturbance. Pacific Connector has filed an *Air, Noise and Fugitive Dust Control Plan*[126] that describes helicopter noise and potential mitigation. In the case of birds, helicopter noise could cause adult birds to flush leaving eggs exposed to weather and predators. For all animals, helicopter disturbance could have negative energetic effects. Mitigation for helicopter noise includes operational restrictions, such as scheduling restrictions near sensitive areas, maintaining a high altitude and flight paths away from noise sensitive areas whenever possible.

The USDOT (2004) has summarized numerous studies and literature that have reported the effects of noise on wildlife, specifically focusing on noise associated with roads. Overall, existing information suggests that fish are unlikely to be adversely affected by noise levels produced from road traffic; reptiles and amphibians show some barrier effect due to roads (but no clear evidence of a noise effect alone); bird numbers and breeding can be strongly affected by the proximity of roads; large mammals can be repelled by road/vehicle noise; and small mammals do not appear to be adversely affected by road noise.

Blasting may be required for pipeline trench excavation in areas where hard, non-rippable bedrock occurs in the trench profile. Approximately 117 miles of the pipeline alignment is considered to have moderate to high blasting potential, although not all substrate in those areas identified may require blasting to achieve the required trench depth. Blasting activities may involve a single blast or a repetitive blasting sequence. Blasting during trench excavation is discussed in more detail in section 4.1.2.5.

Noise from blasting would be short-term and localized. The noise associated with blasting activities is reported to be in the range of 112 dB within 50 feet of the trench (see table 4.5.1.2-7), and may cause alarm in wildlife (e.g., birds, terrestrial mammals, etc.). With the proposed Best Management Practices and mitigation measures applied to trench blasting, the blasting noise would attenuate to 92 dB within 200 feet and 70 dB within 1,025 feet. Mitigation includes blasting methods, which reduce noise through charge placement and timing of detonation, and physical mitigation such as covering the blast areas with soil or blast mats. Pacific Connector has filed a *Blasting Plan* (Appendix C to the POD) and an *Air, Noise and Fugitive Dust Control Plan* (Appendix B to the POD) that further discusses blasting mitigation methods. Noise from blasting would disturb wildlife individuals near blast areas for short periods of time resulting in temporary changes in foraging or breeding behaviors.

In 2005, a study was conducted during a 4,000-foot-long HDD crossing of the Nooksack River crossing in Whatcom County, Washington, to determine if drilling noise associated with the HDD

[126] Appendix B of Pacific Connector's POD filed with the FERC on January 23, 2018.

(noise levels between 47 and 52 dBA at the study area) had a negative effect on wintering bald eagles. Eagles were observed from November 1, 2005, through April 7, 2006, and results indicated that bald eagles were not negatively affected by HDD rig activity (Edge Environmental, Inc. 2006).

Pacific Connector proposes to cross the Coos, Rogue, and Klamath Rivers, Coos Bay at two separate locations, and a Bonneville Power Administration (BPA) powerline corridor using HDD technology. Pacific Connector would cross the South Umpqua River using DP. Noise studies conducted for the HDD and DP of each proposed crossing determined that, with the use of mitigation measures (such as special vinyl fabric acoustic tents or other barriers), noise levels at the seven crossings are not expected to exceed the Oregon State noise regulations of 55 dBA during the day and 50 dBA at night within 25 feet of an NSA. To ensure adequate mitigation and monitoring, we are recommending Pacific Connector file HDD noise mitigation plans for review and approval prior to construction (see section 4.12.2.4). Noise effects on wildlife from the operation of the drilling equipment from the HDD crossings at Coos, South Umpqua, Rogue, and Klamath Rivers should be negligible.

A minimal increase in ambient noise levels would occur during periodic right-of-way vegetation maintenance activities (i.e., mowing, chainsaws) during operation. The major source of operational noise for the Project would be from the Klamath Compressor Station, which is located in an area surrounded by rural residences, agricultural lands, and rangelands and grasslands. Noise from the compressor station would be long-term but localized to one site. The expected increase in L_{dn} noise levels would range from 0.5 dBA to 8.0 dBA above current ambient noise at the nearby NSAs during normal station operations. In terms of environmental noise effects, an increase to the ambient sound level of 10 dBA typically results in the perception of a doubling of sound. Consequently, the Klamath Compressor Station would have noise effects on the surrounding NSAs because of the very quiet existing ambient conditions. With appropriate mitigation measures, we expect the compressor station to operate below our standard of 55 dBA for all NSAs. This sound level could have localized adverse effects on wildlife near the station.

Overall, noise from construction and operation would affect wildlife by causing behavioral avoidance of the noise source. In cases where avoidance of the noise source does not occur, wildlife would be exposed to noise that could interfere with normal behaviors and potentially have physiological effects on individuals.

Habitat Fragmentation and Edge

One manifestation of fragmentation is the amount of edge created through otherwise contiguous habitats. In the context of habitat fragmentation, edge is the portion of habitat (or ecosystem on a larger scale) "near its perimeter, where influences of the surroundings prevent development of interior environmental conditions" (Forman 1995). As compared to interior habitats, edge habitats generally support different species composition, structure, and species' abundance. For example, vertebrate species richness (bird and amphibian) has been positively associated with edges in fragmented Douglas-fir forests (Rosenberg and Raphael 1986), although species benefitted are typically habitat generalists. Edge habitat would no longer favors species that are dependent on forest interior conditions, allowing species that utilize the edge habitat to disperse into the forest interior which can have adverse effects on wildlife and plants through competition for resources, increased predations, spread of disease and insect infestation, and establishment of noxious weeds (Bannerman 1998).

Along with the creation of edge, pipeline construction would further fragment habitat. Habitat fragmentation has already occurred to some extent in the areas crossed by the pipeline route because of existing residential developments, tree harvests, roads, and utility corridors. These sources of habitat fragmentation are expected to increase in the foreseeable future outside of protected areas such as LSRs). Fragmentation can also affect the rate and scope of blowdowns in forested habitats (the effects of blowdowns are discussed in section 4.4).

Because the pipeline is linear, the created patch associated with the new edge would be narrow and elongated unlike edges created by forest practices (Forman and Gordon 1986). Creation of edges by the Project would affect seral stands differently. Douglas-fir or western hemlock would be replanted during restoration of temporary work areas, including TEWAs, in the pipeline right-of-way (except in the 30-foot-wide maintenance corridor centered on the pipe), where conifers would be removed during construction activities. It is anticipated that both temporary and permanently cleared areas in forest habitats would increase the occurrence of windthrow (snapping of branches and uprooting, snapping of boles), which could result in greater effects on forest habitat than just those areas identified for disturbance.

Douglas-fir and western hemlock planted adjacent to edges of clearcut and/or early regenerating stands (assuming conifers from 1 to 10 feet tall at the time of construction) would modify edges with the seral stands from hard to soft to no edge as they grow. In 50 years, which is the operational life of the Project, trees replanted in temporary workspaces outside of the 30-foot-wide maintenance corridor would similarly modify edges of regenerating and mid-seral stands adjacent to the right-of-way, from hard to soft edge characteristics as tree heights increase. As the replanted trees grow, edge contrasts would decrease, as would the effects on forest interiors, because taller trees would reduce direct solar radiation and increase soil moisture and humidity along the edges of stand interiors (Chen et al. 1993; Heithecker and Halpern 2007). During operations, Pacific Connector would use mechanical vegetation management methods or, where access of machinery is infeasible, manual clearing to maintain the 30-foot-wide right-of-way; this vegetation management would increase the edge effect beyond the maintained right-of-way (e.g., light and wind would be able to penetrate farther into previously “interior” forests).

Different species composition and abundance occurs in edge habitats (Forman and Gordon 1986) than in patch interiors, depending on species’ tolerances for the variation in microclimatic parameters. Some terrestrial amphibians, for example, have narrow temperature and moisture tolerances (Spotila 1972; Feder 1983). Moist, cool, and stable microclimatic conditions are essential to these species. Loss of canopy cover and coarse wood can affect amphibians’ microclimatic conditions. Some wildlife species use right-of-way corridors created by pipelines and other linear utilities. For example, bird species’ diversity in powerline corridors through forested vegetation was found to be higher in the corridor than in the adjacent forest (Kroodsma 1984). Often present along the edge are higher levels of flower and fruit production, pollinator, and frugivore densities and seed dispersal. Also, deer and elk use of available browse in corridors or on edges of corridors that are adjacent to hiding and thermal cover have been documented (Hartley et al. 1984; Brusnyk and Westworth 1985). Increased herbivore density in edge habitat provides a food source for predators (Forman 1995), and predators such as coyotes are known to use disturbed forest such as open-canopied logged forests and natural edge habitats along water courses (Kays et al. 2008); therefore, predator density is expected to increase along the edge. Linear rights-of-way can also facilitate the movement of predators such as coyotes through forested landscapes (Way and Eatough 2006).

Few studies have evaluated the establishment of forage in pipeline corridors and utilization by big game. The study conducted in Alberta by Brusnyk and Westworth (1985) focused on forage and browse production on a 17-year-old pipeline right-of-way and on a 2-year-old right-of-way. They compared big game use (moose, deer, and elk) of forage on the two rights-of-way to use in adjacent undisturbed forest ecotones and undisturbed forest. Deer appeared to utilize browse in the 17-year-old corridor but returned to adjacent undisturbed forest, probably utilizing available hiding or thermal cover. Deer utilized the corridors for travel in early winter prior to limiting snow depths. Elk utilized forage on the two-year-old right-of-way primarily where portions were adjacent to forested habitats. The principal conclusion of this study was that pipeline corridors increased local habitat diversity and that diversity—juxtapositions of browse or forage to undisturbed forested habitat—influenced use of the corridors by ungulates. Similarly, studies in Washington and Oregon have shown that elk prefer habitat that is close to cover-forage edges (Rowland et al. 2018).

During right-of-way restoration, Pacific Connector would create habitat diversity features in the right-of-way corridor, such as rock and brush piles, that would provide habitat for a variety of wildlife species including mollusks, amphibians, and small mammals. Such features reduce fragmentation effects of abrupt edge characteristics by creating local irregularities. LWD placed in and/or across the right-of-way may eventually contribute to microsite diversification and provide corridors for some wildlife (e.g., terrestrial mollusks) to travel across an otherwise potential barrier. Such movements would be essential to avoid potential genetic isolation of relatively non-mobile species.

Effects on Mammals

Effects discussed for "General Effects Applicable to All Terrestrial Wildlife" would be relevant to mammals. Because it will not be known where mammals are specifically located, effects can be quantified by acres of disturbance in habitats in which they could occur (see table 4.5.1.2-1). The Project would be cutting a relatively narrow swath (95-foot construction right-of-way and 30-foot-wide maintenance corridor) out of larger areas of potentially suitable habitat. Due to these factors, we conclude that the Project would affect individual mammals but is not expected to have significant effects on mammal species.

The Pacific Connector Pipeline Project is not expected to affect the Pokegama wild horse herd, as the Project would not cross through or affect the HMA.

Timber clearing in winter and early spring would coincide with the bat hibernation period. Bats utilizing trees for hibernation would be killed by timber clearing. Timber clearing in spring and early summer would coincide with natal or maternity periods but would not occur between April 1 and July 15 in order to avoid the migratory bird nesting season. Females and young inhabiting roosts in tree cavities would likely be killed if occupied roost trees and/or snags were felled. Likewise, bats utilizing day roosts under loose bark or in snags with cavities could be killed by timber clearing at any time of the year. Young bats would likely be killed if roost trees were felled before they were able to fly. Most bat species, especially Townsend's big-eared bat, are sensitive to disturbance and would abandon disturbed roosts (Csuti et al. 2001; Verts and Carraway 1998; ODFW 2013a). This disturbance and subsequent abandonment would have energetic repercussions, potentially decreasing successful reproduction and survival.

Noise from traffic and other sources is believed to interfere with bats' echolocation (Jones 2008). We estimate that noise from general construction of the pipeline would be about 72 dBA at 300 feet.

Construction-related traffic and other pipeline construction noise would be limited to daylight hours, except for HDDs, and would mostly avoid periods when bats use echolocation to forage. Consequently, pipeline construction noise would not significantly affect bats. Pipeline construction noise is discussed in more detail in section 4.12.2.2.

Night lighting could act as barriers to bat movements (Kuijper et al. 2008), reduce bat activity in the immediate vicinity (Stone et al. 2009), or have an opposite effect by attracting nocturnal insects (Svensson and Rydell 1998; Rydell and Racey 1993). The Klamath Compressor Station would be equipped with outside lighting to support night work activities. During normal operations, nighttime work or maintenance activities would generally not be scheduled; therefore, these lights would only be used periodically and possibly for short periods during the winter when daylight hours are short.

Pacific Connector would operate 15 new communication towers ranging in height from 40 to 170 feet tall (table 2.1.2.2-2). Of the 15 new towers, 7 would be associated with new project features and Pacific Connector would attempt to co-locate the other 8 towers with existing facilities. It is possible that bats would fly into the communication towers. Placement of 8 towers within existing facility sites is not expected to affect habitat or wildlife more than has already been affected with the original construction and operation of these facilities. New towers would not significantly affect bats, as these towers would not have guy wires or lighting, which would decrease the possibility of collisions but would not entirely eliminate that risk.

Because it will not be known where bat roosts are specifically located, effects on bats are assumed to occur in forested habitat types. Timber clearing is expected to injure or cause mortality to an unknown number of individual bats. Because white-nose syndrome is not known to affect bats in Oregon, the Pacific Connector pipeline is not expected to facilitate spread of this disease. Considering the amount of available forested habitat adjacent to the pipeline, and the dispersed nature in which tree-roosting bats typically roost in the west, construction and operation of the Pacific Connector pipeline would affect individual bats but is not expected to significantly affect bat species.

Effects on Birds

Effects on migratory bird occupied nests, eggs, pre-fledgling young, and potentially adults would be minimized by Pacific Connector's commitment to various seasonal restrictions during construction. Tree felling and brush removal during construction would be conducted outside of the primary migratory bird nesting season, which is April 1 through July 15. The primary migratory bird nesting season is based on data from Adamus et al. (2001) and determined in consultation with FWS as described in the draft *Migratory Bird Conservation Plan*. In addition, tree felling within 0.25 mile of an NSO activity center would occur after September 30 and before March 1, and tree felling within 300 feet of MAMU stands would occur after September 15 but before April 1. Routine vegetation clearing during operations would only be done between August 1 and April 15 of any year, to reduce effects on nesting birds during the primary spring and summer breeding season. Additional restrictions for other migratory birds are listed in the draft *Migratory Bird Conservation Plan* filed with the FERC on August 31, 2018. While these timing restrictions would minimize effects on migratory birds, some mortality could occur outside of the primary nesting season.

If a species' breeding period begins or ends outside of the primary breeding season, the active nest, eggs, or unfledged juvenile birds would be at risk. Numbers of migratory birds, nests, and eggs that might be affected during vegetation clearing and/or construction are estimated and summarized in table I-13 in appendix I. Construction spreads 1 through 6 (including early works) are in BCR 5; spread 7 is mostly in BCR 9 with about 6.5 miles in BCR 5.

To estimate the amount of birds and eggs affected, Pacific Connector compiled data for 33 BBS routes within 50 miles of the pipeline. Numbers of birds for species observed each year on a route were divided by the length of the BBS route (birds per mile), averaged each year for routes reporting the species, and averaged for the 20-year period 1997 to 2016. For each species that had a close or general association with habitats affected by the pipeline, the average number of birds per mile was multiplied by miles of habitat affected (miles of habitat affected are included in table I-13 in appendix I).

Edge habitat created by the pipeline right-of-way is expected to have both positive and negative effects on bird species. Expected positive effects are increased diversity and density of bird species, increased access to a variety of food resources, and increased ground cover favoring ground-nesting species (Rosenberg and Raphael 1986). Potential negative effects include increased brood parasitism, increased nest depredation in grasslands, forests and edge habitats, and lower nesting success (Thomas and Towiell 1982; Burger et al. 1994; Vickery et al. 1994; Marini et al. 1995; Danielson et al. 1997; Brand and George 2000). There have been declines of sagebrush-dependent migratory passerine bird species with loss of sagebrush steppe vegetation and increased fragmentation in remaining sagebrush-dominated habitats (Knick and Rotenberry 1995; Knick et al. 2003). Densities of Brewer's sparrow and sagebrush sparrow, as well as other species dependent on sagebrush for nesting habitat, were greatly reduced near well-field roads and pipelines compared to densities beyond 300 feet (Ingelfinger 2001). Nest parasitism by brown-headed cowbirds is especially likely in fragmented shrub-dominated and forested habitats (Askins 1994, Vander Haegen and Walker 1998). Such effects would be facilitated over the long term because maintenance of the 30-foot permanent easement would create areas of early-seral habitat throughout the operational life of the project. These corridor areas would not only provide habitat used by some wildlife species, but would also connect patches of suitable habitat, allowing wildlife to move between one patch and another (Turner et al. 2001).

Corvids, including common ravens and American crows (*Corvus brachyrhynchos*; also jays and magpies), are opportunistic predators and will prey on other species' nests (Marzluff and Neatherlin 2006; Vander Haegen et al. 2002; Luginbuhl et al. 2001). Studies have shown that corvid populations expand and nest predation increases near human developments (Marzluff and Neatherlin 2006) and corvid predation increases in habitats that have been fragmented by humans (Vander Haegen et al. 2002). Potential effects on nesting birds by predatory corvids attracted to the right-of-way would be addressed by ensuring that all construction contractors practice appropriate and responsible trash disposal every day.

Pacific Connector would apply spatial and temporal buffers to known NSO, golden eagle, peregrine falcon, and great gray owl nesting habitat. Pacific Connector would also perform eagle and buteo hawk nest surveys prior to construction or timber clearing, and any occupied nests would be subject to spatial and temporal buffers appropriate for the species. FWS has drafted *Guidelines for Raptor Conservation in the Western United States* (Whittington and Allen 2008). The draft guidelines recommend spatial buffers for nests of breeding raptors during the breeding periods, which vary by location across the western states. Table 4.5.1.2-8 lists the raptor species that have been reported along the Pacific Connector Pipeline Project route by various sources and the recommended spatial buffers during nesting periods (not included in the table). Human disturbances in spatial buffers risk nest abandonment by adults and nest failure (Whittington and Allen 2008). As previously described for migratory birds, timber clearing and project construction during the breeding period would affect raptor nests, eggs, young, and adults; many effects would be avoided or minimized through vegetation clearing timing restrictions during the breeding season, raptor nest surveys, and other conservation measures provided in the draft *Migratory Bird Conservation Plan*.

TABLE 4.5.1.2-8

FWS Recommended Spatial Buffers Surrounding Raptor Nests of Species that May Occur in the Vicinity of the Pacific Connector Pipeline

Common Name	Scientific Name	Spatial Buffer (miles) c/
Hawks, Eagles, Falcons		
Osprey	*Pandion haliaetus*	0.25
Bald Eagle a/	*Haliaeetus leucocephalus*	0.5–1.0 (0.25)
Northern Harrier b/	*Circus cyaneus*	0.25
Sharp-shinned Hawk	*Accipiter striatus*	0.25
Cooper's Hawk	*Accipiter cooperii*	0.25
Northern Goshawk	*Accipiter gentilis*	0.50
Red-shouldered Hawk	*Buteo lineatus*	0.25
Red-tailed Hawk	*Buteo jamaicensis*	0.33
Ferruginous Hawk b/	*Buteo regalis*	1.00
Golden Eagle	*Aquila chrysaetos*	0.50 (0.50)
American Kestrel b/	*Falco sparvarius*	0.125
Peregrine Falcon	*Falco peregrinus*	1.00 (1.50)
Owls		
Western Screech Owl	*Megascops kennicottii*	0.125
Great Horned Owl	*Bubo virginianus*	0.125
Northern Pygmy Owl	*Glaucidium gnoma*	0.25
Burrowing Owl b/	*Athene cunicularia*	0.25
Northern Spotted Owl	*Strix occidentalis caurina*	0.50 (0.25)
Barred Owl	*Strix varia*	0.25
Great Gray Owl	*Strix nebulosa*	0.25 (0.25)
Short-eared Owl b/	*Asio flammeus*	0.25
Northern Saw-whet Owl	*Aegolius acadicus*	0.125

Source: Whittington and Allen (2008)
Note: Includes special status species that are otherwise addressed in section 4.6.
a/ Spatial buffer dependent on line-of-sight to nest.
b/ Species added to table based on occurrence on BBS routes.
c/ Spatial buffers committed to in the Draft Migratory Bird Conservation Plan are in parenthesis. Note that the National Bald Eagle Management Guidelines (FWS 2007b) recommend a 660-foot (200-meter) buffer surrounding nests during the breeding season applied to timber harvest, road construction, chain saw, and yarding operations (assumed similar to timber clearing & pipeline construction).

Pacific Connector would use eight existing communication towers and construct seven new towers (see table 2.1.2.2-2). Communications towers are estimated to kill millions of birds each year, with mortality near guyed towers greater than self-supporting towers (FCC 2006). Also, the majority of bird-tower collisions are reported from towers over 500 feet tall (Gehring 2004). Most bird-tower collisions occur at night, generally during conditions with low visibility, and during the day under foggy conditions. Bird-tower collisions may also increase with lighting on the towers. Research indicates that white strobe lights on towers may create less of a hazard to migratory birds, although these types of lights are not allowed within three nautical miles of an airport (FCC 2006).

Additionally, some research has indicated that marking guy-wires to make them more visible may reduce avian mortality (FCC 2006).

Use of eight currently existing towers is not expected to affect habitat or wildlife more than has already been affected with the original construction and operation of these facilities. New towers would not have guy wires or lighting and are either 40 or 170 feet tall, which would decrease the possibility of bird collisions but would not eliminate that risk entirely. Some additional mortality could occur from collision with towers but, given the relatively low height and the fact that towers do not have lighting or guy wires, additional mortality is expected to be minimal.

As described above, the Pacific Connector Project would affect migratory bird nests, eggs, young, and adults from tree clearing occurring outside of the primary migratory bird nesting season. Where vegetation clearing cannot be avoided during the breeding season, Pacific Connector would have qualified biologists perform pre-construction surveys of the area to be disturbed, plus a 20-foot buffer adjacent to areas affected. If nests are encountered, Pacific Connector would work with the FWS to avoid nests as feasible. The FWS would require a special use permit if an active nest is encountered that would need to be removed, relocated, or transferred to a rehabilitation center.

Laws and regulations regarding the treatment of migratory birds, including the MBTA and EO 13186, are described above (see section 1.5.1.10). In accordance with the March 2011 MOU between the FERC and the FWS to implement the policies of EO 13186, a draft *Migratory Bird Conservation Plan* was filed with the FERC on August 31, 2018. The draft *Migratory Bird Conservation Plan* identifies avoidance and minimization strategies, as well as habitat restoration. With incorporation of the draft and anticipated final *Migratory Bird Conservation Plan,* we conclude that the Project would affect individual birds but is not expected to significantly affect migratory bird species.

Effects on Game Animals

Numerous studies have shown that both Rocky Mountain and Roosevelt elk are sensitive to human disturbances such as motorized travel on and off roads (Rowland et al. 2000). Roads are generally avoided by elk when they are open but are heavily utilized by elk as travel corridors when closed. During construction of the Pacific Connector pipeline, there would be short-term, localized effects on hunter success rates in the affected hunt units. When construction in a particular hunt unit coincides with hunting seasons, hunter utilization and success in the immediate vicinity would probably be adversely affected for the duration of construction in that area. However, hunter success rates for any species in each affected hunt unit are relatively low despite seemingly extensive hunter efforts (ODFW 2014a).

Where the Pacific Connector pipeline crosses existing roads, the newly created corridor would be potentially accessible from each road and probably more so at points crossed where access roads are adjacent to previously dense and/or forested habitats. The Project would require construction of 15 PARs. Increased hunter success as a result of those access points is likely but any changes in success cannot be predicted or estimated because so little area (the pipeline corridor) in any given hunt unit would be subject to increased hunter access.

After construction, there could potentially be a secondary effect (Comer 1982) on harvest rates because of increased access by hunters using the pipeline right-of-way to access remote areas. Increased public recreation along cleared rights-of-way in the fall hunting season, especially near crossings of existing access points, has been documented elsewhere (Crabtree 1984). Increased public access because of the cleared pipeline right-of-way could increase poaching of game animals and non-game wildlife on a local level. Enforcement of wildlife regulations is the responsibility of the Oregon State Police, Fish and Wildlife Division.

In big game winter management areas in Douglas, Jackson, and Klamath Counties, mature and regenerating forest would be converted to an herbaceous/shrub vegetative cover for the long term, increasing the amount of forage available to big game adjacent to forested stands potentially used for thermal cover (table 4.5.1.2-9). Proposed seed mixes include grasses and legumes that provide forage for deer and elk, such as bluegrass (*Poa* sp.), orchardgrass (*Dactylis glomerata*), alfalfa (*Medicago* L.), trefoil (*Lotus corniculatus*), and clover (*Trifolium* sp.) (Cafferata-Coe 2014), and were developed in consultation with NRCS and land management agencies (see Pacific Connector's ECRP, Appendix I to the POD [appendix F.10 of this EIS]). Forested areas would be the most commonly affected, followed by grasslands/shrublands. Temporary disturbance areas that are forested, regenerating, or recently clear-cut stands removed during construction on big game winter range would be replanted with trees after construction of the pipeline, eventually providing similar habitat to that present prior to construction.

In addition, big game are expected to be displaced from habitats adjacent to construction-related disturbance. In general, deer and elk return to habitats from which they have vacated in some relatively short period of time, which would likely depend on the time of year, available hiding cover, and duration of local disturbances. Following reclamation of the pipeline corridor, big game may utilize the corridor for travel and for foraging, depending on vegetation species planted and rapidity of successful revegetation.

Construction of the Pacific Connector pipeline may coincide with big game calving and fawning times, generally in late spring (May to early June). Calving and/or fawning areas may be close to winter ranges or may be at higher elevations than winter range. During active construction, big game would most likely avoid construction areas and may be adversely affected in one or more ways, including increased energy expense if they escape from disturbances or are displaced to areas of deeper snow accumulation, use of suboptimal habitats that do not provide adequate functions (food, shelter, escape cover), and use of habitats that increase the risk of predation. The expected consequences of these responses would be decreased over-winter survival and decreased calving/fawning success (for example, see Bradshaw et al. 1998).

The BLM, Forest Service, and ODFW recommend the application of seasonal construction restrictions on big-game winter range. Pacific Connector would apply the following ODFW, BLM, and Forest Service recommended seasonal closures for big game winter range (with the exception of big game winter range located in Klamath Basin, where a waiver would be obtained): November 1 to April 15 (BLM - Medford), December 1 to April 30 (Forest Service), and non-federal lands from December 1 to March 31 (private and state). Timber felling and construction activities may occur in ODFW, BLM, and/or Forest Service big game winter ranges in Douglas (Umpqua National Forest), Jackson, and Klamath counties to minimize or avoid effects on migratory birds, NSO, and MAMU.

TABLE 4.5.1.2-9

Acres of Habitat Types Affected in Big Game Winter Ranges by Construction and Operation of the Pacific Connector Pipeline by Landowner

			Acres of Habitat Affected in Winter Range					
Project Component	**County**	**Landowner**	**Forest – Woodland**	**Regenerating or Clear-cut Forest**	**Grasslands/ Shrublands**	**Wetland/ Riparian**	**Other Terrestrial Habitat a/**	**Total Habitat**
Pacific Connector Pipeline and Facility Construction	Douglas	Umpqua National Forest	9	<1	0	0	<1	9
	Jackson	Medford BLM	115	27	67	<1	5	214
		Rogue River National Forest	12	6	2	0	<1	20
		Private / State Forest	131	53	134	11	12	341
		Jackson County Total	*258*	*86*	*203*	*11*	*17*	*575*
	Klamath	Lakeview BLM	3	0	<1	0	0	4
		Private/Other	43	29	138	<1	40	250
		Klamath County Total	*46*	*29*	*139*	*<1*	*40*	*253*
	Total Pipeline and Facility Construction		**313**	**115**	**342**	**11**	**57**	**838**
Pacific Connector Operation/ Maintenance 30-foot Corridor b/	Douglas	Umpqua National Forest	2	0	0	0	<1	2
	Jackson	Medford BLM	27	6	15	<1	<1	49
		Rogue River National Forest	4	1	<1	0	<1	5
		Private / State Forest	32	12	30	2	2	79
		Jackson County Total	*63*	*20*	*45*	*2*	*3*	*134*
	Klamath	Lakeview BLM	<1	0	<1	0	0	1
		Private/Other	11	8	37	<1	9	65
		Klamath County Total	*12*	*8*	*38*	*<1*	*9*	*66*
	Total Operation/Maintenance Corridor		**77**	**27**	**83**	**2**	**13**	**202**
Revegetation Outside 30-foot Maintenance Corridor c/	Douglas	Umpqua National Forest	6	<1	0	0	<1	7
	Jackson	Medford BLM	88	21	52	<1	4	165
		Rogue River National Forest	8	4	2	0	<1	15
		Private / State Forest	99	41	104	8	10	262
		Jackson County Total	*195*	*67*	*158*	*8*	*14*	*442*
	Klamath	Lakeview BLM	2	0	<1	0	0	3
		Private/Other	32	21	101	<1	31	184
		Klamath County Total	*34*	*21*	*101*	*<1*	*31*	*187*
	Total Revegetation Outside Operation/ Maintenance Corridor		**236**	**88**	**259**	**8**	**45**	**636**

Note: Rows/columns may not sum correctly due to rounding. Acres rounded to nearest whole acre. Acreages less than 1 are shown as “<1”.

a/ Other terrestrial habitat includes agriculture, developed, and barren. Restoration efforts will allow habitat type to be converted back to original state.

b/ Upland 30-foot Operation/Maintenance Right-of-Way will be maintained in an herbaceous/shrub state less than 6 feet in height. Riparian 30-foot Operation/Maintenance Right-of-Way will be maintained in an herbaceous/shrub state within a 10-foot corridor centered over the pipeline and the additional 10 feet either side of the pipeline will be maintained in an herbaceous/shrub/tree state less than 15 feet in height (see Typical Drawings 3430.34-X-0015, 3430.34-X-0016 and 3430.34-X-0017 in Appendix 1B to Resource Report 1).

c/ Habitat Revegetation: trees planted in forested habitats, including regenerating and clear-cut forest; grasses and shrubs planted in non-forested habitat and 30-foot maintenance corridor (except riparian areas). On private lands, revegetation would occur in consultation with the landowners.

Sources: BLM Deer and Winter Management Areas, Forest Service Deer Winter Range, ODFW 2007 GIS data delineated from County planning maps, ODFW (2012c) Elk Winter Range for Eastern Oregon.

The ODFW expressed concern that open trenches during construction of the Pacific Connector pipeline could entrap deer and elk. To minimize the potential effect of open trenches on big game in delineated big-game winter and summer range, Pacific Connector would leave breaks at least 5 feet wide at approximately 0.5-mile intervals, and at visible wildlife trails, to serve as routes for big game to cross the construction right-of-way until pipe is ready to be installed (Forman et al. 2003). Alternatively, Pacific Connector would install soft plugs (backfilled trench materials) in the trench after excavation at these distances to provide wildlife passage. Additionally, 20-foot-wide gaps would be left in spoil and topsoil stockpiles at all hard or soft plug locations, and a corresponding gap in the welded pipe string would be left in these locations. Suitable ramps would also be installed from the bottom of the trench to the top to allow any wildlife that enters the trench to escape.

Pacific Connector would install barriers at locations along its pipeline route to discourage unauthorized public access to the right-of-way. These barriers may include boulders, dirt berms, log barriers, signs, and locked gates. Slash from clearing operations would be redistributed on the right-of-way, to improve habitat and to make OHV travel difficult. These barriers should minimize OHV access to the right-of-way and reduce unauthorized hunting or poaching of game animals (see section 4.10.2.5 of this EIS for a further discussion about OHV traffic).

Effects on Amphibians and Reptiles

Effects discussed above under General Effects Applicable to All Terrestrial Wildlife would be relevant to amphibians and reptiles. Because it will not be known where amphibians and reptiles are specifically located, effects are assumed to occur in Wetlands/Eastside Riparian-Wetlands, Developed, Urban, and Mixed Environments, and Mixed Conifer-Hardwood Forest. Some threats to amphibians in habitats crossed by the Project include loss of habitat and its connectivity, changes in hydrology and water quality, predation, and competition with invasive species (ODFW 2006b; Oregon Conservation Strategy 2016). The primary threats to reptiles are habitat loss and fragmentation, predation, and competition with nonnative invasive species, such as turtles, fish, and bullfrogs (ODFW 2006b; Oregon Conservation Strategy 2016). The Project would remove a relatively narrow swath (95-foot construction right-of-way and 30-foot-wide maintenance corridor) out of larger areas of potentially suitable habitat. Due to these factors, we conclude that the Project would affect individual amphibians and reptiles but is not expected to have significant effects on these species.

Effects on Invertebrates

Effects discussed above under General Effects Applicable to All Terrestrial Wildlife would be relevant to invertebrates. Invertebrates are assumed present in all habitat types crossed by the Pacific Connector Project. Of specific concern to invertebrate pollinators is the use of chemical herbicides to control noxious weeds and other invasive plant species that can often colonize areas disturbed by construction activities. Implementation of Pacific Connector's *Integrated Pest Management Plan*[127] would reduce the likelihood of establishment and spread of noxious weeds from construction activities. Control of noxious weeds helps to preserve native plants that pollinators require for survival; however, some chemicals used to control noxious weeds have been shown to have a detrimental effect on pollinators when used within typical to maximum

[127] See Appendix N to the POD, which was included in Pacific Connector's application to the FERC.

application rates, such as 2,4-D, glyphosate, and triclopyr (Forest Service 2005b). These three herbicides are included in the Pacific Connector's *Integrated Pest Management Plan* and would likely have adverse effects on pollinators when applied in the immediate vicinity of project disturbances. Due to these factors, we conclude that the Project would affect individual invertebrates but is not expected to have significant effects on these species.

4.5.1.3 Environmental Consequences on Federal Lands

Wildlife species present on federal lands crossed by the Pacific Connector pipeline would be similar to those discussed for all land ownerships above in section 4.5.1.2, including mammals, birds, amphibians, reptiles, and invertebrates. Wildlife on federal lands is managed under a variety of directives. Species managed on federal lands include NWFP Survey and Manage species, BLM and Forest Service sensitive species, and federally threatened, endangered, and proposed species. The presence of these species on federal lands and potential effects on these species are discussed in section 4.6.

The Forest Service additionally identifies MIS, which include wildlife monitored during forest plan implementation to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent (Forest Service Manual [FSM] 2620.5). On the Umpqua National Forest, MIS include NSO, pileated woodpecker (*Dryocopus pileatus*), primary cavity excavators (nesters), American marten, Roosevelt elk, Columbian black-tailed deer, peregrine falcon, bald eagle, and steelhead (*O. mykiss*; water quality indicator). On the Rogue River National Forest, MIS species include Columbian black-tailed deer, Roosevelt elk, American marten, NSO, pileated woodpecker, and primary cavity excavators (nesters). On the Winema National Forest, MIS include NSO, pileated woodpecker, northern goshawk, three-toed woodpecker (*Picoides dorsalis*) or black-backed woodpecker (*Picoides arcticus*), bald eagle, mule deer, resident trout, and American marten. Potential effects of the pipeline on MIS, and by association wildlife with similar habitat needs, are assessed in the MIS Report (appendix F.6 of this EIS). Additionally, effects on some of these species (Roosevelt elk, Columbian black-tailed deer, peregrine falcons, northern goshawks, mule deer, and bald eagles), including effects on federal lands, are discussed above in section 4.5.1.2.

Federal lands crossed by the pipeline contain 16 of the 17 wildlife habitats affected by the pipeline across all ownership; only the wildlife habitat "Bays and Estuaries" is not affected on federal lands. Wildlife species' associations with these habitats provide a basis for evaluating potential effects on wildlife. The acreage of each wildlife habitat that would be affected on federal land during pipeline construction, and the number of species of herpetofauna (i.e., amphibians and reptiles), birds, and mammals associated with those habitats are shown below in table 4.5.1.3-1. Agriculture and Westside Riparian-Wetlands/Eastside Riparian-Wetlands have the highest number of associated species (290 and 270, respectively), but have very few acres affected. Of all the forest habitats, Southwest Oregon Mixed Conifer-Hardwood Forest would be the most affected by the pipeline (most acres of disturbance) as well as being the forest habitat that supports the greatest number of wildlife species (226 species associated).

TABLE 4.5.1.3-1

Acres of Construction-Related Disturbance to Wildlife Habitat Types by the Pacific Connector Pipeline on Federal Land, and Wildlife Species Associated with Johnson and O'Neil (2001) Habitats

General Habitat Type	Mapped Habitat Type	Late Successional or Old-Growth Forest Crossed a/e/ (acres)	Mid-Seral Forest Crossed b/e/ (acres)	Clearcut/ Regenerating Forest Crossed c/e/ (acres)	Total Acres	Number of Species Associated d/
Forest-Woodland	Westside Lowland Conifer-Hardwood Forest	169	121	138	427	32 – Herpetofauna 115 – Birds 66 – Mammals
	Montane Mixed Conifer Forest	26	14	62	102	21 – Herpetofauna 94 – Birds 60 – Mammals
	Southwest Oregon Mixed Conifer-Hardwood Forest	387	108	127	622	36 – Herpetofauna 126 – Birds 64 – Mammals
	Ponderosa Pine Forest and Woodlands	54	1	26	81	31 – Herpetofauna 126 – Birds 64 – Mammals
	Westside Oak and Dry Douglas-fir Forest and Woodlands	31	<1	0	31	32 - Herpetofauna 115 – Birds 62 – Mammals
	Western Juniper and Mountain Mahogany Woodlands	0	3	0	3	19 - Herpetofauna 93 – Birds 35 – Mammals
	Subtotal	**667**	**246**	**353**	**1,266**	
Grasslands Shrubland	Shrub-steppe	–	–	–	73	23 – Herpetofauna 76 – Birds 47 – Mammals
	Westside Grasslands	–	–	–	17	26 – Herpetofauna 82 – Birds 37 – Mammals
	Eastside Grasslands	–	–	–	3	20 – Herpetofauna 80 – Birds 46 - Mammals
	Subtotal	**–**	**–**	**–**	**93**	–
Wetland/ Riparian	Westside Riparian-Wetlands/Eastside Riparian-Wetlands	–	<1	–	1	38 – Herpetofauna 155 – Birds 77 – Mammals
	Herbaceous Wetlands	–	–	–	<1	18 – Herpetofauna 134 – Birds 44 – Mammals
	Subtotal	**–**	**<1**	**–**	**<1**	
Agriculture	Agriculture, Pastures, and Mixed Environs	–	–	–	2	32 – Herpetofauna 181 – Birds 77 – Mammals
	Subtotal	**–**	**–**	**–**	**2**	
Developed/ Altered	Urban and Mixed Environs	–	–	–	29	37 – Herpetofauna 133 – Birds 64 – Mammals
	Roads	–	–	–	96	N/A
	Subtotal	**–**	**–**	**–**	**124**	
Barren	Coastal Dunes and Beaches	–	–	–	0	6 – Herpetofauna 100 – Birds 26 – Mammals
	Subtotal	**–**	**–**	**–**	**0**	

TABLE 4.5.1.3-1 (continued)

Acres of Construction-Related Disturbance to Wildlife Habitat Types by the Pacific Connector Pipeline on Federal Land, and Wildlife Species Associated with Johnson and O'Neil (2001) Habitats

General Habitat Type	Mapped Habitat Type	Late Successional or Old-Growth Forest Crossed a/e/ (acres)	Mid-Seral Forest Crossed b/e/ (acres)	Clearcut/ Regenerating Forest Crossed c/e/ (acres)	Total Acres	Number of Species Associated d/
Open Water	Open Water - Lakes, Rivers, and Streams	–	–	–	1	17 – Herpetofauna 95 – Birds 20 – Mammals
	Subtotal	–	–	–	**1**	
	Project Total	**667**	**247**	**353**	**1,487**	

Note: Rows and columns may not sum correctly due to rounding. Acreages rounded to nearest whole acre; values less than 1 acre shown as "<1".
a/ Late Successional (80 to 175 years) and Old-Growth Forest (175 + years).
b/ Mid-Seral Forest (40 to 80 years).
c/ Clearcut (0 to 5 years) and Regenerating Forest (5 to 40 years).
d/ Numbers of species associated with each habitat type crossed by the Pacific Connector pipeline were summarized from Pacific Connector's Environmental Resource Report 3, Appendix 3D, Table 3D-1.
e/ Cells with no data result from the fact that non-forested habitat types did not identify seral stage, thus acres are identified only in the "total acres" column.

Effects on wildlife would be similar on federal lands to those discussed for all land ownerships above in section 4.5.1.2, including direct mortality to individuals unable to move away from construction equipment, noise and visual disturbance during construction, and habitat loss and modification. Less mobile wildlife species that are not able to move away from construction activities during clearing and site preparation could experience direct mortality. More mobile species would likely be displaced from the site during active construction. Wildlife in the vicinity of the pipeline would also be disturbed by construction activities and noise, and may move away from the construction site. However, the primary effect on wildlife from construction and operation of the pipeline would be habitat loss.

The discussion of effects on big game in section 4.5.1.2 under Game Animals includes effects on big game on federal lands. Table 4.5.1.2-4 lists the miles of designated big game winter range crossed by the pipeline within and outside federal lands, and table 4.5.1.2-10 lists the acres of habitat types in big game winter ranges affected by pipeline construction and operation within and outside federal lands.

Seasonal road closures on public lands have been applied to big-game winter range on BLM and NFS lands to minimize the effect of winter stress on deer and elk. Additionally, the BLM, Forest Service, and ODFW recommend the application of seasonal construction restrictions on big-game winter range. The following are recommended seasonal closures for big game winter range: November 1 to April 15 (BLM), December 1 to April 30 (Forest Service), and December 1 to March 31 (private and state). Pacific Connector notes that the numerous seasonal restrictions to protect applicable species pursuant to the ESA and the MBTA would require timber-clearing activities to be conducted outside nesting seasons during the spring and summer months. Therefore, Pacific Connector would be required to complete timber-clearing and other construction activities during recommended seasonal closures for big game winter range and appropriate waivers for recommended seasonal big game closures would be necessary.

Effects on wildlife associated with late-successional and riparian habitat on federal land would be generally similar to those described above wherein direct effects would occur during clearing and pipeline construction if individuals are killed, injured, and/or displaced to other locations where possible mortality increases and/or fecundity decreases. The goal for the LSR and Riparian Reserve Forest Service and BLM land allocations is to encourage healthy late-successional and riparian forests; see appendix F. Direct effects on late-successional and riparian habitat (removal and/or conversion to different vegetation) may indirectly affect wildlife by decreasing the amount of habitat locally available and decreasing the effectiveness of adjacent habitats in providing life-requisite functions for wildlife. That effect would not be able to be mitigated on-site and is assumed to persist through the long term. Effects on species inhabiting other, non-forested habitats in the affected areas in late-successional and riparian habitat on federal land (including LSRs, Riparian Reserves and the Matrix/Harvest Land Base) would be similarly affected, although the amount of time required to restore affected non-forested habitats would be shorter (see section 4.4.2.4). Effects on LSRs and Riparian Reserves on federal lands from construction and operation of the Pacific Connector pipeline are addressed in section 4.7.3 and appendix F.

Loss of snags is expected to be a long-term effect. Estimates of snag density (numbers per acre) that would be affected in the construction right-of-way and TEWAs were made on each of the three National Forests during timber reconnaissance conducted in 2006 and 2007, and verified in 2015 (Chapman 2017). Estimates of snag density by size class (inches dbh) and decay class (hard or soft) are provided in table 4.5.1.3-2. In the areas affected by construction, conifer snags less than 13 inches dbh are generally most dense on each forest, although there are numerous hardwood snags in that size category on the Rogue River National Forest. Most of the smaller snags (less than 13 inches dbh) were observed as hard wood, rather than softened due to decay.

TABLE 4.5.1.3-2

Snag Density Estimates on NFS Lands

National Forest	Tree Type	Decay Class	Estimates of Snag Density a/ (Number per Acre) by Size Category (inches dbh)			
			<13	13-24	25-36	>36
Umpqua	conifer	Hard	5.7	0.7	1.0	0
		Soft	0.1	1.0	1.0	0.5
Rogue River	conifer	Hard	1.7	0.2	0.1	0
		Soft	0	0.5	0.2	0.1
	hardwood	Hard	1.7	0	0	0
		Soft	0	0.1	0	0
Winema	conifer	Hard	3.3	0.2	0.1	0
		Soft	0	0.4	0.1	0

a/ Snag density was verified in 2015 but was prior to Stout's Creek fire that affected acreage in Umpqua National Forest.
Source: Chapman 2017

Although no other portions of the pipeline route have been similarly examined, available data for the BLM districts crossed by the proposed pipeline generally show that snag density is higher on the BLM districts (BLM 2008). It is also assumed that snag densities on the Umpqua National Forest have increased following the 2015 Stout's Creek fire. Nevertheless, loss of snags regardless of decay class is expected to be a long-term effect because recruitment of new snags in the affected areas would take much longer than three years.

The Forest Service will require mitigation to meet their respective land use plans; those mitigation actions are described in table 2.1.5-1. Similarly, the Applicant has proposed mitigation on behalf of the BLM, including road closures, road surfacing, fire suppression, and fuels reduction as described in Attachment 2 of the *Comprehensive Mitigation Plan*. Road decommissioning, fuel breaks, and forest thinning mitigation actions will assist in the recovery of late-seral habitat, reduce habitat fragmentation and edge effects, and enhance resilience of mature forest stands. Proposed snag creation and placement of LWD will mitigate the effect of loss of snag habitat and reduction in the contribution of large down wood due to clearing of forested habitat. Reallocation of matrix lands to LSR will meet the neutral to beneficial standard for new developments that affect LSRs and habitat improvement of meadow habitat within LSRs will mitigate effects on unique habitat. Livestock fencing will be used to protect revegetation efforts associated with construction disturbances.

4.5.1.4 Conclusion

Constructing and operating the Project would have both short- and long-term adverse effects on wildlife habitat and terrestrial wildlife species. We expect that some wildlife individuals would experience displacement or mortality during construction and operation, and some wildlife habitat would be removed or modified temporarily or permanently. However, based on the characteristics of the terrestrial wildlife species and habitat, the Applicant's proposed construction and operations procedures and methods, and their implementation of impact minimization and mitigation measures, we conclude that the Project would not significantly affect terrestrial wildlife.

4.5.2 Aquatic Resources

4.5.2.1 Waterway for LNG Carrier Traffic

The waterway for LNG carrier traffic to Jordan Cove's terminal contains a diverse collection of anadromous, estuarine, and marine organisms and associated habitats (figure 4.5-1). The marine environment along the transit route outside of Coos Bay consists of varied habitats used by aquatic organisms including commercial and recreational fish and shellfish and marine mammals. This habitat includes gently sloping nearshore intertidal and subtidal sand area near the Coos Bay mouth and rocky shoreline to the south. Habitats near the mouth of the bay range from sand beaches to rocky shorelines. Offshore, deeper soft bottom habitats extend over 100 feet deep with main pelagic surface water along the ship transit route.

The Coos Bay estuary is described in section 4.3.2.1. Several freshwater streams and sloughs enter the bay, so that its habitats range from marine to estuarine. The bay contains shellfish resources, as well as marine fish. It is a migration corridor for salmon (*Oncorhynchus* spp.) and steelhead (*O. mykiss*) that spawn and rear in the streams that drain into Coos Bay. The bay along the transit route for LNG carrier marine traffic contains mostly sloping beaches with algae and eelgrass beds that supply important habitat for the estuarine organisms. Common attached bottom grasses include native eelgrass (*Zostera marina*), non-native dwarf eelgrass (*Z. japonica*) and surfgrass (*Phyllospadix scouleri*), and attached green algae sea lettuce (*Ulva* spp.). A total of over 14,000 acres of habitat is present in Coos Bay, including some 1,400 acres of eelgrass beds.

Many fish, shellfish, and marine mammal species are common in the waterway leading to the Jordan Cove LNG terminal (see appendix I, table I-1). Most of these aquatic species are mentioned below.

The status and potential project effects of federally listed fish, marine mammals, and turtle species are presented in our BA (see appendix I). EFH fish species that are managed under the MSA are presented in our EFH Assessment attached to our BA (see appendix I). The federally listed species information is summarized in section 4.6, and the EFH assessment is summarized in appendix I.

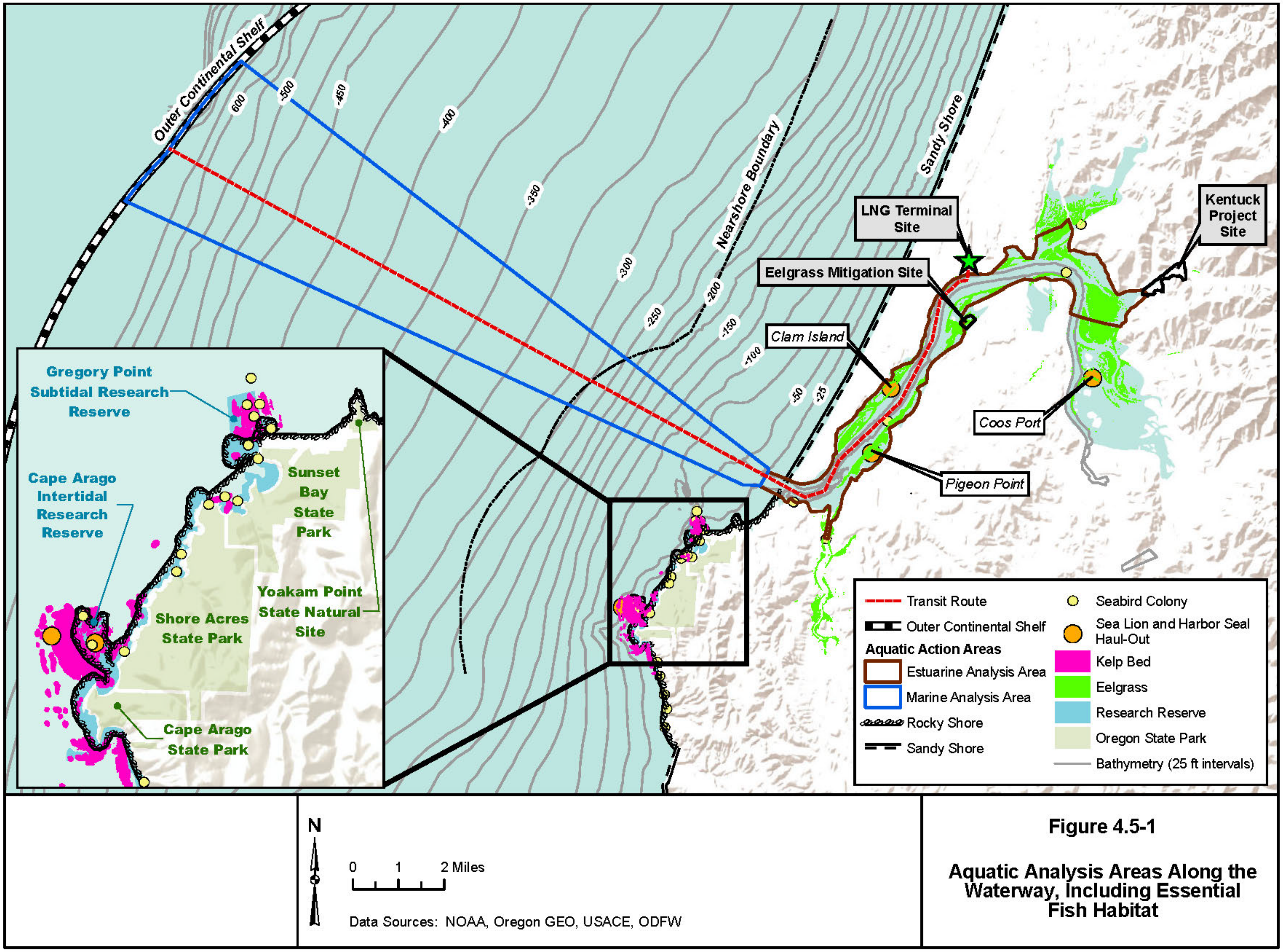


Figure 4.5-1

Aquatic Analysis Areas Along the Waterway, Including Essential Fish Habitat

Marine Fish

Species of groundfish, pelagic, anadromous, and marine species would be present in the waterway for LNG carrier traffic to the terminal, in the nearshore and marine waters outside of the Coos Bay estuary. This includes a variety of rockfish, flatfish, shark, skates, sturgeon, sablefish, cod, and migratory fish such as anchovy and sardine and in the outer regions may rarely include some highly migratory species such as thresher shark (*Alopias* spp.) and tuna.

Marine fish communities in Coos Bay consist of species found in estuarine and marine waters. Their distribution and abundance vary with physical factors such as bottom conditions, slope, current, salinity, and temperature, as well as season, which can affect migration and spawning timing. Some of the more commonly abundant fish include Pacific herring (*Clupea pallasii*), and the non-native American shad (*Alosa sapidissima*). Most fish species are migratory or seasonal, spending only part of their life in these waters. Other common seasonal marine fish species include surfperch (family *Embiotocidae*), lingcod (*Ophiodon elongatus*), rock greenling (*Hexagrammos lagocephalus*), sculpin, surf smelt (*Hypomesus pretiosus*), Pacific herring (*Clupea pallasii*), English sole (*Parophrys vetulus*), black rockfish (*Sebastes melanops*), northern anchovy (*Engraulis mordax*), eulachon (*Thaleichthys pacificus*), longfin smelt (*Spirinchus thaleichthys*), Pacific tomcod (*Microgadus proximus*), sandsole (*Psettichthys melanostictus*), and topsmelt (*Atherinops affinis*). California halibut (*Paralichthys californicus*) is also present in the bay near Jordan Cove. A few common species like kelp greenling (*Hexagrammos decagrammus*) and starry flounder (*Platichthys stellatus*) reside in the bay year-round. The bay from just beyond the LNG terminal site to its mouth is a prime feeding area for many local and seasonal fish species.

Fish abundance varies with salinity. Near NCM 1.5, the sloughs are mostly of high salinity, while farther up the bay, near NCM 15.5, sloughs are generally brackish, of lower salinity. Toward the mouth of the bay, the salinity is higher, especially in the summer, which is when the number of fish increase.

Anadromous Fish

A common group of anadromous fish species found in the waterway for LNG carrier traffic to the terminal includes Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), chum salmon (*O. keta*), steelhead, coastal cutthroat trout (*O. clarkii clarkii*), Pacific lamprey (*Entosphenus tridentata*), western river lamprey (*E. ayersi*), white sturgeon (*Acipenser transmontanus*), green sturgeon (*A. medirostris*), striped bass (*Morone saxatilis*), and American shad (*Alosa sapidissima*). Anadromous is a term describing fish that return from the ocean to the rivers where they were born to spawn. Adult anadromous fish spend a portion of their adult life in the ocean; the amount of time varies among the species. Sexually mature adults migrate or "run" from the ocean and estuaries upstream to fresh water streams to spawn for most salmonid anadromous fish in shallow gravel stretches. Other anadromous stocks noted above have varied spawning habitat uses. After a period, which varies with the species, juveniles migrate downstream to estuaries typically in late winter to summer. Salmon and steelhead undergo smolting (physiological maturation to adjust from fresh to salt water) before entering marine waters as juveniles. Salmon and steelhead and cutthroat typically rear in the ocean for one to five years before returning as adults to their natal streams to spawn, while other anadromous fish (striped bass, American shad, sturgeon, and lamprey) have a range of ocean-rearing periods ranging over multiple years, with striped bass largely confined to the estuary. Salmon typically return to streams in late summer through fall. Steelhead and sea-run cutthroat trout may return to streams in the summer, fall, winter, or spring depending. Lamprey return from spring to fall to fresh water; striped bass are not native but spawn in the spring over a brief period in Coos River. Salmon species die after spawning but some steelhead and anadromous coastal cutthroat survive to return to the ocean and can spawn again. Steelhead typically remain in freshwater streams after emergence for two to three years before migrating to the ocean, with adults returning to spawn in their fourth or fifth year. Sea-run cutthroat usually remain in fresh water for two to four years before smolting and migrating to saltwater, usually staying in the estuaries or near shore (Behnke 1992).

There are eight native species of coldwater[128] anadromous fisheries in the area affected by the Jordan Cove LNG Project: Chinook salmon, coho salmon, chum salmon, steelhead, coastal cutthroat trout, Pacific lamprey, western river lamprey, and green sturgeon. The Oregon Coastal Coho Salmon Evolutionarily Significant Unit (ESU) is present and is listed under the ESA. The North American Green Sturgeon – Southern Distinct Population Segment (DPS), and Southern DPS Pacific eulachon, which are both listed as Threatened under the ESA, may be present or migrate through Coos Bay. The Project effects on these ESA listed fish and their critical habitat are presented in section 4.6 of this EIS.

Shellfish

A large and diverse population of benthic and epibenthic invertebrates is present beyond the entrance to Coos Bay. Clams, crabs, oysters, and shrimp make up important components of these invertebrates in the bay. Some of the most abundant and commercially important of these species include bentnose clams (*Macoma nasuta*), Pacific oyster (*Crassostrea gigas*), Dungeness crab (*Metacarcinus magister*), and ghost shrimp (*Neotrypaea californiensis*). Distribution varies along the route from the LNG terminal to the bay mouth. Principal subtidal clam beds are found in the lower bay and South Slough although the upper bay also has substantial clamming areas. Clam Island, located at the mouth of Coos Bay, has an abundance of recreationally important clams. Some of the highest recreational harvest of clams and crabs occurs at the mouth of Coos Bay with much of the crabbing occurring from the BLM boat ramp, west of the LNG terminal site to the mouth. Razor clams (*Siliqua patula*) are an important commercial and recreational species. Other common recreational clam species include butter clam (*Saxidomus giganteus*), littleneck clam (*Leukoma staminea*), gaper (*Tresus capax*), cockle (*Clinocardium nuttallii*), purple varnish clam (*Nuttallia obscurata*), and softshell clam (*Mya arenaria*). In Jordan Cove, ghost shrimp, a commonly harvested bait shrimp, are found in the fine sediment and eel grass beds. Mud shrimp (*Upogebia pugettensis*) are also harvested in this region.

Coos Bay contains one of only three known native Oregon coastal populations of the Olympia oyster (*Ostrea lurida*). Within its native range, this species has significantly diminished from historical levels (National Fish and Wildlife Federation et al. 2010). Efforts have been taken in the bay to restore this species and improvements in bay water quality and sediment have resulted in self-sustaining populations over the last two decades (Groth and Rumrill 2009; Rumrill 2007). A pilot restoration project began in 2010 that resulted in stocking 4 million juvenile Olympic oysters in South Slough. Because of its low abundance and efforts to improve the quality of the Coos Bay environment and its survival, the Olympia oyster is not harvested.

[128] The term "coldwater" species refer to the primarily to fish that thrive in colder water streams and other water systems which are the most common water systems of the Project area.

Marine Mammals

Thirty species of marine mammals occur in Oregon, including seven species of baleen whales, nine species of toothed whales, eight species of dolphins and porpoises, five species of pinnipeds (seals and sea lions), and a single species of sea otter (NMFS 2017a).

Steller sea lions (*Eumetopias jubatus*), California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and Pacific harbor seals (*Phoca vitulina*) use haulout sites in the vicinity at Cape Arago, Three Arch Rocks, and Shell Island, along the southwest Oregon Coast. Pacific harbor seals use three haul-out sites in Lower Coos Bay: Clam Island (on the western side of the Federal Navigation Channel), Pigeon Point (on the eastern side of the Federal Navigation Channel), and South Slough (by Charleston) (Wright 2013; AECOM 2019). Coos Bay has been reported as an important harbor seal pup production area along the Oregon coast (Brown 1988). Eight species of whales are federally and state-listed. All marine mammals are protected under the MMPA.

Sea Turtles

Four species of sea turtles have been documented off the coast of Oregon: the green (*Chelonia mydas*), olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea*), and loggerhead sea turtles (*Caretta caretta*).

Effects on Aquatic Habitat and Aquatic Species Along the Waterway for LNG Carrier Transit

The following section discusses transit-related effects of the LNG carriers. Although the regular transit of LNG carriers is a part of the operation of the Project, the carriers and their operation do not fall under the jurisdiction of the Commission; therefore, we can disclose but not require mitigation for these activities. Project-related effects from the LNG facility construction actions (including dredging of areas abutting the Federal Navigation Channel) are presented in section 4.5.2.2.

Vessel Strikes

Jordan Cove anticipates that as many as 120 LNG carriers each year would use the waterway to reach its terminal. In addition, in accordance with the WSR and LOR, there must be three tugboats and additional security ships that assist each LNG carrier in transit along the Coos Bay navigation channel. These vessels have the potential to strike aquatic species, including sea turtles and marine mammals, and seabirds and shorebirds during their transit to and from the Jordan Cove terminal.

In the open ocean prior to entering the Coos Bay Federal Navigation Channel, it is estimated that LNG carriers would travel at speeds of about 12 knots. Jordan Cove has proposed to provide measures supplied by NMFS to vessel operators in order to minimize potential ship strikes to cetaceans, and possibly other listed (sea turtles) and non-listed marine species by LNG carriers in a *Ship-Strike Reduction Plan*. Jordan Cove would provide operators of LNG carriers that would visit the terminal with copies of this plan for avoidance of marine mammals or sea turtles while in transit at sea. Some of the suggested measures would include the following:

- train LNG carrier crews to watch out for and avoid marine mammals and sea turtles;
- keep on board vessels copies of marine species reference guides, such as Marine Mammals of the Pacific Northwest, including Oregon, Washington, British Columbia and South Alaska by Pieter Folkens (2001);

- request LNG carriers to establish navigation policies when marine mammals or sea turtles are sighted, including:
  - maintain a distance of 90 meters or greater.
  - attempt to maintain a parallel course to the animal and avoid abrupt changes in direction until the animal has left the area.
  - reduce speed when pods or assemblages of marine mammals or sea turtles are observed nearby; and
- report sightings of any injured or dead marine mammal or sea turtles to the NMFS, regardless of whether the injury or death was caused by the LNG carrier. If the injury or death were caused by collision with an LNG carrier heading to or from the Jordan Cove terminal, the FERC should be notified within 24 hours of the incident. Information to be provided would include the date and location (latitude/longitude) of the strike, the ship name, and the species, if possible.

LNG carriers would enter the waterway at speeds between 8 and 10 knots, and slow between 4 to 6 knots as they proceed up the Coos Bay navigation channel to the Jordan Cove terminal. As required by the WSR, two tugs would escort each LNG carrier in the navigation channel, and another tug would assist in docking the vessel at the terminal. Use of tugs would allow the LNG carriers to maintain steerage even at these slow speeds.

Most sea turtles, marine mammals, and seabirds and shorebirds would be able to avoid LNG carriers traveling at slow speed through the waterway. Even with the additional LNG carriers in the waterway, the number of ships would still be below historic levels for deep-draft traffic to the Port. Effects on aquatic resources from LNG carriers would be not much greater than the effects of current deep-draft cargo ships visiting the Port. Based on the reduced speed of the LNG carriers and the efforts by Jordan Cove to increase the awareness of vessel operators, we conclude that the incidence of accidental strikes of aquatic species by LNG carriers in transit to and from the Jordan Cove terminal would be low.

Ship Grounding

During scoping some commenters raised the possibility that an LNG carrier waiting offshore to enter Coos Bay, either to avoid another ship coming out of the Port or seeking proper tidal conditions, could lose anchorage or steerage and run aground on the North Spit, like the *New Carrisa* incident of 1999. A ship grounding would have the potential to affect aquatic resources, as oil and fuel could leak from a grounded vessel. However, a Coast Guard investigation found that the *New Carrisa* grounding was caused by the captain's error in not having the ship well anchored.

All LNG carriers visiting the Jordan Cove terminal would have to adhere to Coast Guard regulations, including anchoring procedures offshore, in addition to the measures outlined in the WSA, WSR, and LOR. A pilot would board the LNG carrier to guide it through the Coos Bay navigation channel, and the vessel would be accompanied by tugs and security escort boats to keep it on course. In addition, the geometry of the navigation channel would keep the LNG carrier within its confines, away from the shore.

Shoreline Erosion from Waves and Propeller Wash

Propeller wash from LNG carriers and tugboats transiting the waterway to and from Jordan Cove's terminal could cause shoreline and bottom erosion and displace bottom organisms due to scour.

Wakes and waves caused by vessels in the waterway could increase erosion along the shoreline and resuspend loose sediments in the bay. Increased erosion and suspended sediment levels can adversely affect fish eggs and fish survival, benthic community diversity and health, and spawning habitat. At high concentrations, suspended sediments can affect oxygen exchange over the gills, resulting in weakened individuals or mortality. Waves from vessels breaking on the shoreline can also cause fish stranding.

The possible magnitude and effects of the Jordan Cove Project on shoreline erosion were approximated by Jordan Cove through models that assessed effects of waves and propeller wash from LNG carriers in Coos Bay and at the LNG docking area (i.e., Moffat & Nichol 2008; CHE 2011; Moffatt & Nichol 2017f), and the details of the model results on physical conditions in the bay resulting from LNG carrier traffic and docking are presented in section 4.3.

Overall, the models estimated that additional waves generated by the new LNG carrier traffic could increase shoreline sediment transport at the modeled point by 5 to 8 percent over existing conditions (e.g., wind-generated waves plus existing large vessel–generated waves). While both models indicated some additional shore sediment movement could occur from the waves generated by the passage of LNG carriers through Coos Bay, the effects would be small because low magnitude and relative frequency of waves, contributing a small portion of total annual wave energy and sediment transport, and be within the normal magnitude of waves that naturally occur in the bay. Therefore, the total effect would likely be within the range of natural annual variability of wave conditions. Overall, increased sedimentation and disruption of aquatic nearshore habitat from additional tugboat and LNG carrier–generated waves would be unlikely because of the factors discussed in section 4.3.

The effects of propeller wash from LNG carriers and related tugboat vessels on bottom erosion and turbidity likewise would not reach levels to cause substantial disruption to benthic or pelagic resources other than in the immediate access channel and slip area (see section 4.3 for details of modeling results). The bottom velocity caused by the propeller would be similar to the maximum velocity of peak tidal exchange (about 4 fps) along most of the route. Because the disturbance would be relatively similar to what occurs during tidal exchange and confined to the relatively coarse sediment within an 80-foot-wide swath along the 9-mile-long Federal Navigation Channel, the bottom area disturbed would be slight along most of the route. Few organisms would be displaced by physical disturbance or affected by turbidity (see section 4.3 for details); however, as noted below, there are some areas near the entrance to the access channel that would experience bottom erosion and likely benthic disruption as the LNG carrier and tug boat leave after loading.

Mobile organisms would be able to return to the area affected, while some benthic organisms could be permanently displaced. Turbidity would likely be slight due to the coarse characteristics of the navigation channel sediment that is resistant to current induced suspension. The one area that would have marked local bottom scour and increased turbidity would be in the east side of the access channel and slip where bottom scour over about 12 acres may occur during each LNG carrier departure (Moffatt & Nichol 2017g). Overall, some loss of benthic organisms could occur from LNG carrier propeller wash during each transport trip near the slip approach, but the magnitude would be small and likely less than currently occurs under each existing large vessel trip. There would be some additional local bottom disturbance in the docking area. In most cases, this disturbance would likely be much less than estimated because of the conservative assumptions used for the model. While some sessile benthic organisms may be displaced during LNG carrier docking, the limited extent of bottom disturbance and sediment suspension would result in unsubstantial effects on organisms in the slip.

Fish Stranding

Fish stranding can occur when fish become caught in a vessel's wake and are deposited on shore by the wave generated by the vessel's passing. Stranding typically results in mortality unless another wave carries the fish back into the water. However, even in the lower Columbia River where many of the studies of fish stranding have occurred, stranding was not considered a serious problem (Hinton and Emmett 1994). A study of strandings (Pearson et al. 2006) suggests that a series of interlinked factors act together to produce stranding during a ship passage. These factors include:

- Water-surface elevation—Low tides are generally more likely to result in strandings than high tides.
- Beach slope—Low-gradient beaches are generally more likely stranding locations than high-gradient ones.
- Wake characteristics—Ship wakes that result in both the greatest drawn-down and run-up on the beach are generally most likely to result in strandings. Wake characteristics are influenced by a number of dynamics including vessel size and hull form ("short and fat" vessels have a greater displacement effect and generate larger wakes than "long and thin" vessels); vessel draught (the smaller the under-keel clearance, the larger the wakes; thus, loaded vessels are more likely to result in strandings than unloaded vessels); vessel speed (fast moving vessels generate larger wakes than slow vessels); and the distance between the passing vessel and the beach (strandings are generally more likely at beaches close to the shipping channel than more distant beaches). Fish strandings were observed because of four types of vessel passages including oil tankers, container ships, car carriers, and bulk carriers (in order of the vessels observed to cause the highest to lowest stranding frequency).
- Various biological factors—For example, the larger the number of subyearling salmon that are present near the shoreline, the more fish that are likely to be stranded; salmon that are larger and relatively strong swimmers are generally less prone to stranding.
- Vessel speed—No stranding has been observed on the Columbia River at speeds less than 8 to 9 knots (about 10 miles per hour).

The factors discussed above can vary simultaneously, making it difficult to predict where and to what degree strandings may occur. A few areas may have the potential to strand fish in Coos Bay. One is the mud flats on the west side of the navigation channel along the Coos Bay and Empire Range that have beach morphology that has been shown to have potential for stranding, especially at low tide. Jordan Cove (Moffat & Nichol 2008) modeled the potential wave height and overall energy from 200 LNG carrier transits a year (combined inbound and outbound). As noted in section 4.3, the wave's height would not exceed that of normal conditions in Coos Bay and vessel-induced waves contribute a small portion of total waves in the bay. In addition, the LNG carriers would be arriving and leaving at high tide, which is a period when gently sloping beaches are mostly covered, and less likely to be dewatered from waves. The maximum vessel speed once inside the navigation channel, about 6 knots, is less than that observed to cause stranding in the Pearson et al. (2006) study. The one exception is near the Coos Bay entrance (first mile), when vessels may be traveling 8 to 10 knots. While waves generated in this portion of the waterway may be larger than farther in the bay, this is an area likely already receiving larger ocean-generated waves, so the LNG vessel-generated waves would be little different than current conditions in this region. However, outbound tugs that would guide in the LNG carriers may travel at up to 10 knots along the whole channel (Moffat & Nichol 2018b). Wave height for tugs traveling 10 knots would be greater (0.6-0.8 feet) than that of the LNG carriers (0.2 to 0.6 feet) because the LNG carriers would travel at a slower speed, but the waves would be within the range of normal wind-waves of the bay (0.5 to 3 feet; CHE 2011). Additionally, the presence in Coos Bay of subyearling Chinook salmon, which are the outmigrating fish most likely to be stranded, is limited to the summer months, approximately mid-June through the end of August. Other juvenile outmigrating salmonids (e.g., coho salmon and steelhead) would occur in the late spring and summer, but these would be less susceptible to stranding as they would be larger and less shoreline oriented. Considering the conditions, including LNG carriers entering and leaving at high slack tide, low velocity in most areas, wave height within normal range, and limited distribution and frequency of vessel-generated waves, it appears that, while some fish may be stranded, it is unlikely that LNG carrier traffic in the waterway would substantially contribute to marked loss of fish by stranding.

<u>LNG Spills</u>

In a highly unlikely scenario, there could be an accidental spill of LNG from a carrier transiting in the waterway. As explained in section 4.13, in the entire history of LNG carrier transport worldwide, there has never been a major incident resulting in a large LNG spill or fire on water. An LNG spill has an extremely low probability of occurrence and, as described below, would likely affect a small area. As more fully discussed in section 4.13 of this EIS, spilled LNG would not mix in the water column, but would vaporize as warmed by ambient temperature and, if the LNG ignited, a fire could result. The greatest threat to aquatic organisms near an LNG spill would be from changes in water temperature. A spill of LNG would float on the water surface and not mix, but in the process of changing state from solid to liquid would rapidly cool off the upper water layers closest to the LNG spill. As the LNG would vaporize and turn to natural gas, it would be less dense than air and would rise above the water. Aquatic species in the waterway would not be directly affected unless individuals come in direct contact with the LNG. Should an aquatic species directly contact the LNG when it is first released, it could have its flesh frozen because the temperature is very low. The chance of this occurring would be remote because it would require the individual to be near the water surface at the direct point of the LNG spill, before it warms. If an LNG spill from a carrier in the waterway were to ignite, it would cause localized heating of the surface water. Neither the cooling nor heating would likely cause the overall water column to change temperature to the point of affecting aquatic organism beyond the surface layer at the time of initial spill or ignition. Aquatic species, other than possibly the smallest planktonic stages and shellfish, near this spill would be able to detect undesirable temperatures and avoid the LNG spill by swimming away.

The mitigation measures outlined in the WSA, WSR, and LOR would protect public safety and the environment, and ensure that aquatic resources would not be adversely affected by LNG carrier traffic in the waterway to the Jordan Cove terminal.

<u>Fuel or Oil Spills</u>

Fuel (e.g., diesel) used for LNG carrier propulsion could possibly leak or be spilled while en route in the waterway; likewise, oil could be spilled. Adverse effect could occur on marine fish and shellfish from oil spills ranging from direct morality, reduced growth and feeding, and reduced spawning success depending on location magnitude and type of spill. Effect can be compounded when spills intersect the shoreline habitats. These effects can be both short and long term. LNG carriers would have measures aboard to contain fuel or oil spills should they occur, as required under the Coast Guard required hazardous spill response plan for vessels in U.S. waters of 2013 (78 FR 60099). Additionally, LNG carriers are double hulled, which should prevent the escape of fuel or oil, other than spills from the deck. The chance of a spill is low, and any quantities leaked are likely to be small. As reported by Pacific States/British Columbia annual reports (http://oilspilltaskforce.org/documents/), the number of oil spills reported from fishing, recreational, and other harbor marine vessels in Oregon ranged from about 9 to 65 per year, which is infrequent considering that thousands of marine vessels, both recreational and commercial, use Oregon coastal marine waters. Spills or releases of fuel or other oils into surface waters from LNG carriers are more likely to occur during fueling at the dock when the materials are being transferred onto the carrier. As discussed in section 4.3, LNG carriers are required to develop and implement a Shipboard Oil Pollution Emergency Plan, which includes measures to be taken if an oil pollution incident has occurred, or a ship is at risk of one. With the implementation each LNG carrier's Shipboard Oil Pollution Emergency Plan, impacts resulting from the spill of fuel, oil, or other hazardous liquids would be minimized both in occurrence and quantity. We conclude that because fuel or oil leaks from LNG carriers transiting in the waterway to and from the Jordan Cove terminal are not reasonably certain to occur, adverse effects on aquatic resources are not anticipated.

Introduction of Nuisance Species

LNG carrier origin locations are unknown now; they could originate from ports across the Pacific. Operators of commercial vessels have a significant economic interest in maintaining underwater body hull platings in a clean condition. Fouling of bottom platings would result in increased fuel costs for voyages and could reduce the vessel's maximum transit speed. To prevent fouling and the associated economic costs, operators aggressively and conscientiously implement hull plating preservation and maintenance programs. Failure to preserve and maintain hull plating not only raises short-term operation costs but also sets the stage for increased long-term hull maintenance costs. There is a sensitivity to this engineering and economic reality regarding commercial vessels operating at the higher end of the sailing rates schedule, as is the case for LNG carriers.

In addition to the antifouling program measures, fluid dynamics plays a practical role as a barrier to the introduction of invasive species. The amount of water that passes over the hull and through the sea chest is a massively large volume. A sea chest is an opening with associated piping in the hull below the waterline to provide seawater to condensers, pumps, and other associated equipment. The velocity of the seawater, abrasive by nature, along the hull would be expected to "waterblast" off anything that is not affixed to the hull (e.g., a barnacle). The sea chest would have the equivalent of untold multiples of seawater exchange such that an organism would be flushed out with much more velocity and volume of water than the accepted international ballast exchange procedure.

Ballast water may be another source of non-native organisms. Water is held in the ballast tanks and cargo holds of LNG carriers to provide stability and maneuverability during a voyage when vessels are not carrying cargo. Normal ballast exchange requires only three changes of water through the ballast tanks to purge any loading port organisms before arrival at the unloading port. The effects of ballast water exchange, and the measures that would be implemented to minimize or avoid effects from this action, are addressed in section 4.3.

Conclusion

Based on measures and actions that will be in place to mitigate potential adverse effects from actions during operation of LNG carrier transit, including waves size and propeller wash, LNG gas or hazardous substance spills or introduction of invasive species to marine resources, we conclude that the Project would not significantly affect marine resources.

4.5.2.2 Jordan Cove LNG Project

Coos Bay contains a variety of habitat for anadromous, marine, and estuarine fish species. A large diverse invertebrate population exists in Coos Bay. Shellfish (predominantly clams, crabs, and shrimp) are of significant economic importance to the Coos Bay area. Of marine mammals in Coos Bay, only the harbor seal, California sea lion, and killer whale have been observed during field surveys at the proposed location of the Jordan Cove access channel. No turtles have been observed or would be expected in the bay. Fish, shellfish, and marine mammals that may occupy Coos Bay are more fully discussed in the section 4.5.2.1.

Juvenile and larval life stages of vertebrate and invertebrate marine organisms are varied in the bay and near the terminal site. Over 35 species of ichthyoplankton have been documented in Coos Bay (Miller and Shanks 2005). There are some seasonal trends, with highest occurrence October through May, but fewer differences by month in the upper bay than near the ocean. Shanks et al. (2010, 2011) sampled zooplankton and ichthyoplankton in Coos Bay near the Jordan Cove terminal. A variety of zooplankton were found to be present in the bay (see table 4.5.2.2-1). Among the potential forage items, copepod adults, larvaceans, harpacticoid copepods, and Daphnia had the highest peak abundance. Overall, larval fish abundance was generally low, with those that spawn primarily in or near estuaries common (surf smelt, sand lance, and staghorn sculpins [*Leptocottus armatus*]). At times, other larval or juvenile fish were relatively abundant including English sole, buffalo sculpin (*Enophrys bison*), anchovy, and pipefish. A total of nine fish species were captured. Primary fish species spawn in winter and early spring, and larval fish were most abundant in winter samples (Shanks et al. 2011). Over 12 taxa of crab and shrimp larvae were also collected, including some recreational and commercially important crab and shrimp species, such as Dungeness crab and ghost shrimp larvae. Major approximate known oyster and shrimp habitat and clamming and crabbing areas in the bay relative to Project activities are shown in figure 4.5-2. Additional local known clamming areas that are not shown include areas west and southwest of the end of the airport runway and along the shoreline near the Eelgrass Mitigation site (ODFW 2019) and likely other smaller local sites. These habitat areas are mostly oriented along shoreline and shallow areas of the bay except for crabbing areas which extend into deeper water.

TABLE 4.5.2.2-1

Taxa Groups Collected in Coos Bay Near the Jordan Cove Terminal During 2009–2011

Categories	Specific Taxa
Fish larvae/juvenile	Surf smelt, sand lance, staghorn sculpin, buffalo sculpin, anchovy, pipefish, English sole, gunnel, pricklefish
Crab/Shrimp larvae	Porcelain crabs, pea crabs (*Pinnotheres pisum*), green crab (*Carcinus maenas*) (invasive), xanthid crabs, majid crabs, cancer crabs (e.g., Dungeness, rock crab), Lithodidae, Hippidae, Pagurid (hermit crabs), Callinassa (ghost shrimp), Sergestid shrimp, Pachygrapus crassipes (striped shore crab)
Gastropod and Bivalves larvae	Mytilus (mussels), Clinocardium (cockles), Bivalve juveniles, Gastropod juveniles
Larval Invertebrates	Barnacle nauplii and cyprids, Mytilus larvae, bivalve larvae
Cnidaria/ctenophore	Sea anemone, Hydroids, sea goose berry
Polychaete Worm Larvae	Marine worms
Salmonid Food Prey	Mysids, Amphipods, Isopods, Cumaceans, Copepod adults, Harpacticoid copepods, Calanoid copepods, Daphnia, Larvaceans, larval fish

Source: Shanks et al. (2010, 2011)

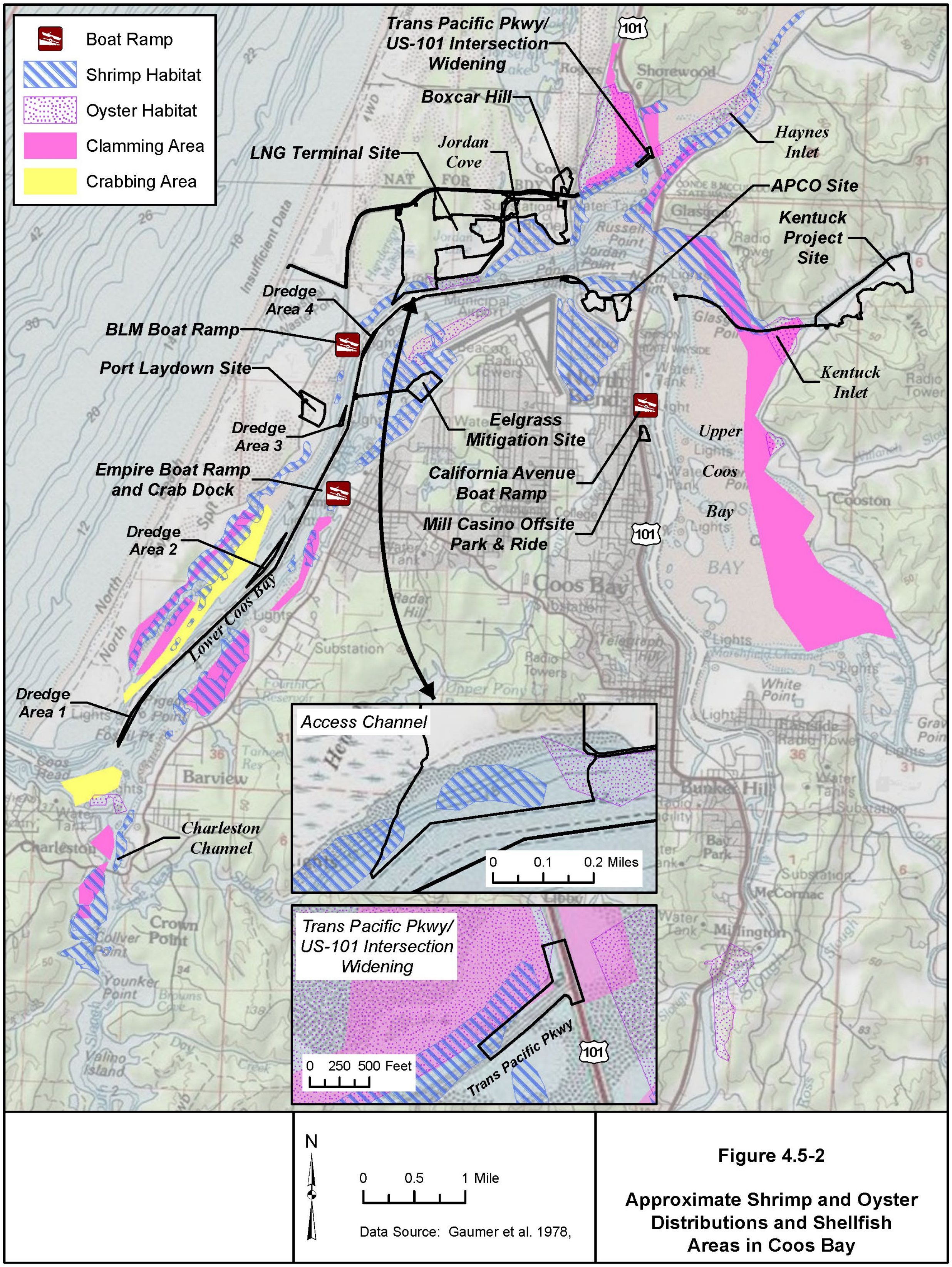


Figure 4.5-2

Approximate Shrimp and Oyster Distributions and Shellfish Areas in Coos Bay

The construction of the slip, access channel, MOF, and adjacent rock pile apron for the Jordan Cove terminal would affect about 37 acres through temporary and permanent impacts below the mean higher high water line. This would include less than 1 acre of salt marsh, about 13 acres of intertidal area of unvegetated sand plus algae/mud/sand habitat, about 4 acres of shallow subtidal, about 18 acres of deep subtidal, and about 2 acres of eelgrass habitat.[129] This would include a pile dike rock apron area that would modify about 2 acres of habitat through intertidal and subtidal addition of small riprap. The habitat areas affected by the access channel are illustrated on figure 4.5-3 and listed in table 4.5.2.2-2. Approximately 18 acres of the habitat impacted by construction would be permanently converted to deepwater habitat. Other Project facilities would also temporarily disturb intertidal and subtidal habitat during construction (table 4.5.2.2-2). The largest other area disturbing estuarine habitat would be from marine waterway modifications (i.e., the proposed modifications in the navigation channel) totaling about 40 acres of mostly deep subtidal habitat including the 27 acres from dredging and 13 acres from the dredge lines used for this dredging. Additional deepwater habitat may be affected over a 6- to 8-year period in the Federal Navigation Channel as the shoreward slope equilibrates after initial dredging. All other facilities would disturb less than about 5 acres in habitat which includes less than 1 acre of eelgrass habitat.

TABLE 4.5.2.2-2

Estuarine Habitat Affected by Construction of the Jordan Cove LNG Project Facilities and Marine Waterway Modifications in the Federal Navigation Channel

	Acres Affected								
Habitat Type	**Slip, Access Channel, TMBB MOF, and Rock Pile Apron**	**Marine Waterway Modifications - Dredge Areas**	**Marine Waterway Modifications - Dredge Lines**	**Kentuck Temp. Dredge line/ Offloading Area**	**Eelgrass Site Temp. Dredge line/Offloading Area**	**APCO Temp. Dredge Transfer**	**Hydraulic Dredge Pipeline and Other a/**	**Trans-Pacific Parkway/ Hwy 101 b/**	**Total**
Eelgrass Habitat	2		<1	<1	<1				2
Shallow Subtidal	4		<1	1			<1		5
Salt Marsh	<1								<1
Intertidal	13		<1	<1	<1		<1	1	14
Deep Subtidal	18	27 c/	13	2	1	1			61
Total	**37**	**27**	**13**	**2**	**1**	**1**	**<1**	**1**	**82**

Note: Columns/rows may not sum correctly due to rounding. Acres are rounded to nearest whole acre. Acreages less than 1 acre are shown as "<1".
MOF = Material Offloading Facility
TMBB = Temporary Material Barge Berth
a/ Includes South Dunes and APCO sites.
b/ Riprap addition.

[129] Applicant plans include transplanting the approximately 2 acres of eelgrass to suitable locations 0.5 miles east of the Project. While the eelgrass habitat would be removed during dredging, the eelgrass plants, assuming successful transplanting, would not be lost to the Coos Bay system (*Compensatory Wetland Mitigation Plan* [Nov 2, 2018]).

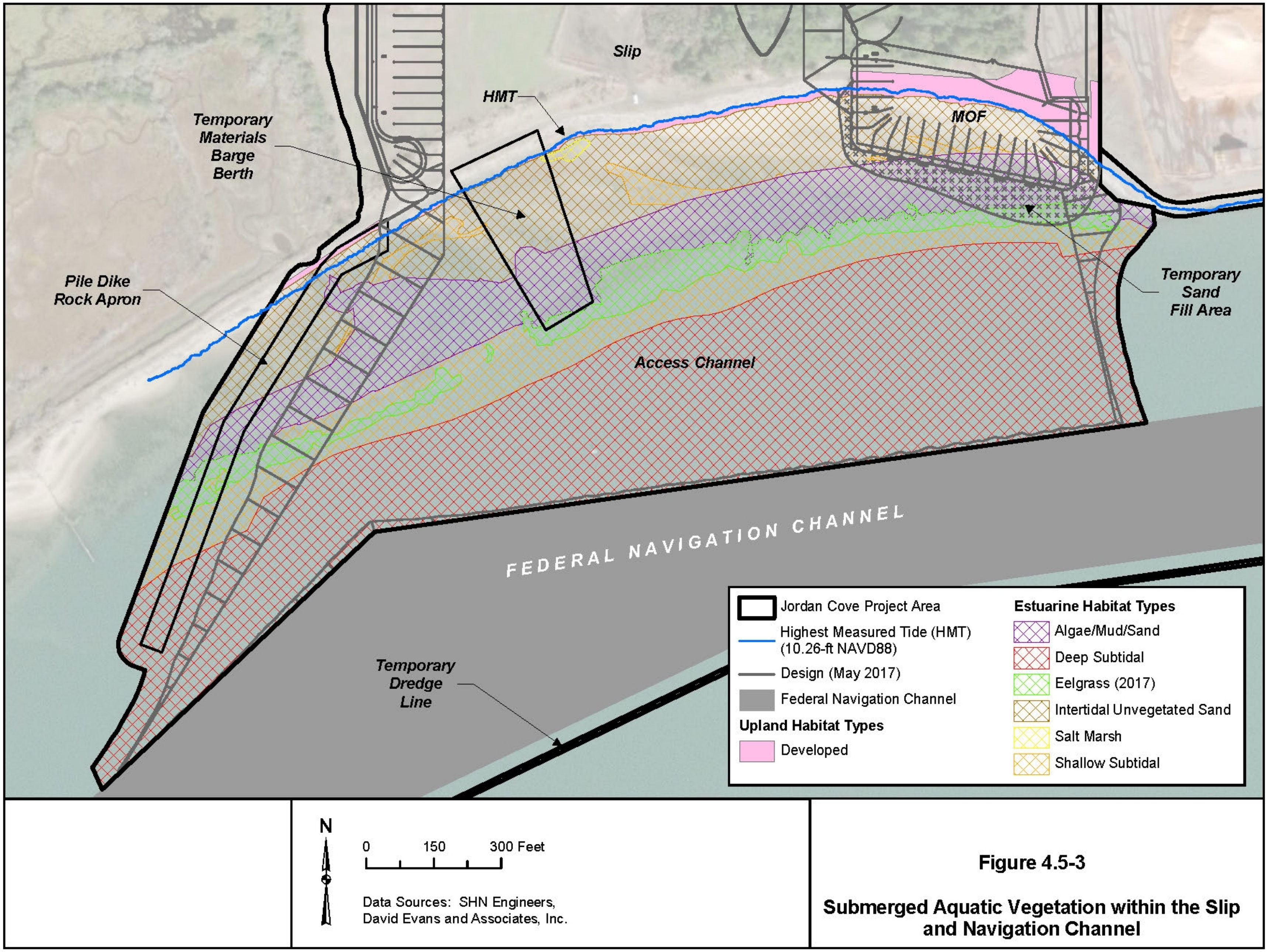


Figure 4.5-3

Submerged Aquatic Vegetation within the Slip and Navigation Channel

Submerged grasses are one of the important major habitat components in Coos Bay. Recreationally and commercially harvested species such as clams and shrimps, Dungeness crab, English sole, and salmonids use the eelgrass beds extensively. Previous studies (Akins and Jefferson 1973) have reported that Coos Bay has 1,400 acres of lower intertidal and shallow subtidal flats covered by eelgrass meadows. ODFW (1979) conducted habitat mapping in Coos Bay and documented intertidal and subtidal aquatic beds. Submerged grass meadows provide cover and food for many organisms including burrowing, bottom-dwelling invertebrates; diatoms and algae; herring that deposit eggs clusters on leaves; tiny crustaceans and fish that hide and feed among the blades; and, larger fish, crabs and wading birds that forage in the meadows at various tides. Eelgrass provides shelter for a variety of fish and may lower predation, allowing more opportunity for foraging. The protective structure attribute of eelgrass is primarily for smaller organisms and juvenile life history stages of fishes.

Project activities associated with the LNG terminal that could potentially affect aquatic resources include in-water construction activities, habitat modification, water appropriations, artificial lighting, and accidental spills of hazardous materials. Measures that would be implemented by Jordan Cove to avoid or reduce effects on aquatic resources are discussed below.

Effects on Aquatic Habitat and Aquatic Species from Construction of the Jordan Cove LNG Facilities

The estuarine portion of the Jordan Cove LNG terminal would include a marine slip, access channel, and MOF. The entire access channel would be located within Coos Bay, while most of the marine slip would be excavated or dredged from existing upland on the North Spit. Many of the construction supplies for the facility would be provided through transport by marine barge and break-bulk ships. This would require the construction of a temporary barge berth. There would also be construction of the Kentuck project site and Eelgrass Mitigation site to mitigate for lost estuarine and wetland habitat (see chapter 2 and section 4.3.3 for further descriptions).

Construction of the LNG facilities and channel improvements would temporarily and permanently affect known oyster and shrimp habitat areas. There are about 753 acres of oyster habitat and 1,730 acres of shrimp habitat in Coos Bay. About 3 acres of oyster habitat and 10 acres of shrimp habitat would be permanently reduced primarily from construction and operation of the access channel. Some local crab harvest areas would also be disturbed by the navigation channel dredging areas. The largest temporary effect would be from the construction of the Eelgrass Mitigation site that would reduce shrimp habitat by about 4 acres. Overall, there would be temporary short-term disturbance of about 1 acre of oyster habitat and 6 acres of shrimp habitat primarily from the construction of the Kentuck project and Eelgrass Mitigation sites in addition to temporary effects from construction of the access channel. Less than about 1 acre of shrimp habitat would be disturbed by the construction of the 1,100-foot-long pile dike rock apron, which would include modification from soft bottom to riprap habitat that could affect future habitat suitability for these organisms.

<u>Dredging of the Slip Access Channel, Navigation Channel, and Other Facilities</u>

About 1.4 mcy would be removed by marine dredging during creation of the access channel in the bay. Effects of dredged material placement to terrestrial habitats is addressed in other portions of the EIS including sections 4.3.3 (Wetlands), 4.4 (Upland Vegetation), and 4.5.1 (Terrestrial

Wildlife). The creation of the access channel would result in the modification of about 37 acres of present-day subtidal and intertidal habitat to deeper water habitat in the bay, about 19 acres of this dredged area is already deep water habitat. The dredging operation to create the access channel would change physical conditions of the bay bottom in this area, locally altering the bathymetry and potentially altering the morphology and water currents. About 19 acres of intertidal to shallow subtidal habitat, including approximately 2 acres of eelgrass habitat and less than 1 acre of salt marsh, would be modified to primarily deep subtidal habitat during the dredging process of the access channel, marine slip, MOF, and rock pile apron. Increasing depth and removal of vegetation would reduce the quality of habitat for juvenile salmonids and other juvenile marine species.

The construction of the access channel would affect local aquatic resources by removal or conversion of some habitats. This would include construction of the temporary barge landing facility on the southwest portion of the access channel, that would occur prior to the excavation and dredging required to complete the LNG carrier offloading facility. Additionally, the MOF would be constructed in the southeast portion of the entrance as a permanent facility to allow offloading of large equipment. There would also be short-term turbidity from dredging in the bay, and additional erosion of the shoreline during construction activities could result in sedimentation. To control upland soil erosion and potential sedimentation, Jordan Cove would follow the measures outlined in its ESCP; for marine waters, measures in their *Dredged Material Management Plan*[130] would be followed.

There is also the potential for an accidental oil or fuel leak from dredging equipment to affect aquatic resources in the bay. To avoid or reduce effects from oil or fuel leaks, Jordan Cove developed a preliminary SPCC Plan.[131]

About 37 acres of current upland habitat excavated and dredged to create the marine slip would be converted to open water, primarily deep subtidal habitat. While this area would have little intertidal habitat due to steep banks, it would supply some subtidal habitat that would not have been present without the Project. This habitat, however, would be highly disturbed due to large vessel arrivals and departures, and would generally be of low quality habitat for most species because of its armored banks, steel retaining walls, and lack of current in the slip.

To improve navigation reliability for LNG carriers, Jordan Cove proposes to excavate four submerged areas in Coos Bay along the vessel access route. This would include the dredging of some 27 acres of deep subtidal habitat at bend areas along the route and the dredge lines for this activity would include another 13 acres of mostly deep subtidal habitat modification. These dredging activities and follow-up maintenance dredging would disturb this habitat and, in the short term, reduce function of these areas primarily from disturbance to benthic and epibenthic organisms living in these areas and organism that feed in these areas. While banks of the dredged areas are intended to be stable, some side slope equilibration may occur over about a 6- to 8-year period. This would equal less than about half a percent each year of the total volume dredged from all four sites, a relatively small amount of substrate volume change. However, at the two smallest expansion areas, marine waterway modification sites 3 and 4, the gradual slope equilibration over

[130] The plan was attached as Appendix N.7 to Resource Report 2, as part of Jordan Cove's application to the FERC filed in September 2017.
[131] This plan was attached as Appendix F.2 to Resource Report 2 of Jordan Cove's application to the FERC filed in September 2017.

the 6- to 8-year period may extend 300 to 700 feet upslope from the dredged areas, respectively. The other two sites are predicted to change slightly from slope equilibration during this period.

The installation of the pile dike rock apron would change habitat from soft bottom to rock habitat over an area of about 2 acres. The construction would include short-term increase of local turbidity from bottom disturbance and initial loss of benthic organisms by burial. While the preferred placement of the riprap would be from a barge, some may occur in the intertidal area by land-based equipment, which may cause short-term effects on benthic organisms from transit of vehicles across the intertidal areas as part of rock placement. Construction would be limited to one in-water work window period when many important fish species, such as salmon, are of low abundances, reducing potential effect from local turbidity increases and loss of benthic and epibenthic resources from rock placement and shoreline vehicle transit used to place the rock. Increased rock areas may supply more habitat for rock-oriented species and cover for potential juvenile salmonid predators. Jordan Cove has identified two specific sites in Coos Bay that would be set aside and/or developed as compensatory wetland mitigation[132] for loss of intertidal and subtidal habitat from dredging. Their construction would also contribute to local turbidity.

The loss of about 2 acres of eelgrass habitat would be mitigated by off-site development and planting within the suitable 7-acre portion of the 9-acre Eelgrass Mitigation site. The objective is to produce about 3 acres of new eelgrass beds, replacing lost eelgrass beds at a ratio of 1.2:1. Additionally, the eelgrass plants in the access channel are proposed to be transplanted to a location 0.5 mile east of the Project. The final eelgrass mitigation requirement would be reduced by the amount of this transplanted eelgrass that successfully re-establishes. The proposed methods of eelgrass bed development have been successfully used for eelgrass mitigation in Coos Bay in the past. Donor stock eelgrass would be obtained from a 19-acre continuous high-density eelgrass bed 1,500 feet southwest of the mitigation site. There would be some short-term loss of eelgrass habitat from those areas dredged during construction and from the removal of donor stock areas when the Eelgrass Mitigation site is planted. The use of salvaged eelgrass from only from high-density areas would reduce short-term effects caused by developing the Eelgrass Mitigation site. As noted above, the total area of eelgrass habitat affected is small relative to that habitat type presence in Coos Bay, but some local short-term reduction in productive estuarine habitat would result.

Disturbance to 17 acres of other estuarine habitats (non-eelgrass) would be mitigated with re-establishment of estuarine habitat on about 91 acres of unvegetated mudflats at the Kentuck project site. This mitigation site would reestablish a minimum of about 73 acres of tideland habitat and additional wetland acreage. It would be a combination of native estuarine habitats (saltmarsh, tidal sand/mudflats) and freshwater wetland habitat (forested, scrub/shrub and emergent) (see section 4.3.3). Kentuck Slough is located on the east shore adjacent to the main inner bay between the area affected by the Project and Coos River mouth. This area would be modified with the addition of some of the dredged tailings from the LNG slip excavation. Additionally, 2.7 acres of floodplain habitat would be re-established adjacent to Kentuck Creek and would include stream enhancements including realignment of Kentuck Creek through the site. This area is close to the main Coos Bay river channel, which would benefit early marine-rearing juvenile salmonids.

The details of the plan, measures of success, and contingencies are provided in the *Compensatory Wetland Mitigation Plan*; however, final acceptance of the adequacy of the plan by ODSL or other

[132] Jordan Cove's *Compensatory Wetland Mitigation Plan* is attached as appendix O of our BA (appendix I of this EIS).

resource agencies is pending. Therefore, Jordan Cove must continue to consult with the COE, NMFS, ODSL, and ODFW and other appropriate resource agencies to develop a final wetland mitigation plan for permanent effects on eelgrass and other estuarine habitats (see section 4.3).

Considering the mitigation measures proposed, and the implementation of mitigation plans, dredging activities would have only short-term effects on subtidal and intertidal habitat in Coos Bay.

Increased turbidity and sediment from dredging for the slip construction and navigation channel expansion would also affect marine and estuarine organisms. There are other project actions that would also increase local turbidity such as eelgrass mitigation site dredging, pile dike rock apron construction, and others. These are discussed in section 4.3.2.2 of this EIS.

Jordan Cove has stated that their construction plans, including their ESCP, would prevent turbid water from on-land construction, dredge material placement, and slip formation to be discharged or allowed to flow into Coos Bay. All in-water work would be restricted to the in-water work window from October 1 to February 15[133], contributing to reducing effects on fish habitat and species.

A large quantity of suspended sediment can reduce light penetration, which in turn reduces primary production of both pelagic and benthic algae and grasses. Increased suspended sediment can affect feeding of benthic and pelagic filter feeding organisms (Brehmer 1965; Parr et al. 1998), and the settling of the suspended particles can cause local burial, affect egg attachment, and modify benthic substrate. High enough levels can have direct adverse effects on fish ranging from avoidance to direct mortality. Use of pumps to convey the material in a hydraulic dredging operation would serve to contain most of the siltation caused by the dredging. The siltation would be conveyed with the material removed to the disposal area where it would settle out before being discharged back to the waterbody. The suspended sediment and turbidity levels would decline to ambient levels following completion of dredging activities.

Because of the short duration and small areas of in-water work for project activities other than dredging, effects on aquatic organisms from elevated turbidity would be localized and short term, likely diminishing in a few hours. However, dredging of the access channel would require in-water work that would occur over a longer timeframe and larger area. Dredging of the access channel would result in temporary siltation and sedimentation effects similar to those that currently occur during COE maintenance dredging of the Coos Bay navigation channel. On average, the COE removes approximately 550,000 cy from the bar, 200,000 cy from NCM 2 to 12, and 150,000 cy from NCM 12 to 15 each year. In-water dredging of the slip and access channel would occur over four in-water work periods totaling about 4 to 6 months.

The ambient turbidity levels in the water (generated by flows, waves and ship traffic) create a background level of turbidity. Within Coos Bay, turbidity measurements observed as total suspended solids (TSS) converted from NTU measurements at the Charleston Bridge over a two-year period show an average summer TSS level of 10 mg/l and an average winter level of 27.3

[133] Based on their draft EIS comments of July 3, 2019, ODFW will require that the in-water work window at the site be changed to October 1 to January 31 to accommodate unlikely eulachon spawning.

mg/l[134]. Some individual events (e.g., winter storms) measured at the Charleston Bridge were recorded between 100 and 500 mg/l. Therefore, aquatic organisms in Coos Bay are adapted to and exposed to periods of high to moderate turbidity during the winter months. Dredge operations are expected to result in similar effects, with higher concentrations of TSS in the immediate area of dredging.

Jordan Cove conducted modeling to estimate turbidity and suspended sediment that would result from access channel construction (Moffatt & Nichol 2006a) and the construction and maintenance dredging for all proposed bay activities (Moffatt & Nichol 2017c). The details of the model results on quantity and distribution of these parameters are discussed in section 4.3.2.1. The maximum TSS at a specific dredge site using a clamshell dredge was estimated to be about 6,000 mg/l decreasing substantially away from the dredge location. Moffatt & Nichol (2006a) also estimated that average turbidity levels during dredging operations (covering changing tidal directions) would not exceed background levels (about 10 to 30 mg/l) for the mechanical dredge at the slip. These levels would be even less for the hydraulic dredge beyond the actual dredge location, while elevated levels would occur outside of the actual dredge area for periods not exceeding 2 hours in duration depending on tidal direction. At lower tidal velocities, values would not exceed 30 mg/l outside of 200 meters, and at high tidal velocity less than 50 mg/l in 200 meters.

The concentrations and distribution are partly dependent on the type of dredging method that would be used. Proposed methods for dredging include use of mechanical or hydraulic (suction) dredging equipment. While the hydraulic cutter suction dredge is preferred due to its lower turbidity generation, a type of mechanical dredge may be used, especially in portions of the nearshore area due to buried wood. Model results for the access channel and slip construction indicate that elevated TSS above background would extend about 0.2 to 0.3 mile beyond the dredge sites during a full tidal cycle with any method considered and would exceed about 500 mg/l for about 0.1 mile. Maximum concentrations outside of the specific dredge location would only occur for about 2 hours or less over the tidal cycle with the plume moving upstream or downstream of the dredge site on flood or ebb tide, respectively. TSS concentrations at the four navigation channel expansion sites (i.e., part of the marine waterway modifications) would reach background level (about 20 mg/l) over a distance of about 1.2 miles[135] with any of the dredging methods. However, hopper style suction dredging would have much higher concentrations during construction with TSS over 500 mg/l extending about 1.0 mile across the dredging site, while the hydraulic cutter suction dredge or mechanical clamshell dredge would produce TSS of 500 mg/l extending about 0.1 mile from the dredge site. The distribution of and concentrations of suspended sediment would be the same for construction or maintenance dredging. If a mechanical excavator would be used for the eelgrass site construction, a confined area of elevated TSS would extend less than 0.1 mile from point of dredging (Moffat & Nichol 2017c). The more limited effect of tidal flow over the area would help confine the distribution of the elevated sediment plume. These elevated levels would be short term and highly localized to the nearshore area of the eelgrass site.

During the dredging process, some small fish (such as sandlance), larvae, and fish eggs could be entrained. Larger fish would be able to avoid this process and would likely actively avoid the area during the dredging disturbance process. In a review of many maintenance dredge studies through

[134] Suspended sediment values based on empirical model conversion of NTU to TSS (mg/l), model developed from stream studies.
[135] Plume distance noted includes total spread both upstream and downstream of dredge site.

1998, Reine and Clarke (1998) concluded that "much of the available evidence suggests that entrainment is not a significant problem for many species of fish and shellfish in many bodies of water that require periodic dredging." However, Dungeness crab in some studies are highly susceptible to entrainment (Reine and Clarke 1998; Pearson et al. 2002, 2005). Based on this review, it appears that entrainment of marine fish and shellfish species would not be a substantial effect on the local marine resources, although some important fish and shellfish may be reduced in abundance locally. Effects would be minimized by the current in-water work windows (October 1 to February 15) and by maintaining the cutterhead near the bottom if a hydraulic dredge is used.

If salmonids are exposed to moderate to high levels of TSS for prolonged periods, many adverse effects could occur including behavioral changes, sub-lethal effects, and increased mortality from predators. Dredging is expected to create spikes of high to moderate turbidity in a localized area. Effects on estuarine organisms and their habitat are expected to be slight and not measurable due to the limited area affected and the short duration of dredging operations, and limitations on construction periods. Rearing and migrating salmonids including ESA listed salmon, which should be uncommon in Coos Bay during the in-water work window, would likely avoid active work areas.

In Coos Bay, suspended sediment from dredging activity could affect shellfish, including clams and oysters including limited Olympia oysters near the Eelgrass Mitigation site and other filter feeders in the immediate vicinity and downstream of the access channel dredging site and Eelgrass Mitigation site. Depending on dredging-induced elevated suspended concentration and exposure duration, effects on individual species and life stage from elevated suspended sediment could include no, minor, or major behavioral effects, physiological stress, reduced growth, or reduced survival and reduced egg hatching success (Wenger et al. 2018). Entrainment of organisms, especially eggs and larvae, may also occur. Dredging of the access channel and marine waterway modifications would be in deep water areas away from major commercial or Olympia oyster areas as well (figure 4.5-2) and would likely not results in substantial effects from elevated turbidity or entrainment of commercial shellfish or Olympia oysters.

The Coquille Tribe indicated that some of the in-water window period would overlap the potential Pacific herring spawning period and requested that the ODFW be required to reduce this allowable in-water construction period to help protect these fish. The decision to modify the ODFW's timing window can only be made by that agency. While most turbidity generated would be offshore away from potential shallow eelgrass spawning sites (other than in the direct slip and access channel construction), some sediment effects to spawning herring may occur.

Jordan Cove's dredging would also directly remove benthic organisms (e.g., worms, clams, benthic shrimp, starfish, and vegetation) from the bay bottom within the access channel and navigation channel modifications. Mobile organisms such as crabs, many shrimp, and fish could move away from the region during the process, although some will be entrained during dredging so that direct mortally or injury could occur. Based on 1978 maps of shellfish (Gaumer et al. 1978), shrimp, soft shell calms, bentnose clams, and cockles are located within the intertidal areas near the slip and within dredge areas (west of the Roseburg Forest Products Company site). The four navigation channel modifications are not located in known clamming areas, or shrimp or oyster habitat (figure 4.5-2). ODFW captured Dungeness crab and red rock crab in this area during 2005 seining efforts near the access channel location. Varied species could be injured or killed during dredging operations. Dredged areas typically have edge areas sloped to maintain their stability, reducing the potential for bank sloughing and restricting direct impacts on areas dredged. Dungeness crabs and sand shrimp (Crangon spp.) can be especially susceptible to entrainment, although many survive dredging (Reine et al. 1998). Dungeness crab entrainment has been reported as substantial in some areas depending on season, salinity, location, and type of dredge used (Pearson et al. 2005, 2002). Reine and Clark (1998) reviewed dredging studies and concluded that "much of the available evidence suggests that entrainment is not a significant problem for many species of fish and shellfish in many bodies of water that require periodic dredging." Dredge entrainment studies over a four-year period in the Columbia River found no juvenile or adult salmonids entrained during dredging, although some other pelagic fish including eulachon were entrained (Larson and Moehl 1990).

When benthic communities on mud substrates have been disturbed by dredging in Coos Bay, they typically recovered to pre-dredging conditions within 4 weeks (McCauley et al. 1977, as cited in Wilber and Clarke 2007). However, recovery in estuarine channel muds has been reported in a review paper of dredging to be typically six to eight months (Newell et al. 1998). In the lower Columbia River, McCabe et al. (1997, 1998) noted benthic organism recovery in three months. Studies of a dredged sandy substrate area in Yaquina Bay Oregon found recovery of benthos took one year (Swartz et al. 1980, as cited in Wilber and Clarke 2007). Newell et al. (1998) developed estimates of recovery based on dredged sediment composition and relative stability (or disturbance) of the benthic environment. Generally, the coarser the substrate and level of stability (i.e., low disturbance level), the longer it would take for full benthic recovery. Based on the estimates of primarily sand substrate in the navigation channel dredging areas (Moffat & Nichol 2006; Moffat & Nichol 2017c), Newell's analysis suggests peak densities of opportunistic colonizers in about 6 months, with about 80 percent recovered of more typical benthos in a year and likely about two years for near full recovery. Considering that the channel might naturally be a partially disturbed environment from tidal currents, high river flows, and natural sediment deposits from the river, resident benthic communities developed and acclimated to ongoing perturbation. Therefore, the estimate of full recovery taking much longer than a year, with the exception noted below, may be conservative even though the channel is primarily composed of sand. Because of the large substrate, it would take longer than a four-week period found by McCauley et al. in Coos Bay to recover. The similarity of sandy substrate, like that of Yaquina Bay, suggests it is likely that recovery would be closer to a year for smaller, shorter-lived benthic resources particularly in the navigation channel modifications; however, longer-lived benthic resources (e.g., clams) could take several years to fully recover (Newell et al. 1998). It is thus likely that rapid initial colonization would occur in 6 months, most typical benthos recovery within a year but some specific groups of benthic resources would never fully recover after initial dredging due to the 3- to 10-year maintenance dredging period.

We would also expect increased organic matter production to the Coos Bay system from Jordan Cove's proposed eelgrass and wetland mitigation sites. The Kentuck project would provide about 73 acres of shallow water habitat as mitigation for the loss of about 16 acres of shallow estuarine water habitat at the access channel and the Eelgrass Mitigation site would provide about 7 additional acres of eelgrass suitable habitat and a minimum of about 3 acres of established eelgrass bed as mitigation for the loss of about 2 acres of eelgrass habitat. The affected shallow water habitat is suitable habitat for oysters (about 3 acres) and shrimp (about 10 acres). The development of the Kentuck project would likely contribute to replacing this type of habitat loss since existing oyster and shrimp habitat is present near Kentuck Slough.

Additionally, although sediment samples to date have not indicated high organic content sediment, some high oxygen demand sediment could be encountered during dredging. This could remove oxygen from the local water areas, putting local organisms at risk from insufficient oxygen. This effect would be temporary, and tidal exchange would be expected to replenish oxygen. In most cases, where dredging and disposal occurs in open coastal waters, estuaries, and bays, localized removal of oxygen has little, if any, effect on aquatic organisms (Bray et al. 1997). Also, Nightingale and Simenstad (2001b) reviewed literature in a summary document on effects of dredging and could find no empirical data indicating reduction in oxygen was an issue of concern for estuarine and marine organisms for dredging actions.

Dredging may also resuspend nutrients to the water column and could affect primary production. At low levels, this could be of benefit, increasing phytoplankton production, which could benefit prey species eaten by fish. However, in estuaries, this production is limited by turbidity and flushing, so any effects would be slight and local.

The initial marine waterway modifications (i.e., widening) in four areas would have minor habitat changes in Coos Bay. Deepwater habitat area would be further deepened in the four areas totaling about 27 acres of benthic deepwater habitat disturbance, plus an additional 10 acres deepwater habitat for the slurry transport lines. Less than an additional acre of shallow water habitat would be disturbed from the dredge lines used. The deeper water habitat is generally less productive than the shallow water environments. As with all dredging, there would be an initial loss of benthic resources from the dredging of the navigation channel that would recover over time. Overall habitat structure of the bay would remain essentially unchanged from the widening of the channel in these areas. Some of this net loss would be offset by added annual benthic production from the newly formed 37-acre slip habitat, even though it would likely be of poor quality.

In conjunction with all dredging activities would be the placement of temporary pipelines (18 to 20 inches in diameter) possibly on the bottom of Coos Bay to the deposition areas of the dredged sediment. This would include a pipeline route up to about 7 miles from the navigation widening area 1 to 4 miles to APCO Sites 1 and 2, one from the Eelgrass Mitigation site to APCO Sites 1 and 2 (about 0.5 mile), and another line extending from the shipping channel near the APCO Site to the Kentuck project (about 1.5 miles). These would have some initial bottom disturbance from placement and would likely kill benthic organisms (e.g., clams, worms) that are under the pipe placements. Most of the line would be in deep water paralleling the navigation channel from the four navigation modifications, which is an area often currently disturbed by shipping and maintenance dredging. Where currents are high some additional scour may occur adjacent to the dredge pipeline and any associated piles used to elevate the pipe in nearshore areas. These would be limited and local in occurrence. Some obstruction or delay of bottom movement of small mobile organisms (e.g., juvenile crabs) could potentially also occur from the dredge pipeline placement on the bottom. Overall, there would be some reduction in benthic organism abundance from this direct placement of the dredge pipes and associated local habitat modifications conditions. The effective periods of this activity would be brief each year, occurring only during the construction in-water work window taking about 5 months total over four in-water work windows.

Maintenance dredging would occur every three to five years, with dredging taking about a month for the slip and access channel and a week for the navigation channel modifications. This would keep the navigation channel depth as it is currently, and the LNG slip depth as originally developed. Thus, after the project-developed initial widening, the current habitat structure of the navigation channel would remain unchanged and slip area would be as originally developed following each maintenance dredging cycle.

Construction windows for in-water dredging, developed by the state, are intended to minimize effects on the overall aquatic environment. The in-water work window (October 1 through February 15) would minimize the exposure of juvenile salmonids to increased turbidity during outmigration but would occur during much of the adult salmonids' upstream migration. Resident estuarine species, however, would be present during the in-water work window.

New Deepwater Habitat

The construction of the slip and berth would add a new region of deeper water habitat in Coos Bay. The area would have steep riprap sides that would have little biological diversity in shoreline habitat. The deeper areas may have slightly different fish composition than the main bay but overall the change in depth would be slight relative to the main adjacent navigation channel. Based on COE surveys, the navigation channel adjacent to the proposed site is 44 feet deep, with proposed slip depth 45 feet similar to the local deep bay areas, although to the side of the channel. While future composition of the channel species cannot be predicted, it appears conditions would not be substantially different than the adjacent navigation channel area. This may, however, result in some species composition differences locally. It would remain a relatively disturbed area for organisms, with the frequency of LNG carrier traffic likely reducing its overall benefit to fish and invertebrate resources. However, the final use of this new environment and changes in use from the existing conditions cannot be completely estimated now and conditions may take time to fully develop. This also holds for the four navigation channel modifications; however, these areas are already deep (all greater than 26 feet and would be deepened to 37 to 41 feet) and would include gradually sloped banks to prevent slumping in these areas. Aquatic resources, such as fish, shellfish, and marine mammals that may use Coos Bay, are under the management of ODFW and NMFS. In its response to our BA and EFH Assessment (appendix I; see also section 4.6 of this EIS), the NMFS can impose conditions through its BO to protect aquatic resources in the new deepwater habitat created by the Jordan Cove terminal slip.

Pile Driving Acoustic Effects

There are three basic types of pilings proposed: steel sheet pile, steel post piles, and wood post piles. The methods of installation that can be used for installation is a vibratory hammer or impact hammer, with some piling installed using both methods. Generally, noise levels are less with the vibratory hammer. Most of the construction-related pilings would be installed well away from the water. However, some pilings would be installed directly in the water or near the water where sound waves may transmit substantially into the water. Jordan Cove would install pipe piles and sheet piles for the Project including the marine and upland piles (see chapter 2). About 600 of these pilings are associated with the marine facility. These steel piles would be for the LNG carrier berth and MOF on the southeast side of the marine slip. Most of these piles would be driven land-side adjacent to the berth and while the upland portions of the marine berth are still isolated from the bay by the berm. Additionally, about five metal piles would be installed in the shallow water in support of dredge tailings pipeline over eelgrass beds to the APCO Site. Some additional temporary pilings would be installed in the wet[136] for the MOF, temporary material barge berth (TMBB), temporary dredge off-loading areas, road widening area, and access bridge to the APCO site. A total of 119 in-water steel pipe piles would be driven for the Project considering all these facilities with a lesser number of sheet piles (most driven primarily by vibratory hammer and some limited impact hammer use). An additional 1,150 wood piles would be installed for the road widening at U.S. Highway 101.

Underwater noise that may result in harassment and/or take of marine mammals is regulated by the NMFS under the MMPA. Under the MMPA, Level A harassment is statutorily defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild; however, the actionable sound pressure level is not identified in the statute. Level B harassment is defined as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

In July 2016, the NMFS finalized their *Technical Guidance for Assessing the Effect of Anthropogenic Sound on Marine Mammals* (NMFS 2016c). Under this new NMFS guidance, Level A harassment is said to occur as a result of exposure to high noise levels and the onset of permanent hearing sensitivity loss, known as a permanent threshold shift (PTS). This revision to earlier NMFS guidelines is based on findings published by the Noise Criteria Group (Southall et al. 2007), which concluded that for transient and continuous sounds, the potential for injury is not just related to the level of the underwater sound and the hearing bandwidth of the animal, but is also influenced by the duration of exposure. The evaluation of the onset of PTS provides additional species-specific insight on the potential for affect that is not captured by evaluations completed using the previous NMFS thresholds for Level A and Level B harassment alone.

Frequency weighting provides a sound level referenced to an animal's hearing ability either for individual species or classes of species, and therefore a measure of the potential of the sound to cause an effect. The measure that is obtained represents the perceived level of the sound for that animal. This is an important consideration because even apparently loud underwater sound may not affect an animal if it is at frequencies outside the animal's hearing range. In the NMFS (2016c) final Guidance document, there are five hearing groups: low-frequency (LF) cetaceans (baleen whales), mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales), high-frequency (HF) cetaceans (true porpoises, Kogia, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*), Phocid pinnipeds (true seals), and Otariid pinnipeds (sea lions and fur seals). All of the above-listed species except Otariid pinnipeds potentially occur in the aquatic analysis area.

There are specific hearing criteria thresholds provided by the NMFS for each functional hearing group. These criteria apply hearing adjustment curves for each animal group known as M-weighting (see table 4.5.2.2-3).

[136] Installing a piling "in the wet" or "in water" means the piling is in direct contact with the water body when it is driven into the substrate with an impact or vibratory hammer

TABLE 4.5.2.2-3

M-Weighted PTS Criteria and Functional Hearing Range for Marine Mammals

Functional Hearing Group	PTS Onset Impulsive	PTS Onset Non-Impulsive	Functional Hearing Range
LF cetaceans (baleen whales)	219 dB_{peak} & 183 dB SEL_{cum}	199 dB SEL_{cum}	7 Hz to 35 kHz
MF cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	230 dB_{peak} & 185 dB SEL_{cum}	198 dB SEL_{cum}	150 Hz to 160 kHz
HF cetaceans (true porpoises, Kogia, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	202 dB_{peak} & 155 dB SEL_{cum}	173 dB SEL_{cum}	275 Hz to 160 kHz
Phocid pinnipeds (underwater) (true seals)	218 dB_{peak} & 185 dB SEL_{cum}	201 dB SEL_{cum}	50 Hz to 86 kHz
Otariid pinnipeds (underwater) (sea lions and fur seals)	232 dB_{peak} & 203 dB SEL_{cum}	219 dB SEL_{cum}	60 Hz to 39 kHz

NMFS has defined the threshold level for Level B harassment at 120 decibels root mean squared (dB_{RMS}) for continuous noise and 160 rms_{90} sound pressure level (SPL) for impulse noise. Within this zone, the sound produced by the Project may approach or exceed ambient sound levels (i.e., threshold of perception or zone of audibility); however, actual perceptibility will be dependent on the hearing thresholds of the species under consideration and the inherent masking effects of ambient sound levels. The Level B harassment threshold was not updated with the July 2016 technical guidance.

Underwater noise from project construction activities could affect fish resources in Coos Bay. State agencies in Washington, Oregon, and California along with federal agencies including the FWS and NMFS have developed interim noise exposure threshold criteria for pile-driving effects on fish (WSDOT 2011; Fisheries Hydroacoustic Working Group 2008; Popper et al. 2006). These threshold criteria are considered levels below which injury effects would not occur to fish from in-water noise. These thresholds should be suitable for all forms of in-water noise. Interim noise exposure threshold criteria for pile driving effects on fish include: 1) a cumulative sound exposure level (SEL_{cum}) of 187 dB re 1 μPa^2 s for fishes more than two grams, 2) a SEL_{cum} of 183 dB relative to 1 square microPascal (re 1 μPa^2) for fishes less than two grams, and 3) a single-strike peak level (SPL_{peak}) of 206 dB re 1 μPa for all sizes of fishes (Fisheries Hydroacoustic Working Group 2008; WSDOT 2011). Generally, the high peak value is associated with potential mortal injury and forms of recoverable injury while the cumulative values are associated with forms of impairment that are likely recoverable forms of injury (Popper et al. 2014). While more recent studies based on additional information have recommended slightly different guidelines (Popper et al. 2014) these have not yet been implemented by the above agencies as new criteria. Piling location relative to water area, substrate piling is driven into, type of piling, and method of pile driving all influence the magnitude of in-water noise level and therefore the likelihood of noise levels injuring marine mammals and fish.

The potential noise levels relative to fish and mammal criteria of sheet pile and post pilings that would be installed at the LNG site out of the water were modeled (Deveau and MacGillvray 2017; O'Neill and MacGillivray 2017b; Wladichuk et al. 2017; Wladichuk et al. 2018). The sheet pile installation modeled were those that would be closest to the water. These sheet piles would be installed behind a 30-foot-wide berm separating the installation from the water. Wladichuk et al. (2018) modeled the installation of 36-inch steel post pilings by impact hammer located 100 feet back from sheet piles and adjacent to the water at the MOF.

The available information on decibel levels from these models were entered in the NMFS impact model for fish (NMFS 2009) for vibratory sheetpile installation to approximate the extent of potential noise effects from a general location in Coos Bay. Model results based on data from Deveau and MacGillvray (2017) indicate essentially no likely effect to fish from sheet piles installed away from the water. If any sheet piles were installed in or near the water edge, some adverse effects on fish that remain near the installation site (table 4.5.2.2-4).

Impact hammer use on steel post piles also was modeled for those near the MOF. Using the criteria noted above, estimated extent of potential injury to fish from these of pile installation are shown in table 4.5.2.2-4. While not directly modeled by Wladichuk et al. (2018), there will be unspecified locations in the bay that will have in-water pilings installed to anchor the navigation channel dredging pipes. Because most of these pilings would be installed with a vibratory hammer, effects on fish would limited in most areas. However, if an impact hammer were used, noise effects on fish in these areas would be limited because of the low number of impacts. Therefore, the extent of noise impact distribution is likely to be absent or limited in most other areas; however, where impact hammer is used, effects could be similar to those shown in table 4.5.2.2-4 if noise-dampening mitigation is not applied.

TABLE 4.5.2.2-4

Modeled Onset of Injury Distances of Unmitigated Metal Pile-Driving Sound Effects on Fish in Coos Bay during Construction

	Distance Threshold (ft) to Onset of Physical Injury to fish		
		Cumulative SEL dB by Fish Size	
Criteria and Hammer Type	**Peak dB**	**Fish ≥ 2 grams**	**Fish < 2 grams**
dB Criteria Threshold	206	187	183
Vibratory Hammer a/	0 ft	380 ft	380 ft
Vibratory Hammer b/	0 ft	<10 ft	< 10 ft
Impact Hammer MOF100-ft set back c/	120 ft	0.5 miles	0.5 miles
Impact Hammer MOF at shore c/	120 ft	1.1 miles	1.1 miles

a/ In water sheet pile noise level values averaged from data in Illinworth and Rodkin (2007). Model estimate from NMFS (2009); assumed 10,000 hammer impacts in 24 hours

b/ Sheet pile 30 feet back from water, peak value from Deveau and MacGillvray (2017). Model estimate from NMFS (2009); assumed 10,000 hammer impacts in 24 hours

c/ Assume 10,000 and 20,000 hammer impacts within 24 hours (Source: Wladichuk et al. 2018)

In addition, there would be 1,150 wood piles and sheet piles constructed at the Trans-Pacific Parkway/U.S. 101 intersection widening. These piles may be installed above or below water level depending on tide level. The methods for wood pile installation are unknown, but sheet piles would be installed by vibratory hammer with an impact hammer being used if necessary. One report measured peak values of 180 dB 10 meters from wood piling when using an impact hammer (Illinworth and Rodking 2007). Data are not available on noise levels from a vibratory hammer on wood, but vibratory hammer noise levels are generally much lower at peak noise production than those from an impact hammer. With the number of pilings to be installed, the frequency of piling contacts would be high. There is some risk of cumulative noise levels associated with wood pile-driving being an issue if peak noise values were near 180 dB. Jordan Cove has indicated that an impact hammer would not be used on sheet piles if they were inundated by high tides; implementation of this commitment would reduce the effects of cumulative and peak noise levels on fish.

Mitigative actions would be taken to reduce the potential effects of noise on fish. The estimates of noise levels that may cause injury to fish (table 4.5.2.2-4) assume that no mitigation (such as a bubble curtain) is in use, and that fish would remain in the area of adverse noise effects during the whole period of installation. Jordan Cove would implement sound attenuation measures in accordance with NMFS guidelines as needed, and fish are mobile and unlikely to remain in areas where cumulative noise levels would result in injury. All in-water pile driving would also occur only during the ODFW in-water approved construction window of October 1 to February 15, which would avoid noise injury to most salmonids.

General equipment used (e.g., trucks, compressors) and construction activity other than pile driving would all have noise levels below any that would affect marine mammals or fish (all less than 90 dB maximum). Noise in air produced by pile driving was modeled by Jordan Cove, and it was found that peak noise within 23 feet for all piles (18- to 72-inch diameter) being driven would be less than 117 dB and maximum of 101 dB at 50 feet, well below levels that would affect fish even if in the water. During pile driving, noise levels in air would decrease to below 90 dB_{RMS} (current in-air behavioral disruption threshold for harbor seals) at approximately 920 feet from the nearest piling rig. The current in-air behavioral disruption threshold for pinnipeds other than harbor seals (e.g., the California sea lion and Steller sea lion) is a less stringent 100 dB_{RMS} (NMFS 2018a). As a result, marine mammals within this distance could experience some behavioral disruption during pile driving. The marine waterway modifications are approximately 1,200 feet from the closest Pacific harbor seal haul-out site (Clam Island), and as a result, in-air noise is not anticipated to disrupt Pacific harbor seals at haul-out sites in lower Coos Bay. Additionally, in-water work would occur between October 1 and February 15, which is outside the Pacific harbor seal pupping season (March through June) and the peak haul-out period (May to July) (AECOM 2019).

Marine mammals inside Coos Bay may be affected by underwater noise from pile-driving during construction. The greatest distance at which PTS due to impulsive peak noise may possibly occur is around 250 feet for the harbor porpoise. Outside Coos Bay, the potential for effects on marine mammals from piling is limited to behavioral disturbance due to noise. Vibratory sheet pile driving has the potential to exceed the NMFS interim behavioral disturbance threshold of 120 dB re 1 μPa at distances of up to 1.2 miles (Deveau and MacGillvray, 2017). Impact pipe pile driving has the potential to exceed the NMFS interim behavioral disturbance threshold of 160 dB re 1 μPa at similar distances (O'Neill and MacGillvray 2017).

Jordan Cove would consult with the NMFS to design a monitoring and adaptive management plan including the development of a pinniped safety zone. If sound levels are determined to exceed NMFS Level A regulatory thresholds for marine mammals or guidelines for listed salmonids, sound attenuation measures would be used in accordance with NMFS guidelines. The NMFS has indicated that they may require additional monitoring as well as noise mitigation for the Project, including potentially the use of bubble curtains, sediment curtains, as well as various ongoing monitoring programs. These measures would be included, if required, in the NMFS BO.

Erosion and Runoff from Upland Facilities

Effects on marine resources could occur from the clearing of vegetation at the terminal, erosion and sediment runoff, and potential hazardous substance spills during construction. While no streams are present in the upland portion of the terminal, the removal of current vegetation could modify the character and amount of water runoff into the bay.

Nearshore vegetation clearing could indirectly affect aquatic resources in the bay; however, the amount of nearshore vegetation that would be removed for this Project is small. No planned nearshore disturbance would occur outside of the upland and shoreline that would be excavated and dredged to create the marine slip for the terminal. Jordan Cove would prevent uncontrolled releases of sediment runoff during construction by implementing erosion control and revegetation measures from its ESCP.

During construction of the LNG terminal facilities, stormwater runoff could erode disturbed soils, creating sediment in nearby surface waters, and affect local aquatic resources. Stormwater runoff from the disturbed portions of the site would be managed in accordance with Jordan Cove's ESCP, ODEQ-approved *Storm Water Management Plan,* and the NPDES Permit Number 1200-C for stormwater discharged during construction activities (see section 4.3.2.2). Following appropriate treatment, such as electro-coagulation, chemical flocculation, or filtration, if needed, all construction stormwater from the LNG terminal site would be directed toward Coos Bay.

Additionally, accidental spills of hazardous materials (e.g., equipment fuel, oils, and paints) during construction could have effects on aquatic resources in the bay. Jordan Cove prepared a preliminary SPCC Plan for construction to minimize the potential for accidental releases of hazardous materials.

Hydrostatic Testing

Water would be used for hydrostatic testing of the LNG storage tanks and piping prior to placing them in service (see chapter 2). The source of water would be potable and raw water from the CBNBWB. After completion of the test, the water would be discharged by filtration through the ODEQ-approved stormwater system or through the existing IWWP. Permits would be obtained for all wastewater discharges as required by ODEQ. Water discharges would be treated, if necessary, to comply with discharge permits. If treatment were required, treatment procedures would be developed prior to discharge. The discharge through the existing IWWP, which connects to the previously existing ocean discharge diffuser location, would be at a rate of about 2.9 mg/d. Given that the water would be used inside the LNG storage tanks, chemicals would not be added, the water would be tested for quality and treated if necessary prior to discharge and would enter the ocean through a diffuser allowing rapid dissipation and mixing, the release of hydrostatic test water would not likely affect the ocean aquatic environment.

Construction Supply Vessel Transit

Much of the supplies needed for construction of the terminal and related facilities may be transported by break bulk ships and barges. These vessels would be similar to those used for typical transport of materials into Coos Bay. Approximately 60 deep-draft commercial cargo ships and 50 barges arrive in Coos Bay per year currently; while the frequency of vessel traffic would increase during the construction period, effects on marine resources would be similar to those that normally occur during commercial vessel traffic. The types of effects would be similar to those described for LNG carrier traffic but likely less due to a reduced number of trips and smaller vessel size. This would include effects of vessel strikes, ship grounding, shoreline erosion and fish stranding from vessel transit in the bay, fuel and oils spills and introduction of nuisance species. See section 4.5.2.1 for details of analysis of LNG transport effects addressing these parameters.

Effects on Aquatic Habitat and Aquatic Species from Operating the Jordan Cove LNG Project

Water Use by LNG Carriers at Berth

Jordan Cove estimates that about 110 to 120 LNG carriers would visit its terminal each year. While at the terminal dock for a period of about 17.5 to 24.5 hours, these LNG carriers would release ballast water while taking on LNG cargo. They also would take in water from the marine slip to cool their engines and would slightly affect the temperature of the water in the slip due to either the release of warm water after engine cooling or contact with the cool hull after taking on LNG cargo. These activities could have effects on aquatic resources in the slip.

Ballast Water

LNG carriers would discharge ballast water into the slip after arriving at the terminal berth and taking on cargo. As explained in section 4.3.2.2, Jordan Cove estimated that an LNG carrier taking on cargo at its berth would discharge about 9.2 million gallons of ballast water into the marine slip during the 17.5 hours it would be hoteled at the terminal. Ships may actually spend 24 hours at the berth so water use may be higher, as noted below. The potential of introduction of nuisance species from vessel transit including ballast water discharge was discussed earlier in section 4.5.2.1. Because the ballast water would have been taken on at sea, it might have slightly higher salinity than the water in Coos Bay that is fed from upstream fresh water sources. The tidal cycling of water in Coos Bay would reduce the effect of more saline seawater from ballast release in the slip on local aquatic resources. We estimate the total slip area to cover about 4.8 mcy (3.7 million m^3) of water. Therefore, the ballast water release would only amount to 1 percent of the entire size of the marine slip. By following Coast Guard and EPA procedures for ballast water, Jordan Cove and the LNG carriers visiting its terminal would probably not introduce exotic non-native organisms from a foreign port into Coos Bay.

Entrainment and Impingement from Vessel Cooling Water Intake

During operation of the terminal, LNG carriers at berth may entrain marine organisms through water taken from the slip to cool engines. Jordan Cove estimates that a 148,000 m^3 steam-powered LNG carrier would take in about 69.7 million gallons (264,000 m^3) of water from the slip for engine cooling while during their 24-hour loading period at the terminal dock. Dual-fuel diesel electric propulsion vessels (160,000 to 170,000 m^3) would take in 20.3 million gallons (76,800 m^3) less than steam-powered vessels over 24 hours.

Currently, no additional screening system other than that already employed on the LNG carriers, is proposed for water intakes. The current screen bar spacing on most LNG carriers is about 24 millimeters (mm; about 1 inch), bar width is 4.5 mm, and the total open area (considering screen open area is about 70 percent of total intake size) of the cooling water intake is about 3.5 to 4.2 m^2 or 36 to 45 square foot intake area. Additional finer mesh screens are located internally on the vessels to prevent larger items from entering the system. These screens would not meet NMFS (1997a) screening criteria for juvenile salmonids. The estimated velocity at the opening of the cooling water intake would range from 1.0 to 4.3 fps (0.30 to 1.32 meters/second), depending on the intake rate of cooling water used and intake area. The NMFS recommends an approach velocity of 0.33 fps for screening systems for salmonids of less than 60 mm, and 0.8 fps for larger juvenile salmonids. These guidelines also include other requirements such as sweeping velocity and type and size of openings that are not present on these screens. The result is likely to be that fish at fry and larger juvenile size salmonids near the intakes may be entrained or impinged during cooling water intake.

In addition, smaller marine and estuarine fish, juvenile stages of crab and shrimp, as well as other zooplankton and eggs and larvae fish could also be entrained. Some estuarine organisms potentially including juvenile salmonids would be removed from Coos Bay with this process during every loading cycle. It is expected that a high portion of juvenile larval stages of fish and invertebrates entrained or impinged would result in mortality. Nevertheless, natural mortality of these early life stages is extremely high. The result would be less than 1 percent of earliest life stages reaching adult size (EPA 2004), with natural mortality over 20 to 30 percent per day during earliest growth periods (Comyns pers. comm. 2003), which is similar to the average values reported by Rumrill (1990) for invertebrates and McGurk (1986) for larval fish. For example, data from an estuarine cooling water intake site determined that intake water larval stage entrainment, had very low natural survival (Marine Research Inc. 2004, as cited in FERC 2005). On a typical LNG carrier, the location of the water intake would be near the inner portion of the slip at depth of about 30 feet, which would likely reduce overall abundance of juvenile salmonids but not necessarily other organisms in the intake area. Salmonids migrating in Coos Bay would more likely be swimming in the main channel, away from the shoreline and the inset slip, reducing their chance of encountering the LNG carrier intakes. Other fish may have more varied distribution relative to the intake location. Therefore, the off-channel artificially created marine slip at the Jordan Cove LNG terminal would probably have a lower presence of juvenile salmonids but more varied overall fish abundance than the rest of Coos Bay.

To make a reasonable estimate of potential loss from cooling water intake, we compared the relative amount of water used by an LNG carrier while at dock at the terminal to the amount of water carried by the tide in Coos Bay past the Project vicinity. There are several assumptions with this method; the three major ones are: (1) organism distribution would be similar in water used to that in the bay as a whole, (2) all organisms entrained would be lost to the system, and (3) no avoidance to entrainment would occur. In addition, the estimate of entrainment loss was compared to what typical natural mortality loss would be for invertebrate and vertebrate life stages that are common in zooplankton as potential fish food sources. This information provides a perspective of how entrainment loss may influence food supply relative to natural conditions. This approach was developed in the Shanks et al. (2010, 2011) documents.

The period at the dock would span approximately two tidal cycles (each tidal cycle takes approximately 12 hours). We used data from Shanks et al. (2010, 2011) to make an average estimate that 106.1 million m^3 of water would be passing through Coos Bay in the vicinity of the Jordan Cove terminal during one tidal cycle. This means that conservatively[137] from 0.07 to 0.25 percent of the water passing the marine slip would be taken in for engine cooling while an LNG carrier is at dock at the terminal, based on average tidal exchanges. Theoretically, organisms in this entrained water would be lost to the Coos Bay system and therefore not available as a food source. Based on the assumption that the concentration of various planktonic organisms is

[137] Values are conservative (likely high) because total cooling water intake/discharge period is about 24 hours while we used the one tidal exchange period, about 12 hours for the estimate. Actual volume of water passing area would be about double, but some portion would be the "same" water.

homogeneous in the resident water in Coos Bay, only about 0.07 to 0.25 percent of the planktonic population would be affected by each LNG carrier.

The loss of these organisms from entrainment can also be compared to loss from natural mortality in the bay environment by comparing estimated loss from entrainment to that occurring from natural mortality of typical pelagic organisms. This comparison was based on comparing instantaneous natural mortality rate (per day) loss, to loss from potential entrainment assuming all entrained organisms suffer 100 percent mortality. The natural mortality rate for various marine pelagic organisms was obtained from Rumrill (1990) and McGurk (1986). Using these rates, comparisons can be made to potential loss from entrainment to that that would naturally occur on a daily basis for a variety of typical marine organisms (table 4.5.2.2-5).

TABLE 4.5.2.2-5

Comparison of Relative Loss of Larval Invertebrates and Larval Fish from Entrainment to Natural Mortality During Cooling Water Intake for One LNG Vessel Docked at the Jordan Cove Terminal

Mortality Category in Literature Source	Taxa Groups b/	Sample size	Natural Mortality Rate M (daily)(M=ln(S)/-t) c/	Estimated Percent Loss from Entrainment Relative to Daily Loss from Natural Mortality a/	
				Low Intake	High Intake
Lowest	Larval Invertebrate 1	14	0.0305	2.4%	8.2%
Lowest	Larval Invertebrate 2	28	0.0161	4.5%	15.5%
Lowest	Larval Fish	29	0.0200	3.6%	12.5%
Average	Larval Invertebrate 1	14	0.1450	0.5%	1.7%
Average	Larval Invertebrate 2	28	0.2470	0.3%	1.0%
Average	Larval Fish	29	0.1969	0.4%	1.3%

a/ Values based on average daily Coos Bay tidal water exchange rate of 106,000,000 m^3, and one LNG carrier water intake of 76,800 m^3 (low) and 264,000 m^3 (high) over 24 hours. Assumes 100% mortality of entrained organisms.
b/ Sources: Invertebrates from Rumrill (1990), and fish from McGurk (1986).
c/ S= Daily Survival, t=days, ln=natural log base e

Average and lowest mortality rates data for larval invertebrates and larval fish from these two sources were similar. Average loss of organisms from entrainment during one LNG carrier loading event would be low, ranging from 0.3 to 1.7 percent of what would occur from natural morality in one day. For the lowest literature mortality rate of larval taxa among those reported, daily entrainment loss would be much higher ranging from 2.4 to 15.5 percent depending on what water volume was used during one vessel loading cycle and which taxa group data are used. These values are conservative estimates when compared to natural mortality that would occur in the Coos Bay system overall because entrainment would not occur daily whereas natural mortality would, not all entrained organisms would suffer mortality, and, as noted, we assumed half the daily water volume passing the loading area.

Because about 110 to 120 LNG carrier trips a year would occur, LNG loading and water intake use would occur on average every 3 days. Therefore, relative fish food organism loss from entrainment annually would be considerably less than that estimated. Overall reduction in food sources for marine predators from entrainment of planktonic organisms appears to be slight, considering numerous factors. On average, water intake would be less than 0.3 percent of the water in Coos Bay passing by the terminal location on a daily tidal cycle, so relatively few organisms would be subject to entrainment assuming similar planktonic organism distribution at the intake. Typical "loss" on average would be about 1.7 percent or less of loss from natural mortality of invertebrate and fish larvae during the day of LNG cargo loading (table 4.5.2.2-5).

Even though the number of fish individuals lost is not expected to be large, some mortality would occur. It is expected that the greatest portion of organism and fish that would be entrained would likely be early life stages, as these are unable to avoid entrainment. As noted above, natural mortality is high for these early stages.

We also considered what effect the direct loss of young stages may have on production of older individuals. EPA (2004) examined the effects of entrainment by California power plants on marine fish and shellfish. The document developed natural mortality information by life stage of common marine and estuarine species or groups of species present in the California coastal region. Many of the species groups are common to Coos Bay. This information supplies an additional indication that loss of early life stages because of high natural mortality would not markedly reduce later life stages. Table 4.5.2.2-6 shows the relative survival percent from one life stage to the next up to age 2, and overall percent survival from larval to age 1 and 2, based on the EPA (2004) document. For most taxa, less than 1 percent of larvae would be expected to survive to age 1, as the highest rate of mortality occurs in early life stages. Adult or harvestable populations of a fish species are also affected by many factors (e.g., currents, food, temperature, usable habitat) that are generally independent of numbers or survival of early life stages. Overall, the loss of marine fish and their prey resources from entrainment, relative to numbers in Coos Bay, would be small based on the information discussed.

TABLE 4.5.2.2-6

Selected Survival Values by Life Stage of Marine Species That May Be Entrained or Impinged

	Percent Survival by Life Stages a/				
Taxa Group/Species b/	**Larvae to Juvenile**	**Juvenile to Age 1**	**Age 1 to Age 2**	**Larvae to Age 1**	**Larvae to Age 2**
Anchovies	0.03%	12.00%	49.66%	<0.01%	<0.01%
Longfin Smelt	0.17%	40.01%	51.17%	0.07%	0.03%
Pacific Herring	0.90%	50.01%	62.31%	0.45%	0.28%
Other Forage Fish	0.05%	27.53%	19.79%	0.01%	0.00%
Flounder	0.19%	31.98%	69.56%	0.06%	0.04%
Rockfish	36.79%	36.79%	80.65%	13.53%	10.92%
Cabezon	1.87%	40.01%	26.18%	0.75%	0.20%
Sculpins	2.26%	40.01%	65.70%	0.90%	0.59%
Dungeness Crab	30.12%	30.12%	60.65%	9.07%	5.50%
Commercial Shrimp	4.98%	11.53%	11.53%	0.57%	0.07%
Forage Shrimp	0.31%	41.85%	33.29%	0.13%	0.04%
Average	**7.06%**	**32.90%**	**48.23%**	**2.32%**	**1.607%**
Median	**0.90%**	**36.79%**	**51.17%**	**0.45%**	**0.07%**

a/ Values based on natural mortality rates by life stage.
b/ Groups include multiple species defined in Appendix B1 of EPA (2004).

Loss of juvenile salmonids from entrainment or impingements could also reduce adult returns. Survival from smolt stage is highly variable among salmonid size, species, and year and easily can range from less than one to more than 10 percent. NMFS (2008b) in their assessment of effects of the Coos Bay airport expansions used a value of 4 percent survival for coho salmon smolts to returning adults. Even so, due to the extremely small portion of total water intake relative to the volume of Coos Bay, likely intake locations (30 feet deep, in the back of the isolated slip) likely away from concentrations of juvenile salmonids, the relative portion of juvenile salmonids that would be entrained and suffer direct mortality would be small.

Overall, the extremely small portion of total water intake relative to the volume of Coos Bay per LNG carrier (0.07 to 0.25 percent) suggests that the loss of zooplankton and ichthyoplankton, other marine invertebrates, eggs, larvae, shellfish, and fish including juvenile salmonids due to operation of the Jordan Cove Project would be low in comparison to total available entrainable size organisms in the bay and occurring from natural mortality. Therefore, we conclude that entrainment and impingement from LNG carrier water intakes at the terminal would not have substantial adverse effects on any marine phase of aquatic resources (e.g., the juvenile stage of salmonids) or their food sources.

Water Temperature in the Slip and Bay

LNG carriers at berth at Jordan Cove's terminal have the potential to both warm the temperature of the marine slip while discharging engine cooling water, and to cool the temperature of the marine slip while loading LNG cargo. Moderate to large temperature increases have the potential to reduce fish and invertebrate growth, reproductive success, and if high enough cause direct mortality. Fish of the north Pacific, including those found in Coos Bay, are adapted to cool water conditions and could be adversely affected by sharp increases in water temperature. Coos Bay temperatures historically remain less than 20°C (McAlister and Blanton 1963).

Moffat & Nichol (2018a) developed a temperature plume model for cooling water discharge from the LNG carriers during LNG gas loading. The model assumed that steam turbine vessel and dual-fuel diesel electric vessel would have a cooling water temperature of 2.0°C (3.6°F) and 2.8°C (5.0°F) above ambient at the point of discharge, respectively. Discharge rate would be 11,000 m^3/hour and 3,200 m^3/hour for about 24 hours of loading, for the former and latter vessels, respectively. Moffat & Nichol modeled the extent of the plume to where plume temperature would decrease to 0.3°C (0.6°F) over ambient water temperature. This model was run for varied bay water temperatures. The result was that the maximum distance from the port discharge point where the plume would reach this temperature was 80 feet for the steam turbine vessel and 37 feet for the dual fuel diesel electric vessel. The average water temperature increases for the total slip volume for one day when an LNG carrier is at dock for the vessel using the larger volume (steam turbine vessel) would range from 0.03 to 0.06°F (see section 4.3.2.2). We expect the actual average increase in water temperature in the slip would be less than the higher value estimated due to tidal exchange and the vessel uptake of heat from its surroundings due to the transfer of liquid gas into the vessel at -260°F (-162°C). While marine species would likely have a range of temperature tolerance, salmonids are known to be sensitive to elevated temperatures. The modified water temperature would be well below levels that would be considered lethal in the short term (a few days) for salmonids, which would be over about 24 to 26°C (WDOE 2002). Mortality of juveniles starts to occur at constant exposure to temperatures above 71.6°F (Hicks 2000), with an acute lethal temperature of 78.4°F (Beschta et al. 1987), while optimum temperatures are much lower for salmonids, with preferred ranges generally between 50ºF and 59ºF for rearing juvenile coho salmon (Brett 1952; Reiser and Bjornn 1979; Jobling 1981; Konecki et al. 1995; McCullough 1999; Sullivan et al. 2000; Carter 2008). Juvenile coho salmon are taxed in the temperature range of 60.1ºF to 68.5ºF but are still capable of growing at a reduced rate (Stenhouse et al. 2012). Short-term local temperature increases would remain well below short-term adverse levels for salmonids, and any small changes in temperature including to the area within 80 feet of the discharge port would be easily avoided by fish. Therefore, the cooling water discharge should result in no adverse effect on salmonid resources from temperature changes. Since salmonids are not tolerant of elevated temperatures, they are likely a reasonable indicator that other estuarine species (which may be less sensitive) would also not be adversely affected by small temperature changes. Considering the total volume of water in Coos Bay, in comparison to the small volume of heated water discharged, virtually no change in bay temperature would occur from operation of the LNG Project.

Water Runoff and Spills of Hazardous Materials

After construction of the terminal, about 100 acres would be covered by impervious surfaces (e.g., compacted gravel). There is the potential for stormwater to run off these hard surfaces into the marine slip or bay, carrying sediment or hazardous materials, which may harm aquatic resources. However, before stormwater is discharged, it would be directed to areas for treatment (see section 4.3.2.2). Low oil potential runoff would be treated primarily by filtration, although cartridge filtration may be implemented, as designated in Jordan Cove's *Stormwater Management Plan*. Examples where cartridge filter would be used are paved roads, parking lots, and dense-grated gravel process areas. As mentioned in section 2.1.1.5, Jordan Cove would design and construct a stormwater drainage and collection system for its terminal. Runoff, including potential hazardous materials from the site, would be designed to meet regulatory requirements from both NMFS and ODEQ, and would be managed by following the ODEQ-approved *Storm Water Management Plan*. Stormwater from areas that have no potential for contamination would be allowed to flow into the slip or bay through designed discharge ports. Stormwater collected in areas that are potentially contaminated with oil or grease would be directed to sumps and then processed through an oily water separator before discharge to the IWWP. Industrial wastewater would be conveyed to the Port's existing ocean outfall, pursuant to the NPDES permit issued by the ODEQ. Stormwater collection and treatment facilities would be designed in consultation with NMFS and the ODEQ.

All areas where LNG may be present would be curbed, bermed, and/or and graded so that any spill would flow to containment trenches leading to impoundment basins. The two LNG storage tanks would be surrounded by a 65-foot-high barrier. Any spills of hazardous materials would be handled in accordance with Jordan Cove's SPCC Plan (see section 4.3.2.2).

Terminal Lighting

Localized changes in light regime have been shown to affect fish species behavior in a variety of ways (Simenstad et al. 1999; Valdimarsson et al. 1997; Tabor et al. 2004; Nightingale and Simenstad 2001a). Disorientation may cause delays in migration, while avoidance responses may cause diversion of migratory routes into deeper, less protected waters. In some cases, increased light may attract both predators and potential prey species (Simenstad et al. 1999; Valdimarsson et al. 1997; Tabor et al. 2004). Juvenile coho salmon show no response to moderately high light intensity but become inactive in very low light (Hoar et al. 1957). Other fish may respond differently; for example, schools of juvenile chum salmon show marked preference for light, while juvenile sockeye prefer the dark. Depending on their reaction, fish may have migration delayed, be moved into less protected deepwater habitat, or they may become more susceptible to predation, as light can attract predators and increase their ability to see fish. Some adverse modification in fish behavior could occur from the lighting present at the terminal, possibly delaying migration, moving fish to less desirable habitat conditions, or subjecting juvenile fish to greater nighttime predation.

Lighting at the LNG terminal would likely include a mixture of low-power fluorescent lighting and higher intensity security lighting that would primarily be located on shore, in and adjacent to the slip. Lighting used at the LNG terminal would be similar to that already in place at other Coos Bay facilities. The facility would have its highest intensity lighting on shore away from the water, although some lower level lighting would be present near the water. Lighting on the tug dock would be low intensity lighting adequate for safety. No high intensity lighting would be present near the water except possibly during vessel docking. When an LNG carrier is not in the berth, the lighting would be reduced to that required for security and would be focused upon the structures and not be in proximity to the water; therefore, the lighting would not serve as an attractant or deterrent to fish species. When an LNG carrier is at the berth, it would physically block the lighting on the berth from the slip waters and, due to its proximity to the slip wall, would block the fish from getting too close to the lighting on the berth. Lighting used would be similar to that already in place at other Coos Bay facilities.

The location of the facility, set back from the main channel of Coos Bay, would reduce fish encountering any shoreline lighting effects. The reduced lighting levels near the water should reduce any behavioral effects on fish near the terminal. As mentioned above, we are recommending that Jordan Cove develop the details of its final lighting plan in consultations with the FWS, NMFS, and ODFW to minimize potential effects on aquatic resources. The limited height intensity lighting and overall large habitat area available for fish avoidance of these regions, and plans to obtain an approved plan with managing agencies, are anticipated to reduce the potential for adverse effects on local and migratory fish resources.

Maintenance Dredging

Jordan Cove has estimated that maintenance dredging would occur every three to five years with varied amounts removed ranging from 115,000 cy to 160,000 cy each dredging cycle for slip and access channel (see section 4.3.2.2 for details). An additional 27,000 cy would be removed from the navigation channel about every three years. Jordan Cove proposes to place maintenance dredged material at land storage sites APCO Sites 1 and 2 (figure 4.5-2).

Modeling conducted by Jordan Cove and the Port (Moffat & Nichol 2006a) suggests a very narrow range of elevated suspended sediment (greater than 100 mg/l) during low tidal velocity extending out a few hundred feet from where the maintenance dredging area of the slip would occur in Coos Bay using a mechanical (clamshell) dredge. The highest concentration levels would occur at lowest tidal velocity when dispersion of suspended sediment would be the least. Peak value at the lowest modeled tidal velocity—the point of clamshell dredging—is estimated to be 830 mg/l, with decreasing values away from the actual dredging site to about 125 mg/l at 200 m (660 feet) from the site. During typical tidal cycles, turbidity would be up to 75 mg/l out about 0.2 to 0.4 mile from the dredging site. Moderately low values of 25 to 50 mg/l may extend out to about 3.5 miles depending on flow, sediment composition, and equipment used, for brief peak periods (about 2 hours daily). During high current velocity, peak values at the point of dredging would be about 90 mg/l, decreasing to 25 mg/l in 100 m (330 feet). Average daily (24-hour) values outside of the direct area being dredged would remain in the range of seasonal background levels of 25 to 50 mg/l during the ODFW-allowed dredging window. Maintenance dredging of the marine waterway modifications (i.e., the navigation reliably improvement areas) is expected to have similar turbidity effects but could be less if a hydraulic suction dredge is used. The number of days dredging would occur would depend on details of equipment used but would likely range from a few days to about a month of dredging to remove about 142,000 cy every three years (COE 2011). If dredging were to occur at the estimated removal rate of about 7,000 cy per day estimated for hydraulic dredging in Jordan Cove's *Dredged Material Management Plan,* active maintenance dredge would occur over 20 days.

Fish are likely to move from this narrow band of elevated suspended sediments during peak occurrences for short durations during dredging (likely several hours over the largest area affected). Additionally, some benthic organisms (e.g., clams, shrimp, and tubeworms) would be removed during this dredging. As noted for construction dredging, full benthic organism recovery at each site may be as long as about a year or more for some benthic organisms. Maintenance dredging would occur from October 1 to February 15 during the Coos Bay in-water work window which would avoid major juvenile salmonid presence in the region.

Because all dredged material would be placed on land where runoff is controlled, there would be no effect on the estuary or marine environment from dredged material disposal. However, the final transport method of the dredged material to these sites has not been finalized and may include some bottom disturbance or effects from piping used to transport the discharge material. Additionally, some reduction in benthic food organisms would linger for part of a year after dredging in each of the re-dredged areas. However, these areas are a relatively small region of the total benthic area of Coos Bay. These small areas of potential direct effects from dredging and pipeline impacting bottom areas would not have substantial effects on the total bay benthic community, but would be recurring every three to five years.

Operational Acoustic Effects

LNG carrier and tugboat operations along the waterway, operational noise at the terminal, and maintenance dredging would generate underwater sounds pressure levels that could elicit responses in aquatic organisms. State agencies in Washington, Oregon, and California along with federal agencies (FWS and NMFS) have developed interim noise exposure threshold criteria for pile-driving effects on fish (WSDOT 2011; Fisheries Hydroacoustic Working Group 2008; Popper et al. 2006). These threshold criteria are described above for pile-driving acoustic effects during construction.

Underwater noise levels are expected to vary by ship type and by vessel length, gross tonnage, vessel speed, and, to some extent, vessel age as older vessels tend to be louder than newer vessels. Based on the general trend for higher underwater noise generated by larger vessels (McKenna et al. 2012), it is possible that some of the LNG carriers could generate more noise if they are larger than the LNG carrier built in 2003 with a 138,028 m^3 capacity reported by Hatch et al. (2008). The vessel in that study produced sound levels (with one standard error) of 182 ± 2 dB re: 1 µPa at 1 meter that attenuated to 160 dB at 35 ± 11 meters and to 120 dB at 16,185 ± 5,359 meters. These vessel noise levels are therefore generally less than threshold levels considered to cause direct harm to fish. Upland operational noise may also travel over water, but is not likely to affect fish, although there may be effects on marine mammals close to the terminal.

Generally, response to changes in noise levels would be behavioral and perceptual, and not physiological in nature, as fish and marine mammals would tend to avoid the area during periods of high noise output. We conclude that operational noise would not have significant adverse effects on aquatic resources.

4.5.2.3 Pacific Connector Pipeline Project

The Pacific Connector pipeline would cross[138] or affect 352 waterbodies: 69 perennial streams, 270 intermittent streams (99 of these are considered ditches), 9 ponds (i.e., all ponds are adjacent to the line and would not be directly crossed), and 4 estuarine channels. Available data indicate that about 72 of these waterbody sites are known or assumed to be inhabited by fish. Appendix I, table I-2, lists information on waterbodies crossed or potentially affected and known fish distribution and classification relative to the crossing.

Aquatic Habitat in the Coos Bay Estuary

The pipeline would cross under about 2.3 miles of Coos Bay in two separate crossings. Coos Bay consists of about 14,000 acres of varied intertidal and subtidal substrate habitat conditions including algae beds, eelgrass sites, marsh lands, and mostly unconsolidated substrate. The upper Coos Bay estuarine habitat contains important rearing habitat supplied by estuarine wetlands, algae, and eelgrass beds, which are important conditions for estuarine fish and migratory salmon, as well as commercial oyster beds and scatter native Olympia oyster areas. The estuarine habitat of the Coos Bay estuary along the pipeline route is in a mix of shallow regions of the Coos Bay near Kentuck Slough and deeper areas under the two navigation channels crossed (see figure 4.5-1). Most of the route and associated work areas are in nearly equal amounts of shallow intertidal and subtidal fine bottom and unconsolidated bottom habitat, with a few regions of mixed seabed of eelgrass, attached algae, tidal marsh and deep navigation channel. The fisheries in these habitats include a mix of anadromous and marine species, as well as shellfish, and are described above in section 4.5.2.1.

Aquatic Habitat in Inland Waterways

The freshwater streams crossed by pipeline route include six major subbasins of rivers in southern Oregon. The aquatic habitat crossed by the pipeline outside of Coos Bay is primarily coldwater streams, but with a few warmwater ponds adjacent to the pipeline. Most stream riparian areas crossed are heavily forested, and are therefore shaded by a mix of conifer and hardwood trees, providing typical salmon and/or trout habitat. Several waterbodies crossed are large (over 100 feet wide), but the majority are small waterbodies with generally no or low flow ,as about 75 percent are intermittent streams. Most of the major streams and many of the minor streams crossed contain salmon and steelhead, some of which are federally listed as threatened fish species.

Fishery Types and Fish Status

Fish species present in the pipeline area can be classified as freshwater resident, anadromous, and estuarine fish. Freshwater streams with habitat suitable for resident fish and anadromous fish that survive best in colder water stream habitats are the most common along the pipeline route and associated facilities other than in the Coos Bay estuary, while fish that thrive in warmer waters, which are uncommon in flowing waters along the route, are typically associated with ponds in southeast Oregon. The status of federally listed fish species and other commercial fish species that are managed under the MSA is presented in our BA and EFH Assessment (see appendix I) that was submitted to the FWS and NMFS. Endangered and threatened species and their respective critical habitat, and other special status species are addressed in section 4.6. The status of other state-listed

[138] Crossing, when referring to the pipeline route, is used here to mean a distinct pipeline or cleared right-of-way crossing of a waterbody including streams, ditches, ponds, or estuarian channels, unless otherwise stated in the text.

fish species and fisheries of concern are also discussed in section 4.6. The EFH assessment summary relative to pipeline-related actions is included in appendix I.

Freshwater Resident Fish

Fish species typically thriving in warmer water areas in the pipeline area include black (*Pomoxis nigromaculatus*) and white crappie (*Pomoxis annularis*), and brown bullhead (*Ameiurus nebulosus*), which are not native to the region. Lakes supply habitat for these typical species in several lakes near the route and are present at pipeline crossing areas, and are likely in some Klamath Basin streams crossed by the pipeline.

Resident fish species more common in habitats between cold and warm waters conditions are present in the area affected by the Project include both non-native and native species. Some important non-native species include smallmouth bass (*Micropterus dolomieu*) and yellow perch (*Perca flavescens*), as they are a common sport fish. These fish are often present in lakes, and smallmouth bass may be found in some larger rivers. Other native resident species of note include the ESA listed Lost River sucker (*Deltistes luxatus*), ESA listed shortnose (*Chasmistes brevirostris*) and Klamath largescale (*Catostomus snyderi*) suckers, and blue chub (*Gila coerulea*). These latter species occur primarily in the Klamath Basin, in Upper Klamath Lake and its tributaries. Umpqua chub (*Oregonichtyhys kalawatseti*) are a FWS species of concern, as this fish species has declined precipitously in the last decade. The pipeline would cross habitat occupied by Umpqua chub.

Resident fish species that spend their entire lives in fresh water and thrive in colder water areas are referred here as coldwater species. The term is used here to mean waters that primarily support salmonids (e.g., trout). Various waterbodies crossed by the Pacific Connector pipeline provide year-long habitat for several resident coldwater fish species. Resident cutthroat trout (*O. clarki*), rainbow trout (*O. mykiss*), and redband trout (*O. m. gibbsi*) are the most common resident coldwater game species along the route.

Non-game fish species, some of which migrate between freshwater and marine habitats (e.g., threespine stickleback [*Gasterosteus aculeatus*]), and others that are freshwater residents (e.g., western brook lamprey [*Lampetra richardonii*], speckled [*Rhinichthys osculus*] and longnose [*R. cataractae*] dace, sculpins, chiselmouth [*Acrocheilus alutaceus*], sucker) also may occur in waterbodies in the pipeline area.

Anadromous Fish

Anadromous fisheries in the pipeline area comprise eight species: Chinook salmon, coho salmon (including two ESA listed coho salmon ESUs), steelhead, coastal cutthroat trout, Pacific lamprey, western river lamprey, Pacific eulachon, and green sturgeon (also ESA listed) (see section 4.5.2.1). Section 4.5.2.1 summarizes most of the major runs of anadromous salmon, steelhead, and trout species in the area affected by the Pacific Connector Project and their general timing of life phases.

Marine (Estuarine) Fish

The marine species that may be present along about 2.3 miles of the pipeline route where it would cross under Coos Bay at two locations between about MPs 0.3 and 1.0 and MPS 1.5 and 3.0 are the same as those discussed above for the Coos Bay portion of the waterway for LNG carrier marine traffic to and from the terminal (section 4.5.2.1).

Marine (Estuarine) Shellfish

Major invertebrate taxa present in Coos Bay are described in section 4.5.2.1. Invertebrate groups include pelagic (in the water column), epibenthic (residing on sediment surface), and benthic (residing in the sediment) organisms. Pelagic invertebrates include juvenile and larval stages of many species, such as crab, shrimp, clams, worms (polychaetes) as well as adult and juvenile crustacean zooplankton (e.g., copepods). Epibenthic organisms including harpacticoid copepods, snails, amphipods, mussels, oysters are all present to varying degrees. Benthic organisms include clams and the most abundant polychaetes and amphipods, the latter an important food for juvenile salmonids.

Aquatic Species of Concern to Native Americans

The Klamath Tribes and Karuk Tribe expressed concerns about potential Project-related impacts on salmon. The Yurok Tribe is concerned about impacts on salmon, steelhead, green sturgeon, and Pacific lamprey. The Coquille Indian Tribe listed the following marine/estuary aquatic species of concern: lamprey, salmon, shellfish, crab, sea mammals, rockfish, lingcod, sculpin, halibut, flounder, perch, herring, greenling, candlefish, snails, mussels, barnacles, chiton, sea urchin, abalone, and dentalium. Salmon and lamprey have particular cultural significance to the Grand Ronde Community. In addition, the Grand Ronde Tribes have concerns about other aquatic resources, including ESA federally listed bull trout, and Oregon Conservation Strategy species rainbow trout, cutthroat trout, and Umpqua chub.

Estuarine Oysters

There are two different types of oysters identified along the pipeline route at the two Coos Bay crossings: 1) commercially grown non-native Pacific oysters; and 2) native Olympia oysters. Neither species can be legally harvested for recreational purposes. Native oyster populations are state-protected to encourage their recovery. Pacific oysters are the private property of their commercial growers.

Four companies lease state lands in Coos Bay to raise Pacific oysters commercially, two of which are near the pipeline crossing. They seed their beds with juvenile oysters (spat) and later harvest adults. These commercial beds are located on the north and east side of Coos Bay from Glasgow Point (north) to Crawford Point (south) in intertidal areas. Another commercial oyster operation is in South Slough. The pipeline route would go directly under one commercial oyster area owned by Clausen Oysters west of Kentuck Slough.

Olympia oysters can be found in the subtidal and intertidal zones of Coos Bay from Haynes Inlet south to Isthmus Slough. Pacific Connector surveyed nearly 7,000 feet of relatively shallow intertidal habitat for Olympia oysters along the previously proposed pipeline route in Haynes Inlet during late June 2011. Olympia oysters were found growing on riprap at the mouth of Haynes Inlet and on substrates within the pipeline right-of-way. Generally, Olympia oysters were found almost exclusively where hard surfaces (e.g., riprap, old oyster or clam shells) are present (Ellis Ecological Services 2011). Olympia oysters are primarily known to be present more inland than most of the Project's developed areas including Haynes Inlet, the downtown Coos Bay area, Millington, and Pony Point near the airport. The mostly outer limit of their distribution in the bay includes within South Slough and the most westerly main channel location on riprap at the end of the airport runway (Groth and Rumrill 2009).

Marine Mammals

The marine mammals that may be present along the pipeline route in Haynes Inlet are the same as those discussed for the Coos Bay portion of the waterway for LNG carrier transit to and from the terminal (see section 4.5.2.1), except for large whale species that only inhabit the deep, open ocean. It is possible that killer whales, gray whales, and pinnipeds could be found in Coos Bay. The potentially present marine mammals are protected under the MMPA.

Freshwater Mussels

Limited native freshwater mussels may be present in some streams along the route. Only eight native mussels are present west of the Continental Divide, most of which belong to the genus *Anadonta* (Nedeau et al. 2009). This genus tends to occur more often in lakes and pond and quiet pools but may found in swifter waters in protected areas without current sheer. Another species, the Western pearlshell (*Margaritifer falcate*), while most common in large streams can be found in cold small streams only a few feet wide (Nedeau et al. 2009). The distribution relative to the project crossing for mussel species in not known; however, it is possible that some may be present near crossings, especially in larger, low-gradient streams. Two sensitive species (see appendix I-4) may be present in streams along the route: California floater mussel (*Anadonta californiensis*) and Western ridged mussel (*Gonidea angulata*). Both species are also addressed in the Forest Service's Biological Evaluation (BE; appendix F.7 of this EIS).

Effects on Aquatic Habitat and Aquatic Species from Construction of the Pacific Connector Gas Pipeline Facilities

The pipeline route would cross under 2.3 miles of estuarine habitat in Coos Bay (not including estuarine habitat in the Coos River) and cross or pass near an additional 349 waterbodies, of which about 69 are known or presumed to be inhabited by fish. In addition, 4 new stream crossings would occur along the 10 temporary or 15 permanent roads with one permanent road stream crossing known to have fish. Existing roads used by the pipeline project for construction would use existing stream crossings although final design may include new or modified structures at some locations (see below), with a total of 47 streams crossed, 5 of which are perennial streams with 1 known to have fish. One new permanent construction road would also cross a known fish-bearing stream (PAR 15.07 crossing an intermittent tributary to Stock Slough).

Pacific Connector proposes to cross under the two Coos Bay estuary crossing locations and three large river crossings (Coos, Rogue, and Klamath Rivers), using HDD methods. At two crossings of the South Umpqua River, Pacific Connector would use a diverted open-cut method at one and a DP method at the other. Pacific Connector proposes to cross Medford Aqueduct using a conventional bore. An additional 24 bore crossings would be used primarily at ditches and canals. All other stream crossings would employ a dry, open-cut method. General stream crossing methods for each of these are described in section 2.4.2.2, and specific crossing methods are listed in appendix I, table I-2. General Project activities potentially affecting aquatic resources include frac-out at estuarine and large river crossings, freshwater in-water construction activities, terrestrial/riparian habitat modification, accidental spills or leaks of hazardous materials, and periodic maintenance of the pipeline.

Right-of-way clearing would occur during periods designated in section 2 and section 4.4 following the guidelines in Project plans such as the ECRP unless site-specific deviations are proposed. The baring of soil upslope of streams has the potential to contribute sediment and elevated turbidity when near streams, especially if on steep slopes; however, the pipeline route has been selected to minimize steep slopes and unstable areas. Additionally, there is an ECRP which includes implementation of BMPs such as silt fences, water bars, slash filter windrows, and other general procedures. Additionally, an upland erosion control and revegetation plan is in place that identifies where specific actions would be needed to curtail substantial erosion and sediment runoff to streams. Therefore, upland erosion from right-of-way clearing would not contribute substantial new sediment to streams, thus avoiding adverse effects on aquatic systems.

Construction of the Pacific Connector pipeline in-water stream crossings would only occur during ODFW recommended in-water construction windows. This timing would minimize the coincidence of pipeline construction with upstream adult salmonid migration and spawning as well as juvenile salmonid outmigration. Resident salmonids, which would be primarily cutthroat and/or rainbow trout, and juvenile coho salmon would be present at pipeline crossings during construction. Other resident fish, such as western brook lamprey and juvenile Pacific lamprey, would also be present during the in-water work window. During construction in the Coos Bay estuary (October 1 through February 15), adult anadromous salmonids, green sturgeon, and possibly eulachon would be present (ODFW 2007b).

The extent of effects on aquatic resources from pipeline construction would depend on the waterbody crossing method, adjacent clearing methods, erosion control, the existing conditions at each crossing location, and the timing of construction. Potential short-term effects that degrade habitat could occur with trenching and laying of the pipe at waterbody crossing sites and sometimes adjacent slope runoff. The installation of the pipeline across a waterbody may result in temporary deposit of a limited amount of sediment in that stream, with associated short-term turbidity affecting aquatic species. Pacific Connector would install erosion control devices during construction to reduce sedimentation and in-stream turbidity at waterbody crossings. Right-of-way clearing would be 75 to 95 feet wide at stream crossings and a permanent 30-foot-wide access route maintained in herbaceous non-forest vegetation. We expect the pipeline right-of-way to be restored and revegetated immediately after pipeline installation. Except for forested areas, vegetation would be expected to re-establish in the area within three years (see section 4.4).

Long-term degradation of habitats can occur if flow or sediment regimes are modified in a manner that results in morphological changes to the bed and banks of the channel. Also, in forested areas, shade would be reduced at waterbody crossings for the time it would take trees to grow after restoration and revegetation. In streams that have very small flows, lack of shade may raise stream water temperatures and reduce LWD supply, which could in turn affect aquatic species. However, streams with low or intermittent flow generally support smaller fish populations and less diverse species composition. Therefore, the quantity of fish resources that could potentially be affected by changes in these parameters would be low.

Pacific Connector developed its project-specific ECRP which includes specifications for waterbody crossing techniques and associated sediment and erosion controls to be implemented during waterbody crossings. A detailed description of construction and mitigation measures that Pacific Connector would implement at waterbody crossings is included in section 4.3.

In addition to actual waterbody crossings by the pipeline, several of the project-related construction activities, such as improving existing access roads (EARs), PARs, TARs, and

TEWAs within riparian areas, could indirectly affect aquatic resources by increasing erosion and runoff to nearby streams, losing future large wood input to streams, and increasing stream temperatures. The potential effects on fish or their habitat would be minimized by BMPs including the ECRP and procedures in place to reduce potential effects on streams.

Fish passage is a potential issue relating to streams crossing by roads that would be used by the project. The final locations of all road-stream crossing and road use levels would not be determined until a construction contractor can assess what final road use would be needed and final designs are developed. However, Pacific Connector, in consultation with ODFW, has developed general plans and designs for methods to be use for road-stream crossings to ensure fish passage is maintained and other effects are minimized (Pacific Connector Gas Pipeline LP 2015). For temporary and permanent roads, designs may include use of existing instream structures, which could include the protection, repair or replacement of these stream-crossing structures. New culverts may be needed in some areas. Fish passage would be ensured for all life stages for any new structure. However, Pacific Connector would not modify the fish passability of existing structures if they use them without needing to replace them. Pacific Connector would submit a fish passage plan to ODFW, and the NMFS or FWS as applicable, and would not construct the crossing until approval is received.

Temporary bridges may be used before culverts are installed. These bridges would span above the ordinary water level and be maintained to stay above water levels during use. All new or temporary crossing structures would meet state fish passage requirements and NMFS fish passage criteria. Any culvert installation would occur during state designated in-water work windows unless otherwise approved by the ODFW, and the NMFS or FWS as applicable on streams with ESA listed fish, and fish passage would be maintained during construction if passage occurred at the crossing prior to construction. If temporary bridges are used, they may be installed outside of the in-water work window if the ODFW and NMFS approve. To provide equipment and material access up and down the construction right-of-way, temporary bridges would be installed outside of the ODFW in-water work window. For flowing waters, efforts would be made to span the water with a temporary bridge from the bank without entering the water. Where bridges cannot safely be installed this way, only equipment needed to install the bridge would be allowed in the stream, minimizing water disturbance. These bridges would have suitable clearance to allow higher flows to pass without inhibition, and any temporary bridges remaining in the fall would be removed before high flows. All installation structures would be approved by the COE, ODSL, ODEQ, ODFW, and, as appropriate, the Forest Service and BLM. Currently, there are no plans to have equipment cross flowing water streams for other purposes. In-water activities would meet state turbidity standards reducing turbidity effects. With procedures in place, disturbance to aquatic systems would be kept to a minimum during periods of greater sensitivity outside of the in-water work window. Riparian disturbance would be kept to that needed for construction. These actions would maintain adequate fish passage and minimize stream disturbance from the use and installation of road-stream crossing structures.

Construction in Estuarine Habitats

During in-water pipeline installation within Coos Bay, fish and other aquatic resources are unlikely to be affected unless a frac-out were to occur. Construction of the pipeline across the Coos Bay estuary would not directly disturb the substrate as crossings utilize HDD crossing methods. The current pipeline route in the bay would be two HDD spans of 0.7 and 1.6 miles with no planned subtidal or intertidal habitat disturbance. Generally, an HDD would avoid direct effects on the bay and associated estuarine resources. However, an HDD requires the use of drilling mud as a lubricant during the process. This fluid is under pressure and there is a possibility of an inadvertent release of drilling mud through a substrata fracture, allowing it to rise to the surface (also referred to as a frac-out).

Drilling mud primarily consists of water mixed with bentonite, which is a naturally occurring clay material. Bentonite by itself is essentially non-toxic (Breteler et al. 1985; Hartman and Martin 1984; Sprague and Logan 1979). However, bentonite can act like a fine particulate sediment in water, which could affect aquatic resources. The dispersal of drilling mud from a frac-out in the bay could interfere with oxygen exchange by clogging the gills of aquatic organisms (EPA 1986). The degree of interference generally increases with water temperature (Horkel and Pearson 1976). Sediments in high concentrations can clog gills, impair vision, make it difficult to feed, and increase the chance of predation. Drilling mud that accumulates on the bay bottom could cover over benthic organisms and estuarine food sources. Most highly mobile aquatic organisms, such as fish, crabs and shrimp, would be able to avoid or move away from the affected area. Local elevation of turbidity could affect fish, including salmonids if present. Other less mobile or immobile organisms, such as echinoderms, clams (i.e., *Macoma* sp.), Pacific oyster, Olympia oyster, and coral/anemone polyps (*Anthoszoa*) (Miller et al. 1990) and other macroinvertebrates, would incur short-term effects from direct mortality if smothered by the drilling mud. However, benthic communities on mud substrates in Coos Bay that were disturbed by more intensive effects from past dredging activities recovered to pre-dredging levels in four weeks (Newell et al. 1998). Some effects may be long term if important habitat elements are affected, such as the effects of turbidity on eelgrass growth (Martin and Tyrrel 2002).

The pipeline route does pass via HDD under commercial Pacific oyster designated areas and native oyster could also be present so there is some risk for oysters should frac-out occur directly in this area. While oyster surveys have not been conducted along the current proposed route, some oysters are likely to be present in the intertidal and shallow subtidal areas where hard surfaces (like Pacific oyster shells) are available. However, typical oyster habitat is not common in the bay because most bottom areas consist of sand and fines.

Attached algae and eelgrass could also be affected by direct burial. Effects would be localized and short term, limited to species in the immediate vicinity of the frac-out, and ameliorated by tidal exchange volume. While tidal exchange would keep much of the bentonite in suspension, because much of the area is shallow and intertidal, depending on timing, some would settle to the bottom, but may be resuspended during tidal change. In these mostly shallow bay areas, accumulation could be contained and removed. Because of the above, effects on benthic organisms from burial under a release of drilling mud are likely to be low.

To prevent a frac-out or address impacts should one occur, Pacific Connector developed its *Drilling Fluid Contingency Plan for Horizontal Directional Drilling Operations*.[139] As discussed in chapter 2, the contingency plan would be implemented in the case of a frac-out into an estuarine or aquatic environment. These measures include, but are not limited to:

- temporarily halting the HDD, and sealing the source of the leak in the fractured zone;
- contacting agencies and developing a site-specific treatment plan;

[139] This plan was attached as Appendix 2.H of Resource Report 2, in Pacific Connector's September 2017 application to the FERC.

- adding higher viscosity drilling fluid or lost circulation material to help seal leaks if required:
- deploying containment structures, if feasible;
- monitoring locations downstream of the HDD to identify areas of drilling mud accumulation;
- in estuary possibly remove muds during low tide if they are exposed; and
- in streams removing the drilling mud from substrate and streambanks, if possible.

The precise amount of drilling lubricant that would escape to water from a frac-out cannot be determined because of the many variables that affect quantity (proximity to water where frac-out occurs, length of time active drilling occurs after a frac-out begins, where in the process and flow rate where it occurs). However, with current designs and contingencies that would be in place at the site of any frac-out, the time period of drilling mud released into a waterbody would likely be short term if it were to occur. The *Drilling Fluid Contingency Plan* includes active monitoring of drilling activity that has procedures in place to detect potential drilling fluid spill such as monitoring sudden drops in drilling fluid pressure that would cause cessation of drilling. If monitoring detected a frac-out, the HDD activity would be immediately stopped. Detailed surveys and plans[140] have been made for each of the HDD crossing sites. Furthermore, the HDD locations are all under a large estuary or major rivers, with large volumes of water and swift flows, where the drilling mud would be diluted. Finally, frac-out most often occurs near the entry and exit locations, which are often landward of the stream channel. Displaced soil and a return flow of the bentonite slurry is another potential source of sediment from HDD crossings. As discussed in chapter 2, the drilling mud returns would be hauled offsite after completion of the HDD crossing and disposed of at an approved disposal facility in accordance with all applicable federal and state regulations. Therefore, we conclude that an inadvertent release of drilling mud from an HDD would have minor, short-term adverse effects on estuarine or aquatic resources.

There could also be oil or fuel leaks from construction equipment. Pacific Connector would implement the measures outlined in its SPCC Plan to avoid or reduce effects from an equipment oil or fuel leak (see section 4.3.2.1 for details). Generally, these measures include storing fuels and oils over 150 feet from water, checking equipment for potential leaks before entering the construction area, and having clean-up equipment and supplies readily available onsite.

Aquatic Nuisance Species in Coos Bay

Invasive species have the potential to modify the food base and induce other ecological modifications in the estuarine area of Coos Bay. Non-indigenous aquatic species (NAS) are aquatic species that degrade aquatic ecosystem function and benefits, in some cases completely altering aquatic systems by displacing native species, degrading water quality, altering trophic dynamics, and restricting beneficial uses (Hanson and Sytsma 2001). Within the Coos Bay estuary, 15 NAS have been identified according to the USGS NAS database for this region (USGS 2019). Many of the invertebrate NAS in the Coos Bay estuary have been introduced by ship fouling or discharge from ballast water of ocean-going vessels.

Pacific Connector identified two NAS that may occur in the Coos Bay estuary: New Zealand mud snails (*Potamopyrgus antipodarum)* and brackish water snail *(Assiminea parasitologica)*. Pacific

[140] See Appendix G.2 of Resource Report 2, in Pacific Connector's September 2017 application to the FERC.

Connector would filter hydrostatic test water and discharge to upland areas through straw to reduce chance of transporting organisms between waterbodies and Pacific Connector proposes to use a treatment of 2 parts per million (ppm) or 2 mg/l of free chlorine residual with a detention time of 30 minutes to treat all non-municipal surface waters that would be used as a water source for hydrostatic testing purposes, and follow ODEQ criteria for this action.

Construction Across Stream Habitats

Construction of the pipeline across all land ownerships would affect 68 perennial stream sites, 257 intermittent stream sites, 8 ponds, and 4 estuary channels by right-of-way clearing or direct pipeline crossings (table 4.5.2.3-1; including Coos Bay crossings discussed above). A total of 279 locations would be direct channel crossings, while 58 would be locations where the waterbody is in the right-of-way clearing area. Direct effects on four perennial streams (and Coos River estuarine channel) would be avoided by placing the pipeline beneath them by HDD, DP, or conventional boring. Another 27 intermittent streams would be bored or employ DP technology under the channel. In all, about 72 of the waterbodies that would be crossed by, or are adjacent to (within the right-of-way clearing), the pipeline are known or assumed to have fish.

One crossing of the South Umpqua River, Pacific Connector would use a diverted open cut. All other waterbody crossings that have flow at the time of construction would be crossed using dry open cut, which is designed to minimize activities directly in flowing water. Of streams that would be directly crossed by the pipeline using the dry open-cut method, 58 would have fish present. About 39 are known or assumed to support anadromous salmon and/or steelhead and 6 of these only containing anadromous fish. Fifty-eight streams directly crossed by the pipeline are known to support coldwater resident fish or important endemic species in the Klamath River Basin, with 19 of these containing only resident fish. Pipeline construction, including direct right-of-way clearing areas, could adversely affect EFH species in up to 55 waterbodies, as well as streams with numerous special status fish species crossings (see section 4.6 for ESA listed species). Our EFH assessment and BA describe effects on those species occupying inland streams, and measures Pacific Connector would implement to avoid, minimize, or mitigate the effects.

In-stream construction could interfere with essential life processes of aquatic species. Most of the waterbodies identified as known, presumed, or classified as being fish bearing would be crossed using isolated or "dry" crossing construction techniques including the flume or dam-and-pump method if water is flowing in the waterbody at the time of construction. At one site on South Umpqua, the diverted open cut method used would require diversion of the flow to one side of the channel at a time. Potential effects of trapping fish from these methods are discussed under the Fish Passage subsection below.

TABLE 4.5.2.3-1

Number of Waterbodies Crossed or Adjacent to the Pacific Connector Pipeline, by Fish Status Category and Fifth-Field Watershed

Fifth-Field Watershed (Fifth-Field HUC)	Estuarine	Ponds a/	Perennial Streams	Intermittent Streams	Fish-bearing Streams/channel with: Anadromous Species (assumed) b/	Fish-bearing Streams/channel with: Resident Species (assumed) b/, c/	EFH Species and Habitat Present (assumed) b/	ESA Species or Habitat Present (assumed) b/
Coos County								
Coos Bay Frontal (1710030403)	4	0	5	10	13	4(10)	12(1)	12(1)
North Fork Coquille River (1710030504)	0	0	4	4	3	1(4)	3	3
East Fork Coquille River (1710030503)	0	0	9	5	2(6)	4(3)	2(6)	2(6)
Middle Fork Coquille River (1710030501)	0	0	3	6	1	0(2)	0(1)	0(1)
Douglas County								
Middle Fork Coquille River (1710030501)	0	0	4	6	0	3	0	0
Olalla Creek-Lookingglass Cr (1710030212)	0	0	4	15	2(3)	2(2)	2(3)	2(3)
Myrtle Creek (1710030210)	0	0	7	6	3(2)	2(1)	3(2)	3(2)
Clark Branch-South Umpqua River (1710030211)	0	0	7	15	4	4	4	4
Days Cr. South Umpqua River (1710030205)	0	3	6	9	4	6	4	4
Upper Cow Creek (1710030206)	0	0	3	6	0	0	0	0
Jackson County								
Upper Cow Creek (1710030206	0	0	0	1	0	0	0	0
Trail Creek (1710030706)	0	1	2	5	3	2	3	3
Rogue River-Shady Cove (1710030707)	0	0	4	14	1(1)	2	1(1)	1(1)
Big Butte Creek (1710030704)	0	0	3	7	2	2	2	2
Little Butte Creek (1710030708)	0	1	5	49	3(1)	4	2(2)	2(2)
Klamath County								
Spencer Creek (1801020601)	0	0	0	7	0	2	0	0
Klamath R-John C Boyle (1801020602)	0	0	0	3	0	0	0	0
Lake Ewauna-Upper Klamath (1801020412)	0	0	1	28	1	1	0	1
Mills Creek-Lost River (1801020409)	0	3	1	62	0	1	0	1
TOTAL	4	**8**	**68**	**257**	**42(13)**	**40(22)**	**38(16)**	**40(16)**

a/ None directly crossed but in ROW adjacent to direct pipeline locations.
b/ Known and assumed, possible or likely (value in parentheses) crossings or pipeline proximity with indicated fish category designation.
c/ Includes primarily coldwater trout possibly resident lamprey, but also estuarine species in Coos Bay and lower Coos system, and endemic species in the Klamath Basin.

Timing of Construction

The degree of effects on aquatic resources associated with construction activities would depend on the timing of in-water construction. Construction during periods of sensitive fish activity (i.e., spawning, juvenile and adult rearing, and migration) can have a greater effect on fish than construction during other periods. Pacific Connector would cross fish-bearing waterways during the in-water work windows specified by the ODFW in consultation with the NMFS within the range of anadromous fish, and with the FWS as appropriate.

The timing restrictions would prevent construction during periods of sensitive fish use and would typically allow construction only in periods of lower flow rates in streams. In general, construction of the pipeline would be timed to miss periods of major juvenile or adult anadromous salmonid migrations in freshwater based on allowed fishery construction windows, typically July 1 to mid-September for most streams, and some other dates for specific waterbodies. These are the current dates and timing restrictions would be subject to change by the ODFW. The Coos River, however, would be crossed by HDD between August 1 and September 30, which is outside of the ODFW designated work window (October 1 to February 15), which may slightly increase risks to fish resources should a frac-out occur, although migrating salmon could be present during both periods. Any modifications to the allowable construction windows would be dictated by stream and fish migration conditions in the year of construction, and would be stated as conditions of state water crossing permits.

Sedimentation and Turbidity Resulting from Pipeline Installation Across Freshwater Streams and Effects on Aquatic Resources

Pipeline crossings of surface waterbodies would cause some downstream turbidity and sedimentation. The type of crossing and stream sediment characteristics can affect turbidity and suspended sediment in streams. Nearly all streams (88 percent) would be crossed using the dry open-cut method (flume and dam-and-pump) (table 4.5.2.3-2). Both “dry” techniques produce much less sediment in the water than alternative “wet” open cut methods (Reid and Anderson 1999; Reid et al. 2002; Reid et al. 2004). While several factors affect the effectiveness of dry construction methods, dry open-cut construction across waterbodies, if properly installed and maintained during construction and restoration, would produce minor levels of sediment and turbidity. Pacific Connector would minimize effects on surface waters and aquatic resources by implementing the waterbody crossing and erosion and sediment control measures as described in its project-specific ECRP, which would reduce the risk of sediment releases during construction.

TABLE 4.5.2.3-2

Proposed Waterbody Crossing Methods for All Waterbody Crossings, by Subbasins and Fifth-Field Watersheds

Subbasins and Fifth-Field Watersheds	Number of Waterbodies Crossed, by Construction Method						
	HDD or Direct Pipe	Bore	Diverted Open-Cut	Dry Open-Cut	Dry Open Cut (Bedrock) b/	Total Crossed	Adjacent Not Crossed a/
Coos Subbasin							
Coos Bay-Frontal Pacific Ocean	3			10		13	6
Coquille Subbasin							
North Fork Coquille River				7		7	1
East Fork Coquille River				9	4	13	1
Middle Fork Coquille River				15	1	16	3
South Umpqua Subbasin							
Olalla Creek-Lookingglass Creek				13	5	18	1
Clark Branch-South Umpqua River	2			8	3	13	8
Myrtle Creek				10	3	13	
Days Creek-South Umpqua River			1	8	5	14	4
Upper Cow Creek				7	1	8	2
Upper Rogue Subbasin							
Trail Creek				4	2	6	2
Shady Cove-Rogue River	1			8	2	11	7
Big Butte Creek		1		2	5	8	2
Little Butte Creek				45	5	50	5
Upper Klamath Subbasin							
Spencer Creek				6		6	1
J.C. Boyle Reservoir-Klamath River				3		3	
Lost Subbasin							
Lake Ewauna-Klamath River	1	6		13		29	9
Mills Creek-Lost River		20		39	1	60	6
TOTAL	**7**	**27**	**1**	**207**	**37**	**279**	**58**

a/ Waterbodies within the construction right-of-way that would not be crossed.
b/ Dry open-cut streams with bedrock streambeds which may require special construction techniques to ensure pipeline design depth including rock hammering, drilling and hammering, or blasting. The need for blasting would be determined by the contractor and would only be initiated after ODFW blasting permits are obtained. These streams are in addition to regular dry open-cut streams.

Duration of crossing can ultimately influence periods of downstream turbidity and suspended sediment elevation to aquatic resources. If channels are dry during construction, small streams (channel width less than 10 feet) are projected to be crossed in less than 24 hours, and intermediate streams (channel width 10 to 100 feet) usually in less than 48 hours. Reid et al. (2004) examined stream crossing data from 46 crossings (23 dam and pump, 12 flumed, and 11 open cut) over a range of stream types across Canada and the U.S. from streams that were mostly less than 10 meters wide. Reid et al. (2004) noted that, in flowing streams they monitored, instream work averaged 38 and 64 hours for dam-and-pump and flumed crossings, respectively. However, the times noted for crossings include all activities that occur, which influence when active suspended sediment may occur, but do not indicate the actual periods when increased suspended sediment development would occur, which is mostly influenced by periods of active instream installation or removal of flow diversions for dry open-cut methods. Additionally, failure of flow sealing and other instream structures at upstream diversions structures can occur from a variety of malfunctions such as pump failure, dam and flume failure, poor dam seal and others. Reid et al. (2004) noted seal failures of monitored diverted open cut crossing in 1 of 23 dam-and-pump projects and 5 of 12 flumed projects. Should these occur, suspended sediment would be relatively elevated over those without failure, but immediate repair work could reduce magnitude and duration of elevated suspended sediment.

Increased sediment loads associated with high turbidity can have effects on fish behavior and physiological processes (e.g., blood chemistry, gill trauma, immune system resistance), and can result in mortality. Salmonids (e.g., trout and salmon) are the most common, abundant, and important species in Project streams and often the most sensitive of common freshwater fish species to elevated suspended sediment. Approximately 27 percent all streams crossed contain salmonids that could be affected if TSS levels are elevated. Salmonids exposed to moderate to high levels of suspended sediment for extended periods could be adversely affected. At high levels, turbidity and suspended sediment directly affects survival and growth of salmonids and other species and interferes with gill function (reviewed and compiled by Bash et al. 2001). Turbidity can also reduce aquatic plant cover (over the long term) by limiting photosynthesis (Goldsborough and Kemp 1988), as well as adversely affecting fish vision, which is a requisite for social interactions (Berg and Northcote 1985), feeding (Vogel and Beauchamp 1999; Gregory and Northcote 1993), and predator avoidance (Meager et al. 2006; Miner and Stein 1996).

Sediment stirred into the water column can be redeposited on downstream substrates, which could bury aquatic macroinvertebrates (an important food source for salmonids, and other fish in estuarine areas). Additionally, downstream fine particle sedimentation could affect spawning substrate habitat, spawning activities, eggs, larvae, and juvenile fish survival, as well as benthic community diversity and health (reviewed and compiled by Bash et al. 2001).

Some studies related specifically to pipeline stream crossing have found varied effects from sediment. For example, rapid recolonization of benthic organisms has been documented on 30 pipeline projects post-construction (Gartman 1984). One long-term study (construction through three years post-construction) of multiple pipeline crossings of a coldwater streams found no measurable effect on fish or benthic resources or their habitat within two months to three years after construction (Blais and Simpson 1997). Reid et al. (2008) found similar conditions for benthic resources ranging from no effect on reductions in abundance or diversity for periods of less than a year, all for wet open-cut crossings, which is not likely representative of most dry crossings.

Dry open-cut construction methods may have the potential to alter fish abundance over the short term. Reid et al. (2002) found that fish abundance downstream of dam-and-pump or flumed crossings reduced immediately after construction in two of four sampled sites, but concluded these reductions were likely not the result of sediment. Additionally, one year after construction, Reid et al. (2002) found no difference in fish abundance below these two sites from preconstruction levels.

Newcombe and Jensen (1996) compiled research from many sources that demonstrates effects on anadromous and resident salmonids by various levels of suspended sediment concentration and exposure duration. They used this information to develop models that estimated the severity of these effects based on sediment concentration and exposure duration.

Output from the model provides severity-of-ill-effects (SEV) scores that are summarized below. Values range from 0 to 14, where an SEV of 0 indicates no effects, an SEV between 1 and 3 indicates behavioral effects, an SEV from 4 to 8 indicates sublethal effects, and an SEV from 9 through 14 indicates lethal and paralethal effects (see Table 1 in Newcombe and Jensen 1996).

1) Behavioral Effects SEV scores
   - 1 = Alarm reaction
   - 2 = Abandonment of cover
   - 3 = Avoidance response

2) Sublethal Effects SEV scores
   - 4 = Short-term reduction in feeding rates and/or feeding success
   - 5 = Minor physiological stress (increase coughing rate and/or increased respiration rate)
   - 6 = Moderate physiological stress
   - 7 = Moderate habitat degradation; impaired homing
   - 8 = Major physiological stress; long term reduction in feeding rate- feeding success; poor condition

3) Lethal and Paralethal Effects SEV scores
   - 9 = Reduced growth rate and/or delayed hatching and/or reduced fish density
   - 10 = 0 to 20 percent mortality and/or increased predation and/or moderate to severe habitat degradation
   - 11= >20 to 40 percent mortality (SEV scores exceeding 11 predict increased mortality rates)

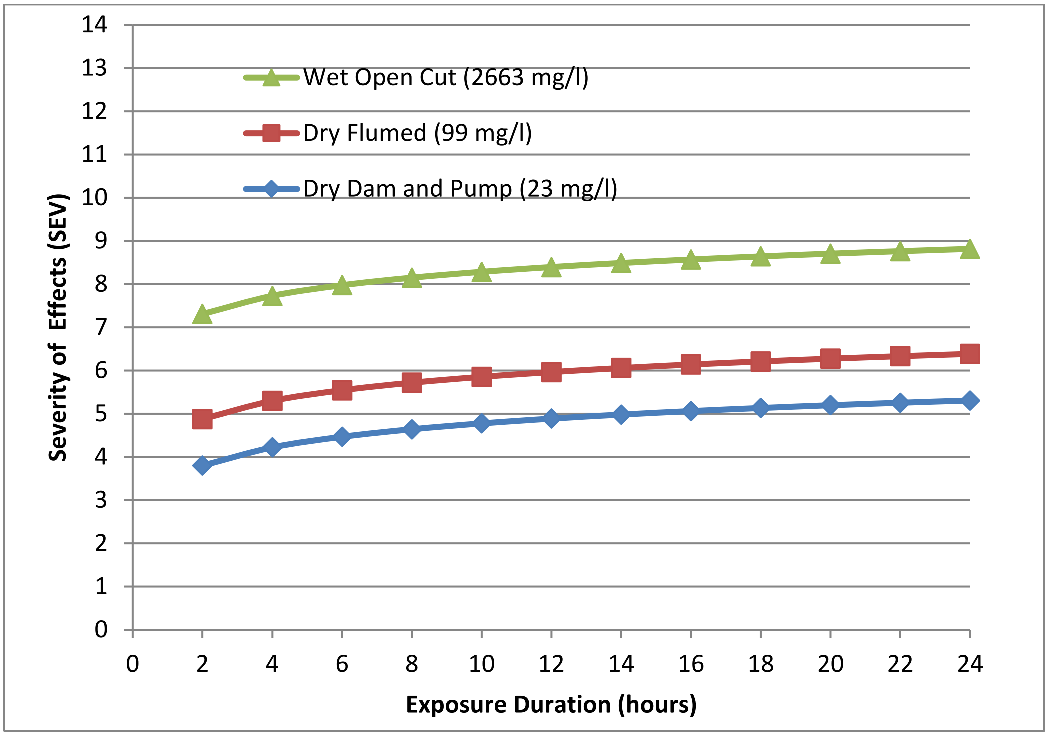
Newcombe and Jensen (1996) developed varied models for this assessment method. The one most relevant for this study is Model 1, which is used to estimate effects on both juvenile and adult salmonids and is based on 171 different study results.

Because of the uncertainty of both available site-specific information and the accuracy of models when applied to varied locations, two approaches were taken to estimate the concentration of suspended sediment and its effect on aquatic resources. One method used literature values from other stream pipeline studies concerning concentrations and durations of the activity to estimate reasonable approximations of likely sediment concentrations and effects on fish. The other was a detailed approach using models to predict sediment concentrations at Project stream pipeline-crossing sites based on known and assumed values, as presented in Pacific Connector's Resource Report 3.

Literature-Based Assessment of Sediment Effects

Application of the Newcombe and Jensen (1996) model to a collection of stream pipeline crossing locations supplies an approximation of what the likely range of effects may be to fish resources (primarily salmonid). The Reid et al. (2004) data are the most complete set of literature information available on likely ranges of suspended sediment that may occur from various crossing methods and likely in-stream construction duration. Reid et al. (2004) measured suspended sediment downstream from 12 flumed pipeline crossings and 23 dam-and-pump crossings (dry open-cut or isolated pipeline construction crossings) and 11 wet open-cut construction crossings. He noted that average suspended sediment concentrations near these 11 "wet cut" crossing sites were 2,663 mg/l, whereas values were much lower at "dry crossing" sites, which averaged 99 mg/l

(12 sites) and 23 mg/l (23 sites) for flumed and dam-and-pump sites, respectively. Using the mean sediment concentration values from Reid et al. (2004) and the Newcombe and Jensen (1996) sensitivity Model 1, the effects on salmonid resources can be approximated (see figure 4.5-4). While crossing times for construction may be in the range of less than one day to four days for dry crossings, actual periods of elevated sediment would occur primarily during periods of installation and removal of isolation structures. Therefore, time of elevated sediment for any one crossing would only be a few hours, which is why the range of duration in the figure 4.5-4 is limited to 24 hours which would more than cover the period of likely elevated sediment resulting from crossing under normal crossing conditions.



Note: Based on the Newcombe and Jensen (1996) effects model based on typical suspended sediment concentrations levels (data from Reid et al. 2004) by crossing type.

Figure 4.5-4. Effects of Pipeline Stream Crossing Suspended Sediment Concentrations on Salmonids

Based on the estimate of likely average conditions of construction at a crossing assuming the average of the Reid et al. (2004) suspended sediment values, SEVs for dam-and-pump crossings would be most likely in the range of 4 to 5, which could include short-term reduced feeding rate or minor physiological stress. Flumed crossing sites would on average have slightly greater effects, with SEVs mostly in the range of 5 to 6, which could result in minor to moderate physiological stress. If some failure occurred in crossing methods, short-term concentrations and duration would be greater with SEV values similar to those of wet open-cuts, likely in the range of SEV 8, implying adverse factors such as long-term reduction in feeding success and major physiological stress, with wet open cut crossing time closer to 14 hours (Reid et al. 2004). All levels of effects would remain sublethal even with some short-term failure in crossing methods, based on the literature concentration and duration values.

Active monitoring of pipeline crossing construction of mostly coldwater fish streams in New Hampshire found similar SEV level results to those shown above. Trettel et al. (2002) monitored suspended sediment levels within 50 to 150 meters (160 to 500 feet) downstream of the active pipeline crossing constructions sites and used information from 75 perennial streams consisting 71 dry dam-and-pump or flumed crossings and 4 open-cut wet sites to estimate SEV levels. They found that the average SEV of the dry crossings was 6.5 with no measurable difference between types of dry crossing, while the four wet crossings averaged an SEV of 7.4. The SEV level of 6 corresponds to moderate stress while SEV 7 suggests the lowest level where some habitat effects would occur. They found that about one-third of the dry crossings equaled or exceeded this SEV level (7) of potential adverse habitat effects. Additionally, 99 percent of all crossings were less than the designated paralethal or lethal range (SEV of 9 or above). The biggest factor affecting elevated SEV levels was the portion of fines in the sediment at the crossing. These results suggest a very low probability of any direct fish mortality from construction, with local crossing area effects consisting of mostly sublethal effects (e.g., physiological stress, short-term reduction of feeding), and limited habitat degradation.

The distance downstream effects could occur is dependent on many factors (e.g., substrate composition, velocity, flow, channel width). Ritter (1984) estimated that for a minor perennial stream (likely average only half a foot deep, and less than 20 feet wide), suspended sediment concentrations may be near background levels in the range of 60 meters (200 feet) to 150 meters (500 feet) downstream during open-cut crossings. These stream sizes would be most typical of crossings along the pipeline route. Reid et al. (2002) found that below four separate dam-and-pump crossings, mean suspended sediment was less than 20 mg/l within 30 meters (100 feet) downstream. However, at another crossing where some high suspended sediment concentrations occurred from leakage, values 340 meters (1,100 feet) downstream were reduced to 20 percent of those at 45 meters (150 feet) downstream. Low concentrations during construction of crossings appear to be more common when BMPs are closely followed. For example, according to Pacific Connector, a Williams Northwest pipeline completed in Washington State had only one state turbidity standard exceeded out of 67 waterbodies crossings. Pacific Connector estimated the changes of suspended sediment concentrations based on the Ritter (1984) model downstream of 13 Project subwatersheds using estimates of substrate sediment composition and other physical conditions at the crossing sites (e.g., width, depth, and flow).

Based on the Reid et al. (2004) average values, effects on salmonids would be low, other than when sealing failure events occur at the planned dry crossings; the effects would likely range from short-term behavioral to short-term sublethal effects, likely lasting a few hours or days depending on severity. Trettel et al. (2002) monitoring suggests adverse effects may be somewhat greater but still sublethal, with occasional local habitat degradation.

Model Estimates of Effects of Suspended Sediment

Pacific Connector incorporated site data, regional data, and available literature-based models to provide an estimate of both suspended sediment level and extent of effects on aquatic resources from pipeline stream crossing construction based on their estimates of sediment concentration and exposure duration. The parameters used in this model assessment are variable and are based on a combination of data. Thus, the results may be considered an approximation, rather than the exact suspended sediment levels that would be observed.

The method for approximating the concentration of suspended sediment at the specific crossing sites and the distance downstream that various concentrations travel relies on the use of two separate models and empirical suspended sediment value comparisons from typical crossing sites for each crossing method. The first is a regression model that estimates the concentration at or near the representative installation area (Reid et al. 2004) (see above) based on selected physical stream conditions. The second model estimates the distance various concentrations of suspended sediment travel downstream (Ritter 1984) based on selected physical site data.

The Reid et al. (2004) model uses site-specific physical parameters at representative crossing to predict sediment concentrations from a wet open-cut crossing at each stream reach in each watershed crossed by the Project. The basic stream reach data were obtained from the ODFW Aquatic Inventories Project. These data were not specifically from a proposed crossing site in a watershed but were considered to be representative of physical conditions of streams crossed in each watershed. Since all crossings would be dry cut, these model estimates were adjusted downward to equal predicted dry cut crossing values based on the average relationship between wet cut and dry cut methods in the Reid et al. (2004) article. Mean suspended sediment concentrations generated during dry open-cut construction for dry fluming construction were 3.7 percent of the wet open-cut concentrations and 0.85 percent of the wet open-cut concentrations for dam-and-pump construction. Pacific Connector assumed in their model that if sealing of the site from stream flow failed during construction, the average suspended sediments levels at the crossing would be equal to wet cut crossing values.

All parameters used in this model (flow, stream width, velocity, percent silt and clay), except for median sediment size (this had a regressed value based on percent fines for each stream reach), were taken from subbasin stream measurements report in ODFW's Aquatic Inventory database from fifth-field watersheds. This information was used to estimate what sediment concentrations would be for a wet open cut at the stream specific set of data.

The model by Ritter (1984) for small stream crossings was used to predict change in concentrations downstream of crossings based on stream characteristics (e.g., flow, depth, roughness). The details of how this model operates are provided in a revision to Pacific Connector's Resource Report 3.[141]

Estimates were made for 9 to 99 stream crossings per fifth-field watershed (average 51 per fifth-field watershed) for which sufficient data were available to conduct the analysis. These crossings were representative of the Project regions and ranges of stream width/gradient that would have normal dry open-cut crossings. Streams not modeled included the Upper Klamath River (except Spence Creek) and Lost River subbasins crossings, other HDD or boring sites, and bedrock stream crossings that would have low sediment during crossings. Due to the dynamic nature of sediment movement in streams, however, some bedrock crossings may have other substrate at the time of crossing.

The resulting estimates of potential suspended sediment concentrations (without major crossing area sealing failures) indicate that suspended sediment concentrations would remain low in most project regions (table 4.5.2.3-3) (see appendix I, tables I-10, I-11, and I-12 for details by watershed). These estimates are based on the average range of suspended sediment concentrations by watershed during low flows, the period when in-stream construction would occur. Estimates of suspended sediment concentrations produced during pipeline construction under summer low-flow conditions may be highest for the waterbodies crossed in the Coos Bay-Frontal Pacific Ocean fifth-field watershed,

[141] Attachment FERC-PCGP-RR3-10 submitted to the FERC in a supplemental filing on May 24, 2018.

followed by crossings in the North Fork Coquille River and Myrtle Creek fifth-field watershed, which is the result of assumed high fines concentrations at the crossings. For flumed crossings, suspended average watershed values ranged from 27 to 153 mg/l, with values even lower for dam and pump crossings, ranging from 7 to 35 mg/l among the 14 watersheds. Exposures to suspended sediment concentrations from any crossing method would decrease to background levels from about 0.6 to 19 kilometers downstream, among the 14 watersheds (table 4.5.2.3-3).

TABLE 4.5.2.3-3

Estimates of Total Suspended Sediment Concentrations (TSS) Generated during In-stream Construction and Estimated Downstream Distance to Attenuate to Ambient TSS in Fish-bearing Watersheds that Would Be Crossed by the Pipeline

	Average Estimates for Streams Sampled in Watershed a/			
Subbasin and Fifth-Field Watersheds	**Wet Open–Cut TSS (mg/l) at 50 m**	**Fluming TSS (mg/l) at 50 m**	**Dam & Pump TSS (mg/l) at 50 m**	**Distance (m) for TSS (Clay Fraction) to Equal Ambient(TSS = 2 mg/l)**
Coos				
Coos Bay-Frontal Pacific Ocean	4,102	153	35	595
Coquille				
North Fork Coquille River	2,923	109	25	1,840
East Fork Coquille River	2,783	104	24	1,744
Middle Fork Coquille River	2,576	96	22	2,072
South Umpqua				
Olalla Creek-Lookingglass Creek	2,425	90	21	1,780
Clark Branch-South Umpqua River	1,951	73	17	2,407
Myrtle Creek	3,436	128	29	1,708
Days Creek-South Umpqua River	727	27	6	633
Upper Cow Creek	1,996	74	17	7,315
Upper Rogue Subbasin				
Trail Creek	804	30	7	18,591
Shady Cove-Rogue River	712	27	6	16,534
Big Butte Creek	1,112	41	9	10,563
Little Butte Creek	1,198	45	10	11,439
Upper Rogue Subbasin				
Spencer Creek	850	32	7	15,577

a/ Stream-specific values are provided in Appendix Y of the BA (see appendix I of this EIS). Nearly all watersheds with at least 12 streams each, usually with multiple reaches per stream.
m = meter; mg/l = milligram per liter; TSS = total suspended solids (sediment)

If there is a failure of isolation structures during either type of dry open-cut construction, it is assumed that the suspended sediment generated during the failure would be similar to suspended sediment generated during wet open-cut construction. Suspended sediment concentrations assumed to occur during failure of isolation structures could be substantial. For the watersheds with highest concentrations, waterbodies in the Coos Bay-Frontal Pacific Ocean, Myrtle Creek, and North Fork Coquille River fifth-field watersheds, modeled suspended sediment assuming average wet open-cut values might be as high as 4,102 mg/l (Coos Bay -Frontal). Other watersheds could be as low as 712 mg/l (Shady Cove-Rogue River) 50 meters (164 feet) downstream from construction (table 4.5.2.3-3). However, each of these watershed values is based on the average of single point estimates from multiple streams but without consideration of how precise the model value is or how the variability of input parameters may affect the model output.

As noted above, Newcombe and Jensen (1996) developed models that estimate severity of effects on fish (primarily salmonids) based on the suspended sediment concentration and the amount of exposure time (i.e., assumed in-water peak disturbance period length) for various fish life stages. Model 1 (effects on juvenile and adult salmonids) was used for the analysis because those are the primary life stages and species of concern that may be present at locations and time of construction. The model requires estimates of both suspended sediment and the duration that values would occur in the stream.

While the actual full process of flumed or dam and pump crossing construction may last more than a day, elevated concentrations would likely peak over a two- to six-hour period, depending on stream width and construction methods with smaller streams taking less time. The number of dry open-cut crossings by stream size category for all watersheds assessed (two Lost River subbasins watersheds not included) is shown in table 4.5.2.3-4 (the number by watershed is given in appendix I, table I-10). Most crossings were of very small (less than 10-foot-wide) streams. Duration time ranged from two hours to six hours. To assess the potential sediment effects if major problems occurred with sealing during installation, a period of six hours duration was applied to sediment concentration estimates developed for wet open-cut crossing values. These times were used to estimate the duration of elevated sediment levels and used in the Model 1 of effects discussed above.

TABLE 4.5.2.3-4

Number of Streams Within Four Width Classed that Would be Crossed by Dry-Open Cuts and Estimated Duration (a/) of In-Stream Generating Actions

	Number by Width Class and Duration b/				
Category	**≤ 10 ft 2 hours**	**>10 ft to ≤25 ft 4 hours**	**> 25 to ≤50ft 5 hours**	**> 50 ft 6 hours**	**Total**
Number	122	47	17	4	190
Percent	64%	25%	9%	2%	100%

a/ Worst-case estimate as many of the smaller streams would be dry during construction.
b/ Total Dam and Pump and Flumed crossing for all watersheds except those in the Lost River subbasin.

Where flumed crossings are used, the magnitude of maximum average watershed severity of sediment effects for juvenile and adult salmonids for most stream crossing (i.e., smallest stream, less than 10 feet wide crossed) would be at most SEV 5 (minor physiological effect) in some of the 14 watersheds. This effect level would occur within 30 meters of stream crossings in six of the watersheds and not in the others. The lowest level of sublethal effect (SEV=4) (short-term reduction of feeding success) would occur in all watersheds to a distance average of about 800 meters below crossing (see appendix I, table I-11). With the longer duration of elevated sediment, severity of effects would be slightly greater for small stream crossings (i.e., 10-25 feet wide), with SEV 5 (minor physiological stress) occurring in about half of the watersheds at an average distance of about 100 meters below the crossings, while lowest sublethal effects (SEV 4) would occur in all watersheds and extend an averaged about 1,800 meters downstream. Except for two watersheds, effect levels on larger streams would be SEV 5 or less. This level would extend on average 180 meters for streams 25 to 50 feet wide (medium), and 280 meters for greater than 50-foot-wide (large) streams. SEV 4 would extend on average about 2,120 and 2,380 meters in the watersheds for the medium and large stream crossings, respectively. While the model results suggest some potential behavioral effect (SEV 1-3) may occur farther downstream in any stream crossing, the sediment concentration that could generate these effects is near background suspended sediment levels (e.g., 2 mg/l), so these effects would be similar to existing stream conditions.

Dam and pump crossings typically have lower suspended sediment generation so almost none of the crossings on the smallest streams (a majority of streams less than 10 feet wide in table 4.5.2.3-4)[142] would have suspended sediment levels reaching any sublethal SEV levels for any watershed, and the few that do would extend less than 50 meters. For the small stream crossing (10-25 feet wide), about half (8 of 14) the watersheds would have some areas reaching the lowest sublethal level (SEV 4), with most of these having sediment effects reduced to potentially only behavioral effects in less than 100 meters from the crossing. For the limited number (up to 21 crossings) of remaining medium and large stream crossings (table 4.5.2.3-4), if dam-and-pump crossings were used, a few watersheds would have no modeled sublethal effects, while the remaining 8 watersheds and up to 13 crossing would be at the lowest sublethal level (SEV 4) (appendix I, table I-11). In these crossings, severity levels would decrease to less than sublethal levels typically in less than about 200 meters of the pipeline crossings.

If the selected dry open-cut method has a failure in sealing, the in-stream construction area sediment levels would be higher than estimated for the crossing type. As noted earlier, if that occurred, then potential wet open-cut suspended sediment concentrations would be assumed. The severity effects model estimate of this assumed elevated sediment level would occur for about six hours (see above). Based on model results, the highest sublethal model effect of SEV 8 (major physiological stress, long-term reduction in feeding rate) would occur within at most 50 meters downstream of the crossing in any watershed, with about half (8 of 14) the watersheds having lesser sublethal effects (i.e., SEV 7 or lower). For most watersheds, if this crossing type occurs, severity levels of SEV 7 (moderate habitat degradation, homing effects) would extend downstream below the crossing between 500 and 2,000 meters (average about 1,000 meters; see appendix I, table I-11). Levels of SEV 6 or less would diminish in distance downstream of these areas as sediment settles. The minimal sublethal effects SEV 4 would still occur mostly from about 5 to 9 kilometers (average about 6.5 kilometers) downstream among the watersheds, over a 6-hour period. No watershed is modeled to have levels reaching the lethal or paralethal range (SEV >9) at any distance below crossings. In the unlikely event that dry crossing methods fail completely and wet open-cut methods must be implemented to complete the crossing, if suspended sediment conditions are high, the longer duration of elevated levels could result in the potential for severity levels to be higher (e.g., SEV 9, reduced fish density) over a limited stream area.

Overall, these effects would be short term, all less than a day as modeled. Some lower levels of effect would occur due to lower suspended sediment concentrations sporadically occurring during the actual crossing activity, and some resuspension of settled sediment with most lasting less than two or three days (Reid et al. 2004). As noted above for value estimates of suspended sediment, the SEV estimates should be considered approximate because the range of accuracy and variability of the input parameters is not directly included in the model estimates. However, the results are reasonable considering that typical dry crossing methods have relatively low concentrations of suspended sediment (Reid et al. 2004) of short duration, likely less than 24 hours (Harper and Trettel 2002).

Sediment may also be contributed to fish streams from pipeline crossings of upstream feeder tributary streams. There were some 22 stream crossings of intermittent stream channels that could result in unlikely (due to lack of flow during crossing) sublethal effects (all SEV 4) to the downstream fish stream, and another seven tributary crossing of perennial streams that could result

[142] Number of streams that would definitely be crossed by dam-and-pump or flumed crossings will be determined during construction, but dam and pump is more often used on smaller streams.

in sublethal effects (SEV 4 or 5) extending into downstream fish streams from these crossings (appendix I, table I-12).

The South Umpqua River diverted open-cut crossing would also result in some increase in suspended sediment. While not directly modeled, the coarse sediment at this crossing area would limit fine sediment distribution downstream of this crossing, likely less than 150 feet, based on model estimates of sediment transport distance, and would likely be less than levels that cause minor physiological stress (SEV 5). Elevated sediment and effects would be mostly reduced within a day of crossing activity termination.

No open-cut or dry-cut crossings would occur when any known adult salmonid resource, including spring Chinook salmon, would be spawning near a crossing during the designated approved construction window. Therefore, direct effects on spawning would be unlikely. Overall, the potential effect of suspended sediment on spawning activities of spring Chinook salmon would be restricted to the South Umpqua River diverted open-cut crossing, which would be limited in its downstream distribution as noted above.

Summary of Suspended Sediment Effects

While the modeled results supply a reasonable estimate of likely level of effects on primarily salmonid fish resources, the models rely on multiple input parameters (e.g., substrate composition and size distribution of fines, median substrate size (d_{50}), and water velocity at each stream) that are specific to fish streams in the watershed but not to specific crossing locations. Therefore, overall summary assessment of effects considered both literature results from other pipeline crossings and the modeled results of Project streams. For both modeled and literature-based assessments, effects would be mostly short term (less than 1 to 4 days) and remain at a near to moderate distance from the crossing location (downstream distance a few hundred feet based on literature, and a few hundred to a few thousand feet based on models). The model results and literature evaluation are most representative of salmonids. While salmonids are species sensitive to elevated turbidity and modeled results presented should be conservative to fish in general, some may have varied responses. Pacific lamprey adults, for example, may be in larger anadromous streams during the in-water work window. While some effects could occur to this species, they are likely to be short term and not lethal because elevated sediment levels would be short term.

Overall model results are based on regional watershed averages, but site-specific conditions may vary from these averages. However, the literature-based values of typical project-wide effects provide comparable results, suggesting more specific model estimated effects are reasonable. The results for either method is that crossings would cause at least some short-term adverse effects, primarily avoidance, short-term feeding reduction, and likely minor to moderate stress, but unlikely any direct effects on growth, fish density, or survival. No long-term adverse effects are expected unless some major failure occurred during construction. However, if failure occurred under certain conditions, some marked effects could be expected such as reduced fish density of salmonids in a limited stream area.

Sediment releases would affect primarily short-term stream habitat conditions. Sediment from stream crossings could affect spawning habitat below crossings as Project-generated sediment could increase gravel embeddedness downstream, although elevated fall and winter flows following crossing would likely flush fines from any local spawning sites. Habitat quality, including fish food sources, would be temporarily decreased downstream (e.g., visibility, flushed and covered benthic organisms, reduced fish movement) with overall habitat suitability (Anderson et al. 1996) temporarily decreasing, though not necessarily to levels that would cause moderate habitat degradation (SEV 7).

The Project could result in short-term adverse effects on estuarine and freshwater critical habitat for the Oregon Coast ESU of coho salmon. Short-term effects on critical habitat within the estuarine analysis area would include effects on food and rearing habitat as a result of dredging the access channel, marine waterway modifications, and the slip. Dredging in proximity to the Coos Bay shipping channel would decrease water quality and affect cover (e.g., aquatic vegetation and eelgrass).

Because of the linear nature of the Pacific Connector Project, the number of stream crossings and ultimately total area of stream habitat and individual streams that would be affected in any watershed would be extremely small. There would be 250 actual dry open cut stream channel crossings (table 4.5.2.3-2) in 231 miles of pipeline route over 17 fifth-field watersheds (watersheds with no crossing not included). Since almost no individual stream would have more than one crossing, effects on each stream would be limited to the crossing location. As an example of the relative portion of streams that may be affected in the short term by stream crossings, we examined the potential stream area affected in the four fifth-field watersheds of the Coquille subbasin, a route area with a high number of stream crossings. Those four watersheds have 3,093 miles of stream (Ecotrust 2015). The Project would cross 37 stream channels by dry open cut crossings in that length. Assuming the area affected from sediment to be 1,000 feet per stream crossing, about 0.2 percent of all stream length in this subbasin would have some short-term effect from sediment during construction. Overall cumulative effects would be unsubstantial based on the dispersed distribution of crossings and magnitude of effects at each and lengths of stream channel potentially affected.

Inadvertent Release of Drilling Mud from HDDs and DPs

Pacific Connector proposes to use the HDD method to cross under the Coos, Rogue, and Klamath Rivers. Generally, an HDD would avoid direct effects on a river and its associated aquatic resources. However, as discussed above for the Coos Bay crossing, an HDD requires the use of drilling mud (bentonite) as a lubricant which may leak (also referred to as a frac-out). This fluid is under pressure and there is a possibility of an inadvertent release of drilling mud through a substrata fracture, allowing it to rise to the surface.

As noted above, this release of drilling muds could interfere with various life activities for fish and benthic organisms. Drilling mud that accumulates on the stream bottom could cover over food sources and fish eggs. The majority of highly mobile aquatic organisms, such as fish, would be able to avoid or move away from the affected area while less mobile organisms, like juvenile ammocete lamprey, could incur direct mortality if smothered by the drilling mud. These effects would be localized and short term, limited to species in the immediate vicinity of the frac-out, and ameliorated by river volume.

The effects of an in-stream frac-out on spawning habitat, eggs, and juvenile survival depend on the timing of the release. If spawning habitat is nearby, redds could be affected near a frac-out (Reid and Anderson 1999). During establishment of the spawning bed, the female as part of the normal preparation behavior would likely clean out a minor addition of sediment. However, a heavy sediment load dispersing downstream could settle into spawning beds and clog interstitial spaces, reducing the amount of available spawning habitat, which could be a limiting factor in areas of already reduced habitat. When redds are active, eggs could be buried, disrupting the normal exchange of gases and metabolic wastes between the egg and water (Anderson 1996). The effects of sediment intrusion into the redd on larval survival are more severe during the earlier embryonic stages than following development of the circulatory system of larvae, possible because of a higher efficiency in oxygen uptake by the older fish (Shaw and Maga 1943; Wicket 1954). Clogging of interstitial spaces also reduces cover and food availability for juvenile salmonids (Cordone and Kelley 1961). Benthic organisms could also be affected by burial. However, bentonite is more likely to stay in suspension and less likely to immediately settle than common bottom sediment so, in flowing water effects on benthic organisms from burial under a release of drilling mud are likely to be low and unsubstantial. As discussed earlier, under Construction in Estuarine Habitat, Pacific Connector developed a Contingency Plan that includes measures to reduce effects should frac-outs occur.

DP technology would be used to cross the South Umpqua River at MP 71.3. Like HDD, DP crossings use a bentonite lubricant that theoretically could have an inadvertent return to the surface where it could enter the water contributing to suspended sediment levels. Because the excavated hole is continuously supported and the risk of hydraulic fracture is low, the DP alignment can be designed much shallower than is typical for HDD. Because of the limited amount of lubricant used and relatively low pressure of this construction, the chance of any inadvertent return occurring is remote. Therefore, the chance of accidental contribution of increased suspended sediment to this crossing is unlikely and adverse effects on fish and aquatic organisms at this crossing are likely to be unsubstantial.

Overall drilling mud releases to any waterbody would be short term and diluted from large river water volumes and swift flows. Additionally, frac-out most often occurs near entry and exit points, which may be out of the stream channel. Also, as noted for the HDD crossing in Coos Bay, Pacific Connector has conducted detailed crossing plans for each site and has contingency plans in place should it occur.

Streambank Erosion and Stream Bed Stability

The clearing and grading of vegetation during construction could increase erosion along streambanks, resulting in sedimentation and higher turbidity levels in the waterbodies crossed. Alteration of the natural drainage ways or compaction of soils by heavy equipment near streambanks during construction may accelerate erosion of the banks, runoff, and the transportation of sediments into waterbodies. Erosion, sedimentation, and higher turbidity levels related to the Project could affect aquatic resources, as discussed above. Effects on aquatic organisms due to erosion would depend on sediment loads, stream velocity, turbulence, streambank composition, and sediment particle size.

The rootwad network of trees adjacent to stream supplies bank stability. Those within 25 feet of the stream are considered most important at providing the root source aiding in bank stability (WDNR 1997). To aid in maintaining this bank stability, Pacific Connector would cut most trees near the bank (right-of-way width of 75 to 95 feet at the crossing), except those in the trench line, at ground level leaving the root systems in place helping to maintain short-term bank stability. Roots would be removed over the trench line or from any steam banks that would need to be cut down or graded to accomplish the pipeline crossing. To minimize these effects, Pacific Connector would use temporary equipment bridges, mats, and pads to support equipment that must cross the waterbody (perennial, intermittent, and ephemeral if water is present) or work in saturated soils adjacent to the waterbody. Pacific Connector would also install sediment barriers, such as silt fence and straw/hay bales, across the right-of-way at the edge of waterbodies throughout construction except for short periods when the removal of these sediment barriers is necessary to dig the trench, install the pipe, and restore the right-of way.

Pacific Connector proposes several measures to reduce the risk of erosion, bank failure, bed scour, and channel migration both from initial field evaluations and planned future actions. These are discussed in detail in section 4.3. The ECRP would be followed to help mitigate potential for bank and bed erosion, which would include not using riprap as a planned method to stabilize streambanks, but riprap may be used on site-specific conditions. Immediately after installation of a waterbody crossing, the contours of the streambed, shoreline, and streambanks would be restored to preconstruction configurations (i.e., contour/elevations) to restore the physical integrity/condition of these features and to minimize the loss of stream complexity. Additional erosion control measures would include the installation of erosion control fabric (such as jute or excelsior) on streambanks at the time of recontouring. Stream banks would be restored to original contours, and selected site-appropriate riparian vegetation plantings would occur.

Pacific Connector has conducted a scour and channel migration analysis that identified channels with high risk of potential scour or migration, and pipe exposure. The channel migration and scour analysis rated crossings as to their risk of pipe exposure. Based on this analysis, Pacific Connector proposes to implement site-specific crossing methods at 11 waterbody crossings to reduce the risk of pipe exposure and reduce changes in stream channel habitat at potential areas of risk. Additionally, Pacific Connector has conducted an initial assessment of crossing conditions of all streams suitable for analysis based on the FWS risk matrix (GeoEngineers 2017d, 2018a, and 2018b). This assessment was intended to determine where stream crossings may pose an elevated risk to increase streambank erosion and streambed instability. GeoEngineers, using a combination of field and GIS data, rated the 173 pipeline stream crossings based on the matrix. Streams were lumped into categories based on their relative risk of project actions at that site affecting the stream and the sensitivity of the stream crossing to be affected crossing actions. The ratings help determine what kinds of BMPs would be most appropriate for each stream category depending on how the stream crossing were ultimately rated for project actions and stream conditions at that site based on the risk category the crossing fell into. Stream crossings that are unstable can ultimately adversely affect aquatic resources from such factors as loss of local habitat and addition of sediment to downstream habitat; these effects would last as long as it takes the crossings to stabilize.

Relatively few of the streams were considered to have marked potential for bank instability. Most streams were determined to be adequately protected with standard BMPs. Some streams would require additional specific BMPs to protect the stream channel and bank conditions (GeoEngineers 2017d, 2018b, and 2018c). Seven stream crossings were considered to need site-specific crossing measures to reduce the risk. Additionally, the BLM and Forest Service made recommendations for crossing designs on eight perennial stream crossing on their lands (see section 4.3). Most of these were the same crossing that Pacific Connector had concluded needed site-specific crossing BMPs. These recommended crossing plans were adopted by Pacific Connector for these crossings.

Proper substrate restoration would also be used maintain stream geomorphic and habitat conditions. Substrate characteristics and physical habitat features would be determined through pre-construction surveys, and the upper 1 foot of existing substrate would be replaced with clean cobble or gravel (not derived from crushed gravel), or a combination of both, or in some cases matching existing substrate during reconstruction after pipe installation. Many of these actions would be determined prior to construction based on results of the pre-construction survey (see below) and determined by a qualified EI specifically trained to determine proper restoration actions to implement based on river channel processes or a suitably trained professional. On non-federal lands, this person would have the authority to select appropriate additional BMP construction methods, bank stability actions, and revegetation types and methods to help reduce the risk of instability of the crossing and potential for future erosion (GeoEngineers 2017d and 2018a). Additional oversight such as site-specific stream crossing erosion control, vegetation planting, and suitable seed mixture would occur on federal land.

A pre-construction survey would be conducted by a technically qualified team of Pacific Connector on all stream crossings to confirm and clarify conditions developed in the aforementioned matrix analysis. This would include surveys of sites currently not accessible due to property ownership issues. Following these surveys, if substantial changes were to occur to parameters of the risk matrix for a crossing, changes would be made to risk level and appropriate final methods of crossing and BMPs made at each stream crossing. Following the final surveys, special additional BMPs, as described in GeoEngineers (2017d and 2018a), would be implemented depending on individual site conditions and may include such actions as changes in bank material and bank angle modifications, specific substrate composition used, plants used on the bank, artificial stabilizing bank material, rootwad enhancement, type of bed and bank restoration structure and various other actions. As described in section 4.3, additional specific post-construction monitoring at various intervals over a 10-year period would occur and corrective actions taken if bank or bed issues are encountered. Additionally, as discussed below, Pacific Connector would supplement lost existing LWD and sources of local LWD in nearly all streams to various degrees, which should help stabilize bed, bank and habitat conditions. These actions are expected to reduce the chance of modification of stream habitat from erosion to occur from the result of the crossing actions to be unsubstantial in most areas.

Construction of New TARs, New PARs, EARs, and TEWAs

Construction of all of these facilities has the potential to contribute sediment to streams occupied by fish and influence benthic food organisms as discussed above concerning the effect of added sediment to streams. Section 4.3 addresses the sediment runoff that would occur from numerous TARs, PARs, EARs, and TEWAs that would be constructed or rebuilt along the route.

Within the range of coho salmon along the route, two new road crossings (PARs), one of which is fish-bearing, would be built, and seven existing road crossing on EARs would also be improved. Additionally, three non-fish-bearing stream crossings would be constructed on PARs. Road crossings are areas of potentially the highest relative contribution of sediment to streams. An additional five new roads (PARs and TARs) have the potential to contribute sediment to streams because they are within 200 feet of streams in this area. EAR road segment of gravel and especially dirt surfaces within 200 feet of streams or where road ditches direct road flow to hillslope channels leading to streams will also possibly contribute some sediment to streams. Sediment contribution to streams is affected by many factors (cover, slope, substrate) but typically decreases exponentially in distance from the road to the stream. Most potential sediment runoff to a stream channel from roads would occur within 100 feet of a stream, but some sediment, about 10 percent, can be contributed from roads between 100 and 200 feet, with contribution beyond 200 feet considered to be non-existent (Dube et al. 2004). Most road segments outside of this distance would have minimal potential for sediment delivery to streams. TEWAs near streams (within 100 feet) are common (>100) along the route, adjacent to both fish-bearing and non-fish-bearing streams. While some additional roads would be built or modified in other Project areas, these areas have limited fish streams along the route, and some additional sediment from these roads would have limited potential to affect fish or their habitat.

As discussed in section 4.3, multiple actions would be implemented to reduce potential sediment quantity entering fish streams. These would include such actions as graveling new road surfaces, restoring all TARs to preconstruction conditions, following land-managing agencies' engineering design and road management standards, and installing BMPs according to the ECRP for all related construction actions, which may include silt fence/straw bales, sediment barriers, temporary slope breakers, or prefabricated construction mats to prevent rutting/compaction.

While some additional sediment to streams may occur, implementation of the TMP, ECRP, BMPs, maintenance procedures, and monitoring would minimize the amount of sediment entering streams, especially fish-bearing streams, reducing the potential for adverse effects on fish and their habitat from sediment runoff.

Crossing Unstable Slopes

Slope failure near the waterbody during pipeline operation could result in soil and sedimentation falling into the waterbody. Pacific Connector evaluated all likely unstable areas during selection of the proposed pipeline route and rated these areas as low, moderate or high risk. After field reconnaissance of the moderate and high risk sites, the route was moved away from those sites remaining at risk as necessary to areas considered to have low risk. Five unstable slope areas, initially considered to have moderate to high risk, were not accessible (see section 4.1.2 for details of landslide potential). One of these sites crosses slopes (MP 65.25 to MP 65.50) near Rice Creek, a fish-bearing stream. The risks to the pipeline at these sites were not considered hazardous enough to require additional rerouting or mitigation at this time. A final determination cannot be made until access is allowed at these sites. Once these are assessed, if risk remains unacceptable, rerouting would be preferred but stabilization would also be considered. The final assessment considered protective measures that would be adequate to reduce this risk at all accessible sites. The known landslide risk areas have thus been mostly avoided along the route (see section 4.1).

Resuspension of Potentially Contaminated Sediments

The Rogue River is considered to have excessive mercury levels based on elevated levels found in fish tissue and is therefore a human health concern (ODEQ 2012e). There are multiple mine sites in the basin, some of which are mercury mines. Mercury, in very low concentration, was found at seven mines within 500 feet of the right-of-way route. Only the values near East Fork Cow Creek were of potential concern. The State has expressed concern for soil disturbance from Project activities along the route in this Rogue River basin due to potential mercury levels there. However, given the lack of specific information about excessive mercury levels along the route and with adequate BMPs in place to prevent excessive soil entry to streams, only East Fork Cow Creek would have special actions taken, as indicated below.

Elevated heavy metals in water and sediment can have adverse effects on aquatic organisms. Fish and other aquatic organisms are sensitive to mercury levels even at very low concentrations. Because of concerns about hazardous waste from historic mining activities near the crossing of the East Fork

Cow Creek (approximately MPs 109 to 110), Pacific Connector evaluated the currently proposed route in the area for mercury-contaminated soils and stream sediment. Examination of the underlying rock type (volcanic) of the proposed route indicates it is unlikely to contain elevated mercury in the bedrock (GeoEngineers 2009a). Broeker (2010) examined this route and sampled soil and stream samples near the proposed stream crossings. Of the three crossing measurements, one value (0.29 milligram per kilogram [mg/kg]) exceeded the ODEQ Level II screening value for freshwater (0.2 mg/kg). The other two were less than the freshwater value but two of the three were equal to or exceeded the bioaccumulation value of 0.07 mg/kg. The six soils samples were considered low in mercury, although they were slightly higher than the ambient background levels. Two intermittent stream channels occur up slope in this region that theoretically could carry sediment and related mercury downslope. However, Broeker (2010) concluded that these intermittent streams would stop on upslope benches and not reach the stream. He concluded upslope delivery to streams was not likely unless erosion was not controlled. Special erosion control provisions, in addition to what usually are implemented, were agreed to by Pacific Connector for this region to reduce possibly elevated mercury levels reaching the stream (Pacific Connector 2013).

Additionally, while levels of mercury in the East Fork Cow Creek are sometimes over ODEQ Level II screening levels, little sediment would be disturbed or suspended from the crossing activity since the crossing would be done in the dry. The pipeline route had been moved about 2,500 feet to avoid areas where elevated mercury levels were measured, so soil is unlikely to have concentrations of naturally occurring mercury exceeding those measured. With adjacent upland disturbance following the standard ECRP and supplemental erosion control actions, additional site-specific ground cover actions would be taken at this crossing, and upslope potential sediment entry into the stream would be controlled and minimized. Overall, adverse effects on fish from mercury would not occur from Pacific Connector Pipeline Project actions.

Vegetation and Habitat Removal and Modification

Sections 4.4 and 4.5.1 list the acres of riparian habitat that would be directly affected by all construction-related activities. Much of this habitat is in forested areas, where stream shading and organic input are most prominent. The analyses were conducted by considering effects on riparian vegetation present within a one site-potential tree height buffer on either side of a waterbody on both federal and non-federal lands. This is the area with the greatest potential effects on streams. Federal lands have additional areas called Riparian Reserves, which are different than the riparian areas shown here. The analyses here do not consider effects on Riparian Reserves because those effects would be limited to certain federal lands; the analyses provided below consider effects on all lands, hence the analysis of effects on Riparian Zones rather than to Riparian Reserves. Table 4.5.2.3-5 lists riparian areas disturbed by construction and the 30-foot-wide maintenance corridor adjacent to perennial and intermittent waterbodies crossed by the pipeline. Tables I-8 and I-9 in appendix I list these cleared areas by watershed. Removal or alterations in other habitats (e.g., clearcut/regenerating forest, shrub and grasslands, and wetlands) would also contribute to effects on aquatic resources, but to a lesser degree because riparian influence (e.g., shade, organic input, sediment and nutrient filtration) on stream conditions would be less.

TABLE 4.5.2.3-5

Total Terrestrial Habitat (acres) Affected/Removed (a/) by Construction and within the 30-Foot-Wide Maintained Operation Corridor Riparian Zones (One Site-Potential Tree Height Wide) Adjacent to Perennial and Intermittent Waterbodies Crossed/Near the Pacific Connector Pipeline Project

	Forest Habitat b/					Other Habitat b/						
Landowner	**Late Successional Old Growth Forest**	**Mid-Seral Forest**	**Forest Regenerating**	**Clearcut, Forest**	**Forest Total**	**Forested Wetland**	**Nonforested Wetland**	**Nonforested Habitat Unaltered**	**Agriculture**	**Altered Habitat**	**Other Total**	**Total Riparian Area Affected (acres)**
Construction												
BLM-Coos Bay District	7	4	11	0	22	0	<1	0	<1	5	5	27
BLM-Roseburg District	3	2	<1	<1	5	0	<1	0	0	<1	<1	6
BLM-Medford District	12	1	<1	0	13	0	0	6	0	<1	6	19
BLM-Lakeview District	1	0	0	0	1	0	0	<1	0	0	<1	1
Forest Service-Umpqua National Forest	2	5	2	0	9	0	<1	0	0	3	3	12
Forest Service-Rogue River-Siskiyou National Forest	2	<1	1	0	3	0	0	<1	0	<1	<1	3
Forest Service-Fremont-Winema National Forest	1	<1	2	0	3	0	<1	<1	0	<1	<1	4
Federal Subtotal	**28**	**13**	**15**	**<1**	**56**	**0**	**<1**	**6**	**<1**	**8**	**15**	**71**
Non-Federal Subtotal	**13**	**58**	**36**	**7**	**114**	**<1**	**39**	**87**	**86**	**50**	**262**	**377**
Overall Total	**41**	**71**	**52**	**7**	**170**	**<1**	**39**	**94**	**86**	**58**	**277**	**448**
30-foot-wide corridor												
BLM-Coos Bay District	2	1	2	0	5	0	<1	0	<1	2	2	7
BLM-Roseburg District	1	1	<1	<1	2	0	0	0	0	<1	<1	2
BLM-Medford District	3	<1	0	0	3	0	0	2	0	<1	2	5
BLM-Lakeview District	<1	0	0	0	<1	0	0	0	0	0	0	<1
Forest Service-Umpqua National Forest	<1	1	<1	0	2	0	<1	0	0	<1	<1	2
Forest Service-Rogue River-Siskiyou National Forest	<1	0	<1	0	1	0	0	<1	0	<1	<1	1
Forest Service-Fremont-Winema National Forest	<1	<1	<1	0	1	0	<1	0	0	<1	<1	1
Federal Subtotal	**7**	**3**	**4**	**<1**	**14**	**0**	**<1**	**2**	**<1**	**2**	**4**	**17**
Non-Federal Subtotal	**3**	**4**	**9**	**1**	**28**	**<1**	**7**	**18**	**15**	**2**	**43**	**71**
Overall Total	**10**	**17**	**12**	**1**	**41**	**<1**	**7**	**20**	**15**	**4**	**47**	**88**

Note: Rows/columns may not sum correctly due to rounding.

a/ Project components considered in calculation of habitat "Removed:" Pipeline Project construction right-of-way, temporary extra work areas, aboveground facilities, and permanent and temporary access roads (PAR, TAR).

b/ Habitat Types within Riparian Zones generally categorized as: Late Successional (Mature) or Old Growth Forest (coniferous, deciduous, mixed ≥80 years old); Mid-Seral Forests (coniferous, deciduous, mixed ≥40 but ≤80 years old); Regenerating Forest (coniferous, deciduous, mixed ≥5 but ≤40 years old); Clearcut Forests; Forested and Nonforested Wetland, Unaltered Nonforested Habitat (grasslands, sagebrush, shrublands), Agriculture and Altered Habitats (urban, industrial, residential, roads, utility corridors, quarries).

Effects on waterbodies and resident and anadromous fish due to removal of riparian vegetation and maintenance within the construction and operation corridor adjacent to but not crossed by the pipeline Project would be similar to effects on riparian vegetation for streams crossed by the pipeline:

- loss of riparian vegetation along the banks, reducing shade and potentially increasing water temperatures;
- decreased LWD recruitment in streams and on adjacent uplands;
- removal of an important source of terrestrial food for aquatic organisms; and
- potentially increase in mass slope failures and/or erosion due to surface runoff adjacent to waterbodies that could increase sediment in the waterbody.

Pacific Connector would minimize effects on riparian vegetation by narrowing the width of its standard construction right-of-way at waterbody crossings, and by maintaining a setback between waterbody banks and TEWAs in forested areas. A riparian strip at least 25 feet wide on private lands, including widths ranging from 50 to 100 feet on fish-bearing streams as designated for Oregon State Riparian Management Areas, and 100 feet wide on federally managed lands, as measured from the edge of the waterbody, would be permanently revegetated. Pacific Connector would plant native tree and shrub species along all fish-bearing streams. Within a 30-foot-wide corridor centered on the pipeline, plants would be kept less than 15 feet high. Overall, about 84 acres (23 percent) of former riparian habitat cleared by pipeline construction would be maintained long term in an herbaceous state. The management of vegetation including the riparian areas is presented in detail in section 4.4. Restricting the low-growth vegetation area to a small portion of the total right-of-way clearing would allow much of the ecological function of the riparian conditions relative to fish needs (e.g., shade, future LW, and organic input) to more quickly return. This would limit the overall long-term effects of loss of riparian habitat to a small portion of each stream crossed, reducing future negative effects on fish resources. For most streams, this would limit the overall long-term impacts of loss of riparian habitat, primarily as a result of LWD reduction, to a small portion of each stream crossed, reducing future negative effects on aquatic resources. For some larger streams, loss of older trees in the originally cleared area may reduce functional future LWD input.

Water Temperature

The effects of water temperature on salmonid life stages have been extensively reviewed by McCullough (1999) and others. Maximum water temperatures ranging from 71.6 to 75.2°F (22 to 24°C) limit distribution of many salmonid species. For spring Chinook salmon, for example, the optimum temperature for growth is 60.1°F (15.6°C) and higher temperatures during summer could reduce growth and lead to increased mortality rates (McCullough 1999). Vegetative cover that provides shade, especially during summer, is one factor that regulates water temperature (WDNR 1997). If sufficient loss of shade occurs, temperatures in streams are known to increase. Increasing stream temperatures can result in reduced fish production and spawning success, and, if high enough, reduced fish survival also, especially for important northwest salmon and trout species found in many Project streams. The current Oregon state water quality temperature standards, which are addressed in section 4.3 of this EIS, include provisions to limit anthropogenic increases in stream temperature especially in salmon- and trout-bearing streams. Construction of the pipeline across waterbodies would necessitate removal of trees and riparian shrubs at the crossing locations that, if extensive enough along any single waterbody, may influence these stream temperatures. Pacific Connector has proposed to mitigate potential temperature increases on waterbodies through riparian plantings. This would include, as mitigation for loss of riparian shade vegetation, replanting the equivalent of 1:1 ratio for acres of construction or 2:1 for permanent riparian vegetation loss with the goal to restore shade along the affected or nearby stream channels in the same watershed (GeoEngineers 2017f). Plantings would incorporate recommendations by the Forest Service and BLM for their lands in Riparian Reserve areas. The lengths of planting areas on streambanks would be determined prior to construction. Plantings are preferred to be continuous and not small parcels. Final plant species and spacing would follow those in the ECRP, which includes specific recommendations by the Forest Service and BLM, unless differently recommended by the landowner.

Temperature modeling was done by the BLM and Forest Service for some of the streams that would be crossed (NSR 2015a, 2015b, 2015c). During the low-flow conditions of 2013, modeled 7-day maximum stream temperatures just below in the three East Fork Cow Creek crossings showed potential increases of 1.0°F to 5.1°F (NSR 2015b). Wetted width on these channels was less than 5 feet, with the smallest channel and lowest flow having the highest temperature increase. The model also tended to overestimate the known temperature, so the results may be elevated, and the 2015 analysis of this creek showed larger temperature increases than those reported in NSR (2009) of similar locations primarily due to much lower flows during 2013. Again, these were very small streams (0.02 to 0.12 cubic foot per second) that also had a natural downstream decrease in temperature below the modeled areas likely from natural groundwater inflow. Steinnon Creek, a small 6-foot-wide stream, was also modeled to have a 7-day maximum stream temperature increase of 0.4°F assuming right-of-way clearing results in zero percent shade, also under the low flow conditions (0.22 cubic foot per second) of summer 2015 (NSR 2015c). Two other modeled creeks (Middle Creek and Big Creek tributary) had estimated increases of 0.1 and 1.1°F in 7-day maximum stream temperature (NSR 2015b). As with other streams, size affected relative change with Middle Creek having a flow of 1.62 cubic feet per second (12 feet wide) and Big Creek tributary 0.08 cubic feet per second (5 feet wide).

The results of the stream temperature model discussed above are likely conservative estimates based on other literature studies and modeling estimates. For example, Pacific Connector modeled 15 streams along the route (GeoEngineers 2017f), where the average temperature increase was modeled at 0.03°F and the maximum increase among the streams was 0.3°F, with the highest value occurring at one of the smallest streams (table 4.3.2.2-9). Additionally, changes in temperature, especially in small streams, may recover quickly from cooler surrounding conditions downstream (e.g., streambed cooling, evaporation, hyporheic inflows, or shade). This natural cooling was observed at one of the Project streams that the Forest Service modeled (NSR 2015c).

Other studies have noted lower temperature results in similar conditions as well. Two eastern U.S. studies looking at effects of right-of-way clearing in forested areas on stream temperature found no noticeable changes (Brown et al. 2002; Blais and Simpson 1997). More locally (i.e., in the north Oregon Cascades) a study of existing transmission line clearing found no significant downstream temperature changes from the clearings (Tetra Tech 2013). Modeled worst-case temperature conditions changes for this study estimated about 1.1°F (median of about 0.4°F) in the modeled maximum and maximum daily mean temperature across the assumed future clearing of the modeled 22 streams, for an estimated 150-foot-wide clearing (Tetra Tech 2013). The right-of-way width for these studies' crossings was much larger than what is proposed for the Pacific Connector Pipeline Project (for most streams, Pacific Connector will reduce the right-of-way width to 75 feet). Based on the literature studies noted above and project-specific models, estimated stream temperature changes that would result from right-of-way clearing are expected to be minor (see sections of 4.3.2.2 and 4.3.4.2).

These results demonstrate the effects that low-flow conditions, most common in very small channels, have on changes in water temperatures; as noted by Brown and Kygier (1970), given the same solar input, stream temperature is inversely proportional to flow. Observations of these streams also suggest that LWD and low-growing willows, huckleberries, and other brush species can provide effective shade for small, narrow channels. Blann et al. (2002) noted that riparian grasses and forbs supply as much shade as wooded buffers for streams less than 8 feet (2.5 meters) wide.

Models addressing the temperature effect of adding shade from riparian revegetation plantings and other actions is that water temperature would be comparable to the existing condition and remain below ODEQ thresholds on the East Fork Cow Creek. Additionally, any temperature increases in small streams would likely be masked by the assimilative capacity of larger streams at the stream network scale (NSR 2009, 2014a) (see section 4.3.2.2). Any small increases in temperature in low-flowing streams would be substantially reduced by the existing temperature of larger, high-flow volume streams when they merge.

Over the whole pipeline project region, plantings and regrowth in riparian areas, as suggested by these modeling results, would help moderate potential temperature increases in the short term (a few years). Much of the riparian area would be allowed to regrow from plantings with herbaceous plants (only 10 feet wide would be maintained without some growth) and conifer and other trees (all but 30-foot width). On small streams and, to a lesser extent on larger streams, even 10- to 15-foot-high trees would supply substantial shade, reducing solar heating effects on streams. Additionally, many small streams have intermittent flow (about 80 percent of stream crossings are intermittent) and most would not have flow during periods of greatest temperature, with few of these having fish populations. Thus, the slight effects of solar heating from clearing would gradually be reduced or eliminated over time, based on the model, most between 5 and 10 years, with most areas of potentially higher increases absent flow or fish populations.

As discussed in section 4.3.2.2, potential cumulative watershed temperature increases from Project riparian clearing would be unlikely. GeoEngineers (2017f) provided an estimate the likely relative change in cumulative watershed heat input to streams from Project clearing at stream crossings. While actual total watershed stream temperature changes were not predicted, a relative measure can be approximated through an estimate of increased heat budget from clearing. In the example they provided for the South Umpqua subbasin, the thermal load from the Project due to initial construction clearing in these watersheds was about 16.5 million kcal/day, or about 0.032 percent. The relative unmitigated (i.e., no supplemental riparian plantings) change in heat load to these watershed streams relative to existing uncleared conditions would be an increase of only 0.004 percent once vegetation grows back outside of the 30-foot permanently maintained right-of-way clearing. The regrowth to achieve these levels would be expected to occur within 10 years in the Coos and Coquille subbasins and 20 years in others along the route. Considering the very small portion of total watershed riparian stream cover removed and low estimates of thermal increase, streamside clearing would not result in any measurable cumulative watershed-level changes in water temperature.

Based on available information, we conclude that any changes in water temperature, related to 75- to 95-foot-wide right-of-way vegetation clearing at waterbody crossings, are likely to be very small and undetectable through measurements, except for possibly the very smallest perennial streams and occasional intermittent flowing streams that may have flow during a hot period. Small streams with the greatest potential for measurable temperature increase also often contain limited numbers of fish because small headwater streams are often not fish-bearing or, if fish are present, their small size and often high gradient limit the stream's suitability as fish habitat. Any temperature changes that may occur would gradually be reduced or eliminated over time as most riparian vegetation, from plantings and natural vegetation regrowth would increase stream shading.

Large Woody Debris

One effect on fisheries that would result from forest clearing at pipeline crossings and construction of the pipeline right-of-way within the riparian zone adjacent to but not crossing streams, TEWAS, and PARs, and TARs is the reduction of LWD in streams and on adjacent uplands (Harmon et al. 1986; Sedell et al. 1988). Large logs provide in-stream channel structures (i.e., pools and riffles), which are critical to salmon spawning and rearing. As the size of individual logs or accumulations of logs increases, the size and stability of pools that are created also increase (Beschta 1983). Riparian forests that undergo harvesting of large trees take on secondary-growth characteristics and contribute lower quantities of large wood than unmanaged, old-growth forests (Bisson et al. 1987). However, sufficiently wide, carefully managed riparian buffers that retain a full complement of ages, sizes, and species of native trees and vegetation can ensure adequate recruitment of LWD to streams (Bisson et al. 1987; Murphy and Koski 1989; Morman 1993).

Pacific Connector has proposed to mitigate for effects on waterbodies by installing LWD at agency- and landowner-approved and appropriate areas within the construction right-of-way across certain waterbodies. The use of LWD as a mitigation measure for effects associated with in-stream construction has been documented as an effective means of creating in-stream habitat heterogeneity, reducing streambank erosion, reducing sediment mobilization (Bethel and Neal 2003), and enhancing local fish abundance (Scarborough and Robertson 2002). Placement of LWD on the streambanks and in the streams, can provide slight shade and increase bank stability, while vegetation is maturing following construction. Additionally, placement of LWD in streams or keyed into streambanks can provide habitat for benthic invertebrates and important food source for salmonids, and increase habitat for forage species with the creation of pools and enhancement of the salmonid rearing potential of an area (Cederholm et al. 1997; Slaney et al. 1997).

To mitigate for short-term losses of LWD from riparian clearing and in-stream removal of wood during construction, Pacific Connector has developed a *Large Woody Debris Plan* which includes a proposal to install 733 pieces of LWD over several fifth-field watersheds along the pipeline route where the two ESA-listed coho salmon ESUs are present. Sizes would be based on those recommended by the current ODF and ODFW (1995) protocol for piece size by streambank full width category. The plan includes placing from one to four pieces of LWD per stream crossed in the stream or on the bank, depending on forest conditions, stream flow, and landowner approval. This number of pieces, if no other LWD were present in the stream reach affected by clearing, would be near the range of what is considered "desirable" by ODFW (Foster et al. 2001) for forested streams. Foster et al. (2001) noted that more than 20 LWD pieces/100 meters of stream length (i.e., 4.6 pieces/75 feet of right-of-way clearing) with more than 3 "key" pieces/100 meters (i.e., 0.7 "key" pieces/75 feet right-of-way clearing) is considered "desirable" in forested streams in Oregon. Bilby and Ward (1991) found LWD density in old-growth forest streams in southeast Washington to have a similar range. Based on their LWD regression model estimates using channel width,[143] LWD values in old-growth forest would be expected to range from about 1 to 7 pieces per 75 feet of stream channel length for streams ranging from about 50 to 10 feet wide. The sizes of LWD pieces to be installed are based on ODF and ODFW (1995) guidelines for sizes of LWD pieces to be present in streams to meet habitat needs for specific stream sizes and number of streams crossed. These final numbers would be developed as part of Pacific Connector's Mitigation Plan, which may have some modification prior to construction. Some long-term loss of local stream habitat would remain even with the LWD mitigation due to reduced future sources of LWD from the right-of-way.

Specific streams for LWD installation have been identified by Pacific Connector; however, the specific locations within the streams would be determined through discussion with ODFW, NMFS, and other agencies as appropriate, and in consideration of the BMPs outlined in the *Stream Crossing Risk Analysis Addendum* (GeoEngineers 2018a). The size of LWD installed would follow ODF and ODFW (1995) suggested guidelines for size of LWD based on stream size. Depending on private landholder approval, some pieces may be installed at various times and locations, but in general, LWD would be placed at waterbody crossings during the last phases of pipeline construction and right-of-way restoration. Pacific Connector has proposed that, if for some reason not all pieces proposed are installed, they would be donated to local water conservation groups for installation locally.

Long-term losses of LWD input would largely be mitigated through riparian replanting of conifers in the right-of-way, although some limited long-term reduction would remain from the absence of trees in the 30-foot-wide maintenance corridor and relatively smaller sizes of regrown trees in the remaining 45 to 65 feet of the right-of-way. These trees would be allowed to grow to natural tree size.

The NMFS, upon review of this proposed LWD plan, determined that the Applicant's proposed number of LWD pieces, location, and methods of their proposed installation is not adequate to meet the loss of supply of LWD from riparian forest habitat related to right-of-way riparian clearing. However, we conclude that the proposed plan is consistent with ODF and ODFW protocols. Further, we note that the contribution of LWD to a stream from the 75 to 95-foot area cleared on both sides of a stream for construction represents an insignificant source for any stream other than extremely short headwater reaches.

<u>Fish Passage</u>

Waterbody crossings using the dry crossing methods, either flume or dam–and-pump, may result in some fish being trapped in streams. Flumes and dams would be completely installed and functioning before any in-stream trenching disturbance occurs. Up to about 250 stream crossings would be dry open cut, although most of these would be dry during crossing as they are intermittent streams (tables 4.5.2.3-1 and 4.5.2.3-2). Construction across a waterbody would take up to 4 days using dry open-cut methods, but less for small and intermediate streams. At one crossing of the

[143] Model: Log10 frequency of LWD = -1.12 log10 of Channel Width (m) +0.46

South Umpqua River, a diverted open-cut crossing (only crossing of this type) would be used. This is similar to a dry open cut in that all in channel construction would be done in the "dry" but would require diversion of the flow to one side of the channel at a time. This method could take about 14 days to complete. Because one channel would be open during the entire crossing, no passage of fish would be impeded, and no fish removal would be required.

For typical crossings, once streamflow is diverted through the flume pipe, but before pipeline trenching begins, fish trapped in any water remaining in the work area between the dams would be removed and released using the methods in Pacific Connector's *Fish Salvage Plan*.[144] Pacific Connector would use seining[145] as the primary method to salvage fish but would also use electrofishing if all fish cannot be removed by seining. All methods of capture and holding have risks of stress, injury, or mortality of fish and fish inadvertently left in the construction crossing area may die.

Tribal governments have expressed concern that the fish salvage methods proposed in the initial application would not adequately capture and protect lamprey, which is an important resource to tribal communities (see section 4.11). Adult Pacific lamprey are expected to be captured during the proposed salvaging; however, the salvage methods proposed in the application (which were developed primarily for salmonids) may not have been effective for salvaging lamprey ammocete larvae, which may remain in dewatered sediments. Electrofishing procedures to sample Pacific lamprey larvae were recommended by the FWS (see Appendix A in FWS 2010a), and the Coquille Tribe indicated that they would provide Pacific Connector with additional measures that would be effective at salvaging lamprey. As a result, we recommended in the draft EIS that Pacific Connector file a revised *Fish Salvage Plan* that contained methods suitable to collect and salvage all lamprey life stages, together with documentation that the final *Fish Salvage Plan* was developed in consultation with interested tribes, ODFW, FWS, and NMFS. Pacific Connector has filed a revised plan that contains methods aimed at collecting and salvaging all lamprey life stages; however, they did not file documentation that this plan was developed in consultation with interested tribes, ODFW, FWS and NMFS; therefore, **we recommend that:**

- **<u>Prior to construction</u>, Pacific Connector should file with the Secretary documentation that the final *Fish Salvage Plan* was developed in consultation with interested tribes, ODFW, FWS, and NMFS.**

Because the flume would maintain streamflow, some fish may move upstream through the flume. With the dam-and-pump method, the fish would not be able to move upstream or downstream through the work area until the dams have been removed. Flumes and dams would be removed as soon as possible following backfilling of the trench. Based on information from average stream crossing times (Reid et al. 2004) estimated durations when complete or partial blockage may occur for fluming would range from 36 to 92 hours, and for dam-and-pump, the range is from 20 to 56 hours.

<u>Aquatic Nuisance Species</u>

Currently, there are 161 reported NAS in Oregon, of which 93 are documented in the USGS hydrologic basins crossed by the Pacific Connector pipeline (USGS 2019). Some of the major potential aquatic invasive species are mussels, including the zebra and quagga mussels (*Dreissena*

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[144] See Appendix F.3 of Resource Report 3, which was included in Pacific Connector's application to the FERC.
[145] A fine meshed net pulled through the water to capture fish.

polymorpha, and *Dreissena rostriformis bugenisis*), and New Zealand mud snail (*Potamopyrgus antipodarumis*) as well as Cyanobacteria (blue-green algae), and freshwater mold (Saprolegnia). Invasive species can have multiple adverse effects when introduced to their non-native environment. The most common effect is competition with native species for habitat and resources, often with the reduction or elimination of the native species. They also may cause effects on human uses of the water. For example, zebra mussels have been found to multiply to such vast numbers that they effectively block water intakes, such as drinking water supplies. Additionally, invasive species may crossbreed with native stocks of organisms indirectly causing the reduction of viable native pure species. Some invasives may directly kill other native species that have no natural defenses against them. Pacific Connector's *Hydrostatic Test Plan*[146] includes measures that would prevent the spread of invasive species from one water basin to another. These plans would also be used for equipment used between waterbodies.

The procedures are outlined in Attachment C to the *Hydrostatic Test Plan*. Additional supplemental invasive species protective actions for cleaning of equipment used among water bodies was developed by ODFW specifically for this project and have been incorporated by Pacific Connector in their *Hydrostatic Test Plan*. Plans to be implemented to protect against aquatic nuisance species will need approval of appropriate agencies, including ODFW. Some items in the *Hydrostatic Test Plan* that would aid in ensuring invasive aquatic species are not transported between streams, including preventing the spread of quagga and zebra mussels, New Zealand mudsnail, and aquatic plant invasion, are:

- Clean all aquatic plants, animals, and mud from vehicles, boats, motors or trailers and discarding the debris in the trash. Rinsing, scrubbing, or pressure washing should occur away from storm drains, ditches, or waterways.
- Drain live wells, bilge, and all internal compartments.
- Dry equipment including boats between uses, if possible (leaving compartments open and sponging out standing water).
- Scrub or pressure wash life jackets, waders, boats, landing nets, and other gear that comes in contact with the water.
- Clean and sanitize as needed which may include heated power wash before moving establishing sanitizing areas away from areas where it may enter surface water including use of bleach solution and run through portable pumps for 10 minutes
- Inspect everything for signs of aquatic invasive species before launching and before leaving.

Blasting

Blasting in stream channels can have adverse effects on fish, especially for fish with swim bladders. Explosives detonated near water produces shock waves that can be lethal to fish, eggs, and larvae by rupturing swim bladders and addling egg sacs (British Columbia Ministry of Transportation 2000). Explosives detonated underground produce two modes of seismic wave (Alaska Department of Fish and Game 1991). Shock waves propagated from ground to water are less lethal to fish than those in-water explosions since some energy is reflected or lost at the ground-water interface (Alaska Department of Fish and Game 1991). Peak overpressures as low as 7.2 pounds per square inch (psi) produced by blasting on a gravel/boulder beach caused 40

[146] See Appendix V.2 of Resource Report 3, which was included in Pacific Connector's application to the FERC.

percent mortality in coho smolts and other studies revealed 50 percent mortality in smolts with peak overpressures ranging from 19.3 to 21.0 psi (Alaska Department of Fish and Game 1991).

The best way to reduce or eliminate effects on fish is to keep fish out of regions where pressure waves are harmful. The Alaska Department of Fish and Game (1991) reported that a pressure change of 2.7 psi is the level for which no fish mortality occurs and is from 1.7 to 4.5 psi below any level where mortality would be expected. Based on normal charges used in trenching (about 1 to 2 pounds at 8-millisecond delay) the zone of the above pressure wave would extend 34 to 49 feet, depending on substrate near the charge (Alaska Department of Fish and Game 1991). Typically, the dry area (where fish could not be) would be at least 25 feet wide during construction. If blasting were to occur with only a 25-foot-wide dry working space buffer between the blast and the stream, the potentially hazardous pressure wave (i.e., greater than 2.7 psi) would extend no more than an additional 25 feet. Likely, the effects would be felt over a much smaller distance as this distance estimate is based on a very conductive energy transfer substrate, which is unlikely to occur at most crossings. Pacific Connector developed a *Blasting Plan* that outlined measures to reduce effects on resources. Prior to any blasting, proper permits would be obtained and agencies notified as required by permits. Blasting may occur in uplands adjacent to streams or in dry streambeds, and Pacific Connector does not anticipate conducting any in-water blasting. Pacific Connector would attempt to minimize shock waves from blasting that may affect aquatic resources by the types of explosives selected, the size of charges, and the sequences of firing. Currently, about 37 crossings have known bedrock, some of which may require blasting (table 4.5.2.3-2). Fish would be removed from the crossing area, in accordance with Pacific Connector's *Fish Salvage Plan*. Where blasting would occur near a crossing, fish would be excluded an additional 25 feet upstream and downstream from the crossing area by use of barrier nets. In addition, bubble/air curtains may be used to disrupt shock waves, depending on input from state agencies during the state permitting process.

Hydrostatic Testing

After the pipeline is installed, Pacific Connector would fill it with water under pressure to test it (see section 2.4.2.1). The maximum amount of water used for hydrostatic testing would be about 64 million gallons. Pacific Connector would obtain its hydrostatic test water from commercial or municipal sources or surface water rights owners to lakes, impoundments, and streams from possibly 14 different locations. Water may be withdrawn from nine streams, including Coos River, East and Middle Fork Coquille Rivers, Olalla Creek, South Umpqua River, Rogue River, Lost River, and Klamath River. Pacific Connector would obtain all necessary appropriations and withdrawal permits, including from the OWRD, prior to use. All the streams identified as potential test water sources include anadromous salmonids or resident trout. About 32 potential discharge locations for the test water have been identified. During the test, it may be necessary to discharge water at each of the sites; however, discharges would be minimized and water would be conserved as much as practical by cascading water between test sections when feasible (pumping from one segment to the next).

Potential effects on aquatic resources associated with hydrostatic testing include entrainment of organisms including fish, reduced downstream flows, erosion and scouring at release points, and the transfer of aquatic nuisance species through the test water from one water basin to another. Estimates of potential water intake amounts from streams indicate flows below intake would be reduced by less than 10 percent of instantaneous flow based on typical monthly flows (cfs) during the month of withdrawal for all but one potential locations, where it would about 35 percent during withdrawal (duration about 6 to 11 days at each potential location) (Ambrose 2018; table 4.5.2.3-6). Final selection of intake rates and sites would be reviewed by ODFW and OWRD prior to testing, so that potential effects on fish habitat from flow reductions would be unlikely considering nearly all flow changes would be small and final flow changes would be restricted as noted below, and resource agencies noted above will make final approval on allowable withdrawals. Pacific Connector has developed a *Hydrostatic Test Plan* to minimize effects from hydrostatic testing on resources. This plan is discussed in more detail in section 4.3.2.2 of this EIS.

To prevent the entrainment of most aquatic species, the pumps and intake hoses for hydrostatic test water removal would be screened, in accordance with NMFS screening criteria. To ensure water withdrawal does not cause downstream water level issues (ramping rate), Pacific Connector would submit their withdrawal plans to ODFW for review prior hydrostatic testing. To prevent the transfer of organisms from one water basin to another, Pacific Connector would try to return hydrostatic test water to its basin of origin. However, given the linear nature of the pipeline and the need to cascade test water from one section to another, such a return may not always be possible. Therefore, Pacific Connector would treat the test water after withdrawal (most likely with chlorine) to prevent the spread of invasive species and pathogens. To prevent erosion or scour at discharge locations, the hydrostatic test water would be discharged at low head into energy dissipating devices and dewatering structures in uplands at least 150 feet from streams. Volume and flow rates would be controlled to prevent overland flows directly to waterbodies. Specific hydrostatic discharge sites have been reviewed and approved by BLM and Forest Service on their lands to minimize runoff and avoid effects on beneficial uses.

The hydrostatic testing would remove water from several different waterbodies along the pipeline route. The NMFS has indicated that to insure fish and aquatic habitats are adequately protected during these withdrawals that no more than 10 percent of existing flow at the time of withdrawal be removed during hydrostatic testing. Therefore, **we recommend that**:

- **<u>Prior to construction</u>, Pacific Connector should file with the Secretary, for review and written approval by the Director of OEP, a revised *Hydrostatic Test Plan* that requires that any water withdrawal from a flowing stream does not exceed an instantaneous flow reduction of more than 10 percent of stream flow.**

TABLE 4.5.2.3-6

Hydrostatic Testing Water Requirements and Flow Impacts on Water Sources

Alignment Location	Pump Rate (gpm)	Pump Rate (cfs)	Total Estimated Volume Needs (gallons)	Water Source Name	Water Source MP Inter-section (MP)	Water Source Basin Area (sq miles)	Reference Gage	Reference Gage Basin Area (sq. miles)	Estimated Time of Use (month)	50% Exceedance Flow for Reference Gage (cfs)	50% Exceedance Flow for Water Source (cfs)	Adjusted Flow Based on Hydrostatic Test Water Use (cfs)	Estimated Flow Reduction Duration (days)	% Flow Reduction
Spread 1	300	0.67	2,800,000	Coos River a/	11.08	400	StreamStats	n/a	October	n/a	131	130.3	6.5	0.51%
Spread 1	300	0.67	2,800,000	EF Coquille River	29.64	101	StreamStats	n/a	October	n/a	27.4	26.7	6.5	2.44%
Spread 2	300	0.67	2,500,000	EF Coquille River a/	29.64	101	StreamStats	n/a	October	n/a	27.4	26.7	5.8	2.44%
Spread 2	300	0.67	2,500,000	MF Coquille River	50.28	17.5	StreamStats	n/a	October	n/a	1.91	1.2	5.8	35.06%
Spread 3	300	0.67	4,000,000	Olalla Creek	58.79	68	StreamStats	n/a	June/July	n/a	9.25	8.6	9.3	7.24%
Spread 3	300	0.67	4,000,000	S. Umpqua River	71.25	1410	StreamStats	n/a	June/July	n/a	642	641.3	9.3	0.10%
Spread 4	300	0.67	2,800,000	S. Umpqua River a/	71.25	1410	StreamStats	n/a	July/Aug	n/a	268	267.3	6.5	0.25%
Spread 4	300	0.67	2,800,000	S. Umpqua River	94.70	571	StreamStats	n/a	July/Aug	n/a	137	136.3	6.5	0.49%
Spread 5a	300	0.67	2,500,000	S. Umpqua River a/	94.70	571	StreamStats	n/a	Sept	n/a	87	86.3	5.8	0.77%
Spread 5b	300	0.67	2,800,000	Rogue River a/	122.80	1090	StreamStats	n/a	Sept	n/a	1330	1329.3	6.5	0.05%
Spread 7	300	0.67	4,800,000	Klamath River a/	199.20		USGS 11509500	3920	February	1175	1175	1174.3	11.1	0.06%
Spread 7	300	0.67	4,800,000	Lost River	212.00	1350	StreamStats	n/a	February	n/a	88	87.3	11.1	0.76%

a/ Primary Water Source; all others are a Secondary Water Source.

*Klamath River Flow Estimate Based on Mean of February Monthly Means (2000-2017) at USGS Gage 11509500

Source: Table 1 in Attachment F, Hydrostatic Test Water Withdrawal Hydrologic Assessment, to Pacific Connector's updated *Hydrostatic Test Plan* submitted to the FERC November 8, 2018.

Hyporheic Exchange

Removal and replacement of native stream material and pipe installation has the potential to locally disrupt the structure and organization of the hyporheic zone in the immediate area of the pipeline crossing. Mixing of shallow groundwater and surface water in streams is a form of hyporheic exchange and can affect important physical factors such as temperature, dissolved oxygen, and chemical composition of streams that may influence aquatic habitat. However, such alterations are expected to be minimal relative to the adjacent unaffected streambed and stream banks and could either increase or decrease permeability over an extremely narrow segment of a stream channel, up to 12 feet in width at the maximum trench width even during construction. Two of the major factors affecting hyporheic exchange are reach slope and hydraulic conductivity of alluvial sediment (Wondzell 2011), which is primarily related to coarseness of sediment. Crossing actions would not affect reach slope and would not substantially change the substrate composition of the reach. As discussed in section 4.3, an assessment was made of likely crossing areas that may affect this exchange rate (GeoEngineers 2017g) and actions taken to reduce potential effects of these crossings. Fourteen stream crossings were categorized as having a "high" sensitivity, which would suggest a high likelihood of a functioning hyporheic zone, mostly associated with larger waterbodies with greater floodplain widths and instream morphologic features. As discussed in section 4.3, however, there are several site-specific crossing construction plans and BMPs in place to help reduce the chance of there being functional effects on this exchange, such as returning natural material to trenched areas and installing trench plugs adjacent to wetlands and waterbodies, all of which would help return natural hyporheic exchange rates after construction is complete. Local disruption of hyporheic function by construction and presence of the pipeline would not be expected to result in measurable effects to flow, dissolved oxygen, or nutrient enrichment during construction or operation and would not adversely affect aquatic habitat in streams crossed.

Fuel and Chemical Spills

For any large construction project, there is the potential for spills of fuel or other hazardous liquids from storage containers, equipment working in or near streams, and fuel transfers. Any spill of fuel or other hazardous liquid that reaches a waterbody would be detrimental to water quality. The chemicals released during spills could have acute, direct effects on fish, or could have indirect effects such as altered behavior, changes in physiological processes, or changes in food sources. Fish could also be killed if a large volume of hazardous liquid is spilled into a waterbody. Ingestion of large numbers of contaminated fish could affect primary and secondary fish predators in the food chain.

To minimize the potential for spills, Pacific Connector has developed an SPCC Plan. Pacific Connector's implementation of this SPCC Plan would minimize the potential for and the effect of any spill near surface waters. The SPCC Plan would be updated with site-specific information prior to construction. Specific measures in this plan include prohibiting liquid transfer, vehicle and equipment washing, and refueling within 100 feet of waterbodies and specific steps to be followed to control, contain, and clean up any spill that occurs. The SPCC Plan is further described in section 4.3.2.2. Pacific Connector's implementation of this SPCC Plan would minimize the potential for and the effect of any spill near surface water on aquatic resources.

Benthic and Sessile Organisms

Benthic and sessile organisms including benthic invertebrates and freshwater mussels would be affected by most of the same factors noted primarily for fish discussed above. This would include effects from elevated turbidity and suspended sediments, release of drilling muds, herbicide application, blasting, fuel and chemical spills, and habitat modification. Mayflies, caddisflies, and stoneflies prefer large substrate particles in riffles and are adversely affected by fine sediment deposited in interparticle spaces (Cordone and Kelley 1961; Waters 1995; Harrison et al. 2007). Fish and benthic macroinvertebrate abundance downstream of pipeline construction sites have been reported short-term reductions following construction-generated suspended sediment (Reid and Anderson 1999). Reid et al. (2008) summarized the results of nine wet open-cut pipeline stream crossing studies and noted all measured effects on downstream stream invertebrate population abundance or diversity (six of nine studies) were less than a year in duration with three studies having no measured effects on invertebrate abundance. Since the proposed action does not include wet open cuts, effects on benthic invertebrates would be limited. Risk of adverse effect on relatively sessile species, such as mollusks, could extend downstream from construction sites if degradation of water quality affects downstream habitats. However, because they are relatively immobile, the trenched crossing would have the greatest effect and would directly kill many at the trenching site because most would be unable to actively move from the area. In the case of many aquatic invertebrates, including insect larvae, these areas would be rapidly (weeks/months) recolonized from upstream drift and new egg deposition from adults. In some cases, for longer-lived organism, such as mussels, recolonization would take longer as they are immobile and most take years to grow to full size. The largest effect on most benthic and sessile organisms would be directly at the crossing location and the effect would be short term. In the case of mussels, local effects may be long term. However, the overall area affected for any given stream would be small so adverse effects on local mussel or other benthic species would be slight.

Effects on Aquatic Habitat and Aquatic Species from Operation of the Pacific Connector Gas Pipeline Project

Once installed, maintenance of the pipeline would include activities such as aerial inspections, gas flow monitoring, and visual inspection of surrounding vegetation for signs of leaks, and integrity management, which includes smart pigging[147] to investigate the interior surface of the pipe for any signs of stress cracking, pitting, and other anomalies. All the maintenance activities would be outlined in the *Operations and Maintenance Plan* that would be prepared according to operating regulations in USDOT 49 CFR Subpart L, Part 192 and would be completed prior to going in-service. The *Stream Crossing Risk Analysis Addendum* (GeoEngineers 2018a) outlines the measures that will be contained in the final stream crossing monitoring plan. These general maintenance activities would require only surface activities and usage of the existing right-of-way, such as insertion of the pig at one of the pig launching facilities.

Potential estuarine or stream channel disturbance would occur if an integrity issue with the pipeline occurred. If this happened, the pipeline would likely be unearthed (except non-trenched crossings like HDD, which may be rebored) within the right-of-way and repair work done in-water. Within stream sites, repair work could require isolated flow from the section of pipe that is to be exposed. Typically, repairs would be made to the pipe within the right-of-way (within the trench) or, depending on the site-specific conditions and nature of the repair needed, a reroute around the affected section may be considered. Effects would be similar to those discussed above for initial installation except on a much smaller scale, because they would only involve one crossing compared to many streams and, in the case of the estuary, likely just a portion of whole route would be disturbed not the whole 0.7- or 1.6-mile HDD sections, or possibly just rebored without

[147] A pig is a remotely operated pipe inspection and cleaning tool.

having to disturb the estuary bottom. However, should repairs be needed out of the standard stream crossing window (i.e., during periods of fish spawning or egg incubation) there would be additional adverse effects on key fish resources at the specific site. The actions would include similar BMPs and mitigation. Any future repairs would require additional permit approval from appropriate state and federal agencies, which would determine the acceptable parameters of these actions. Such pipeline integrity-based in-water projects are very infrequent.

Vegetation maintenance would be limited adjacent to waterbodies to allow a riparian strip to permanently revegetate with native plant species across the entire right-of-way. To facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide would be maintained in an herbaceous state. In addition, trees that are within 15 feet of the pipeline and have roots that could compromise the integrity of the pipeline coating would be selectively cut and removed from the permanent right-of-way.

Herbicide Application

Pacific Connector would not use herbicides for routine vegetation maintenance; however, Pacific Connector would implement an *Integrated Pest Management Plan* (see Appendix N to the POD [in appendix F.10 of this EIS]) that addresses control of noxious weeds. The plan was developed in consultation with the ODA, BLM, and the Forest Service. The plan would include the selective use of herbicides where necessary to control noxious weeds by limited application from the ground, where allowed by landowners. Pacific Connector would only use agency-approved herbicides authorized in current planning documents to control noxious weeds where infestations occur in the right-of-way after construction and during operation. Permits or approvals for the use of herbicides and adjuvants on federal lands would be obtained prior to use/treatment, as detailed in the *Integrated Pest Management Plan*. Herbicides would not be applied by aerial or broadcast spraying. Noxious weeds would be removed only by manual methods in the riparian zones, which is defined as one site potential tree height, and within federal lands Riparian Reserves that are defined as being greater than 150 feet in most areas along the route, and greater than 100 feet in other areas.

Herbicides can have toxic or other adverse effects on fish and other aquatic organisms. In general, most effects on aquatic systems occur from direct spray of herbicides, and possibly drift when herbicides are sprayed, and leaching through soils and groundwater (Tu et al. 2001). Pacific Connector would not directly spray, or otherwise apply, herbicides in waterbodies or in riparian zones. The risk of drift would be avoided by selectively applying herbicides from the ground. The five types of potential herbicides that could be used have various levels of toxicity to aquatic organisms. However, the restriction to selective applications outside of riparian zones would greatly reduce the potential of adverse effects on fish by keeping herbicides outside of riparian zones and preventing herbicides from reaching streams.

4.5.2.4 Environmental Consequences on Federal Lands

The Pacific Connector Pipeline Project would have some effect on 41 waterbodies and associated riparian areas in the approximately 77 miles of federal lands that would be crossed by the pipeline. The effects on federal lands in designated land use categories (e.g., Riparian Reserve, ACS, Key Watersheds) from the proposed action are addressed fully in section 4.7 and appendix F, and effects on special status species are discussed in section 4.6 and the BE (appendix F). Watersheds crossed on federal lands and characteristics of those watersheds are discussed in section 4.7 and appendix F. Aquatic species present on federal lands would be similar to those discussed in section 4.5.2.3, except no marine and estuarine fish and shellfish are present in the waterbodies crossed on federal lands. Aquatic species found on federal lands would be mostly the same as those on non-federal lands with freshwater habitat. Commercial and recreational fisheries of importance in waterbodies crossed include primarily anadromous salmon and steelhead and resident trout. Specials status species present in some stream segments crossed include federally listed Oregon coastal coho salmon and Southern Oregon/Northern California coastal coho salmon ESU. EFH habitat is also present along the route for coho and Chinook salmon stocks. Other state and federal fish species of special status are discussed in section 4.6. Aquatic habitats that would be affected by the pipeline on federal lands are primarily coldwater and anadromous streams, with a few warmwater ponds adjacent to the construction areas. Much of the stream riparian areas crossed on BLM and NFS lands is heavily forested and shaded by coniferous trees in the Coast Range and mixed conifer-hardwood forest in the Klamath Mountains.

The general effects on aquatic resources, and mitigation for those effects, would be similar on federal lands to those discussed above in section 4.5.2.3 for the entire pipeline. Crossing techniques for most waterbodies would include dry-open cut methods. Twelve perennial and 29 intermittent streams would be directly crossed by the pipeline construction on federal lands (table 4.5.2.4-1). Of these streams, 3 are known to contain anadromous fish, and 8 known or assumed to contain resident fish species. ESA species and EFH habitat for salmon may be present in 3 stream disturbance areas (table 4.5.2.4-1).

TABLE 4.5.2.4-1

Number of Streams Crossed by the Pacific Connector Pipeline Route on Federal Lands by Fish Status Category within Each Fifth-Field Watershed Coinciding with the Pacific Connector Project

Fifth Field Watershed (Fifth Field HUC)	Federal Land Agency	Perennial Streams	Intermittent Streams	Fish-bearing Streams with (a/): Anadromous Species (assumed) b/	Fish-bearing Streams with (a/): Resident Species (assumed) a/, b/	EFH Species and Habitat Present (assumed) a/	ESA Species or Habitat Present (assumed) a/
Coos County							
Coos Bay Frontal-Pacific Ocean	BLM Coos Bay Dist.	0	0	0	0	0	0
North Fork Coquille River (1710030504)	BLM Coos Bay Dist.	3	0	2	1(2)	2	2
East Fork Coquille River (1710030503)	BLM Coos Bay Dist.	0	2	0	0	0	0
Middle Fork Coquille River (1710030501)	BLM Coos Bay Dist.	1	6	0	0	0	0
Middle Fork Coquille River (1710030501)	BLM Roseburg District	0	1	0	0	0	0
Douglas County							
Middle Fork Coquille River (1710030501)	BLM Roseburg Dist.	1	0	0	1	0	0
Days Creek-South Umpqua (1710030205)	BLM Coos Bay Dist.	0	1	0	0	0	0
Upper Cow Creek (1710030206)	Forest Service Umpqua NF	3	4	0	0	0	0
Jackson County							
Upper Cow Creek (1710030206)	Forest Service Umpqua NF	0	1	0	0	0	0
Trail Creek (1710030501)	Forest Service Umpqua NF	0	0	0	0	0	0
Trail Creek (1710030501)	BLM Medford Dist.	1	0	1	1	1	1
Shady Cove-Rogue River (1710030707)	BLM Medford Dist.	0	3	0	0	0	0
Big Butte Creek (1710030704)	BLM Medford Dist.	2	0	0	0	0	0
Little Butte Creek (1710030708)	BLM Medford Dist.	0	6	0	1	0	0
Little Butte Creek (1710030708)	Forest Service Rogue River NF	1	1	0	2	0	0
Klamath County							
Spencer Creek (1801020601)	Forest Service Winema NF	0	3	0	0	0	0
Spencer Creek (1801020601)	BLM Lakeview NF	0	1	0	0	0	0
TOTAL		**12**	**29**	**3**	**6(2)**	**3**	**3**

a/ Known and assumed (value in parentheses) crossings by the pipeline with indicated fish category designation
b/ Trout
Note: Based on Pacific Connector's analysis, numbers may differ from federal agency analysis of streams, in some watersheds.

Riparian Reserve Areas

Riparian Reserve is a land use allocation specific to BLM and NFS lands. BLM and Forest Service management objectives include protection of aquatic resources and ESA-listed fish species in streams on both BLM RMP and Forest Service-managed lands. One difference between BLM and Forest Service management of these areas is the width of streamside riparian buffer. The details of these two plans are described in section 4.7 and appendix F. This allocation was developed in conjunction with the ACS (NFS) and Riparian Reserve that are incorporated into each of the BLM and Forest Service LMPs for management of areas associated with streams, lakes, and potentially unstable areas. The ACS was developed as part of the NWFP *Standards and Guidelines* to restore and maintain the ecological health of watersheds and aquatic ecosystems contained within NFS lands (Forest Service and BLM 1994b) for a variety of species. In 2016, the BLM signed a ROD that approved the Northwestern and Coastal Oregon RMP and the Southwestern Oregon RMP and adopted a similar strategy for riparian areas. The Forest Service system for managing primarily stream riparian areas includes components of the ACS are Riparian Reserves and Key Watersheds (see section 4.7 and appendix F). Riparian Reserves are intended to serve as corridors in the matrix and enable the Forest Service to manage these land allocations to maintain and restore riparian structures and functions of these unique and important features. The BLM also has Riparian Reserve under its current management plan. As described in section 4.7 and appendix F, Riparian Reserve has unique sets of guidance that are applicable wherever these occur, although these differ now between the two agency plans. The Forest Service ACS places an emphasis on efforts to maintain and restore aquatic and riparian habitat that is necessary to support anadromous salmonids. The nine objectives listed for the ACS include maintaining and restoring aquatic systems, floodplains, wetlands, upslope habitats, and riparian zones in general to support invertebrate and vertebrate species dependent on those habitats. The description of these nine objectives and how they would be maintained under the proposed actions is presented fully in section 4.7 and appendix F. The BLM's Riparian Reserve land use allocation has associated Management Direction and Management Objectives but does not include Key Watersheds.

The Pacific Connector pipeline would cross Riparian Reserve areas of both NFS and BLM lands along the route. Project effects on Riparian Reserve resulting from all construction activities (e.g., pipeline right-of-way, TEWAs, permanent and temporary access roads) are discussed in section 4.7 and appendix F.

Key Watersheds on NFS Lands

Key watersheds on NFS land, as designated by the NWFP (Forest Service and BLM 1994a), provide high water quality and are crucial to at-risk fish species and stocks. They are the highest priority for watershed restoration. Tier 1 Key Watersheds consist primarily of watersheds directly contributing to anadromous salmonid, bull trout, and resident fish species conservation. Tier 2 watersheds do not necessarily contain at-risk fish stocks but are important sources of high quality water (Forest Service and BLM 1994a). The Key Watersheds include three Tier 1 (Days Creek – South Umpqua River [formerly named South Umpqua River], North and South Forks Little Butte, Spencer Creek) and one Tier 2 (Clover Creek) watershed. Potential effects on these Key Watersheds and actions that would be taken by the Project to ensure Key Watershed functions are maintained are discussed in section 4.7 and appendix F.

Measures That Would Mitigate Effects on Aquatic Resources on Federal Lands

Pacific Connector would develop project design, construction, and operation measures to avoid or minimize effects on aquatic resources to the extent practicable. To compensate for unavoidable effects along streams from loss of upslope and riparian vegetation and LWD input that do not meet the objectives of the ACS, Pacific Connector has developed a *Large Woody Debris Plan* and supplemental riparian plantings efforts to help maintain the functions of the system after construction. Actions that would be taken on NFS lands to help meet ACS objectives on those lands are included in chapter 2. No similar actions have been developed in BLM plans. These additional actions and mitigation measures agreed to for NFS lands are summarized in table 2.1.5-1. The effects of implementation of these measures on meeting the ACS and Riparian Reserve management objectives and management direction are discussed in section 4.7 and appendix F.

To ensure that the Pacific Connector Pipeline Project is consistent with the objectives of the ACS on NFS lands, which would in turn aid fish populations on federal land, Pacific Connector would develop a variety of enhancements (at the direction of the Forest Service): (1) donate LWD to agencies/conservation groups to perform in-stream restoration projects; and/or (2) relocate large boulders greater than 24 inches in diameter for use as fish habitat structures. As part of Project development, the BLM and Forest Service have also developed site-specific stream crossing plans for perennial streams on their lands that include specific riparian plantings and other actions to aid at maintaining stream and riparian functions. To mitigate for Project actions that, even with site-specific actions, may impede maintaining ACS and Riparian Reserve management objectives and direction on each watershed (e.g., pipeline crossing LWD placement and riparian vegetation plantings), Pacific Connector would fund the following types of projects that would be implemented on Forest Service areas not directly affected by Project activity:

- add LWD to several miles of streams outside of the area that would be affected by the Project;
- restore degraded riparian habitats through off-site revegetation projects;
- conduct off-site fish passage projects at road crossings;
- improve stream road crossings and replace or stabilize culverts that may contribute sediment from fill failure to streams;
- conduct pre-commercial thinning projects where feasible to improve riparian habitats;
- install fences in allotments to improve riparian habitats;
- decommission roads and waterbody features (e.g., culverts, crossings, bridges) identified by the Forest Service that are no longer needed for resource management to provide numerous benefits including lower road density, minimization of channel extensions, minimization of sedimentation, improvement of fish passage through culvert removal, and reduction of riparian habitat fragmentation;
- close roads that are not in use, which would reduce sediment runoff to streams; and
- stormproof roads (such as adding water bars, ditch cleaning, culvert bypass) to also reduce fine sediment to streams and reduce the risk of road blow out, which could contribute heavy sediment loads to streams.

The list of mitigation measures noted above is not all that would be in place on NFS lands (see table 2.1.5-1) but identifies some of the major efforts that would be undertaken to reduce and mitigate impacts from the proposed action on aquatic resources. Following Project construction, habitat and ecosystem function would be restored in place as much as possible. However, although mitigation actions would restore habitat and have long-term benefits to wetlands, estuarine ecosystems, and habitat for salmonids in general, there would be effects on some non-target species. The goal of additional mitigation would be to restore habitat with similar ecological function for the remaining effects on aquatic resources to ensure project actions meet the ACS objectives and direction at multiple scales. These actions would reduce effects on fish resources on Forest Service federal lands by reducing factors known to be harmful or limiting to fish species including elevated suspended sediment and sediment in the stream channel, which affects fish production and survival; loss of LWD in streams, which reduces habitat quality; loss of future riparian LWD and other vegetation supplying input of organic matter; and loss or restriction of fish movement (passage) in streams. Specific sites and actions for the mitigation measures were identified through meetings with the Forest Service. These are provided in the *Mitigation Plan for Federal Lands* included in appendix F of this EIS. The details of these mitigation actions and how they relate to ensuring the ACS is being met is discussed in section 4.7 and appendix F.

Similarly, the Applicant has proposed mitigation on behalf of the BLM, including road closures, road surfacing, road decommissioning, road drainage improvements, LWD addition, and fish passage improvements including culvert replacement and irrigation intake screening, as described in Attachment 2 of the *Comprehensive Mitigation Plan* filed with FERC on August 30, 2019. All are actions that will assist in meeting objectives of the Aquatic Conservation Strategy like that discussed above for Forest Service–designated mitigative actions.

4.5.2.5 Conclusion

Constructing and operating the Project would have both short-term effects on fish and invertebrate individuals as well as short- and long-term effects on aquatic habitat. Individual fish and shellfish as well as their food sources would be directly lost as a result of Project construction, the initial and maintenance dredging, decreased water quality, and entrainment from vessel water intake. Habitat modifications would also reduce local important habitat areas including rearing, spawning, and cover areas (e.g., aquatic vegetation, eelgrass). Short-term effects from the pipeline would also include direct local reduction in food sources primarily from bottom disturbance resulting from stream crossings and short-term elevated turbidity; elevated turbidity would also cause short-term sublethal stress to fish and invertebrate stream organisms and movement blockages over limited specific stream locations and time, while limited reduction of riparian vegetation and trees would have limited short- and long-term reduction in stream habitat components. However, the distribution of adverse effects would be limited to areas near the Project (e.g., at the LNG facilities, marine waterway modifications, and near and downstream of pipeline stream crossings) and with BMPs and impact avoidance measures implemented during construction as well as mitigative actions implemented following construction would limit long-term adverse effects. As a result, we conclude that the Project would not significantly affect fish and aquatic invertebrates.

4.6 THREATENED, ENDANGERED, AND OTHER SPECIAL STATUS SPECIES

This section analyzes the effects of the Project on special status species. In addition to species listed as threatened or endangered under the federal ESA[147] and Oregon ESA[148], agencies and organizations such as the FWS, BLM, Forest Service, ODA, and ODFW maintain lists of species that are considered special concern, sensitive, rare, or are otherwise offered protections under agency planning documents. These species are broadly defined in this assessment as "special status species."[149] Although the term "special status species" is used differently by various agencies, for the purposes of this assessment, the term "special status species" includes:

- species that are listed or proposed for listing by the federal government as endangered or threatened, or are candidates for listing;
- species that are identified by the BLM or Forest Service as "sensitive species";
- species listed by the State of Oregon as endangered, threatened, or are candidates for listing; and
- species identified by federal or state agencies as rare or protected by federal or state planning documents (e.g., Standards and Guidelines in resource management plans such as "Survey and Manage" species identified in the NWFP).

Using data from the Oregon Biodiversity Information Center (ORBIC),[150] FWS, NMFS, discussions with Forest Service and BLM specialists, and information reviews of published and unpublished information, the Applicant's prepared lists of threatened, endangered, proposed, candidate, and special status species that potentially occur near the proposed Project, are described

[147] Federal agencies are required by Section 7 of the ESA (Title 19 U.S.C. Part 1536[c]), as amended (1978, 1979, and 1982), to ensure that any actions authorized, funded, or carried out by the agency do not jeopardize the continued existence of a federally listed endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat of a federally listed species. The action agency (e.g., the FERC) is required to consult with the FWS and/or the NMFS to determine whether federally listed endangered or threatened species or designated critical habitat are found in the vicinity of the Project, and to determine the proposed action's potential effects on those species or critical habitats. For actions involving major construction activities with the potential to affect listed species or designated critical habitat, the federal agency must submit its BA to the FWS and/or NMFS and, if it is determined that the action may adversely affect a listed species, the federal agency must submit a request for formal consultation to comply with Section 7 of the ESA. In response, the FWS and/or NMFS would issue a BO as to whether or not the federal action would likely jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Jordan Cove and Pacific Connector filed an applicant-prepared draft BA (APDBA) in December 2017, and a revised APDBA in September 2018. We submitted a BA and EFH Assessment to the FWS and NMFS on July 29, 2019 with a request to initiate formal consultation.

[148] Oregon has its own ESA that requires state agencies to protect and promote the recovery of state-listed threatened and endangered species. At the state level, consultation is conducted with the ODA for state listed plant species and the ODFW for fish and wildlife species. However, state regulations pertaining to the protection of botanical resources are limited to ORS 564 and OAR Chapter 603, Division 73. Oregon regulations regarding state endangered and threatened plants only apply on non-federal public lands (e.g., state, county, city, etc. lands).

[149] The term "special status species" is also used by the BLM, but in a narrower agency-specific definition than in this assessment. BLM "special status species" include species listed as threatened or endangered under the ESA, species that are proposed for listing under the ESA, species that are candidates for listing under the ESA, and species designated by the BLM as "sensitive" under criteria in BLM Manual 6840. The Forest Service uses similar designations. For the Forest Service, "Survey and Manage" are managed under specific criteria provided in the Northwest Forest Plan rather than the agency "special status species" programs. Several species are designated as both "special status species" for the Forest Service and "Survey and Manage species." Those species are noted in the assessment and are analyzed here under criteria for both programs.

[150] Formerly known as the Oregon Natural Heritage Information Center (ORNHIC).

in the following sections. Species that were initially considered but were dropped from further consideration due to a lack of habitat or because they were not detected during targeted field surveys are listed in tables I-3, I-4, and I-5 in appendix I.

4.6.1 Federally Listed Threatened and Endangered Species

Table 4.6.1-1 lists the federally endangered, threatened, and proposed species that potentially occur in the Project area and are discussed below. Additional species (beyond those listed in table 4.6.1-1) are federally listed in Oregon (i.e., the Canada lynx, bull trout Klamath River DPS, yellow-billed cuckoo Western DPS, streaked horned lark, and slender Orcutt grass); however, these species are not known or expected to occur within the Project area and are not discussed further in this document (Canada lynx: Verts and Carraway 1998, McKelvey et al. 2000, ORBIC 2006b; bull trout Klamath River DPS: FWS 1998a, 2002a, ORBIC 2006b; yellow-billed cuckoo: FWS 2013b; streaked horned lark: FWS 2017b; SBS 2008a, 2012, 2013, 2014, 2017a; and slender Orcutt grass: ORBIC 2017b, FWS 2006b). In addition, the North American wolverine occurs in Oregon and has been proposed for listing as threatened under ESA; wolverines have been occasionally documented in Oregon, most recently in the Wallowa-Whitman National Forest in Northeast Oregon during 2011-2012 (Magoun et al. 2013), but no evidence for a reproducing, self-sustaining population has been found in the state. There appears to be an extremely remote chance of a wolverine dispersing into southwest Oregon, but that is not foreseeable during the construction of the proposed action, and as a result, the North American wolverine is not discussed further in this document. Wolverines are listed as threatened under the Oregon ESA. The Eastern DPS of the Steller sea lion, which occurs on the west coast of the U.S. and within the Project area, was delisted on December 4, 2013 (78 FR 66139), and thus is not discussed in this section.

Table 4.6.1-1 lists all potentially affected federally listed and proposed species, indicates the portion of the Project area where they may occur, and provides our preliminary determination of effect. A more detailed assessment for each of these species per the requirements of the ESA is found in our BA that was provided to the Services (see appendix I of this EIS); however, the assessment provided in this section of the EIS (i.e., 4.6.1) complies with the disclosure and assessment requirements of the NEPA.

TABLE 4.6.1-1

Federally Listed and Proposed Species Potentially Occurring in the Project Area

Species	Federal Status	State Status	Portion of the Project Area Where Species May Occur	Effect of Proposed Project on Species, Critical Habitat a/
Mammals				
gray wolf *Canis lupus*	Endangered – Critical Habitat	Delisted	Pacific Connector pipeline	NLAA, NE
Pacific marten (Coastal DPS b/) *Martes caurina*	Proposed Threatened	Sensitive	Jordan Cove terminal	NJ/LAA c/
Pacific fisher (West Coast DPS b/) *Pekania pennanti*	Proposed Threatened	Sensitive	Pacific Connector pipeline	NJ/LAA c/
blue whale *Balaenoptera musculus*	Endangered	Endangered	LNG carrier transit route in the waterway	LAA
fin whale *Balaenoptera physalus*	Endangered	Endangered	LNG carrier transit route in the waterway	LAA

TABLE 4.6.1-1 (continued)

Federally Listed and Proposed Species Potentially Occurring in the Project Area

Species	Federal Status	State Status	Portion of the Project Area Where Species May Occur	Effect of Proposed Project on Species, Critical Habitat a/
killer whale –Eastern North Pacific Southern Resident stock *Orcinus orca*	Endangered – Critical Habitat	No listing	LNG carrier transit route in the waterway	NLAA, NE, NLAA/NAM d/
humpback whale *Megaptera novaeangliae* (Central American and Mexican DPSs)	Endangered, and Threatened – Proposed Critical Habitat	Endangered	LNG carrier transit route in the waterway	LAA, NLAA/NAM d/
Sei whale *Balaenoptera borealis*	Endangered	Endangered	LNG carrier transit route in the waterway	NLAA
sperm whale *Physeter macrocephalus*	Endangered	Endangered	LNG carrier transit route in the waterway	NLAA
North Pacific right whale *Eubalaena glacialis*	Endangered – Critical Habitat	Endangered	LNG carrier transit route in the waterway	NLAA, NE
gray whale (Western North Pacific Stock) *Eschrichtius robustus*	Endangered	Endangered	LNG carrier transit route in the waterway	NLAA
Birds				
short-tailed albatross *Phoebastria albatraus*	Endangered	Endangered	LNG carrier transit route in the waterway	NLAA
Western snowy plover *Charadrius alexandrinus nivosus*	Threatened – Critical Habitat	Threatened	Jordan Cove terminal, navigation reliability improvements dredge area	NLAA, NLAA
marbled murrelet *Brachyrampus marmoratus*	Threatened – Critical Habitat	Threatened	LNG carrier transit route in the waterway, Pacific Connector pipeline	LAA, LAA
Northern spotted owl *Strix occidentalis caurina*	Threatened – Critical Habitat	Threatened	Pacific Connector pipeline	LAA, LAA
Fishes				
North American green sturgeon (Southern DPS) *Acipenser medirostris*	Threatened – Critical Habitat	Sensitive Critical	Waterways in area of LNG carrier transit route Bay area of Jordan Cove terminal Estuarine crossings of Pacific Connector pipeline	LAA, LAA
Coho salmon (South OR/North CA Coast ESU) *Oncorhynchus kisutch*	Threatened – Critical Habitat	Sensitive	Waterways in area of LNG carrier transit route Stream crossings of Pacific Connector pipeline	LAA, LAA
Eulachon (Southern DPS) *Thaleichthys pacificus*	Threatened– Critical Habitat	No listing	Waterways in area of LNG carrier transit route Bay area of Jordan Cove terminal Estuarine crossings of Pacific Connector pipeline	LAA, NE
Coho salmon (Oregon Coast ESU) *Oncorhynchus kisutch*	Threatened – Critical Habitat	Sensitive	Waterways in the area of LNG carrier transit route Bay area of Jordan Cove terminal Estuarian and stream crossings of Pacific Connector pipeline	LAA, LAA
Lost River sucker *Deltistes luxatus*	Endangered – Critical Habitat	Endangered	Stream crossings of Pacific Connector pipeline	LAA, NLAA
shortnose sucker *Chasmistes brevirostris*	Endangered – Critical Habitat	Endangered	Stream crossings of Pacific Connector pipeline	LAA, NLAA
Amphibians and Reptiles				
green turtle *Chelonia mydas*	Threatened – Critical Habitat	Endangered	LNG carrier transit route in the waterway	NLAA, NE

TABLE 4.6.1-1 (continued)

Federally Listed and Proposed Species Potentially Occurring in the Project Area

Species	Federal Status	State Status	Portion of the Project Area Where Species May Occur	Effect of Proposed Project on Species, Critical Habitat a/
leatherback turtle *Dermochelys coriacea*	Endangered – Critical Habitat	Endangered	LNG carrier transit route in the waterway	NLAA, NLAA
Olive Ridley turtle *Lepidochelys olivacea*	Threatened	Threatened	LNG carrier transit route in the waterway	NLAA
loggerhead turtle *Caretta caretta*	Endangered	Threatened	LNG carrier transit route in the waterway	NLAA
Oregon spotted frog *Rana pretiosa*	Threatened –Critical Habitat	Sensitive Critical	Pacific Connector pipeline	NLAA, NLAA
Invertebrates				
vernal pool fairy shrimp *Branchinecta lynchi*	Threatened – Critical Habitat	No listing	Pacific Connector pipeline	LAA, NLAA
Franklin's bumble bee *Bombus franklini*	Proposed Threatened	No listing	Pacific Connector pipeline	NJ/LAA c/
Plants				
Applegate's milk-vetch *Astragalus applegatei*	Endangered	Endangered	Pacific Connector pipeline	LAA
Gentner's fritillary *Fritillaria gentneri*	Endangered	Endangered	Pacific Connector pipeline	LAA
Western lily *Lillium occidentale*	Endangered	Endangered	Jordan Cove terminal Pacific Connector pipeline	NLAA
large-flowered woolly meadowfoam *Limnanthes pumila* ssp. *grandiflora*	Endangered – Critical Habitat	Endangered	Pacific Connector pipeline	NLAA, NLAA
Cook's lomatium *Lomatium cookii*	Endangered – Critical Habitat	Endangered	Pacific Connector pipeline	NLAA, NLAA
Kincaid's lupine *Lupinus suphureus* var. *kincaidii*	Threatened – Critical Habitat	Threatened	Pacific Connector pipeline	LAA, NE
rough popcornflower *Plagiobothrys hirtus*	Endangered	Endangered	Pacific Connector pipeline	NLAA

a/ Effects Key:
NLAA = Not likely to adversely affect, LAA = Likely to adversely affect, NE = No effect, NJ = not likely to jeopardize the continued existence for proposed species, NAM = not adversely modify proposed critical habitat.
b/ DPS=Distinct Population Segment
c/ This represents a provisional effect determination for this ESA proposed species. This provisional effect determination would apply if the species becomes listed prior to the completion of consultaion on the Project.
d/ This represents a provisional effect determination for this ESA proposed critical habitat. This provisional effect determination would apply if the final rule is implemented as proposed prior to the completion of consultaion on the Project.

4.6.1.1 Mammals

Gray Wolf (Federal Endangered Species, State Delisted)

The federal ESA in Oregon protects gray wolves west of highways 395-78-95 (ODFW 2017e). Gray wolves were delisted from the Oregon ESA in 2015 (ODFW 2017f), but are protected as a special status game mammal. Wolves are habitat generalists that only require the presence of ungulate prey and absence of excessive human-caused mortality (FWS 2013c). Wolf pack territory size is a function of prey density and can range from 25 to 1,500 square miles (FWS 2013c). Both male and female wolves disperse, sometimes greater than 600 miles (FWS 2013c).

A radio-collared male (i.e., OR7) dispersing from a pack in northeastern Oregon has been documented in southwestern Oregon and northern California since 2011, including near the Project in Jackson, Douglas, and Klamath Counties (ODFW 2013b). In 2014, a female joined the male, and they produced their first litter that year consisting of three pups (ODFW 2014e). This was the first evidence of wolves breeding in the Oregon Cascades since the early twentieth century (ODFW 2014d). The den was located within the Rogue River National Forest, between Crater Lake and Mount McLoughlin (Young 2014), approximately 6 miles from the pipeline route. Additional pups were born in 2015, 2016, and 2017 (ODFW 2018b). The Area of Known Wolf Activity (AKWA) initially mapped by ODFW for OR7 in 2014 (ODFW 2014c) is crossed by the pipeline route. The AKWA for OR7 and the Rogue Pack has shifted in size and shape since 2014. As currently mapped, it is less than 5 miles from the pipeline route in Jackson and Klamath Counties. In 2018, the Rogue pack consisted of a minimum of six wolves and was considered a breeding pair (ODFW 2019b).

A second AKWA (Keno) was established in southwest Oregon in 2014 with limited evidence that three wolves inhabited an area approximately 280 square miles. ODFW recently removed the AKWA designation for the Keno wolves and is designating it as no longer active, but possibly used as a corridor for wolves moving between Oregon and California (ODFW 2018b). Approximately 2.48 miles of the pipeline route would pass through this area.

Several other radio-collared wolves dispersed from northeastern Oregon to southwest Oregon. One single male wolf (OR25) dispersed in 2015 and established an AKWA spanning northern Klamath County with portions in adjacent Jackson County and Lake County. A radio-collared female wolf (OR28) dispersed in late 2015 and was joined by a collared male (OR3) to establish the Silver Lake AKWA which coincided with the Silver Lake Wildlife Management Unit in western Lake County. The pair produced one pup in 2016 but the male was killed in 2016 (ODFW 2017g). In late 2018, wolves were discovered in the central portion of the Oregon Cascades. At least three wolves were using an area in the eastern Indigo Wildlife Management Unit of Lane and Douglas Counties (ODFW 2019b).

Given the occurrence of gray wolves in the areas affected by the Project, potential direct and indirect effects from construction and operation of the pipeline include the following:

- Construction-related noise. Construction would produce noise. Wolves appear most vulnerable to human disturbance in and around denning and rendezvous sites. However, no active denning sites are known within 1 mile of the pipeline.
- Locally concentrated human activities. Available evidence has shown that wolves subjected to increased vehicular traffic will avoid roads and will move pups if disturbed during denning. Wolves disturbed during winter indicated a physiological stress response to snowmobile stimuli. However, the closest documented den to the Project is more than six miles away. Additionally, disturbance during construction would be temporary.
- Increased risk of collision with construction vehicles along Project area roadways. Vehicles have killed a small number of wolves. However, overall, 80 percent of all wolf mortalities in the Northern Rocky Mountain population (which includes wolves in the Project area) are caused by humans but only 3 percent are due to accidental human interactions including vehicle collisions and capture mortality (FWS 2012a). The chance that a Project-related vehicle would kill or injure a gray wolf would be minimized through implementation of BMPs including speed restrictions.
- Habitat alteration. Construction would remove forested habitat that might be used by some species that are preyed upon by wolves. However, corridors created within forested

habitats are used for movement and foraging by big game species, which are prey for wolves.

Below is a determination of effects summary for this species and critical habitat.

The Project **may affect** the gray wolf because:

- dispersing and resident wolves have been documented recently near the Project area;
- the OR-7 wolf family den was near the pipeline route in 2014;
- construction noise could disturb wolves if present near the pipeline; and
- increased human presence associated with construction activities could affect wolf behavior and movements, including the chance of collisions with vehicles.

However, the Project is **not likely to adversely affect** the gray wolf because:

- human presence and noise generated during construction may be detected by wolves if present, but wolves have been shown to tolerate some human disturbance and could move away from Project-related disturbance to adjacent suitable habitats;
- the one known den in southwestern Oregon is at least six miles from the pipeline;
- trash would be removed on a daily basis and speed limits for construction vehicles would limit roadside carrion that otherwise could attract wolf to the Project and result in human-wolf conflict; and
- following construction, the restored and revegetated pipeline corridor is likely to increase habitat diversity and forage used by ungulates such as deer (Brusnyk and Westworth 1985; Forman 1995), which are prey for gray wolves.

No critical habitat has been designated or proposed for the gray wolf in Oregon.

Pacific Marten-Coastal DPS (Federal Proposed Threatened Species, State Sensitive Species)

On October 9, 2018, the FWS proposed to list the coastal DPS of Pacific marten *(Martes caurina)* as a threatened species under the ESA (83 FR 150576). The coastal marten is a mammal in the weasel family and is native to forests of coastal Oregon and coastal California. They occur primarily in older forests, although there is one remnant population occupying the coastal dune forest of central Oregon. Coastal marten historically ranged throughout coastal Oregon and coastal northern California but have not recently been detected throughout much of the historical range, despite extensive surveys. The species exists in four small populations and is absent from the northern and southern ends of its historical range. In Oregon, there are two identified isolated small extant population areas: central coastal and southern coastal. The Jordan Cove LNG Project falls within the southern portion of the central coastal Oregon extant population area, and the Pacific Connector pipeline crosses the Pacific marten historical range.

The central coastal Oregon population centers on the coastal forest of the Oregon Dunes National Recreation Area (ODNRA) and is managed by the Siuslaw National Forest, with verified detections on the BLM-managed North Spit. Most of this area comprises coastal forest that is less than 70 years old, and consists of shore pine and transitional shore pine/Douglas–fir–hemlock forests within the ODNRA. These forests grow on nutrient-poor sandy soils, dominated by young stands of shore pine and Sitka spruce. The dense understory is dominated by willow (*Salix* *hookeri*), Pacific waxmyrtle (*Myrica californica*), and berry-producing ericaceous shrubs such as evergreen huckleberry (*Vaccinium ovatum*) and salal (G*aultheria shallon*). These shore pine forests have a variable tree overstory; however, the common denominator with this habitat and older forest habitats is the presence of dense, spatially extensive ericaceous shrub understories and diverse and abundant prey.

Coastal martens have a generalist diet that changes seasonally with prey availability. Overall, their diet is dominated by mammals (primarily voles in central coastal Oregon extant population area), but birds, insects, and fruits are seasonally important. Martens rest and den in locations that protect them from predation and weather elements, including large logs, cavities in snags, chambers, and broken tops. Coastal martens that occupy dune habitat in Oregon use rest structures that include squirrel nests in trees (most commonly), bare branches, and basal hollows from old overturned trees (FWS 2018a). The most common den structures used by martens are large diameter live and dead trees with cavities (Thompson et al. 2012).

Reports by Zielinski et al. (2001) and Moriarty et al. (2016) noted a relatively high incidence of road kills in the last 30 years (i.e., 17) and it was assumed that animals were abundant. Linnell et al. (2018) used recent surveys to refine the extent of the central coastal Oregon population size of fewer than 87 adults divided into two subpopulations; however, there is no information at this time on long–term trends in population size. FWS (2018a) further divides this population into two subpopulations of approximately 30 adults each, separated by the Umpqua River, a relatively large barrier to movement and dispersal. Martens in this population occur in the highest densities reported for any North American marten subspecies (1.13 per square kilometer; Linnell et al. 2018). The southern coastal Oregon extant population area is located over 40 miles to the south and would not be affected by the Project.

Threats to coastal marten include loss of habitat due to wildfire, timber harvest, and vegetation management (FWS 2018a). Trapping, collisions with vehicles, and rodenticides are all impacting marten individuals, and the threat of disease carries the risk of further reducing populations. Changes in vegetation composition and distribution have also made coastal martens more susceptible to predation from larger carnivores. These threats are expected to be exacerbated by the species' small and isolated populations. Linnell et al. (2018) suggest that small population size, consistent annual human-caused mortality (primarily trapping and road kills), and isolation indicate this coastal marten population is likely to remain vulnerable to extirpation.

Section 4.4 describes five forested and two woodland vegetation types that may be suitable habitat for marten and would be affected by the construction and operation of the Jordan Cove LNG Project. The vegetation types are shown on figures 4.4-1a and 4.4-1b. Table 4.4.1.5-1 estimates that approximately 76 acres and 62 acres of forested and woodland vegetation would be cleared for the LNG facilities and temporary construction areas, respectively.

Wildlife surveys of the LNG Project area did not document marten, including four track plate stations placed in forested areas at the Project from September 2005 to April 2006 (LBJ 2006; SHN 2013b). Although there are no known occurrences of marten in the Jordan Cove LNG Project area (ORBIC 2017b), marten have been documented on the North Spit (BLM 2005), indicating there is some potential for martens to occur within the LNG Project area. Given that the LNG Project falls within the southern portion of the central coastal Oregon extant population area and coastal dune forest habitat would be removed, potential direct and indirect effects from construction and operation of the Project include construction-related noise, vehicle-related mortality, locally concentrated human activities, and habitat removal:

- Construction-related noise. Construction of the Jordan Cove LNG Project could disturb marten if present. Similar to other wildlife responses to noise, marten exposed to Project-related noise may move out of the affected area and experience displacement. If adjacent marten habitats are at carrying capacity, displaced individuals would cause increased competition for resources, increased susceptibility to predation, or promote disease that may be facilitated by crowding. Martens appear most vulnerable to human disturbance in and around denning and resting habitat. No active denning sites are currently known in the vicinity of the Project.
- Vehicle-Related Mortality. Martens are subject to road kills, and increased vehicular traffic has the potential to increase vehicle collision mortality. The LNG facility construction work force would use public roads and highways, which would increase traffic and increase the likelihood of vehicle-related mortality for marten. However, the majority of this traffic along U.S. Highway 101 would occur south of the Project, outside the central coastal Oregon extant population area.
- Locally concentrated human activities. Increased human presence during LNG Project construction could lead to increased predator presence (e.g., coyote) due to garbage being identified as a potential food source.
- Habitat loss. FWS (2018a) has identified known marten use between the Trans-Pacific Parkway and Horsfall Beach Road, indicating that marten individuals could use the forest habitat proposed for disturbance at the LNG facility. A total of 138 acres of forest and woodland habitat would be removed within the approximately 100,000-acre (403 km^2) population area. FWS (2018a) identifies habitat loss and fragmentation as likely causes of marten population declines and continued low population levels. Construction would remove forested habitat that might be used by martens for resting habitat during foraging events, would reduce available habitat for prey species, and otherwise increase fragmentation within suitable habitat. Due to their relatively high energy demand, marten are particularly sensitive to habitat loss and degradation which may increase travel distances to avoid openings when traveling between suitable habitats (FWS 2018a).

During Project construction, trash would be removed daily to reduce the potential for attracting predator species to the area, and speed would be limited to 15 miles per hour (mph) for non-earthmoving equipment on the site in active construction areas to ensure personnel safety and reduce emissions which would reduce the potential for vehicle collisions. Speed would only be limited by the safe travel speed of the haul road and equipment for earth-moving operations.

We received comments from the Forest Service regarding the potential for soil vibrations resulting from vibratory pile driving to adversely affect wildlife species, including the marten; however, potential soil vibrations resulting from pile driving would only affect wildlife located in direct proximity (within 300 feet) of pile driving (see section 4.5), if not already displaced by noise and/or habitat loss associated with construction as described above.

Jordan Cove has also proposed[151] to mitigate for upland habitat values lost to the construction of the LNG terminal and related facilities through the Panhandle site, which is an approximately 133-acre parcel north of Trans-Pacific Parkway that is part of a larger natural area that extends north into the ODNRA. It contains coastal dune forest, herbaceous, shrub, unvegetated sand, wetlands, and open water habitat types; it is in proximity to the central coastal Oregon population and contains habitat important to coastal marten. Activities associated with ecological uplift at the Panhandle site (see section 4.5) could disturb or displace marten. If heavy equipment is needed for the weed removal, marten could be displaced temporarily due to noise, and/or permanently due to habitat modification, especially considering European beachgrass stabilized historic sand dunes that now provide habitat for the marten at the ODNRA. However, the proposed ecological uplift is anticipated to improve habitat quality for marten overall and in the long term. Additionally, because the site is only accessible via a sand trail, uplift actions would most likely need to be accomplished by hand rather than by mechanical means. Standard measures to avoid or minimize effects on wildlife, such as those presented in the *Comprehensive Mitigation Plan*, would also apply to actions taken at this mitigation site.

Below is a determination of effects summary for coastal DPS of Pacific marten. No critical habitat has been proposed for this species.

The Project **may affect** the coastal DPS of Pacific marten because:

- martens have been documented within the southern portion of the central coastal Oregon extant population area, which overlaps with the LNG Project area;
- increased human presence associated with construction activities could affect marten behavior and movements, including the chance of collisions with vehicles; and
- the Project would remove potentially suitable habitat for the central coastal Oregon population.

If FWS lists the coastal DPS of Pacific marten prior to completion of the Project, the provisional determination **may affect, likely to adversely affect** would be warranted because:

- forest and woodland habitat potentially suitable for the central coastal Oregon population of marten would be removed during construction of the LNG terminal, resulting in habitat loss and fragmentation that could affect marten predator elusion and avoidance, foraging, reproduction, and ability to fight off disease and infection; and
- construction of the Jordan Cove LNG Project could disturb marten if present.

Because the coastal DPS of Pacific marten are proposed for listing, the Project **would not likely jeopardize the continued existence** of the coastal DPS of Pacific marten for the following reasons:

- increases in traffic from the LNG facility construction workforce would be temporary, limited to the anticipated five-year duration of LNG terminal construction, and would occur primarily south of the Project, outside the central coastal Oregon extant population area; and

[151] Proposed in the *Comprehensive Mitigation Plan* as *Attachment 27- Terminal Upland Mitigation Plan* filed with FERC on August 30, 2019

- the habitat that would be removed during construction of the LNG facility is at the southern edge of the central coastal Oregon extant population area, where marten movements are already constrained by Coos Bay and the habitat is currently affected by proximity to industrial activity in the Jordan Cove area of Coos Bay south of the Trans-Pacific Parkway.

Pacific Fisher-West Coast DPS (Federal Proposed Threatened Species, State Sensitive-Critical Species)

The FWS proposed to list the West Coast DPS of the Pacific fisher as threatened under the ESA on October 7, 2014 (79 FR 60419). In April 2016, the FWS determined that the fisher does not warrant listing under the ESA (81 FR 22710). However, on September 21, 2018, the decision to deny the fisher protected status was rescinded and the comment period for the proposed rule to list the West Coast DPS of the fisher was reopened (84 FR 644). The FWS is scheduled to issue a new finding by September 21, 2019 (84 FR 644).

Fishers occur in the northern coniferous and mixed forests of Canada and the northern United States (69 FR 18770). The West Coast DPS includes fishers in Washington, Oregon, and California. In Oregon, this species is currently known to occur in Curry, Douglas, Jackson, Josephine, and Klamath Counties (Aubry and Lewis 2003; Aubry pers. comm. 2007 as cited in FWS 2014b). Currently, there are two documented populations of fisher in southern Oregon, one in the northern Siskiyou Mountains and one in the southern Cascade Range, that were believed to be genetically isolated from each other (FWS 2014b). However, recent research shows that the two populations may be connected by a dispersing fisher (Barry et al. 2018; FWS 2014b).

Fisher habitat consists of mature, closed canopy coniferous and mixed conifer and hardwood forests at low to middle elevations, including riparian corridors with continuous canopies, and large stands with low levels of fragmentation and a high percentage of dead and downed timber (ODFW 2019c; FWS 2016a). Fishers prefer large tracts of contiguous interior forest and typically avoid thinned or open forests, including areas where there is substantial human disturbance. A variety of large conifer tree species are used for denning and resting, including Douglas-fir, white fir, incense cedar, red fir, sugar pine, western white pine, ponderosa pine and lodgepole pine (Aubry and Raley 2006; Cummins et al. 2018). In the southern Oregon Cascades, average home range sizes for females were approximately 9.7 square miles and between 24 square miles for males during the non-breeding season and 57 square miles for males during the breeding season, based on locations of radio telemetered study animals (Aubry and Raley 2006).

Loss and fragmentation of habitat due to timber harvest and thinning, roads, urban development, recreation, and wildfire are the main reasons for the decline of the fisher in the west, along with exposure to rodenticides (FWS 2012b, 2018b). Habitat loss, modification, and fragmentation continue to occur as a result of forest management practices and stand replacing wildfire, and appear to pose a substantial threat to fishers (FWS 2012b). In addition to removing forage, rest, and den sites, fragmentation can increase predation risk, impede movements, and affect prey species composition, abundance, and availability (FWS 2012b). Fragmentation can also increase energetic costs to fishers, which may result in nutritional stress that can reduce animal condition, ultimately affecting survival, reproduction, and recruitment (Lofroth et al. 2010). Additionally, linear infrastructure such as roads, power lines, and pipelines can also affect fisher populations and their habitat (FWS 2016a). As well as being sources of mortality from vehicle collision, these linear infrastructure features can result in permanent removal or alteration of potential fisher habitat and can disrupt movement patterns (FWS 2016a). However, linear infrastructure is considered to be a low-level impact on fishers currently and in the future (FWS 2016a).

Recent telemetry studies in the southern Oregon Cascades identified fisher home ranges that overlap with the Project on the Winema National Forest (Cummins 2018). Location databases show one observation within 1 mile and one observation within 1 to 3 miles of the Project on the Winema National Forest. These observations, together with the availability of suitable habitat within the pipeline right-of-way, indicate that there is potential for fishers to be present within the analysis area.

Section 4.5 discusses the various wildlife habitat types (from Johnson and O'Neil 2001) crossed by the Project. Late successional and old-growth forest within six forest and woodland habitat types crossed by the pipeline may provide habitat for the fisher. These habitat types include Westside Lowland Conifer-Hardwood Forest, Montane Mixed Conifer Forest, Southwest Oregon Mixed Conifer-Hardwood Forest, Ponderosa Pine Forest and Woodlands, Westside Oak and Dry Douglas-fir Forest and Woodlands, and Western Juniper and Mountain Mahogany Woodlands. Table 4.5.1.2-5 estimates that approximately 773 acres of these habitat types would be cleared for the construction of the pipeline.

Given the potential for occurrence of fishers in the areas affected by the Project, potential direct and indirect effects from construction and operation of the pipeline include the following:

- <u>Habitat removal during breeding season</u>. Fishers give birth from mid-March to early April, natal dens are used until late May or beginning of June, and maternal dens are used until late July-early August, when kits are 4 months old and mobile. Removal of habitat during the breeding season could result in the potential death of kits if natal or maternal den trees or snags are felled. However, timing restrictions for NSO and migratory birds would limit the potential for occupied den sites to be disturbed due to overlap in the habitats and areas used by these species and overlap in breeding seasons.
- <u>Construction-related noise and human activity</u>. Construction would produce noise and construction activities could affect fishers by disturbing animals. Fishers are sensitive to disturbance and avoid areas used by humans (CBD 2000). As described above, fishers are vulnerable to human disturbance and fishers have been documented within 1 mile of the pipeline. The response of fishers to Project-related noise and activity would likely be similar to their response to other anthropogenic activities such as recreation, hunting, and logging that already occur within the area. Seglund (1995) found that rest sites were frequently greater than 328 feet (100 meters) from human disturbance, including recent timber harvest, houses, campground, and roads, indicating that anthropogenic disturbance could result in fisher displacement; this behavior modification could then result in reduced fitness (Naney et al. 2012). Other activities such as traveling or foraging appeared to be less susceptible to disturbance as these activities were documented closer to human disturbance (Seglund 1995; Lofroth et al. 2011). Due to this species' mobility, it should be able to temporarily relocate to portions of its home range that would not experience noise above ambient during construction, although this displacement could have energetic costs. Timing restrictions for NSO and migratory birds would limit the potential for occupied den sites to be disturbed due to overlap in the habitats and areas used by these

species and overlap in breeding seasons. However, construction of the Project could disturb fishers using rest structures within the fisher analysis area.

- Locally concentrated human activities. Construction activities could affect fishers by disturbing animals.
- Increased risk of collision with construction vehicles along Project area roadways. Human-caused mortality from vehicle collisions are listed as one of the threats to fisher populations (FWS 2018b). During construction, there would be a slight increase in the number of vehicles traveling along public roadways in areas along the Pipeline Project and a slight increase in risk of vehicles colliding with fishers. However, the chance that a Project-related vehicle would kill or injure a fisher would be minimized through implementation of BMPs including speed restrictions (see Appendix B of the POD [appendix F.10 to this EIS]). During pipeline operation, there would be no measurable increase in traffic above existing traffic volumes in the area. Vehicle-related mortality of a fisher due to Project construction and operation is possible but traffic accessing the pipeline right-of-way on unpaved forest roads is not expected to increase the risk of mortality to fishers.
- Habitat alteration loss and fragmentation. Construction would remove forested habitat and would modify habitat, particularly by removing large trees, snags, and large woody debris that are used for fisher den and rest sites. The 773 acres of LSOG habitat removed or modified by Project construction would constitute 0.24 percent of available habitat within five miles of the Project, based on a review of Johnson and O'Neil (2001) habitat types, Gap Analysis Project data, aerial photographs, and LSOG coverage within five miles of the Project (BLM 2008a; ORNHIC and The Wetland Conservancy 2009; USGS 2011). Loss of structural elements negatively affects fisher reproduction and energy budgets (Lofroth et al. 2010). The cleared right-of-way could also fragment habitat, which is detrimental to fishers because they prefer large areas of contiguous, unfragmented forest (CBD 2000). Fragmentation can increase predation risk, impede population-level movements, and affect prey species composition, abundance, and availability (FWS 2012b). The cleared right-of-way also has the potential to act as a barrier to dispersal, similar to the barriers posed by U.S. Highway 140 and I-5. However, the pipeline is likely to be a porous or soft barrier because it would remain vegetated. Additionally, fishers have been documented crossing more extensive or hard barriers, including U.S. Highway 140 and I-5 (Barry et al. 2018; Cummins 2018).
- Wildland fire as an indirect effect associated with increased human presence. The possibility of ignition in conifer, hardwood, and sagebrush/grass fuel types could range from low to extreme depending on weather conditions and patterns, current fire risk rating, moisture conditions, and fuel loadings. There is some possibility of human-caused fire, whether related to pipeline activities or to Project-induced increase of human presence in the area.

Pacific Connector has proposed a Comprehensive Mitigation Plan that would fund off-site mitigation, including acquisition of late-successional and old growth forest, that would benefit fishers. Mitigation projects such as snag creation projects proposed by the Forest Service to meet LRMP objectives would also benefit fishers. Pacific Connector has also proposed projects on BLM land that may benefit fishers, such as fire suppression, road decommissioning, and silvicultural projects.

Below is a determination of effects summary for Pacific fisher-West Coast DPS. At this time, no critical habitat has been proposed or designated for this species. More details will be provided should this species become listed as threatened under the ESA, including potential exceptions and/or any designation of critical habitat.

The Project **may affect** the fisher because:

- individuals from the southern Oregon Cascades population may occur within the analysis area and could be disturbed by construction of the Pipeline Project; and
- suitable habitat is available within the analysis area and would be impacted by construction of the Pipeline Project.

If FWS lists the fisher prior to completion of the Project, the provisional determination **may affect, likely to adversely affect** would be warranted because:

- fishers likely occur within the Project area, and there is suitable habitat within the pipeline right-of-way;
- the Project would remove large trees and snags that could be fisher habitat during the time of construction as well as over the lifetime of the Project;
- habitat would be fragmented during Project construction, which would increase impacts on fishers; and
- noise, equipment, and vehicles could disturb or injure fisher if present.

Because fishers are proposed for listing, the Project **would not likely jeopardize the continued existence** of the fisher for the following reasons:

- LSOG habitat removed or modified by Project construction constitutes only 0.24 percent of available habitat within 5 miles of the pipeline;
- the cleared right-of-way is not expected to pose a barrier to dispersal because it would remain vegetated and be considered a porous or soft barrier, and likely be less severe than hard barriers that fisher have been documented crossing, such as U.S. Highway 140 and I-5; and
- observations of fishers within the analysis area have been limited, indicating few individuals would be disturbed by construction.

Whales

Eight species of federally listed whales potentially occur off the coast of Oregon, including the blue, fin, southern resident killer, humpback, sei, north Pacific right, gray (Western North Pacific Stock) and sperm whales. All of these whale species are federally protected under the MMPA. Baleen whales tend to feed during the summer in the northern latitudes and migrate to the tropical southern latitudes in the winter for breeding. Toothed whales (e.g., killer whales and sperm whales) are relatively rare visitors along the Oregon coast; however, whales could be encountered off the coast of Oregon throughout the year.

Potential effects to whales include increased risk of ship strike, exposure to underwater noise, effects of fuel spills, and effects to prey resources. We estimated the risk of ship strike to federally listed whale species based on each species' density, the length of the whale, the proportion of the time spent at the surface, the proportion of the year each species is present, and the anticipated vessel transits of the marine analysis area. Whale density estimates were based on habitat specific densities for blue whales, fin whales, and humpback whales (Becker et al. 2012; Calambokidis et al. 2015). These data indicate humpback whales have the greatest likelihood of occurrence in the marine analysis area of the federally listed whales, followed by blue whales and fin whales; the potential for ship strike to these species could not be ruled out. Quantified comparable estimates for other species were not available, but the existing data were examined to qualitatively determine the level of risk to these species. For southern resident killer, sei, sperm, north Pacific right, and Western North Pacific gray whales, the risk of ship strike is expected to remain discountable due to the low usage of the area by these species. These data sources and analyses are further described in our BA (appendix I of this EIS).

We received comments on the draft EIS regarding ship strike risk and effects to prey species of southern resident killer whale, as well as comments regarding gray whale occurrence near the Project; additional information on these species is provided below.

The southern resident killer whale DPS primarily occurs in the inland transboundary waters of British Columbia and Washington in the summer and fall and in outer coastal waters in winter and spring. The spring and winter habitat use (including Oregon waters) is not well defined, and therefore the threats associated with this time of year can only be generalized. Genetic stock identification analyses indicate that the main Chinook salmon stocks that southern resident killer whales target are from the relatively large drainages of Washington and California (Hanson 2015; Hanson *et al.* In prep, as cited in 84 FR 49216). Less is known of the diet composition during the winter and spring months, and research into this important life history component is continuing. Two killer whales were documented near the Project area in May 2017 during marine mammal surveys for the Project, although these were likely transient killer whales not belonging to the southern resident DPS (AECOM 2017). Available information indicates that killer whales are less susceptible to ship-strike than larger baleen whales, as carcasses indicating trauma and/or wounds from boat propellers have not been reported along the Oregon and Washington coasts (Norman et al. 2004). From 1995 to 2006, 10 killer whales were injured (eight) or killed (two) within the inland waterways of British Columbia (including L98; see Williams and O'Hara 2009) but none of the records were from whales struck in the open ocean. Due to the lack of data and habitat-based density estimates, it was not possible to quantify the risk of vessel strike to southern resident killer whales in the marine analysis area. However, qualitatively this risk is considered to be very low based on the apparently low use of the region by southern resident killer whales and the low rate at which these animals are struck in other open ocean parts of their eastern North Pacific range. It is worth noting that southern resident killer whales are known to successfully live in areas (e.g., Puget Sound) with extensive deep sea traffic with few ship strikes (Carretta et al. 2018).

Gray whales have been reported in Coos Bay only on an occasional basis. Although the eastern Pacific stock of gray whales (delisted) overlaps the western Pacific stock of gray whales (ESA-listed as Endangered), the likelihood of this stock occurring in the vicinity of Coos Bay is very low. The degree to which western gray whales occur in Oregon waters is uncertain; however, a few records do exist from the known spatial and temporal overlap with the eastern gray whale population (Weller et al. 2012). These records include six western North Pacific gray whales off Vancouver Island, two off California, 13 whales in San Ignacio Lagoon, Mexico, and three migrating from Russia to the west coast of North America (Weller et al. 2012; Lang et al. 2011; Urban et al. 2013; Mate et al. 2015). One whale, named "Flex," was confirmed within 11 nmi (20 km) of the central Oregon coast (Mate et al. 2011). Therefore, western North Pacific gray whales may occasionally occur in the marine analysis area, but the frequency of occurrence and duration of stay cannot be quantified. Conversely, the delisted eastern Pacific stock of gray whales, despite several years of unusal mortality events, are stable to increasing with recent abundance estimates of up to 26,960 animals (Carretta et al. 2018). Project effects on whales would be associated with LNG and construction supply vessel transits in the waterway inbound and outbound from the Jordan Cove terminal, as well as construction activities such as dredging and pile driving. Potential direct effects of the Project could include injury and/or mortality due to ship-strikes, injury or behavioral disturbance due to noise from vessels and construction activities, and potential adverse effects from a ship fuel spill. Spills could indirectly affect whales by harming or contaminating forage species.

Critical habitat for the humpback whale has been recently proposed that would overlap with the marine analysis area. On October 9, 2019, the NMFS proposed to designate critical habitat for the endangered Western North Pacific DPS, the endangered Central America DPS, and the threatened Mexico DPS of humpback whales. Areas proposed as critical habitat include specific marine areas located off the coasts of California, Oregon, Washington, and Alaska (84 FR 54354). Because it is believed that individuals from the Western North Pacific DPS do not occur along the coast of Oregon, only the Centrial American and Mexico DPSs are suspected to spend time along the Oregon coast. Critical Habitat Units 12 (Columbia River Area), 13 (Coastal Oregon), and a small portion of 14 (Southern Oregon/Northern California) make up the coastal region of Oregon that includes biologically important feeding areas (e.g., Columbia River, Stonewall and Heceta Bay) and specifically waters off Clatsop, Tillamook, Lincoln, Lane, Douglas, Coos, and Curry Counties between 50-meter shoreward out to the 1,200-meter isobath for Units 12 and 13, and the 2,000-meter isobath depth contours for Unit 14. The proposed Critical Habitat area's primary essential feature is prey (84 FR 54354). Humpback whales from each of the Central America and Mexico DPSs travel to U.S. coastal waters specifically to access energy-rich feeding areas. Although prey availability can vary from year to year, humpback whales consistently feed on euphausiid (krill) species and small pelagic fishes, such as northern anchovy, Pacific herring, Pacific sardine, and capelin. The potential factors that could negatively impact the essential prey feature and the ability of feeding areas to support the conservation of listed humpback whales in the North Pacific include climate change, direct harvest of the prey by fisheries, marine pollution, and underwater noise. Each of these threats could independently or in combination result in the need for special management or protections of the essential prey feature to ensure population growth and recovery of both the Central America and Mexico DPSs. Critical habitat had not been proposed for the Central American and Mexican humpback whale DPSs at the time the draft EIS was developed.

Critical habitat for the southern resident killer whale has been recently proposed that would overlap with the Project area. On September 19, 2019, NMFS proposed to revise the critical habitat designation for the southern resident killer whale DPS to include six new areas along the west coast of the United States (84 FR 49214). Coastal Area 3-Central/Southern Oregon Coast Area extends from Cape Meares south to the Oregon/California border which includes waters off Tillamook, Lincoln, Lane, Douglas, Coos, and Curry Counties between 6.1-meter and 200-meter isobath depth contours. This proposed Critical Habitat area's primary essential feature is passage, or "passage conditions to allow for migration, resting, and foraging" (84 FR 49214). The proposed expanded critical habitat of the southern resident killer whale DPS had not been proposed at the time the draft EIS was developed.[152]

Below is a determination of effects summary for whales and critical habitat.

The Project **may affect** federally listed whales because:

- federally listed whales occur within the aquatic analysis areas (figure 4.5-1 in section 4.5; includes the Coos Bay estuary and marine environment out approximately 12 nautical miles to the outer continental shelf);
- vibratory sheet pile driving has the potential to exceed the NMFS interim behavioral disturbance threshold of 120 decibel (dB) re 1 microPascal (µPa) at distances of up to 1.2 miles (Deveau and MacGillvray 2017) and impact pipe pile driving has the potential to exceed the NMFS interim behavioral disturbance threshold of 160 dB re 1 µPa at 1.1 miles (O'Neill and MacGillvray 2017); and
- the proposed action would increase shipping traffic (LNG carriers) within the aquatic analysis areas.

However, the Project is **not likely to adversely affect** federally listed southern resident killer whales, sei whales, sperm whales, north Pacific right whales, or gray whales (Western North Pacific Stock) for the following reasons:

- The increase in annual ship traffic due to the Project is expected to result in a localized potential increase of the risk of ship strike to whales; however, the risk of ship strike is expected to remain discountable due to the low usage of the area by southern resident killer, sei, sperm, north Pacific right, and Western North Pacific gray whales.
- Although unlikely, should any whale enter the the bay during pile driving, activities would be stopped until the whales have moved through the agreed upon buffer outlined in the recommended *Marine Mammal Monitoring Plan.*
- LNG carrier noise would contribute to overall noise within the marine analysis area while carriers are transiting to and from the LNG terminal, and effects of ship noise on whales could exceed NMFS interim noise exposure criteria for Level B single non-pulse noise; however, they are not expected to affect southern resident killer, sei, sperm, north Pacific right, or north Pacific gray whales due to their low usage of the area.
- Killer whales are transient through the marine analysis area and the marine analysis area is not recognized as a regularly used area.
- Killer whales primarily target salmonids from larger river systems other than those affected by the Project (e.g., Columbia River basin, Taku River to the north, and Central Valley, California to the south); no substantial change in the quantity or quality of prey species that may occur within the marine analysis area is expected as a result of the Project (see section 4.5.2).

[152] On February 24, 2015, NMFS published a 12-month finding (80 FR 9682) stating the intention to move forward with a proposed rule to designate critical habitat in coastal waters. A proposed rule was expected to be published in 2017; the revised timeline is to publish a proposed rule in September 2019 and a final rule in 2020.

- Given vessel design, on-board spill kits, safety records, and implementation of Coast Guard recommendations, it is not likely that there would be a major ship spill of hazardous materials that may adversely affect water quality or aquatic species.
- The relative population density of these whales within the marine analysis area[153] would be low enough so that Project-related effects of LNG carrier transit in the waterway would be discountable.

The Project is **likely to adversely affect** blue whales, fin whales, and humpback whales because:

- the increase in annual ship traffic due to the proposed action is expected to result in a localized increase of the risk of ship strikes, which baleen whales are more affected by;
- based on acoustic analysis, LNG carrier noise would contribute to overall noise within the marine analysis area while transiting to and from Coos Bay and effects of ship noise on whales could exceed NMFS interim noise exposure criteria for Level B single non-pulse noise; and
- blue whales, fin whales, and humpback whales are known to utilize the waters off the Oregon coast.

No critical habitat has been designated or proposed for blue, fin, sei, or sperm whales.

The Project would have **no effect** on designated critical habitat for the North Pacific right whale because:

- none of the designated critical habitat occurs within the marine analysis area off the Oregon coast.

Because critical habitat for humpback whale DPSs is proposed, the Project would **not adversely modify** the proposed critical habitat for the following reasons:

- The Central America and Mexico DPS humpback whales would travel through the marine analysis area on their way to high use feeding areas. However, the essential feature is prey and the highest documented use areas are generally north of the proposed Project.
- Humpback whales target krill and smaller fish such as Pacific sardine seasonally in documented high use areas (e.g., Columbia River, Stonewall, and Heceta Bay). However, known activities associated with the proposed Project would not substantially change the quantity or quality of prey species that may occur within the marine analysis area.

Additionally, the Project would adhere to the MMPA and all conservation measures and requirements outlined in the *Marine Mammal Monitoring Plan*, BO, and Incidental Harassment Authorization (IHA). If NOAA Fisheries designates Critical Habitat for the three humpback whale DPSs, as proposed, a **may affect, not likely to adversely affect** determination would be warranted based on the above reasoning.

[153] Whale density estimates were based on habitat specific densities for blue whales, fin whales, and humpback whales (Becker et al. 2012; Calambokidis et al. 2015). Quantified comparable estimates for other species were not available, but the existing data were examined to qualitatively determine the level of risk to these species. These data sources and analyses are further described in our BA (appendix I of this EIS).

Because critical habitat for the southern resident killer whale DPS is proposed, the Project would **not adversely modify** the proposed critical habitat for the following reasons:

- The essential feature for the Coastal Area 3-Central/Southern Oregon Coast proposed critical habitat area, extending from Cape Meares south to the Oregon/California border, is identified as passage only.
- Killer whales are transient through the the marine analysis area is not recognized as a regularly used area or known to be used as a high prey area.
- Killer whales primarily target salmonids from larger river systems other than those affected by the Project (e.g., Columbia River basin, Taku River to the north, and Central Valley, California to the south); no substantial change in the quantity or quality of prey species that may occur within the marine analysis area is expected as a result of the Project (see section 4.5.2).
- LNG carrier noise would contribute to overall noise within the marine analysis area while carriers are transiting to and from the LNG terminal; however, they are not expected to affect southern resident killer whale passage due to low southern resident killer whale usage of the area.
- The Project would adhere to the MMPA and all conservation measures and requirements outlined in the *Marine Mammal Monitoring Plan*, BO, and IHA.

If NMFS designates the Coastal Area 3-Central/Southern Oregon as critical habitat for the southern resident killer whale DPS, a **may affect, not likely to adversely affect** determination would be warranted based on the above reasoning.

The Project would have **no effect** on designated critical habitat units (CHUs) for the Eastern Northern Pacific Southern Resident stock of killer whales because:

- none of the designated CHUs occur within the marine analysis area off the Oregon coast.

As described above, listed whales inside Coos Bay near the Jordan Cove LNG Project may be affected by noise from pile driving during construction, and the use of an impact hammer has impulsive peak source levels that are high enough to cause PTS (an indicator of hearing damage) in these species. Therefore, **we recommend that:**

- **<u>Prior to construction,</u> Jordan Cove should file with the Secretary, for review and written approval by the Director of OEP, a *Marine Mammal Monitoring Plan* that identifies how the presence of listed whales will be determined during construction, and measures Jordan Cove will take to reduce potential noise effects on whales and other marine mammals, and ensure compliance with NMFS underwater noise criteria for the protection of listed whales.**

4.6.1.2 Birds

Short-tailed Albatross (Federal Endangered Species, State Endangered Species)

The short-tailed albatross was listed as endangered throughout its range in the United States on July 31, 2000 (FWS 2000a). In the North Pacific, the coastal habitat for the short-tailed albatross is in high-productivity areas with expansive deep water beyond the continental shelf. Short-tailed albatross rarely occur closer to the coast, but have been documented to occur off the Oregon coast near Coos Bay (in 1961, 2000, and 2001; National Audubon Society 2013). Because the closest breeding population of short-tailed albatross is within the Hawaiian Islands, the Project should not affect recovery criteria for the species. The short-tailed albatross could potentially be encountered within the LNG carrier transit route; however, short-tailed albatross are expected to avoid LNG marine traffic. Below is a determination of effects summary for the short-tailed albatross and critical habitat.

The Project **may affect** short-tailed albatross because:

- short-tailed albatross may occur within the marine analysis area during operation of the proposed action; and
- the proposed action would increase shipping traffic (LNG carriers) within the marine analysis area.

However, the Project is **not likely to adversely affect** short-tailed albatross for the following reasons:

- other species of albatross have infrequently collided with airplanes in flight but collisions of any albatross species with ships are unknown and are expected to be highly unlikely; and
- an increase of 120 LNG carrier trips per year to the LNG terminal is not expected to cause a measurable increase in potential ship strikes on short-tailed albatrosses.

No critical habitat has been designated or proposed for the short-tailed albatross.

Western Snowy Plover (coastal) (Federal Threatened Species with Critical Habitat, State Threatened Species)

The Pacific Coast population of western snowy plover has been listed as a threatened species under the ESA since March 5, 1993 (FWS 1993a). The Pacific coast population includes birds that nest adjacent to tidal waters, including all nesting birds on the mainland coast, peninsulas, offshore islands, adjacent bays, estuaries, and coastal rivers (FWS 1993a). The western snowy plover is a year-round, uncommon resident of the North Spit (BLM 2005); the spit supports the most productive snowy plover population segment on the Oregon coast (BLM 2008b). Western snowy plovers may be encountered along the LNG carrier transit route from nearshore coastal waters to the LNG terminal. Potential effects include increased noise associated with construction of the Jordan Cove LNG Project, operation activities associated with shipping, increased recreation, increased habitat conversion, habitat degradation by human encroachment, and increased illegal harvest (Comer 1982).

As proposed by the Applicant, construction noise during pile driving at the Jordan Cove LNG Terminal would exceed ambient levels at nesting habitat (as close as approximately 1 mile from the terminal), and nesting plovers could experience sound levels up to 75 dBA, which is 20 dB above ambient (55 dBA; see section 4.12 of this EIS). However, we are recommending that noise-related mitigation be implemented, which would reduce these noise effects; considering this mitigation, noise at western snowy plover nesting habitat is not anticipated to exceed 65 dBA (see section 4.12 of this EIS for more details). FWS has not identified specific noise thresholds for disturbance and disruption of western snowy plover (PC Trask 2019); however, for other birds, FWS determined that detection occurs at around 4 dB above ambient noise levels and harassment occurs at 20-25 dB above ambient or when the total sound level (project and ambient noise levels combined) exceeds 90 dB (FWS 2003c, 2006c).

Conservation measures proposed to reduce overall effects to snowy plover include implementation of BMPs, and education and outreach. Jordan Cove would also work with the applicable agencies to assist with ongoing management activities and recreation use restrictions on the North Spit; management activities may include fencing, signage, application of shell hash, tree removal, beach grass elimination, and maintenance.

We received comments on the draft EIS that the Project would result in an increase in recreation on the North Spit, and that this increase would negatively affect nesting snowy plover. We considered this potential activity and determined that it would not result in an adverse effect to snowy plovers because effects from increases in recreation, if any, would be minimized through the proposed education of construction and operations employees on recreational use restrictions. We also received comments from the Forest Service regarding the potential for soil vibrations resulting from vibratory pile driving to adversely affect snowy plovers; however, vibrations from pile driving would not be detectable within western snowy plover nesting habitat.

CHUs OR-10 and OR-9 are located 2.6 and 6.9 miles from the LNG terminal, respectively; both units were occupied by western snowy plovers at the time of listing (1993) and in 2018 (Lauten et al. 2018). Noise from pile driving at the LNG Terminal could result in noise levels up to 60 dBA within western snowy plover critical habitat at CHU OR-10 (see figure 4.12-3 in section 4.12). However, we are recommending that noise-related mitigation be implemented, which would reduce these noise effects (see section 4.12 of this EIS). Considering this mitigation, noise at CHU OR-10 is not anticipated to exceed 55 dBA (i.e., ambient; see figure 4.12-4 in section 4.12).

Below is a determination of effects summary for the western snowy plover and critical habitat.

The Project **may affect** western snowy plovers because:

- the closest western snowy plover nesting habitat to the Project is on the North Spit approximately 1 mile from LNG terminal site, and contained active nests during 2018 surveys (Lauten et al. 2018);
- temporary construction activities would occur at the Port Laydown site, which is less than 1 mile from known nesting sites;
- the meteorological station is located east of the foredune, approximately 100 feet from the northern extent of known nesting sites;
- impact hammer noise associated with the marine waterway modifications temporary facilities is expected to be above ambient levels, and may disturb wintering western snowy plovers if present along the eastern edge of the primary nesting area on the North Spit, which is within 0.25 miles of Dredge Area 1; and
- Jordan Cove terminal construction and operations personnel would likely use the North Spit for recreational purposes and increased recreational use could result in increased plover disturbance including destruction of nests by dogs, off-road vehicle traffic, inadvertent trampling, or increased predation if scavengers and predators (corvids, coyotes, striped skunk, feral cats) are attracted to nesting areas due to the presence of trash and food remains.

However, the Project is **not likely to adversely affect** western snowy plover because:

- Jordan Cove LNG Project construction noise at nesting habitat as close as approximately 1 mile away is not expected to result in harassment of nesting plovers (see section 4.12 of this EIS).
- Dredging operations would take place within the ODFW in-water work window (i.e., October 1 through February 15), which is outside of the nesting period for western snowy plovers (i.e., March 15 through September 15) and the dredging noise level is unlikely to affect wintering plovers because they are located approximately 0.25 mile away at their closest location to the dredging. Access to dredging areas would be by marine transport with no land-based access near primary snowy plover habitat.
- The meteorological station proposed east of the foredune on the North Spit, approximately 100 feet from the northern extent of nesting habitat, would be constructed outside the nesting season (March 15 to September 15) to avoid disturbance to snowy plovers and would include spikes or other deterrent measures on any potential perching surface, bird deterrent measures if guy-lines are required, and shielded security lighting to reduce glare. Operational activities would be maintenance-related and would be scheduled outside of the nesting season.
- Jordan Cove would reduce disturbance by humans, pets, vehicles or human-attracted predators through implementation of (1) BMPs to reduce predator density related to increased human presence and habitat removal, and (2) education and outreach programs intended to train all construction and operations staff on the need for snowy plover conservation; current snowy plover regulations and recreational use restrictions; and the importance of conservation measures, including: litter control, avoidance of nesting and foraging areas, keeping pets on-leash, and remaining on established roads and trails.

Even though the northern end of CHU OR-10 on the North Spit is located approximately 2.6 miles from the Jordan Cove LNG Project, the Project **may affect** designated critical habitat for the western snowy plover because:

- temporary construction activities would occur at the Port Laydown site, which is approximately 1 mile from critical habitat;
- the marine waterway modifications Dredge Area 1 is approximately 0.25 mile from critical habitat; and
- the Project would result in a large but temporary increase in people employed on the North Spit during construction, and a much smaller long-term increase of operations staff. The additional human presence could increase use of the North Spit with concomitant potential increase of pets, vehicles, and/or human-attracted predators.

However, the Project is **not likely to adversely affect** designated critical habitat for the western snowy plover because:

- dredging noise level is unlikely to affect physical or biological features (PBF) at CHU OR-10 approximately 0.25 miles away;
- pile-driving noise level is unlikely to affect PBF at CHU OR-10 approximately 2.6 miles away; and

- Jordan Cove would reduce potential secondary effects on the critical habitat PBF that identifies disturbance by humans, pets, vehicles or human-attracted predators through implementation of (1) BMPs to reduce predator density related to increased human presence and habitat removal, and (2) education and outreach programs intended to train all construction and operations staff on the need for snowy plover conservation; current snowy plover regulations and recreational use restrictions; and the importance of conservation measures, including: litter control, avoidance of nesting and foraging areas, keeping pets on leash, and remaining on established roads and trails.

Marbled Murrelet (Federal Threatened Species with Critical Habitat, State Threatened Species)

MAMUs in Washington, Oregon, and California were listed as threatened under the ESA on October 1, 1992 (FWS 1992a). Critical habitat for the MAMU was first designated on May 24, 1996 (FWS 1996) and subsequently revised in 2011 (FWS 2011b, 2016b). Throughout the forested portion of their range, MAMU habitat use is positively associated with the presence and abundance of mature and old-growth forests, large core areas of old-growth, low amounts of edge and fragmentation, proximity to the marine environment, and increasing forest age and height, although the presence of platforms is the most important characteristic of nesting habitat (FWS 2006d).

Through a combination of GIS data provided by the BLM and private timber companies, and field surveys conducted between 2007 and 2018, Pacific Connector identified 175 occupied and presumed occupied MAMU stands within 0.25 mile of the proposed action, or within 0.5 mile of federally-designated critical habitat that would be affected by the proposed action.

Construction of the Project would remove a total of about 806 acres of MAMU habitat (suitable, recruitment, capable; FWS 1996, 2014c; BLM 1995a, 1995b)[154], including about 78 acres of suitable habitat removed from 37 stands (18 occupied MAMU stands and 19 presumed occupied stands). There is the potential that effects could extend over a total of about 7,145 acres of suitable nesting habitat in the terrestrial nesting analysis area (i.e., the extent of disturbance/disruption of MAMU during the breeding season; FWS 2014c), where Project-related noise, primarily use of access roads, may affect MAMU behavior, including breeding activities. HDD and DP activities are not anticipated to disturb nesting MAMU as noise associated with this work would attenuate to ambient levels before reaching MAMU stands. Ten occupied and 24 presumed occupied MAMU stands occur within CHU OR-06 (b, c, and d) within the proposed terrestrial nesting analysis area. Overall, construction of the Pacific Connector Pipeline Project would remove about 4 acres of suitable MAMU nesting habitat (PBF-1) and about 12 acres of recruitment habitat and 15 acres of capable habitat, as defined above (both of which make up PBF-2) within CHU OR-06-d.

Because MAMUs dive to forage, MAMUs that forage offshore and/or within Coos Bay could be directly affected by underwater noise generated during construction of the LNG Project and noise generated by LNG carriers transiting the marine analysis area and estuary. Underwater noise

[154] Suitable habitat includes coniferous forest that provides structures, or may provide structures and/or a forested buffer necessary for nesting MAMUs, and generally consist of late seral forest; recruitment habitat is coniferous forested stands greater than 60 years of age that do not provide suitable nesting structures for MAMUs and could become suitable habitat within 25 years; and capable habitat is coniferous forested stands from 0 to 60 years of age that could become suitable habitat.

harassment or potential injury to MAMU could occur from pile driving associated with in-water temporary piles within the estuarine analysis area. However, the low abundance and density of MAMU and the limited number and area of in-water pile installation would make these effects unlikely. MAMUs foraging within the marine and estuarine analysis areas could potentially fly away from approaching carriers. This could result in expenditure of additional energy and thus reduce energy available for reproduction and other survival behaviors.

Pacific Connector would implement several measures to reduce effects on MAMU habitat, including using UCSAs, and replanting conifer trees outside of the 30-foot-wide maintenance corridor on certain federal lands and non-federal lands. However, replanted trees may be harvested from non-federal lands or federal lands slated for timber harvest (i.e., Matrix lands and Harvest Land Base), and if allowed to grow would provide minimal benefit to MAMUs because it would take decades at a minimum to restore replanted forests to recruitment or suitable habitat conditions. UCSAs would be used to store forest slash, stumps, and dead and downed log materials that would be removed and scattered across the right-of-way after construction during restoration; use of the UCSAs would be a short-term modification of understory species and would not affect the nesting habitat or characteristics. To ensure that trees with active murrelet nests and chicks are not felled, timber would be removed outside of the entire MAMU breeding season (after September 15 but before April 1) within 300 feet[155] of MAMU stands to avoid this direct effect on MAMU. During operations and maintenance, vegetation maintenance activities would occur only between August 1 and April 15 of any year, generally outside the critical breeding season, and Pacific Connector would apply daily timing restrictions during activities within 0.25 mile of MAMU stands during the late breeding season (August 6 – September 15) to reduce effects on MAMU.

Pacific Connector has also proposed in their *Comprehensive Mitigation Plan* to fund off-site mitigation, including 1,075 acres of LSOG habitat acquisition and a program to reduce nest predation by corvids, that would benefit MAMU. Specifically, Pacific Connector has secured options on private land for 580 acres of old-growth (age class 200+ years); 482 acres of late-successional (age class 140 – 160 years); and 13 acres of late-successional (age class 112 – 121 years) forest, some of which is within the range of MAMU. These forests would be subject to harvest in accordance with Oregon Forest Practices Act in the absence of acquisition and preservation. Pacific Connector would also provide $350,000 (plus reasonable cost) to support a program identified by the FWS to reduce nest predation by corvids, generally through public outreach efforts (including seasonal interpretive rangers and materials) and control of anthropogenic food sources at Oregon State Parks that support or are adjacent to MAMU suitable habitat. Additional details are provided in Pacific Connector's *Comprehensive Mitigation Plan*, filed with FERC on August 30, 2019. Pacific Connector has also proposed projects on BLM land that may benefit MAMU, such as fire suppression projects. Below is a determination of effects summary for the MAMU and critical habitat.

The Project **may affect** MAMUs because:

- suitable habitat is available within the terrestrial nesting analysis area;

[155] This 300-foot buffer on MAMU stands was proposed by Pacific Connector based on guidance provided by FWS in the Conservation Framework (FWS 2014c). We are recommending that Pacific Connector adhere to FWS-recommended timing restrictions within threshold distances of MAMU stands as identified in the Biological Opinion on the BLM's Approval of the Proposed Resource Management Plan for Western Oregon (FWS 2016c).

- MAMUs have been located within the terrestrial nesting analysis area during survey efforts for the proposed action; and
- MAMUs are expected to forage offshore in the marine analysis area, and within Coos Bay in the estuarine analysis area.

The Project is **likely to adversely affect** MAMUs for the following reasons:

- LNG carrier traffic in the estuarine and marine analysis areas to the Jordan Cove LNG terminal could cause potential behavioral effects on foraging MAMU.
- Disturbance associated with construction of the Pacific Connector Pipeline Project (including clearing of timber and access road use) would occur within the MAMU breeding season and within 0.25 mile of known MAMU stands.
- Proposed actions that generate noise above local ambient levels in approximately 7,145 acres of suitable habitat might disturb or disrupt MAMUs and interfere with essential nesting behaviors:
  - 82 MAMU stands (25 occupied and 57 presumed occupied) are within 0.25 mile of the pipeline that could be constructed during the breeding season.
  - 168 MAMU stands (50 occupied and 118 presumed occupied) are within 0.25 mile of access roads that could be used during pipeline construction in the breeding season.
- Blasting for the pipeline trench may occur within 0.25 mile of 10 MAMU stands between April 1 and September 30.
- Helicopter use within 0.25 miles of eight occupied MAMU stands during the breeding period (between April 1 and September 15) could occur and disturb MAMU adults and nestlings, as well as potentially blow nestlings out of the nest tree within six occupied MAMU stands from rotor wash.
- The Pacific Connector Pipeline Project would remove approximately 78 acres of suitable nesting habitat within the range of the MAMU; or approximately 0.5 percent of the 14,310 acres of suitable habitat available in the terrestrial nesting analysis area.
- The Pacific Connector Pipeline Project would remove approximately 307 acres of recruitment habitat and 421 acres of capable habitat within the range of the MAMU. This habitat removal does not support the recovery of the species.
- The Pacific Connector Pipeline Project would modify (cause other indirect effects such as increases in edge habitat and loss of interior forest habitat, including increased predation) approximately 656 acres of suitable, 2,058 acres of recruitment, and 2,449 acres of capable habitat.
- Turbidity generated during HDD if a frac-out occurred could affect local major prey species for chicks such as anchovy, sand lance, and smelt.

The Project **may affect** MAMU critical habitat because:

- the Project occurs within designated MAMU critical habitat; and
- the Project would affect habitat within designated critical habitat.

The Project is **likely to adversely affect** MAMU critical habitat because:

- the proposed action could remove or degrade individual trees with potential nesting platforms or the nest platforms themselves, resulting in a decrease in or elimination of the value of the trees for future nesting use (PBF 1, or suitable or potentially suitable habitat);
- the proposed action could remove or degrade trees adjacent to trees with potential nesting platforms that provide habitat elements essential to the suitability of the potential nest tree or platform, such as providing cover from weather or predators (PBF 2, or recruitment/capable habitat); and
- the proposed action would remove 4.33 acres of suitable MAMU nesting habitat (PBF-1), 11.77 acres of recruitment habitat (PBF-2), and 15.09 acres of capable habitat (PBF-2) within CHU OR-06-d.

As described above, construction of the pipeline (including clearing of timber, access road use, helicopter use, and blasting), as well as pipeline operation and maintenance, would occur within the MAMU breeding season and within 0.25 mile of known MAMU stands. These activities could disturb or disrupt MAMUs and interfere with essential nesting behaviors during the breeding season. Therefore, to reduce these effects during the breeding season, **we recommend that:**

- **<u>Prior to construction</u>, Pacific Connector should file with the Secretary its commitment to adhere to FWS-recommended timing restrictions within threshold distances of MAMU and NSO stands <u>during construction, operations, and maintenance</u> of the pipeline facilities.**

The FWS timing restrictions for MAMU and NSO, as referenced in the above recommendation, were outlined in FWS (2016c).

Given the anticipated avoidance of disturbance and disruption to MAMU during the breeding season per inclusion of the recommendation above into the proposed action (i.e., implementation of distance and timing restrictions, without exception), noise and visual effects on breeding MAMU as a result of construction would be minimized. However, there would be a loss of future breeding opportunities due to the removal of suitable, recruitment, and capable habitat during construction, as there would be less suitable habitat available for nesting. Additionally, the quality of the remaining habitat would be reduced due to habitat fragmentation and the addition of edge along the pipeline corridor. Removal of suitable nesting habitat by harvest of old-growth timber has been cited as the primary reason for the species' decline (FWS 1992a). Suitable MAMU nesting habitat takes a long time to develop (more than 250 years on average); therefore, any removal of suitable habitat may affect the recovery of the MAMU. Jordan Cove has indicated an interest in working with the FWS to discuss possible mitigation and conservation measures and filed a *Comprehensive Mitigation Plan* in August 2019. However, the Project would result in long-term negative effects on this threatened species even with consideration of the *Comprehensive Mitigation Plan* filed on August 30, 2019.

FWS has requested that the Applicant follow the Conservation Framework (FWS 2014c) in full or perform standard protocol surveys (Mack et al. 2003) for the species in suitable habitat that would be affected by the proposed Project. Therefore, **we recommend that:**

- **Prior to construction, Pacific Connector should conduct standard protocol surveys of all suitable MAMU and NSO habitat that might be affected by the Project unless an alternate approach is approved by the FWS. Furthermore, Pacific Connector should file with the Secretary the results of these surveys and documentation of its consultation with the FWS regarding the survey methods.**

Northern Spotted Owl (Federal Threatened Species with Critical Habitat, State Threatened Species)

In Oregon, the NSO is found in low- and mid-elevation coniferous forest in the Coast, Siskiyou, and Cascade Ranges (Forsman 2003). Suitable habitat for NSOs provides elements necessary for nesting, roosting and foraging. NSOs generally nest in forests with multilayered, multispecies canopies with large (20–30 inches dbh or greater) overstory trees, a high basal area (greater than 240 square feet/acre), and a high diversity of different diameters of trees. NSOs have large home ranges and utilize large tracts of land containing substantial acreage to meet their biological needs and a wide array of forest types and structures are necessary to support the various life histories (FWS 2011a). Typically, a larger area is required for NSOs in more fragmented habitats (Courtney et al. 2004). NSOs remain on their home range throughout the year. As a result, NSOs have large home ranges that provide all the habitat components and prey necessary for the survival and successful reproduction of a territorial pair.

Home ranges contain three distinct use areas: 1) the nest patch, which research has shown to be an important attribute for site selection by NSOs and includes approximately 70 acres of usually contiguous forest (300-meter radius around an activity center; FWS et al. 2008), 2) the core area, which is used most intensively by a nesting pair and varies considerably in size across the geographic range, but on average encompasses approximately 500 acres around the nest site (0.5-mile radius around the activity center), and is generally made up of mostly mature/old-growth forest (FWS 2007c; Courtney et al. 2004), and 3) the remainder of the home range which is used for foraging and roosting and is essential to the year-round survival of the resident pair (FWS 2007c). NSO home range size varies by physiographic province. In the Coast Range Physiographic Province (MP 0.00 to MP 51.74), the home range is assumed to be circular with a radius of 1.5 miles. Within the Klamath Mountains Physiographic Province (MP 51.74 to MP 122.67), the home range radius is 1.3 miles, and in the West Cascades (MP 122.67 to MP 167.76) and East Cascade Physiographic Provinces (MP 167.76 to MP 190.64) the home range radius is 1.2 miles (FWS 1992b). Surveys conducted by Pacific Connector in 2007 identified 12 NSO pairs and a resident single but no nests. In 2008, surveys found NSO pairs at 20 locations, with two nests identified, and resident singles noted at six sites. Surveys in 2015 along the Blue Ridge route did not document any NSO. In addition to NSO sites identified by these surveys, Pacific Connector also considered home range information from the BLM and Forest Service, historic home ranges, best location home ranges (alternate sites closest to proposed action), and Pacific Connector-assumed home ranges (determined by Pacific Connector's assessment of habitat maps). Taking a conservative approach, all owl sites (known, best location, and Pacific Connector-assumed) were analyzed as if occupied and reproductive.

The Project would affect habitat within 97 NSO home ranges and 8 nest patches. About 37 miles of pipeline route would cross 7 designated critical habitat sub-units. Project construction would remove a total of about 517 acres of NRF habitat for NSO, of which 134 acres would be permanently lost within the 30-foot-wide corridor maintained in an herbaceous state. Additionally, 214 acres of NRF habitat for NSO would be modified and used as UCSAs. Approximately 1,158 acres of dispersal habitat (high NRF, NRF, and dispersal only habitat) would be removed by the Project. Approximately 919 acres of NSO capable habitat would be removed by construction of the proposed Project, of which 216 acres would remain in a permanent herbaceous/shrub state within the 30-foot operational right-of-way. Approximately 13,294 acres of NSO habitat (1,307 acres of high NRF/NRF habitat, 4,147 acres of dispersal only habitat, and 5,690 acres of capable habitat) occur within 100 meters (328 feet) of habitat removal, of which 4,326 acres (or 32.5 percent of NSO habitat within 100 meters of habitat removal) of interior NSO habitat would be indirectly affected (1,586 acres of high NRF/NRF habitat, 1,388 acres of dispersal only habitat, and 1,352 acres of capable habitat). The Pacific Connector Pipeline Project would remove 442 acres from LSRs, of which 379 acres is NSO habitat or capable of becoming NSO habitat (approximately 69 acres of high NRF, 93 acres of NRF [includes about 9 acres of "post-fire" NRF], 71 acres of dispersal only habitat, and 146 acres of capable habitat).

Potential direct effects on NSOs would include the following: (1) removal of a known nest tree during the entire breeding season (March 1 through September 30), and (2) human and noise disturbance due to right-of-way clearing and construction during the breeding period, including noise due to blasting and helicopter support during construction, and smoke from prescribed burnings. However, these direct effects would be reduced as described below. Potential indirect effects include the following: (1) removal or modification of suitable NRF habitat, dispersal habitat, and habitat that would be capable, over the life of the Project, to achieve dispersal or NRF habitat characteristics but for the Project's effects within LSR, Riparian Reserves, or NSO home ranges; (2) habitat fragmentation; and (3) other indirect effects that occur due to Project-related increases in edge habitat and loss of interior forest habitat, including increased predation, increased competition, and effects on prey utilized by NSOs. HDD and DP activities are not anticipated to disturb nesting NSO because noise associated with this work would attenuate to ambient levels before reaching NSO sites.

Pacific Connector would reduce effects on NSO habitat using the BMPs for crossing forested lands described in section 4.4 of this EIS. Pacific Connector would reduce effects on NSO habitat by replanting conifer trees outside of the 30-foot-wide maintenance corridor on certain federal lands and non-federal lands. However, replanted trees may be harvested from non-federal lands or federal lands slated for timber harvest (i.e., Matrix lands and Harvest Land Base), and if allowed to grow would provide minimal benefit to NSOs because it would take 80 years at a minimum to restore replanted forests to suitable habitat conditions. Timber removal would occur outside the entire NSO breeding season (March 1 through September 30) within 0.25 mile of NSO activity centers, and as a result, no nest trees within activity centers would be removed during the NSO nesting period, and disturbance or disruption would also be reduced. Additionally, Pacific Connector would install the pipeline within 0.25 mile of activity centers after the critical breeding period (after July 15). However, activities from pipeline construction during the late breeding period (July 16 through September 30) could disrupt or disturb NSO at 10 NSO activity centers within 0.25 mile of the pipeline right-of-way, and construction activities off the right-of-way would occur during the entire breeding season and could disturb NSO at two known activity centers located 0.25 mile of pipeline project components, if NSO are present.

For operations and maintenance activities, Pacific Connector would not conduct vegetation maintenance activities within 0.25 mile of NSO activity centers during the critical breeding season (March 1–July 15) to reduce disturbance and disruption to NSO. Other operations and maintenance activities may occur within the breeding season.

Pacific Connector has also proposed in their *Comprehensive Mitigation Plan* to fund off-site mitigation, including 1,075 acres of LSOG habitat acquisition and barred owl management, that would benefit NSO. Specifically, Pacific Connector has secured options on private land, as previously described. Additional details are provided in Pacific Connector's *Comprehensive Mitigation Plan*, filed with FERC on August 30, 2019. Mitigation projects such as snag creation projects proposed by the Forest Service to meet LRMP objectives would also benefit NSO. Pacific Connector has also proposed projects on BLM land that may benefit NSO, such as fire suppression and road decommissioning projects. Below is a determination of effects summary for the NSO and critical habitat.

The Project **may affect** NSOs because:

- suitable habitat is available within the Provincial Analysis Area;[156] and
- NSO pairs and resident singles have been located within the Provincial Analysis Area during survey efforts.

The Project is **likely to adversely affect** NSOs for the following reasons:

- Noise from construction of the pipeline (including access road use, helicopter use, and blasting) within 0.25 miles of NSO sites during the breeding season would occur and could disturb or disrupt NSOs and interfere with essential nesting behaviors.
- Construction of the Pacific Connector Pipeline Project would remove approximately 517 acres of high NRF and NRF habitat (including 26 acres of "post fire NRF" within the 2015 Stouts Creek fire area) within the provincial analysis area. This would result in effects on nest patches, core areas, and home ranges of known, best location, and Pacific Connector-assumed owls, some of which are currently below thresholds needed to sustain NSOs. Once suitable NRF habitat is reduced or modified in NSOs' home ranges, there is an increased likelihood that NSOs remaining in the Project area would be subject to:
  - displacement from nesting areas;
  - concentration into smaller, fragmented areas of suitable nesting habitat that may already be occupied;
  - increased interspecific (with barred owls) and intraspecific competition for suitable nest sites and forage;
  - decreased survival due to increased predation and/or limited resource (forage) availability; and
  - diminished reproductive success for nesting pairs.

[156] The Provincial Analysis Area includes the extent of the following potential Project effects: 1) habitat removal or modification, and 2) disturbance/disruption of NSO during the breeding season

- Construction of the Pacific Connector Pipeline Project would remove and modify high NRF, NRF, dispersal only, and capable habitat for NSOs throughout the Project area, including removal of habitat within the home range of 97 NSOs, 58 of which are currently below sustainable threshold levels of suitable habitat for continued persistence in their home range and/or core area.[157]
- Construction of the Pacific Connector Pipeline Project would bring one NSO core area (best location activity center affected by 2015 Stouts Creek fire) below the 50 percent NRF threshold, and two NSO home range (known activity centers, one of which was affected by the 2015 Stouts Creek fire) below the 40 percent NRF threshold (best location activity center).
- At least 38.5 miles of interior forest in NSO habitat would experience fragmentation as a result of the Project, which may create favorable conditions for survival and reproduction of barred owls, a major threat to NSO.

The Project **may affect** NSO critical habitat because:

- the Project would occur within designated NSO critical habitat; and
- the Project would affect habitat within designated critical habitat.

The Project is **likely to adversely affect** NSO critical habitat because:

- The Project would remove or potentially downgrade PBFs in critical habitat sub-units ORC-6, KLE-1, KLE-2, KLE-3, KLE-4, KLE-5, and ECS-1 as defined in the Final Rule designating critical habitat for the NSO (FWS 2012b).

As described above, construction of the pipeline (including access road use, helicopter use, and blasting), as well as pipeline operations and maintenance, would occur within the NSO breeding season and within 0.25 mile of NSO activity centers. These activities would disturb or disrupt NSOs and interfere with essential nesting behaviors during the entire breeding season. Therefore, to reduce these effects during the breeding season, we are recommending that Pacific Connector adhere to FWS-recommended timing restrictions within threshold distances of NSO activity centers (FWS 2016c; see recommendation above in the MAMU section).

Given the anticipated avoidance of disturbance and disruption to NSO during the breeding season per inclusion of the recommendation above into the proposed action (i.e., implementation of distance and timing restrictions, without exception), noise and visual effects on breeding NSO as a result of construction would be minimized. However, there would be a loss of future breeding opportunities due to the removal of suitable habitat during construction, as there would be less suitable habitat available for nesting. Additionally, the quality of the remaining habitat would be reduced due to habitat fragmentation and the addition of edge along the pipeline corridor. Habitat loss and modification, whether to nesting, roosting or foraging habitats, due to forest clear-cutting has been the primary factor causing declines of the NSO (FWS 1992c). Habitat losses and habitat fragmentation have indirect effects that can affect survival and reproduction of NSOs. Jordan Cove has indicated an interest in working with the FWS to discuss possible mitigation and filed a *Comprehensive Mitigation Plan* in August 2019. However, the Project would result in long-term

[157] FWS et al. (2008) consider core areas with 50 percent or greater NRF habitat and home ranges with at least 40 percent NRF habitat to be necessary to maintain NSO life history function.

negative effects on this threatened species even with consideration of the *Comprehensive Mitigation Plan* filed on August 30, 2019.

As described above, FWS has requested that the Applicant follow the Conservation Framework (FWS 2014c) in full or perform standard protocol surveys (FWS 2012c) for the species in suitable habitat that would be affected by the proposed Project. Therefore, we are recommending that Pacific Connector conduct standard protocol surveys of all suitable NSO habitat that might be affected by the Project unless an alternate approach is approved by the FWS (see recommendation above in the MAMU section).

4.6.1.3 Fish

In this section, we summarize the listing status, life history, and presence and determination of Project action effects on the federally listed fish species and their critical habitat that could be affected by the Project. The species addressed include the Coho Salmon-Southern Oregon/Northern California Coast ESU, Coho Salmon-Oregon Coast ESU, North American Green Sturgeon–Southern DPS, Eulachon–Southern DPS, Lost River sucker, and shortnose sucker. Project effects on waterbodies are described in section 4.3 of this EIS. Minimization measures are proposed, as well as following relavant state and federal regulation, such as the ODFW in-water work window for instream construction timing, to reduce effects on threatened and endangered fish species. Overall, the types, methods, and magnitude of effects on listed fish species are discused for fish in general as presented earlier in section 4.5 of this EIS.

Coho Salmon-Southern Oregon/Northern California Coast ESU (Federal Threatened Species, State Sensitive Species)

The Southern Oregon/Northern California Coast (SONCC) ESU coho salmon was listed as a threatened species on June 28, 2005, between Punta Gorda, California, and Cape Blanco, Oregon (70 FR 37160). It includes all naturally spawning populations as well as three artificial propagation programs, of which one, the Cole Rivers Hatchery (ODFW stock #52) located on the Rogue River, is within the Project area.

Critical habitat for the SONCC ESU was designated in May 5, 1999 (74 FR 24249) and includes the accessible reaches of all rivers (including water, substrate, and adjacent riparian zone of estuarine and riverine reaches) between the Mattole River in California and the Elk River in Oregon. The Pacific Connector pipeline route would cross designated critical habitat within waterbodies of the Upper Rogue HUC (17100307) below Lost Creek, Willow Creek, and Fish Lake Dams.

Major rivers, estuaries, and bays known to support coho salmon within the range of the SONCC ESU include the Rogue River, Smith River, Klamath River, Mad River, Humboldt Bay, Eel River, and Mattole River (NMFS 1999), two of which (i.e., the Rogue and Klamath Rivers) are within the Project area although this ESU is currently prevented from accessing the potential Project-affected Klamath River areas due to dam passage barriers downstream.

Direct and indirect effects on SONCC Coho salmon are not expected within the marine analysis area. Coho salmon can avoid acoustic effects from LNG carriers during transit. Potential oil and gas spills from LNG carriers in the marine analysis area are highly unlikely to occur; even if LNG spilled or leaked, it would turn to vapor and would not mix with water, and vessel response plans required to address accidental spills of LNG and other petroleum products onboard would be implemented. Effects within the riverine analysis area are expected from in-water construction activities resulting in short-term increased sediment levels that would be stressful to fish, short-term benthic food source reduction, temporary migration impedance, short-term terrestrial/riparian habitat modifications, and limited long-term reduction in LWD sources. Limited fish mortality would also occur from fish salvage. Below is the determination of effects summary for SONCC Coho Salmon ESU and critical habitat.

The Project **may affect** coho salmon in the SONCC ESU because:

- juvenile and subadult life stages of coho salmon are expected to occur within the marine analysis areas during construction and operation of the proposed action; and
- several stages and activities of coho salmon (upstream adult migration, juvenile rearing, and juvenile out-migration) are expected to occur at various locations in the riverine analysis area during construction and operation of the proposed action.

The Project is **likely to adversely affect** coho salmon in the SONCC ESU for the following reasons:

- Juveniles would be exposed to elevated TSS concentrations during standard dry open-cut construction (fluming or dam-and-pump) for 2 to 5 hours. Such an exposure could cause injury, a short-term reduction in both feeding rate and feeding success, and minor physiological stress.
- A site crossing failure while dry open-cut construction is underway could result in elevated TSS concentrations for six hours while repair of failed isolation structures occurs, which could cause moderate habitat degradation injury, a short-term reduction in both feeding rate and feeding success, impaired fish homing, and possibly major physiological stress.
- Literature-based estimates of suspended sediment effects from pipeline construction on severity of ill effect (SEV) scores suggest typical dry crossing methods could result in SEVs of 4 and 6 for Coho salmon within a few hundred feet (e.g., 150 to 500 feet) below the crossing, which may include factors ranging from short-term reduction in feeding to moderate physiological stress. If failure of sealing occurs, SEV scores for coho salmon could be as high as 8, which may include habitat degradation, major physiological stress, and long-term reduction in feeding rate or success.
- Construction-induced blasting at 13 streams (4 at streams known to contain coho) could cause mortality to fish by rupturing swim bladders, but active fish removal from area prior to blasting would reduce risk of occurrence.
- Fish salvage would occur for some dry stream crossings as discussed in Pacific Connector's *Fish Salvage Plan*.[158] Capture and handling constitutes a taking under ESA and subjects coho salmon to injury and mortality.
- Lack of LWD is a limiting factor in most streams within range of SONCC coho salmon. Removal of mid-seral riparian forest (40 to 80 years old) would have long-term effects on recruitment of LWD, and removal of LSOG forest (80 years old or older) would have permanent effects on recruitment of LWD because planted conifers would not attain those

[158] Appendix L of Pacific Connector's POD filed with the FERC in January 2018.

age classes within the 50-year life of the Project, plus the ongoing loss of trees within the 30-foot-wide maintance corridor.

The Project **may affect** designated critical habitat for coho salmon in the SONCC ESU because:

- the Pacific Connector pipeline crosses designated critical habitat within waterbodies of the Upper Rogue HUC (17100307) below the Lost Creek, Willow Creek, and Fish Lake Dams.

The Project is **likely to adversely affect** designated critical habitat for coho salmon in the SONCC ESU for the following reasons:

- a failure of dry open-cut crossing could cause moderate or more severe habitat degradations in some crossing areas;
- food resources would potentially be affected over the short term by dry open-cut and diverted open-cut construction methods that would remove substrate and benthos at crossing sites;
- freshwater migration corridors would potentially be affected over the short term by dry open-cut and diverted open-cut construction methods that would create temporary barriers to in-stream movements; and
- approximately 9 acres of native riparian vegetation (forest, wetlands, unaltered, and nonforested habitats) and altered habitat would be removed during construction within riparian zones associated with designated critical habitat. Adverse effects on riparian zones associated with critical habitat would be long term or permanent depending on whether mid-seral riparian forests (2 acres) or LSOG riparian forests (2 acres) are removed.

Coho Salmon-Oregon Coast ESU (Federal Threatened Species, State Sensitive Species)

This Coho salmon ESU was first proposed for listing on July 25, 1995 (60 FR 38011) and subsequently listed as threatened on June 20, 2011 (76 FR 35755). The Oregon Coast ESU includes all naturally spawned populations of coho in Oregon coastal streams south of the Columbia River and north of Cape Blanco, including the Cow Creek (ODFW stock #37) coho salmon hatchery program (NMFS 1995). Critical habitat for Oregon Coast coho salmon was designated on February 11, 2008 (73 FR 7816) and includes water, substrate, and adjacent riparian zones of estuaries and rivers within the range of the Oregon Coast ESU. There are three subbasins that coincide with the Project: South Umpqua Subbasin (HUC 17100302) and Coquille Subbasin (HUC 17100305), which are crossed by the Pacific Connector pipeline; and Coos Subbasin (HUC 17100304), which includes the Coos Bay estuary where the LNG terminal, slip, navigation channel improvements, and HDD portion of the Pacific Connector pipeline route would be located contain critical habitat watersheds. Within these subbasins are eight fifth-field watersheds crossed that contain designated critical habitat. Life stage requirements of coho salmon, within freshwater habitats in the Oregon Coast ESU, are expected to be similar to those described above for Coho salmon in the SONCC ESU.

Coho salmon would be expected to avoid acoustic effects from LNG carriers during transit of marine areas, and no substantial adverse oil and gas marine spills from LNG carriers are expected. Short-term adverse effects on coho salmon in the estuarine analysis area would result from locally increased turbidity from dredging activities and LNG carrier propeller wash and ship wake, causing avoidance and short-term reduction in food supply. Entrainment and impingement of coho salmon could occur in LNG carriers' cooling water intake port during LNG carrier loading and possibly dredging. Acoustic effects would likely cause at least avoidance during LNG terminal construction. Habitat modification would occur from all dredging activity and restoration activities at the Kentuck project site. Suspended sediment released accidentally during HDD construction across Coos Bay and the Coos River would also result in elevated sediment levels. Effects within the riverine analysis area primarily from in-water construction activities would include short-term increased sediment levels causing fish stress, reduced short-term benthic food supplies, temporary migration impedance, terrestrial/riparian habitat modifications, and limited long-term reduction in LWD sources. Limited mortality from fish salvage would also occur. Below is the determination of effects summary for Oregon Coast Coho Salmon ESU and critical habitat.

The Project **may affect** coho salmon in the Oregon Coast ESU because:

- several stages and activities of coho salmon (upstream adult migration, juvenile rearing, and juvenile out-migration) are expected to occur at various locations in the riverine analysis area during construction and operation of the proposed action;
- several stages and activities of coho salmon (juveniles, adults) are expected to occur within the estuarine and marine analysis area during construction and operation of the proposed action.

The Project is **likely to adversely affect** coho salmon in the Oregon Coast ESU for the following reasons:

- Short-term increase in noise associated with in-water or nearwater pile driving at various temporary construction activities throughout the bay may cause disturbance and physical injury to Oregon Coast coho if they are in proximity to the noise during construction.
- Some juvenile coho may be subject to localized entrainment by dredging associated with the access channel and Navigation Reliability Improvements, as well as ongoing maintenance dredging.
- Local short-term increases in suspended sediment in Coos Bay from in-water construction, particularly during dredging of Jordan Cove terminal access channel and navigation channel widening, may result in behavioral effects on rearing coho salmon juveniles with physiological consequences that may affect growth and survival.
- Short-term effects on the benthic community and potential food resources for Oregon Coast coho would result from dredging the proposed marine waterway modifications in Coos Bay.
- Installation of the proposed pipeline beneath Coos Bay and the Coos River using HDD construction would avoid effects on coho unless an inadvertent return of drilling fluid occurred. An inadvertent return would temporarily increase sedimentation and turbidity and likely result in behavioral avoidance of the affected area.
- Individual Coho salmon may be directly affected by local restoration activities at the Kentuck project due to short-term construction-related increases in turbidity, in-water work, and isolation measures.
- Water intakes by LNG carriers at the Jordan Cove terminal berth during engine cooling operations could entrain or impinge juvenile salmon.

- Removing eelgrass from donor stocks in the bay to develop the Eelgrass Mitigation site may reduce cover and food sources for rearing juvenile coho salmon in the short term:
- Exposure to TSS concentrations during dry open-cut construction (fluming or dam-and-pump) for 2 to 6 hours could potentially cause minor physiological stress (increased coughing rate and/or increased respiration rate) in juvenile coho salmon.
- A site crossing failure while dry open-cut construction is underway could result in elevated TSS concentrations for six hours while repair of failed isolation structures could cause moderate habitat degradation, impaired homing by fish, moderate to major physiological stress, and, in very limited areas, reduced growth and reduced fish density.
- Literature-based estimates of suspended sediment effects from pipeline construction on SEV scores suggest typical dry crossing methods could result in SEVs between 4 and 6 for coho salmon within a few hundred feet (e.g., 150 to 500 feet) below the crossing, which may include factors ranging from short-term reduction in feeding to moderate physiological stress. If failure of sealing occurs, SEV scores for coho salmon could be as high as 8, which may include habitat degradation, major physiological stress, and long-term reduction in feeding rate or success.
- Blasting at 22 streams (12 known or assumed to have Coho salmon at the crossing) could cause mortality to fish by rupturing swim bladders but active fish removal from the area prior to blasting would reduce risk of occurrence.
- Fish salvage would occur within isolated construction sites, possibly when adult and juvenile coho salmon are present. Coho salmon are considered vulnerable to electrofishing, subject to injury and mortality. Seining, electrofishing, and handling during salvage may adversely affect Oregon Coast coho salmon.
- Lack of LWD is a limiting factor in most streams within range of Oregon Coast coho salmon. Removal of mid-seral riparian forest (40 to 80 years old) would have long-term effects on recruitment of LWD, and removal of LSOG forest (80 years old or older) would have permanent effects on recruitment of LWD because planted conifers would not attain those age classes within the 50-year life of the Project, plus the ongoing loss of trees within the 30-foot-wide maintance corridor.

The Project **may affect** designated critical habitat for coho salmon in the marine analysis area, the estuarine analysis area, and the riverine analysis area for the Oregon Coast ESU because:

- actions associated with construction and operation of the LNG Terminal and access channel and slip would occur within designated critical habitat; and
- construction and operation of the Project would occur in or cross designated critical habitat within waterbodies of the Coos, Coquille, and South Umpqua subbasins.

The Project is **likely to adversely affect** proposed critical habitat for coho salmon in the Oregon Coast ESU for the following reasons:

- dredging of the Jordan Cove terminal access channel in Coos Bay and marine waterway modifications could remove eelgrass and benthic community that are potential food resources and rearing habitat for Oregon Coast coho salmon;
- increases in turbidity are expected to temporarily affect the water quality downstream from stream crossing sites during construction;

- TSS concentrations generated during dry open-cut construction and potential failure of isolation structures would adversely affect freshwater habitats by changing coho habitat preferences (SEV = 3) or causing moderate habitat degradations (SEV = 7 or 8);
- a failure of dry open-cut crossing lasting up to 6 hours could cause moderate or more habitat degradations in some streams;
- food resources would potentially be affected over the short term by dry open-cut and diverted open-cut construction methods that would remove substrate and benthos at crossing sites;
- freshwater migration corridors would potentially be affected over the short-term by dry open-cut and diverted open-cut construction methods that would create temporary barriers to in-stream movements; and
- approximately 59 acres of native riparian vegetation (forest, wetlands, and nonforested habitats) and altered habitat would be removed during construction within riparian zones associated with designated critical habitat associated with waterbodies within range of Oregon Coast coho ESU. Adverse effects on riparian zones associated with critical habitat would be long term or permanent depending on whether mid-seral riparian forests (11 acres) or LSOG riparian forests (2 acres) are removed.

North American Green Sturgeon – Southern Distinct Population Segment (Federal Threatened Species, State Sensitive-Critical Species)

On January 23, 2003 (NMFS 2003), NMFS determined that the North American green sturgeon comprises two DPSs that qualify as species under the ESA: (1) a northern DPS consisting of populations in coastal watersheds northward of and including the Eel River in California; and (2) a southern DPS consisting of coastal and Central Valley populations south of the Eel River, with the only known spawning population in the Sacramento River. On April 7, 2006, NMFS listed the southern DPS as federally threatened under the ESA, including spawning populations of green sturgeon south of the Eel River, principally the Sacramento River spawning population (71 FR 17757). Designated critical habitat extends from U.S. marine waters to 110 meters depth (360 feet) or 60 fathoms from Monterey Bay, California, north to Cape Flattery, Washington, including the Strait of Juan de Fuca (74[195] FR 52300 [October 9, 2009]). Critical habitat includes three components that are occupied by and are essential to different life stages of green sturgeon: (1) freshwater riverine systems, (2) estuarine areas, and (3) nearshore marine waters. No rivers in Oregon were included in the listing. However, many estuaries were part of the critical habitat proposal in Washington, Oregon, and California. Estuaries in Oregon proposed for inclusion were the Columbia River estuary, Winchester Bay, Yaquina Bay, Nehalem Bay, and Coos Bay. Large numbers of this green sturgeon DPS are within Coos Bay. Subadults and adults may occupy Coos Bay for feeding, optimization of growth, and thermal refuge, and the Bay supplies oversummer habitat. Similarly, coastal marine waters 110 meters deep or less. The North American green sturgeon (both northern and southern DPSs) occurs within Coos Bay and its adjacent waterbodies (Israel and May 2007) and is considered abundant in the bay (73 [174] FR 52084 [September 8, 2008]). This fish may also occur in the lower portions of the Coos River.

Green sturgeons spawn every three to five years in deep pools in large, turbulent river mainstems, generally from March through July (Tracy 1990; Moyle et al. 1992). Little is known about sturgeon feeding, but some studies have found that adults and juveniles feed on benthic invertebrates including shrimp, mollusks, amphipods, and even small fish (Moyle et al. 1992; Radtke 1966). Natural reproduction in this estuary is considered low (Wagoner et al. 1990). The Coos River system is not considered to provide suitable spawning habitat for green sturgeon (Whisler et al. 1999). Green sturgeon, likely less than three years of age, may utilize both shallow and deep-water habitats within the estuarine area, though there is no information relating individual occurrence to DPS membership. Green sturgeon may also occur in bottom areas along the LNG carrier transit route, in waters mostly less than 110 meters deep, which would be primarily only during entry and exit of the vessels as they would travel in deeper water during transit between ports.

Direct and indirect effects on green sturgeon in the southern DPS are not expected within the marine analysis area. Green sturgeon might detect noise from LNG carriers but would be able to avoid adverse effects from noise. Potential oil and gas spills from LNG carriers in the marine analysis area are unlikely to affect aquatic resources because they are highly unlikely to occur; if LNG spilled or leaked, it would turn to vapor, would not mix with water, and would not contaminate surface water; and vessel response plans required to address accidental spills of LNG and other petroleum products onboard would be implemented. Effects on green sturgeon in the estuarine analysis area include acoustic effects such as avoidance during terminal construction, increased turbidity sedimention affecting benthic food sources from dredging activities, bed and bank erosion from LNG carrier propeller wash and ship wake, loss of forage from removal of eelgrass and shallow water habitat, and elevated suspended sediment released from an accidental drilling mud release during HDD construction across Coos Bay and the Coos River. Effects within the riverine analysis area include increased turbidity and sedimentation causing short-term avoidance and food source reduction from in-water construction activities on Stock Slough. Below is the determination of effects summary for the Southern DPS of green sturgeon and critical habitat.

The Project **may affect** green sturgeon (Southern DPS) because:

- adult and/or subadult green sturgeon may occur within the estuarine analysis area during construction and operation of the proposed action;
- adult and/or subadult green sturgeons may occur within the marine analysis area during operation of the proposed action; and
- adult green sturgeon may occur in Stock Slough, which is included in the riverine analysis area during construction of the proposed action.

The Project is **likely to adversely affect** green sturgeon (Southern DPS) because:

- short-term increase in noise generated from in-water and nearshore pile driving at various temporary construction sites throughout the bay may cause disturbance and physical injury to green sturgeon if individuals are in proximity to the noise during construction;
- on a localized basis, the proposed action may affect migratory and feeding behavior, potential food resources, and water quality (TSS) during the short-term construction period and periodic maintenance dredging within the estuarine analysis area;
- bottom disturbance from Project construction, navigation channel widening, and maintenance dredging may reduce the abundance and diversity of benthic food supply within Coos Bay.

The Project **may affect** critical habitat for green sturgeon (Southern DPS) because:

- Project activities would occur within portions of the Coos Bay estuary, Stock Slough, and coastal marine waters, which have been designated as critical habitat;

The Project is **likely to adversely affect** critical habitat for the southern DPS of green sturgeon because:

- bottom disturbance from Project construction, navigation channel widening, and maintenance dredging may disrupt local food supply and habitat usability within Coos Bay; and
- suspended sediment produced during dry open-cut crossing Stock Slough could affect water quality in freshwater riverine critical habitat.

Eulachon – Southern Distinct Population Segment (Federal Threatened, No State Status)

On March 18, 2010, the NMFS published in the Federal Register the final rule to list the southern DPS of the Pacific eulachon as threatened under the ESA (75 FR 13012 [March 18, 2010]). The NMFS has identified the eulachon southern DPS as those populations which spawn in rivers south of the Nass River in British Columbia, Canada, to and including the Mad River in California (NMFS 2008c). The southern DPS has been further segregated into four subareas: Klamath River, Columbia River, Fraser River, and British Columbia coastal rivers south of the Nass River (NMFS 2008c). A total of 16 distinct regions in Washington, Oregon, and California have been designated as critical habitat for Pacific eulachon (76 FR 65323 [October 20, 2011]). No part of the Project or its effects would occur within waterbodies included in the eulachon critical habitat designation.

Adult Pacific eulachon usually spend three to five years in saltwater before returning to freshwater to spawn from late winter though early summer in rivers (74 FR 10857 [March 13, 2009]). Fertilized eggs adhere to river bottoms and shortly after hatching, the larvae are carried downstream and dispersed by estuarine and ocean currents (74 FR 10857 [2009]). No recent spawning runs have been documented for the Coos River, although some may have occurred historically and have recently been found in Winchester Creek, a major tributary to South Slough that enters Coos Bay near the ocean (Willson et al. 2006; Wagoner et al. 1990, NMFS 2018b).

Little is known about the use of marine waters by eulachon and, due to paucity of sampling, little specific information exists on eulachon distribution off the U.S West Coast, including Oregon (Gustafson et al. 2010). Larvae and young juveniles become widely distributed in coastal waters, with fish found mostly at depths up to 15 meters (171 feet) but sometimes as deep as 182 meters (597 feet; Hay and McCarter 2000). Larger rearing fish have been reported to be in the near benthic habitats in open marine waters of the continental shelf between 20 and 150 meters (66 to 492 feet) deep (Barraclough 1964 as cited in Gustafson et al. 2010).

Adults and juveniles commonly forage at moderate depths (15 to 182 meters [50 to 600 feet]) in inshore waters, feeding on zooplankton, primarily eating crustaceans (Hay and McCarter 2000). Adults are found rarely in Coos Bay (64 FR 66601 [1999]), but have been reported to utilize both shallow and deep habitats in the estuary (64 FR 66601 [1999]). A 1971 report (Cummings and Schwartz 1971) noted their distribution only in the outer 7 miles of Coos Bay. Detailed larvae and juvenile fish sampling in Coos Bay over a 3.5-year period (1998-2001) found no eulachon (Miller and Shanks 2005). More recently, pelagic Tucker trawl samples over a 17-month period found larvae and small juveniles of a close relative, surf smelt, but no eulachon near the proposed terminal in Coos Bay (Shanks et al. 2011). However, given the limited survey effort and highly variable presence of eggs and larvae, eulachon occurrence in Coos Bay could not be ruled out (Storch and Van Dyke 2014).

Direct and indirect effects on eulachon in the southern DPS are not expected within the marine analysis area. Eulachon might detect noise from LNG carriers, but would be able to avoid adverse effects from noise. Potential oil and gas spills from LNG carriers in the marine analysis area are unlikely to affect aquatic resources because they are highly unlikely to occur; if LNG spilled or leaked, it would turn to vapor, would not mix with water, and would not contaminate surface water; and vessel response plans required to address accidental spills of LNG and other petroleum products onboard would be implemented. Effects on eulachon in the estuarine analysis area include increased turbidity from dredging activities and LNG carrier propeller wash and ship wake causing avoidance and reduced food supply, increased suspended sediment should an HDD construction failure occur in Coos Bay or the Coos River, entrainment and impingement in LNG carriers' water intake ports, acoustic effects including avoidance during terminal construction, habitat modification from dredging, and restoration activities at the Kentuck project site. Below is the determination of effects summary for Pacific eulachon (Southern DPS) and critical habitat.

The Project **may affect** Pacific eulachon (Southern DPS) because:

- Adult Pacific eulachon may be present within the estuarine analysis area during construction and operation of the Project;
- Pacific eulachon may occur within the marine analysis area during operation of the proposed action;

The Project is **likely to adversely affect** Pacific eulachon (Southern DPS) because:

- Bottom disturbance and suspended sediment from Project construction, navigation channel widening, and maintenance dredging may affect the abundance and diversity of potential benthic and pelagic food resources, water quality, and suspended sediment during the short-term duration of these actions within the estuarine analysis area.
- Short-term increase in noise generated from the MOF land-based pile driving and in-water pile driving in various Coos Bay estuarine analysis areas may cause physical injury to individual eulachon at a limited distance during construction.
- Although eulachon would be rare in Coos Bay, and their large size would allow most to be able to avoid the LNG carrier cooling water intake, some limited number could be entrained during dredging and vessel loading in the bay.

The Project would have **no effect** on critical habitat for the Pacific eulachon (Southern DPS) because no designated critical habitat is present within the areas affected by the Project.

Lost River Sucker (Federal Endangered Species, State Endangered Species)

The Lost River sucker was listed as a federally endangered species on July 18, 1988, because of a variety of factors including loss of habitat and access to historical range, overfishing, degraded water quality, lack of adaquate recruitment, inadequate regulatory mechanisms, and a variety of other reasons resulting in declining populations (FWS 1988). Lost River sucker critical habitat was originally proposed in 1994 (59 FR 61744) but that proposal was never finalized. In 2011, a revised critical habitat designation was proposed and ultimately finalized in December 11, 2012 (77 FR 73739). Designated critical habitat for the Lost River sucker includes two units: the Upper Klamath Lake Unit and Lost River Basin Unit

The present distribution of the Lost River sucker includes Upper Klamath Lake and its tributaries, Clear Lake Reservoir and its tributaries, Tule Lake and the Lost River, the Klamath River, and Copco, Iron Gate, and John C. Boyle Reservoirs with no substantial change since listing (Reclamation 2007, 2012; FWS 2007d). They have also been found in Tule Lake (Reclamation 2012; FWS 2007d, 2013d). Critical habitat that could potentially be affected by construction of the Pacific Connector pipeline includes the Klamath River.

In the Upper Klamath Lake watershed, the Lost River sucker spawning runs are primarily limited to Sucker Springs in Upper Klamath Lake, and the Sprague and Williamson Rivers. Spawning runs also occur in the Wood River and in Crooked Creek in this watershed. In the Project vicinity, Lost River suckers spawn in the Lost River and are present in John C. Boyle Reservoir, downstream from the pipeline crossing at river mile (RM) 225 (NRC 2004). In addition to collections of Lost River suckers in John C. Boyle Reservoir, ORBIC (2012) cites records of collections in Lake Ewauna and in the Lost River Diversion Channel connecting the Klamath River (at RM 249.8) to the Lost River at the Lost River Diversion Dam, approximately 10 river miles downstream from the Pacific Connector pipeline crossing of the Lost River at RM 9.5.

The Pacific Connector pipeline route would cross Lost River (MP 212.07) 7.6 miles upstream of the known spawning area downstream of Anderson–Rose Dam, using a dry, open-cut method during low flows that coincide with the ODFW instream construction window extending from July 1 through March 31.

Spawning occurs within limited areas of the Lost River (FWS 2013d; Reclamation 2012), and occasional individuals have been found in this stream (NMFS and FWS 2013), which suggests it is possible that Lost River sucker occurs at the Pacific Connector pipeline crossing of Lost River at MP 212.07 during the non-spawning period. An additional 31 dry open-cut small intermittent stream crossings could also contain Lost River suckers as surveys have not been conducted for their presence.

Potential effects on the Lost River sucker are associated with pipeline stream crossings. These effects include the release of drilling mud from Klamath River HDD potential frac-out as well as potential entrainment or entrapment of fish, and increased turbidity and suspended sediment in occupied stream affecting fish avoidance and benthic food supply. Pacific Connector would install a temporary flowing stream crossing by lifting or spanning a structure from a bank so that equipment does not enter flowing waters. However, if it is not possible to do this safely, only equipment necessary to install the bridge would cross the stream. This would cause some limited short-term bottom benthic disruption and possibly elevated suspended sediment. Adults and juveniles subject to fish salvage associated with the Lost River crossing could be injured or killed if electrofishing is used, and stressed if seining is used. Incidental take of a Lost River sucker is possible, but salvage operations would follow Pacific Connector's *Fish Salvage Plan* which describes netting methods (e.g., beach seining, dip netting) that would be used before using electrofishing. There are additional salvage methods that have been specifically developed for these listed suckers to further reduce the potential effects of salvage (see the Klamath Project

Operations Biological Opinion [Reclamation 2008] consistent with Reclamation's *Handling Guidelines for Klamath Basin Suckers)*. Below is the determination of effects summary for Lost River sucker and critical habitat.

The Project **may affect** Lost River suckers because:

- Lost River suckers occur within the Upper Klamath River subbasin and Lost River subbasin, which would be affected during construction of the proposed action.

The Project is **likely to adversely affect** Lost River suckers because:

- Lost River suckers could occur in 19 waterbodies crossed by dry open-cut construction in the Lake Ewauna-Klamath River watershed and in 13 waterbodies west of MP 214.38 (including the Lost River) crossed in the Mills Creek-Lost River watershed and be indirectly affected by elevated suspended sediment levels, streambank erosion and stability, and aquatic nuisance species introductions; and
- fish salvage during the crossing of 31 ditches crossed by dry-open cuts and the Lost River crossing could result in injuring or killing of Lost River suckers if electroshocking is used, and stressing fish if seining is used.

The Project **may affect** designated critical habitat for the Lost River sucker because:

- there is a low risk of HDD failure during crossing of the Klamath River, resulting in a frac-out that releases drilling mud into the river.

However, the Project is **not likely to adversely affect** designated critical habitat for the Lost River sucker because:

- HDD crossing methods would avoid critical habitat in the Klamath River;
- the potential for hydraulic fracture during HDD drilling is so unlikely as to be discountable; and
- in the event of released bentonite, corrective actions would contain and temporally limit drill mud volumes.

Shortnose Sucker (Federal Endangered Species, State Endangered Species)

The shortnose sucker was listed as a federally endangered species on July 18, 1988 (FWS 1988). The final rule to list the shortnose sucker as endangered suggested several reasons for their decline, including the construction of dams, water diversions, overfishing, competition and predation by exotic species, water quality problems associated with timber harvest, removal of riparian vegetation, livestock grazing, lack of adaquate recruitment, inadequate regulatory mechanisms and agricultural practices. Shortnose sucker critical habitat was originally proposed in 1994 (59 FR 61744) but that proposal was never finalized. In 2011, a revised critical habitat designation was proposed and ultimately finalized in December 11, 2012 (77 FR 73739). Designated critical habitat for the shortnose sucker includes two units: the Upper Klamath Lake Unit and Lost River Basin Unit. The Klamath River is the only critical habitat for the shortnose sucker crossed by the pipeline or potentially affected by any Project actions.

Currently, shortnose suckers are present in upper Klamath Lake and tributaries, Lost River, Clear Lake Reservoir, the Klamath River, and three large Klamath reservoirs (Keno, Copco, and possibly Iron Gate Reservoirs) with no substantial change since listing (Reclamation 2007, 2012). They have also recently been found in Tule Lake and Gerber Reservoir (Reclamation 2012; FWS 2007d, 2013e).

Shortnose suckers live in lakes and spawn in rivers, streams or springs associated with the lake habitats, generally from early February through mid-April. After hatching, larval suckers migrate out of spawning substrates, which are usually gravels or cobbles, and drift downstream into lake habitats from early May to mid-June (FWS 1988, 1993b). The shortnose sucker is known to migrate out of Tule Lake to spawn in the Lost River below Anderson–Rose Dam about 7.6 miles downstream from the Lost River crossing. Therefore, the Pacific Connector pipeline would cross the Lost River where shortnose suckers could be present.

Potential effects on the shortnose sucker are associated with pipeline stream crossings. These effects include the release of drilling mud from Klamath River HDD potential frac-out as well as potential entrainment or entrapment of fish, and increased turbidity and suspended sediment affecting fish avoidance and benthic food sources in occupied streams, and fish being injured or killed during fish salvage efforts. Pacific Connector would install temporary flowing stream crossing by lifting or spanning a structure from a bank so that equipment does enter flowing waters. However, if it is not possible to do this safely, only equipment necessary to install the bridge would cross the stream. This would cause some limited, short-term bottom benthic disruption and possibly elevated suspended sediment. Adults and juveniles subject to fish salvage within the isolated construction site at the Lost River could be injured or killed if electroshocking is used and stressed if seining is used. Pacific Connector has included guidelines noted above under the Lost River sucker section in their *Fish Salvage Plan* that would be used near listed suckers. However, despite these measures, it is still possible that shortnose suckers could be killed by salvage operations and modifications to these plans may be needed to reduce this risk (see the Lost River Sucker section above).

Spawning occurs within limited areas of the Lost River (FWS 2013d; Reclamation 2012), and occasional individuals have been found in this stream region (NMFS and FWS 2013), suggesting it is possible that shortnose sucker could occur at the Pacific Connector pipeline crossing of Lost River at MP 212.07 during the non-spawning period. An additional 31 dry open-cut small intermittent stream crossings cannot be ruled out completely from potentially having shortnose sucker present because surveys have not been conducted for their presence.

The Project **may affect** shortnose suckers because:

- shortnose suckers occur within the Upper Klamath River subbasin and Lost River subbasin, which would be affected during construction of the proposed action.

The Project is **likely to adversely affect** shortnose suckers because:

- there is a possibility that shortnose suckers could occur within the Lost River when it would be crossed by the Pacific Connector pipeline and may be affected by elevated suspended sediment;

- shortnose suckers could occur in 19 waterbodies crossed by dry open-cut construction in the Lake Ewauna-Klamath River watershed and in 13 waterbodies west of MP 214.38 (including the Lost River) crossed in the Mills Creek-Lost River watershed and be indirectly affected by elevated suspended sediment levels, streambank erosion and stability, and aquatic nuisance species introductions; and
- adults and juveniles subject to fish salvage within the isolated construction site at 31 ditches crossed by dry-open cuts and the Lost River could be affected if electroshocking is used and stressed if seining is used.

The Project **may affect** designated critical habitat for the shortnose sucker because:

- there is a low risk of HDD failure during crossing of the Klamath River, resulting in a frac-out that releases drilling mud into the river.

However, the Project is **not likely to adversely affect** designated critical habitat for the shortnose sucker because:

- HDD crossing methods would avoid critical habitat in the Klamath River;
- the potential for hydraulic fracture is so unlikely as to be discountable; and
- in the event of released bentonite during an HDD crossing, corrective actions would contain and temporally limit drill mud volumes.

4.6.1.4 Amphibians and Reptiles

Oregon Spotted Frog (Federally Threatened Species, Critical Habitat, State Sensitive-Critical)

On August 29, 2014, FWS listed the Oregon spotted frog as threatened (79 FR 51657). Critical habitat for the Oregon spotted frog was finalized in May 2016 and includes critical habitat in Oregon (Units 7 through 14; 81 FR 29335). This species is almost always found in or near a perennial body of water that includes zones of shallow water and abundant emergent or floating aquatic plants, which the frogs use for basking and escape cover (Corkran and Thoms 1996; FWS 2013f). The closest designated CHU to the Project is CHU 14 – Upper Klamath, which consists of 262 acres of lakes and creeks in Klamath and Jackson Counties and is currently occupied by Oregon spotted frogs (1 FR 2933). The Buck Lake population within CHU 14 is the closest occurrence of Oregon spotted frogs to the Project. This site includes seasonally wetted areas adjacent to the western edge of Buck Lake encompassing Spencer Creek downstream due west of Forest Service Road 46, three unnamed springs, and Tunnel Creek (81 FR 29335).

Oregon spotted frogs at Buck Lake have been consistently monitored from 2012 to 2016, along with other populations in the Oregon Cascades (Adams et al. 2017). Observations of frogs at two sites in Buck Lake and one in Tunnel Creek (both in CHU 14) indicate some variability in counts for each of several life stages but adults and larva or juveniles were found each year. Spencer Creek upstream of Buck Lake is almost equally subdivided into Buck Marsh, closest to Clover Creek Road, and Buck Meadow, closest to Buck Lake (Lerum 2012). Buck Marsh is fed by several springs with evidence of beaver activity, and Buck Meadow is a pasture that often floods in the spring but does not stay flooded long enough to provide Oregon spotted frog breeding habitat. Further, soils in Buck Marsh are dense, possibly compacted by past heavy livestock use, and provide little water infiltration. Neither Buck Marsh nor Buck Meadow currently provide habitat for Oregon spotted frogs (Lerum 2012). Riparian vegetation is sparse and is unlikely to support beaver occupancy that could help to create suitable habitat (Lerum 2012).

The Project would cross Spencer Creek on the north side of Clover Creek Road, approximately 6,400 feet upstream from the CHU 14 at Buck Lake and pass within 280 feet of critical habitat in Spencer Creek downstream of Buck Lake. Potential effects on Oregon spotted frogs include changes to habitat quality and acoustic. Conservation measures proposed by Pacific Connector to reduce construction and operation effects on waterbodies and riparian zones would apply to Oregon spotted frogs.

Spencer Creek upstream of Buck Lake is not currently suitable habitat for Oregon spotted frogs and is unlikely to become suitable habitat and support Oregon spotted frogs at the time of construction as described above. Clover Creek road separates the right-of-way from Spencer Creek downstream of Buck Lake so sediment from the construction right-of-way is not expected to enter Spencer Creek.

The Project **may affect** Oregon spotted frogs because:

- the Pacific Connector pipeline route would cross Spencer Creek, which is hydrologically connected to Buck Lake which is occupied by the frog; and
- the Pacific Connector pipeline route is within 280 feet of Spencer Creek and would cross tributaries to Spencer Creek downstream of Buck Lake, which is occupied by the Oregon spotted frog.

However, the Project **is not likely to adversely affect** Oregon spotted frogs for the following reasons:

- Buck Lake is approximately 6,400 feet downstream from where the pipeline route would cross Spencer Creek. Suspended sediment generated by the proposed action is expected to remain in the water column for 1,450 feet downstream from the construction site.
- Suspended sediment resulting from the crossing of Spencer Creek would pass through Buck Marsh, which Oregon spotted frogs do not currently inhabit. If the Oregon spotted frog does occur in Buck Marsh at the time of pipeline construction, conservation measures would limit potential effects due to acoustic shock, introduction of non-native species and/or disease, fuel and chemical spills, and herbicides.
- Future presence of Oregon spotted frogs in Spencer Creek upstream of Buck Lake at the time of construction is extremely unlikely and considered to be discountable.
- Although the right-of-way occurs as close as 280 feet from Spencer Creek downstream of Buck Lake, they are not hydrologically connected because Clover Creek road separates the right-of-way from Spencer Creek; BMPs and erosion control measures should prevent sediment from the construction right-of-way from entering Spencer Creek.

The Project **may affect** designated critical habitat for the Oregon spotted frog because:

- the Pacific Connector pipeline route would be within 280 feet of designated critical habitat within Spencer Creek downstream of Buck Lake.

The Project **is not likely to adversely affect** designated critical habitat for the Oregon spotted frog because:

- the designated critical habitat within 280 feet of the pipeline is not hydrologically connected to the right-of-way because it is separated by Clover Creek Road.

Sea Turtles

Four federally listed sea turtles potentially occur near the Project: green sea turtles, leatherback sea turtle, olive ridley sea turtle, and loggerhead sea turtle. All four species are federally threatened or endangered and state threatened or endangered.

Green sea turtles have been sighted from Baja California to southern Alaska, but most commonly occur from San Diego south (NMFS 2007a). Green turtles primarily use three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas (NMFS 2007a). Reports of stranding suggest that the green turtle is a frequent visitor to the coast of California. Based on this data, green turtles are likely infrequent, transient visitors to the Oregon Coast, but may occasionally be found in the marine analysis area.

The leatherback sea turtle is the most common sea turtle in United States waters north of Mexico (NMFS and FWS 1998), and numerous sightings have been documented off the Oregon Coast. Adult leatherback turtles are highly migratory and available information indicates that eastern Pacific migratory corridors exist along the west coast of the United States (NMFS and FWS 1998). The west coast of the United States may represent some of the most important foraging habitat in the world for the leatherback turtle (NMFS and FWS 1998). Despite occasional reports of leatherbacks sighted at sea, and a growing database documenting their incidental catch in coastal and pelagic fisheries, there are very few areas where the species is routinely encountered. Exceptions include Monterey Bay, California (NMFS and FWS 1998). These data suggest that leatherback sea turtles would be present in the marine analysis area in higher densities relative to other sea turtle species, but still in low densities overall.

At-sea occurrences of olive ridley sea turtles in waters under United States jurisdiction are limited to the west coast of the continental United States and Hawaii, where the species is rare, but possibly increasing. During feeding migrations, olive ridley turtles may disperse into waters off the Pacific west coast as far north as Oregon (FWS 2013g). Based on sightings off the Oregon coast, olive ridley turtles may occasionally occur in the marine analysis area.

Loggerhead sea turtles occupy three different ecosystems during their lives—the terrestrial zone, the oceanic zone, and the neritic zone (NMFS 2007b). In the United States, occasional sightings are reported from the coasts of Washington and Oregon, but most records are of juveniles off the coast of California (NMFS 2007b). The potential importance of Oregon waters and the marine analysis area to loggerhead turtles is unknown, although two loggerhead turtles have been reported stranded in Oregon and Washington since the beginning of 1997 through 2007 (NMFS 2008d).

Direct effects of the proposed action include injury and/or mortality due to ship-strikes, underwater ship noise, and potential adverse effects from a vessel spill at sea. Spills could indirectly affect federally listed sea turtles by affecting forage species. Below is a determination of effects summary for the federally listed sea turtles and critical habitat.

The Project **may affect** federally listed sea turtles because:

- these sea turtles may occur within the marine analysis area during operation of the proposed action;
- the proposed action would increase shipping traffic (LNG carriers) within the marine analysis area; and
- the continental U.S. Pacific Coast provides important foraging habitat for leatherback turtles.

However, the Project is **not likely to adversely affect** federally listed sea turtles because:

- Ship strike on sea turtles would be highly unlikely, and Jordan Cove would provide a ship strike avoidance measures package to LNG carrier operators transporting cargo from the terminal that consists of multiple measures to avoid striking marine mammals, which should also benefit sea turtles. There is limited evidence that leatherback turtles have been struck by ships, and a measurable increase in collision potential as a result of the proposed action is expected to be highly unlikely.
- Noise produced by LNG carriers would contribute to overall noise levels within the marine analysis area en route to the Port of Coos Bay and effects of ship noise on sea turtles could exceed NMFS interim noise exposure criteria for Level B single non-pulse noise (NMFS 2016c, NMFS 2017b, NMFS 2018c), but would not exceed existing background ship noise levels and would not cause injury.

No critical habitat has been designated or proposed for the olive ridley or loggerhead sea turtles. Critical habitat was established for the green turtle on Culebra Island, Puerto Rico, on September 2, 1998 (NMFS 1998); however, no critical habitat for green sea turtles occurs on the U.S. Pacific Coast, and the Project would therefore have **no effect** on designated critical habitat for the green turtle.

The Project **may affect** designated critical habitat for the leatherback turtle because:

- Critical habitat coincides with nearshore waters in the marine analysis area through which LNG carriers would transit to Coos Bay and the LNG terminal.

However, the Project is **not likely to adversely affect** designated critical habitat for the leatherback turtle because:

- LNG carriers and the Jordan Cove LNG Project are not likely to contribute oil, fuel, lubricants, or other contaminants to critical habitat to the extent that would adversely affect the occurrence of prey species, primarily jellyfish, of sufficient condition, distribution, diversity, and abundance to support individual as well as population growth, reproduction and development (PBF 1); and
- disturbance of benthic habitats within Coos Bay due to dredging would be of sufficiently short duration and small scale relative to the area available for settlement of larvae of the scyphozoan prey species within Area 2 that effects on PBF 1 would be unmeasurable and would therefore be discountable.

4.6.1.5 Invertebrates

Vernal Pool Fairy Shrimp (Federally Threatened Species with Critical Habitat, No State Status)

Vernal pool fairy shrimp were listed as threatened under the ESA on September 19, 1994 (FWS 1994a). This crustacean inhabits vernal pools, or seasonal wetlands that fill with water during fall and winter rains, in California and southwestern Oregon. The vernal pool fairy shrimp was identified relatively recently (in 1990) and was not discovered in Jackson County, Oregon until 1998 (FWS 2005s). As a result, it is possible that additional locations for the species will be found in Oregon in the future (FWS 2005a). Suitable vernal pool habitat occurs within and adjacent to Project facilities (habitat has not yet been surveyed). Additionally, a proposed pipe storage yard is in the Burrill Lumber industrial yard adjacent to the vernal pool fairy shrimp CHU VERFS 3A.

Potential effects on vernal pool fairy shrimp and critical habitat include possible disturbance to pools from driving or storing equipment or pipes near or on pools or wetlands, and alteration of hydrology. Although nine vernal pools within the right-of-way between MPs 145.3 and 145.4 are outside the known range for vernal pool fairy shrimp, the vernal pools may provide suitable habitat for the species because the pools occur within the appropriate soils type (Agate-Winlo) for vernal pool fairy shrimp, occur near (i.e., within 8.2 miles of) the known and relatively recently (1998) expanded range of the species, and the species' absence has not been confirmed. Based on the relatively recent expansion of the known range of this species and the presence of potentially suitable habitat (including soil type) that has not been surveyed, there is potential for this species to be present within the right-of-way and be affected by pipeline construction.

These effects would be minimized through avoidance and minimization measures. Specifically, Pacific Connector has indicated they would avoid using areas within yards that may contain vernal pool fairy shrimp and, if this species is noted during survey efforts, they would implement proper sedimentation control barriers to reduce potential effects on the species. Additionally, if Pacific Connector is not able to avoid the vernal pool complex between MPs 145.3 and 145.4, they have committed to implementing mitigation measures consistent with FWS's Vernal Pool Conservation Strategy for Jackson County, Oregon, as amended December 29, 2015 (FWS 2011c and 2015b).

Below is a determination of effects summary for the vernal pool fairy shrimp and critical habitat.

The Project **may affect** vernal pool fairy shrimp for because:

- Potentially suitable habitat for vernal pool fairy shrimp has been identified near four proposed Jackson County pipe storage yards, as well as within and adjacent to the pipeline right-of-way between MPs 145.34 and 145.40.

The Project is **likely to adversely affect** vernal pool fairy shrimp because:

- Effects on vernal pool fairy shrimp are possible due to the Project's crossing of potentially suitable, unsurveyed habitat within the pipeline right-of-way between MPs 145.34 and 145.40 (within Agate-Winlo soils).

The Project **may affect** vernal pool fairy shrimp critical habitat because:

- the Project occurs adjacent to designated vernal pool fairy shrimp critical habitat; and

- the Project may affect suitable habitat within designated critical habitat adjacent to the Project.

However, the Project is **not likely to adversely affect** vernal pool fairy shrimp critical habitat because:

- Although the proposed Burrill Lumber pipe yard occurs within 250 feet of designated vernal pool fairy shrimp CHU (VERFS 3A), it is separated from the CHU by Agate Road, which is a two-lane paved road that acts as a barrier to hydrologic connectivity that is considered a definitive boundary to the area of effects.
- Burrill Lumber pipe yard has been previously disturbed, and additional surface disturbances and/or soil compaction by heavy machinery from use within Burrill Lumber pipe storage yard should be minimal. Also, Agate Road is located between Burrill Lumber pipe yard and CHU VERFS 3A, which is raised and paved, and would serve as an existing barrier between the pipe yard and CHU. Therefore, use of the Burrill Lumber pipe storage yard is not expected to adversely modify geographic, topographic, and edaphic features potentially within 250 feet of the yard that support systems of hydrologically interconnected pools, swales, and other ephemeral wetlands and depressions within the matrix of surrounding uplands (PBF 2).
- Proposed conservation measures would reduce the potential for increased sediment mobilization, increased fugitive dust, and the potential spread of invasive species to suitable vernal pool habitats.

Franklin's Bumble Bee (Federally Proposed Endangered Species, No State Status)

On August 13, 2019, the FWS proposed to list Franklin's bumble bee (*Bombus franklini*) as an endangered species under the ESA (84 FR 40006). The species was first described in 1921 and was later determined to be one of the rarer species of the *Bombus* genus (Frison 1921, 1922). Franklin's bumble bee has the most restrictive range of any North American bumble bee, limited historically to Douglas, Jackson and Josephine Counties of southwestern Oregon as well as Trinity and Siskiyou Counties of northern California (FWS 2018c). Since the late 1990s, Franklin's bumble bee observations have declined significantly, and none have been observed since a 2006 observation in southern Jackson County, Oregon (FWS 2018c). The species has long been considered to have a relatively small population size and relatively small colony size compared to other *Bombus* species (FWS 2018c).

Franklin's bumble bee has a flight season starting in mid-May, through the end of September and sometimes into October (Xerces Society and Thorp 2010). Colonies have an annual cycle initiated each spring as the queen emerges and searches for suitable nest sites (FWS 2018c). In the early stages of the colony development, the founding queen collects food and cares for her eggs and the larvae (FWS 2018c). She collects nectar and pollen to support the production of her eggs which are fertilized the previous fall by sperm she stores through hibernation (FWS 2018c). As the colony matures, workers assume the duties of food collection, defense, nesting and larval care while the queen produces eggs and resides within the nest (FWS 2018c). Near the end of the cycle, reproductive queens and fertile males are produced, and work together to select mating territories (FWS 2018c). After mating, new queens build up fat before hibernating/overwintering, and at the cycle's end, all worker bees along with new and old males die as well as the founding queen. Only the inseminated queens are left to carry on the lineage through hibernation and into the following year (Duchateau and Velthius 1988). Overwintering habitat includes micro-habitats such as ground cavities, rotting logs, loose soil, and other protected sites for queens to hibernate, as well as abundant floral resources and suitable nest sites for emerging queens the following spring (FWS 2018c). The nesting biology of Franklin's bumble bee is currently unknown but the species is likely to nest in small underground cavities such as abandoned rodent burrows, typically sheltered areas that offer places for resting, food storage, nesting and room for the colony to grow, as well as on the ground, rock piles and sometimes residential garages (FWS 2018c; Hobbs 1968; Plath 1927; Plowright and Stephen 1980; Thorp et al. 1983; Thorp 1999; Xerces Society and Thorp 2010).

Franklin's bumble bee requires a constant and diverse supply of flowers that bloom throughout the colony's life cycle, from spring to autumn (Xerces Society and Thorp 2010). These types of areas are typically found in habitats of open (non-forested) meadows in proximity to seeps and other wet meadow environments (FWS 2018c). Franklin's bumble bee is known to be a habitat generalist and a generalist forager, meaning they gather food (pollen and nectar) from a wide variety of flowering plants and do not require synchrony with any one particular plant species (FWS 2018c; Xerces Society 2013). Because of this, the species is only limited to areas that provide floral resources for food, and protected areas for nesting, within its known range (FWS 2018c; Xerces Society and Thorp 2010). Individuals have been observed collecting pollen from plant species such as lupine (*Lupinus* spp.) and California poppy (*Eschscholzia californica*); collecting nectar from horsemint or nettle-leaf giant hyssop (*Agastache urticifolia*) and mountain monardella (*Monardella odoratissima*); on clover (*Trifolium* sp.); and may also collect pollen and nectar from vetch (*Vicia ssp.*) (Brooks 1999; FWS 2018c; Xerces and Thorp 2010).

As described above, the species requires sufficient floral resources for food (e.g., plants flowering from spring to autumn) in close proximity to nesting sites and overwintering sites, connectivity among colonies and populations (minimum of 6 km^2 area), and spatial heterogeneity (FWS 2018c). The Project pipeline overlaps the species' historical range (Douglas and Jackson Counties, Oregon) for approximately 121 miles between approximately MPs 46 and 166 (figure 1.1-1, table 4.7.2.1-1, FWS 2018c).

Overall, the Project crosses approximately 40 miles of habitat with which the species is assumed to be associated, including 34 miles of grassland and shrubland habitats and 6 miles of wetland and riparian habitats (table 4.5.1.2-1). These habitats constitute 17.5 percent of the total Project mileage, although these values include habitat within Coos and Klamath County, where the species is not currently known to occur (table 4.5.1.2-1). Approximately 966 acres of these habitat types would be disturbed during construction (851 acres grassland/shrubland, 115 acres wetland/riparian; table 4.5.1.2-5). Franklin's bumble bee has not been documented within 3 miles of the Project, despite extensive survey efforts (ORBIC 2017a; FWS 2018c).

If present during construction, Franklin's bumble bee colonies could be destroyed as a result of vegetation or debris clearing and right-of-way construction, including direct mortality of bee individuals. Additionally, effects could occur due to the loss of suitable foraging, nesting and/or overwintering habitat, resulting in habitat loss and fragmentation. Effects of habitat disturbance would be reduced through revegetation efforts outlined in Pacific Connector's ECRP (Appendix I of the POD [appendix F.10 of this EIS]). Habitats that are typically occupied by this species (grassland/shrubland and wetland/riparian) temporarily impacted during construction would be replanted following construction and could provide food sources to Franklin's bumble bees if present. As required by FERC's *Plan*, Pacific Connector has consulted with the NRCS and land management agencies regarding recommended seed mixtures for the Project area (Appendix I of the POD [appendix F.10 of this EIS]). The Recommended Seed Mixtures for Private Lands as described in the ECRP includes species in which Franklin's bumble bee has been observed foraging in the past, including red clover (*Trifolium pretense*) and white clover (*Trifolium repens*).

Herbicide use could also affect Franklin's bumble bee. Application of herbicides during noxious weed treatments may indirectly affect Franklin's bumble bee by reducing nectar and pollen sources, and could directly affect Franklin's bumble bee if bees are exposed hazardous herbicides. Vegetation at aboveground facilities would be periodically maintained using mowing, cutting, trimming and the selective use of herbicides. Project herbicide application could reduce available floral food sources for Franklin's bumble bees, as use of herbicides can lead to a decrease in the number of flower plants overall (FWS 2018c; Potts et al. 2010). Additionally, some research suggests herbicides are more toxic to bees than previously thought, and specifically that exposure of bees to glyphosate can alter their beneficial gut microbiota, potentially making them susceptible to infections (Motta et al. 2018). However, herbicides would only be used where they are most appropriate treatment method and would be applied using spot treatments to minimize impact on native or non-target species. Additionally, Pacific Connector would not use aerial herbicide applications, would not use herbicides for general brush/tree control within the 30-foot maintained operational corridor, and would not use herbicides within 100 feet of a wetland or waterbody, unless allowed by the appropriate agency. If herbicides are used to control noxious weed infestations, Pacific Connector would employ a state or federally-licensed herbicide applicator to ensure that the appropriate herbicides are utilized for the targeted weed species during its proper phenological period and at the specified rate. The applicator would ensure that the herbicides are used according to the labeling restrictions and according to all applicable laws and restrictions and according to the appropriate land managing agency decision documents. Permits for the use of herbicides on federal lands would be obtained prior to use/treatment, as described in the *Integrated Pest Management Plan* (Appendix N of the POD [appendix F.10 of this EIS]).

Below is a determination of effects summary for the Franklin's bumble bee.

The Project **may affect** Franklin's bumble bee because:

- Potentially suitable habitat for Franklin's bumble bee occurs along the pipeline right-of-way and within the known range of the species, approximately between MPs 46 and 166.

If FWS lists Franklin's bumble bee prior to completion of the Project, the provisional determination **may affect, likely to adversely affect** would be warranted because:

- Franklin's bumble bee individuals could be disturbed or killed during vegetation clearing during construction; and
- the Project would disturb potentially suitable habitat during construction, resulting in a temporary decrease is suitable foraging and/or nesting habitat.

Because Franklin's bumble bee is proposed for listing, the Project **would not likely jeopardize the continued existence** of Franklin's bumble bee for the following reasons:

- Potentially suitable habitat within the pipeline project right-of-way would be restored following construction and could provide suitable habitat once revegetated.
- The herbaceous revegetation of previously forested areas (e.g., along the permanent right-of-way that would be maintained in an herbaceous state) may create some new foraging habitat for Franklin's bumble bee.
- The Project does not overlap with the area of the highest density of known observations of the species (i.e., in southern Oregon near Ashland, close to the California border), and no Franklin's bumble bees have been observed within 3 miles of the Project.

4.6.1.6 Plants

A botanical analysis area applies to the extent of Project-related effects on listed plant species. For most listed plant species, the botanical analysis area for this Project extends to 98 feet (30 meters) each side of the pipeline project (i.e., construction right-of-way, TEWAs, UCSAs, rock source and disposal sites, proposed storage yards, and aboveground facilities) as well as the footprint for the Jordan Cove LNG Project. The botanical analysis area, in general, includes the area surveyed for sensitive and listed plant species (at least 100 feet from habitat removal on federal lands and at least 50 feet from habitat removal on non-federal, private lands) and distance that indirect effects on plants would be expected. For vernal pool–dependent species, the botanical analysis area was extended to 250 feet (76 meters). Surveys are incomplete in areas of potential habitat along the pipeline route where landowner permission was denied. Pacific Connector would survey these areas after the Project is certificated, but before construction begins (i.e., if the Project is approved and Pacific Connector gains access using eminent domain proceedings under Section 7h of the NGA). Pacific Connector identified unsurveyed areas that may contain suitable habitat for listed species; these areas would be required to be surveys prior to construction (see chapter 5).

Pacific Connector has developed a *Federally-listed Plant Conservation Plan* to address how avoidance, minimization, propagation, restoration, and other conservation measures would be applied to protect listed plant species, as well as how potential effects on unsurveyed lands would be addressed. For example, if populations of listed plant species are identified where surveys were previously denied, Pacific Connector would apply mitigation measures that have been developed for surveyed lands to reduce and avoid effects on these species including (1) minor alignment or route adjustments; (2) narrowing or necking-down the construction right-of-way; or (3) eliminating or removing a portion of a TEWA or UCSA (depending on where new populations of these species were identified). Additional construction measures that would be implemented in areas that contain listed plants to reduce and avoid effects on these species, if they occur, include the following measures listed below.

- The construction right-of-way and TEWAs would be surveyed and flagged to clearly mark the limits of construction disturbance (i.e., clearing/grading).
- Where feasible, the Environmental Inspector (EI) would monitor the survey and flagging efforts and would provide additional protective buffers or neckdowns to ensure protection of adjacent plant populations or provide additional avoidance. The EI would consult with Pacific Connector's Chief Inspector and the construction contractor during construction to

determine where additional buffer protections or neckdowns could be accommodated without affecting construction safety.

- Known plant populations adjacent to the construction right-of-way or other plants populations identified during preconstruction surveys would be protected by a safety fence and silt fence to ensure these plants are not inadvertently affected by Project activities.
- BMPs outlined in Pacific Connector's *Air, Noise and Fugitive Dust Control Plan* (see Appendix B of the POD [appendix F.10 to this EIS]) to reduce wind erosion and fugitive dust emissions during construction and restoration activities would be implemented. Water would be used to control fugitive dust along the construction right-of-way (no Dustlok® would be used within 150 feet of any listed plants). Only enough water would be sprayed to control the dust or to reach the optimum soil moisture content to create a surface crust; no runoff would be generated.
- Equipment would be inspected and cleaned of potential noxious weed seed or plant parts consistent with the requirements of Pacific Connector's *Integrated Pest Management Plan*.
- Topsoil salvaging would occur within affected populations after species-specific seed, bulb, or whole plant salvage has occurred. The salvaged topsoil would be returned to its original location during restoration.
- During restoration, all areas would be regraded as closely as possible to the original contours to ensure preconstruction drainage patterns are not affected.
- The construction right-of-way would be restored to its original contours and reseeded with an appropriate seed mixture recommended by FWS prior to the following growing season.
- When feasible, Pacific Connector would collect and bag seeds and/or bulbs of affected listed plants and provide these seeds and/or bulbs to a suggested repository. Upon FWS approval, the collected seeds would be replanted within or adjacent to the construction right-of-way on suitable federal lands where future protection can be managed or on private lands where a conservation easement has been acquired.
- Wetland mats would be used in travel areas between MPs 195.5 to 196.6 in saturated soil areas to reduce soil rutting and soil compaction and protect existing Applegate's milk-vetch plants that may be present.

The *Federally-listed Plant Conservation Plan* includes specific mitigation plans for Applegate's milk-vetch, Gentner's fritillary, Kincaid's lupine, and Cox's mariposa-lily. In addition, the Forest Service has developed mitigation measures/requirements related to their right-of-way Grant that may also indirectly benefit listed plant species (see section 2 of this EIS and appendix F).

Below is a discussion of each federally-listed plant species that could be affected by the Project. The mitigation measures discussed above would apply to all federally-listed plants discussed in this section.

Applegate's Milk-vetch (Federally Endangered Species, State Endangered Species)

FWS listed Applegate's milk-vetch (*Astragalus applegatei*) as endangered on July 28, 1993 (FWS 1993c). This species has a narrow range, known only in the Lower Klamath Basin (the plain containing Lower Klamath Lake), near the city of Klamath Falls in southern Oregon. It was believed to be extinct until its rediscovery in 1983 and at the time of listing was only known from two extant sites. Applegate's milk-vetch grows in flat-lying, seasonally moist, alkaline soils with underlying clay hardpans. The species' habitat was historically characterized by sparse, native bunchgrasses and patches of bare soil, allowing for some seed dispersal by wind. Today, dense coverage of the habitat by introduced grasses and weeds means seed dispersal is highly localized, with most seedling establishment found adjacent to mature plants (FWS 1998b). Continued destruction, modification, and/or curtailment of its habitat or range due to urban and commercial development, and loss of habitat through competition with non-native weeds, are the principal threats to the survival of the species (FWS 2009a).

The Pacific Connector Project is located within known and historic Applegate's milk-vetch range between MPs 191.20 to 214.30. The "Collins Tract site," which is located within and adjacent to the botanical analysis area between approximately MP 195.3 and MP 196.7, contains 19 sub-populations of Applegate's milk-vetch, several of which were discovered by FWS and SBS during surveys conducted for Pacific Connector. This area was revisited in 2018 and no new sites were documented. Pacific Connector has revised its proposed route slightly in this area to avoid direct effects on the plants identified in 2008 within the Collins Tract site. Survey efforts of the pipeline route subsequent to these initial survey efforts in 2007 and 2008 have not identified any additional plants; however, Pacific Connector has not surveyed all potential habitat. Additionally, in 2009, the FWS and The Nature Conservancy documented 675 plants within and adjacent to the proposed Klamath Falls Memorial Drive 2 pipe storage yard, in an area that has not been surveyed for the Project (ORBIC 2017a).

The route has been relocated to avoid known populations of Applegate's milk-vetch as well as suitable habitat found during surveys conducted during summer 2008; therefore, no direct effects on known plants in those sites are expected. Additionally, Pacific Connector would resurvey the Klamath Falls Memorial Drive 2 pipe storage yard prior to construction and avoid the use of the proposed yard within 30 meters of known and documented Applegate's milk-vetch plants. Project surveys of all suitable habitat have not been completed for this species; therefore, additional plants could potentially be encountered and affected by the Project. Measures to reduce impacts on unidentified plants are included in the *Applegate's Milk-vetch Mitigation Plan*. Pacific Connector would also provide in-lieu fee payments for a conservation easement or land acquisition to preserve 4.0 acres of occupied Applegate's milk-vetch habitat and would provide funding for third-party research of Applegate's milk-vetch. Additionally, per FWS request, two years of seed collection would be conducted for any Applegate's milk-vetch plants within or adjacent to the construction right-of-way and workspaces prior to construction. Applegate's milk-vetch plants within the construction right-of-way and workspaces would also be salvaged and provided to a FWS-approved conservation entity. Below is a determination of effects summary for Applegate's milk-vetch and critical habitat.

The Project **may affect** Applegate's milk-vetch because:

- suitable habitat is available within the botanical analysis area; and
- individual plants have been located within the analysis area during survey efforts.

The Project is **likely to adversely affect** Applegate's milk-vetch because:

- approximately 175.3 acres of potential suitable habitat that has not been surveyed occurs within the botanical analysis area along the pipeline route, which includes 77 acres within the pipeline right-of-way; therefore, it is possible that unidentified plants occur within the construction right-of-way and workspace;

- surface disturbance and excavation would occur within potentially suitable habitats and could impact unidentified plants (including in areas where surveys have not been completed); and
- indirect effects, including potential changes in hydrology and soil characteristics, introduction and spread of invasive plants and noxious weeds, alterations to vegetation cover and species composition of associated habitat, and effects from fugitive dust, could impact documented or suspected plants and habitat outside the construction right-of-way, but within 30 meters of the Project pipeline.

Critical habitat has not been designated for Applegate's milk-vetch.

Gentner's Fritillary (Federally Endangered Species, State Endangered Species)

FWS listed Gentner's fritillary (*Fritillaria gentneri*) as endangered on December 10, 1999 (FWS 1999). Gentner's fritillary is found in small, scattered locations in the Rogue and Klamath River watersheds in Jackson and Josephine Counties in Oregon (FWS 2003d; 2016d). This species is highly localized, with populations occurring within a 30-mile radius of Jacksonville Cemetery in Jacksonville, Oregon (FWS 2003d). Since the 2003 publication of the recovery plan, nine new Gentner's fritillary populations (approximately 131 flowering plants within 1.6 acres) have been detected outside of the four recovery unit boundaries (FWS 2016d). It is difficult to census populations of Gentner's fritillary because this species does not flower every year and individuals can remain dormant for one or more years underground.

Gentner's fritillary is often found on the edge of dry woodland and forests where the overstory can be dominated by Oregon white oak, madrone, Douglas-fir, and ponderosa pine; it also occurs in open chaparral and grassland environments. It occurs at a wide range of elevations, from 1,000 to 5,100 feet, and is usually associated with shrubs that provide protection from the wind and sun (FWS 2003d).

The Pacific Connector Project crosses the plant's range between approximately MP 113 through MP 155. Surveys for Gentner's fritillary have occurred within suitable habitat near the pipeline from 2007 through 2018. Surveys are expected to continue to complete recommended second year survey efforts, where necessary. Additionally, surveys will be initated in other areas that receive survey permission. Since 2007, survey efforts have identified Gentner's fritillary individuals in three locales: (1) 21 feet from TEWA 128.01-W; (2) near MP 129.1 approximately 54 feet from TEWA 128.92-N; and (3) within 21 feet of TEWA 142.07-N near MP 142.1. Direct impacts on known individuals of Gentner's fritillary would be avoided. Additionally, TEWA 128.01-W, TEWA 128.92-N, and TEWA 142.07-N have been removed from the proposal or modified to avoid indirect impacts on known individuals of Gentner's fritillary as well as unidentified *Fritillaria* plants near MP 129. TEWA 142.07-N has also been removed from the proposal to avoid indirect impacts on known individuals of Gentner's fritillary; however, unidentified *Fritillaria* plants near MP 142.1 that could be Gentner's fritillary occur within the pipeline right-of-way and would be impacted if a reroute of the pipeline alignment is not implemented.

Additionally, Project surveys of all suitable habitat have not been completed for Gentner's fritillary; therefore, additional plants could potentially be encountered and affected by the Project.

Per FWS request, Pacific Connector will conduct additional surveys where prior surveys are older than 10 years and would survey previously unsurveyed federal and private lands in accordance with existing FWS protocols (FWS 2016d).

Measures to reduce impacts on this species are included in the *Gentner's Fritillary Mitigation Plan*. Pacific Connector would also provide in-lieu fee payments for a conservation easement or land acquisition to preserve 4.2 acres of Gentner's fritillary habitat on privately-owned land or would work with a FWS-approved conservation entity to aid in this species recovery. Similarly, Pacific Connector has proposed mitigation on behalf of the BLM, including outplanting of Gentner's fritillary within suitable habitat as described in Attachment 2 of the *Comprehensive Mitigation Plan* filed with FERC on August 30, 2019. Below is the determination of effects summary for Gentner's fritillary.

The Project **may affect** Gentner's fritillary because:

- suitable habitat is available within the analysis area; and
- individual plants have been located within the analysis area during survey efforts.

The Project is **likely to adversely affect** Gentner's fritillary because:

- approximately 240.9 acres of potential suitable habitat that has not been surveyed occurs within the botanical analysis area along the pipeline route, which includes 50.4 acres within the pipeline right-of-way; therefore, it is possible that unidentified plants occur within the construction right-of-way and workspace;
- *Fritillaria* spp. have been identified within and adjacent to areas that would be affected by the Project;
- Gentner's fritillary can remain dormant underground for one year or longer, does not flower every year, and has been documented to not flower for several years; therefore, it is possible that protocol surveys conducted for the Project did not locate this species; and
- indirect effects, including potential changes in hydrology and soil characteristics, introduction and spread of invasive plants and noxious weeds, alterations to vegetation cover and species composition of associated habitat, and effects from fugitive dust, could impact documented or suspected plants and habitat outside the construction right-of-way, but within 30 meters of the Project pipeline.

Critical habitat has not been designated for Gentner's fritillary.

Western Lily (Federally Endangered Species, State Endangered Species)

FWS listed the western lily (*Lilium occidentale*) as endangered on August 17, 1994 (FWS 1994b). This lily is currently known from 23 small populations in freshwater marshes and swamps, early successional fens (bogs), coastal scrub and prairie, openings in coastal, Sitka spruce–dominated coniferous forests, as well as other poorly drained soils along the coast of southern Oregon and northern California (FWS 2009b). Western lilies have an extremely restricted distribution, and only occur along the coast within 4 miles of the Pacific Ocean. Occurrences within the Coos Bay area are reported to occur in Blacklock soils; however, it also grows in soils that are well drained that have a substantial layer of organic soil (SHN 2013c).

The closest known western lily occurrence in relation to the Project is approximately 1 mile south of the Myrtlewood Off-site Park & Ride at the Hauser Bog (ORBIC 2017b). However, the Myrtlewood Off-site Park & Ride is located completely in the paved parking lot and does not contain suitable habitat for the western lily. There are no other known occurrences within two miles of the Project (ORBIC 2017b). There are no records of western lily north of Hauser, and the FWS typically considers Hauser the northern extent for the species along the Oregon coast.

Surveys for western lily within potential habitat in the analysis area (i.e., poorly drained bogs with acidic organic soils and within six miles of the coast below 300 feet elevation) were conducted between 2006 and 2017 (SHN 2013c; SBS 2008a, 2012, 2013, 2014, 2017a). Jordan Cove conducted surveys at the LNG terminal site in 2006, 2012, and 2013 and surveys were conducted by SBS for Pacific Connector between 2007 and 2017. No occurrences of western lily were detected during these surveys, and only limited areas of potential suitable habitat were identified.

Although no plants were identified in the area that would be affected by the Project and potential occurrence of this species in this area is low, surveys of all potential habitat in the area have not been completed for this species; therefore, western lily could potentially be encountered and affected by the Project. Additionally, this species is difficult to detect when not flowering, and surveys may overlook western lily juveniles or vegetative adults, especially non-flowering individuals growing within dense vegetation (FWS 2008b). Below is the determination of effects summary for western lily and critical habitat.

The Project **may affect** the western lily because:

- known populations occur within 1 mile of the botanical analysis area; and
- potential suitable habitat is available within the analysis area.

The Project is **not likely to adversely affect** the western lily because:

- surveys of potential western lily habitat at the Jordan Cove site and associated facilities and along the pipeline route did not document western lily and potential suitable habitat within the botanical analysis area is limited;
- surveys in potentially suitable habitat would occur prior to ground-disturbing activities; if plants are identified, conservation measures developed to avoid or reduce effects on any documented plants would be implemented; and
- consultations with the FWS would be reinitiated if this species is found to be present in the area and effects cannot be avoided.

Critical habitat has not been designated for the western lily.

Large-Flowered Woolly Meadowfoam (Federally Endangered Species, State Endangered Species)

The large-flowered woolly meadowfoam (*Limnanthes pumila* ssp. *grandiflora*) was federally listed as endangered on November 7, 2002 (FWS 2002b). It is an endemic species restricted mostly to the Agate Desert area in the Rogue River Valley of southern Oregon. It grows on the wetter, inner edges of vernal pools at elevations between 1,220 and 1,540 feet. In the Rogue River Valley, large-flowered woolly meadowfoam is often found in the same vernal pool habitats as Cook's lomatium (*Lomatium cookii*) and the vernal pool fairy shrimp.

In 2010, FWS designated eight CHUs (5,840 acres) for the large-flowered woolly meadowfoam in the Agate Desert complex in Jackson County, Oregon. Two of the units designated are shared by the designated habitat for Cook's lomatium. All designated CHUs are currently occupied (or expected to be occupied; FWS 2010b). Within the vicinity of White City, Oregon, where multiple pipe storage yards would be located, CHUs RV6 (6A through 6H) and RV8 have been designated. Industrial parks and agriculture surround all units. Two of the eight RV6 subunits (i.e., RV6B, RV6C, and RV6D) are near or adjacent to proposed pipe storage yards: Unit RV6C is across an existing paved road from the Burrill Lumber pipe storage yard and Unit RV6D is 590 feet northeast of this pipe storage yard. Unit RV8 is over 1.8 miles west of the proposed Rogue Aggregates and the other three pipe storage yards.

Botanical surveys were conducted within identified suitable habitat for this species where access was permitted, during the flowering season in April 2007. In 2007, survey efforts documented approximately 36 large-flowered woolly meadowfoam plants approximately 1,165 feet east of the proposed Burrill Lumber pipe storage yard. Additionally, ORBIC (2017a) has reported several other subpopulations of large-flowered woolly meadowfoam (approximately 16,200 plants) near proposed pipe storage yards, including within the Ken Denman State Game Management Preserve across an existing paved road east of the Burrill Lumber pipe storage yard.

No surveys have been permitted within Avenue F & 11th Street and WC Short pipe storage yards Based on aerial photography and off-site observation in April 2018, the Avenue F & 11th Street and WC Short pipe storage yards do not appear to contain vernal pools. However, off-site observations identified approximately 0.46 acre of highly modified, low-quality vernal pool habitat along the northern and western edge of the Avenue F & 11th Street pipe yard. This area is associated with active industrial sites or previously disturbed industrial areas and is not expected to provide high-quality vernal pool habitat or support individuals of large-flowered woolly meadowfoam. Additionally, Pacific Connector would avoid using portions of pipe storage yard within 250 feet of potential vernal pool habitat (boundary of indirect effects) or no longer pursue use of the pipe storage yard; therefore, no direct or indirect effects on potential vernal pool habitat are expected from use of the Avenue F & 11th Street and WC Short pipe storage yards. Below is the determination of effects summary for large-flowered woolly meadowfoam.

The Project **may affect** large-flowered woolly meadowfoam because:

- the pipeline occurs near occupied, large-flowered woolly meadowfoam habitat.

The Project is **not likely to adversely affect** large-flowered woolly meadowfoam because:

- surveys of potentially suitable habitat at proposed pipe storage yards in Jackson County and along the Project did not document large-flowered woolly meadowfoam plants;
- the 0.46-acre of unsurveyed potential habitat within the Avenue F and 11th and WC Short pipe storage yards consists of low-quality vernal pool habitat within active industrial sites or previously disturbed industrial areas and is unlikely to contain large-flowered woolly meadowfoam;
- Pacific Connector would avoid using portions of the pipe storage yards within 250 feet (indirect effect) of this species or potentially suitable vernal pool habitat;

- effects on suitable habitat are likely to be discountable to the point where no meaningful measurement, detection, or evaluation of effects would be possible (i.e., effects would not reach a level where individual plants would be lost);
- sedimentation barriers would be used, as appropriate, to prevent run-off and changes in hydrology;
- conservation measures have been developed to avoid or reduce effects on any plants identified during surveys prior to construction; and
- construction of the pipeline is not expected to adversely modify hydrology in nearby suitable habitat areas within 250 feet of proposed pipe storage yards.

The Project **may affect** designated critical habitat for large-flowered woolly meadowfoam because:

- the Project occurs adjacent to large-flowered woolly meadowfoam critical habitat.

The Project is **not likely to adversely affect** large-flowered woolly meadowfoam critical habitat because:

- Construction of the pipeline is not expected to adversely modify designated critical habitat areas within 250 feet of pipeline components (i.e., subunit RV6C); existing features (i.e., paved Agate Road) and proposed conservation measures would provide sufficient protection from adjacent development and invasive plant and noxious weed sources; and
- The Burrill Lumber pipe yard is hydrologically disconnected from subunit RV6D due to topography (flow is away from RV6D) and distance (greater than 590 feet) and is hydrologically isolated from subunit RV6C by the raised Agate Road.
- no dust-related impacts from use of the Burrill Lumber pipe storage yard would be expected because Pacific Connector would implement measures in the *Air, Noise and Fugitive Dust Control Plan* (see Appendix B of the POD [appendix F.10 to this EIS]) to reduce potential impacts from fugitive dust; and
- implementation of measures outlined in the *Integrated Pest Management Plan* would reduce the risk of spread and introduction of invasive plants and noxious weed species.

Cook's Lomatium (Federally Endangered Species, State Endangered Species)

Cook's lomatium was listed as federally endangered on November 7, 2002 (FWS 2002b). Jackson County populations occur along the margins and bottoms of vernal pool habitats within the 20,510-acre Agate Desert area of the Rogue River Valley, Jackson County. In the Rogue River Valley, Cook's lomatium is often found in the same vernal pool habitats as the large-flowered meadowfoam and the vernal pool fairy shrimp.

In 2010, the FWS designated 16 units (6,289 acres) of critical habitat for the Cook's lomatium, including three CHUs in Jackson County, totaling 2,282 acres. Two of the designated units in Jackson County are shared by the designated habitat for large-flowered woolly meadowfoam. All designated CHUs are currently occupied (FWS 2010b). CHUs RV6 (A, F, G, and H) and RV8 have been designated within the vicinity of White City, Oregon, where multiple pipe storage yards would be located. Industrial parks surround these units. CHUs RV6A and RV6H are located approximately 0.5 mile south and 0.8 mile southeast, respectively, of the Avenue F & 11th Street and WC Short pipe storage yards.

Four pipe storage yards, Burrill Lumber, WC Short, Avenue F & 11th Street, and Rogue Aggregates, occur within the Agate Desert near White City in proximity to known occupied vernal pools. No vernal pool habitat or individuals of Cook's lomatium were observed during surveys of the Burrill Lumber and Rogue Aggregates pipe storage yards, and no potential vernal pools were located within 250 feet of the Burrill Lumber pipe storage yard. Although the layout for the Rogue Aggregates pipe storage yard has been reconfigured since surveys in 2007, unsurveyed portions do not contain suitable soil types for Cook's lomatium. Several patches of Cook's lomatium have been documented in the Denman Wildlife Management Area and Agate Desert Preserve, 0.5 mile south of the Avenue F & 11th Street and WC Short pipe storage yards (Friedman 2006; ORBIC 2017a). Surveys have not been conducted within the Avenue F & 11th Street and WC Short pipe storage yards because access has not been granted; however, based on aerial photography and off-site observation in April 2018, Avenue F and 11th and WC Short pipe storage yards do not appear to contain suitable habitat for Cook's lomatium. However, a long drainage ditch running along the northern and western edge of the Avenue F and 11th pipe storage yard, which could provide 0.46 acre of low-quality habitat for Cook's lomatium, was observed during these off-site surveys. Pacific Connector would avoid using portions of pipe storage yards within 250 feet of potential vernal pool habitat (boundary of indirect effects); therefore, no direct or indirect effects on potential vernal pool habitat are expected from use of the Avenue F & 11th Street and WC Short pipe storage yards. Below is the determination of effects summary for Cook's lomatium and critical habitat.

The Project **may affect** Cook's lomatium because:

- suitable, occupied habitat is available within the vicinity of the Project.

The Project is **not likely to adversely affect** Cook's lomatium because:

- surveys of suitable habitat at pipe storage yards in Jackson County and along the pipeline did not document Cook's lomatium;
- Pacific Connector would avoid using portions of pipe storage yards within 250 feet of high-quality vernal pool habitat, as well as areas with potential vernal pool habitat;
- effects on suitable habitat are likely to be discountable to the point where no meaningful measurement, detection, or evaluation of effect would be possible (i.e., effect would not reach a level where individual plants would be affected);
- sedimentation barriers would be used, as appropriate, to prevent run-off and changes in hydrology;
- conservation measures have been developed to avoid or reduce effects on any plants identified during surveys prior to pipeline construction;
- known sites within the vicinity of the Project are farther than 0.5 mile from pipe storage yards; and
- unsurveyed habitat is low-quality vernal pool habitat located over 0.25 mile from known sites with no apparent hydrologic connectivity.

The Project **may affect** designated Cook's lomatium critical habitat because:

- the Project occurs in the vicinity of Cook's lomatium critical habitat.

The Project is **not likely to adversely affect** designated critical habitat for Cook's lomatium because:

- the pipeline is over 0.5 mile from the nearest critical habitat subunit RV6A; and
- the pipeline project is not expected to adversely modify habitat areas that provide buffer protection from adjacent development and weed sources, continuous nonfragmented habitat, and intact hydrology (PCEs 1 and 4).

Kincaid's Lupine (Federally Threatened Species, State Threatened Species)

Kincaid's lupine was listed as federally threatened on January 25, 2000 (FWS 2000b). It is a long-lived perennial herb inhabiting native prairies and foothills (FWS 2000b). In Douglas County, Oregon, it occupies sites that are more shaded than sites in the Willamette Valley, occurring in areas with tree (i.e., Douglas-fir, California black oak, Pacific madrone, ponderosa pine, incense cedar, hairy manzanita, and poison oak) and shrub canopy cover of 50 to 80 percent (BLM et al. 2008). About 585 acres have been designated as critical habitat for this species; however, all of these designated habitats are located outside of areas that would be disturbed by the Project.

The pipeline is located within known or historical Kincaid's lupine range between MPs 46.8 and 99.3. Multiple populations of lupine have been identified in the Project's botanical analysis area within Douglas County, including 11 sites within 2.5 miles of the pipeline (ORBIC 2017a). Surveys in 2007 identified three populations of Kincaid's lupine in the vicinity of the pipeline: 1) within and adjacent to the construction right-of-way on private land between approximately MPs 57.84 and 57.92; 2) on private land near MP 59.60 (approximately 300 feet north of MP 59.60; 67 and 222 feet to the north and west of TEWA 59.30-N; and approximately 40 and 85 feet to the south and west of EAR 59.62); and 3) and on private land within the construction right-of-way and along proposed access roads between MPs 96.48 to 96.90.

Pacific Connector has modified the pipeline route to avoid the population located within the construction right-of-way between MP 57.84 and MP 57.92. No direct impacts are anticipated to the population near MP 59.60, as plants are located at least 67 feet from pipeline facilities. The two sites, near MP 57.84-57.92 and 59.60, were revisited in 2017, and both populations appeared to be stable or slightly increasing (SBS 2017b).

Pacific Connector also modified the construction right-of-way between MP 96.48 and 96.90 to avoid direct impacts on the Kincaid's lupine individuals identified during surveys in 2007. Additionally, the population between MP 96.48 and 96.90 was burned during the 2015 Stouts Creek fire. This population was revisited in 2016 to determine the affect of the fire, associated fire-suppression activity, and subsequent logging activities. Kincaid's lupine was observed in only 2 of the original 28 subpopulations documented in the area during surveys in 2007, and no viable plants were observed in the pipeline right-of-way or within proposed access roads (SBS 2016). Although no plants were relocated along the construction right-of-way between MP 96.48 and 96.90 in 2016, it is possible that construction of the pipeline and use of access roads could affect this population if plants resprout in this area. Pacific Connector would conduct additional surveys within the Stouts Creek fire area (MP 96.48 to 96.9) prior to ground disturbance.

No additional plants have been documented in other areas of the pipeline route, where access was granted, during subsequent surveys. However, not all suitable habitats within the Project area have been surveyed to date, indicating that additional unknown populations may be present within areas that could be affected by the Project. If other Kincaid's lupine populations are identified during additional surveys, Pacific Connector would, to the extent practicable, implement applicable mitigation measures, such as necking down the construction right-of way, excluding a portion of an identified TEWA or pipe storage yard, and erecting a protective fence or barrier, to avoid or reduce impacts on newly observed populations. Persisting subpopulations at MPs 96.48 to 96.9 would be flagged/fenced to reduce potential disturbance.

The Project could affect unknown populations of Kincaid's lupine within and adjacent to the pipeline right-of-way. The *Federally-listed Plant Conservation Plan* contains a Kincaid's Lupine Mitigation Plan that specifically addresses mitigation that would be implemented for Kincaid's lupine. Additionally, Pacific Connector would provide in-lieu fee payments for 124 acres of lupine meadow restoration on the Umpqua National Forest, a conservation easement or land acquisition to preserve 5.0 acres of habitat on privately owned land, and third-party research on Kincaid's lupine. Pacific Connector would also work with a FWS-approved conservation entity to aid in this species recovery. Per FWS request, Pacific Connector would also conduct two years of seed collection for any Kincaid's lupine plants within or adjacent to the construction right-of-way and workspaces prior to construction. Kincaid's lupine plants within the construction right-of-way and workspaces would also be salvaged and provided to an FWS-approved conservation entity.

Below is the determination of effects summary for Kincaid's lupine and critical habitat.

The Project **may affect** Kincaid's lupine because:

- suitable habitat is present within the analysis area; and
- individual plants have been located within the analysis area during survey efforts.

The Project is **likely to adversely affect** Kincaid's lupine because:

- approximately 991.6 acres of potential suitable habitat that has not been surveyed occurs within the botanical analysis area along the pipeline route, which includes 448.7 acres within the pipeline right-of-way; therefore, it is possible that unidentified plants occur within the construction right-of-way and workspace;
- surface disturbance and excavation would occur within potentially suitable habitats, and could impact unidentified plants (including in areas where surveys have not been completed);
- indirect effects, including potential changes in hydrology and soil characteristics, alterations to vegetation cover and species composition of associated habitat, and effects from fugitive dust, could impact documented or suspected plants and habitat outside of the construction right-of-way, but within 30 meters of the Project pipeline and along access roads; and
- trenching activities associated with the pipeline could affect below-ground stems, and the expected effect to extant plants is unknown.

The Project would have **no effect** on Kincaid's lupine critical habitat because:

- the pipeline does not occur within designated Kincaid's lupine critical habitat.

Rough Popcornflower (Federally Endangered Species, State Endangered Species)

The rough popcornflower was federally listed as endangered on January 25, 2000 (FWS 2000c). It is found in seasonal wet meadows or wet prairies in poorly drained clay or silty clay loam soils at elevations ranging from 100 to 900 feet. This plant occurs mostly on private lands in the Umpqua River drainage near Sutherlin and Yoncalla in northern Douglas County (FWS 2003e). As of 2010, there were 17 extant populations of rough popcornflower distributed from Yoncalla Creek near Rice Hill, south to Sutherlin Creek near Wilbur, of which five populations have been introduced (FWS 2010c). Six populations are considered protected and have a documented occupancy of at least 5,000 plants (FWS 2010c).

The closest known occurrences of rough popcornflower to the Project include multiple subpopulations approximately 1.7 miles north of the Winchester pipe storage yard and 17.5 miles north of the pipeline right-of-way at MP 68 (ORBIC 2017a, 2017c). Surveys for rough popcornflower have been conducted in potential habitat between MPs 51.7 and 67.0. To date, no individuals of rough popcornflower have been documented during surveys. However, Pacific Connector has not been granted access to approximately 99.83 acres of potentially suitable rough popcornflower habitat within the analysis area, the majority of which (93.16 acres) is associated with the Winchester pipe storage yard.

Due to the potential for the plant to occur within areas of potential habitat that have not been surveyed by Pacific Connector and may be disturbed by construction activities, the Project may affect rough popcornflower. Below is the determination of effects summary for rough popcornflower and critical habitat.

The Project **may affect** rough popcornflower because:

- populations occur near a pipe storage yard; and
- potential suitable habitat might be present within the 98-foot (30-meter) botanical analysis area.

The Project is **not likely to adversely affect** rough popcornflower because:

- where access has been granted, surveys for the Project have not documented individuals of rough popcornflower;
- surveys in potentially suitable habitat identified within the Winchester pipe storage yard and within potential habitat along the right-of-way; if any plants are identified, conservation measures developed to avoid or reduce effects on documented plants would be implemented; and
- consultation with the FWS would be reinitiated if this species is found to be present in the area and effects cannot be avoided.

Critical habitat has not been designated for rough popcornflower.

4.6.1.7 Conclusions and Recommendations for Threatened and Endangered Species

Based on informal consultations with the FWS and NMFS, 35 federally listed and proposed species were identified as potentially occurring near the Project. The FERC would only authorize the Project to proceed if the FWS' and NMFS' BOs find the Project, as described, would not jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. Further, to ensure compliance with the ESA, **we recommend that:**

- **Jordan Cove and Pacific Connector <u>should not begin construction until</u>:**

  a. **the Commission staff completes formal ESA consultations with the NMFS and FWS; and**
  b. **Jordan Cove and Pacific Connector have received written notification from the Director of OEP that construction and/or implementation of conservation measures may begin.**

4.6.2 State-Listed Threatened or Endangered Species

In addition to species that are federally threatened or endangered, there are 13 species designated as threatened or endangered by the State of Oregon that could potentially occur in the area affected by the Project (table 4.6.2-1).

TABLE 4.6.2-1

State-Listed Species Potentially Occurring in the Area Affected by the Proposed Project

Species	FWS/NMFS Status	ODFW Status	Portion of the Project Area Where Species Potentially Occur
Mammals			
Kit fox *Vulpes macrotis*	None	Threatened	Pacific Connector Pipeline
Gray Whale *Eschrichtius robustus* (Eastern North Pacific stock)	Delisted	Endangered	LNG carrier transit route in the waterway, Navigation Reliability Improvements Dredge Areas
Birds			
California brown pelican *Pelecanus occidentalis*	None	Endangered	Marine Waterway Modification Dredge Areas, Jordan Cove terminal
Plants			
Pink sand verbena *Abronia umbellata* ssp. *Breviflora*	Species of Concern	Endangered	Jordan Cove terminal
Point Reyes bird's-beak *Cordylanthus maritimum* ssp. palustre (*C. maritimus* ssp. *palustris*)	Species of Concern	Endangered	Jordan Cove terminal; Pacific Connector pipeline
Wayside aster *Eucephalis vialis* (*Aster vialis*)	Species of Concern	Threatened	Pacific Connector pipeline
Peck's milk-vetch *Astragalus peckii*	None	Threatened	Pacific Connector pipeline
Pumice grape-fern *Botrychium pumicola*	None	Threatened	Pacific Connector pipeline
Cox's mariposa-lily *Calochortus coxii*	Species of Concern	Endangered	Pacific Connector pipeline
Umpqua mariposa-lily *Calochortus umpquaensis*	Species of Concern	Endangered	Pacific Connector pipeline
Dwarf woolly meadowfoam *Limnanthes pumila ssp. pumila*	Species of Concern	Threatened	Pacific Connector pipeline
Silvery phacelia *Phacelia argentea*	Species of Concern	Threatened	Jordan Cove terminal Pacific Connector pipeline
Wolf's evening primrose *Oenothera wolfii*	None	Threatened	Jordan Cove terminal

4.6.2.1 Mammals

Kit Fox (No ESA Status, State Threatened Species)

The kit fox reaches its northern limit in southern Oregon. In Oregon, it is found in arid desert valleys dominated by halophytic plants like greasewood and shadscale, intermingled with sagebrush. Although the Project may affect suitable kit fox habitat, the expected distribution of this species does not include the Project area. Because kit foxes have not been recently observed within the area affected by the Project (ORBIC 2017a), the Project is not expected to affect this species.

Gray Whale (Eastern North Pacific stock; Federal Delisted Species, State Endangered Species)

The gray whale is a large baleen whale that is distributed in the northern Pacific Ocean in western and eastern stocks. The eastern stock, found along the west coast of North America, was federally delisted on June 16, 1994 (59 FR 115), but remains state endangered in Oregon. The eastern Pacific stock feeds in the summer in the Chukchi Sea, the western Beaufort Sea, and the northern Bering Sea. They migrate south from November through early February to lagoons on the Pacific coast of central and southern Baja California. Northward migration occurs after the calving and breeding season, from early February to May. These whales have the longest known migration of any mammal. Gray whales feed on infaunal benthic species that are buried in sediments (Maser et al. 1981). Gray whales are federally protected under the MMPA.

Potential effects on gray whales include injury and/or mortality due to ship strikes, underwater ship noise, construction noise (including pile driving and dredging) and potential adverse effects from a ship fuel spill at sea. Spills could indirectly affect gray whales by impacting forage species. These potential effects would be similar to the effects on federally listed whales that are discussed above, except that gray whales migrate in coastal waters north and south parallel to the Pacific Coast, making them more susceptible to ship strikes in nearshore waters during migration.

According to the Oregon Parks and Recreation Department (OPRD 2007), gray whales are the most predominant whales seen along the Oregon coast. They migrate twice a year, in winter and spring, and about 200 of them feed along the coast during the summer months. Gray whales have on occasion entered Coos Bay beyond the Jordan Cove LNG Project site and have been seen in Coos Bay at about the same frequency as killer whales. Gray whales may be encountered along the LNG carrier transit route during their southern migration from November through early February or from early February to May during the northern migration. Based on data in Pacific waters between 1999 and 2003, gray whales are struck by ships at a rate of 1.2 whales annually (Angliss and Outlaw 2007). The increase in shipping traffic resulting from LNG carriers could cause an increase in the probability of whales being struck by ships, or of being disturbed during migration. Measures that Jordan Cove would implement to avoid or reduce effects on federally listed whales (see section 4.6.1.1) would serve to avoid or reduce effects on the gray whale.

4.6.2.2 Birds

California Brown Pelican (Federal Delisted Species, State Endangered Species)

The brown pelican was listed as a federally endangered species on June 2, 1970, within California, Oregon, Texas, and Washington states, as well as Central and South America (FWS 1970). It was delisted in December 2009 (FWS 2009c); however, Oregon still considers the brown pelican an endangered species under state law (ODFW 2017h).

The California brown pelican is a primarily coastal species, rarely seen inland or far out at sea (FWS 2005b). They feed mostly in shallow estuarine waters, normally staying within 20 miles of shore (FWS 2005b). Pelicans make extensive use of sand spits, offshore sand bars, and islets for nocturnal roosting and daily loafing, especially by non-breeders and during the non-nesting season (FWS 2005b).

Brown pelicans nest in colonies, mostly on small coastal islands in California (FWS 1985, 2007e). Brown pelicans generally breed between February and October and are most abundant in Oregon during post-breeding migration (FWS 2005b). In Oregon, numbers peak in late August through October and gradually decline from October through early November as birds move south (Gilligan et al. 1994). Because brown pelicans have wettable feathers, they return to land daily to roost and dry their feathers (FWS 2005b). Sand islands within three large estuaries in Oregon and Washington serve as primary night roosts (Jaques and O'Casey 2006 as cited in FWS 2007e). The total number of brown pelicans in Oregon in 2001 was estimated to be 6,095 (Marshall et al. 2003).

Brown pelicans are regularly seen in moderate numbers during the summer months in Coos Bay, and they also occur in small numbers in the winter (Contreras 1998). There are numerous recent records of brown pelicans in the Coos Bay area from June through September (eBird 2019). Coos Bay provides excellent habitat for this species. Brown pelicans were recorded foraging near the Project site more than 500 feet from the shore and loafing across the bay in moderate numbers daily during surveys in October 2012 (SHN 2012). The species was also observed during surveys conducted in 2005-2006 until early September (LBJ 2006). The Project site provides no nesting habitat for the brown pelican. Roosting and feeding sites have been documented within the Project area, although the last observation was in 1985. Roosting was reported on the north side of Coos Bay on a sunken jetty close to the Bay mouth and on a sand spit on the North Spit of Coos Bay, as well as on dredge spoil islands around MPs 3R through 4R (ORBIC 2017a).

In the past, California brown pelicans have been affected by human disturbances at nesting colonies and roosting habitats. Existing nesting and roosting habitats within the Coos Bay Estuary and Jordan Cove LNG Project area have not been documented. If they occur within the estuary during construction and operation of the proposed action, pelicans may be associated with on-shore fish-cleaning stations where they possibly feed on offal (Marshall et al. 2003). Existing fish-cleaning stations are present at the Empire Boat Ramp, Oceanside RV Park and Bastendorff Beach County Park, both in Charleston. Fish-cleaning could also occur at the Charleston Marina, California Street Boat Ramp, and BLM Boat Ramp, though they are not designated as such.

Noise and human activities associated with construction and operation of the Project are likely to be the only direct effect to brown pelicans if they occur within one or more of the Project's analysis areas. Jordan Cove is proposing construction of its access channel in Coos Bay, dredging for the marine waterway modifications, and all in-water pile driving during the ODFW recommended in-water work window between October 1 and February 15. This schedule would reduce effects on brown pelicans because there is a gradual decline in populations in Oregon as birds move south from October through early November (Gilligan et al. 1994). However, land-based pile driving activities including those associated with sheet piling installation at the LNG terminal and slip would occur during the summer months when brown pelicans are likely to be present and could affect pelicans foraging within approximately 2.5-3.25 miles of the LNG Terminal site (see figure 4.12-3 in section 4.12). Effects would likely include movement of birds outside of this area of impact. Impact pile driving on land at the MOF could result in underwater noise levels that elicit behavioral responses in birds, and in some locations exceed the auditory injury threshold which could result in temporary or permanent auditory threshold shifts and a decrease in sensory capability (WSDOT 2019; Wladichuk et al. 2017; Wladichuk et al. 2018; Wladichuk and MacGillivray 2018). However, the limited area that would exceed the auditory injury threshold for birds and limited number of these dry pilings that would be installed indicate that effects would likely be confined to disruption of foraging. Therefore, noise created by pile driving and construction in general is likely to affect brown pelicans if present and could disrupt brown pelican feeding behavior.

Brown pelicans that forage within the vicinity of the Jordan Cove LNG Project (i.e., the estuarine analysis area) could ingest low levels of contaminants through the food web that are re-suspended from dredging activities. However, sediments at the Jordan Cove LNG Project site and pipeline route within Coos Bay are not expected to contain levels of sediment contaminants that could adversely affect brown pelicans. Access channel dredging and maintenance dredging would not occur during the period of peak pelican abundance in the lower bay. Therefore, dredging activities would not substantially disrupt normal behavior patterns for brown pelicans.

Pacific Connector is proposing construction across Coos Bay using HDD construction in two segments (MP 0.12 to MP 1.11 and MP 1.40 to MP 3.09). It is possible that the brown pelican could be present within Coos Bay and its vicinity during the time of construction (see Contreras 1998). Therefore, noise and human activities associated with construction and operation of the pipeline are likely to affect brown pelicans as sources of disturbance and disruption if they are present and could disrupt brown pelican feeding behavior.

There is some evidence in the literature that high intensity continuous anti-collision lights on structures may result in an increased number of bird strikes, especially at night or during fog and overcast conditions. The number of strikes can apparently be reduced by strobe or blinking the anti-collision lights. The LNG storage tanks would not be illuminated with high intensity lighting. The intensity and number of lights would be limited to what is required for security and operations. With the low-intensity lighting to be used, the likelihood of adverse effects on brown pelicans from collisions with the LNG storage tanks is minimal.

Brown pelicans may be encountered during any portion of the LNG carrier transit route in the waterway. There is no evidence that pelicans are struck by current cargo ships using the Port.

During operation of the Pacific Connector pipeline, aerial inspection of the pipeline route would occur within the permanent right-of-way. Aerial inspections would generally occur during all times of year, although inspections would not affect nesting or breeding brown pelicans since they do not nest or breed within Coos Bay. Additionally, aerial inspection should not disturb migrating, roosting, or foraging brown pelicans because air traffic is a constant disturbance within Coos Bay from the existing North Bend airport.

The proposed action would create auditory and visual disturbances that are likely to cause foraging brown pelicans to temporarily avoid areas of high activity. The proposed action area does not contain existing nesting or roosting habitat and would not affect nesting or roosting individuals.

As a result, the proposed action would temporarily affect foraging individuals but is not expected to affect nesting or roosting by brown pelicans.

4.6.2.3 Plants

Pink Sand Verbena (Federal Species of Concern, State Endangered Species)

The historical range of pink sand verbena (*Abronia umbellata* ssp. *breviflora*) was from northern California to Vancouver British Columbia, Canada (ODA 2017c). Its present range is along coastal beach and foredune, predominantly from Cape Blanco (Curry County), southern Oregon to Point Reyes National Seashore in Marin County, California and sporadically along Oregon's northern and central coast. Pink sand verbena only inhabits the littoral sandy beach areas and unstabilized sand dunes of the coastal strip and usually occurs on beaches in fine sand between the high-tide line and the driftwood zone, and in areas of active sand movement below the foredune (ORBIC 2010). In the northern portion of its range, most populations of pink sand verbena occur on broad beaches and/or near the mouths of creeks and rivers.

Of the 12 reported occurrences in Oregon, only 2 have more than 50 plants; many of the populations consist of only one plant and will probably not persist. Two populations of pink sand verbena documented near the mouth of Coos Bay, contained approximately 300,000 plants when surveyd in 2012 (ORBIC 2017a). Approximately 15 miles north of the entrance to Coos Bay, 19 plants were documented in 1995 within a protected (public entry prohibited) snowy plover nesting area (ORBIC 2012). There are no known occurrences of pink sand verbena within two miles of the Jordan Cove Project area (ORBIC 2017a). No pink sand verbena plants have been reported within the Pacific Connector pipeline area (ORBIC 2017a) and the pipeline route would not affect coastal sand dune habitat; therefore, Pacific Connector has not conducted botanical surveys for this species and no incidental documentations of this species has occurred.

Jordan Cove identified suitable habitat for the plant along the eastern portion of the LNG terminal in areas of actively moving dunes and European beachgrass. However, surveys conducted at the Jordan Cove Project area in 2006, 2012, and 2013 did not locate any pink sand verbena plants (SHN 2006b, 2013c). As surveys conducted within the Jordan Cove Project area, as well as historic data, indicate that pink sand verbena is not present within the Project area, the Project is not expected to affect this species.

Point Reyes Bird's-beak (Federal Species of Concern, State Endangered Species)

Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris* [*Chloropyron maritimum* ssp. *palustre*]) inhabits salt marshes along the coast, sometimes growing just above tidewater in wet areas. Its habitat requirements are specific: approximately 7.5 to 8.5 feet (2.28 to 2.59 meters) above mean lower low water, soil salinity of 34 to 55 parts per thousand, sandy substrate covered by 1 to 10 cm (0.39 to 3.93 inches) organic silt, and less than 30 percent bare soil in summer. Point Reyes bird's-beak occurs along the Pacific Coast from Tillamook County, Oregon, south to Santa Clara County, California. In Oregon, the species is restricted to Netarts Bay, Yaquina Bay, and Coos Bay, with most known occurrences located in Coos Bay. Within the counties crossed by the Project, Point Reyes bird's-beak is found in Coos County.

Several occurrences of Point Reyes bird's-beak are near both the Jordan Cove LNG Project and the Pacific Connector Pipeline Project. Populations with 1,000 to 10,000 plants are located along the margins of Coos Bay and on sand salt marshes near the edge of high water marks (ORBIC 2017a). Several occurrences of Point Reyes bird's-beak are near the Jordan Cove LNG Project, and this species is known to occur within the intertidal wetland between APCO Sites 1 and 2; however, there is no suitable habitat on APCO Site 2 as this area is dominated by upland vegetation. This species also occurs outside the LNG terminal area along the west and southeast shoreline of the South Dunes site (ORBIC 2017a) and potential habitat for this species has also been observed along the shoreline south of the South Dunes site. Jordan Cove would conduct an additional survey in this area of potential habitat prior to construction.

The area affected by the Pacific Connector Pipeline Project is within the vicinity of documented populations of Point Reyes bird's-beak and the pipeline route would cross suitable habitat. Populations with 1,000 to 10,000 plants were located in 1982 and 1999 along the margins of Coos Bay approximately 260 feet south of TEWA 0.10 (HDD pull-back) and on sand salt marshes near the edge of high water marks on the west side of Haynes Inlet approximately 815 feet north of the Jordan Cove Meter Station near the proposed HDD across Coos Bay (ORBIC 2017a). These plants are farther than 100 feet from the pipeline route and should not be affected by construction. Surveys conducted for Pacific Connector in 2007 located one population of about 1,000 Point Reye's bird's-beak plants approximately 1.7 miles south of MP 1.7 (FERC 2009). Additional surveys occurred in 2017 along the pipeline route near MPs 0.3, 1.0, and 1.47 near the edge of high water marks where the pipeline HDD exits and enters land. Approximately 30 Point Reyes bird's beak plants were located at the margin of Coos Bay near MP 0.9, approximately 475 feet northwest of the construction right-of way and 700 feet west/northwest of TEWAs 1.09-N and 1.09-W. This portion of the pipeline would be constructed by HDD and should not affect plants observed at this location.

Point Reyes bird's-beak is found within and near the Jordan Cove and Pacific Connector Project areas; however, construction of the Project should not directly affect individual plants. Indirect effects to this species and its habitat could potentially occur due to changes in hydrology from dewatering activities and/or a lowering of groundwater levels through the use of groundwater for construction activities. However, these effects would be temporary and short term and a monitoring program would be conducted prior to, during, and after construction to monitor potential impacts on ground and surface waters (see section 4.3 for additional details). Additionally, Pacific Connector has committed to protecting plants adjacent to the pipeline construction right-of-way through the appropriate installation of safety and silt fence as determined by Pacific Connector's EIs.

Wayside Aster (Federal Species of Concern, State Threatened Species)

The wayside aster's (*Eucephalis* [*Aster*] *vialis*) range is limited to central, southern, and western Oregon and the northern California state line (ORBIC 2010). About 100 populations are known, totaling fewer than 9,000 individuals. Most populations are centered in the southern Willamette Valley of Lane County or in southern Jackson and Josephine Counties, although a few populations exist in the adjacent counties of California (ORBIC 2010). None of the known populations are protected, and many populations are along roadsides and in areas of residential development. Wayside aster occurs in areas of natural and man-made disturbance, edges and openings in woodlands and forests, in second and old-growth, and in shaded roadsides.

Several populations of wayside aster plants have recently been documented within Douglas and Jackson Counties; however, except for the two sites discussed below, these records are more than 0.5 mile from the Pacific Connector Project area. Botanical surveys for this species in potential habitat have been conducted by Pacific Connector in Coos Bay, Roseburg, and Medford BLM Districts; Umpqua National Forest; and Jackson County. This species was documented in 2007 adjacent to a previously proposed existing access road that would require improvements; however, this road is no longer proposed for use as an access road. This site was revisited in 2009 and additional surveys were conducted within 0.25 mile of this site; however, no plants were located. This species was also documented in 2018 within and adjacent (within 100 feet) to the Project near MP 74.9. Approximately 430 plants were observed, with approximately 95 of these plants occurring in the construction right-of-way (SBS 2018 [unpublished]). Additionally, there are approximately 45.3 acres of potential suitable wayside aster habitat on private lands within the pipeline route that have not been surveyed.

Individuals of wayside aster occur along the pipeline route; therefore, construction and operation of the Project would directly and indirectly affect this species and this species' habitat. Potential indirect effects to documented or suspected plants and habitat include potential changes in hydrology and soil characteristics, alterations to vegetation cover and species composition of associated habitat, and effects from fugitive dust. To reduce impacts, Pacific Connector has committed to protecting plants adjacent to the pipeline construction right-of-way through the appropriate installation of safety and silt fence as determined by Pacific Connector's EIs. Although the pipeline project would impact individuals of and habitat for wayside aster, construction and operation of the pipeline is not likely to contribute to a trend toward federal listing or loss of viability of this species.

Peck's Milk-vetch (Federal Species of Concern, State Threatened Species)

Peck's milk-vetch (*Astragalus peckii*) occurs east of the Cascades Mountain range. Most populations of Peck's milk-vetch are centered in three separate areas: one in north-central Deschutes County, another in north-central Klamath County, and the third in south-central Klamath County. These populations total about 300,000 individuals. The plant occurs in very dry sites, on loose, sandy soil or pumice, often in or along dry water courses, in sagebrush or rabbitbrush openings in ponderosa pine forests (in the south) or in western Juniper woodlands (in the north), and occasionally on barren flats.

Peck's milk-vetch has not been documented within the vicinity of the Project (ORBIC 2017a). No suitable habitat for Peck's milk-vetch occurs within the areas crossed by the pipeline route; therefore, Pacific Connector did not conduct botanical surveys for this species. As this species is not expected to occur along the pipeline route, it would probably not be affected by construction and operation of the Project.

Pumice Grape-Fern (No ESA Status, State Threatened Species)

This species is one of the rarest grape-ferns, and in Oregon is found only within the Crater Lake area and Paulina Mountains in Deschutes and Klamath Counties. Most known populations are found in fine pumice gravel at elevations above 7,800 feet (2,400 meters). It has also been located within frost pockets in lodgepole pine forests with bitterbrush, in areas with deep, sterile pumice. In Oregon, pumice grape-fern *(Botrychium pumicola*) is typically associated with Brewer's sedge and buckwheat (*Eriogonum* spp.) species (Eastman 1990; ORBIC 2010).

The Project is not located near known sites of this plant, and no suitable habitat for this plant occurs within the areas crossed by the pipeline route; therefore, Pacific Connector did not conduct botanical surveys for this species. As the pumice grape-fern is not expected to occur along the pipeline route, the Project would probably have no effect on this species.

Cox's Mariposa Lily (Federal Species of Concern, State Endangered Species)

The Cox's mariposa lily (*Calochortus coxii*) is endemic to serpentine and ultramafic soils and is limited to a small area (30 square miles) along a 30-mile serpentine ridge system in Douglas County, Oregon (ODA 2019). All known populations are on serpentine soils, mostly on shady, north-facing, mesic sites near ridgelines, typically, growing in serpentine grasslands and forest margins. This species is a Bureau Sensitive Species and is the subject of a conservation agreement between the BLM and the FWS to reduce or eliminate threats to the species (BLM and FWS 2004).

Population monitoring studies associated with the proposed pipeline on BLM lands from 2011 through 2015 demonstrated relatively high interannual variation in population estimates for Cox's mariposa lily. For example, 6,966 plants were observed in 2011, whereas 13,865 individuals were observed in 2012 (Gray and Bahm 2015). Populations are also known to occur on private lands; however, surveys haven't been conducted on private lands since the early 1990s (ORBIC 2017a; Aaron Roe, Botanist Roseburg BLM District, personal communication, February 1, 2019). Threats to this species include fire exclusion, encroachment by conifers, noxious weed invasion, logging, grazing, road construction, and off-highway vehicle recreational use (Gray and Bahm 2015; BLM and FWS 2004).

Based on existing data, the pipeline route would cross one population between MP 74.1 and 75.0 on lands administered by the BLM Roseburg District (ORBIC 2017a). In 2012, surveys conducted by the BLM documented approximately 1,300 plants within and adjacent to the Project, with approximately 300 plants occurring in the construction right-of-way (BLM 2017a). In 2018, surveys for Cox's mariposa lily were conducted during the flowering season between MPs 74 and 75 of the pipeline route. Approximately 1,990 plants were documented within and adjacent (within 100 feet) to the Project during these surveys (SBS 2018 [unpublished]). Additionally, there are approximately 45.3 acres of potential suitable Cox's mariposa lily habitat on private lands within the pipeline route that have not been surveyed.

Constructing and operating the Project would affect about 13.45 acres of Cox mariposa lily habitat and one known population of this species. An additional, 0.9 mile of suitable Cox's mariposa lily habitat would be fragmented. Other effects to documented or suspected plants and habitat include potential changes in hydrology and soil characteristics, alterations to vegetation cover and species composition of associated habitat, and effects from fugitive dust.

Pacific Connector has developed a Cox's mariposa lily specific mitigation plan (included as an attachment to the *Federally-Listed Plant Conservation Plan*[159]) to avoid and reduce potential effects on this species. As described in the mitigation plan, Pacific Connector would determine if site-specific neck-downs can be incorporated into the construction right-of-way to reduce direct effects on the population of Cox's mariposa lily between MPs 74 and 75. The construction right-of-way in this area utilizes the typical 95-foot width with TEWAs because of the steep and narrow ridgeline alignment; thus, neck-downs would be dependent on site-specific conditions and would

[159] Appendix J to Pacific Connector's POD filed with the FERC.

be based on species presence and the work area requirements to ensure safe pipeline installation. Appropriate barriers would be installed along areas that contain this species to ensure that the mariposa lily populations in the vicinity are not affected by sediments and debris from the right-of-way. In locations where individual plants cannot be avoided by construction activities, plants would be salvaged during the late summer or fall after the growing season of the year preceding actual pipeline construction. Additional mitigation techniques that would be employed to protect these populations of Cox's mariposa lily include seed collection and bulb salvage, and site restoration and monitoring. However, there has not been any research on the effectiveness of seed collection and bulb salvage as mitigation techniques for this species. Additionally, Pacific Connector has proposed mitigation on behalf of the BLM, including managing approximately 50 acres of BLM-managed lands adjacent to the pipeline route between MPs 74 and 75 to enhance habitat conditions for Cox's mariposa lily. These habitat improvements include thinning trees, noxious weed control, and seeding and planting of Cox's mariposa lily into unoccupied suitable habitat as described in Attachment 2 of the *Comprehensive Mitigation Plan* filed with FERC on August 30, 2019.

Although the avoidance and minimization measures listed above may reduce affects to Cox's mariposa lily, the BLM has indicated that construction and operation of the Project would result in a significant environmental effect on this species that is likely to contribute to a trend toward federal listing or loss of viability. Furthermore, as proposed, the BLM has concluded that the Project would not meet the objectives of the 2004 conservation agreement to reduce or eliminate threats on this species.

The BLM identified and evaluated an alternative that would reduce impacts on this species; however, its implementation would involve relocating the pipeline across newly affected lands whose owners were not provided an opportunity to comment on the alternative. Therefore, we were unable to include this alternative in our analysis. The BLM may include additional requirements in any ROD or right-of-way grant it may issue.

Umpqua Mariposa Lily (Federal Species of Concern, State Endangered Species)

The Umpqua mariposa lily (*Calochortus umpquaensis*) is known to occur within 17 localities; none of which are protected. This plant grows in both forests and meadows on serpentine soils at elevations below 2,500 feet, but it is the most vigorous in margins between forests and meadows. In southwestern Oregon, it is associated with a diverse array of plants, and it is found in diverse soils, aspects, and slopes.

Several large populations of this plant (5,000 to 60,000-plus) have previously been documented approximately 1.3 and 2.5 miles east of the pipeline alignment near MP 99.55, adjacent to the Green Butte (EAR 102.30) and Callahan Creek (EAR 104.24) access roads. Pacific Connector conducted botanical surveys for this species between 2007 and 2017 in potential habitat within the vicinity[160] of the pipeline in lands administered by the Roseburg BLM District and Umpqua National Forest. In 2016, seven plants were observed adjacent to EAR 102.3 and 25 feet east of the Hatchet Quarry MP 102.3 Rock Source/Disposal Site near a previously (1992) documented population. Additionally, potential suitable habitat would also be crossed by the pipeline near the

[160] Provided in Pacific Connector's Initial Response to the FERC staff's Environmental Information Request dated January 3, 2018, filed with the FERC on January 23, 2018.

site where Cox's mariposa-lily was documented (MPs 74.08 to 75.02), although no individuals of Umpqua mariposa lily were observed during surveys conducted for the pipeline in this location.

Although, Umpqua mariposa lily individuals have been documented adjacent to EARs 102.30 and 104.24, no road improvements are necessary. Additionally, plants are separated from the access roads by topography and/or Callahan Creek; therefore, it is not expected that use of the existing access roads would directly or indirectly affect these populations. The population along EAR 102.30 and 25 feet east of the Hatchet Quarry MP 102.3 Rock Source/Disposal Site may be indirectly affected by the Pacific Connector Project; however, construction of the Project should not directly affect individual plants. Additionally, Pacific Connector has committed to protecting plants adjacent to the pipeline construction right-of-way through the appropriate installation of safety and silt fence as determined by Pacific Connector's EIs.

Dwarf Woolly Meadowfoam (Federal Species of Concern, State Threatened Species)

Dwarf woolly meadowfoam's (*Limnanthes pumila* ssp. *pumila*) range is restricted to two small protected areas, totaling about 2 square miles with at least 10,000 individuals (ORBIC 2010). Dwarf woolly meadowfoam inhabits small depressions in thin clay soil overlying old basalt at the edges of deep vernal pools, which are dry by mid-summer and generally exposed to full sunlight. The only known occurrences are on Table Rock in Jackson County (on Lower and Upper Table Rocks); which is over 12 miles southwest of the Pacific Connector pipeline and 1.4 to 2.4 miles north of four proposed Jackson County pipe storage yards (ORBIC 2017a).

Because the dwarf woolly meadowfoam is endemic to vernal pools at Table Rocks, Pacific Connector did not conduct botanical surveys for this species. Additionally, this species was not documented incidentally during survey efforts for other vernal pool–associated species conducted for the Project. As this species is not expected to occur along the pipeline route, it would probably not be directly affected by construction and operation of the Project.

Silvery Phacelia (Federal Species of Concern, State Threatened Species)

The silvery phacelia (*Phacelia argentea*) is known from 24 occurrences, totaling 15,000 individuals, along the coastline of Coos and Curry Counties and in adjacent northern California, Del Norte County (ORBIC 2010). In March 2015, a petition was submitted to the FWS to list the silvery phacelia as a threatened or endangered species (FWS 2015c); however, the petition was denied in 2015 due to lack of substantial information that this species was a listable entity (FWS 2015d). Silvery phacelia is the only phacelia growing along the coastline in open sand or on dunes along the south coast of Oregon. It inhabits sandy beach dunes and bluffs near the coast, and some partially-stabilized or unstabilized dunes.

Silvery phacelia has not been documented in the vicinity of the Project and the closest known plants are located more than 10 miles south of the entrance to the Coos Bay Estuary (ORBIC 2017a); however, suitable habitat for this species does exist at the LNG terminal area, in regions of active and semi-active dunes where the European beachgrass and the red fescue-salt rush herbaceous vegetation associations occur (see section 4.4 of this EIS). There is marginal habitat at the APCO Site and the meteorological station, although the European beachgrass in these areas is generally too dense to support this species. Surveys conducted by Jordan Cove have not detected this species (SHN 2006b, 2012) and, due to the lack of suitable habitat, botanical surveys for this species were not conducted along the pipeline route. Based on the lack of occurrences (from both historical data as well as surveys), it is not expected that the Project would affect this species.

Wolf's Evening Primrose (No ESA Status, State Threatened Species)

Wolf's evening primrose (*Oenothera wolfii*) occurs in well-drained sandy soils with adequate moisture in coastal bluff scrub, coastal prairie, roadsides, and coastal dune habitats from Curry County in southern Oregon to the northern California coast (Tibor 2001). This species is associated with a high disturbance regime and several occurrences in California are located along roadsides with sandy soil (CNDDB 2005 as cited in FERC 2015). Wolf's evening primrose is typically associated with low elevation coastal habitats, but there have been reported occurrences in lower montane coniferous forest in California, at elevations greater than 2,500 feet (Tibor 2001).

The closest known occurrence of Wolf's evening primrose to the Project is in Port Orford, Oregon, approximately 60 miles to the south of the Jordan Cove LNG terminal site; however, suitable habitat for this species is present at the LNG terminal site. There is marginal habitat at the APCO Site and the meteorological station, although the European beachgrass in these areas is generally too dense to support this species. Surveys conducted at the LNG terminal site did not detect the Wolf's evening primrose (SHN 2006b, 2012). Considering the lack of occurrences (based on historic and recent survey data), it is not expected that the Project would affect this species.

4.6.3 Other Special Status Species

In addition to the federal and state threatened, endangered, and proposed species described above, there are species that have been given special status designations by federal or state agencies and Indian tribes that could potentially occur in the Project area (see tables I-3, I-4, and I-5 in appendix I). The FWS and NMFS maintain a list of federal species of concern, which are species whose conservation standing is of concern but for which status information is still needed. The ODFW also assigns special status to fish and wildlife species that are not listed. State special status designations include sensitive and sensitive-critical (ORBIC 2016). Sensitive refers to fish and wildlife that are facing one or more threats to their populations and/or habitats. Species or taxa with a sensitive-critical subdesignation are sensitive species of particular conservation concern. Sensitive-critical species have current or legacy threats that are impacting their abundance, distribution, diversity, and/or habitat. They may decline to the point of qualifying for threatened or endangered status if conservation actions are not taken.

In addition to the threatened and endangered plant species described above, ODA designates candidate species for listing. ODA candidate species include any plant species designated for study by the director of ODA whose numbers are believed low or declining, or whose habitat is sufficiently threatened and declining in quantity and quality, so as to potentially qualify for listing as a threatened or endangered species in the foreseeable future (ODA 2017d).

4.6.3.1 U.S. Fish and Wildlife Service and National Marine Fisheries Service

The FWS (2006e, 2006f, 2013h, 2017c, 2019a) and NMFS (2006, 2019) list 30 fish and wildlife species of concern that potentially occur in counties coinciding with the Project. The list of federal species of concern includes 1 mammal, 6 birds, 3 reptiles, 6 amphibians, 9 fish, and 5 invertebrates (ORBIC 2019). These species, and expected habitat for each species, are listed in tables I-3 and I-4 in appendix I of this EIS. The FWS has noted that the Umpqua chub may be present in the Umpqua

River, and this species is of concern because it has rapidly decreased in abundance. This species is discussed in detail in the BE (see appendix F.7 of this EIS).

The FWS lists one plant species as a federal candidate for listing, and 33 federal plant species of concern that potentially occur in counties coinciding with the Project (FWS 2019b). These species are listed in table I-5 in appendix I of this EIS, along with expected habitat for each species.

4.6.3.2 Oregon Department of Fish and Wildlife

The ODFW (2016) identified 71 state sensitive species that potentially occur in counties coinciding with the Project area, some of which (i.e., 18) are also considered federal species of concern. This list includes 15 mammals, 28 birds, 13 fish, 2 reptiles, and 13 amphibians. The ODFW does not assign special status for invertebrates. Tables I-3 and I-4 in appendix I provide the following information for each state special status species: expected habitat and documentation within each county, BLM district, and National Forest crossed by the Pacific Connector pipeline and vicinity.

Although the state sensitive species listed in tables I-3 and I-4 may occur in counties noted by FWS (2006e, 2006f) and ODFW (ORBIC 2012, 2016), distributions and/or habitat associations of some preclude their potential occurrence in the area that would be affected by the Project.

4.6.3.3 Oregon Department of Agriculture

The ODA identified 41 candidates for listing that potentially occur in counties coinciding with the Project area, 15 of which are also federal species of concern. Descriptions of expected habitat, documented or suspected occurrences, and a description of potential Project effects on these special status species as a result of the Project are presented in table I-5 in appendix I.

4.6.3.4 Tribal Species of Concern

The Coquille Indian Tribe identified the following plant and animal species as species of concern. According to the Tribe, this list is not comprehensive, but does represent the most significant and important traditional cultural plant and animal species that are found on the Coquille Forest and other Tribal lands. A more complete list and description of plant usage can be found in "Ethnobotany of the Coquille Indians". Significant and important plants include, but are not limited to:

- Trees (bark and wood): Port Orford cedar, western red cedar, Sitka spruce, big leaf maple, myrtle, red alder, madrone, Pacific yew.
- Shrubs (wood, nuts and berries): elderberry, willows, hazel, vine maple, rhododendron, azalea, manzanita, ocean spray, Labrador tea, huckleberry, salal, thimbleberry, salmonberry, Oregon grape.
- Flowers and vines (roots and fiber): yarrow, camas, tiger lily, columbine, various *Lomatium* and *Brodiaeas*, iris, trailing blackberry, yerba buena, beargrass.
- Wet Meadow/Riparian Plants: cattail, tule, various sedges and ferns, skunk cabbage, various mosses.
- Marine/Estuary: eelgrass, giant kelp, bull kelp, sea lettuce, surfgrass.

Impacts on these species would be similar to the impacts on vegetation described in section 4.4. Project effects on the wetland and estuary species of traditional-cultural importance would be as described for wetlands and waters in section 4.3. Species that are protected by federal and/or state jurisdictions (e.g., various sedges) are also addressed elsewhere in this section and in appendix I.5.

The following list of mammals, bird, and fish is also not comprehensive, but does represent many of the Coquille Indian Tribe's species of concern:

- Terrestrial: deer, elk, coyote, cougar, bear, bobcat, raccoon, beaver, squirrel.
- Marine/ Estuary: lamprey, salmon (all available species), shellfish, crab, sea mammals, rockfish, lingcod, sculpin, halibut, flounder, perch, herring, greenling, candlefish (i.e., eulachon), snails, mussels, barnacles, chiton, sea urchin, abalone (*Haliotis spp*.), dentalium (*Dentalium spp*.) (other seasonally available estuary species).
- Streams: salmon (all available species), lamprey, sturgeon, trout, mussels.
- Birds: Eagles, hawks, owls, cormorant, kingfisher, herons, osprey, flicker (*Colaptes auratus*), woodpeckers (particularly pileated), grebe, crows and ravens, and colorful neo-tropicals.

Impacts on these species would be similar to the impacts on wildlife and aquatic resources described in section 4.5. Species that are protected by federal and/or state jurisdictions (e.g., owls) are also addressed elsewhere in this section and in appendix I.3.

4.6.3.5 Assessment of Other Special Status Species

Of the other special status species identified above as potentially occuring in counties coinciding with the Project, only a subset have the potential to be affected by the Project. Table 4.6.3.5-1 identifies the number of these other special status mammals, birds, fish, amphibians, reptiles, invertebrates, and vascular plants potentially affected by the Project. For species that are also BLM and Forest Service sensitive species or the Forest Service's Survey and Manage species, occurrence and potential effects on federal lands are also described below in section 4.6.4, Environmental Consequences on Federal Lands.

TABLE 4.6.3.5-1

Numbers of Other Special Status Species Potentially Affected by the Project a/

Taxonomic Group	Federal Status: FWS or NMFS Species of Concern	State Status: ODFW Sensitive or ODA Candidate	Total b/
Mammals	1	11	11
Birds	5	25	28
Non-anadromous Fish	4	4	4
Anadromous Fish	3	5	6
Amphibians and Reptiles	4	9	9
Aquatic Invertebrates	2	N/A	2
Terrestrial Invertebrates	1	N/A	1
Vascular Plants	0	2	2

Sources: FWS (2006e, 2006f, 2017c), NMFS (2006d), ORBIC (2016, 2017a), ODFW 2016b.

a/ Other Special Status Species include FWS and NMFS fish, wildlife, and plant species of concern and candidate species, ODFW Sensitive and Sensitive-Critical fish and wildlife species, and ODA candidate species for listing. Forest Service sensitive and Survey and Manage species and BLM sensitive species are only tallied here if they meet this criteria for Other Special Status Species. Species are not tallied here if they are also federal or state listed or proposed.

b/ Rows do not sum because a species is tallied in multiple columns where it is considered special status by multiple agencies.

Descriptions of expected habitat, documented or suspected occurrences, and potential Project effects on these other special status species within the Project area are presented in tables I-3, I-4, and I-5, respectively, in appendix I. Additionally, effects on these species and proposed measures to reduce effects would be similar to the those described for general fish and wildlife in section 4.5 of this EIS.

4.6.4 Environmental Consequences on Federal Lands

The BLM and Forest Service maintain lists of sensitive species to ensure that their actions do not contribute to or cause a trend toward listing under the ESA. Additionally, until 2016, the BLM and Forest Service maintained a list of Survey and Manage species, or species that are rare and uncommon or poorly understood that are closely associated with late successional or old-growth forests within the range of the NSO (Forest Service and BLM 2001a). In August 2016, the BLM issued two RODs for two new RMPs (BLM 2016a and 2016b). These two plans supersede the NWFP on BLM lands, and eliminated requirements to survey and manage for species included on the 2001 ROD Survey and Manage species list on BLM lands. Potential effects on Survey and Manage species on NFS lands are discussed here.

Species that are on both the sensitive list and the Survey and Manage list are discussed on NFS land under section 4.6.4.3, Survey and Manage Species. Additionally, although the Forest Service and BLM include federal and state threatened, endangered, proposed, and candidate species on their species lists, these species are not discussed in this section as they are presented above.

4.6.4.1 Description of BLM and Forest Service Sensitive Species

The BLM maintains a list of Special Status Species (including BLM sensitive species) as required by BLM 6840, Special Status Species Manual, to ensure that BLM actions do not contribute to a loss of viability or cause a trend toward listing under the ESA. Like the BLM, the Forest Service is required by Forest Service Manual (FSM) 2760 to maintain a list of sensitive species for each region, including species listed as federally threatened, endangered, or proposed under the ESA, as well as species that are threatened by human activities. Activities on NFS lands must be managed to ensure that current federally listed species do not become extirpated or that activities do not result in ESA listing for other sensitive species. As required in FSM 2760, the Forest Service is obligated to evaluate Project effects on sensitive species in a BE (see appendix F.7).

The Pacific Northwest Regional Office of the Forest Service and Oregon/Washington State Office of the BLM established an interagency program for the conservation and management of special status species. New criteria for BLM Special Status Species and Forest Service Sensitive Species were jointly approved in 2015 by the Region 6 Regional Forester and BLM Oregon/Washington State Director for determination of species included within the BLM and Forest Service Sensitive Species Program. The new criteria were designed to make the BLM and Forest Service more consistent in their approaches to the development of lists of species with conservation concerns. The BLM (2015) and Forest Service (Forest Service 2015) identify federally listed, federally proposed, and sensitive species required under their respective policies.

According to Instruction Memorandum No. OR-2015-028, sensitive species are those that are documented or suspected endangered or threatened at the federal or state level, federal de-listed species, are Oregon Heritage List 1 or List 2, and have been documented on at least one Oregon BLM district. These species should be managed to ensure that activities on BLM lands do not contribute to their listing.

Table 4.6.4.1-1 lists the BLM and Forest Service sensitive species documented or suspected to occur within the districts and forests crossed by the Pacific Connector pipeline (BLM 2015; Forest Service 2015).[161]

TABLE 4.6.4.1-1

Numbers of BLM and Forest Service Sensitive Species within the Four BLM Districts and Three National Forests Crossed by the Proposed Pacific Connector Pipeline a/

	Number in BLM Districts				Number in National Forests		
Taxonomic Group	**Coos Bay**	**Roseburg**	**Medford**	**Lakeview**	**Umpqua**	**Rogue River-Siskiyou**	**Fremont-Winema**
Mammals	4	5	4	6	5	6	5
Birds	8	7	9	13	11	9	12
Reptiles	1	1	1	1	1	1	1
Amphibians	1	1	3	2	1	3	2
Non-anadromous Fish	1	1	2	10	2	0	10
Anadromous Fish	5	3	4	0	3	4	0
Invertebrates	14	10	16	7	14	21	21
Fungi	13	12	14	0	11	16	4
Non-vascular Plants	34	17	18	5	26	27	12
Vascular Plants	35	36	91	44	31	99	49

Note: A species is tallied in multiple columns where it occurs and is sensitive on multiple BLM Districts or National Forests.
a/ Source: BLM 2015; Forest Service 2015

Not all species documented or suspected in BLM districts and national forests crossed by the Project occur within the area affected by the Project. Many were excluded from consideration after review of range and habitat information. Other species were excluded if they were not known to occur in the Project vicinity based on special status species locations within 3 miles of the

[161] The 2015 Regional Forester's Special Status Species (RFSSS) list was used for EIS because the Project was initiated prior to transmittal of the 2019 RFSSS list. Per the Instruction Memorandum provided with the transmittal of the 2019 RFSSS list, projects initiated prior to transmittal of the 2019 RFSSS list may use either the 2019 RFSSS list or the RFSSS list that was in effect when the Project was initiated.

Project obtained from the BLM Geographic Biotic Observations (GeoBOB) database and Forest Service Natural Resource Information System (NRIS) database (BLM 2006a, 2012, 2017a; Forest Service 2006, 2012, 2017c; NSR 2012), and through ORBIC data requests (ORBIC 2006a, 2012, 2017a).

Pacific Connector conducted surveys from 2007 through 2018 for special status species, including BLM and Forest Service sensitive species. Special status mollusks, fungi, and vascular and non-vascular plants not detected during these complete, targeted surveys were determined to not be present, and thus not affected by the Project. Forest Service and BLM sensitive species that are documented or suspected to occur on BLM districts and/or national forests crossed by the Project, but were dropped from further consideration due to a lack of habitat or because they were not detected during targeted field surveys are listed in tables I-3, I-4, and I-5 in appendix I. Information provided for each of these species in appendix I includes expected habitat, county, national forest, and BLM district distribution, known occurrences in relation to the Project, and effects determination and rationale for this determination.

BLM and Forest Service sensitive species that may be affected by the Project are listed below in table 4.6.4.1-2, excluding the state and federally listed, proposed, and candidate species discussed above, and the Survey and Manage species on NFS land discussed below. Where suitable habitat was documented for a species, but species-specific surveys were not conducted, presence was assumed, and potential effects on these species are discussed here.

TABLE 4.6.4.1-2

BLM and Forest Service Sensitive Species with the Potential to be Affected by the Project a/

Common Name	Scientific Name	Forest Service Sensitive	BLM Sensitive
Mammals			
Pallid bat	*Antrozous pallidus*	X	X
Townsend's big-eared bat	*Corynorhinus townsendii*	X	X
Fringed myotis	*Myotis thysanodes*	X	X
Pacific marten	*Martes caurina*	X	X
Pacific fisher	*Pekania pennanti*	X	X
Birds			
Grasshopper sparrow	*Ammodramus savannarum*	X	
Red-necked grebe	*Podiceps grisegena*	X	X
Horned grebe	*Podiceps auritus*	X	X
American white pelican	*Pelecanus erythrorhynchos*	X	X
Snowy egret	*Egretta thula*		X
Aleutian Canada goose	*Branta canadadnsis leucopareia*		X
Harlequin duck	*Histrionicus histrionicus*	X	X
Bufflehead	*Bucephala albeola*	X	
Franklin's gull	*Larus pipixcan*		X
White-tailed kite	*Elanus leucurus*	X	X
Upland sandpiper	*Bartramia longicauda*	X	
Bald eagle	*Haliaeetus leucocephalus*	X	X
American peregrine falcon	*Falco peregrinus anatum*	X	X
Greater sage-grouse	*Centrocercus urophasianus*	X	X
White-headed woodpecker	*Picoides albolarvatus*	X	X
Lewis' woodpecker	*Melanerpes lewis*	X	X
Purple martin	*Progne subis*	X	X
Oregon vesper sparrow	*Pooecetes gramineus affinis*		X
Tricolored blackbird	*Agelaius tricolor*	X	X

TABLE 4.6.4.1-2 (continued)

BLM and Forest Service Sensitive Species with the Potential to be Affected by the Project a/

Common Name	Scientific Name	Forest Service Sensitive	BLM Sensitive
Reptiles			
Western pond turtle (formerly Pacific pond turtle)	*Actinemys marmorata*	X	X
Amphibians			
Foothill yellow-legged frog	*Rana boylii*	X	X
Terrestrial Invertebrates			
Oregon shoulderband	*Helminthoglypta hertleini*	X (also Survey and Manage)	X
Traveling sideband	*Monadenia fidelis celeuthia*	X	X
Siskiyou hesperian	*Vespericola sierranas*	X	X
Franklin's bumblebee	*Bombus franklini*	X	X
Western bumblebee	*Bombus occidentalis*	X	X
Siskiyou short-horned grasshopper	*Chloealtis aspasma*	X	X
Gray-blue butterfly	*Plebejus podarce*	X	X
Johnson's hairstreak	*Callophrys johnsoni (Mitoura johnsoni)*	X	X
Insular blue butterfly	*Plebejus saepiolus littoralis*	X	X
Mardon skipper	*Polites mardon*	X	X
Coronis fritillary	*Speyeria coronis coronis*	X	X
Aquatic Invertebrates			
Western ridgemussel	*Gonidea angulata*	X	X
California floater	*Anodonta californiensis*	X	X
A caddisfly (no common name)	*Namamyia plutonis*	X	X
Montane Peaclam	*Pisidium ulttramontanum*	X	X
Archimedes springsnail	*Pyrgulopsis archimedis*	X	
A caddisfly (no common name)	*Rhyacophila chandleri*	X	X
caddisfly (no common name)	*Rhyacophila leechi*		X
Non-anadromous Fish			
Umpqua chub	*Oregonichthys kalawatseti*	X	X
Millicoma dace	*Rhinichthys catarctae* ssp.		X
Anadromous Fish			
Pacific lamprey	*Entosphenus tridentata*	X	X
Chinook Salmon Southern Oregon Coast/California Coast ESU, Fall-run, Spring-run	*Oncorhynchus tshawytscha*	X	X
Steelhead Klamath Mountains Province ESU Summer/winter run	*Oncorynchus mykiss*	X	X
Steelhead Oregon Coast ESU	*Oncorynchus mykiss*	X	X
Vascular Plants			
Rogue Canyon rockcress	*Arabis modesta*	X	X
Bensonia	*Bensoniella oregana*	X	X
Bristly sedge	*Carex comosa*	X	X
Coastal lip-fern	*Cheilanthes intertexta*	X	X
Pine woods cryptantha	*Cryptantha simulans*	X	
California globe-mallow	*Iliamna latibracteata*	X	X
Bellinger's meadowfoam	*Limnanthes floccosa* ssp. *bellingeriana*	X	X
Lichens			
no common name	*Bryoria subcana*	X	X

a/ Excluding state and federally listed, and select proposed and candidate species and Survey and Manage species, which are discussed in other sections of this EIS.

Excluding federal and state threatened, endangered, and select proposed and candidate species (discussed above), and Survey and Manage species on NFS lands (discussed below), a total of 58 BLM and Forest Service sensitive species have the potential to be affected by the Project: 5

mammal, 19 bird, 1 reptile, 1 amphibians, 18 invertebrate, 6 fish, 7 vascular plant, and 1 lichen species (table 4.6.4.1-2). Tables I-3, I-4, and I-5 in appendix I provide habitat descriptions for these species. Forest Service sensitive species that would potentially be affected by the proposed action on NFS lands are additionally addressed in the BE (appendix F.7), and Survey and Manage species that would potentially be affected by the proposed action on NFS lands are addressed in more detail in the Survey and Manage Report (appendix F.5 of this EIS).

4.6.4.2 Assessment of BLM and Forest Service Sensitive Species

BLM and Forest Service sensitive species that may be present and potentially affected by construction of the pipeline on federal lands are described here. If species were documented during targeted surveys, those locations and potential effects are also described.

Mammals

There are five BLM and Forest Service sensitive mammals that may be present and potentially affected by construction of the pipeline on federal land: the pallid bat (*Antrozous pallidus pacificus*), Townsend's big-eared bat (*Corynorhinus townsendii*), fringed myotis (*Myotis thysanodes*), marten (*Martes caurina*), and fisher (*Pekania pennanti*). Descriptions of expected habitat, documented or suspected occurrences, and a description of potential Project effects on these special status species within the Project area are presented in table I-3 in appendix I. As all five of these species are Forest Service sensitive, they are additionally addressed in the BE if effects are anticipated on NFS lands (appendix F.7). Marten and fisher are also discussed above as federal proposed threatened species.

Birds

There are 19 BLM and/or Forest Service sensitive birds that may be present and potentially affected by construction, maintenance, and operation of the pipeline on federal land. Descriptions of expected habitat, documented or suspected occurrences, and a description of potential Project effects on these special status species as a result of the Project are presented in table I-3 in appendix I. Forest Service sensitive birds that would potentially be affected by the proposed action are additionally addressed in the BE (appendix F.7).

Fish

There are six BLM and/or Forest Service sensitive fish species that may be present along the LNG carrier transit route, in the waters of Coos Bay potentially affected by construction of the pipeline, or in waters crossed by the pipeline. Of these species, four are anadromous and two are non-anadromous. Descriptions of life histories, expected habitat, and potential occurrences of these special status fish species within the Project area are presented in table I-4 in appendix I. Forest Service sensitive fish that would potentially be affected by the proposed action are additionally addressed in the BE (appendix F.7).

Amphibians and Reptiles

There are two BLM and Forest Service sensitive amphibians and reptiles that may be present and potentially affected by construction of the pipeline on federal land: western pond turtle (*Actinemys marmorata*) and foothill yellow-legged frog (*Rana boylii*). Descriptions of expected habitat, documented or suspected occurrences, and a description of potential Project effects on these special status species within the Project area are presented in table I-3 in appendix I. As both species are Forest Service sensitive, they are additionally addressed in the BE (appendix F.7).

Invertebrates

Aquatic

There are seven BLM and Forest Service sensitive aquatic invertebrates that may be present and potentially affected by construction of the pipeline on federal land. All these species are associated with freshwater environments. Table I-4 in appendix I summarizes the life history, habitat associations, and occurrence of these invertebrates. six of these species are Forest Service sensitive aquatic invertebrates, and thus are additionally addressed in the BE if effects are anticipated on NFS lands (appendix F.7).

Terrestrial

There are 11 BLM and Forest Service sensitive terrestrial invertebrates that may be present and potentially affected by the construction of the pipeline on federal land. Descriptions of expected habitat, documented or suspected occurrences, and a description of potential Project effects on these special status species within the Project area are presented in table I-3 in appendix I. As all 11 species are Forest Service sensitive terrestrial invertebrates they are additionally addressed in the BE (appendix F.7), with the exception of Franklin's bumble bee, which is discussed above as a federal proposed endangered species.

Approximately 20 acres of the right-of-way near known populations of two Forest Service sensitive terrestrial invertebrates (Mardon skipper [*Polites mardon*] and Siskiyou short-horned grasshopper [*Chloealtis aspasma*]) on the Dead Indian Plateau would be restored with grasses (including *Festuca* sp.) preferred by these species in addition to the rehabilitation required under BMP guidelines. This mitigation on the Rogue River National Forest has the potential to increase the habitat and local range for these two species.

Three BLM and Forest Service sensitive mollusk species were located during surveys for the Project: Siskiyou Hesperian (*Vespericola sierranas*), traveling sideband (*Monadenia fidelis celeuthia*), and Oregon shoulderband (*Helminthoglypta hertleini*). These three species are discussed in the following paragraphs; Siskiyou hesperian and traveling sideband are additionally addressed in the BE as they were observed on NFS lands during surveys (appendix F.7).

Field Survey Locations and Potential Effects

Traveling sideband is a BLM and Forest Service sensitive species (BLM 2015; Forest Service 2015) and an Oregon endemic terrestrial snail. During surveys in 2007 and 2010, this species was observed at nine locations on the Rogue River and Winema National Forests (between MP 154.9 and 175.4), and at six locations on BLM land in the Lakeview and Medford BLM Districts (MPs 116.3 to 176.9). Shells and live individuals were located within and outside the right-of-way, as well as within proposed TEWAs and UCSAs (SBS 2008a, 2011b). During surveys in 2012 and 2015, this species was observed at five locations on the Rogue River and Umpqua National Forests (between MP 104.9 and 162.5) and four locations on BLM land in the Roseburg and Medford BLM Districts (MPs 91.7 to 116.9), adjacent to the right-of-way and TEWAs.[162] Direct mortality

[162] See Table D.3-10 in Pacific Connector's Resource Report 3, included as part of their September 2017 filing with the FERC.

could occur to this species if they are within the right-of-way during Project clearing or construction due to their low mobility. Clearing of the right-of-way could affect habitat by removing forest overstory, potentially making the area unsuitable for this species. Indirect effects could result from the alteration of composition and structure of vegetation resulting in changes in microclimate. Realignments following the 2007 and 2010 surveys resulted in avoidance of some but not all the sites observed during Project surveys. As currently proposed, Pacific Connector would directly affect 5 of the 14 sites observed during Project surveys on NFS lands, and 4 of the 10 sites observed during Project surveys on BLM-managed lands. Indirect effects are expected to the traveling sideband sites observed even if direct effects on these sites are avoided because 5 and 4 of the sites are within approximately 100 feet of Project disturbance on NFS lands and BLM-managed lands, respectively, and thus would be affected by changes in microclimate conditions.

Siskiyou hesperian is a BLM and Forest Service Sensitive species (BLM 2015; Forest Service 2015) and a riparian associated terrestrial snail. During Project surveys in 2007, 2008, and 2010, this species was observed at 14 locations on the Rogue River and Umpqua National Forests (between MPs 110.2 and 164.7), and 10 locations in the Medford and Roseburg BLM Districts (MPs 79.8 to 151.5). In 2011, 2012, and 2014, this species was observed at nine locations within the Rogue River and Winema National Forests (between MPs 154.5 and 168.9), and two locations in the Medford BLM District (MP 148.7 and 153.5). Shells and live individuals were observed within and outside the right-of-way, as well as proposed TEWAs and UCSAs (SBS 2008, 2011b; April 27, 2015 response to FERC data request). During surveys in 2015, this species was observed at eight locations on the Rogue River National Forest (between MP 155.7 and 160.6) and one location on BLM land in the Medford BLM District (MP 128.8), within and adjacent to the right-of-way and TEWAs.[163] During surveys in 2017, active individuals were observed at one location on the Rogue River National Forest (MP 154.6; Tona 2018). Direct mortality to individuals could occur if they are located within the right-of-way during Project clearing or construction. Another potential direct effect is destruction or alteration of hydrology of riparian, wetland, or aquatic habitats used by this species. Indirect effects could result from the alteration of composition and structure of vegetation resulting in changes in microclimate. The increase in sun exposure could reduce moisture levels and potential decrease dispersal between populations or suitable habitat. As currently proposed, Pacific Connector would directly affect 11 of the 31 sites observed during Project surveys on NFS lands, and 6 of the 13 sites observed during Project surveys on BLM-managed lands. Indirect effects are expected to the Siskiyou hesperian sites observed even if direct effects on these sites are avoided as 16 and 5 of the sites on NFS lands and BLM-managed lands, respectively, are within approximately 100 feet of Project disturbance, and thus would be affected by changes in microclimate conditions.

Oregon shoulderband is a BLM and Forest Service sensitive species (BLM 2015; Forest Service 2015) and a terrestrial snail endemic to northern California and southwest Oregon. This species is also managed as a Survey and Manage species on NFS lands; however, it was not observed on NFS lands during surveys for the Project. During Project surveys in 2007, this species was observed at five locations in the Roseburg BLM District (MPs 64.6 to 76.0). Shells and live individuals were observed within and outside the right-of-way (SBS 2008a). Direct mortality to individuals could occur if they are located within the right-of-way during Project clearing or

[163] See Table D.3-10 in Pacific Connector's Resource Report 3, included as part of their September 2017 filing with the FERC.

construction. Clearing of the right-of-way could affect habitat by removing forest overstory, potentially making the area unsuitable for this species. Indirect effects could result from the alteration of composition and structure of vegetation resulting in changes in microclimate. The increase in sun exposure could reduce moisture levels and potential decrease dispersal between populations or suitable habitat. As currently proposed, Pacific Connector would directly affect two of the five sites observed during Project surveys on BLM-managed lands. Indirect effects are expected to the Oregon shoulderband sites observed even if direct effects on these sites are avoided as two of the sites on BLM-managed lands are within approximately 100 feet of Project disturbance, and thus would be affected by changes in microclimate conditions.

Plants and Fungi

A total of 271 BLM and/or Forest Service sensitive bryophyte, lichen, fungus, and vascular plant species were identified as potentially occurring within the Project area (see table I-5 in appendix I). Between 2007 and 2018, SBS surveyed for special status fungi and vascular and non-vascular plant species in suitable habitat, where access was granted, within 50 feet (non-federal lands) or 100 feet (federal lands) of the right-of-way, TEWAs, UCSAs, and access roads (note that surveys continued through 2018). Plant and fungus species documented on federal lands during surveys are described below. Descriptions of expected habitat, documented or suspected occurrences, and potential Project effects on all species within the area affected by the Project are presented in table I-5 in appendix I. Forest Service sensitive plants and fungi that would potentially be affected by the proposed action are additionally addressed in the BE (appendix F.7).

<u>Bryophytes</u>

Of the 41 BLM and/or Forest Service sensitive bryophytes identified as potentially occurring within the area affected by the Project, none were documented during surveys of the currently proposed route.

<u>Lichens</u>

There are 16 BLM and/or Forest Service sensitive lichens identified as potentially occurring within the area affected by the Project. Potential Project effects on lichens include trampling or killing of individual plants. One BLM and Forest Service sensitive species, *Bryoria subcana*, was documented during surveys of the currently proposed route. This species is also an Survey and Manage species under the 2001 ROD list (Forest Service and BLM 2001a).

Bryoria subcana is a BLM and Forest Service Sensitive coastal lichen species and was observed during Project surveys in the BLM Coos Bay District, approximately 100 feet of the right-of-way near MP 21.88BR. The species was observed just east of the area affected by the Project and may be avoided by activities within the corridor; however, construction would disturb vegetation and soils within 200 feet of the site and could modify microclimate conditions around the observation. The removal of trees and woody debris could negatively affect *Bryoria subcana* in adjacent areas by removing its habitat and affecting its association with the trees, affecting site persistence even if the entire site is not disturbed. In addition, modification of shading, moisture, and habitat conditions within 200 feet of the observation as a result of the Project construction and operation would likely make habitat within the site no longer suitable for the species. Restored portions of the corridor and TEWAs would be dominated by early seral vegetation for approximately 30 years, which would result in long-term changes to habitat conditions. A portion of the corridor would be maintained in low-growing vegetation for pipeline maintenance and would not provide habitat for the species during the life of the Project. *Bryoria subcana* is not likely to persist at the site following Project implementation. However, there are 32 other known sites of this species within the range of the NWFP, including 30 other sites located on BLM and NFS lands (NSR 2014b). The loss of this one site represents a loss of approximately 3 percent of the known sites. Therefore, remaining sites of this species would continue to provide a reasonable assurance of species persistence.

See table I-5 in appendix I for a list of sensitive lichen species identified as potentially occurring within the Project area, descriptions of their expected habitat, and documented or suspected occurrences, including documented occurrences of the one sensitive lichen species observed during Project surveys.

Fungi

Of the 26 BLM and/or Forest Service sensitive fungi identified as potentially occurring within the Project area, none were documented during surveys.

Vascular Plants

There are 188 BLM and/or Forest Service sensitive vascular plants identified as potentially occurring within the Project area, 10 of which were documented during Project surveys: Rogue Canyon rockcress (*Arabis modesta*), Bensonia (*Bensoniella oregana*), Cox's mariposa lily, Umpqua mariposa lily, bristly sedge (*Carex comosa*), coastal lip fern (*Cheilanthes intertexta*), pine woods cryptantha (*Cryptantha simulans*), clustered lady's slipper (*Cypripedium fasciculatum*), California globe-mallow (*Iliamna latibracteata*), and Bellinger's meadowfoam (*Limnanthes floccosa* ssp. *bellingeriana*). Two of these species—Cox's mariposa lily and Umpqua mariposa lily—are also state-listed species and are discussed above in section 4.6.2.3. One of these species, clustered lady's slipper, is a Forest Service Survey and Manage species and is discussed below under section 4.6.4.3. Potential effects on Umpqua mariposa lily, pine woods cryptantha, California globe-mallow, and Bellinger's meadowfoam on NFS lands are additionally discussed in the BE (appendix F.7 of this EIS).

Field Survey Locations and Potential Effects

Rogue Canyon rockcress is a regional endemic found within chaparral and lower montane coniferous forests in northern California and southern Oregon (CNPS 2018). In Oregon, it is only known from Jackson and Josephine Counties (NRCS 2018). This species has been found on dry, serpentine soils on exposed slopes and rocky cliffs in the Rogue River canyon at elevations between 490 and 1,480 feet (NatureServe 2018). Two sites of Rogue Canyon rockcress were observed during Project surveys in 2017 on state forest lands 24 feet and 90 feet north/northwest of TEWA 124.30-N. This species was not observed on BLM or Forest Service land during Project surveys.

Bensonia is found mainly within the Siskiyou Mountains of southwestern Oregon in Curry and Josephine Counties, with a few small disjunct populations in adjacent Humboldt County, California (NatureServe 2018). The rhizomatous species grows in wet meadows and edges near bogs and springs. Populations seem to be associated with cloud or fog banks that blanket the mountain tops at certain times of year. Most plants are in meadows on gentle slopes, and they thrive on partial shade. The species has been found at elevations between 2,000 to 4,750 feet (Hoover and Holmes 1998). One bensonia site was noted near the Project in 2011 in the Roseburg

BLM District, approximately 100 feet east of the existing Signal Tree Road Quarry at MP 47. Pacific Connector surveyed this area in 2013 and no special status species were observed, including bensonia. Due to the distance between this site and the Project, no effects are anticipated.

Bristly sedge is found from Quebec to Minnesota and south, as well as in the Pacific Northwest and Montana (NatureServe 2018). This species habitat includes marshes, lakeshores, and wet meadows. In Oregon, this species is known from Columbia, Klamath, and Multnomah Counties; although it is believed to be extirpated or possibly extirpated in Columbia and Multnomah Counties (NatureServe 2018). One population of bristly sedge was documented in 2012 on private land 66 feet south of TEWA 184.30. This species was not observed on BLM or Forest Service land during Project surveys.

Coastal lip fern grows in crevices and bases of rocks and is found mainly in California, although it also occurs in Oregon and Nevada (The Jepson Herbarium 2018). In Oregon, this species is known from Douglas and Jackson Counties (NRCS 2018). Two observations of coastal lip fern site were noted near the Project in the Medford BLM District. One observation is located approximately 65 feet west of the pipeline right-of-way near MP 148.9 and the other observation is greater than 100 feet from the pipeline right-of-way near MP 149.9. Due to the distance between these sites and the Project, direct effects are not anticipated; however, the Project could potentially indirectly affect individuals and/or habitat of this species.

Pine woods cryptantha is found in dry gravelly sites, disturbed areas, and open conifer forests from elevations between 820 and 8,530 feet (The Jepson Herbarium 2018). This species' range includes California north to Washington and east to Idaho (NRCS 2018). Five observations of pine woods cryptantha were documented during Project surveys in 2017. One site was located in the Rogue River-Siskiyou National Forest approximately 96 feet northwest of MP 155.8. One site was located on the Fremont-Winema National Forest on the edge of Clover Creek Road and 10 feet from the pipeline right-of-way near MP 175.3, and two sites were located in the Lakeview BLM District: 1) within the right-of-way near MP 176.96 and 2) on the edge of Clover Creek Road near MP 176.98. To reduce adverse effects, the Forest Service may require as part of the federal right-of-way Grant that during construction Pacific Connector fence the *Cryptantha simulans* plants located approximately 10 feet from the proposed Project right-of-way near MP 175.3, and to the extent possible reduce disturbance within the right-of-way near these plants. Because this species was observed within the pipeline right-of-way, the Project may directly and indirectly affect individuals and habitat of this species.

California globe mallow is found in southwestern Oregon, extending into Humboldt County in northern California (Malaby 2005). This species inhabits moist forests, streamsides, lower montane coniferous forests, and montane chaparral; often in recently burned areas (Malaby 2005; CNPS 2018). In Oregon, California globe mallow is found in coastal ranges in Coos and Douglas Counties and is also known from Curry, Jackson, Josephine, and Linn Counties. Three observations of California globe mallow were observed during Project surveys in 2017: one in the Roseburg BLM District and two in the Umpqua National Forest. The observation in the Roseburg BLM District was located within the pipeline right-of-way near MP 99.9, within the area burned during the Stouts Creek fire in 2015. The sites in the Umpqua National Forest are in the pipeline right-of-way near MP 106.2 and MP 106.7; both sites were in recently burned areas. Because this species was observed within the pipeline right-of-way, the Project may directly and indirectly affect individuals and habitat of this species.

Bellinger's meadowfoam is associated with vernally wet meadows or vernal pools and is generally found on basalt scablands at elevations between 1,000 and 4,000 feet in Jackson and Klamath Counties, Oregon, and Shasta County, California. Six Bellinger's meadowfoam populations were located in the Project area. Two populations were in the Rogue River-Siskiyou National Forest: within the pipeline right-of-way near MP 154.1 and within the pipeline right-of-way between MP 154.71 to 154.82. The other four populations were in the Medford BLM District: near MPs 120.3, MP 128.8, and MP 129.0, and TEWA 128.79-N. All these observations are located greater than 100 feet from the pipeline route, except for the observation in TEWA 128-79. Six hundred plants were observed in and near TEWA 128.79-N during Project surveys in 2017.

In 2010, 30,000 Bellinger's meadowfoam plants within less than one acre were documented between MPs 154.8 and 154.7, near Heppsie Mountain (SBS 2011a), also within the Rogue River National Forest. Potential effects on this site include removal of individuals, temporary disturbance, and permanent loss or alteration of habitat including changes in hydrology. The site is in a vernally moist scabland meadow within the right-of-way and a TEWA and therefore would be disturbed by the Project (SBS 2011a; Rolle 2014). Measures to avoid this site considered but excluded to avoid a rare fungus, *Gymnomyces abietis*, which was also found at the same location on the north end of the meadow at MP 154.8. *Gymnomyces abietis* is a Forest Service Survey and Manage species, discussed below in section 4.6.4.3. Although Project activities would affect the local population at MP 154.7, the species would not likely be eliminated from the site as it is able to grow on disturbed soil (Rolle 2014). Conservation measures at this site include recontouring, reseeding, and controlling for noxious weeds. Additionally, although the site that would be affected is one of only a few Bellinger's meadowfoam sites on NFS land, a large number of sites are known from BLM and private land in eastern Jackson County. More undocumented sites are likely to occur on unsurveyed private lands (Rolle 2014). Consequently, the expected loss of individuals and habitat at this site is not expected to affect the viability of Bellinger's meadowfoam over the broader geographic area of the low mountains and foothills of eastern Jackson County (Rolle 2014).

4.6.4.3 Survey and Manage Species

The BLM and Forest Service first identified Survey and Manage species in 1994 as rare amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropods that occupy LSOG forests in the range of the NSO (see Forest Service and BLM 1994a, the NWFP ROD). The agencies established standards and guidelines for management of these rare species in the *Standards and Guidelines for Management for Late-Successional and Old-Growth Related Species in the Range of the Northern Spotted Owl* (Forest Service and BLM 1994b). The NWFP ROD established overall objectives for managing Survey and Manage species populations that were referred to as "persistence objectives." These objectives were based on the Forest Service viability provision in the 1982 National Forest System Land and Resource Management Planning Regulation for the National Forest Management Act of 1976.

In 2001, the Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines (2001 ROD; Forest Service and BLM 2001a) modified the management direction provided in the NWFP ROD for Survey and Manage species and amended BLM and Forest Service land management plans in the range of the NSO accordingly. The management direction for Survey and Manage species varies based on its assigned category, which establishes varying levels of surveys and management of known sites (refer to the 2001 ROD and appendix F.5 to this EIS for additional details on the categories). For the Survey and Manage Standards and Guidelines, the major elements were retained with some restructuring for clarity, and the 1994 list of Survey and Manage species was modified to remove 72 species in all or part of their range because new information indicated they were secure or otherwise did not meet the basic criteria for Survey and Manage. Based on the history of the Survey and Manage rule, it should be noted that by definition, there is a general concern for persistence for any of the species listed in the 2001 ROD. That concern is the basic reason species are listed in the Survey and Manage Standards and Guidelines.

In 2004 and again in 2007, the BLM and Forest Service issued a ROD to eliminate the Survey and Manage requirements of the 2001 ROD and to provide protection for species on the Survey and Manage lists by managing them under the agencies' special-status species programs. In 2014, the Court issued a remedy order in the case of *Conservation Northwest et al. v. Bonnie et al.*, No 08-1067-JCC (W.D. Wash.)/No. 11-35729 (9th Circ.). As the latest step in the ongoing litigation challenging the 2007 ROD, this remedy order vacated the 2007 ROD to remove or modify the Survey and Manage mitigation measure standards and guidelines, which returned the agencies to the status quo in existence prior to the 2007 ROD. Thus, the 2001 ROD was reinstated, including any amendments or modifications to the 2001 ROD that were in effect as of March 21, 2004, returning the species to the category assigned in the 2001 ROD.

In accordance with the 2014 Court decision, this assessment was completed using the 2001 ROD Survey and Manage Standards and Guidelines, with the 2003 Annual Species Review (ASR) modifications for the species list and category assignments (excepting the 2001 ASR red tree vole category change in a portion of its range and 2003 ASR red tree vole removal from a portion of its range).

In 2016, the BLM approved two new RMPs, including the Northwestern and Coastal Oregon RMP and the Southwestern Oregon RMP (BLM 2016a, 2016b). All lands managed by the BLM that occur in the Pacific Connector Project are within the revised RMPs' management areas. The past RMPs were developed consistent with the 1994 NWFP and thereby included Survey and Manage species measures. The 2016 RMPs revises the past RMPs in their entirety and removes all measures for Survey and Manage species, although Forest Service Survey and Manage species identified as BLM sensitive species would continue to receive protections consistent with BLM's sensitive species management program.

Although some species covered by the Survey and Manage Standards and Guidelines also occur on private land, land managed by the BLM, and areas outside the NSO range, the requirements of the 1994 NWFP and 2001 ROD apply to lands managed by the Forest Service within the range of the NSO and to lands managed by the BLM within the range of the NSO in California.

The NWFP ROD and the 2001 ROD do not prescribe a well-defined process for evaluating effects on species persistence or viability from a proposed activity. The 2001 ROD states "instead, common sense and agency expertise must be used in making determinations of compliance with the viability provision" (Standards and Guidelines). The Forest Service has embraced this approach for evaluating effects of the Project on the persistence of affected Survey and Manage species in the NSO range. The Standards and Guidelines and 2001 ROD are intended to "provide a reasonable assurance of species persistence" for all the Survey and Manage species. If the Project is constructed, it would affect numerous known sites of Survey and Manage species. This assessment seeks to determine, should the Project be constructed, whether there would be a reasonable assurance of species persistence for those Survey and Manage species affected by the Project in the NSO range. The evaluation of species persistence is presented in appendix F.5 to this EIS, and this section summarizes the results of the evaluation. Attachment A to appendix F.5 lists the Survey and Manage species considered in the persistence evaluation.

This section is organized by taxonomic group and includes a brief overview of the species considered in the persistence evaluation; a summary of the distribution of sites of the species in the NSO range; an analysis of the effects of the Project on the sites; and breakdowns of the number of sites of each species in the NSO range, the number of affected sites of each species across the analysis area, and the number of affected sites on the Umpqua, Rogue River-Siskiyou, and Fremont-Winema National Forests. Details on the methodology used for the persistence evaluation (e.g., establishment of sites for each species, mapping of general habitat and site distribution, analysis of effects on sites) and a glossary of key terms used in the evaluation available in appendix F.5. The factors used to evaluate the Project effects are outlined in appendix F.5 and were derived from the 2001 ROD criteria for species persistence and relative rarity. This persistence evaluation is not intended to serve as an annual species review or an evaluation of the relative rarity of the species. This analysis is focused only on the effects on the species that could result from implementation of the Project and is intended to provide sufficient information to support subsequent findings by the Forest Service.

This assessment provides a conservative site-specific analysis of effects on sites, which consist of the recorded observations of Survey and Manage species from agency geodatabases and a surrounding protection buffer, and generally assumes that site persistence would not be maintained following Project implementation if a site falls within the analysis area. This conservative approach was considered sufficient if Project-related effects on the sites would not substantially alter the distribution of the species across the NSO range (e.g., the species would still be well distributed or locally abundant near the Project area). However, if the initial analysis revealed that remaining sites (i.e., those not affected by the Project) may not provide a reasonable assurance of species persistence, a closer evaluation of the effects on each site was conducted to further assess effects of the Project and determine if site persistence would be maintained at any of the sites following Project implementation, or if measures would be needed to protect or avoid the site(s). Additional details on the methodology used to evaluate effects are presented in appendix F.5.

Incomplete or Unavailable Information

CEQ regulations 40 CFR 1502.22 require a discussion of incomplete or unavailable information. Information is incomplete or unavailable for:

- **Total populations of Survey and Manage species beyond those represented in the geodatabases of the agencies used in this report.** Although a statistically reliable region-wide survey has been completed for most of the Survey and Manage species (Forest Service and BLM 2007: 142), the results of those surveys have not been biologically interpreted, and the final results have not yet been published. In absence of a published interpretation of the results of those regional surveys, this assessment relies on the known sites of affected species that have been inventoried and recorded in the known site geodatabases of the BLM and Forest Service. These data constitute "best available information" for populations of Survey and Manage species and provide sufficient information to make a reasoned choice between the alternatives and to make an informed decision related to the persistence standards of the 2001 Survey and Manage ROD. A total population estimate is not necessary to make a reasoned choice between the alternatives.

- **Total acres of the specialized microsites and habitats used by certain Survey and Manage species.** This analysis was completed using geodatabase records of observations (i.e., "known sites"), regionally available vegetation inventory data, and evaluation criteria developed from the 2001 ROD. In many cases, Survey and Manage species rely on specialized habitats that may not be catalogued in agency geodatabase records or vegetation inventories. This is one of the reasons why pre-Project surveys are required for Survey and Manage species. Habitat requirements for each of the species considered are discussed in detail in appendix F.5. In this assessment, estimates are provided of the general areas where specialized habitats may be found, but these should not be interpreted as the actual acres of available specialized habitats; the actual acres of available specialized habitats are typically a fraction of the general habitat description. For example, some mollusks rely on moist microsites found in late-successional coniferous forests. A regional inventory of late-successional coniferous forests is available, but a regional inventory of moist microsites is not; there are many, many more acres of late-successional forests than there are acres of moist microsites within those forests. This assessment identifies known sites and broad habitat classifications such as "late-successional coniferous forests below 6,000 feet" where specialized habitats and the species in question may be found, but makes no estimates of, nor does the analysis rely on, estimates of specialized habitats that may exist within those broad vegetation categories. The cost of acquiring such an inventory of microsite environments over the entire area of the NWFP would be exorbitant and is not essential to making a reasoned choice between the alternatives. As noted in the Final Supplemental EIS for Survey and Manage Species, "the likelihood that an activity modifying late-successional forest will occur within the range of a truly rare or localized species population must be viewed in light of the relatively conservative degree of modification of late-successional forest projected to occur within the NWFP area. For example, management activities (timber harvest and prescribed fire) are projected to modify approximately 3 percent of the late-successional forest within the area over the next decade" (Forest Service and BLM 2000: 180). Pre-Project survey data and existing known sites of Survey and Manage species within the area of the NWFP provide sufficient information to determine whether there is a "reasonable assurance of species persistence," which is the standard of the 2001 Survey and Manage ROD.

- **Recovery of occupied sites after disturbance.** Survey and Manage species are associated with LSOG forests on NFS lands. The construction corridor and TEWAs will be reforested and replanted with native vegetation similar to what occupied the Project area prior to disturbance. It will be at least 80 years before those areas provide late-successional habitat. A 30-foot-wide maintenance corridor centered along the pipeline route would be maintained in low growing brush and grass vegetation (no trees) for the life of the Project. When the Project is decommissioned, it would be at least an additional 80 years before this strip provides late-successional stand characteristics. Information is not generally available as to how effectively the affected Survey and Manage species will reoccupy these areas. This analysis presumes that if the "site" is within the construction clearing or TEWAs, the Project would result in a long-term loss of that site. This analysis does not speculate on when or if the affected species may reoccupy the site. Since sites are presumed lost if affected, and that provides the basis for the assessment, data related to recovery or reoccupation of sites are not essential to the decision to be made or the choice between alternatives.

Survey and Manage Species Surveys and Evaluations

Surveys conducted for the Project in and near the Project area through 2016 resulted in numerous observations of Survey and Manage species. These survey results in combination with results from prior surveys conducted near the Project area were used to identify the Survey and Manage species that could be affected by the Project. Observation data stored in agency geodatabases were converted to "sites" or "known sites" using a standardized mapping protocol based on buffer distances described in the 2001 ROD. Species evaluated include those that have sites on NFS lands in or near the Project area. The species considered include 31 fungi, 2 lichens, 1 vascular plant, 2 mollusks, 1 mammal, and 1 bird.

Fungi

The diverse fungi of the Pacific Northwest include several hundred saprobic (decomposers), parasitic, and symbiotic (mutualistic) macro- and micro-fungi species. The 2003 list includes 194 species of fungi under the Survey and Manage Standards and Guidelines. Of these species, 31 are considered in this evaluation of the Project because they have been documented on NFS lands in or near the Project area. Appendix F.5 of this EIS presents additional details on each species, while the key information used to evaluate Project-related effects is summarized in this section.

The fungi considered in this analysis consist primarily of mycorrhizal or symbiotic species, which include truffles, false truffles, chanterelles, boletes, coral fungi, and gilled mushrooms. Some of the species are saprobic gilled mushrooms or parasitic fungi. The mycorrhizal fungi form symbiotic relationships with vascular plants to exchange nutrients and water for photosynthate. The saprobic species are found on dead or decaying wood, including snags. The fungi fruit at different times of year, and many do not fruit annually, although they may still be present in the soil. Although surveys have been conducted across the Project area and in other parts of the NSO range, the difficulty in detecting fungi when fruiting bodies are not present has limited the ability to fully describe the range and distribution of many species within the NSO range. The fungi species considered in this analysis are listed in table 4.6.4.3-1 with the currently known number of sites in the NSO range. Many of these species are likely more abundant than currently documented, and more survey effort would be expected to locate additional sites of the species.

TABLE 4.6.4.3-1

Regional Site Count of Fungi Species Potentially Affected by the Project

Species	Total Sites in NSO Range a/	Sites on NFS Lands in NSO Range b/	Sites in NFS Reserves in NSO Range c/
Albatrellus ellisii	112	72	33 (46%)
Arcangeliella crassa	26	21	2 (10%)
Boletus pulcherrimus	60	34	21 (62%)
Choiromyces alveolatus	21	17	11 (65%)
Clavariadelphus occidentalis	177	63	21 (33%)
Clavariadelphus sachalinensis	273	35	20 (57%)
Clavariadelphus truncatus	332	127	56 (44%)
Collybia bakerensis	149	145	64 (44%)
Collybia racemosa	71	24	13 (54%)

TABLE 4.6.4.3-1 (continued)

Regional Site Count of Fungi Species Potentially Affected by the Project

Species	Total Sites in NSO Range a/	Sites on NFS Lands in NSO Range b/	Sites in NFS Reserves in NSO Range c/
Cortinarius magnivelatus	47	28	8 (29%)
Cortinarius olympianus	73	44	27 (61%)
Cortinarius verrucisporus	52	32	5 (16%)
Cudonia monticola	82	35	9 (26%)
Galerina atkinsoniana	96	68	55 (81%)
Gastroboletus subalpinus	91	81	36 (44%)
Gomphus clavatus	189	102	53 (52%)
Gomphus kauffmanii	159	99	53 (54%)
Gymnomyces abietis	21	18	10 (55%)
Hygrophorus caeruleus	56	47	14 (30%)
Mycena overholtsii	205	201	94 (47%)
Polyozellus multiplex	87	83	40 (38%)
Ramaria araiospora	152	69	26 (38%)
Ramaria coulterae	67	19	26 (32%)
Ramaria rubrievanescens	143	105	53 (50%)
Ramaria rubripermanens	231	103	35 (34%)
Rhizopogon truncatus	210	70	26 (34%)
Sarcodon fuscoindicus	74	38	18 (46%)
Sedecula pulvinata	3	3	2 (67%)
Sparassis crispa	106	51	9 (18%)
Spathularia flavida	194	81	52 (64%)
Tremiscus helvelloides	318	62	34 (55%)

a/ Total site count reflects the number of sites generated by the 8/2/17 FME extract.
b/ Site count reflects only those sites on NFS lands using land ownership data for the NSO range (dated October 2011).
c/ Site count reflects only those sites on NFS lands and in reserve land allocations based on 1994 ROD reserve land allocations for the NSO range (data dated December 2002 and September 2009) and National Hydrography Dataset, v. 2.1.0 to represent “Riparian Reserves” across the NSO range. These counts underestimate the number of sites in reserves, but regionally mapped reserve data are not available. The percentage represents the estimated proportion of sites in NFS reserves to total sites on NFS lands.

Habitat for these species varies and has generally been classified as coniferous, mixed hardwood-coniferous, and/or hardwood forests, including the LSOG component of these forests. Forests that may provide suitable habitat have been mapped using available data for the NSO range that were also used for the NWFP Effectiveness Monitoring 15-year report to map LSOG forests (Moeur et al. 2011). The data are the best available data on forest types across the NSO range but likely overestimate the amount of potential habitat available in the region for many of the species considered in this analysis, particularly those with microsite conditions that have not been mapped at a regional scale. The extent of potential habitat for each species varies based on its distribution across the NSO range and its habitat preferences, and additional details on habitat are presented in appendix F.5.

The Project could affect site persistence of 31 Survey and Manage fungi at one or more sites in or near the Project area. Vegetation removal and grading activities in the construction corridor and in TEWAs would disturb vegetation and soil within sites and could result in the removal of populations or individuals of fungi. Construction of the Project would create an open corridor, which would be dominated by early seral vegetation for approximately 30 years. This is a long-term effect that could modify microclimate conditions around populations or individuals adjacent to the corridor during the early seral vegetation phase, although not all species are affected by open corridors or change in forest age (e.g., *P. fallax, P. piceae, P. sipei*, and *P. spadicea*). The removal of coniferous, mixed hardwood-coniferous, and hardwood forests, including the LSOG component of these forests, and disturbance to soil, understory substrate (e.g., rocks, downed logs), and roots of trees could negatively affect the fungi in adjacent areas by removing their habitat, disturbing soil or duff around trees or roots of trees, and affecting mycorrhizal associations with the trees or other relationships between the fungi and their hosts, potentially affecting site persistence even if the entire site is not disturbed. For some species that are found in more open habitats (e.g., *C. olympianus*, *H. caeruleus*, *S. flavida*), these microclimate changes may not affect site persistence. In addition, modification of shading, moisture, and habitat conditions as a result of the corridor and TEWAs could make habitat within the sites no longer suitable for the species. Material storage within UCSAs would disturb understory habitat in some sites, which could also modify microhabitats near extant populations or individuals, potentially making the habitat no longer suitable for the species. Road improvements and establishment could remove habitat and extant populations or individuals of the fungi. The specific effects on sites in and near the Project area vary by species and depend on where the sites are in proximity to the corridor and other activities. Table 4.6.4.3-2 presents a summary of the number of sites of each species that would be affected by the Project; additional details for each species are included in appendix F.5.

TABLE 4.6.4.3-2

Fungi Sites Potentially Affected by the Project

Species	Total Affected NFS Sites a/	Affected Sites in NFS Reserves	Remaining Sites on NFS Lands in NSO Range	Remaining Sites on all Lands in NSO Range
Albatrellus ellisii	9	2	63	103
Arcangeliella crassa	1	—	21 b/	26 b/
Boletus pulcherrimus	7	—4	31 b/	57 b/
Choiromyces alveolatus	1	—	17 b/	21 b/
Clavariadelphus occidentalis	1	—	62	171
Clavariadelphus sachalinensis	7	2	28	258
Clavariadelphus truncatus	9	3	118	312
Collybia bakerensis	2	—	143	147
Collybia racemosa	1	—	23	70
Cortinarius magnivelatus	5	—	24 b/	43 b/
Cortinarius olympianus	4	3	41 b/	70 b/
Cortinarius verrucisporus	5	—	29 b/	49 b/
Cudonia monticola	1	—	34	81
Galerina atkinsoniana	1	—	67	95
Gastroboletus subalpinus	2	—	79	89
Gomphus clavatus	3	1	99	186
Gomphus kauffmanii	7	6	91	152
Gymnomyces abietis	1	1	18 b/	21 b/
Hygrophorus caeruleus	6	—1	846 b/	55 b/
Mycena overholtsii	2	1	199	203
Polyozellus multiplex	1	1	82	86
Ramaria araiospora	3	—	67	149
Ramaria coulterae	3	1	17	65
Ramaria rubrievanescens	2	—	103	141
Ramaria rubripermanens	7	—	96	223
Rhizopogon truncatus	6	1	64	203
Sarcodon fuscoindicus	1	—	37	72
Sedecula pulvinata	1	1	3 b/	3 b/
Sparassis crispa	1	—	50	104
Spathularia flavida	5	4	76	189
Tremiscus helvelloides	1	1	61	310

a/ Affected sites are those on NFS land that would be directly or indirectly affected by Project activities based on the analyses presented in appendix F.5.
b/ Although one or more sites would be affected by the Project, individuals within some of the sites would not be affected, and site persistence would be maintained for those sites following project implementation. The remaining site count includes sites that may be affected, but for which site persistence is expected to be maintained. Only sites for which site persistence would be affected were removed from the remaining site count.

The species listed below appear to be more common than previously documented or are relatively common across the NSO range based on new information available from surveys for the Project and/or other sources since the 2003 Annual Species Review resulting in the December 2003 Survey and Manage species list. For these species, the Project would affect individuals or habitat at one or more sites and could affect site persistence, but the remaining sites in the NSO range would continue to provide a reasonable assurance of species persistence:

Albatrellus ellisii
Clavariadelphus occidentalis
Clavariadelphus sachalinensis
Clavariadelphus truncatus
Collybia bakerensis
Cortinarius olympianus
Cudonia monticola
Galerina atkinsoniana
Gastroboletus subalpinus
Gomphus clavatus
Gomphus kauffmanii
Mycena overholtsii
Polyozellus multiplex
Ramaria araiospora
Ramaria coulterae
Ramaria rubripermanens
Ramaria stuntzii
Rhizopogon truncatus
Sparassis crispa
Spathularia flavida
Tremiscus helvelloides

The species listed below are not necessarily more common than previously documented despite new information available from pre-disturbance surveys for the Project and/or other sources since these species were last assessed in 2003. For these species, the Project would affect individuals or habitat at one or more sites and could affect site persistence, but the remaining sites in the NSO range would provide a reasonable assurance of species persistence:

Arcangeliella crassa
Boletus pulcherrimus
Choiromyces alveolatus
Collybia racemosa
Cortinarius magnivelatus
Cortinarius verrucisporus
Gymnomyces abietis
Hygrophorus caeruleus
Sedecula pulvinata

The species listed below is not necessarily more common than previously documented despite new information available from pre-disturbance surveys for the Project and/or other sources since these species were last assessed in 2003. For this species, the Project would affect site persistence at one or more sites, and the remaining sites in the NSO range may not provide a reasonable assurance of species persistence. These species are known from a low number of sites within a part of the NSO range, has limited habitat requirements, and has a distribution pattern in which every site may be important for dispersal opportunities to ensure the persistence of the species in the NSO range:

Sarcodon fuscoindicus

As described in section 3, subsequent to the draft EIS, the proposed route was modified by the Applicant to avoid a *Sarcodon fuscoindicus* (a Survey and Manage fungi species) occurrence located between MPs 111.5 and 111.6. This variation would provide a no-disturbance buffer for this species. The buffer is necessary to protect these sites to comply with the 2001 Survey and Manage ROD to maintain the persistence of the affected species within the range of the NSO.

With this modification, the construction corridor segment, along with associated UCSAs, was 25 feet (8 meters) to the northeast of the proposed route identified in the draft EIS, such that at least one of the two observations within the site is at least 100 feet from the Project corridor. With this modification, the observation site that is closer to the Project area may still incur indirect effects; however, the other observation would be located at least 100 feet from the Project corridor where indirect effects are unlikely. Overall, the site would be expected to persist as a result of this modification. In addition to the route modification, measures incorporated into the Project as design features would be implemented to minimize soil and vegetation disturbance in the Project area and restore areas following construction, which could minimize adverse effects on all Survey and Manage fungi in and near the Project area. The Forest Service will prepare and implement a monitoring plan that describes specific protocols to monitor affected sites and habitat adjacent to the sites over the long term.

For lands directly affected by the Project, the Forest Service would waive implementation of Management Recommendations for Survey and Manage species through amendment of the land management plans for the National Forests that encompass the Project area, except for the species for which there is not reasonable assurance of species persistence in the NSO range. In those cases, the agencies would require avoidance of sites where the species is found or would decline to adopt the LMP amendment.

Table 4.6.4.3-3 lists the fungi species and the number of affected sites on each National Forest.

TABLE 4.6.4.3-3

Affected Fungi Sites by National Forest

	Number of Sites Affected a/		
Species	**Umpqua**	**Rogue River-Siskiyou**	**Fremont-Winema**
Albatrellus ellisii b/	2	2	6
Arcangeliella crassa	—	—	1
Boletus pulcherrimus	—	4	1 (2)
Choiromyces alveolatus	—	—	0 (1)
Clavariadelphus occidentalis	4	—	—
Clavariadelphus sachalinensis	5	2	—
Clavariadelphus truncatus	5	3	1
Collybia bakerensis	—	—	52
Collybia racemosa	1	—	—
Cortinarius magnivelatus	—	—	5
Cortinarius olympianus	1	3	—
Cortinarius verrucisporus	—	—	5
Cudonia monticola	1	—	—
Galerina atkinsoniana	1	—	—
Gastroboletus subalpinus	—	—	1 (1)
Gomphus clavatus	3	—	—
Gomphus kauffmanii	—	5 (1)	1
Gymnomyces abietis	—	1	—
Hygrophorus caeruleus	—	1	3 (2)
Mycena overholtsii	—	—	2
Polyozellus multiplex	—	1	2
Ramaria araiospora	51	—	—
Ramaria coulterae	—	61	2
Ramaria rubrievanescens	2	—	—
Ramaria rubripermanens	4	—	2 (1)
Rhizopogon truncatus	5	31	—
Sarcodon fuscoindicus c/	—	—	—
Sedecula pulvinata	—	11	—

TABLE 4.6.4.3-3 (continued)

Affected Fungi Sites by National Forest

Species	Number of Sites Affected a/		
	Umpqua	Rogue River-Siskiyou	Fremont-Winema
Sparassis crispa	1	—	—
Spathularia flavida	31	4	—
Tremiscus helvelloides	—	1	—

a/ First number presents sites directly affected (i.e., in Project area), number in parentheses presents sites indirectly affected (i.e., sites wholly in analysis area).
b/ Site count for the species is not additive because one site occurs on two National Forests.
c/ Site(s) must be avoided through a re-route of the Project alignment, or Management Recommendations would not be waived.

Lichens

Lichens are distinct symbiotic organisms that consist of a fungus and an algae or cyanobacterium, which make them members of two or three biological kingdoms. They play a major ecological role, particularly in old-growth forests, by cycling nutrients and producing biomass. Lichens tend to be dispersal limited and grow slower than vascular plants. The 2001 Survey and Manage ROD including the 2001-2003 ASR modifications to the species list includes 45 lichen species. Of these, two are considered in this evaluation because they have been documented on NFS lands in or near the Project area. Appendix F.5 presents additional details on each species, while the key information used to evaluate Project-related effects is summarized in this section.

Both lichens considered in this analysis are epiphytic lichens, which grow directly on trees or shrubs. *Chaenotheca subroscida* commonly occurs on pine trees in upland habitats and *Leptogium teretiusculum* tends to be associated with riparian habitat.

Although surveys have been conducted across the Project area and in other parts of the NSO range, the difficulty in detecting some lichens because of their size has limited the ability to fully describe the range and distribution of some species within the NSO range. The lichen species considered in this analysis are listed in table 4.6.4.3-4 with the currently known number of sites in the NSO range, and the distributions of the species are briefly discussed after the table.

TABLE 4.6.4.3-4

Regional Site Count of Lichen Species Potentially Affected by the Project

Species	Total Sites in NSO Range a/	Sites on NFS Lands in NSO Range b/	Sites in NFS Reserves in NSO Range c/
Chaenotheca subroscida	396	110	73 (66%)
Leptogium teretiusculum	267	16	9 (56%)

a/ Total site count reflects the number of sites generated by the 8/2/17 FME extract.
b/ Site count reflects only those sites on NFS lands using land ownership data for the NSO range (dated October 2011).
c/ Site count reflects only those sites on NFS lands and in reserve land allocations based on 1994 ROD reserve land allocations for the NSO range (data dated December 2002 and September 2009) and National Hydrography Dataset, v. 2.1.0 to represent "Riparian Reserves" across the NSO range. These counts underestimate the number of sites in reserves, but regionally mapped reserve data are not available. The percentage represents the estimated proportion of sites in reserves to total sites on NFS lands.

Habitat for these species has been classified as coniferous, mixed hardwood-coniferous, and/or hardwood forests, including the LSOG component of these forests. Forests that may provide suitable habitat have been mapped using available data for the NSO range that were also used for the NWFP Effectiveness Monitoring 15-year report to map LSOG forests (Moeur et al. 2011). The extent of potential habitat for each species varies based on its distribution across the NSO range and habitat preferences. Additional details on habitat for these species are presented in appendix F.5.

The Project could affect site persistence of two Survey and Manage lichens at one or more sites on NFS lands in or near the Project area. Vegetation removal and grading activities in the construction corridor and in TEWAs would disturb vegetation and soil within sites and could result in the removal of populations or individuals of lichens. Construction of the Project would create an open corridor, which would be dominated by early seral vegetation for approximately 30 years. This is a long-term effect that could modify microclimate conditions around populations or individuals adjacent to the corridor during the early seral vegetation phase. The removal of coniferous, mixed hardwood-coniferous, and hardwood forests, including the LSOG component of these forests, and disturbance to soil, understory substrate (e.g., rocks, downed logs), and roots of trees could negatively affect the lichens in adjacent areas by removing their habitat, disturbing soil or substrate around trees or roots of trees, and affecting associations with the trees or other substrate, potentially affecting site persistence even if the entire site is not disturbed. In addition, modification of shading, moisture, and habitat conditions as a result of the corridor and TEWAs could make habitat within the sites no longer suitable for the species. Material storage within UCSAs would disturb understory habitat in some sites, which could also modify microhabitats near extant populations or individuals, potentially making the habitat no longer suitable for some of the species. Road improvements and establishment could remove habitat and extant populations or individuals of the lichens. The specific effects on sites in and near the Project area vary by species and depend on where the sites are in proximity to the corridor and other activities. Table 4.6.4.3-5 presents a summary of the number of sites of each species that would be affected by the Project; additional details for each species are included in appendix F.5.

TABLE 4.6.4.3-5

Lichen Sites Potentially Affected by the Project

Species	Total Affected NFS Sites a/	Affected Sites in NFS Reserves	Remaining Sites on NFS Lands in NSO Range	Remaining Sites on all Lands in NSO Range
Chaenotheca subroscida	6	4	104	382
Leptogium teretiusculum	1	1	15	261

a/ Affected sites are those that would be directly or indirectly affected by Project activities based on the analyses presented in appendix F.5. Using the spatial analysis process described in appendix F.5, these sites may be clipped by the Project area or fall outside the Project area, but within the analysis area.

The two lichen species analyzed appear to be more common than previously documented or are relatively common across the NSO range based on new information available from surveys for the Project and/or other sources since these species were last assessed in 2003. The Project would affect site persistence at one or more sites, but the remaining sites in the NSO range would provide a reasonable assurance of species persistence.

Measures incorporated into the Project as design features would be implemented to reduce soil and vegetation disturbance in the Project area and restore areas following construction, which could reduce adverse effects on all Survey and Manage lichens in and near the Project area. The Forest Service will prepare and implement a monitoring plan that describes specific protocols to monitor affected sites and habitat adjacent to the sites.

For lands directly affected by the Project, the Forest Service would waive implementation of Management Recommendations for Survey and Manage species through amendment of the land management plans for the National Forests that encompass the Project area. Table 4.6.4.3-6 lists the lichen species and the number of affected sites on each National Forest.

TABLE 4.6.4.3-6

Affected Lichen Sites by National Forest

Species	Number of Sites Affected a/		
	Umpqua	Rogue River-Siskiyou	Fremont-Winema
Chaenotheca subroscida	—	5	1
Leptogium teretiusculum	—	1	—

a/ All sites are directly affected (i.e., are located in the Project area).

Vascular Plants

Vascular plants are the most dominant organism in LSOG forests and serve an essential role by providing a food source and cover or shelter for animals and influencing microclimate conditions for other species, such as fungi and lichens. Vascular plants include seed-bearing plants, such as flowering plants and conifer trees, and spore-bearing forms, such as ferns, horsetails, and clubmosses. The Survey and Manage 2001 ROD including 2001-2003 ASR modifications includes 12 plant species. Of the 12 species, clustered lady's slipper (*Cyripedium fasciculatum*) is evaluated for this Project because it has been documented on NFS lands in or near the Project area. Appendix F.5 presents additional details on the species, while the key information used to evaluate Project-related effects is summarized in this section.

Surveys for vascular plants have been conducted in much of the NSO range, and the results of these surveys have contributed information to characterize the known extent of the plants in the NSO range. Additional surveys for Survey and Manage species were conducted for the Project as recently as the fall of 2018. Table 4.6.4.3-7 includes the currently known number of *C. fasciculatum* sites in the NSO range. The range of *C. fasciculatum* in the NSO range is relatively well known, and more survey effort would be expected to locate additional sites of the species within its currently known range.

TABLE 4.6.4.3-7

Regional Site Count of Plant Species Potentially Affected by the Project

Species	Total Sites in NSO Range a/	Sites on NFS Lands in NSO Range b/	Sites in NFS Reserves in NSO Range c/
Cypripedium fasciculatum	1,392	1540	198 (37%)

a/ Total site count reflects the number of sites generated by the 8/2/17 FME extract.
b/ Site count reflects only those sites on NFS lands using land ownership data for the NSO range (dated October 2011).
c/ Site count reflects only those sites on NFS lands and in reserve land allocations based on 1994 ROD reserve land allocations for the NSO range (data dated December 2002 and September 2009) and National Hydrography Dataset, v. 2.1.0 to represent "Riparian Reserves" across the NSO range. These counts underestimate the number of sites in reserves, but regionally mapped reserve data are not available. The percentage represents the estimated proportion of sites in reserves to total sites on NFS lands.

C. fasciculatum is well distributed across most of its known range in the NSO range. Sites are distributed in two general groups in the Klamath Mountains and Cascade Range in Oregon and California and the eastern Cascade Range in Washington. The species appears to be well distributed in the Klamath Mountains in California and Oregon.

General habitat for this species consists of coniferous and mixed hardwood-coniferous forests, including the LSOG component of these forests, across each species' currently known range. Forests that may provide suitable habitat have been mapped using available data for the NSO range that were also used for the NWFP Effectiveness Monitoring 15-year report to map LSOG forests (Moeur et al. 2011). The extent of potential habitat for each species varies based on its distribution across the NSO range and habitat preferences, and additional details on habitat are presented in appendix F.5.

The Project could affect site persistence of *C. fasciculatum* at one site on NFS land in the Project area. The site occurs on the Umpqua National Forest. Vegetation removal and grading activities in the construction corridor and in TEWAs would disturb vegetation and soil within sites and could result in the removal of populations or individuals of plants. Construction of the Project would create an open corridor, which would be dominated by early seral vegetation for approximately 30 years. This is a long-term effect that could modify microclimate conditions around populations or individuals adjacent to the corridor during the early seral vegetation phase. The removal of coniferous and mixed hardwood-coniferous forests, including the LSOG component of these forests, and disturbance to soil could negatively affect the plants in adjacent areas by removing their habitat, potentially affecting site persistence even if the entire site is not disturbed. In addition, modification of shading, moisture, and habitat conditions as a result of the corridor and TEWAs could make habitat within the sites no longer suitable for the species. Material storage within UCSAs would disturb understory habitat in some sites, which could also modify microhabitats near extant populations or individuals, potentially making the habitat no longer suitable for some of the species. Road improvements and establishment could remove habitat and extant populations or individuals of the plants. The specific effects on sites in and near the Project area vary by species and depend on where the sites are in proximity to the corridor and other activities. Table 4.6.4.3-8 presents a summary of the sties that would remain after the single site is affected by Project activities; additional details for each species are included in appendix F.5.

TABLE 4.6.4.3-8

Vascular Plant Sites Potentially Affected by Project

Species	Total Affected NFS Sites a/	Affected Sites in Reserves	Remaining Sites on NFS Lands in NSO Range	Remaining Sites on all Lands in NSO Range
Cypripedium fasciculatum	1	1	1,539	1,390

a/ Affected sites are those that would be directly or indirectly affected by Project activities based on the analyses presented in appendix F.5. Using the spatial analysis process described in appendix F.5, these sites may be clipped by the Project area or fall outside the Project area, but within the analysis area.

Cypripedium fasciculatum appears to be more common than previously documented based on new information available from surveys for the Project and/or other sources since these species were last assessed in 2003. Many sites have been documented in southwest Oregon since the 2001 ROD was published. Should the Project be constructed, it is unlikely that the loss of one site from Project effects would affect the status of *C. fasciculatum* in the NSO range. The Project would affect site persistence at one site on NFS lands, but the remaining sites in the NSO range would provide a reasonable assurance of species persistence.

Measures incorporated into the Project as design features would be implemented to reduce soil and vegetation disturbance in the Project area and restore areas following construction, which could reduce adverse effects on Survey and Manage plants in and near the Project area. The Forest

Service will prepare and implement a monitoring plan that describes specific protocols to monitor affected sites and habitat adjacent to the sites.

For lands directly affected by the Project, the Forest Service would waive implementation of Management Recommendations for Survey and Manage species through amendments to the land management plans for National Forests that encompass the Project area.

Mollusks

Approximately 350 species of mollusks, including land snails, aquatic snails, slugs, and clams, are found in the Pacific Northwest (Forest Service and BLM 2000). Slugs and snails are found in colonies, which may consist of hundreds to many thousands of individuals. Most mollusks are found in moist forests and riparian areas near streams, springs, and seeps. The 2001 ROD including 2001-2003 ASR modifications includes 38 species of mollusks. Of these species, two are considered in this evaluation of the Project because they have been documented on NFS lands in or near the Project area. Appendix F.5 presents additional details on each species, while the key information used to evaluate Project-related effects is summarized in this section.

The mollusk species considered in this analysis include evening fieldslug (*Deroceras hesperium*) and Chace sideband (*Monadenia chaceana*). *Deroceras hesperium* is a land slug that requires high moisture environments and is found along the forest floor. A recent study on the molecular characteristics of *D. hesperium* revealed that the mollusk is likely a variant of the more common *D. laeve* (Roth et al. 2013), and *D. hesperium* may no longer belong on the Survey and Manage list, pending an annual species review. Since the species is on the 2003 list, it is evaluated like other Survey and Manage species on the list in this assessment. *Monadenia chaceana* is a land snail that is found in talus or under rocks in moist forests. Both mollusks may be associated with Riparian Reserves.

Surveys for mollusks have been conducted in parts of the NSO range, and the results of these surveys have contributed information to characterize the known extent of the mollusks in the NSO range. Surveys for the Project resulted in several observations of both species. The mollusk species considered in this analysis are listed in table 4.6.4.3-9 with the currently known number of sites in the NSO range. The ranges of these species in the NSO range are relatively well known, and more survey effort would be expected to locate additional sites of the species within their currently known ranges.

The distribution of the species and their ranges within the NSO range vary. *Deroceras hesperium* has a distribution pattern with limited potential for connectivity between isolated sites or site clusters. Sites are found in four general areas in Oregon, including a relatively large cluster of sites located in the southern Cascade Range, and other clustered sites located in the northern Cascade Range and southern Coast Range. Scattered sites are in the northern Cascade Range, and several isolated sites are in other areas. *Monadenia chaceana* has multiple sites or clusters of sites that are nested within a web of potential interconnections. Sites are primarily found in a large group of several clusters in the eastern Klamath Mountains and southern Cascade Range in Oregon and extreme northern California.

TABLE 4.6.4.3-9

Regional Site Count of Mollusk Species Potentially Affected by the Project

Species	Total Sites in NSO Range a/	Sites on NFS Lands in NSO Range b/	Sites in NFS Reserves in NSO Range c/
Deroceras hesperium	54	27	13 (48%)
Monadenia chaceana	258	246	34 (14%)

a/ Total site count reflects the number of sites generated by the 8/2/17 FME extract.
b/ Site count reflects only those sites on NFS lands using land ownership data for the NSO range (dated October 2011).
c/ Site count reflects only those sites on NFS lands and in reserve land allocations based on 1994 ROD reserve land allocations for the NSO range (data dated December 2002 and September 2009) and National Hydrography Dataset, v. 2.1.0 to represent "Riparian Reserves" across the NSO range. These counts underestimate the number of sites in reserves, but regionally mapped reserve data are not available. The percentage represents the estimated proportion of sites in reserves to total sites on NFS lands.

General habitat for these species consists of a subcomponent (e.g., moist riparian areas, shaded rocky areas) of coniferous, mixed hardwood-coniferous, and hardwood forests, including the LSOG component of these forests, across each species' currently known range. Forests that may provide suitable habitat have been mapped using available data for the NSO range that were also used for the NWFP Effectiveness Monitoring 15-year report to map LSOG forests (Moeur et al. 2011). The extent of potential habitat for the species varies based on its distribution across the NSO range and habitat preferences, and additional details on habitat are presented in appendix F.5.

The Project could affect site persistence of two Survey and Manage mollusk species at one or more sites in or near the Project area. Vegetation removal and grading activities in the construction corridor and in TEWAs would disturb vegetation and soils within sites and could result in injury or mortality to individuals of mollusks. Construction of the Project would create an open corridor, which would be dominated by early seral vegetation for approximately 30 years. This is a long-term effect that could modify microclimate conditions around populations or individuals adjacent to the corridor during the early seral vegetation phase. The removal of forests and understory components could negatively affect the mollusks in adjacent areas by removing their habitat, potentially affecting site persistence even if the entire site is not disturbed. In addition, modification of shading, moisture, and habitat conditions as a result of the corridor could make habitat within sites no longer suitable for the species. Material storage within UCSAs could disturb understory habitat in sites, which could remove rocks, logs, or woody debris, potentially making the habitat unsuitable for the species or injuring individuals.

The specific effects on sites in and near the Project area vary by species and depend on where the sites are in proximity to the corridor and other activities. Table 4.6.4.3-10 presents a summary of the number of sites of each species that would be affected by the Project; additional details for each species are included in appendix F.5.

TABLE 4.6.4.3-10

Mollusk Sites Potentially Affected by the Project

Species	Total Affected NFS Sites a/	Affected Sites in NFS Reserves	Remaining Sites on NFS Lands in NSO Range	Remaining Sites on all Lands in NSO Range
Deroceras hesperium	1	1	26	53
Monadenia chaceana	7	7	251	398

a/ Affected sites are those that would be directly or indirectly affected by Project activities based on the analyses presented in appendix F.5. Direct effects are those that would take place within the Project area, such as from ground disturbance, vegetation removal, or removal of individuals. Indirect effects are those that would take place outside of the Project area, such as from edge effects or increased open canopy. Using the spatial analysis process described in appendix F.5, these sites may be clipped by or fall outside the Project area, but within the analysis area.

Deroceras hesperium is not necessarily more common than previously documented despite new information available from pre-disturbance surveys for the Project and/or other sources since this species was listed in the 2001 ROD. The Project would affect site persistence at one site, but the remaining sites in the NSO range would provide a reasonable assurance of species persistence. Although this species has a somewhat limited distribution in the NSO range, the affected site is part of a large cluster of sites in the southern Cascade Range in Oregon. The distribution and connectivity of the species would likely remain the same despite the loss of one site.

Monadenia chaceana appears to be more common than previously documented based on new information available from surveys for the Project and/or other sources since this species was listed in the 2001 ROD. The Project would affect site persistence at nine sites, but the remaining sites in the NSO range would provide a reasonable assurance of species persistence.

Measures incorporated into the Project as design features would be implemented to reduce soil and vegetation disturbance in the Project area and restore areas following construction, which could reduce adverse effects on Survey and Manage mollusks in and near the Project area. The Forest Service will prepare and implement a monitoring plan that describes specific protocols to monitor affected sites and habitat adjacent to the sites.

For lands directly affected by the Project, the Forest Service would waive implementation of Management Recommendations for Survey and Manage species through amendments to the land management plans for the National Forests that encompass the Project area. Table 4.6.4.3-11 lists the mollusk species and the number of affected sites in each National Forest.

TABLE 4.6.4.3-11

Affected Mollusk Sites by National Forest

	Number of Sites Affected a/		
Species	**Umpqua**	**Rogue River=Siskiyou**	**Fremont-Winema**
Deroceras hesperium	—	—	1
Monadenia chaceana	—	2 (4)	1

a/ First number presents sites directly affected (i.e., in Project area), number in parentheses presents sites indirectly affected (i.e., sites wholly in analysis area). a

Vertebrates

A diverse array of vertebrate species, including mammals, birds, amphibians, and reptiles, inhabit the forests of the Pacific Northwest and provide essential functions in the ecosystem, such as dispersing fungal spores and lichens and serving as a food source for predators. The 2001 ROD including the 2001-2003 ASR modifications to the species list includes seven vertebrate species. Two vertebrate species are considered in this evaluation of the Project because they have been documented on NFS lands in or near the Project area. Appendix F.5 presents additional details on each species, and the key information used to evaluate Project-related effects is summarized in this section.

The vertebrate species considered in this analysis include red tree vole (*Arborimus longicaudus*) and great gray owl (*Strix nebulosa*). *Arborimus longicaudus* is a small arboreal rodent that lives in tree canopies of coniferous and mixed hardwood-coniferous forests and seldom goes to the forest floor (Forest Service and BLM 2001b). It is a primary prey item of the NSO, as well as other predators found in coniferous forests. *Strix nebulosa* is a forest owl that uses existing stick nests constructed by other raptors and large corvids, and nests between March 1 and July 31

(Williams 2012). It forages in natural forest openings, typically larger than 10 acres, and nests in coniferous and mixed hardwood-coniferous forests.

Surveys for the vole and owl have been conducted across much of the NSO range, and the results of these surveys have contributed information to characterize the known extent of the species in the NSO range. Surveys for the Project resulted in multiple observations of both species in the surveyed areas. The vertebrate species considered in this analysis are listed in table 4.6.4.3-12 with the currently known number of sites in the NSO range, and the distributions of the species are briefly discussed after the table. The ranges of these species in the NSO range are relatively well known, and more survey effort would be expected to locate additional sites of the species within their currently known ranges.

TABLE 4.6.4.3-12

Regional Site Count of Vertebrate Species Potentially Affected by the Project

Species	Total Sites in NSO Range a/	Sites on NFS Lands in NSO Range b/	Sites in NFS Reserves in NSO Range c/
Arborimus longicaudus	4,946	1,524	624 (34%)
Strix nebulosa	177	55	16 (12%)

a/ Total site count reflects the number of sites generated by the 8/2/17 FME extract.
b/ Site count reflects only those sites on NFS lands using land ownership data for the NSO range (dated October 2011).
c/ Site count reflects only those sites on NFS lands and in reserve land allocations based on 1994 ROD reserve land allocations for the NSO range (data dated December 2002 and September 2009) and National Hydrography Dataset, v. 2.1.0 to represent “Riparian Reserves” across the NSO range. These counts underestimate the number of sites in reserves, but regionally mapped reserve data are not available. The percentage represents the estimated proportion of sites in reserves to total sites on NFS lands

The distribution of the species and their ranges within the NSO range vary. Both species have multiple sites or clusters of sites that are nested within a web of potential interconnections. Most *A. longicaudus* sites are found in the Klamath Mountains in Oregon, where sites are abundant and close together in large clusters or groups. Sites are more scattered in the western Cascade Range in Oregon, although they are still relatively abundant. *Arborimus longicaudus* appears to be well distributed within its range in Oregon. Most *S. nebulosa* sites are found in a large group in the southern Cascade Range and eastern Klamath Mountains, where the species appears to be well distributed.

General habitat for *A. longicaudus* consists of LSOG coniferous and mixed hardwood-coniferous forests across the species’ currently known range in Oregon. General habitat for *S. nebulosa* consists of coniferous and mixed hardwood-coniferous forests, including the LSOG component of these forests, with a subcomponent of natural forest openings (e.g., meadows) that are used for foraging. Forests that may provide suitable habitat have been mapped using available data for the NSO range that were also used for the NWFP Effectiveness Monitoring 15-year report to map LSOG forests (Moeur et al. 2011). The extent of potential habitat for the species varies based on its distribution across the NSO range and habitat preferences, and additional details on habitat are presented in appendix F.5.

The Project could affect site persistence of two Survey and Manage vertebrates at more than one site or habitat area in or near the Project area. Vegetation removal in the construction corridor and TEWAs and along roads could result in the removal of trees that support *A. longicaudus* nests or cause injury or mortality to individuals. Construction of the Project would create an open corridor, which would be dominated by early seral vegetation for approximately 30 years. This is a long-term effect that could modify microclimate conditions around populations or individuals adjacent to the corridor during the early seral vegetation phase. The removal of forests and potential nest trees could negatively affect *A. longicaudus* in adjacent areas by removing its habitat and opening the tree canopy, potentially affecting site persistence at the habitat areas even if the entire habitat area is not disturbed. In particular, modification of shading and habitat conditions as a result of the corridor, TEWAs, and roads could make entire habitat areas no longer suitable for the species because of the preference for closed canopy habitats. Activities within the corridor and TEWAs would result in extensive noise disturbance during vegetation clearing, grading, and pipeline installation and could result in *S. nebulosa* nest abandonment and loss of young during the nesting season. No active *S. nebulosa* nest sites were documented in the Project area; therefore, direct effects on the owl (e.g., removal of active nests, injury to owls) are not anticipated. Vegetation removal across the Project area would also result in a long-term loss of habitat that may be suitable for the species. Conversely, if constructed, the construction corridor would also create an early seral plant community suitable for foraging by great grey owls.

The specific effects on sites in and near the Project area vary by species and depend on where the sites are in proximity to the corridor and other activities. Table 4.6.4.3-13 presents a summary of the number of sites (habitat areas for *A. longicaudus*) of each species that would be affected by the Project; additional details for each species are included in appendix F.5.

Both species appear to be more common than previously documented based on new information available from surveys for the Project and/or other sources since these species were last assessed in 2003. The Project would affect site persistence at multiple sites or habitat areas of each species, but the remaining sites in the NSO range would provide a reasonable assurance of species persistence.

TABLE 4.6.4.3-13

Vertebrate Sites Potentially Affected by the Project

Species	Total Affected NFS Sites a/	Affected Sites in NFS Reserves	Remaining Sites on NFS Lands in NSO Range	Remaining Sites on All Lands in NSO Range
Arborimus longicaudus	525 (55) b/	10 (24)	1,469 c/	4,843
Strix nebulosa	1	1	54	171

a/ Affected sites are those that would be directly or indirectly affected by Project activities based on the analyses presented in appendix F.5. Direct effects are those that would take place within the Project area, such as from ground disturbance, vegetation removal, or removal of individuals. Indirect effects are those that would take place outside of the Project area, such as from edge effects or increased open canopy. Using the spatial analysis process described in appendix F.5, these sites may be clipped by or fall outside the Project area, but within the analysis area.
b/ *A. longicaudus* sites are habitat areas (55 sites were converted to 25 habitat areas in the analysis area), as mapped in accordance with the management recommendations for the species (Forest Service and BLM 2001b).
c/ The total of remaining sites is based on site data, not habitat areas. Habitat areas were not produced for the entire regional area, just the analysis area.

Measures incorporated into the Project as design features would be implemented to minimize vegetation disturbance in the Project area and restore areas following construction, which could minimize adverse effects on Survey and Manage vertebrates in and near the Project area. The Forest Service will prepare and implement a monitoring plan that describes specific protocols to monitor affected sites and habitat adjacent to the sites.

For lands directly affected by the Project, the Forest Service would waive implementation of Management Recommendations for Survey and Manage species through amendments to the land management plans for the National Forests that encompass the Project area. Table 4.6.4.3-14 lists the vertebrate species and the number of affected sites or habitat areas in each National Forest.

TABLE 4.6.4.3-14

Affected Vertebrate Sites by National Forest

	Number of Sites Affected a/		
Species	**Umpqua**	**Rogue River-Siskiyou**	**Fremont-Winema**
Arborimus longicaudus b/	125	—	—
Strix nebulosa	—	0 (1)	—

a/ First number presents sites directly affected (i.e., in Project area), number in parentheses presents sites indirectly affected (i.e., sites wholly in analysis area).
b/ *A. longicaudus* sites are habitat areas, as mapped in accordance with the management recommendations for the species (Forest Service and BLM 2001b).

In conclusion, the Project could affect site persistence of 37 Survey and Manage species at one or more sites or habitat areas in or near the Project area. The remaining sites would provide a reasonable assurance of these species persistence. Therefore, the analysis summarized in this section, supported by the information presented in appendix F.5, indicate that construction and operation of the Project would provide a reasonable assurance of persistence of Forest Service Survey and Manage species that would be affected.

4.7 LAND USE

4.7.1 Jordan Cove LNG Terminal

4.7.1.1 Land Ownership and Existing Land Use

Land Ownership

The 197-acre LNG terminal site (figure 4.7-1a) is owned by Fort Chicago Holdings II US LLC (Fort Chicago Holdings), an affiliate of Jordan Cove. As depicted in figure 4.7-1a, the terminal site consists of two parcels that are connected by an access corridor. The two parcels are commonly referred to as the Ingram Yard and South Dunes properties. The associated terminal sites depicted in figures 4.7-1b and 4.7-1c are privately owned lands that Jordan Cove has secured or would secure agreements to use. Ownership of lands required for the Project is summarized in table 4.7.1.1-1. With the exception of BLM land crossed by the IWWP (within an existing utility corridor), no federal lands would be used for the Jordan Cove Project.

In addition, the COE possesses a 40-acre perpetual easement that coincides with the boundaries of the Ingram Yard loading terminal site. Located between Roseburg Forest Products and Jordan Cove lands, this easement reserves: "*[t]he perpetual right, power, privilege and easement in, upon, over, and across the lands described herein for sand stabilization*." As part of the COE Section 408 process, the COE would need to issue a "consent to easement structures," which would address the COE's rights and how Jordan Cove would provide alternatives should the rights need to be exercised.

TABLE 4.7.1.1-1

Land Ownership of the Jordan Cove Project Area Facilities

Project Facility/Activity	Ownership
Construction and Operation	
LNG Terminal Ingram Yard South Dunes Site (including Workforce Housing Facility) Access and Utility Corridor Slip	Fort Chicago Holdings II US LLC and COE (easement)
Access Channel	State of Oregon (easement)
Material Offloading Facility (MOF)	State of Oregon (easement)
Industrial Wastewater Pipeline	Designated Trans-Pacific Parkway roadway, railway, & utility corridor (permission from Coos County and an easement from BLM)
Meteorological Station Site	Oregon International Port of Coos Bay
Pile Dike Rock Apron	Fort Chicago Holdings II US LLC, State of Oregon (easement) Oregon International Port of Coos Bay, State of Oregon (easement)
Temporary Construction	
LNG Terminal Ingram Yard Laydown Area South Dunes Laydown, Housing, and Parking Area Hydraulic Dredge Pipeline	Fort Chicago Holdings II US LLC
Trans-Pacific Parkway/U.S. 101 Widening	ODOT and Coos County Rights-of-Way
Roseburg Laydown Site	Roseburg Forest Products Company and COE (easement)
Port Laydown Site	Oregon International Port of Coos Bay
APCO Laydown Site	APCO Coos Properties, LLC
Boxcar Hill Site	Oregon Dunes Sand Park, LLC and Fort Chicago Holdings II US LLC
Myrtlewood Offsite Park & Ride	Private
Temporary Dredge Lines	State of Oregon (easement)
Kentuck Line	State of Oregon (easement)
Environmental Mitigation Areas	
Kentuck Project Site	Fort Chicago Holdings II US LLC and private
Eelgrass Mitigation Site	State of Oregon
Lagoon Site	Oregon International Port of Coos Bay
North Bank Site	Fort Chicago Holdings II US LLC and private
Panhandle Site	Oregon International Port of Coos Bay

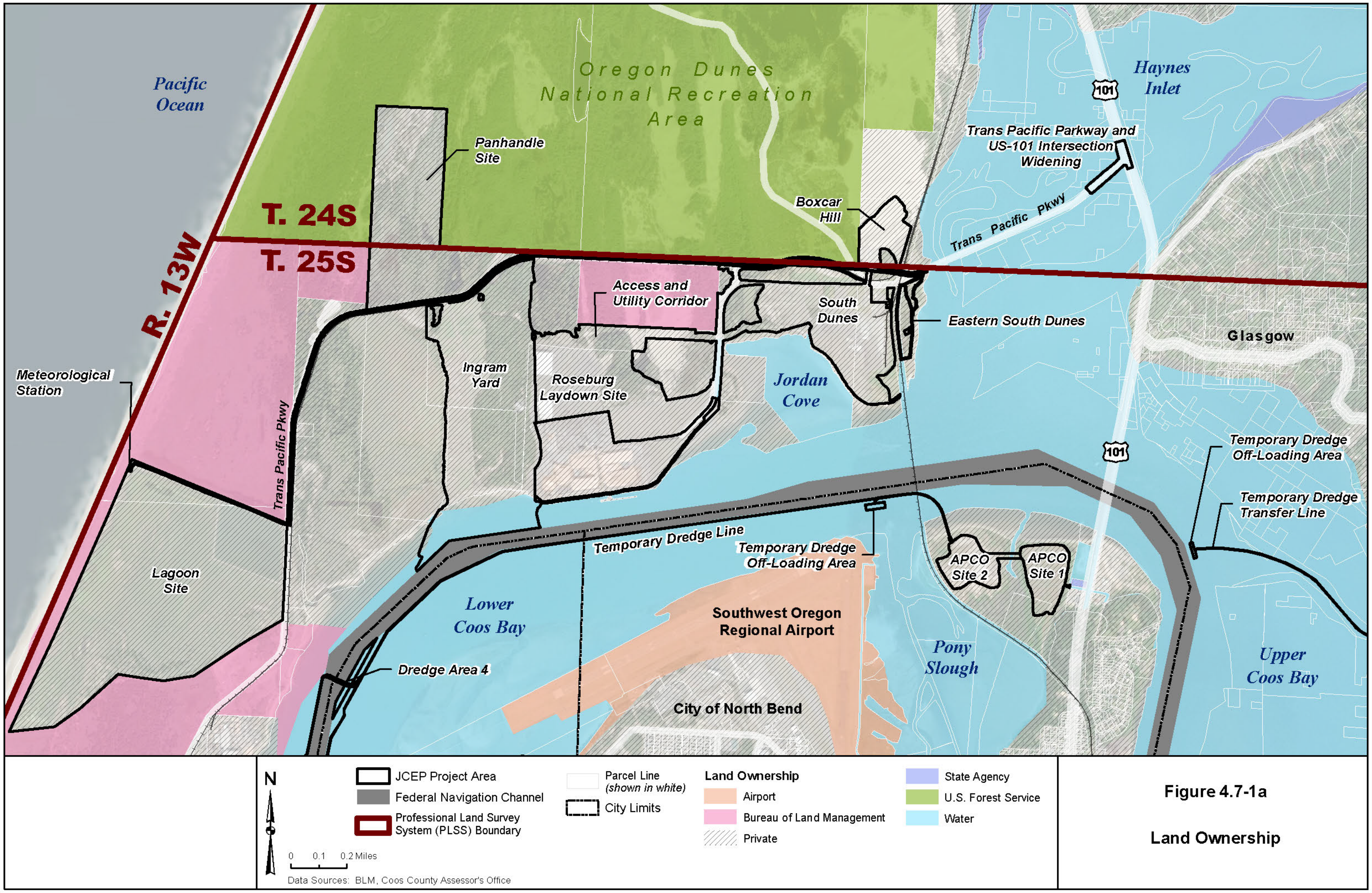


Figure 4.7-1a

Land Ownership

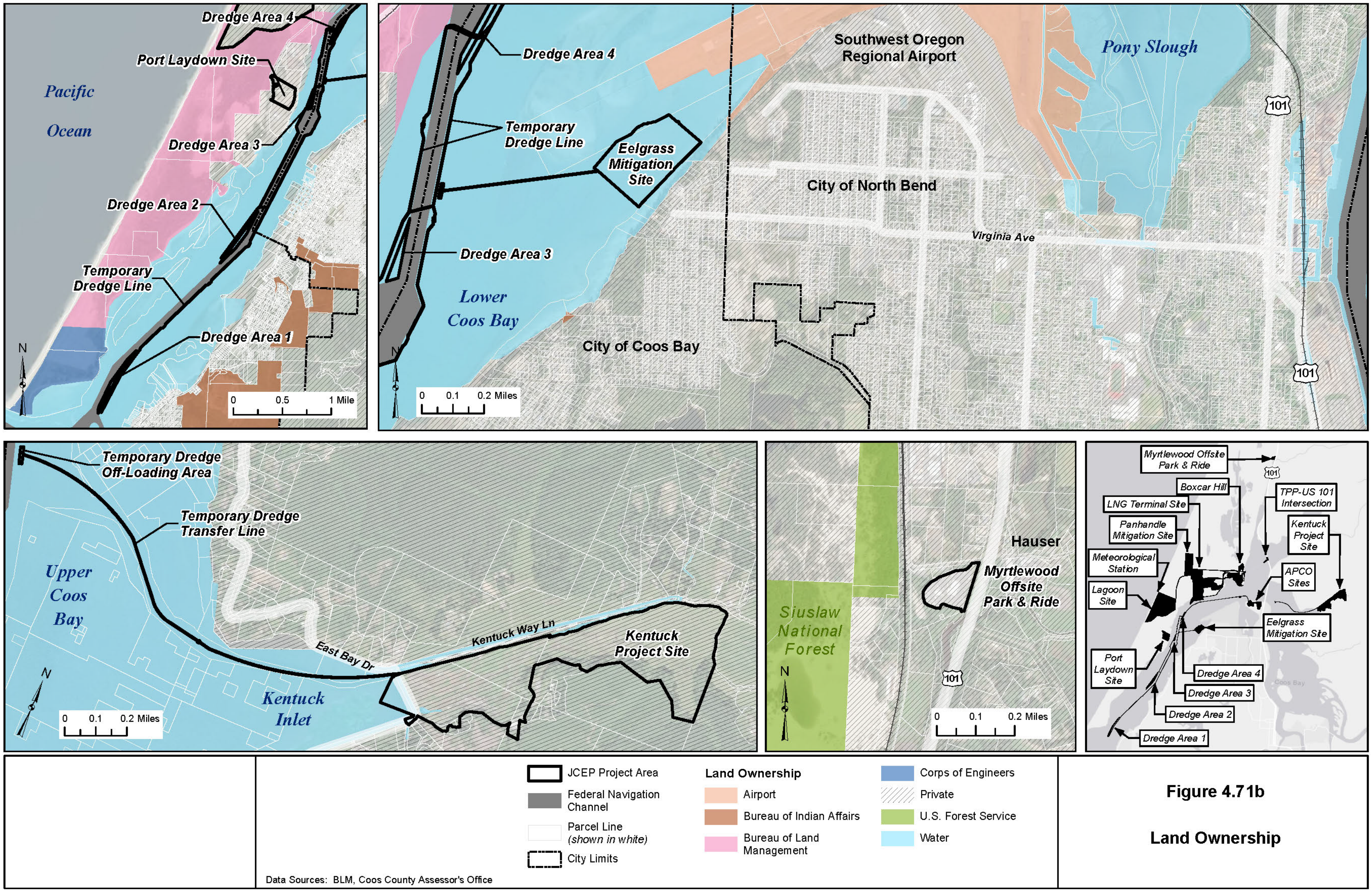
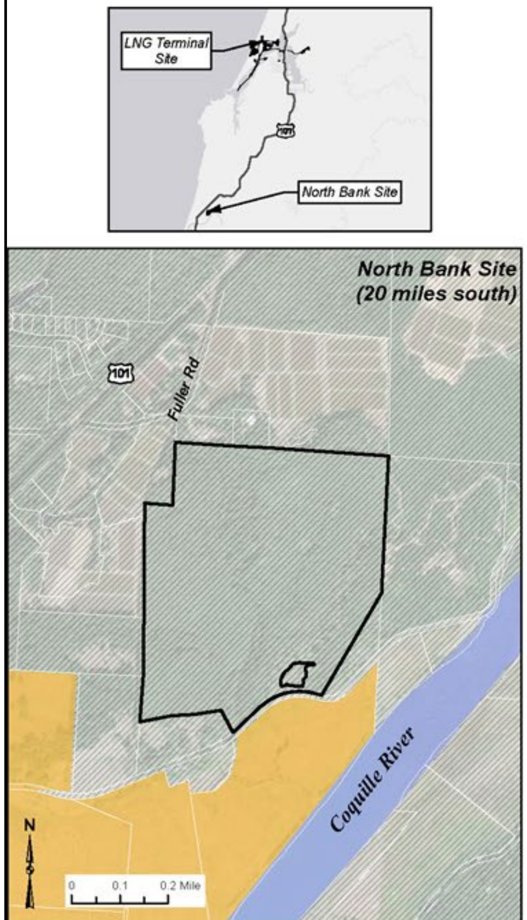


Figure 4.71b

Land Ownership



JCEP Project Area
Parcel Line
(shown in white)

Land Ownership
Private
State Agency
U.S. Fish and Wildlife Service

Data Sources: BLM, Coos County Assessor's Office

Figure 4.7-1c

Land Ownership

Existing Land Use

The LNG terminal site consists of a combination of brownfield decommissioned industrial facilities, an existing landfill requiring closure, and open land covered by grasslands, sand, and shrubs, as well as an area of forested dunes (see figures 4.7-2a, 4.7-2b, and 4.7-2c). Portions of the proposed site and the Port Laydown site were previously used for disposal of dredged material.

Land uses affected by construction and operation of the LNG terminal and associated facilities are identified in table 4.7.1.1-2. Lands affected during construction include areas that would be permanently and temporarily altered. Operation-related estimates include only those lands that would be permanently affected. Lands affected by operation would be permanently converted from their former uses to the project facilities identified in table 4.7.1.1-2.

Forest/Woodland

A total of 122 acres of forest/woodland would be affected during construction, with 72 acres permanently affected (table 4.7.1.1-2). More than 85 percent of the forest/woodland affected during construction is located on the terminal site, with an additional 13 percent on the adjacent Roseburg laydown site. Almost all of the permanently affected forest/woodland is located on the terminal site. Permanently affected areas would remain cleared of vegetation for the life of the Project. Areas temporarily disturbed during construction would be restored and, to the extent possible, native plant species would be used for stabilization and to prevent erosion of the disturbed areas. Impacts on vegetation are discussed in more detail in section 4.4.

Industrial/Commercial

Industrial/commercial lands that would be used during construction include parts of the terminal site and also the Roseburg Laydown Site, Port Laydown Site, and off-site park and ride sites. With the exception of the industrial/commercial lands that would become part of the terminal site, almost all impacts on existing industrial/commercial lands would be temporary.

Open Land

Open land disturbed during construction would primarily be located on the terminal site (68 percent) and the APCO Sites 1 and 2 (14 percent) (table 4.7.1.1-2). Open land on the terminal site includes land covered by grasslands, sand, and shrubs. Approximately 79 of the 190 acres of open land that would be disturbed on the terminal site during construction would be permanently affected and converted to site uses. The remaining acres would be restored following construction. Although no permanent facilities are proposed for the APCO Sites 1 and 2, the sites would be used for dredge disposal, with disposal expected to raise site elevations above existing grade by between 37 and 49 feet over a 30 year planning horizon.

In addition to the acres of open land identified in table 4.7.1.1-2, approximately 104 acres of the Kentuck project site would be converted to a wide-ranging habitat of mudflats, salt marsh, willowed scrub/shrubs, and fish structures to provide mitigation for both the Jordan Cove and Pacific Connector projects. Formerly a golf course, much of the Kentuck project site is shown as open land with wetlands on figure 4.7-2b. Delineated wetlands on the site are shown on figure 4.3-1e.

Open Water

An estimated 78 acres of open water would be affected during construction, with 30 acres permanently affected (table 4.7.1.1-2). Open water would primarily be disturbed during construction as part of activities related to the access channel (36 percent) and the four dredge areas (34 percent). Impacts related to construction of the access channel that would connect the terminal to the Federal Navigation Channel would be permanent.

Other

The IWWP would be located entirely within an existing roadway, railway, and utility corridor. Installation would disturb approximately 0.2 acre of the existing corridor, with no permanent effects anticipated.

Residential

No residential lands would be affected by construction and operation of the Project (table 4.7.1.1-2). However, mitigation activities associated with the Kentuck Project site would affect an estimated 7.4 acres currently designated for residential use. Impacts on existing residences are discussed in section 4.7.1.3.

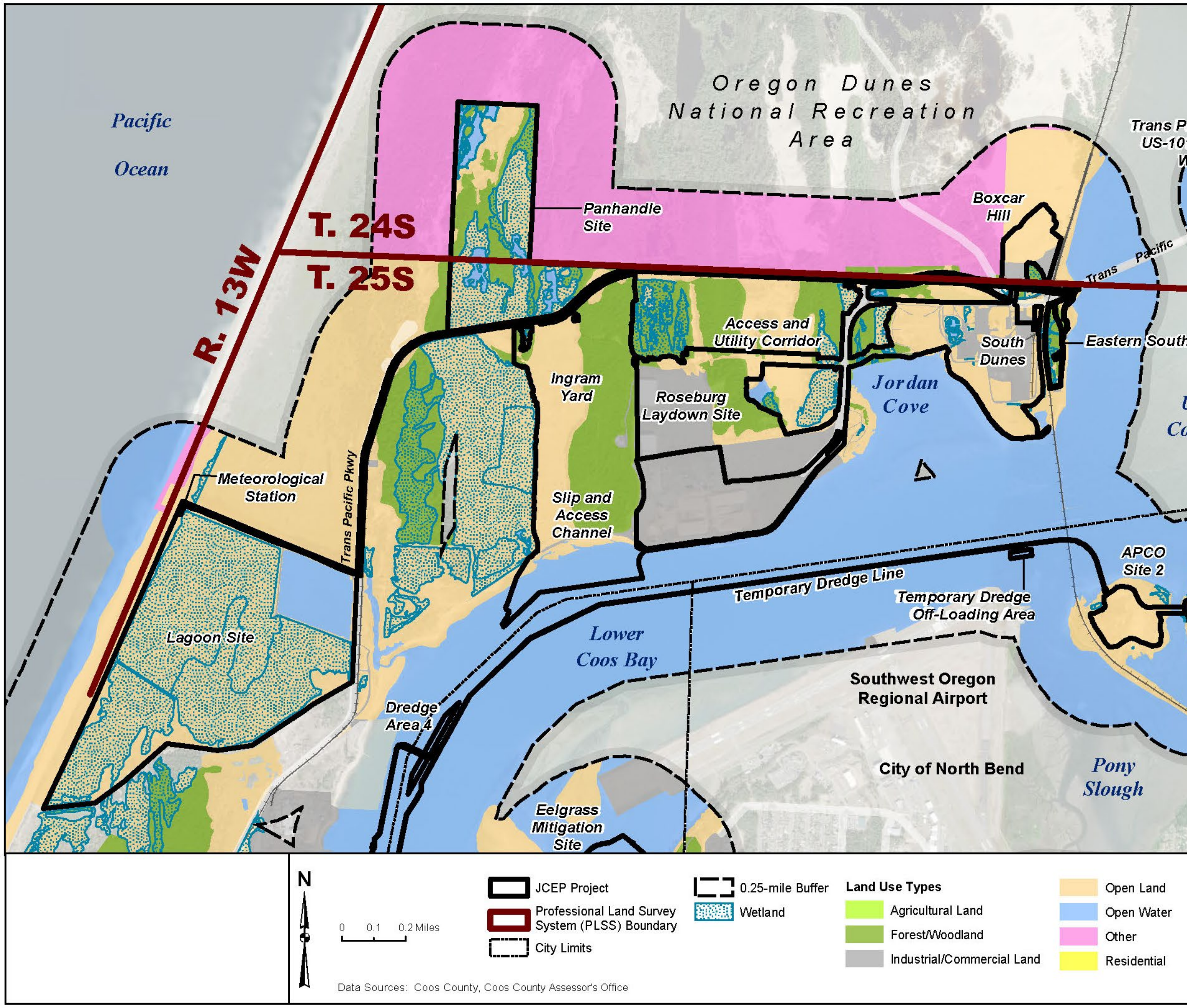


Figure 4.7-2a

Land Use Types
within 0.25 Mile

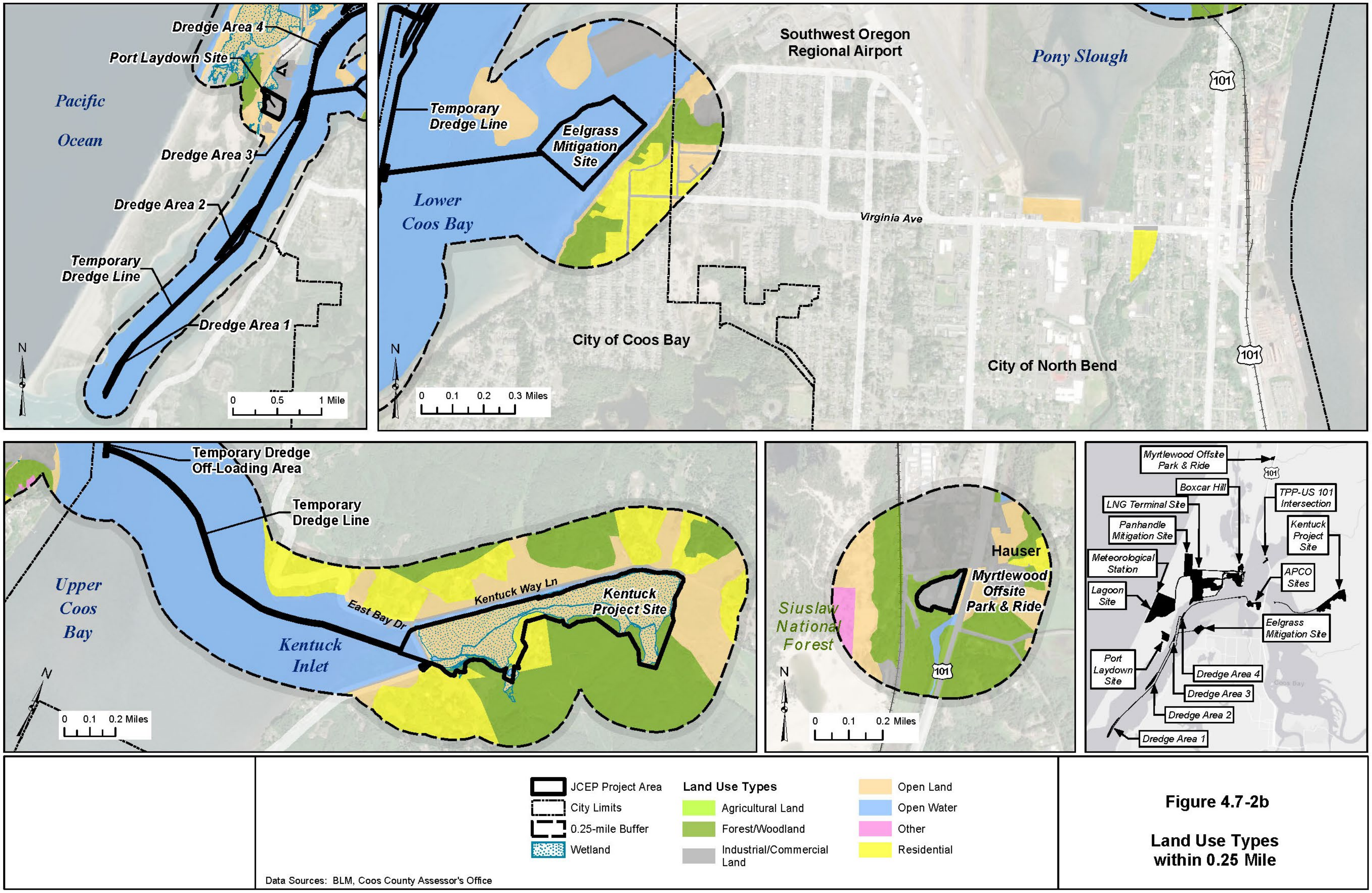
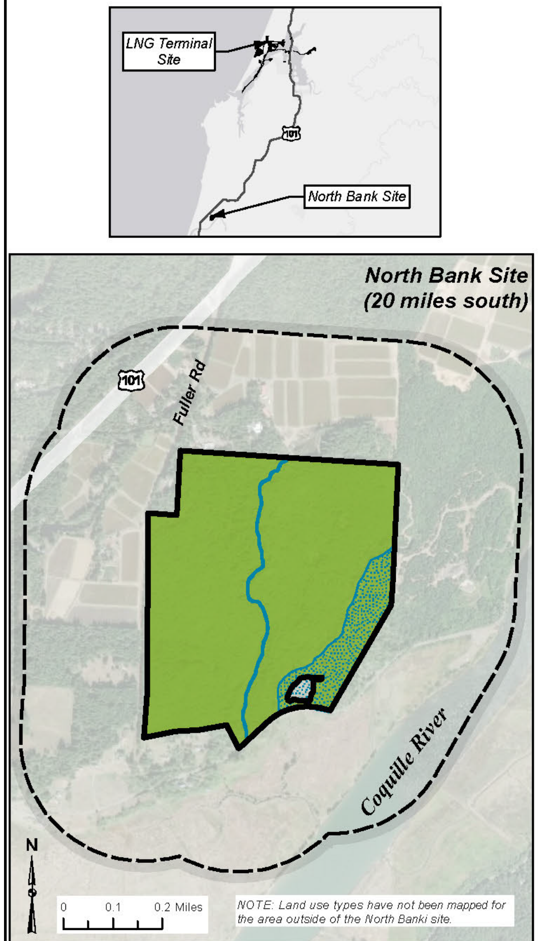


Figure 4.7-2b

Land Use Types within 0.25 Mile



JCEP Project Area
City Limits
0.25-mile Buffer
Wetland

Land Use Types

Agricultural Land
Forest/Woodland
Industrial/Commercial Land
Open Land
Open Water
Other
Residential

Data Sources: BLM, Coos County Assessor's Office

Figure 4.7-2c

Land Use Types within 0.25 Mile

TABLE 4.7.1.1-2

Land Uses Affected by Construction and Operation of Aboveground Jordan Cove Project Area Facilities (in acres) a/

Project Facility/Activity	Forest/Woodland Const	Forest/Woodland Oper	Industrial/Commercial Const	Industrial/Commercial Oper	Open Land Const	Open Land Oper	Open Water Const	Open Water Oper	Other Const	Other Oper	Residential Const	Residential Oper
LNG Terminal Site												
Ingram Yard	72.9	45.9	4.3	2.8	40.8	34.0	0.0	0.0	0.0	0.0	0.0	0.0
South Dunes	5.7	2.5	35.0	13.8	51.4	7.9	1.0	0.2	0.0	0.0	0.0	0.0
Access and Utility Corridor, Fire Department	9.7	7.0	4.1	4.0	12.8	9.9	0.0	0.0	0.0	0.0	0.0	0.0
Hydraulic Dredge Pipeline	0.1	0.0	6.2	0.0	0.7	0.0	1.0	0.0	0.0	0.0	0.0	0.0
Slip	16.4	16.4	1.1	1.1	22.7	20.4	0.0	0.0	0.0	0.0	0.0	0.0
Pile Dike Rock Apron	0.0	0.0	<0.1	<0.1	0.6	0.8	2.5	1.5	0.0	0.0	0.0	0.0
Industrial Wastewater Pipeline	0.3	0.0	6.7	0.0	8.1	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Access Channel	0.0	0.0	0.3	0.2	4.1	4.1	27.8	27.1	0.0	0.0	0.0	0.0
Material Offloading Facility (MOF)	0.4	0.4	1.0	0.9	1.3	1.2	0.6	0.5	0.0	0.0	0.0	0.0
Trans-Pacific Parkway/US-101 Widening	0.0	0.0	3.7	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0
Meteorological Station and Access Road	0.0	0.0	0.7	<0.1	0.9	<0.1	0.0	0.0	0.0	0.0	0.0	0.0
Roseburg Laydown Site	16.2	0.0	60.6	0.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Port Laydown Site	0.0	0.0	33.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
APCO Sites 1 and 2	0.0	0.0	12.2	0.0	27.2	0.4	0.4	0.2	0.0	0.0	0.0	0.0
Off-Loading Area and Temporary Dredge Transfer Line for APCO Site 2	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Boxcar Hill Site	0.3	0.0	5.9	0.0	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Additional Park & Ride Site (approximate)	0.0	0.0	7.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Myrtlewood Offsite Park & Ride	0.0	0.0	6.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temporary Dredge Off-Loading Area and Temporary Dredge Transfer Line for Kentuck Project Site	0.0	0.0	<0.1	0.0	<0.1	0.0	1.9	0.0	0.0	0.0	0.0	0.0
Temporary Dredge Off-Loading Area and Temporary Dredge Line for Eelgrass Mitigation Site	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Dredge Areas	0.0	0.0	0.0	0.0	0.0	0.0	26.5	0.0	0.0	0.0	0.0	0.0
Temporary Dredge Line	0.0	0.0	0.0	0.0	<0.1	0.0	13.1	0.0	0.0	0.0	0.0	0.0
Total	**122.0**	**72.2**	**189.1**	**22.8**	**190.1**	**78.7**	**78.0**	**29.5**	**0.2**	**0.0**	**0.0**	**0.0**

a/ Note that columns may not sum correctly due to rounding.
b/ Const = construction
c/ Oper = operation
d/ Acres for the proposed Environmental Mitigation Areas are not included in this table (see table 4.7.1.1-1).

4.7.1.2 Coastal Zone Management

The Jordan Cove LNG terminal would be located within the Oregon coastal zone. The coastal zone is formally defined as extending from the Washington border on the north to the California border on the south; seaward to the extent of state jurisdiction as recognized by federal law (i.e., the territorial sea, extending 3 nautical miles offshore); and inland to the crest of the Oregon Coast Range. The Oregon Coastal Management Program of the ODLCD coordinates management of the State's coastal zone and reviews project-specific compliance and consistency with the CZMA. Procedures for ODLCD coastal zone reviews are specified in federal (15 CFR 930) and state regulations (OAR 660-035). Jordan Cove and Pacific Connector are currently in the process of filing their Coastal Zone Management Act (CZMA) application with the State. The Commission cannot authorize the start of construction until a consistency determination has been provided by the Oregon Coastal Management Program. Therefore, **we recommend that**:

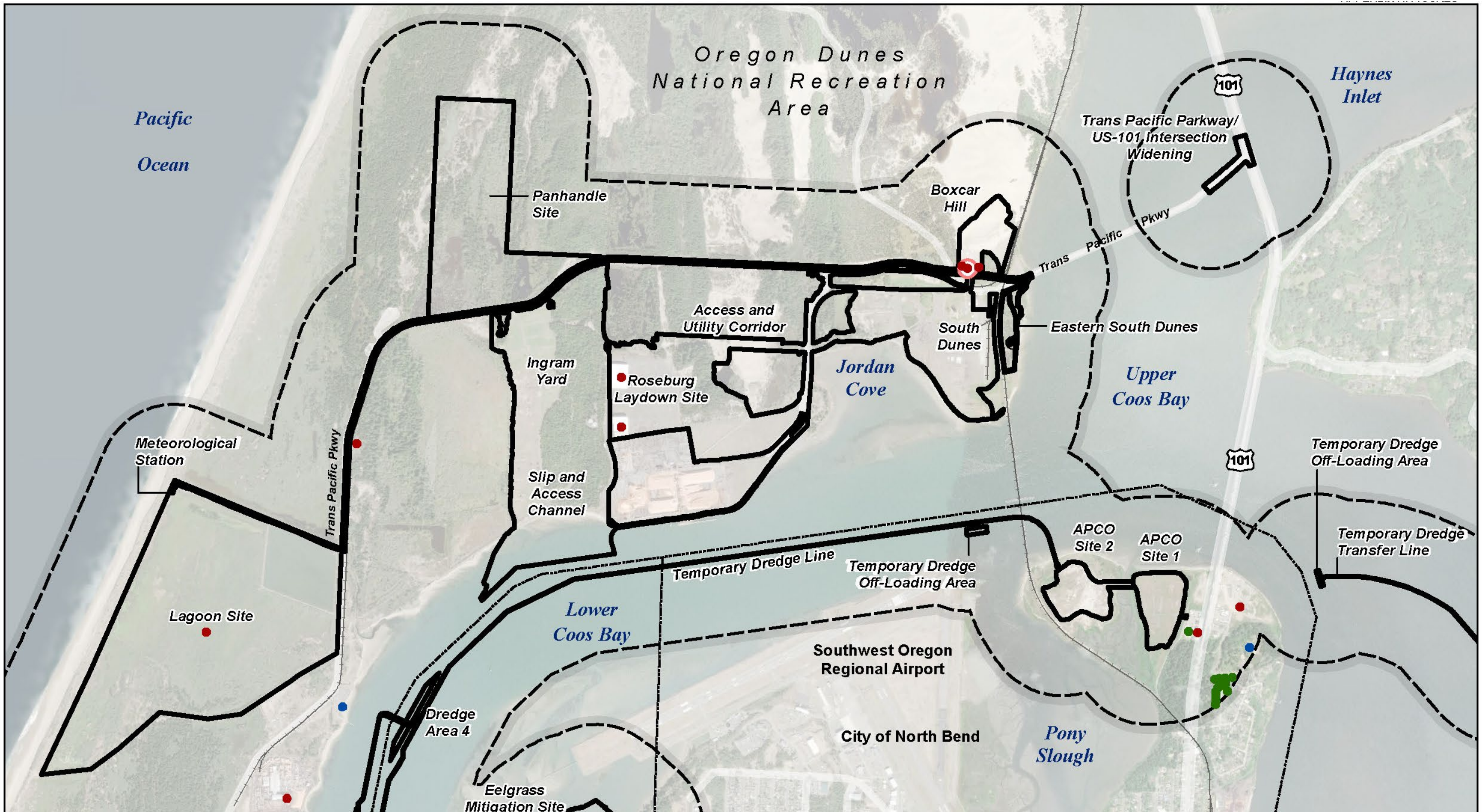
- **Jordan Cove and Pacific Connector <u>should not begin construction</u> of the Project <u>until</u> they file with the Secretary a copy of the determination of consistency with the Coastal Zone Management Plan issued by the State of Oregon.**

4.7.1.3 Existing Residences, Commercial Buildings, and Planned Developments

The nearest residential structure to the LNG terminal site is about 1.1 miles to the southeast. There are no residences within 50 feet of any of the Jordan Cove LNG Project area facilities or the navigation route, with the exception of one residence located approximately 20 feet from the Kentuck project site and another located approximately 30 feet from the North Bank site. Neither of these residences are expected to be affected by Project-related construction or operations. All structures within 0.25 mile of the Project facilities are shown in figure 4.7-3a, figure 4.7-3b, and figure 4.7-3c. The following structures are located within 50 feet of the Jordan Cove facilities:

- one CBNBWB facility approximately 50 feet from the Trans-Pacific Parkway work area;
- two structures within the construction work area for the Roseburg Laydown site;
- one structure (disused building) on the South Dunes site that would be removed;
- three structures within the construction work area for the Boxcar Hill site: one business and one shed that would not be affected, and one shed that would be removed; and
- one structure, the Myrtlewood Factory and Gift Shop, within the parking area that would be used as the Myrtlewood Off-site Park & Ride.

None of the above listed structures would be affected with the following exceptions: 1) the shed would be removed from the construction work area for the Boxcar Hill site; 2) two structures within the construction work area for the Roseburg Laydown site would be removed; and 3) a disused structure would be removed on the Eastern South Dunes area. No mitigation is proposed for these impacts.



JCEP Project Area
City Limits
0.25-mile Buffer

Type of Structure
- Business
- Church
- Residential
- Misc./Government
- Abandoned

Permanently Impacted Structure

Data Sources: Coos County, Coos County Assessor's Office

Figure 4.7-3a

Structures within 0.25 Mile of the Jordan Cove Site

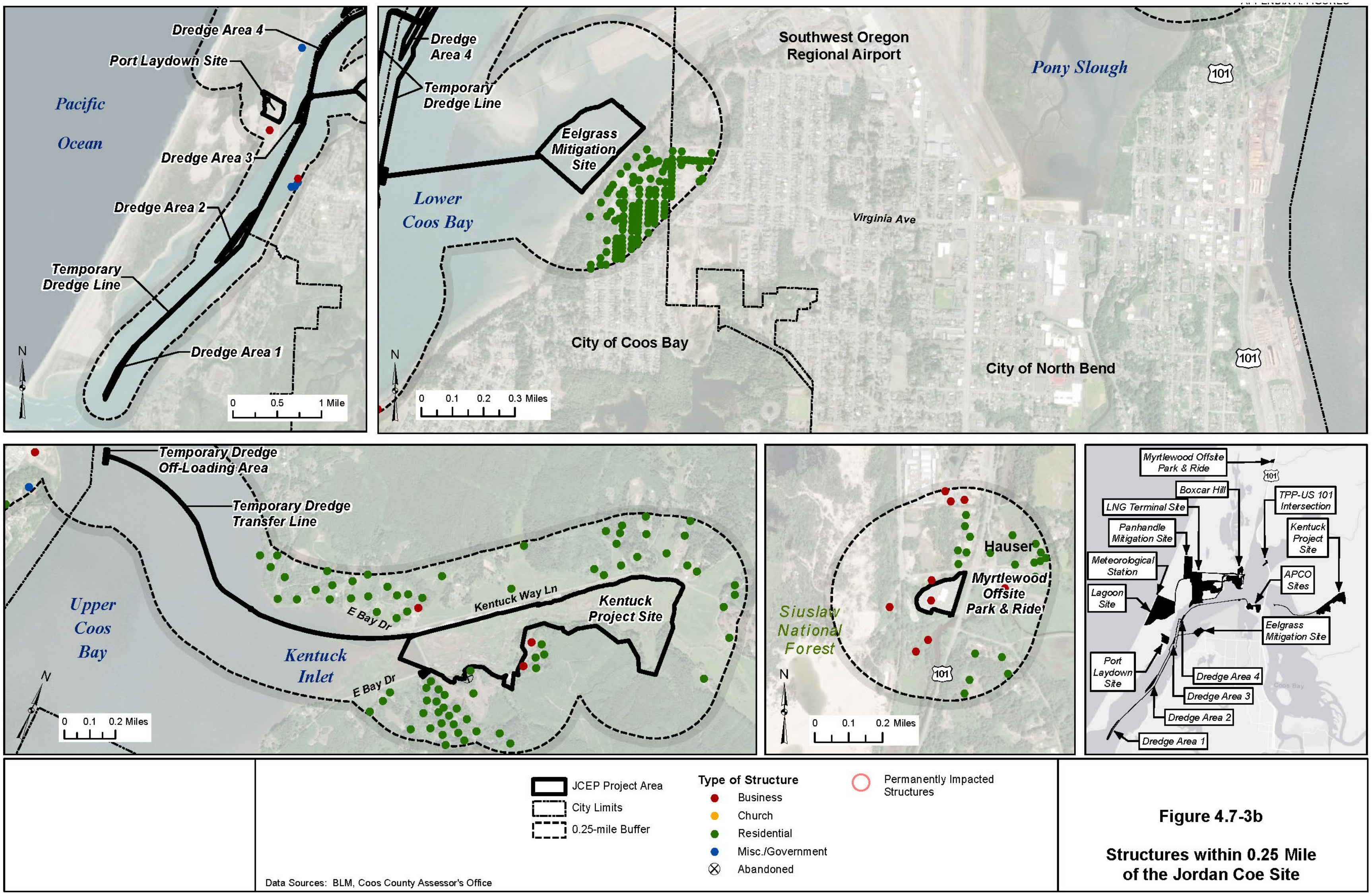
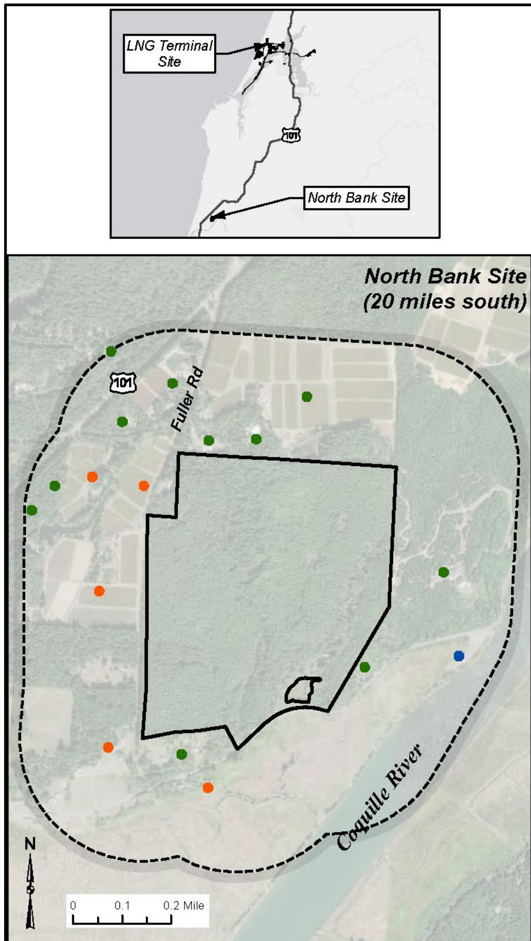


Figure 4.7-3b

Structures within 0.25 Mile of the Jordan Coe Site



JCEP Project Area

Type of Structure

Farm Building

Residential

Misc./Government

Data Sources: BLM, Coos County Assessor's Office

Figure 4.7-3c

Structures within 0.25 Mile of the Jordan Cove Site

There are currently no planned residential or commercial developments identified within 0.25 mile of the Jordan Cove Project site. However, the Coos County Airport District is planning to extend one of the runways at the Southwest Oregon Regional Airport, which is approximately 0.55 mile south of the LNG terminal site. According to the October 2013 Southwest Oregon Regional Airport Master Plan Update (Coos County Airport District 2013), the Airport Layout Plan and the implementation plan included a proposed 400-foot-long extension of Runway 4-22; however, current plans do not identify this large of an extension. Current proposals are limited to cordoning off the northeast corner of the existing runway to gain land acreage for safety purposes to meet FAA regulations (Krug 2018).

The City of North Bend has indicated that it expects to consider adoption of a proposed North Point Area Master Plan for the North Point District in the near future. The North Point District consists of approximately 80 acres made up of the northernmost parcels of North Point. The District is located southeast across Coos Bay from the LNG terminal site, and east across Pont Slough from the airport. The City of North Bend is also proposing to redevelop Simpson Park along Highway 101 to include a new Visitor Information Center and Parks Department facilities. The closest Project components to these areas would be the APCO sites. Advanced Health has demolished the McAuley Hospital in downtown Coos Bay, approximately 3 miles south of the proposed LNG terminal site, and is redeveloping the site to provide housing for Oregon Health and Science University medical students (Johnson 2018). Construction and operation of the LNG terminal is not expected to affect these plans or future uses.

4.7.1.4 Timber

The dune areas at the LNG terminal site currently contain non-merchantable timber. Before mobilizing earth-moving equipment, the trees would be felled and selectively processed for commercial timber. Scrub and stumps from across the site would be processed into mulch for use during construction operations.

4.7.2 Pacific Connector Pipeline and Associated Facilities

4.7.2.1 Land Ownership

The pipeline would cross public and private lands. Approximately 64 percent of the land crossed is privately owned, 34 percent is federal land and 2 percent is state lands (table 4.7.2.1-1). No tribal-owned lands or county lands would be crossed. Federally managed lands are discussed below.

TABLE 4.7.2.1-1

Land Crossed by the Pacific Connector Pipeline by Ownership

	Federal Land		**State Land**		**Private Land**		
County	**Miles**	**Percent of Overall Total**	**Miles**	**Percent of Overall Total**	**Miles**	**Percent of Overall Total**	**Total**
Coos	17.1	7.4	3.4	1.5	26.4	11.5	**46.9**
Douglas	21.3	9.3	0.0	0.0	43.7	19.0	**65.0**
Jackson	30.2	13.1	0.2	0.1	25.6	11.2	**56.0**
Klamath	9.4	4.1	0.0	0.0	52.1	22.7	**61.5**
Total	**78.0**	**33.9**	**3.6**	**1.6**	**147.8**	**64.4**	**229.4**

4.7.2.2 Existing Land Use

Land Use

Pipeline

The pipeline would cross a variety of land uses including forest land (62 percent), rangeland (14 percent), agricultural lands (13 percent), and developed land (8 percent) (table 4.7.2.2-1).

TABLE 4.7.2.2-1

Land Uses Crossed by the Pacific Connector Pipeline Right-of-Way

U.S. Geological Survey Land Use Classification a/			Project Total (miles) b/	Percent of Total b/
Developed Land	Residential		0.3	0.1
	Industrial		0.8	0.3
	Transportation/Communication		16.1	7.0
	Other Developed Land		1.1	0.5
	Commercial and Services		<0.1	<0.1
		Subtotal	***18.3***	***7.9***
Agricultural Land	Cropland and Pasture		30.7	13.4
	Orchards, Groves, Vineyards, Nurseries		0.1	<0.1
		Subtotal	***30.9***	***13.4***
Rangeland	Herbaceous Rangeland		8.9	3.9
	Shrub and Brush Rangeland		17.2	7.5
	Mixed Rangeland		7.0	3.1
		Subtotal	***33.1***	***14.4***
Forest Land	Deciduous Forest Land		4.4	1.9
	Evergreen Forest Land		46.1	20.1
	Clearcut Forest Land		7.5	3.3
	Regenerating Forest Land		51.6	22.5
	Mixed Forest Land		32.7	14.3
		Subtotal	***142.2***	***62.0***
Water	Streams		0.7	0.3
	Ditches and Canals		0.2	0.1
	Bays and Estuaries		2.4	1.0
		Subtotal	***3.3***	***1.4***
Wetlands	Forested Wetlands		0.1	<0.1
	Non-Forested Wetlands		1.5	0.7
		Subtotal	***1.6***	***0.7***
Other	Beaches		<0.1	<0.01
	Mines, Quarries, Gravel Pits		<0.1	0.01
		Subtotal	***<0.1***	***0.01***
		Project Total	**229.4**	**100**

a/ Land uses crossed by the Pipeline are categorized in accordance with a land use classification system developed by the U.S. Geological Survey (USGS), which is a standardized system of identifying land use and land cover (Anderson et al. 1976). Note: Developed Land as used here is named Urban or Built-Up Land in the USGS system and Other as used here is named Barren Land.

b/ Totals may not sum correctly due to rounding. Miles are rounded to the nearest tenth of a mile (values below 0.1 are shown as “<0.1”).

A summary of acres affected by the construction and operation of the Pacific Connector pipeline is presented in table 4.7.2.2-2.

Developed Land

Pipeline construction would affect an estimated 714 acres of developed lands, mainly consisting of existing industrial land (47 percent; 338 acres) and transportation/communication corridors (45 percent; 319 acres) (table 4.7.2.2-2). The majority of the construction-related disturbance on existing industrial land (319 acres) would be related to temporary pipe storage. An estimated 109 developed acres would be permanently disturbed, with almost all (98 percent) of this disturbance related to the permanent right-of-way. The majority (88 percent) of the right-of-way disturbance would be located in existing transportation/communication corridors. Other developed areas disturbed during construction would be allowed to return to their existing uses.

TABLE 4.7.2.2-2

Acres of Land Affected by Construction and Operation of the Pacific Connector Pipeline Project

Project Feature	Residential	Commercial	Industrial	Transportation/ Communication	Other Developed Land	Cropland/Pasturel and	Orchards, Groves, Vineyards, Nurseries	Herbaceous Rangeland	Shrub/Brush Rangeland	Mixed Rangeland	Deciduous Forest Land	Regenerating Evergreen Forest	Mixed Forest Land	Clearcut Forest Land	Regenerating Forest	Streams/Lakes	Ditches/Canals	Bays and Estuaries	Forested Wetlands	Nonforested Wetlands	Beaches	Mines, Quarries, Gravel Pits	Total
Construction Disturbance a/																							
Construction ROW	3.6	0.4	6.0	160.4	12.0	353.4	1.4	101.4	195.2	78.2	51.6	535.5	379.9	89.9	590.2	5.2	3.3	0.0	1.4	16.2	0.2	0.2	2,585.5
Aboveground Facilities (Klamath CS/Communication Tower)	0.0	0.0	0.0	<0.1	1.6	0.0	0.0	0.0	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			0.0	0.0	23.0
Temporary Extra Work Areas	3.1	0.1	12.8	65.9	16.7	172.8	0.4	40.2	70.7	55.1	16.4	107.8	97.6	30.3	201.7	3.0	0.9	0.1	0.5	4.8	2.9	22.2	925.8
Uncleared Storage Areas	<0.1	0.0	0.0	21.1	0.0	0.3	0.0	3.1	10.9	2.8	5.5	158.6	204.5	52.2	211.5	0.5	<0.1	0.0	0.0	0.1	0.0	0.0	671.2
Rock Source/Disposal	0.0	0.0	0.0	2.5	0.0	2.8	0.0	1.7	0.0	0.0	0.0	3.3	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	26.4	41.2
Contractor and Pipe Storage Yards	4.1	0.8	319.1	46.5	14.3	14.4	0.0	130.2	0.0	126.0	0.0	0.0	0.1	0.0	0.0	<0.1	0.0	4.4	0.0	1.3	0.0	0.0	661.3
Access Roads (TARs/PARs) b/	<0.1	0.0	0.0	22.9	0.0	1.7	0.0	0.9	0.2	1.1	0.1	0.3	<0.1	0.3	0.5	<0.1	<0.1	0.0	0.0	0.6	0.0	0.0	28.7
Total	**10.8**	**1.3**	**338.0**	**319.3**	**44.7**	**545.3**	**1.9**	**277.5**	**298.4**	**263.1**	**73.7**	**805.5**	**682.1**	**172.7**	**1008.4**	**8.7**	**4.1**	**4.5**	**1.9**	**23.0**	**3.0**	**48.8**	**4,936.7**
Operation Disturbance																							
Permanent Easement c/	2.0	0.2	4.7	93.4	6.3	189.4	0.7	53.9	104.2	42.1	26.6	279.0	199.0	46.8	313.3	3.1	1.5	2.9	0.8	8.7	0.1	0.1	1378.8
Aboveground Facilities d/	0.0	0.0	1.7	<0.1	0.0	0.3	0.0	0.5	21.7	0.5	0.0	<0.1	0.1	0.1	0.6	0.0	0.0	0.0			0.0	0.0	25.5
Permanent Access Roads	0.0	0.0	0.0	0.4	0.0	0.1	0.0	0.9	0.2	0.6	0.0	0.0	<0.1	0.0	0.5	<0.1	<0.1	0.0	0.0	<0.1	0.0	0.0	2.7
Total	**2.0**	**0.2**	**6.4**	**93.7**	**6.3**	**189.8**	**0.7**	**55.2**	**126.2**	**43.2**	**26.6**	**279.0**	**199.1**	**46.8**	**313.4**	**3.1**	**1.4**	**2.9**	**0.8**	**8.7**	**0.1**	**0.1**	**1,407.0**
30-Foot Maintenance Corridor (Operation)	1.1	0.1	2.8	56.9	3.8	111.8	0.4	32.3	62.5	24.9	15.9	167.4	118.8	27.6	186.8	1.7	0.8	<0.1	0.5	5.2	0.1	0.1	821.5

Note: Rows and columns may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown a "<1").
a/ Construction disturbance associated with the aboveground facilities is included in the pipeline construction ROW effects.
b/ Includes road improvements. Portions of some of the PARs are located within the construction ROW and, therefore, there is some duplication in the acreage calculations.
c/ The permanent easement is located within the disturbed acreage of the construction ROW. It is not an addition to the construction effects.
d/ Operation-related disturbance from aboveground facilities is summarized by facility in table 4.7.2.2-3.
CS = communication station; PAR = permanent access road; TAR = temporary access road

Agricultural Land

About 545 acres of cropland and pastureland would be temporarily affected by pipeline construction, with approximately 2 acres of orchards, groves, vineyards, and nurseries also expected to be affected (table 4.7.2.2-2). The majority of this disturbance would be associated with the construction right-of-way (65 percent) and TEWAs (32 percent). Grazing and other agricultural uses would not be allowed in the affected areas during construction. With the exception of the permanent right-of-way in orchards, agricultural lands disturbed during construction would be restored and returned to their original condition. Shallow-rooted crops and pasture grasses may be grown across the entire 50-foot-wide permanent easement. The planting of deep-rooted crops, such as orchards and vineyards, would not be permitted directly over the pipeline. Pacific Connector would negotiate with landowners and provide compensation for crop losses or orchards taken out of use as a result of pipeline construction. Landowners could select seed mixes or crops to be planted over the right-of-way in agricultural crop land or pastures.

To lessen effects on agricultural lands, Pacific Connector would segregate topsoil and repair any damaged irrigation systems or drain tiles. The segregation of topsoil is discussed in section 4.2. In addition, in agricultural areas the pipeline would have a minimum depth cover of 5 feet over the top of the pipe, where possible, to avoid operational effects. The largest proportion of agricultural lands that would be crossed by the pipeline are irrigated cropland in Klamath County.

Rangeland

Pipeline construction would affect an estimated 839 acres of rangeland (table 4.7.2.2-2). Temporary disturbance would result from the construction right-of-way (45 percent), TEWAs (20 percent), and pipe yards (31 percent). During construction, fences would be temporarily removed and affected lands would be unavailable for grazing. To reduce effects on rangelands (and pasture), Pacific Connector would erect temporary fences and gates to landowner specifications. Fences that are cut during construction would be braced and secured to prevent slack wires. If construction activities break or destroy a natural barrier used for livestock control, gaps would be temporarily fenced to prevent passage of livestock. After construction, fences, gates, and cattle guards (including any natural barriers broken) would be restored to their original state as soon as practical. Pacific Connector would contact the owners of fences prior to disturbing them and provide landowners with an opportunity to remove livestock from the construction right-of-way. Hayfields and pastures would not be cleared except in areas directly over the trench or where grading would be required to create a level working surface. Potential effects on grazing allotments on federal lands are discussed below in section 4.7.3.

Forest Land

Excluding areas along the pipeline route that have been clear cut recently and storage areas where trees would not be cleared, about 1,990 acres of upland forest would need to be cleared during pipeline construction activities. Less than one acre of forest would be permanently removed for access roads. During operation of the pipeline, a 30-foot-wide corridor centered on the pipeline would be kept in an herbaceous state, resulting in a permanent loss of about 804 acres of forest land. Outside of that 30-foot-wide corridor, forest would be restored within the remainder of the construction right-of-way. Pacific Connector would also follow the procedures for cutting forest along all lands crossed by its pipeline as outlined in the *Right-of-Way Clearing Plan for Federal*

Lands[164] (note that although the title of the plan specifies "federal lands," the plan contains measures that would be applied on all lands). However, even with restoration, this would be a long-term to permanent effect, as it takes many years for trees to mature.

Approximately 65 miles of commercial private forestlands would be affected by the pipeline. Forest operations are not expected to be significantly altered, nor would the costs of forestry operations be expected to increase due to the presence of the pipeline; however, the Coquille Tribe raised concerned regarding the ability of operators to cross the pipeline. Surrounding forestry operators would be able to cross the pipeline right-of-way with heavy hauling and logging equipment, provided they coordinate those crossings with Pacific Connector and safety precautions are implemented to protect the integrity of the pipeline. While the requirement to coordinate with the pipeline operator would be an inconvenience for some forest operators, it does not constitute a significant change in forestry operations because the operator would be able to continue to cross the pipeline area in order to access or haul timber. Additionally, timber operators generally develop and carefully consider future harvesting and access plans. The need to consult with the pipeline operator if those plans include future crossings of the pipeline right-of-way would not represent a significant imposition or significant change in normal planning activities. The coordination requirement would also not significantly increase the cost of conducting forestry operations. In some situations, however, the presence of a pipeline along a ridge would require a change in log landing locations, which would affect timber operations. See additional discussion of potential effect on timber operations, including impacts on State Forest lands, in section 4.7.2.5. ODF requirements are discussed in section 1.5.2.6 of this EIS.

Other

Construction would also affect an estimated 1.9 acres of forested wetlands and 23 acres of non-forested wetlands (table 4.7.2.2-2). A majority of the affected non-forested wetlands (70 percent) would be affected by the construction right-of-way, followed by TEWAs (21 percent). Other land uses that would be affected during construction include an estimated 3 acres of beaches and 49 acres of strip mines, quarries, and gravel pits (table 4.7.2.2-2). The affected beaches would primarily be used for TEWAs. The affected strip mines, quarries, and gravel pits would be used for TEWAs (45 percent) and rock source/disposal (54 percent). Approximately 0.1 acre of beach and 0.1 acre of strip mines, quarries, and gravel pits would be permanently affected and no longer be available for other uses.

Aboveground Facilities

Table 4.7.2.2-3 identifies the land uses that would be permanently affected by operation of the aboveground facilities.

[164] Included as Appendix U of Pacific Connector's POD filed on January 23, 2018.

TABLE 4.7.2.2-3

Acres Affected by Pacific Connector Proposed Aboveground Facilities

Facility a/	MP	Acres Disturbed During Construction b/	Land Use	Jurisdiction
Jordan Cove Meter Station, MLV #1, Pig Receiver, and Communication Tower c/, d/, e/	0.00	1.7	Industrial	Private
MLV #2 (Boone Creek Road)	22.2	0.1	Regenerating Evergreen Forest Land	Private
MLV #3 (Myrtle Point Sitkum Road)	32.5	0.1	Regenerating Evergreen Forest Land	Private
MLV #4 (Deep Creek Spur) e/	51.6	0.1	Mixed Rangeland	Private
MLV #5 (South of Olalla Creek)	59.6	0.1	Cropland Pasture	Private
MLV #6 and Launcher/Receiver (Clarks Branch) e/	71.5	0.5	Herbaceous Rangeland	Private
MLV #7 (Pack Saddle Road)	80.0	0.1	Mixed Forest Land	BLM
MLV #8 (Hwy 227)	94.7	0.1	Mixed Rangeland	Private
MLV #9 (BLM Road 33-2-12)	113.7	0.1	Regenerating Evergreen Forest Land	Private
AMLV #10 (Shady Cove) e/	122.2	0.1	Mixed Rangeland	Private
AMLV #11 and Launcher/Receiver (Butte Falls) 5	132.5	0.3	Mixed Rangeland	Private
MLV #12 (Heppsie Mtn Quarry Spur)	150.7	0.1	Shrub and Brush Rangeland	BLM
MLV #13 (Clover Creek Road)	169.5	0.1	Regenerating Evergreen Forest	Private
MLV #14 and Launcher/Receiver (Keno)	187.4	0.4	Regenerating Evergreen Forest Land, Shrub and Brush Rangeland	Private
AMLV #15 (Klamath River) e/	196.5	0.1	Cropland Pasture	Private
AMLV #16 (Hill Road) e/	211.6	0.1	Cropland Pasture	Private
Klamath Compressor Station, Klamath-Beaver and Klamath-Eagle Meter Stations, MLV #17, Pig Launcher and Communications Tower e/	228.8	21.4	Shrub and Brush Rangeland, Trans. Comm, Utilities Corridor	Private
Total		**25.4**		
Communication Sites				
Blue Ridge Communication Tower – Coos County f/	~ 20	0.2	Transportation, Communications, and Utilities/Commercial	BLM
Signal Tree Communication Tower – Coos County f/	~45	0.2		BLM
Sheep Hill Communication Tower – Douglas County f/	~70	0.2		Private
Harness Mountain Communication Tower – Douglas County g/	~75	0.0		Private
Starvout Communication Tower – Jackson County f/	~115	0.2		Private
Flounce Rock Communication Tower – Jackson County f/	~123	0.2		BLM
Robinson Butte Communication Tower – Jackson County f/	~159	0.2		Forest Service
Stukel Mountain Communication Tower – Klamath County f/	~209	0.2		BLM
	Total	**1.6**		
	Grand Total	**27.0**		

Note: Rows and columns may not sum correctly due to rounding. Miles are rounded to the nearest tenth of a mile.
a/ MLVs denoted as AMLV are automated valves and would include a 40-foot-tall communication tower.
b/ Temporary construction disturbance associated with the aboveground facilities is included within the Pipeline construction ROW, and is not double counted in total Pipeline disturbance estimates.
c/ The 17 mainline block valves (MLVs) would be located within areas disturbed by the construction right-of way or within associated aboveground facility footprints (*i.e.*, meter stations and the compressor station); however, the permanent operation acres provided would remain as permanent disturbance associated with these graded, graveled and fenced facilities.
d/ The Jordan Cove meter station would be located entirely within the proposed LNG terminal.
e/ Communication facilities are included in the disturbed areas associated with the meter station, mainline block valves and compressor station.
f/ Communication facilities would utilize existing towers and equipment buildings, where space is available for lease, with no associated disturbance. If construction of new facilities is required, Pacific Connector would obtain an approximate 100 x 100 foot (0.23 acre) area in the immediate area of the existing communication tower facilities.
g/ The Harness Mountain Communication Tower is an existing communication facility, with no new disturbance is required.

4.7.2.3 Coastal Zone Management

Coos County and a portion of Douglas County, up to the crest of the Coastal Range, are within Oregon's coastal zone. Therefore, Pacific Connector would need to obtain a finding from the ODLCD that the portion of its pipeline within the coastal zone (MPs 0 to 53) is consistent with the CZMA. This consistency determination would be made for both the pipeline portion as well as the LNG portion of the Project. Coastal zone management is discussed further in section 4.7.1.2.

4.7.2.4 Existing Residences, Commercial Buildings, and Planned Developments

Existing Residences

No commercial buildings or residences are located within 50 feet of the proposed pipeline or aboveground facility workspaces. The edge of the construction work area for the pipeline would be located within 50 feet of seven residences (see table 4.7.2.4-1). Two of these residences are abandoned and would be removed as part of the Project. For the residences within 50 feet of construction work areas, Pacific Connector developed site-specific drawings depicting the temporary and permanent rights-of-way and has noted special construction techniques and mitigation measures (see appendix J). We are seeking any additional comments from the affected landowners on these site-specific drawings.

TABLE 4.7.2.4-1

Residences within 50 Feet of the Construction Right-of-Way or Temporary Extra Work Areas

MP	Distance from Pipeline (feet)	Distance from Edge of Construction Work Area (feet)	Number of Residences
49.7	106	41	1
56.9 a/	0	0	1
57.5	57	17	1
65.6	112	47	1
65.9	92	15	1
199.7	161	33	1
228.8 a/	1,680	0	1

a/ Abandoned residences at MP 56.9 and 228.8 would be removed prior to construction.

Within 50 feet of residences, the edge of the construction work area would be fenced for a distance of 100 feet on either side to ensure that construction equipment and materials, including the spoil pile, remain within the construction work area. Fencing would be maintained, at a minimum, throughout the open trench phases of pipeline installation. Where possible, the width of the construction right-of-way would be reduced near residences, and TEWAs would be located as far away from residences as practical. Pacific Connector would also limit the period of time the trench remains open prior to backfilling in residential areas.

Pacific Connector would implement numerous measures to reduce effects on residential properties including:

- Landowners would be notified at least 45 days prior to construction, and Pacific Connector would implement a Landowner Complaint Resolution Procedure. If a landowner is not satisfied with Pacific Connector's response to a complaint, they would be directed to call or email FERC's Dispute Resolution Division for further assistance.

- Pacific Connector would install orange safety fence between the construction right-of-way and the residence.
- Pacific Connector would attempt to schedule activities during normal working hours. Pacific Connector does not currently plan to work on Sundays; however, certain activities, such as waterbody crossing construction and hydrotesting, may require a 24-hour work schedule.
- Pacific Connector would comply with all local noise ordinances.
- Access and traffic flows would be maintained during construction activities through residential areas, particularly for emergency vehicles. Access to residences would be maintained at all times.
- Dust minimization techniques such as watering would be used on-site and all litter and debris would be removed daily from the construction site.
- Mature trees, vegetation screens, and landscaping would be preserved to the extent possible. Landowners would be compensated for the removal of any trees.
- Immediately after backfilling the trench, all lawn areas and landscaping within the construction work area would be restored.
- Pacific Connector would provide alternative sewer facilities if septic system is disturbed during construction. Pacific Connector would repair and restore septic systems affected by construction.
- Pacific Connector would compensate landowners for damage to homes should the home be damaged by pipeline construction.

During the scoping process, many landowners expressed concern about the pipeline and requested that the pipeline be moved off their property. Section 3.4 evaluates route alternatives to lessen effects on specific tracts where landowners raised routing concerns. Other comments expressed concern about effects on water wells, utility lines, septic systems, slope erosion, farming operations, loss of future development opportunities, and effects on environmental resources. As appropriate, these comments have been addressed throughout this analysis.

Concerns were raised about the location of the pipeline relative to the Woods Valley Airport, a licensed airport on the Indian Lake Ranch located near Trail, Oregon. As currently proposed, the pipeline would cross the grass runway. Pacific Connector outlined the measures that it proposes to implement to reduce impacts on the airport in a filing with FERC dated January 3, 2018. These measures include crossing the grassed airstrip as a tie-in crossing, scheduling construction at a time negotiated with the landowner, and either salvaging and replacing the existing sod or installing new sod following construction. In a letter to the FERC dated August 17, 2018, legal counsel for the property owner indicated that they believed Pacific Connector's January 3, 2018 response to be inadequate and requested that FERC require Pacific Connector to relocate the pipeline to avoid crossing the airstrip. Concerns expressed in the letter include safety concerns related to burying a natural gas pipeline several feet below a runway that is the location of aircraft take-offs and landings.

Planned Developments

Pacific Connector's communications with Coos County, the City of North Bend, Douglas County, Jackson County, and Klamath County did not identify any large-scale residential, commercial, or business projects/planned developments within 0.25 mile of the pipeline.

Comments received from affected landowners and other interested parties during scoping expressed concern that the pipeline would affect the ability of landowners to undertake small-scale developments, such as adding a home site, barn, or other structure, or subdividing a lot into two parcels for development. In some cases, Pacific Connector modified the route of the pipeline to avoid improvements on private parcels, as discussed in section 3.4 (Pipeline Route Alternatives) of this EIS.

4.7.2.5 Timber

Pipeline construction would require clearing all forested vegetation and timber from a 95-foot-wide temporary right-of-way and associated TEWAs. Timber removal and construction activities would take place over two years. While Pacific Connector anticipates that timber clearing would typically be done from May through November (the usual dry period in Oregon), timing restrictions would be imposed within habitat for federally listed NSO and MAMU (see section 4.6). Timber clearing within MAMU stands or within 300 feet of MAMU stands would not occur during the MAMU breeding season, which occurs between April 1 to September 15, in order to prevent impacts on nesting MAMU. Habitat removal within 0.25 mile of an NSO activity center would occur outside of the NSO's breeding season (see section 4.6).

Impacts on forest and timber resources would depend on the clearing (logging) methods used, quantity of lumber removed, and the age of affected stands. The Pacific Connector pipeline would cross approximately 39.3 miles of LSOG forests, 43.7 miles of mid-seral forests, and 59.5 miles of recently harvested forested lands. Table 4.7.2.5-1 lists the log types that occur along the pipeline's route.

TABLE 4.7.2.5-1

Merchantable Timber to be Cleared for the Proposed Pacific Connector Pipeline, by Class and Age

Type of Timber	Diameter to Breast Height (inches dbh)	Inside Top Bark Height Diameter (inches)	Age
Small conifer sawlog	10-20	6-10	26–60 years
Medium conifer sawlog	20-30	8-12	61–100-125 years
Large conifer sawlog	30 and larger	8-16	125–250 years; with an unquantified population of ancient relic trees 300 to 500 years

While timber cruises have not yet been conducted, information available indicates that approximately 1,573 acres of large mature trees over 40 years in age and approximately 1,177 acres of small to medium trees under 40 years in age would be harvested to construct the pipeline. A portion of these 1,177 acres of small to medium trees would not be merchantable (e.g., those less than 25 years in age). Future timber production would be lost on these younger (small and medium) stands. The exact number and board feet of these non-merchantable trees would be determined during timber cruises. Operating the pipeline would permanently affect approximately 517 acres of forest, which would be removed from the future timber base.

Timber cruises would be conducted prior to vegetation clearing to determine timber volumes, values, and species composition within forested lands. These timber cruises would be completed on private lands in compliance with professional forestry standards and on federal lands to required federal agency standard. Information gathered from timber cruises would be used to determine damage payments during easement acquisition. Pacific Connector would be required to retain qualified foresters and logging engineers to develop site-specific logging plans for each area to be logged. These plans would identify the size, height, volume, and value of trees in each portion of the construction right-of-way, how the timber would be felled and yarded, where landings and log decks would be placed, the haul routes that would be used to remove the logs, and how logging debris would be disposed of. Logging methods would vary by location, and would not be known until timber contractors evaluate site-specific conditions. The exact timber harvest and decking requirement locations would be determined by the contractor within the access roads and staging areas already approved for the pipeline.

Merchantable timber would be cut and removed from the construction right-of-way and TEWAs. In limited areas, TEWAs have been identified for log storage and decking. Clearing of forest is a two-step process: tree felling followed by yarding. Pacific Connector's *Right-of-Way Clearing Plan for Federal Lands* outlines different scenarios that may be used to cut and remove timber from the right-of-way along the pipeline route, based on slope, stand density, and tree types. Ground-based skidding and cable (where feasible) logging methods would likely be the standard method.

In some isolated rugged topographic areas with poor access, helicopter logging may be used. Cable and helicopter logging methods would minimize the potential for soil compaction. Any timber cleared from the right-of-way that would be used for instream or upland wildlife habitat diversity structures would be stored on the edge of the right-of-way or in TEWAs for later use during restoration efforts. Prior to clearing operations, the EI or Pacific Connector's authorized representative would flag existing snags on the edges of the construction right-of-way or TEWAs where feasible to save from clearing. These snags would be saved as and used in placement projects to benefit primary and secondary cavity nesting birds, mammals, reptiles, and amphibians. During this process, other large diameter trees on the edges of the construction right-of-way and TEWAs would also be flagged to save/protect as green recruitment or habitat/shade trees, where feasible. Some of these trees would be girdled to create snags to augment the number of snags along the right-of-way to benefit cavity nesting birds, mammals, reptiles, and amphibians; however, snags that are determined to be a threat to worker safety would be removed.

Danger trees are those trees at risk of falling on workers or vehicles and thus would need to be removed for safety reasons. A tree may be at risk of falling for a number of reasons including the tree's location and the presence of defects, insects, disease, work activities, and weather conditions. Such trees would be felled in advance of logging, pipeline construction, road construction/reconstruction, and road maintenance. Additionally, danger trees could be created from trees felled for the pipeline. This would occur if trees outside of approved construction areas are damaged during felling of harvested timber. While this could result in growth loss, for which Pacific Connector would compensate the land-management agency (or landowner on private lands) for any trees removed and any loss in timber productivity, the FERC requires that all operations be contained within the certificated work areas. Danger trees would be designated by qualified Pacific Connector representatives, in accordance with OSHA standards and the Forest Service/BLM–published *Field Guide for Danger Tree Identification and Response* (Forest Service and BLM 2008). Danger trees exterior to the right-of-way would be directionally felled, when consistent with OSHA guidelines, away from the construction right-of-way if trees are to be left, and towards the construction right-of-way if trees are to be removed. To ensure safety during construction, Pacific Connector has requested a variance to Section IV.A.1 of the FERC's *Plan* for removing danger trees outside the approved construction limits. Pacific Connector would compensate the respective land manager/owner for any merchantable danger trees that are felled.

Logs would not be stored next to conifer trees bordering the sides of the right-of-way to avoid damage to live trees. Logs planned for removal from the site would be hauled off the site as soon as practical following yarding in order to prevent disease problems, as well as potential theft problems. Slash pieces larger than 8 inches in diameter may be decked for short periods in agency or landowner designated and approved storage areas or in places where roads cross the right-of-way and made available to the public. However, Pacific Connector has stated that they may place LWD in UCSAs adjacent to standing conifers.

Where feasible, logs yarded out of wetlands or riparian zones would be skidded with at least one end suspended from the ground so as to minimize soil disturbance. Pacific Connector proposes that any debris entering a waterbody as a result of felling and yarding of timber would be removed as soon as practical after entry into the waterbody and shall be placed outside the 100-year floodplain where practical, unless specified otherwise by the applicable landowner or land-managing agency. Logs and slash would not be yarded across perennial streams unless fully suspended. During logging/clearing operations, the direction of log or slash movement would be conducted to minimize sediment delivery to waterbodies, including intermittent streams. Logs firmly embedded in the bed or bank of waterbodies that are in place prior to felling and yarding of timber would not be disturbed, unless they prevent trenching and fluming operations. Any existing logs that are removed from waterbodies to construct the pipeline crossing would be returned to the waterbody after the pipeline has been installed, backfilling is complete, and during the time the streambanks are being restored.

In addition to the above mentioned impact minimization measures, Pacific Connector would implement the following measures to further reduce impacts on timber:

- All tree felling and vegetation clearing would occur within the certificated construction work areas, except for danger trees adjacent to the right-of-way, additional work areas, and travel corridors. Trees within the certificated construction work areas would be directionally sheared or felled so as to prevent damage to adjacent trees, facilities, or structures.
- Where ground skidding is used, the following measures would be employed to minimize significant detrimental soil disturbance (compaction and displacement):
  - low ground weight (pressure) vehicles would be used;
  - logging machinery would be restricted to the 30-foot permanent right-of-way wherever possible to prevent soil compaction;
  - the removal of soil duff layers would be avoided in order to maintain a cushion between the soil and the logs and the logging equipment;
  - designed skid trails would be used to restrict detrimental soil disturbance (compaction and displacement) to a smaller area of the right-of-way over the pipeline trenching area; and
  - landings, yarding, and load-out areas used for timber harvesting would be scarified or after use and prior to the rainy season where the potential for sediment delivery to waterbodies is possible.

- Material designated to remain on site to meet resource concerns would be placed in designated UCSAs along the edge of the right-of-way and then scattered/redistributed across the right-of-way during final cleanup and reclamation (following seeding). In upland areas, stump removal would be limited to the trenchline and areas where grading is necessary to construct a safe, level working plane.
- Off-site slash disposal and/or burning may occur in areas where slash is concentrated, such as landings. Slash would be machine or hand piled with the outer edge of piles no closer than 20 feet from the outer drip line of live trees, and burned according to state burning requirements and landowner, BLM, and Forest Service stipulations. Burns would occur during the wet season.
- Outside of the 30-foot-wide permanent pipeline easement, which would be kept clear of trees with roots that could compromise the integrity of the pipeline coating, the temporary construction area would be restored and revegetated using native seeds, to the extent possible, and saplings according to the ECRP.

State Lands

The proposed route would cross the Southwest Oregon and the Eastern Oregon Forest Practices Regions, which contain mature forest. Trees within this portion of the right-of-way would be cut and merchantable trees would be sold as directed by Oregon Department of Forestry (ODF). As stipulated within ORS 527.670(3), a written plan must be submitted to the ODF State Forester before extracting timber within:

- 100 feet of a stream classified as Type F (stream with fish or fish and domestic water use) or Type D (stream with domestic water use but no fish use);
- 300 feet of a specific site involving threatened or endangered wildlife species, or sensitive nesting, roosting, or water sites;
- 300 feet of any resource site identified in OAR 629-665-0100 (Sensitive Bird Nesting, Roosting, and Watering Resource Sites on Forestlands), OAR 629-665-0200 (threatened and endangered species that use Resource Sites on Forestlands), or OAR 629-645-0000 (Significant Wetlands); and
- 300 feet of any nesting or roosting site, or critical habitat of threatened or endangered species listed by the FWS or by the ODFW Commission.

If necessary, Pacific Connector would prepare and submit to the ODF State Forester for approval a written plan describing how the pipeline would be in compliance with the Forest Practices Act (OAR 629-605-0170), prior to harvesting activities. In addition to the written plan, Pacific Connector would be required to submit a Notification to the ODF. The Notification serves three purposes: notification of a forest operation (ORS 527.670), a request for a Permit to Use Fire or Power Driven Machinery (PDM, ORS Chapter 477), and notice to the Department of Revenue of timber harvest (ORS 321.550).

4.7.3 Environmental Consequences on Federal Lands

4.7.3.1 Land Requirements on Federal Lands

The Pacific Connector pipeline would cross approximately 31 miles of NFS lands and 47 miles of BLM lands (table 4.7.3.1-1). Between MPs 200.5 and 227.2, the pipeline would cross 31 irrigation facilities that fall under the jurisdiction of Reclamation.

Temporary impacts of the pipeline on federal lands would include timber and brush clearing, grading, trenching, impacts on visual quality at some locations, and soil compaction as a result of equipment driving and storage of logs, slash, pipe lengths, and other supplies. Long-term impacts include the time it would take trees to grow back within the temporary construction right-of-way. Permanent impacts would include the conversion of forest to herbaceous vegetation within a 30-foot-wide corridor kept clear of trees, and prohibitions of use of the operating pipeline easement. The pipeline and associated facilities would not cross, and therefore no acreage would be removed from, any federally designated wilderness, wildlife refuge areas, or inventoried roadless areas.

TABLE 4.7.3.1-1

Federal Lands Affected by the Pacific Connector Pipeline Project

Pipeline Facility/Component	Jurisdiction: BLM	Jurisdiction: Forest Service	Jurisdiction: Reclamation
Miles Crossed by Pipeline	46.9	30.7	0.3
Temporary Construction Acreage Requirements (acres)			
Construction ROW	535	351	4
Temporary Extra Work Areas	165	103	<1
Uncleared Storage Areas	179	126	0
Off-site Source/Disposal	7	9	0
Existing Roads Needing Improvements in Limited Locations a/	4.7	1	0
Temporary Access Roads (TAR)	0	>1	0
Total Temporary Impacts (acres)	**891**	**590**	**4**
Permanent Construction Acreage Requirements (acres)			
Permanent Easement	284	186	2
Permanent Access Roads (PAR)	<1	0	0
Aboveground Facilities	<1	0	0
Total Permanent Impacts (acres)	**284**	**186**	**2**
ROW (acres)			
30-Foot Maintained ROW (acres)	171	112	1

Note: Columns may not sum correctly due to rounding. Miles rounded to the nearest tenth of a mile (values below 0.1 are shown as "<0.1"). Acres rounded to the nearest whole acre (values less than 1 shown as "<1").

a/ Road improvements necessary for construction would not be restored; however, no additional maintenance would occur on access roads improved for construction of the Project. Acres are not included in the Permanent Construction acres total.

Pacific Connector would protect its pipeline from corrosion over time through a CP system. The CP system would consist of a number of sites where below ground rectifier/anode beds would be installed that input a low voltage electrical charge into the pipeline. These rectifier/anode beds would typically be spaced about 15 to 20 miles apart, usually installed within the previously disturbed pipeline construction right-of-way. The CP system would be installed about one year after the pipeline would be constructed, to allow the trench to stabilize and for collection of post-construction data on electro-conductivity soil potentials, which is required before the system can be designed and installed. Pacific Connector would consult with appropriate federal, state, and local regulatory agencies after pipeline construction to acquire the permits necessary for the CP system. A *Corrosion Control Plan* was included as Appendix F to Pacific Connector's POD (appendix F.10 of this EIS). Based on a preliminary analysis of CP sites that could create a potential for new electrical service, there is no need for new electrical service on federal lands.

Table 4.7.3.1-2 provides acres affected by the pipeline broken out by land use type and ownership for each federal jurisdiction.

TABLE 4.7.3.1-2

Federal Lands Required for Construction and Operation of the Pacific Connector Pipeline by Land Use Type (acres)

Jurisdiction/ Project Element	Residential	Industrial	Transportation/ Communication	Cropland/Pastureland	Orchards, Groves, Vineyards, Nurseries	Herbaceous Rangeland	Shrub/Brush Rangeland	Mixed Rangeland	Deciduous Forest Land	Evergreen Forest Land	Mixed Forest Land	Clearcut Forest Land	Regenerating Forest Land	Streams	Ditches	Forested Wetlands	Nonforested Wetlands	Strip Mines, Quarries, Gravel Pits	Total
Coos Bay BLM																			
Construction a/	0	0.1	30.63	0.43	0	0	0	0	0	93.59	76.37	2.94	78.45	0.22	0	0.38	.07	0.67	**283.75**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Permanent Easement b/	0	0	14.31	0.19	0	0	0	0	0	36.60	26.63	0.89	24.48	0.12	0	0.20	0.03	0	**103.44**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	8.81	<1	0	0	0	0	0	21.78	15.90	0.53	14.71	<1	0	<1	0	0	**62.05**
Roseburg BLM																			
Construction a/	0	0	22.69	0	0	0.36	5.02	0	0	74.58	138.66	5.10	64.69	0.04	0	0	0.01	0	**311.15**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0.09	0	0	0	0	0	0	0	**0.09**
Permanent Easement b/	0	0	7.47	0	0	0.06	1.82	0	0	22.50	33.24	0.81	15.21	0.02	0	0	0	0	**81.04**
Permanent Access Roads c/	0	0	0.02	0	0	0	0	0	0	0	0.01	0	0.03	0	0	0	0	0	**0.05**
30-Foot Maintenance Corridor	0	0	4.79	0	0	<1	1.11	1	0	13.47	19.670	0.49	9.06	<1	0	0	0	0	**48.63**
Medford BLM																			
Construction a/	0	0	5.69	0	0	11.62	55.53	2.73	30.76	73.27	60.64	0	32.34	0.40	0.05	0	0.07	0	**273.10**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0.09	0	0	0	0	0	0	0	0	0	0	0	**0.09**
Permanent Easement b/	0	0	1.89	0	0	3.97	18.94	1.30	10.49	24.53	29.77	0	10.82	0.14	0.03	0	0.03	0.0	**91.92**
Permanent Access Roads c/	0	0	0.03	0	0	0.03	0.11	0	0	0	0	0	0	0	0	0	0	0	**0.16**
30-Foot Maintenance Corridor	0	0	1.14	0	0	2.38	11.35	0.78	6.29	14.75	11.82	<1	6.52	0.08	0.02	<1	0.02	<1	**55.16**
Lakeview BLM																			
Construction a/	0	0	1.19	0	0	0	0.67	0.64	0	15.85	0	0	0	0.02	0	0	0	0	**18.37**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Permanent Easement b/	0	0	0.65	0	0	0	0.22	0.16	0	6.81	0	0	0	0.01	0	0	0	0	**7.85**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	2.17	0	0	0	1.02	0.89	0	4.15	0	0	0	0.02	0	0	0	0	**4.71**
Umpqua National Forest																			
Construction a/	0	0	13.28	0	0	0	0	0	0	151.49	0	17.92	17.23	0.14	0.08	0	0.23	12.05	**212.42**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Permanent Easement b/	0	0	3.92	0	0	0	0	0	0	44.92	0	9.24	7.25	0.06	0.04	0	0.06	0	**65.50**

TABLE 4.7.3.1-2 (continued)

Federal Lands Required for Construction and Operation of the Pacific Connector Pipeline by Land Use Type (acres)

Jurisdiction/ Project Element	Residential	Industrial	Transportation/ Communication	Cropland/Pastureland	Orchards, Groves, Vineyards, Nurseries	Herbaceous Rangeland	Shrub/Brush Rangeland	Mixed Rangeland	Deciduous Forest Land	Evergreen Forest Land	Mixed Forest Land	Clearcut Forest Land	Regenerating Forest Land	Streams	Ditches	Forested Wetlands	Nonforested Wetlands	Strip Mines, Quarries, Gravel Pits	Total
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	2.47	0	0	0	0	0	0	26.78	0	5.53	4.41	0.04	0.03	<1	0.03	0	**39.26**
Rogue River National Forest																			
Construction a/	0	0	18.03	0	0	0.15	7.94	3.09	0	141.81	0	0	99.62	0.23	0	0	0	15.67	**286.55**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Permanent Easement b/	0	0	5.30	0	0	0	1.57	0.98	0	47.56	0	0	28.5	0.06	0	0	0	0	**84.07**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	2.71	0	0	<1	0.96	0.59	0	28.81	0	<1	17.34	0.03	0	0	0	0	**50.44**
Winema National Forest																			
Construction a/	0	0	2.54	0	0	1.35	0	0	0	56.05	0	<0	30.83	0.07	0	0	0.26	0	**91.09**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Permanent Easement b/	0	0	0.50	0	0	0.60	0	0	0	22.82	0	0	12.43	0.03	0	<1	0.17	0	**36.54**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0	0	0.28	0	0	0.37	0	0	0	13.69	0	<1	7.47	0.02	0	<1	0.10	0	**21.92**
Bureau of Reclamation																			
Construction a/	0.18	0	0	1.11	0	0	2.85	0	0	0	0	0	0	0	<1	0	0	0	**4.15**
Aboveground Facilities Outside the ROW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Permanent Easement b/	0.07	0	0	0.12	0	0	1.71	0	0	0	0	0	0	0	<1	0	0	0	**1.90**
Permanent Access Roads c/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
30-Foot Maintenance Corridor	0.04	0	0	0.04	0	0	1.06	0	0	0	0	0	0	0	<1	0	0	0	**1.14**

Note: Rows may not sum correctly due to rounding. Acres rounded to nearest whole acre (values below 1 are shown as "<1".

a/ Construction disturbance associated with pipeline facilities including construction ROW, TEWAs, UCSAs, TARs, existing roads needing improvements, pipe yards, off-site source and disposal areas, and hydrostatic discharge locations outside the ROW.

b/ The operational ROW is located within the disturbed acreage of the construction ROW. It is not an addition to the construction impacts.

c/ Portions of some of the PARs are located within the construction ROW and, therefore, there is some duplication in the acreage calculations.

BLM Lands

The Pacific Connector pipeline would cross approximately 47 miles of BLM lands within the Coos Bay, Roseburg, Medford, and Lakeview Districts. Of the aboveground facilities, three MLVs would be located on BLM lands. Pacific Connector also proposes to construct one new TAR to support construction and three new PARs on BLM lands to support construction and operation.

Acres of BLM lands, by land use classification, that would be affected by pipeline construction and operation are listed above in table 4.7.3.1-2. The BLM expressed concerns regarding impact of the pipeline on current and future forest management activities on federally administered lands that might result from prohibited or restricted land management and use activities within or near the pipeline right-of-way. In response, Pacific Connector provided a list of activities that would be prohibited or restricted on the pipeline right-of-way (table 4.7.3.1-3).

TABLE 4.7.3.1-3

Land Management and Land Use Activities That Would be Prohibited or Restricted on the Proposed Pacific Connector Pipeline Construction and Operational Rights-of-Way

Location	Prohibited/ Restricted Activities	Duration
Directly over the pipeline	Obstructions that may endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance and use of the pipeline (i.e. trees, engineered structures, buildings, roads-parallel, other utilities-parallel, logging, blasting, mining)	During the construction, operations, and maintenance of the pipeline facilities.
Within the pipeline ROW clearing limits	Obstructions that may endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance and use of the pipeline (i.e. engineered structures, buildings, roads-parallel, limited logging, blasting, mining)	During the construction of the pipeline facilities.
Within the pipeline ROW	Obstructions that may endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance and use of the pipeline (i.e. engineered structures, buildings, roads-parallel, limited logging, blasting, mining)	During the construction, operations, and maintenance of the pipeline facilities.
Within one-quarter mile of the pipeline	Some blasting and mining	During operation and maintenance of the pipeline facilities.
On existing federally managed roads and trails	Only when within the ROW, obstructions that may, endanger, hinder or conflict with the construction, operation, inspection, protection, maintenance, and use of the pipeline as described above; otherwise none	During the construction, operations, and maintenance of the pipeline facilities.

The BLM also expressed concerns about how prohibited or restricted activities within the pipeline right-of-way may affect parties who hold valid existing rights of federal lands in the Project area. In response, Pacific Connector stated that such situations would be handled on a case-by-case basis. In general, Pacific Connector would identify all landowners and interested parties in each of these situations and would work directly with them. The BLM also asked Pacific Connector to identify the requirements and timelines for notification to Pacific Connector when activities are planned on the federal lands, either by the agency or a third party. Pacific Connector responded that for any aboveground alterations Pacific Connector would rely on its Operations & Maintenance Manual Public Awareness and Damage Prevention (Policy 10.17.00.09). This policy requires the company to notify in writing at least once per year any landowner or interested party within 660 feet from either side of the pipeline. The notification would include written information of where the pipeline is and who and how to reach Pacific Connector for any concerns they may have with the pipeline. These notifications would provide the landowner or interested party with the information they need to contact the company to discuss any work around the pipeline or right-of-way.

National Forest System Lands

The pipeline would cross through approximately 30.6 miles of NFS lands within the Umpqua, Rogue River, and Winema National Forests. Acreages of NFS lands, by land use classification, that would be affected by pipeline construction or operation of the Pacific Connector pipeline and associated aboveground facilities are included above in table 4.7.3.1-2.

Reclamation Lands

Between MPs 200.5 and 227.2, Pacific Connector's pipeline route would cross two parcels of withdrawn land totaling 0.7 mile, and 31 irrigation facilities that are managed by Reclamation's Klamath Basin Area Office of the Mid-Pacific Region. Acres of Reclamation land, by land use classification, that would be affected by the Project are included above in table 4.7.3.1-2. Construction of the Pacific Connector pipeline across Reclamation lands and facilities would affect less than half an acre of agricultural land, about 4 acres of rangeland, and less than a tenth of an acre of irrigation ditches.

Construction in the Klamath Basin would occur between October 15 and March 15 to minimize impacts on agricultural activities in the area and to cross the Reclamation irrigation facilities when they are not likely to be used or contain water. Pacific Connector included a *Klamath Facilities Crossing Plan* as Appendix O of its POD, and a *Winter Construction Plan for the* Klamath Basin as Appendix 1E in Resource Report 1 of its 2017 application to the FERC.

During construction across Reclamation lands and features, their use would be temporarily interrupted. However, after pipeline installation, Pacific Connector would restore those lands and features to their original condition and use.

4.7.3.2 Grazing Allotments on BLM and NFS Lands

The proposed Pacific Connector pipeline route would cross 11[165] livestock grazing allotments, 5 of which occur on NFS lands managed by the Umpqua, Rogue River, and Winema National Forests, and 6 of which occur on BLM lands managed by the Medford and Lakeview Districts (see table's 4.7.3.2-1 and 4.7.3.2-2). Pacific Connector believes grazing deferments would not be necessary for the Project because grazing is not a dominant land use crossed by the pipeline route. Pacific Connector has consulted with the BLM and the Forest Service regarding grazing resources.

[165] One additional allotment (Fish Lake) on the Rogue River National Forest would also be included. The pipeline corridor does not cross this allotment; the only portion affected by Pacific Connector is an old quarry which has been identified as a rock source and disposal area near MP 160.4.

TABLE 4.7.3.2-1

Grazing Allotments on National Forest System Lands Crossed by the Pacific Connector Pipeline Project

Allotment Number	Allotment Name/Pasture	MP	Allotment Acres	Management Category a/	Total AUMs b/	3-Year Average AUMs	Season Used	Livestock Kind	Grazing System	Notes
Umpqua National Forest – Tiller Ranger District										
00R12	Diamond Rock	105.4 - 113.2	23,565	PB: I, A, F	680	187	5/1-10/31	Cow/Calf	Continuous Season	Managed in conjunction with an adjoining allotment.
Rogue River National Forest – Ashland Ranger District										
00R08	South Butte	153.8 - 168.1	25,592	PB: A, F	230	230	6/1-10-15	Cow/Calf	Continuous	1035 AUs
Winema National Forest – Klamath Ranger District										
OR250	Indian	168.1 - 172.7	10,619	PB: I,A, F	906	665	7/1-10/15	Cow/Calf	Continuous Season	Managed with Buck Allotment as 1 Allotment.
OR220	Buck	172.7 - 175.4	15,932	PB: I,A, F						Same as Indian, managed as 1 Allotment.

a/ 'PB' classification indicates that allotments that have potential to be managed under a quality management strategy. Basic resource damage is not occurring.
P = lack of permittee interest participation;
I = lack of total AMP implementation;
A = lack of reliable range analysis data, and
F = lack of funding to implement quality management.
b/ AUM = animal unit month

TABLE 4.7.3.2-2

Grazing Allotments on BLM Lands Crossed by the Pacific Connector Pipeline Project

Allotment Number	Allotment Name/Pasture	MP	Allotment Acres	Management Category a/	Total AUMs	3-Year Average AUMs	Season Used	Livestock Kind	Grazing System b/	Notes
Medford District										
10038	Crowfoot	123.5 - 128.4	7,400	I			4\15-6\30	Cattle	SS	
10031	Summit Prairie/McNeil	131.4 - 131.8	30,578	I	1,158	827	6\1-10\30	Cattle	DF	
10024	Big Butte	136.8 - 141.9	21,802	I	1,663	301	4\16-5\31	Cattle	SL	Rice Place pasture now closed to grazing
00126	Heppsie Mountain	148.3 - 153.8	4,105	I	294	277	5/1-10/15	Cattle	SL	
Lakeview District										
0147	Grubb Spring	176.1 – 179.7	3,564 e/	C	130 c/	130 c/	5/1 – 9/15	Cattle	d/	
0848	Pope	216.5 - 216.8	446 f/	C	48 c/	63 c/	5/1 – 7/31	Cattle	d/	

a/ I = intensive management
C = custodial
M = maintain
b/ SS = Spring/Summer: Use throughout the critical growing season annually.
DF = Deferred: Delay of livestock grazing on an area for an adequate period of time to provide for plant reproduction, establishment of new plants, or restoration of vigor of existing plants.
SL = Season Long: Season long use annually, including during the growing season (spring, summer, and fall).
c/ BLM licensed AUMs only.
d/ Grazing is every year for the listed season; no other specific grazing system.
e/ BLM Klamath Falls Resource Area acres only listed
f/ A portion of the allotment was recently sold reducing the acreage.

Potential impacts on grazing allotments may occur from the temporary loss of forage from Project vegetation clearing and grading activities. In addition, construction activities could disturb improvements such as developed springs and fences or other barriers that restrict livestock to the allotment. From current survey activities, Pacific Connector is not aware of any range improvements such as springs that would be impacted. Pacific Connector does not believe it is necessary to remove livestock from the allotments during construction activities because of the significant size of most of the allotments crossed. Prior to construction, Pacific Connector would coordinate with the BLM and Forest Service regarding lease holder notifications.

Pacific Connector would mitigate impacts on grazing allotments during construction by installing temporary fences as needed to control livestock movement. After construction, permanent repairs to fences and natural barriers or other improvements that were disrupted by construction activities would occur to equivalent or better standards to ensure that livestock do not trail outside the allotment. Additional permanent fences may also be required during operation. After the pipeline is installed, the right-of-way would be restored and revegetated, as discussed in section 4.4. Revegetation is expected to return allotment forage quantity and values to preconstruction conditions within one to two growing seasons.

4.7.3.3 BLM and Forest Service Land Use Plans and Land Allocations

Federal lands are managed under a framework of laws passed by Congress, regulations promulgated through the federal rule-making process by the Secretaries of the Interior and Agriculture to implement these laws passed, Executive Orders issued by the President, and policies developed by the agencies to govern day-to-day actions. Each administrative unit of the BLM and Forest Service has a land management plan that provides a framework for on-the-ground implementation of these various laws, regulations and agency policies.

Overview of Statutes Applicable to Federal Land Use Planning

Although a number of federal statutes apply to the Pacific Connector pipeline where it crosses federal lands, there are six primary federal land-use laws that provide the framework for federal land use plans:

- The Multiple Use, Sustained Yield Act of 1960 (MUSY)
- The National Environmental Policy Act of 1969 (NEPA),
- The Endangered Species Act of 1973 (ESA),
- The Federal Land Policy and Management Act of 1976 (FLPMA),
- The National Forest Management Act of 1976 (NFMA), and
- The Oregon and California Revested Lands Sustained Yield Management Act of 1937 (O&C Act).

Three of these statutes—NEPA, ESA, and FLPMA—apply to both the BLM and the Forest Service. The relevance of NEPA and ESA to federal land management along the route of the Pacific Connector pipeline is discussed in section 1 of this EIS. For the Pacific Connector pipeline, the O&C Act applies primarily to BLM lands and to a lesser degree to NFS lands. BLM's RMPs are based on the requirements of FLPMA. The Forest Service's LRMPs are based on the requirements of the NFMA. FLPMA and NFMA were enacted in a manner to complement each other. Reclamation does not have any land use plans or land allocations administered by the

Klamath Basin Area Office that would be amended or modified or which need to be addressed in this EIS.

The O&C Act of 1937 applies to lands granted by the federal government to the Oregon and California Railroad Company. These lands were reconveyed to the federal government when the Oregon and California Railroad (O&C) went bankrupt. A similar, but smaller land grant in 1869 to the Southern Oregon Company was associated with the Coos Bay Wagon Road. These lands were also subsequently reconveyed to the federal government. The O&C Act of 1937 requires the Secretary of the Interior to manage Coos Bay Wagon Road lands and O&C lands for permanent forest production in conformity with the principle of sustained yield. These lands must also be managed in accordance with BLM RMPs in addition to applicable environmental laws such as the ESA. The O&C and Coos Bay Wagon Road land grants resulted in a patchwork of alternating federal and non-federal parcels across western Oregon and northern California. Table 4.7.3.3-1 lists the O&C and Coos Bay Wagon Road lands crossed by the Pacific Connector pipeline.

TABLE 4.7.3.3-1

O&C Lands, Coos Bay Wagon Road Lands, and Reserved Public Domain Lands Crossed by the Pacific Connector Pipeline (miles) a/

Jurisdiction	O&C Lands	Coos Bay Wagon Road Lands	Reserved Public Domain Lands b/	Total
BLM – Coos Bay District	1.14	15.8	0.13	17.07
BLM – Roseburg District	10.85	1.79	0.74	13.358
BLM – Medford District	12.31	0.0	2.86	15.17
BLM – Lakeview District	1.03	0.0	0.26	1.29
Total BLM	**25.33**	**17.59**	**3.99**	**46.90**
Forest Service– Umpqua NF	3.44	0.0	7.37	10.81
Forest Service– Rogue River NF	0.0	0.0	13.87	13.87
Forest Service – Winema NF	0.0	0.0	6.03	6..03
Total NFS	**3.44**	**0.0**	**27.27**	**30.71**
Total	**28.77**	**17.59**	**31.26**	**77.61**

Note: Rows and columns may not sum correctly due to rounding. Miles are rounded to the nearest tenth of a mile (values below 0.1 are shown as “<0.1”).
a/ Source: Table 8.5-5, Resource Report 3, p. 36.
b/ Reserved Public Domain Lands are the remaining lands not classified as O&C or Coos Bay Wagon Road lands

Enacted in 1976, the FLPMA established a unified, comprehensive, and systematic approach to managing and conserving public lands to provide for multiple uses and sustained yield of goods and services from public lands. The act includes provisions for withdrawing or otherwise designating or dedicating federal lands for specified purposes. It also establishes procedures for disposing of public lands, acquiring non-federal lands for public purposes, exchanging lands consistent with the prescribed mission of the department or agency involved and for issuing right-of-way Grants across lands administered by multiple federal agencies. The BLM is the authorizing agency for the Pacific Connector pipeline right-of-way grant application.

The BLM under Title II of the FLPMA, and the Forest Service under the provisions of the MUSY, are required to manage lands sustainably for multiple uses. Although there are distinct differences between the BLM and Forest Service planning regulations, the following elements are common to the two agencies:

- use of a systematic, interdisciplinary approach that utilizes information from the physical, biological, economic, and other sciences;
- considering present and potential uses of public lands;
- giving priority to areas of critical environmental concern;
- considering the relative scarcity of the various values of public lands;
- weighing long-term and short-term public benefits;
- complying with applicable pollution control laws; and
- coordinating land-use planning with other relevant federal and state agencies.

The Forest Service is also subject to the requirements of the NFMA, which was enacted as an amendment to the 1974 Forest and Rangeland Renewable Resources Planning Act. In NFMA, Congress established a comprehensive notice and comment process for adopting, amending, and revising LRMPs for units of the NFS (e.g., National Forests). Planning regulations later promulgated by the Secretary of Agriculture explain that National Forest planning and decision making occurs at four levels: nationwide, region wide, LRMPs, and projects. One of the statutory requirements of the NFMA is to "specify…guidelines for LRMPs developed to achieve the goal of providing for diversity of plant and animal communities based on the suitability and capability of the specific lands area in order to meet multiple use objectives." This biodiversity requirement led to the development of the NWFP, which currently guides the management of NFS lands in southwest Oregon and meets the NFMA's biodiversity goal.

Northwest Forest Plan

In 1994, the Secretaries of Agriculture and Interior jointly signed a *Record of Decision for Amendments to Forest Service and BLM Planning Documents within the Range of the Northern Spotted Owl* (otherwise known as the Northwest Forest Plan (NWFP); Forest Service and BLM 1994a). This decision amended national forest LRMPs and established the following land allocations to be used on NFS lands in the area covered by the NWFP.[166]

- **Congressionally Reserved Areas—**Lands reserved by act of Congress including National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges and Department of Defense lands.
- **Late-Successional Reserves (LSRs)**—In combination with other land allocations and standards and guidelines are intended to maintain functional, interactive LSOG forest ecosystems for species that are dependent on this type of habitat.[167]
- **Adaptive Management Areas—**Areas designed to develop and test new management approaches to integrate and achieve ecological, economic and other social and community objectives.

[166] When the NWFP was signed in 1994, it applied to both national forest and BLM lands in the range of the NSO. Subsequently in August 2016 the BLM revised its management plans in southwest Oregon and replaced the management direction from the NWFP. As a result, the NWFP no longer applies to BLM lands.
[167] Appendix F.3 of this EIS provides a comprehensive discussion of LSRs as they relate to the Project.

- **Administratively Withdrawn Areas**—Areas identified in Forest Service LRMPs not scheduled for timber harvest (e.g., recreation sites, administrative facilities).
- **Key Watersheds**—Large watersheds that are a system of refugia that either provide, or are expected to provide, high-quality habitat that is crucial for maintaining and recovering habitat for at-risk stocks of anadromous salmonids and resident fish species. Key Watersheds are not a designated area or matrix but overlay all land allocations. Tier 1 Key Watersheds contribute directly to conservation of at-risk stocks of anadromous salmonids, bull trout and resident fish. While Tier 2 Key Watersheds may not contain at-risk fish species, they are important sources of high-quality water.
- **Riparian Reserves**—Areas along all streams, wetlands, ponds, lakes and unstable and potentially unstable areas where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. Riparian Reserves are also intended to serve as connectivity corridors between other reserves and the Matrix lands.[168] Riparian Reserves exist within all land allocations of the NWFP.
- **Matrix**—The lands outside the other designated areas listed above. Matrix lands are the area in which most timber harvest and other silvicultural activities would be conducted.

Attachment A to the NWFP ROD, "Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Species within the Range of the Northern Spotted Owl," provides detailed requirements and instructions for how land managers should treat forest lands subject to the NWFP (Forest Service and BLM 1994b).[169] Some standards and guidelines apply to all NFS lands, while others are only applicable to certain land allocations or activities. More than one set of standards and guidelines may apply in some areas. Where standards and guidelines overlap, both are applied. Where there are conflicts, the standard and guideline that provides the most protection for LSOG-associated species governs. The acres of NWFP allocations affected by the Pacific Connector pipeline are displayed in table 4.7.3.3-2.

Forest Service Land and Resource Management Plans

Current Forest Service LRMPs for the Rogue River, Umpqua, and Winema National Forests were adopted in the early 1990s (Forest Service 1990a, 1990b, and 1990c). In 1994, the NWFP ROD amended the LRMPs for those portions of National Forests within the range of the NSO to include the NWFP land allocations and standards and guidelines in addition to the existing direction in those plans. Wherever there were conflicts between the NWFP and the underlying land management plan, the direction that provided the most protection for late-successional and old-growth–dependent species was adopted.

[168] Appendix F.4 of this EIS provides a comprehensive discussion of Riparian Reserves as they relate to the Project.

[169] Standards and Guidelines: "the rules and limits governing actions, and the principles specifying environmental conditions or level to be achieved or maintained" (Forest Service and BLM 1994b: C-1).

TABLE 4.7.3.3-2

Forest Service NWFP Land Allocations – Acres Impacted by the Pipeline a/

Project Component	Late Successional Reserves	Unmapped LSRs	Matrix	Riparian Reserves b/
Forest Service – Umpqua				
Construction ROW	57.74	0.00	66.77	8.85
TEWAs	10.07	0.00	30.76	5.81
UCSAs	18.67	0.00	24.86	0.87
Off-site Source/Disposal	4.93	0.00	0.00	0.00
Temporary Access Roads (TAR)	0.00	0.00	0.24	0.00
Existing Roads Improvements	0.01	0.00	0.00	0.00
Total Temporary Impacts	91.53	0.00	122.63	15.53
Permanent Easement	30.56	0.00	35.23	4.83
Permanent Access Roads (PAR)	0.00	0.00	0.06	0.00
30-Foot Maintained	18.32	0.00	21.15	2.90
Forest Service – Rogue River-Siskiyou				
Construction ROW	159.07	0.00	0.00	3.81
TEWAs	51.51	0.00	0.00	1.08
UCSAs	71.36	0.00	0.00	1.13
Off-site Source/Disposal	0	0.00	4.91	0.00
Temporary Access Roads (TAR)	0.00	0.00	0.00	0.00
Existing Roads Improvements	1.00	0.00	0.00	0.00
Total Temporary Impacts	282.93	0.00	4.91	6.02
Permanent Easement	84.16	0.00	0.06	2.11
Permanent Access Roads (PAR)	0.00	0.00	0.00	0.00
Aboveground Facilities	0.00	0.00	0.00	0.00
30-Foot Maintained	50.50	0.00	0.00	1.27
Forest Service – Fremont-Winema				
Construction ROW	0.00	0.00	68.75	3.94
TEWAs	0.00	0.00	11.25	0.29
UCSAs	0.00	0.00	11.60	0.43
Temporary Access Roads (TAR)	0.00	0.00	0.00	0.00
Existing Roads Improvements	0.00	0.00	0.00	0.00
Total Temporary Impacts	**0.00**	**0.00**	**91.60**	**4.66**
Permanent Easement	0.00	0.00	36.78	1.92
30-Foot Maintained	0.00	0.00	22.07	1.16

a/ Due to differences between the landownership and land use allocation shapefiles, the acres will vary slightly when compared to the vegetation and land use tables organized by jurisdiction.

b/ Riparian Reserves overlay other land use allocations.

BLM Resource Management Plans

The BLM revised its management plans in August 2016. Land allocations in BLM plans provide a sustained yield of timber, contribute to the conservation and recovery of an threatened and endangered species, provide clean water in watersheds, provide recreation opportunities, and coordinate management of land surrounding the Coquille Forest with the Coquille Tribe.

The **Northwestern and Coastal Region Record of Decision** applies to the Coos Bay and the Swiftwater Field Office of Roseburg District. Land allocations are as follows:

- **Congressionally Reserved Lands and National Conservation Areas** – Lands reserved by act of Congress including National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges, and Department of Defense lands.
- **District Designated Reserves** – Lands reserved from sustained-yield timber production for other purposes
    - **Areas of Critical Environmental Concern** – Lands managed to maintain or restore relevant and important values in Areas of Critical Environmental Concern, including Research Natural Areas and Outstanding Natural Areas.
    - **Timber Production Capability Classification** – Manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system, for other uses if those uses are compatible with the reason for which the BLM has reserved these lands (as identified by the Timber Production Capability Classification codes).
    - **Lands Managed for their Wilderness Characteristics** – Protect wilderness characteristics (i.e., roadlessness, naturalness, opportunities for solitude and primitive unconfined recreation, and identified supplemental values), while allowing competing resource demands that do not conflict with preserving long-term wilderness characteristics.
- **Harvest Land Base**— Manage forest stands to achieve continual timber production that can be sustained through a balance of growth and harvest.
    - **Low Intensity Timber Area** – Use low intensity management to provide complex early-successional ecosystems, develop diverse late-successional ecosystems for a portion of the rotation and provide a variety of forest structural stages distributed both temporally and spatially.
    - **Moderate Intensity Timber Area** – Use moderate intensity management to provide complex early-successional ecosystems, develop diverse late-successional ecosystems for a portion of the rotation and provide a variety of forest structural stages distributed both temporally and spatially.
- **Late Successional Reserve** – Lands are managed to maintain nesting-roosting habitat for the NSO and nesting habitat for the MAMU, promote the development of nesting-roosting habitat for the NSO in stands that do not currently support NSO nesting and roosting, promote the development of nesting habitat for the MAMU in stands that do not currently meet nesting habitat criteria, promote the development and maintenance of foraging habitat for the NSO, including creating and maintaining habitat to increase diversity and abundance of prey for the NSO.
- **Riparian Reserves** –Areas along streams and wetlands where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. Riparian Reserves exist in all land allocations. Conservation and recovery of ESA-listed fish species and their

habitats and provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species.

The **Southwestern Oregon Record of Decision and Approved Resource Management Plan** applies to the Klamath Falls Field Office of Lakeview District, Medford District, and South River Field Office of Roseburg District. Land allocations are as follows:

- **Congressionally Reserved Lands and National Conservation Areas** – Lands reserved by act of Congress including National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges, and Department of Defense lands.
- **District Designated Reserves** – Lands reserved from sustained-yield timber production or for other purposes.
  - **Areas of Critical Environmental Concern** – Lands managed to maintain or restore relevant and important values in Areas of Critical Environmental Concern, including Research Natural Areas and Outstanding Natural Areas.
  - **Timber Production Capability Classification** – Manage areas identified as unsuitable for sustained-yield timber production through the Timber Production Capability Classification system, for other uses if those uses are compatible with the reason for which the BLM has reserved these lands (as identified by the Timber Production Capability Classification codes).
  - **Lands Managed for their Wilderness Characteristics** – Protect wilderness characteristics (i.e., roadlessness, naturalness, opportunities for solitude and primitive unconfined recreation, and identified supplemental values), while allowing competing resource demands that do not conflict with preserving long-term wilderness characteristics.
- **Harvest Land Base**— Manage forest stands to achieve continual timber production that can be sustained through a balance of growth and harvest.
  - **Low Intensity Timber Area** – Use low intensity management to provide complex early-successional ecosystems, develop diverse late-successional ecosystems for a portion of the rotation and provide a variety of forest structural stages distributed both temporally and spatially.
  - **Moderate Intensity Timber Area** – Use moderate intensity management to provide complex early-successional ecosystems, develop diverse late-successional ecosystems for a portion of the rotation and provide a variety of forest structural stages distributed both temporally and spatially.
  - **Harvest Land Base** – Uneven Aged Timber Area – Use uneven – aged timber management to increase diversity of stocking levels and size classes within and among the stands.
- **Late Successional Reserve** – Lands are managed to maintain nesting-roosting habitat for the NSO and nesting habitat for the MAMU, promote the development of nesting-roosting habitat for the NSO in stands that do not currently support NSO nesting and roosting, promote the development of nesting habitat for the MAMU in stands that do not currently

meet nesting habitat criteria, promote the development and maintenance of foraging habitat for the NSO, including creating and maintaining habitat to increase diversity and abundance of prey for the NSO.

- **Late-Successional Reserve Dry –** Applied variously on drier sites, lands are managed to Enable forests to: (1) recover from past management measures, (2) respond positively to climate-driven stresses, wildfire and other disturbance with resilience, (3) ensure positive or neutral ecological impacts from wildfire, and (4) contribute to NSO recovery.

- **Riparian Reserves** –Areas along streams and wetlands where the conservation of aquatic and riparian-dependent terrestrial resources receives primary emphasis. Riparian Reserves exist in all land allocations. Conservation and recovery of ESA-listed fish species and their habitats and provide for conservation of Bureau Special Status fish and other Bureau Special Status riparian-associated species. Riparian Reserves are further disaggregated into moist and dry zones that recognize the broad diversity of BLM landscapes by applying different implementing standards and guidelines.

Although Late Successional Reserves and Riparian Reserves are land allocations on both BLM and NFS lands and have similar objectives, implementing standards and guidelines in BLM management plans vary significantly from those on NFS lands because of the greater geologic and geographic diversity of BLM lands. BLM east-side management area land allocations do not apply to the Pacific Connector project area. The acres of BLM RMP allocations affected by the Pacific Connector pipeline is displayed in table 4.7.3.3-3.

TABLE 4.7.3.3-3

BLM RMP Land Allocations – Acres Impacted by the Pacific Connector Pipeline

Pipeline Component	District-Designated Reserve (No Harvest)	District-Designated Reserve (Non-Forest)	Eastside Manage-ment Area	Harvest Land Base (Low Intensity Timber Area)	Harvest Land Base (Moderate Intensity Timber Area)	Harvest Land Base (Uneven-Aged Timber Area)	Late-Succes-sional Reserve (Dry Forest)	Late-Succes-sional Reserve (Moist Forest)	Riparian Reserve (Dry Forest)	Riparian Reserve (Moist Forest)	Totals
BLM – Coos Bay District											
Construction ROW	1.25	7.14	0.00	8.23	29.89	0.00	0.00	128.16	0.00	17.59	192.26
TEWAs	0.08	1.42	0.00	1.27	8.70	0.00	0.00	28.57	0.00	5.98	46.02
UCSAs	0.36	0.74	0.00	0.65	5.44	0.00	0.00	30.91	0.00	3.73	41.83
Off-Site Source/Disposal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.51	0.00	1.50	4.01
Temporary Access Roads (TAR)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Temporary Impacts	**1.70**	**9.29**	**0.00**	**10.15**	**44.03**	**0.00**	**0.00**	**190.15**	**0.00**	**28.81**	**284.12**
Permanent Easement	0.55	4.41	0.00	4.36	15.62	0.00	0.00	69.17	0.00	9.49	103.60
Aboveground Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30-Foot Maintained	0.32	2.64	0.00	2.62	9.41	0.00	0.00	41.52	0.00	5.63	62.15
BLM – Roseburg District											
Construction ROW	3.95	16.79	0.00	0.09	20.04	34.08	58.12	17.49	2.23	1.33	154.11
TEWAs	0.67	6.93	0.00	0.00	9.52	10.94	18.64	2.27	1.28	0.42	50.67
UCSAs	0.33	4.74	0.00	0.00	14.98	28.57	46.27	3.18	4.87	0.00	102.94
Off-site Source/Disposal	0.37	0.20	0.00	0.00	2.26	0.00	0.00	0.14	0.00	0.00	2.98
Temporary Access Roads (TAR)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Temporary Impacts	**5.33**	**28.66**	**0.00**	**0.09**	**46.79**	**73.59**	**123.03**	**23.08**	**8.37**	**1.75**	**310.70**
Permanent Easement	2.24	8.99	0.00	0.01	10.53	17.01	30.03	9.16	1.07	0.69	80.73
Aboveground Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.09
30-Foot Maintained	1.34	5.66	0.00	0.00	6.19	10.14	18.57	5.49	0.62	0.41	48.43
BLM – Medford District											
Construction ROW	58.53	25.82	0.00	7.77	0.00	23.07	48.38	0.00	10.72	0.00	174.27
TEWAs	19.15	9.10	0.00	1.70	0.00	7.12	25.44	0.00	2.19	0.00	64.70
UCSAs	7.98	2.70	0.00	3.23	0.00	9.64	9.50	0.00	0.87	0.00	33.93
Temporary Access Roads (TAR)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Temporary Impacts	**85.67**	**37.61**	**0.00**	**12.71**	**0.00**	**39.83**	**83.33**	**0.00**	**13.78**	**0.00**	**272.91**
Permanent Easement	30.39	13.91	0.00	4.16	0.00	12.26	25.52	0.00	5.61	0.00	91.85
Aboveground Facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.09
30-Foot Maintained	18.23	8.40	0.00	2.49	0.00	7.32	15.31	0.00	3.37	0.00	55.12

TABLE 4.7.3.3-3 (continued)

BLM RMP Land Allocations – Acres Impacted by the Pacific Connector Pipeline

Pipeline Component	District-Designated Reserve (No Harvest)	District-Designated Reserve (Non-Forest)	Eastside Manage-ment Area	Harvest Land Base (Low Intensity Timber Area)	Harvest Land Base (Moderate Intensity Timber Area)	Harvest Land Base (Uneven-Aged Timber Area)	Late-Succes-sional Reserve (Dry Forest)	Late-Succes-sional Reserve (Moist Forest)	Riparian Reserve (Dry Forest)	Riparian Reserve (Moist Forest)	Totals
LM – Lakeview District											
Construction ROW	0.00	0.74	2.96	0.00	0.00	10.89	0.00	0.00	0.22	0.00	14.82
TEWAs	0.00	0.18	0.58	0.00	0.00	2.72	0.00	0.00	0.06	0.00	3.54
Temporary Access Roads (TAR)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Temporary Impacts	**0.00**	**0.92**	**3.54**	**0.00**	**0.00**	**13.61**	**0.00**	**0.00**	**0.28**	**0.00**	**18.36**
Permanent Easement	0.00	0.29	1.56	0.00	0.00	5.88	0.00	0.00	0.11	0.00	7.84
30-Foot Maintained	0.00	0.18	0.93	0.00	0.00	3.54	0.00	0.00	0.07	0.00	4.71

4.7.3.4 Proposed Amendments to BLM and Forest Service Land Management Plans

Amendment of BLM Resource Management Plans

BLM lands are managed according to the direction in RMPs. Approximately 46.9 miles of the proposed Pacific Connector Pipeline route would cross federal land administered by the BLM in southwest Oregon. The Coos Bay District and the Roseburg District-Swiftwater Field Office are managed according to the provisions of the Northwestern and Coastal Oregon RMP (BLM 2016a). The Lakeview District-Klamath Field Office, Medford District and the Roseburg District-South River Field Office are managed according to the provisions of the Southwestern Oregon RMP (BLM 2016b).

FLPMA as amended, and its implementing regulations in Title 43, CFR part 1600 requires all projects on BLM lands, including third-party projects authorized by permits or right of way grants, to be consistent with the RMP of the administrative unit where the project occurs. Where projects would not be consistent with the underlying RMP, the project cannot be implemented unless the RMP is amended to make provision for the project, or the project is modified to be consistent with RMP direction. An RMP does not authorize projects or activities or commit the BLM to act. A plan may constrain the agency from authorizing or carrying out projects and activities, or the manner in which they may occur.

For the Pacific Connector Pipeline Project, the BLM worked cooperatively with the FERC staff, other cooperating agencies, and the Applicant to incorporate BMPs, design features and project requirements which would avoid, minimize, rectify, reduce or eliminate environmental consequences (40 CFR 1502.14(f) and 1508.20(a-d)). The BMPs, design features, or requirements specific to BLM lands are included as attachments to the project proponent's POD. There are 28 appendices in the POD; they include draft monitoring elements to ensure that the actions are implemented. Collectively, the POD is incorporated into the project's description, is summarized in section 2.6.3 of the EIS, and included in appendix F.10.

Given the linear nature of the pipeline corridor, resources on BLM lands and the topography of BLM lands in southwest Oregon it is not possible for the Pacific Connector project to conform to every requirement of the respective BLM RMPs. Pacific Connector has cooperated with the BLM to make its proposal consistent with the BLM RMPs as much as is feasible, but even with route adjustments, modified project design features, and BMPs, the proposed right-of-way for the Project on BLM-managed lands would not conform to the Southwestern Oregon RMP and the Northwestern and Coastal RMP (RMPs for Western Oregon). Amendment of these RMPs would be necessary to make provision for the project to allow it to proceed.

The RMPs for Western Oregon allow for the construction of linear rights-of-way within the LSR "as long as northern Spotted Owl (NSO) nesting-roosting habitat continues to support nesting and roosting at the stand level, and NSO dispersal habitat continues to support movement and survival at the landscape level," and construction of linear rights-of-way "as long as the occupied stand continues to support MAMU nesting" (Southwestern Oregon ROD page 71, Northwestern and Coastal ROD, page 65). BLM staff initially evaluated that the proposed right-of-way would cross approximately 268 acres of LSR and approximately 116 acres of known or presumed occupied MAMU habitat and/or NSO nesting-roosting habitat within the LSR land allocation. Additional analysis concluded that the clearing and removal of vegetation required within the LSR for the proposed Project would result in the loss of stand-level NSO nesting and roosting habitat and MAMU nesting habitat in the project corridor.

BLM management direction in the RMPs for Western Oregon specific to wildlife prohibits activities that "disrupt MAMU nesting at occupied sites... within all land use allocations within 35 miles of the Pacific Coast and within reserved land use allocation between 35-50 miles of the Pacific Coast" (Southwestern Oregon ROD, page 118, Northwestern and Coastal ROD, page 98). BLM staff concluded that construction of the Project would likely result in disruption of MAMU nesting at some occupied sites within these two discrete geographic ranges.

In order to consider the Right-of-Way Grant, the BLM must address these inconsistencies by amending the affected RMPs to make provisions for the Pacific Connector project. BLM therefore proposes to amend the RMPs to re-allocate all lands within the proposed temporary use area and right-of-way to a District-Designated Reserve, with management direction to manage said lands for the purposes of the Pacific Connector Gas Pipeline right-of-way. Approximately 868 acres would be re-allocated from existing land allocations in the affected RMPs to the District Designated Reserves (see table 4.7.3.3-3).

District-Designated Reserve is an existing land use allocation in both the Northwestern and Coastal Oregon RMP and the Southwestern Oregon RMP. Under these RMPs, District-Designated Reserves encompass a wide variety of lands, including constructed facilities, infrastructure, roads, communication sites, seed orchards, quarries, lands biologically or physically unsuitable for timber production, Areas of Critical Environmental Concern, and lands managed for their wilderness characteristics. District-Designated Reserves are reserved from sustained-yield timber production in order to manage them for another set of specific values and resources. Within the District-Designated Reserve, the BLM would maintain the values and resources necessary for construction, operation, maintenance, and decommissioning of the proposed Pacific Connector project.

Specifically, BLM proposes to add the following text to the RMPs for Western Oregon (BLM 2016a:59, BLM 2016b:57):

District-Designated Reserve – Pacific Connector Gas Pipeline

Management Objectives

- See *District-Designated Reserves management objectives.*
- Maintain the values and resources for which the BLM has granted the right-of-way for the Pacific Connector Gas Pipeline Project.

Management Direction

- Allow the construction, operation, maintenance, and decommissioning of the Pacific Gas Connector Pipeline, notwithstanding the restrictions and requirements of management direction described for resource programs.

District-Designated Reserve allocations establish specific management for a specific use or to protect specific values and resources. The project-specific amendment would not change RMP requirements for other projects or authorize any other actions within the *District-Designated Reserve – Pacific Connector Gas Pipeline*. Other uses that are compatible with the purpose of the District-Designated Reserve may be authorized on a case-by-case basis following completion of environmental analysis. The environmental consequences of this proposed amendment are the same as the environmental consequences of construction and operation of the Pacific Connector project and are discussed at length elsewhere in this EIS.

Therefore, the resource impacts of the proposed plan amendments are those associated with construction, operation, maintenance and decommissioning of the proposed pipeline. With this amendment, the granting of a right-of-way on BLM-managed lands for the Pacific Connector Project would conform to the Southwestern Oregon Record of Decision and Resource Management Plan (BLM 2016b) and the Northwestern and Coastal Oregon ROD and RMP (BLM 2016a).

Amendments to Forest Service Land and Resource Management Plans

This section summarizes EIS appendix F.2 (Forest Service Forest Plan Amendments and Compensatory Mitigation), which contains the full text of the independent Forest Service analysis. Reviewers who seek additional information should review the applicable sections in appendix F.2. Section numbers that refer to sections in the appendix are so noted.

The Forest Service amendment process is described in section 1.3.3 of this EIS and in section 1.1 of appendix F.2. The proposed amendments to Forest Service LRMPs are described in section 2.1.3.2 of this EIS and in section 2 of appendix F.2. The Forest Service compensatory mitigation plans are discussed in sections 1.3.3 and 2.1.5 of this EIS and throughout appendix F.2. The proposed Forest Plan amendments and related compensatory mitigation evaluated in this section are unique for each national forest and are addressed separately in the following sections.

<u>Evaluation of Umpqua National Forest Proposed Forest Plan Amendments</u>

The proposed Pacific Connector pipeline incorporates the most up-to-date engineering and technological practices for pipeline construction and operation. However, even with following these practices, it has been determined that one Forest Plan standard associated with rare and/or isolated species (Survey and Manage), and two Forest Plan standards associated with the soil, water, and riparian resources, would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Umpqua National Forest LRMP[170] as amended by the NWFP and the January 2001 Record of Decision for Amendments to the Survey and Manage Protection Buffer, and Other Mitigation Measures Standards and Guidelines (Survey and Manage ROD). One additional amendment proposes to reallocate acres from the Matrix land allocation to the LSR land allocation.

[170] In the draft EIS, there was a third proposed amendment related to riparian resources (UNF-2) that would have amended a standard that stated “Utility/transportation corridors, roads or transmission lines may cross but must not parallel streams and lake shores within the riparian unit”. The reroute of the pipeline in the East Fork Cow Creek eliminated the parallel alignment and therefore the amendment is no longer needed (see EIS section 3.4.2.8).

Forest Plan Amendments Related to Rare Aquatic and Terrestrial Plant and Animal Communities (FS-1, UNF-4):

Amendment FS-1: Project-Specific Amendment to Exempt Management Recommendations for Survey and Manage Species on the Umpqua National Forest.

One Forest Plan standard associated with rare and/or isolated species (Survey and Manage) would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Umpqua National Forest LRMP as amended. This standard is:

- Management Direction: Manage All Known Sites (Survey and Manage ROD, Standards and Guidelines Page 8). Current and future known sites will be managed according to the Management Recommendation for the species. Professional judgment, Appendix J2 in the Northwest Forest Plan Final SEIS, and appropriate literature will be used to guide individual site management for those species that do not have Management Recommendations.

The proposed amendment to this standard is:

- Management Direction: Manage All Known Sites (Survey and Manage ROD, Standards and Guidelines Page 8). Current and future known sites will be managed according to the Management Recommendation for the species, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Professional judgment, Appendix J2 in the Northwest Forest Plan Final SEIS, and appropriate literature will be used to guide individual site management for those species that do not have Management Recommendations. (Proposed amendment FS-1 on the Umpqua National Forest)

While the amendment would provide an exception to meeting this standard, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore, any effects of the pipeline's construction and operation on Survey and Manage species within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented".

The purpose of this project-level amendment is to make the proposed Pacific Connector pipeline project consistent with the Umpqua National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to this amendment are:

- 36 CFR 219.9(a)(2)(ii) – [the plan must include plan components to maintain or restore] "Rare aquatic and terrestrial plant and animal communities."
- 36 CFR 219.9(b)(1) – "The responsible official shall determine whether or not the plan components required by paragraph (a) provide ecological conditions necessary to: …maintain viable populations of each species of conservation concern within the plan area."

Because the proposed amendment is "directly related" to these two substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendment (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the amendment, it is important to recognize that the applicable sections of 36 CFR 219.9(a) and (b) that are described above, requires plan components to maintain or restore rare aquatic and terrestrial plant and animal communities, across the entire planning area (i.e., the Umpqua National Forest). This plan amendment does not alter these LRMP plan requirements for managing rare plant and animal communities across 99.98 percent of the Umpqua National Forest. The proposed pipeline construction corridor including the temporary extra work areas (TEWAs) and the uncleared storage areas (UCSAs) is approximately 209 acres of the 983,129-acre Umpqua National Forest. Within this 209-acre construction corridor surveys have identified 69 Survey and Manage sites that could be potentially impacted by construction activities. The proposed amendment does not waive the persistence objective for Survey and Manage species. The analysis that was conducted (see section 4.6.4.3 of the EIS and appendix F.5) determined the Survey and Manage persistence objectives would be met. This means that for Umpqua National Forest lands within the project area, individual sites of Survey and Manage species may be impacted or lost to construction activities, but affected species are expected to persist within the range of the NSO despite the loss of these individual sites.

The amendment modifies this standard so that in the 209 acres of the project construction area the project need not be in compliance with this standard' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 209 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the management requirement described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements". The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.9(a) and (b) rule requirements within the "scope and scale" of the proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.9(a) and (b) requirements are being addressed.

How the Required Mitigation Measures would Maintain or Restore Effects to Rare Aquatic and Terrestrial Plant and Animal Communities and Meet the Applicable 36 CFR 219.9(a) and 36 CFR 219.9 (b) Requirements

The Forest Service has worked to inventory, analyze, and evaluate rare aquatic, terrestrial plant and animal communities that could be affected by this project. In addition, a third-party consultant for technical support was also utilized in reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's applicant prepared Plan and Procedures for construction and restoration enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures incorporated into amendments for Survey and Manage species are designed to minimize, maintain or restore the potential for habitat fragmentation, edge effects, and loss of long-term habitats associated with effected species. To ensure adequate restoration and revegetation of the right-of-way, design features are identified in the ECRP (Appendix I of the POD), *Right-of-Way Clearing Plan* (Appendix U of the POD), *Leave Tree Protection Plan* (Appendix P of the POD). In addition, routing considerations were identified during project development to ensure avoidance of known populations of rare plant and animal communities (see section 3.4.2, EIS Route Variations, as well as appendix F.5, *Survey and Manage Persistence Evaluations*, and proposed amendment UNF-4 Reallocation of Matrix Lands to LSR).

As a basis for Survey and Manage determinations, appendix F.5 provides background research on Survey and Manage species that could be affected by the Pacific Connector Project; a review of survey reports prepared by others for the Pacific Connector Project; and processing and analysis of spatial data obtained from the BLM, Forest Service, and other sources over the past 12 years. Background information was used in combination with new information available as a result of surveys for the Pacific Connector Project and recent surveys in other portions of old growth forests to discuss the currently known distribution of the species in old growth forests within the NSO range. Impacts on sites as a result of the Pacific Connector Project were analyzed to determine if the species would continue to have a reasonable assurance of persistence in the NSO range following implementation of the Pacific Connector Project, taking into consideration the status and distribution of the species and general habitat in the NSO range.

Some of the required mitigation measures in the POD sections to protect rare plant and animal communities include: flagging existing snags on the edges of the construction right-of-way or TEWAs where feasible to save from clearing; snags would be saved as and used in LWD placement post-construction to benefit primary and secondary cavity nesting birds, mammals, reptiles, and amphibians; other large diameter trees on the edges of the construction right-of-way and TEWAs would also be flagged to save/protect as green recruitment or habitat/shade trees, where feasible; trees would be girdled to create snags to augment the number of snags along the right-of-way to benefit cavity nesting birds, mammals, reptiles, and amphibians. See Appendices P and U of the POD and section 2.6.3 of the EIS for a complete list of applicable mitigation measures for pipeline construction. Additional measures include low ground weight (pressure) vehicles would be used; logging machinery would be restricted to the 30-foot permanent right-of-way wherever possible to prevent soil compaction; the removal of soil duff layers would be avoided in order to maintain a cushion between the soil and the logs and the logging equipment; designed skid trails would be used to restrict detrimental soil disturbance (compaction and displacement) to a smaller area of the right-of-way over the pipeline trenching area; and the temporary construction area would be restored and revegetated using native seeds, to the extent possible, and saplings (Appendix I of the POD).

In an effort to minimize, maintain or restore the impacts on Survey and Manage species, Pacific Connector adopted route variations to avoid certain species identified in the Survey and Manage Persistence Evaluations by co-locating the proposed construction corridor adjacent to existing roads, through managed timber stands or otherwise avoid unique LSOG habitats to the maximum extent practicable (see section 3.4.2 of this EIS).

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service and BLM are described in the POD (Environmental Briefings and Compliance Plan, Appendix G of the POD) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing right-of-way grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to soil, water and riparian resources, are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the right-of-way grant and agreed upon conditions. The BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

Amendment UNF-4: Reallocation of Matrix Lands to LSR

The other proposed Forest Plan amendment related to rare aquatic and terrestrial plant and animal communities on the Umpqua National Forest is UNF-4. This proposed amendment would change the designation of approximately 585 acres from the Matrix land allocation to the LSR land allocation in Sections 7, 18, and 19, T.32S., R.2W.; and Sections 13 and 24, T.32S., R.3W., W.M., OR. (see figure 2.1-4). This change in land allocation is proposed as mitigation for the potential adverse impact of the Pacific Connector Pipeline Project on LSR 223 on the Umpqua National Forest. This is a plan level amendment that would change future management direction for the lands reallocated from Matrix to LSR (for additional information on consistency with LSR Standards and Guidelines see section 4.7.3.6. and appendix F.3 of the EIS).

The purpose of this amendment is to make the proposed Pacific Connector pipeline project consistent with the Umpqua National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to this amendment are:

- 36 CFR 219.8(a)(1)(i) – [the plan must include plan components to maintain or restore] "Interdependence of terrestrial and aquatic ecosystems in the plan area."
- 36 CFR 219.8(b)(1) – [the plan must include plan components to guide the plan area's contribution to social and economic sustainability] "Social, cultural and economic conditions relevant to the area influenced by the plan."
- 36 CFR219.9(b)(1) "The responsible official shall determine whether or not the plan components required by paragraph (a) of this section provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area,"

- 36 CFR 219.9(a)(2)(ii) – [the plan must include plan components to maintain or restore] "Rare aquatic and terrestrial plant and animal communities."

Because the proposed amendment is "directly related" to these four substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendment (36 CFR 219.13 (b)(5)). However, because this proposed amendment would simply modify the area to which existing direction applies, the existing formatting for the planning requirements listed above would be retained (36 CFR 219.13(b)(4)).

In considering the "scope and scale" of the amendment, it is important to recognize that the applicable sections of 36 CFR 219.8 and 219.9 that are described above, requires plan components to maintain or restore rare aquatic and terrestrial plant and animal communities, and provide for social and economic sustainability across the entire planning area (i.e., the Umpqua National Forest). This plan amendment does not alter these LRMP plan requirements across 99.94 percent of the Umpqua National Forest. The proposed land reallocation is approximately 585 acres of the 983,129-acre Umpqua National Forest. The proposed amendment would benefit rare aquatic and terrestrial plant and animal communities by placing these acres in an LSR where providing habitat for these species is the primary goal.

The timber probable sale quantity (directly related to economic conditions) would not be affected before the Umpqua National Forest LRMP is revised because the Forest has the capacity to maintain probable sale quantity without the acres of matrix lands that would be reallocated to LSR. If a linear relationship between acres and outputs is assumed, the potential effect would be less than two-tenths of one percent of the Forest's probable sale quantity since this proposed amendment would affect less than two-tenths of one percent of the Forest's matrix land base. This proposed amendment would not prevent future vegetation management activities such as thinning that would benefit LSR habitat and could also contribute to the local forest products industry.

How the Compensatory Mitigation Actions would help to Maintain or Restore Rare Aquatic and Terrestrial Plant and Animal Communities in the Plan Area (36 CFR 219.9(a), 36 CFR 219.9 (b)).

In addition to reallocation of 585 acres of Matrix to LSR, the CMP on the Umpqua National Forest includes proposals for stand density fuel breaks on 3,105 acres, stand density management on 816 acres, terrestrial habitat improvements on 478 acres and decommissioning approximately 5 miles of roads that would benefit rare plant and animal communities. The CMP on the Umpqua National Forest also includes proposals to improve aquatic and riparian habitat that would benefit rare aquatic plant and animal communities (see the discussion of *How the Compensatory Mitigation Actions would help to Maintain or Restore the Ecological Integrity of Riparian Areas, Soils, and Soil productivity in the Plan Area (36 CFR 219.8(a)(3)(i), (36 CFR 219.8(a)(2)(ii))* below for a discussion of benefits to aquatic habitats).

Stand density fuel breaks would reduce the threat of losing late-successional habitat to fire. High intensity fire has been identified as the single factor most impacting late successional and old growth forest habitats on federal lands in the area of the NWFP. Construction of the pipeline and associated activities removes both mature and developing stands and would increase fire suppression complexity; however the corridor also provides a fuel break. Fuels reduction adjacent to the corridor would increase the effectiveness of the corridor as a fuel break. Density management would increase longevity of existing mature stands by reducing losses from disease, insects and fire. Stand density management and fuels reduction would lower the risk of loss of developing and existing mature stands and other valuable habitats to high-intensity fire.

Stand density management would enhance LSOG habitat by increasing the growth, health, and vigor of the trees remaining in the stands, and restoring species and structural diversity to those considered characteristic under a natural disturbance regime. Thinning of young stands is a recognized treatment within LSR if designed to accelerate development of late-successional habitat characteristics. The proposed treatments include 228 acres of pre-commercial thinning, 288 acres of commercial thinning and 300 acres of off-site pine removal. The Pacific Connector pipeline would result in additional fragmentation and preclude the recovery of fragmented habitat for those stands adjacent to the pipeline corridor. Both mature stands and developing stands would be removed during pipeline construction. Density management of forested stands would assist in the recovery of late-seral habitat, impact from fragmentation, reduction in edge effects and enhance resilience of mature stands over time. Accelerating development of mature forest characteristics would shorten the impacts of those biological services loss due to pipeline construction.

Terrestrial habitat improvements include proposals for large woody debris placement on 164 acres, snag creation on 324 acres, noxious weed treatments on 6.7 miles of road and 124 acres of Lupine meadow restoration. Large wood replacement would partially mitigate for the barrier effect of the corridor by creating structure across the corridor for use by small wildlife species. Placement in wood deficient areas adjacent to the corridor allows for scattering of stockpiled wood, reducing localized fuel loads while improving habitat in deficient stands. Larger logs maintain moisture longer and are less likely to be fully consumed by fire. Managing for the proposed levels provide for a greater assurance of species abundance. The objective of snag creation is to mitigate for the immediate and future impacts on snag habitat from the clearing of the pipeline right-of-way. The construction and operation of the pipeline project has the potential to create vectors for noxious weeds. The proposed noxious weed treatments are intended to reduce populations of noxious weeds that are in close proximity to the pipeline project right-of-way. The long-term benefits of meadow restoration would include the restoring of native plant populations and species diversity. Restoring native plant communities and increasing vegetation diversity generally contributes to restoring habitat for a broad group of plant and animal species.

Although the Pacific Connector project has been routed to avoid LSOG habitat as much as possible, the project would cause habitat fragmentation within LSR 223. Road decommissioning reduces the edge effects over time by revegetating road surfaces and eliminating road corridors. Revegetating selected roads in conjunction with the density management proposed for adjacent plantations would create larger blocks of late successional habitat in the future.

These projects have been designed by an interdisciplinary team of resource professionals on the Umpqua National Forest with input and coordination with the FWS, NOAA Fisheries, and State agencies. They were planned within the watersheds that would be affected by the Pacific Connector Pipeline Project. They are a component of the Pacific Connector application and would be a requirement of the Right-of-Way Grant. Overall, these projects would help maintain and restore rare aquatic and terrestrial plant and animal communities on the Umpqua National Forest (see tables 2.1.1-3 and 2.1.1-4 and figures 2.1-1 through 2.1-5 in appendix F.2 for additional information).

Forest Plan Amendments Related to Soil, Water and Riparian Areas (UNF-1 and UNF-3):[171]

Two Forest Plan standards associated with the soil, water, and riparian resources would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Umpqua National Forest LRMP. These standards are:

- Standard & Guideline 1 (UNF LRMP IV-33). Maintain all effective shading vegetation on perennial streams. Utilize silvicultural practices to establish shade on perennial streams where currently lacking.
- Standard & Guideline 1 (UNF LRMP IV-67). The combined total amount of unacceptable soil condition (detrimental compaction, displacement, puddling or severely burned) within an activity area (e g., cutting unit, range allotment, site preparation area) should not exceed 20 percent. All roads and landings, unless rehabilitated to natural conditions, are considered to be in detrimental condition, and are included as part of this 20 percent.

The proposed amendments to these standards are:

- Standard & Guideline 1 (UNF LRMP IV-33). Maintain all effective shading vegetation on perennial streams, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector Project design requirements must be implemented. Utilize silvicultural practices to establish shade on perennial streams where currently lacking. (proposed amendment UNF-1)
- Standard and Guideline 1 (UNF LRMP IV-67). The combined total amount of unacceptable soil condition (detrimental compaction, displacement, puddling or severely burned) within an activity area (e.g., cutting unit, range allotment, site preparation area) should not exceed 20 percent. All roads and landings, unless rehabilitated to natural conditions, are considered to be in detrimental condition, and are included as part of this 20 percent, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. (proposed amendment UNF-3)

While the amendments would provide an exception to meeting these standards, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore any effects of the pipeline's construction and operation on the soil, water and riparian resources within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented."

[171] The draft EIS included (UNF-2) that would have amended a standard that stated "Utility/transportation corridors, roads or transmission lines may cross but must not parallel streams and lake shores within the riparian unit". The reroute of the pipeline in the East Fork Cow Creek eliminated the parallel alignment and therefore the amendment is no longer needed (see Final EIS section 3.4.2.8).

The purpose of these two project-level amendments is to make the proposed Pacific Connector pipeline project consistent with the Umpqua National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to these two amendments are:

- 36 CFR 219.8(a)(3)(i) – The plan must include plan components "to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity.
- 36 CFR 219.8(a)(2)(ii) – [The plan must include plan components to maintain or restore] "soils and soil productivity, including guidance to reduce soil erosion and sedimentation."

Because the two proposed amendments are "directly related" to these two substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendments (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the two amendments, it is important to recognize that the applicable sections of 36 CFR 219.8(a) that are described above, requires plan components to "maintain or restore" the soil, water and riparian resources across the entire planning area (i.e., the Umpqua National Forest). These plan amendments do not alter these LRMP plan requirements for managing the soil, water, and riparian resources across 99.98 percent of the Umpqua National Forest. The proposed pipeline construction corridor including the TEWAs and the UCSAs is approximately 209 acres of the 983,129 acre Umpqua National Forest. Of the 209 acres of pipeline corridor construction it is estimated that approximately 3 of these acres would not meet the standards for riparian area management described above and approximately 54 to 127 acres would not meet standards for soils described above.

The amendments modify to standards so that in the 209 acres of the project construction area the project need not be in compliance with these standards' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 209 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the two management requirements described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements". The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.8(a) rule requirements within the "scope and scale" of these proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.8(a) requirements are being addressed.

How the Required Mitigation Measures would Maintain or Restore Effects to Soil, Water, and Riparian Resources and Meet the Applicable 36 CFR 219.8(a) Requirements

The Forest Service has worked with Pacific Connector Gas Pipeline to inventory, analyze, and evaluate the geologic, soil, and hydrologic resources that could be affected by this project. In addition, a third-party consultant for technical support was also utilized in reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's applicant prepared *Plan* and *Procedures* for construction and restoration are enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures, incorporated into amendments for soil, water, and riparian resources are designed to minimize, maintain or restore the potential for soil movement, slope stability, water quality, and to ensure adequate restoration and revegetation. These measures are identified in the ECRP (Appendix I of the POD); *Right-of-Way Clearing Plan* (Appendix U of the POD); *Wetland and Waterbody Crossing Plan* (Appendix BB of the POD); the *Forest Service Site Specific Stream Crossing Prescriptions* (NSR 2014a); the *Stream Crossing Risk Analysis*; and *Stream Crossing Risk Analysis Addendum* (GeoEngineers 2017d, 2018b). Pacific Connector would also follow the FERC's applicant prepared Wetland Procedures and the Best Management Practices for the State of Oregon. To further reduce potential for landslides on steep slopes, the Forest Service, BLM, and FERC are also recommending additional industry best management practices and measures identified from the *Technical Report on Soil Risk and Sensitivity Assessment* (NSR 2014c) be incorporated into Pacific Connector's terms and conditions of the Right-of-Way Grant as described in the POD's identified above. See 4.2.3.3 of the EIS for a description of soil risk and sensitivity assessment.

Areas with soils rated moderate to very high for risk or sensitivity (39 acres total) would be recommended for more site-specific validation of the risk criteria used in the *Technical Report on Soil Risk and Sensitivity Assessment* (NSR 2014c) to confirm that specific locations merit consideration of the more aggressive soil remediation measures, such as: a 2- to 3-inch organic mulch surface application (80 percent coverage) of woodchips, logging slash, and/or straw; adaptive seed mixes and vegetation to better fit site conditions; deep subsoil decompaction with hydraulic excavators that leave constructed corridor mounded and rough with maximum water infiltration so that water cannot flow downhill for any appreciable distance; more aggressive use of constructed surface water runoff dispersion structures such as closely placed and more pronounced slope dips and water bars, etc.; more aggressive use of constructed surface runoff entrapments such as silt fencing, sediment settling basins, or straw bale structures, etc.; more aggressive placement (100 percent coverage) and depth (3 to 4 inches) of ground cover using woodchips, logging slash, straw bales, wattles (see Appendices U and I of the POD). In efforts to protect soil productivity, topsoil segregation would be required for pipeline construction at wetland and waterbody crossings on NFS lands (Appendix U of the POD).

Some of the required mitigation measures in Appendix BB of the POD and *Forest Service Site Specific Stream Crossing Prescriptions* (NSR 2014a) to protect wetlands and minimize, maintain or restore compaction include: limiting the construction right-of-way width to 75 feet through wetlands; placing equipment on mats; using low-pressure ground equipment; limiting equipment operation and construction traffic along the right-of-way; locating TEWAs more than 50 feet away from wetland boundaries; cutting vegetation at ground level; limiting stump removal to the construction trench; segregating the top 12 inches of soil, or to the depth of the topsoil horizon; using "push-pull" techniques in saturated wetlands; limiting the amount of time that the trench is open by not trenching until the pipe is assembled and ready for installation; not using imported rock and soils for backfill; and not using fertilizer, lime, or mulch during restoration in wetlands. Pacific Connector must also follow the FERC *Procedures*. See 4.3.3.2 of the EIS for a complete list of applicable mitigation measures for pipeline construction at specific waterbody and stream crossings.

In an effort to minimize, maintain or restore the impacts on streams and riparian areas, Pacific Connector adopted route variations to co-locate the proposed construction corridor adjacent to existing roads and along dry ridge tops (see section 3.4.2, EIS). In addition, Pacific Connector has committed to limit construction at waterbody crossings to times of dry weather or low water flow. Pacific Connector would implement the required erosion control measures at the proposed stream crossings to minimize, maintain or restore potential erosion and sedimentation impacts. The applicable mitigation measures and monitoring requirements in the POD relating to water waterbody crossings are included in the *Site Specific Forest Service Stream Crossing Prescriptions* (NSR 2014a), and *Wetland and Waterbody Crossing Plan* (Appendix BB of the POD). In addition, applicable mitigation measures from the FERC approved applicant prepared Procedures for Wetland and Waterbody Crossings would be required.

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to: facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service, and BLM are described in the POD (*Environmental Briefings and Compliance Plan*, Appendix G) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing Right-of-Way Grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to soil, water and riparian resources, are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the right-of-way grant and agreed upon conditions. BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

How the Compensatory Mitigation Actions would help to Maintain or Restore the Ecological Integrity of Riparian Areas, Soils, and Soil productivity in the Plan Area (36 CFR 219.8(a)(3)(i), (36 CFR 219.8(a)(2)(ii)).

Part of the CMP on the Umpqua National Forest includes proposals to remove eleven old culverts that may block fish passage either by poor design or by failure over time, decommission approximately 7.2 miles and storm proof approximately 11.4 miles of road.

Removing culverts that block fish passage and replacing them with fish-friendly designs can allow fish and other aquatic organisms to access previously unavailable habitat. Stream crossing replacement would directly improve stream connectivity and habitat for aquatic species by immediately restoring access to formerly inaccessible habitats. Indirectly, these projects would reduce potential sediment levels in the long term by decreasing the potential for road failure. Stream crossing projects also reduce stream velocities by increasing stream crossing sizes, eliminating flow restrictions and allowing passage to additional reaches of habitat by removing barriers to aquatic species which improves access to spawning and rearing habitat and allows unrestricted movement throughout stream reaches during seasonal changes in water levels (Hoffman and Dunham 2007).

Decommissioning and storm proofing roads can substantially reduce sediment delivery to streams (Madej 2000; Keppeler et al. 2007). Proposed road decommissioning and storm proofing would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the Project would occur. Decommissioning roads would restore natural drainage patterns and thereby avoid large volumes of added sediment to the stream network that would be likely to eventually occur. In addition limited road maintenance dollars could be focused on the remaining road systems resulting in more maintenance of culverts and ditchlines resulting in less potential for catastrophic failure. Madej (2000) concluded that by eliminating the risk of stream diversions and culvert failures, road removal treatments significantly reduce long-term sediment production from retired logging roads.

These projects have been designed by an interdisciplinary team of resource professionals on the Umpqua National Forest with input and coordination with the FWS, NMFS, and State agencies. They were planned within the watersheds that would be affected by the Pacific Connector pipeline project. They are a component of the Pacific Connector application and would be a requirement of the Right-of-Way Grant. Overall, these projects would help maintain and restore riparian and soil resources on the Umpqua National Forest (see tables 2.1.1-3 and 2.1.1-4 and figures 2.1-1 through 2.1-5 in appendix F.2 for additional information).

Evaluation of Rogue River National Forest Proposed Forest Plan Amendments

The proposed Pacific Connector pipeline incorporates the most up-to-date engineering and technological practices for pipeline construction and operation. However, even with following these practices, it has been determined that one Forest Plan standard associated with rare and/or isolated species (Survey and Manage), two Forest Plan standards associated with the soil, water, and riparian resources, and three Forest Plan standards associated with visual resources[172] would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Rogue River National Forest LRMP as amended by the NWFP and the January 2001 Survey and Manage ROD.

[172] In the draft EIS, there was a fourth amendment for visual resources (RRNF-3) that addressed visual guidelines for the Pacific Crest Trail. The new crossing of the Pacific Crest Trail on an existing road has eliminated the need for this amendment (see section 3.4.2.9 of the FEIS).

Forest Plan Amendments Related to Rare Aquatic and Terrestrial Plant and Animal Communities (FS-1, RRNF-7):

Amendment FS-1: Project-Specific Amendment to Exempt Management Recommendations for Survey and Manage Species on the Rogue River National Forest.

One Forest Plan standard associated with rare and/or isolated species (Survey and Manage) would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Rogue River National Forest LRMP as amended by the NWFP and the January 2001 Survey and Manage ROD. This standard is:

- Management Direction: Manage All Known Sites (Survey and Manage ROD, Standards and Guidelines Page 8). Current and future known sites will be managed according to the Management Recommendation for the species. Professional judgment, Appendix J2 in the Northwest Forest Plan Final SEIS, and appropriate literature will be used to guide individual site management for those species that do not have Management Recommendations.

The proposed amendment to this standard is:

- Management Direction: Manage All Known Sites (Survey and Manage ROD, Standards and Guidelines Page 8). Current and future known sites will be managed according to the Management Recommendation for the species, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Professional judgment, Appendix J2 in the Northwest Forest Plan Final SEIS, and appropriate literature will be used to guide individual site management for those species that do not have Management Recommendations. (Proposed amendment FS-1 on the Rogue River National Forest)

While the amendment would provide an exception to meeting this standard, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore any effects of the pipeline's construction and operation on Survey and Manage species within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented".

The purpose of this project-level amendment is to make the proposed Pacific Connector pipeline project consistent with the Rogue River National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to this amendment are:

- 36 CFR 219.9(a)(2)(ii) – [the plan must include plan components to maintain or restore] "Rare aquatic and terrestrial plant and animal communities."
- 36 CFR 219.9(b)(1) – "The responsible official shall determine whether or not the plan components required by paragraph (a) provide ecological conditions necessary to: …maintain viable populations of each species of conservation concern within the plan area."

Because the proposed amendment is "directly related" to these two substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendment (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the amendment, it is important to recognize that the applicable sections of 36 CFR 219.9(a) and (b) that are described above, requires plan components to maintain or restore rare aquatic and terrestrial plant and animal communities, across the entire planning area (i.e., the Rogue River National Forest). This plan amendment does not alter these LRMP plan requirements for managing rare plant and animal communities across 99.95 percent of the Rogue River National Forest. The proposed pipeline construction corridor including the TEWAs and the UCSAs is approximately 281 acres of the 628,443-acre Rogue River National Forest. Within this 281-acre construction corridor, surveys have identified 90 Survey and Manage sites that could be potentially impacted by construction activities. The proposed amendment does not waive the persistence objective for Survey and Manage species. The analysis that was conducted (see section 4.6.4.3 of the EIS and appendix F.5) determined the Survey and Manage persistence objectives would be met. This means that for Rogue River National Forest lands within the project area, individual sites of Survey and Manage species may be impacted or lost to construction activities, but affected species are expected to persist within the range of the NSO despite the loss of these individual sites.

The amendment modifies this standard so that in the 281 acres of the Project construction area the project need not be in compliance with this standard' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 281 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the management requirement described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements." The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.9(a) and (b) rule requirements within the "scope and scale" of the proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.9(a) and (b) requirements are being addressed.

How the Required Mitigation Measures would Maintain or Restore Effects to Rare Aquatic and Terrestrial Plant and Animal Communities and Meet the Applicable 36 CFR 219.9(a) and 36 CFR 219.9 (b) Requirements

The Forest Service has worked to inventory, analyze, and evaluate rare aquatic, terrestrial plant and animal communities that could be affected by this project. In addition, a third-party consultant for technical support was also utilized in reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's applicant prepared Plan and Procedures for construction and restoration enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures incorporated into amendments for Survey and Manage species are designed to minimize, maintain or restore the potential for habitat fragmentation, edge effects, and loss of long-term habitats associated with effected species. To ensure adequate restoration and revegetation of the right-of-way, design features are identified in the ECRP (Appendix I of the POD), *Right-of-Way Clearing Plan* (Appendix U of the POD), and *Leave Tree Protection Plan* (Appendix P of the POD). In addition, routing considerations were identified during project development to ensure avoidance of known populations of rare plant and animal communities (see section 3.4.2, EIS). As well as appendix F.5, *Survey and Manage Persistence Evaluations*, and proposed amendment RRNF-7 Reallocation of Matrix Lands to LSR.

As a basis for Survey and Manage determinations, appendix F.5 provides background research on Survey and Manage species that could be affected by the Pacific Connector Project; a review of survey reports prepared by others for the Pacific Connector Project; and processing and analysis of spatial data obtained from the BLM, Forest Service, and other sources over the past 12 years. Background information was used in combination with new information available as a result of surveys for the Pacific Connector Project and recent surveys in other portions of old growth forests to discuss the currently known distribution of the species in old growth forests within the NSO range. Impacts on sites as a result of the Pacific Connector Project were analyzed to determine if the species would continue to have a reasonable assurance of persistence in the NSO range following implementation of the Pacific Connector Project, taking into consideration the status and distribution of the species and general habitat in the NSO range.

Some of the required mitigation measures in the POD sections to protect rare plant and animal communities include: flagging existing snags on the edges of the construction right-of-way or TEWAs where feasible to save from clearing; snags would be saved as and used in LWD placement post-construction to benefit primary and secondary cavity nesting birds, mammals, reptiles, and amphibians; other large diameter trees on the edges of the construction right-of-way and TEWAs would also be flagged to save/protect as green recruitment or habitat/shade trees, where feasible; trees would be girdled to create snags to augment the number of snags along the right-of-way to benefit cavity nesting birds, mammals, reptiles, and amphibians. See Appendices P and U of the POD and section 2.6.3 of the EIS for a complete list of applicable mitigation measures for pipeline construction. Additional measures include low ground weight (pressure) vehicles would be used; logging machinery would be restricted to the 30-foot permanent right-of-way wherever possible to prevent soil compaction; the removal of soil duff layers would be avoided in order to maintain a cushion between the soil and the logs and the logging equipment; designed skid trails would be used to restrict detrimental soil disturbance (compaction and displacement) to a smaller area of the right-of-way over the pipeline trenching area; and the temporary construction area would be restored and revegetated using native seeds, to the extent possible, and saplings (Appendix I of the POD).

In an effort to minimize, maintain or restore the impacts on Survey and Manage species, Pacific Connector adopted route variations to avoid certain species identified in the Survey and Manage Persistence Evaluations by co-locating the proposed construction corridor adjacent to existing roads, through managed timber stands or otherwise avoid unique LSOG habitats to the maximum extent practicable (see section 3.4.2, EIS).

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service and BLM are described in the POD (Environmental Briefings and Compliance Plan, Appendix G of the POD) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing Right-of-Way Grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to soil, water and riparian resources, are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the Right-of-Way Grant and agreed upon conditions. The BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

Amendment RRNF-7: Reallocation of Matrix Lands to LSR

The other proposed Forest Plan amendment related to rare aquatic and terrestrial plant and animal communities on the Rogue River National Forest is RRNF-7. This proposed amendment would change the designation of approximately 522 acres from the Matrix land allocation to the LSR land allocation in Section 32, T.36S., R.4E. W.M., OR (see figure 2.2-1). This change in land allocation is proposed as mitigation for the potential adverse impact of the Pacific Connector Pipeline Project on LSR 227 on the Rogue River National Forest. This is a plan-level amendment that would change future management direction for the lands reallocated from Matrix to LSR (for additional information on consistency with LSR Standards and Guidelines see section 4.7.3.6. and appendix F.3 of the EIS).

The purpose of this amendment is to make the proposed Pacific Connector pipeline project consistent with the Rogue River National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to this amendment are:

- 36 CFR 219.8(a)(1)(i) – [the plan must include plan components to maintain or restore] "Interdependence of terrestrial and aquatic ecosystems in the plan area."
- 36 CFR 219.8(b)(1) – [the plan must include plan components to guide the plan area's contribution to social and economic sustainability] "Social, cultural and economic conditions relevant to the area influenced by the plan."
- 36 CFR219.9(b)(1) "The responsible official shall determine whether or not the plan components required by paragraph (a) of this section provide the ecological conditions necessary to: contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern within the plan area,"

- 36 CFR 219.9(a)(2)(ii) – [the plan must include plan components to maintain or restore] "Rare aquatic and terrestrial plant and animal communities."

Because the proposed amendment is "directly related" to these four substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendment (36 CFR 219.13 (b)(5)). However, because this proposed amendment would simply modify the area to which existing direction applies, the existing formatting for the planning requirements listed above would be retained (36 CFR 219.13(b)(4)).

In considering the "scope and scale" of the amendment, it is important to recognize that the applicable sections of 36 CFR 219.8 and 219.9 that are described above, requires plan components to maintain or restore rare aquatic and terrestrial plant and animal communities, and provide for social and economic sustainability across the entire planning area (i.e., the Rogue River National Forest). This plan amendment does not alter these LRMP plan requirements across 99.92 percent of the Rogue River National Forest. The proposed land reallocation is approximately 522 acres of the 628,443 acre Rogue River National Forest. The proposed amendment would benefit rare aquatic and terrestrial plant and animal communities by placing these acres in a late successional reserve where providing habitat for these species is the primary goal.

The timber probable sale quantity (directly related to economic conditions) would not be affected before the Rogue River National Forest LRMP is revised because the Forest has the capacity to maintain probable sale quantity without the acres of matrix lands that would be reallocated to LSR. If a linear relationship between acres and outputs is assumed, the potential effect would be less than one-half of one percent of the Forest's probable sale quantity since this proposed amendment would affect less than one-half of one percent of the Forest's matrix land base. This proposed amendment would not prevent future vegetation management activities such as thinning that would benefit LSR habitat and could also contribute to the local forest products industry.

How the Compensatory Mitigation Actions would help to Maintain or Restore Rare Aquatic and Terrestrial Plant and Animal Communities in the Plan Area (36 CFR 219.9(a), 36 CFR 219.9 (b)).

In addition to the reallocation of 522 acres of Matrix to LSR, the CMP on the Rogue River National Forest includes proposals for stand density management on 618 acres, terrestrial habitat improvements on 1,153 acres and decommissioning approximately 57.5 miles of roads that would benefit rare plant and animal communities. The CMP on the Rogue River National Forest also includes proposals to improve aquatic and riparian habitat that would benefit rare aquatic plant and animal communities (see the discussion of **How the Compensatory Mitigation Actions would help to Maintain or Restore the Ecological Integrity of Riparian Areas, Soils, and Soil productivity in the Plan Area (36 CFR 219.8(a)(3)(i), (36 CFR 219.8(a)(2)(ii))** below for a discussion of benefits to aquatic habitats).

Stand density management would enhance LSOG habitat by increasing the growth, health, and vigor of the trees remaining in the stands, and restoring species and structural diversity to those considered characteristic under a natural disturbance regime. Thinning of young stands is a recognized treatment within LSR if designed to accelerate development of late-successional habitat characteristics. The proposed treatments include 618 acres of pre-commercial thinning. The Pacific Connector pipeline would result in additional fragmentation and preclude the recovery of fragmented habitat for those stands adjacent to the pipeline corridor. Both mature stands and developing stands would be removed during pipeline construction. Density management of forested stands would assist in the recovery of late-seral habitat, impact from fragmentation, reduction in edge effects and enhance resilience of mature stands over time. Accelerating development of mature forest characteristics would shorten the impacts of those biological services loss due to pipeline construction.

Terrestrial habitat improvements include proposals for large woody debris placement on 511 acres, snag creation on 622 acres, and 20 acres of habitat planting for the Mardon Skipper butterfly. Large wood replacement would partially mitigate for the barrier effect of the corridor by creating structure across the corridor for use by small wildlife species. Placement in wood deficient areas adjacent to the corridor allows for scattering of stockpiled wood, reducing localized fuel loads while improving habitat in deficient stands. Larger logs maintain moisture longer and are less likely to be fully consumed by fire. Managing for the proposed levels provide for a greater assurance of species abundance. The objective of snag creation is to mitigate for the immediate and future impacts on snag habitat from the clearing of the pipeline right-of-way. The Dead Indian Plateau region is one of four known sites for Mardon Skipper butterflies in the world. It is also adjacent to a known site for Short-horned grasshoppers. Both of these species are on the Regional Forester's Sensitive Species list. As a long-term opening, the pipeline corridor would provide a unique opportunity to develop habitat for these two species. Planting the corridor with plants preferred by these species has the potential to increase the habitat and local range for both species. This action would provide both short-term and long-term habitat for the local population of Mardon Skipper butterflies and short-horned grasshoppers.

Although the Pacific Connector project has been routed to avoid LSOG habitat as much as possible, the project would cause habitat fragmentation within LSR 227. Road decommissioning reduces the edge effects over time by revegetating road surfaces and eliminating road corridors. Revegetating selected roads in conjunction with the density management proposed for adjacent plantations would create larger blocks of late successional habitat in the future.

These projects have been designed by an interdisciplinary team of resource professionals on the Rogue River National Forest with input and coordination with the FWS, NMFS, and State agencies. They were planned within the watersheds that would be affected by the Pacific Connector pipeline project. They are a component of the Pacific Connector application and would be a requirement of the Right-of-Way Grant. Overall, these projects would help maintain and restore rare aquatic and terrestrial plant and animal communities on the Rogue River National Forest (see tables 2.2.1-3 and 2.2.1-4 and figures 2.2-1 and 2.2-2 in appendix F.2 for additional information).

Forest Plan Amendments Related to Soil, Water and Riparian Areas (RRNF -5, RRNF-6):

Two Forest Plan standards associated with the soil, water, and riparian resources would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Rogue River National Forest LRMP. These standards are:

- Management Prescription 26 Restricted Riparian Standard & Guidelines for Facilities (10), (RRNF LRMP 4-308). Helispots and transmission corridors should be located outside this management area.

- Standard & Guideline for Soils (3) (RRNF LRMP 4-41, 4-83, 4-97, 4-123, 4-177, 4-307). No more than 10 percent of an activity area should be compacted, puddled or displaced upon completion of project (not including permanent roads or landings). No more than 20 percent of the area should be displaced or compacted under circumstances resulting from previous management practices, including roads and landings. Permanent recreation facilities or other permanent facilities are exempt.

The proposed amendments to these standards are:

- Management Prescription 26 Restricted Riparian Standard & Guidelines for Facilities (10), (RRNF LRMP 4-308). Helispots and transmission corridors should be located outside this management area, **with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented**. (Proposed amendment RRNF-5)
- Standard & Guideline for Soils (3) (RRNF LRMP 4-41, 4-83, 4-97, 4-123, 4-177, 4-307). No more than 10 percent of an activity area should be compacted, puddled or displaced upon completion of project (not including permanent roads or landings). No more than 20 percent of the area should be displaced or compacted under circumstances resulting from previous management practices, including roads and landings, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Permanent recreation facilities or other permanent facilities are exempt. (Proposed amendment RRNF-6)

While the amendments would provide an exception to meeting these standards, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore any effects of the pipeline's construction and operation on the soil, water and riparian resources within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented".

The purpose of these two project-level amendments is to make the proposed Pacific Connector pipeline project consistent with the Rogue River National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to these three amendments are:

- 36 CFR 219.8(a)(3)(i) – The plan must include plan components "to maintain or restore the ecological integrity of riparian areas in the plan area, including plan components to maintain or restore structure, function, composition, and connectivity
- 36 CFR 219.8(a)(2)(ii) – [The plan must include plan components to maintain or restore] "soils and soil productivity, including guidance to reduce soil erosion and sedimentation."

Because the two proposed amendments are "directly related" to these two substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendments (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the two amendments, it is important to recognize that the applicable sections of 36 CFR 219.8(a) that are described above, requires plan components to "maintain or restore" the soil, water and riparian resources across the entire planning area (i.e., the Rogue River National Forest). These plan amendments do not alter these LRMP plan requirements for managing the soil, water, and riparian resources across 99.95 percent of the Rogue River National Forest. The proposed pipeline construction corridor including the TEWAs and the UCSAs is approximately 281 acres of the 628,443 acre Rogue River National Forest. Of the 281 acres of pipeline corridor construction, it is estimated that approximately 2.5 of these acres would not meet the standards for riparian area management described above and approximately 62 to 144 acres would not meet standards for soils described above.

The amendments modify two standards so that in the 281 acres of the Project construction area the project need not be in compliance with these standards' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 281 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the two management requirements described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements." The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.8(a) rule requirements within the "scope and scale" of these proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.8(a) requirements are being addressed.

How the Required Mitigation Measures would Maintain or Restore Effects to Soil, Water, and Riparian Resources and Meet the Applicable 36 CFR 219.8(a) Requirements.

The Forest Service has worked with Pacific Connector Gas Pipeline to inventory, analyze, and evaluate the geologic, soil, and hydrologic resources that could be affected by this project. In addition, a third-party consultant for technical support was also utilized in reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's applicant prepared Plan and Procedures for construction and restoration are enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures, incorporated into amendments for soil, water, and riparian resources are designed to minimize, maintain or restore the potential for soil movement, slope stability, water quality, and to ensure adequate restoration and revegetation. These measures are identified in: the ECRP (Appendix I of the POD); *Right-of-Way Clearing Plan* (Appendix U of the POD); *Wetland and Waterbody Crossing Plan* (Appendix BB of the POD); the *Forest Service Site Specific Stream Crossing Prescriptions* (NSR 2014a); and the *Stream Crossing Risk Analysis* and *Stream Crossing Risk Analysis Addendum* (GeoEngineers2017d, 2018b). Pacific Connector would also follow the FERC's applicant prepared Wetland Procedures and the Best Management Practices for the State of Oregon. To further reduce potential for landslides on steep slopes, the Forest Service, BLM, and FERC are also recommending additional industry best management practices and measures identified from the *Technical Report on Soil Risk and Sensitivity Assessment* (NSR 2014c) be incorporated into Pacific Connector's terms and conditions of the right-of-way grant as described in the POD's identified above. See section 4.2.3.3 of the EIS for a description of soil risk and sensitivity assessment.

Areas with soils rated moderate to very high for risk or sensitivity (17 acres total) would be recommended for more site-specific validation of the risk criteria used in the *Technical Report on Soil Risk and Sensitivity Assessment* (NSR 2014c) to confirm that specific locations merit consideration of the more aggressive soil remediation measures, such as: a 2- to 3-inch organic mulch surface application (80 percent coverage) of woodchips, logging slash, and/or straw; adaptive seed mixes and vegetation to better fit site conditions; deep subsoil decompaction with hydraulic excavators that leave constructed corridor mounded and rough with maximum water infiltration so that water cannot flow downhill for any appreciable distance; more aggressive use of constructed surface water runoff dispersion structures such as closely placed and more pronounced slope dips and water bars, etc.; more aggressive use of constructed surface runoff entrapments such as silt fencing, sediment settling basins, or straw bale structures, etc.; more aggressive placement (100 percent coverage) and depth (3 to 4 inches) of ground cover using woodchips, logging slash, straw bales, wattles (see Appendices U and I of the POD). In efforts to protect soil productivity, topsoil segregation would be required for pipeline construction at wetland and waterbody crossings on NFS lands (Appendix U of the POD).

Some of the required mitigation measures in Appendix BB of the POD and *Forest Service Site Specific Stream Crossing Prescriptions* (NSR 2014a) to protect wetlands and minimize, maintain or restore compaction include: limiting the construction right-of-way width to 75 feet through wetlands; placing equipment on mats; using low-pressure ground equipment; limiting equipment operation and construction traffic along the right-of-way; locating TEWAs more than 50 feet away from wetland boundaries; cutting vegetation at ground level; limiting stump removal to the construction trench; segregating the top 12 inches of soil, or to the depth of the topsoil horizon; using "push-pull" techniques in saturated wetlands; limiting the amount of time that the trench is open by not trenching until the pipe is assembled and ready for installation; not using imported rock and soils for backfill; and not using fertilizer, lime, or mulch during restoration in wetlands. Pacific Connector must also follow the FERC Waterbody and Wetland Construction and Mitigation Procedures. See 4.3.3.2 of the EIS for a complete list of applicable mitigation measures for pipeline construction at specific waterbody and stream crossings.

In an effort to minimize, maintain or restore the impacts on streams and riparian areas, Pacific Connector adopted route variations to co-locate the proposed construction corridor adjacent to existing roads and along dry ridge tops (see section 3.4.2, EIS). In addition, Pacific Connector has committed to limit construction at waterbody crossings to times of dry weather or low water flow. Pacific Connector would implement the required erosion control measures at the proposed stream crossings to minimize, maintain or restore potential erosion and sedimentation impacts. The applicable mitigation measures and monitoring requirements in the POD relating to water waterbody crossings are included in the *Site Specific Forest Service Stream Crossing Prescriptions* (NSR 2014a) and *Wetland and Waterbody Crossing Plan* (Appendix BB of the POD). In addition, applicable mitigation measures from the FERC approved applicant prepared Procedures for Wetland and Waterbody Crossings would be required.

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to: facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service and BLM are described in the POD (Environmental Briefings and Compliance Plan, Appendix G) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing Right-of-Way Grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to soil, water and riparian resources, are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the Right-of-Way Grant and agreed upon conditions. The BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

How the Compensatory Mitigation Actions would help to Maintain or Restore the Ecological Integrity of Riparian Areas, Soils, and Soil Productivity in the Plan Area (36 CFR 219.8(a)(3)(i), 36 CFR 219.8(a)(2)(ii)).

Part of the CMP on the Rogue River National Forest includes proposals to place LWD in-stream for 1.5 miles, repair stream crossings at 32 sites, and decommission approximately 57.5 miles of road.

Placement of LWD in streams adds structural complexity to aquatic systems by creating pools and riffles, trapping fine sediments and can contribute to reductions in stream temperatures over time (Tippery et al. 2010). Placing LWD in streams affects channel morphology, the routing and storage of water and sediment, and provides structure and complexity to stream systems. Complex pools and side channels created by instream wood provide overwintering habitat to stream salmonids and other aquatic organisms (Solazzi et al. 2000). They also provide cover from predators during summer low flow periods when predation is at its highest. Providing more stream channel structure results in better over wintering habitat, improved summer pool habitat, and more abundant spawning gravels.

Restoring stream crossings reconnects aquatic habitats by allowing the passage of aquatic biota and restoring riparian vegetation. Stream crossing replacement would directly improve stream connectivity and habitat for aquatic species by immediately restoring access to formerly inaccessible habitats. Indirectly, these projects would reduce potential sediment levels in the long term by decreasing the potential for road failure. Stream crossing projects also reduce stream velocities by increasing stream crossing sizes, eliminating flow restrictions and allowing passage to additional reaches of habitat by removing barriers to aquatic species which improves access to spawning and rearing habitat and allows unrestricted movement throughout stream reaches during seasonal changes in water levels (Hoffman and Dunham 2007).

Decommissioning roads can substantially reduce sediment delivery to streams (Madej 2000; Keppeler et al. 2007). Proposed road decommissioning and stormproofing would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the Project would occur. Decommissioning roads would restore natural drainage patterns and thereby avoid large volumes of added sediment to the stream network that would be likely to eventually occur. In addition limited road maintenance dollars could be focused on the remaining road systems resulting in more maintenance of culverts and ditchlines resulting in less potential for catastrophic failure. Madej (2000) concluded that by eliminating the risk of stream diversions and culvert failures, road removal treatments significantly reduce long-term sediment production from retired logging roads.

These projects have been designed by an interdisciplinary team of resource professionals on the Rogue River National Forest with input and coordination with the FWS, NMFS, and State agencies. They were planned within the watersheds that would be affected by the Pacific Connector pipeline project. They are a component of the Pacific Connector application and would be a requirement of the Right-of-Way Grant. Overall, these projects would help maintain and restore riparian and soil resources on the Rogue River National Forest (see tables 2.2.1-3 and 2.2.1-4 and figures 2.2-1 and 2.2-2 in appendix F.2 for additional information).

Forest Plan Amendments Related Visual Resources (RRNF -2, RRNF-4):

Two Forest Plan standards associated with visual resources would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Rogue River National Forest LRMP.[173] These standards are:

- Management Strategy 6, Foreground Retention, Standard and Guideline (1) (RRNF LRMP 4-72). Manage the area for Retention Visual Quality Objective. Catastrophic occurrences may dictate a need for short term departure from Retention. Assess the impacts on visual resources in all project environmental analysis. Specifically address how the visual quality objective will be met.
- Management Strategy 9, Middle Ground Partial Retention, Standard and Guideline (1), (RRNF LRMP, 4-112). Manage the area for Partial Retention Visual Quality Objective. Catastrophic occurrences may dictate a need for short-term departure from Partial Retention Visual Quality Objective. Blend and shape regeneration openings with the natural terrain to the extent possible. Assess the impacts on visual resources in all project environmental analysis. Specifically address how the visual quality objective will be met.

The proposed amendments to these standards are:

- Management Strategy 6, Foreground Retention, Standard and Guideline (1), (RRNF LRMP 4-72). Manage the area for Retention Visual Quality Objective (VQO), with the exception of the Pacific Connector Pipeline right-of-way, where the VQO would be

[173] In the draft EIS, there were two additional modifications associated with the visual guidelines for the Pacific Crest Trail (RRNF-3). The new crossing of the Pacific Crest Trail on an existing road has eliminated the need for this amendment (see section 3.4.2.9 of the Final EIS).

amended to Foreground Partial Retention where the pipeline would cross the Big Elk Road. The applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Catastrophic occurrences may dictate a need for short term departure from Retention. Assess the impacts on visual resources in all project environmental analysis. Specifically address how the visual quality objective will be met. (Proposed amendment RRNF-2)

- Management Strategy 7, Foreground Partial Retention, Standard and Guideline (4), (RRNF LRMP 4-86). Correct unacceptable form, line, color or texture as a result of management activities either during the operation or within two years after completion of the activity, with the exception of the Pacific Connector Pipeline right-of-way which shall attain the amended VQO within 10 - 15 years after completion of the construction phase of the project where the pipeline crosses the Big Elk Road. The applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. (Proposed amendment RRNF-2)
- Management Strategy 9, Middle Ground Partial Retention, Standard and Guideline (1), (RRNF LRMP, 4-112). Manage the area for Partial Retention Visual Quality Objective, with the exception of the Pacific Connector Pipeline right-of-way which shall attain the VQO within 10 - 15 years after completion of the construction phase of the project where the pipeline is adjacent to Highway 140.[174] The applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Catastrophic occurrences may dictate a need for short-term departure from Partial Retention Visual Quality Objective. Blend and shape regeneration openings with the natural terrain to the extent possible. Assess the impacts on visual resources in all project environmental analysis. Specifically address how the visual quality objective will be met. (Proposed amendment RRNF-4)

While the amendments would provide an exception to meeting these standards, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore any effects of the pipeline's construction and operation on the visual resources within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented."

The purpose of these two project-level amendments is to make the proposed Pacific Connector pipeline project consistent with the Rogue River National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to these two amendments are:

- 36 CFR 219.10(a)(1) – […the responsible official shall consider: …] "(1) Aesthetic values,… scenery,... viewsheds...".
- 36 CFR 219.10(b)(i) – [the responsible official shall consider] "Sustainable recreation; including recreation settings, opportunities,…and scenic character…"

[174] Duration of impact specifications are found in the National Forest Landscape Management Handbook 462 (USDA Forest Service 1974). The recommended duration to meet standards for Middleground Partial Retention is 3 years (see Rogue River National Forest LRMP Final EIS p. III-119).

Because the proposed amendments are "directly related" to these two substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendments (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the two amendments, it is important to recognize that the applicable sections of 36 CFR 219.10 that are described above, requires plan components to provide for aesthetic values and scenic character across the entire planning area (i.e., the Rogue River National Forest). These plan amendments do not alter these LRMP plan requirements for managing visual resources across 99.99 percent of the Rogue River National Forest. The proposed pipeline construction corridor including the TEWAs and the UCSAs is approximately 281 acres of the 628,443 acre Rogue River National Forest. Of the 281 acres of pipeline corridor construction it is estimated that approximately 14 of these acres would not meet the standards for visual resources described above.

The amendments modify three standards so that in the 281 acres of the project construction area the project need not be in compliance with these standards' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 281 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the two management requirements described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements." The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.10 rule requirements within the "scope and scale" of these proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.10 requirements are being addressed.

How the Required Mitigation Measures would Consider, Minimize, Maintain or Restore Effects to Aesthetic Values and Scenic Character and Meet the Applicable 36 CFR 219.10(a) and 36 CFR 219.10(b) Requirements.

The Forest Service has worked to inventory, analyze, and evaluate visual resources, view sheds, and aesthetics that could be affected by this project. Forest Service landscape architect provided technical support to FERC and Forest Service third-party contractors by reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's applicant prepared Plan and Procedures for construction and restoration enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures incorporated into amendments for Visual Quality Objectives, are designed to minimize, maintain or restore the potential for long-term impacts on visually sensitive areas. To ensure adequate restoration and revegetation of the right-of-way, design features are identified in the ECRP (Appendix I of the POD), *Right-of-Way Clearing Plan* (Appendix U of the POD), *Leave Tree Protection Plan* (Appendix P of the POD), *Aesthetics Management Plan* (Appendix A of the POD), and *Recreation Management Plan* (Appendix S of the POD).

A visual assessment was conducted to determine the potential effects on visual resources associated with the pipeline. Representative viewpoint points (also referred to as KOPs) were identified within the view shed for the pipeline, defined as the area from which the pipeline would be potentially visible. Photographs of existing visual conditions were used in preparing computerized visual simulations for each KOP. Because the appearance of the pipeline right-of-way would change with time, a series of simulations were prepared to illustrate how the pipeline right-of-way would look at different timeframes following construction. These KOPs would also serve as monitoring points for mitigation.

Pacific Connector produced POD A that outlined measures to reduce visual impacts along its pipeline route. To the extent feasible, Pacific Connector would use revegetation efforts to shape and blend the pipeline easement, enhance the setting, and mimic the natural features of the landscape. These measures would consist of revegetating all disturbed areas and replanting trees in TEWAs and any other areas of the temporary construction right-of-way that were forested prior to construction (see Appendix I of the POD).

On Forest Service lands, Pacific Connector would maintain a cleared 30-foot width centered over the pipe allowing the remainder of the permanent easement to be reforested. This allows trees to naturally reestablish along the edges of the permanent easement at a staggered, more natural-looking interval. Replacing slash in forested areas of the right-of-way during restoration activities would immediately affect the visual contrast in color and texture of the disturbed right-of-way areas. Over time, as the right-of-way revegetates and narrows in width and changes in form, texture and color, potential visual impacts would diminish.

Additionally, a row, or if necessary, clusters of trees and/or shrubs would be planted across the right-of-way to provide visual screens at key road and trail crossings in sensitive view sheds. For all revegetation practices, Pacific Connector and/or its contractors would only use agency-approved tree and plant species, in compliance with management plan objectives and in consultation with agency specialists.

Site Specific Crossing Prescriptions:

<u>Big Elk Road (MP 161.41).</u> Within the Rogue River National Forest, the Pipeline crosses an area managed for Foreground Retention with high scenic integrity. Pacific Connector would neck down to a width of 50 feet immediately adjacent to either side of the Big Elk Road crossing. The construction right-of-way would then expand from 50 feet to the full 95-foot construction right-of-way width at 100 feet from either side of the road. To ensure that the appropriate large trees are conserved on either side of Big Elk Road, Pacific Connector's Environmental Inspectors would verify the limits of the staked construction limits in conjunction with a Forest Service representative (see Appendix P of the POD). Pacific Connector would implement the mitigation recommendations detailed in sections 3.2 and 3.3 and further described in Appendix I of the POD to minimize, maintain or restore potential visual effects at this road crossing, and a buffer of vegetation would mask the right-of-way on both sides of the road. Pacific Connector would additionally revegetate the right-of-way using large native trees and shrubs to begin the mitigation process.

Upon completion of construction in the area, Pacific Connector would revegetate the construction right-of-way using native trees (not within the 30-foot operational easement), shrubs, and plants. Section 3.0 of Appendix A of the POD describes additional measures to be used on federal lands for protecting and mitigating for visual resources. Pacific Connector would coordinate with the Forest Service and the Pacific Crest Trail Association regarding the need for and location of trail detours.

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to: facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service and BLM are described in the POD (*Environmental Briefings and Compliance Plan*, Appendix G) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing right-of-way grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to visual resources and recreational resources are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the Right-of-Way Grant and agreed upon conditions. The BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

Evaluation of Winema National Forest Proposed Forest Plan Amendments

The proposed Pacific Connector pipeline incorporates the most up-to-date engineering and technological practices for pipeline construction and operation. However, even with following these practices, it has been determined that one Forest Plan standard associated with rare and/or isolated species (Survey and Manage), two Forest Plan standards associated with the soil, water, and riparian resources, and three Forest Plan standards associated with visual resources would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Winema National Forest LRMP as amended by the NWFP and the January 2001 Survey and Manage ROD.

Forest Plan Amendments Related to Rare Aquatic and Terrestrial Plant and Animal Communities (FS-1):

One Forest Plan standard associated with rare and/or isolated species (Survey and Manage) would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Winema National Forest LRMP as amended by the NWFP and the January 2001 Survey and Manage ROD. This standard is:

- Management Direction: Manage All Known Sites (Survey and Manage ROD, Standards and Guidelines Page 8). Current and future known sites will be managed according to the

Management Recommendation for the species. Professional judgment, Appendix J2 in the Northwest Forest Plan Final SEIS, and appropriate literature will be used to guide individual site management for those species that do not have Management Recommendations.

The proposed amendment to this standard is:

- Management Direction: Manage All Known Sites (Survey and Manage ROD, Standards and Guidelines Page 8). Current and future known sites will be managed according to the Management Recommendation for the species, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Professional judgment, Appendix J2 in the Northwest Forest Plan Final SEIS, and appropriate literature will be used to guide individual site management for those species that do not have Management Recommendations. (Proposed amendment FS-1 on the Winema National Forest)

While the amendment would provide an exception to meeting this standard, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore any effects of the pipeline's construction and operation on Survey and Manage species within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented."

The purpose of this project-level amendment is to make the proposed Pacific Connector pipeline project consistent with the Winema National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to this amendment are:

- 36 CFR 219.9(a)(2)(ii) – [the plan must include plan components to maintain or restore] "Rare aquatic and terrestrial plant and animal communities."
- 36 CFR 219.9(b)(1) – "The responsible official shall determine whether or not the plan components required by paragraph (a) provide ecological conditions necessary to: …maintain viable populations of each species of conservation concern within the plan area."

Because the proposed amendment is "directly related" to these two substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendment (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the amendment, it is important to recognize that the applicable sections of 36 CFR 219.9(a) and (b) that are described above, requires plan components to maintain or restore rare aquatic and terrestrial plant and animal communities, across the entire planning area (i.e., the Winema National Forest). This plan amendment does not alter these LRMP plan requirements for managing rare plant and animal communities across 99.99 percent of the Winema National Forest. The proposed pipeline construction corridor including the TEWAs and the UCSAs is approximately 92 acres of the 1,043,547-acre Winema National Forest. Within this 92 acre construction corridor surveys have identified 40 Survey and Manage sites that could be potentially impacted by construction activities. The proposed amendment does not waive the persistence objective for Survey and Manage species. The analysis that was conducted (see section 4.6.4.3 of the EIS and appendix F.5) determined the Survey and Manage persistence objectives would be met. This means that for Winema National Forest lands within the project area, individual sites of Survey and Manage species may be impacted or lost to construction activities, but affected species are expected to persist within the range of the NSO despite the loss of these individual sites.

The amendment modifies this standard so that in the 92 acres of the project construction area the project need not be in compliance with this standard' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 92 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the management requirement described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements." The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.9(a) and (b) rule requirements within the "scope and scale" of the proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.9(a) and (b) requirements are being addressed.

How the Required Mitigation Measures would Maintain or Restore Effects to Rare Aquatic and Terrestrial Plant and Animal Communities and Meet the Applicable 36 CFR 219.9(a) and 36 CFR 219.9 (b) Requirements

The Forest Service has worked to inventory, analyze, and evaluate rare aquatic, terrestrial plant and animal communities that could be affected by this project. In addition, a third-party consultant for technical support was also utilized in reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's applicant prepared Plan and Procedures for construction and restoration enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures incorporated into amendments for Survey and Manage species are designed to minimize, maintain or restore the potential for habitat fragmentation, edge effects, and loss of long-term habitats associated with effected species. To ensure adequate restoration and revegetation of the right-of-way, design features are identified in the ECRP (Appendix I of the POD), *Right-of-Way Clearing Plan* (Appendix U of the POD), and *Leave Tree Protection Plan* (Appendix P of the POD). In addition, routing considerations were identified during project development to ensure avoidance of known populations of rare plant and animal communities (see section 3.4.2, EIS Route Variations, as well as appendix F.5, *Survey and Manage Persistence Evaluations*).

As a basis for Survey and Manage determinations, appendix F.5 provides background research on Survey and Manage species that could be affected by the Pacific Connector Project; a review of survey reports prepared by others for the Pacific Connector Project; and processing and analysis of spatial data obtained from the BLM, Forest Service, and other sources over the past 12 years.

Background information was used in combination with new information available as a result of surveys for the Pacific Connector Project and recent surveys in other portions of old growth forests to discuss the currently known distribution of the species in old-growth forests within the NSO range. Impacts on sites as a result of the Pacific Connector Project were analyzed to determine if the species would continue to have a reasonable assurance of persistence in the NSO range following implementation of the Pacific Connector Project, taking into consideration the status and distribution of the species and general habitat in the NSO range.

Some of the required mitigation measures in the POD sections to protect rare plant and animal communities include: flagging existing snags on the edges of the construction right-of-way or TEWAs where feasible to save from clearing; snags would be saved as and used in LWD placement post-construction to benefit primary and secondary cavity nesting birds, mammals, reptiles, and amphibians; other large diameter trees on the edges of the construction right-of-way and TEWAs would also be flagged to save/protect as green recruitment or habitat/shade trees, where feasible; trees would be girdled to create snags to augment the number of snags along the right-of-way to benefit cavity nesting birds, mammals, reptiles, and amphibians. See Appendices P and U of the POD and section 2.6.3 of the EIS for a complete list of applicable mitigation measures for pipeline construction. Additional measures include low ground weight (pressure) vehicles would be used; logging machinery would be restricted to the 30-foot permanent right-of-way wherever possible to prevent soil compaction; the removal of soil duff layers would be avoided in order to maintain a cushion between the soil and the logs and the logging equipment; designed skid trails would be used to restrict detrimental soil disturbance (compaction and displacement) to a smaller area of the right-of-way over the pipeline trenching area; and the temporary construction area would be restored and revegetated using native seeds, to the extent possible, and saplings (Appendix I of the POD).

In an effort to minimize, maintain or restore the impacts on Survey and Manage species, Pacific Connector adopted route variations to avoid certain species identified in the Survey and Manage Persistence Evaluations by co-locating the proposed construction corridor adjacent to existing roads, through managed timber stands or otherwise avoid unique LSOG habitats to the maximum extent practicable (see section 3.4.2, EIS).

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service, and BLM are described in the POD (Environmental Briefings and Compliance Plan, Appendix G) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing Right-of-Way Grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to soil, water and riparian resources, are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the Right-of-Way Grant and agreed upon conditions. BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

How the Compensatory Mitigation Actions would help to Maintain or Restore Rare Aquatic and Terrestrial Plant and Animal Communities in the Plan Area (36 CFR 219.9(a), 36 CFR 219.9 (b)).

The CMP on the Winema National Forest includes proposals to improve aquatic and riparian habitat that would benefit rare aquatic plant and animal communities (see the discussion of *How the Compensatory Mitigation Actions would help to Maintain or Restore the Ecological Integrity of The Soils and Soil Productivity, including guidance to reduce soil erosion and sedimentation in the Plan Area (36 CFR 219.8(a)(2)(ii))* below for a discussion of benefits to aquatic habitats). The CMP also includes proposals to decommission approximately 29.2 miles of road.

Although the Pacific Connector project has been routed to avoid LSOG habitat as much as possible and is aligned along existing roads, the project would still cause some habitat fragmentation. Road decommissioning reduces the edge effects over time by revegetating road surfaces and eliminating road corridors. Revegetating selected roads could create larger blocks of late successional habitat in the future.

These projects have been designed by an interdisciplinary team of resource professionals on the Winema National Forest with input and coordination with the FWS, NMFS, and State agencies. They were planned within the watersheds that would be affected by the Pacific Connector pipeline project. They are a component of the Pacific Connector application and would be a requirement of the Right-of-Way Grant. Overall, these projects would help maintain and restore rare aquatic and terrestrial plant and animal communities on the Winema National Forest (see tables 2.3.1-3 and 2.3.1-4 and figures 2.3-1 and 2.3-2 in appendix F.2 for additional information).

Forest Plan Amendments Related to Soil, Water and Riparian Areas (WNF -4, WNF-5):

Two Forest Plan standards associated with the soil, water, and riparian resources would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Winema National Forest LRMP. These standards are:

- Detrimental Soils Conditions, Standard and guideline 12-5 (WNF LRMP, 4-73). The cumulative effects of detrimental soil conditions should not exceed 20 percent of the total acreage within the activity area: any reason for exceeding the limitation shall be documented in an environmental assessment. Detrimental soil conditions include compaction, displacement, puddling, and moderately or severely burned soil from all activities (including roads, skid trails, and landings). Sites where the standards for displacement, puddling, and compaction are not currently met will require rehabilitation such as ripping, backblading, or fertilization. The potential for creating detrimental soil conditions will be specifically addressed through project environmental analyses. If needed, alternative management practices will be developed, and mitigating measures will be planned and implemented.

- Soil and Water, Standard & Guideline 3 (WNF LRMP 4-137). The cumulative total area of detrimental soil conditions in riparian areas shall not exceed 10 percent of the total riparian acreage within an activity area. Detrimental soil conditions include compaction, displacement, puddling, and moderately or severely burned soil.

The proposed amendments to these standards are:

- Detrimental Soils Conditions, Standard and guideline 12-5, (WNF LRMP, 4-73). The cumulative effects of detrimental soil conditions should not exceed 20 percent of the total acreage within the activity area: any reason for exceeding the limitation shall be documented in an environmental assessment, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Detrimental soil conditions include compaction, displacement, puddling, and moderately or severely burned soil from all activities (including roads, skid trails, and landings). Sites where the standards for displacement, puddling, and compaction are not currently met will require rehabilitation such as ripping, backblading, or fertilization. The potential for creating detrimental soil conditions will be specifically addressed through project environmental analyses. If needed, alternative management practices will be developed, and mitigating measures will be planned and implemented. (Proposed amendment WNF-4)
- Soil and Water, Standard & Guideline 3 (WNF LRMP 4-137). The cumulative total area of detrimental soil conditions in riparian areas shall not exceed 10 percent of the total riparian acreage within an activity area, with the exception of the operational right-of-way and the construction zone for the Pacific Connector Pipeline, for which the applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. Permanent recreation facilities or other permanent facilities are exempt. (Proposed amendment WNF-5)

While the amendments would provide an exception to meeting these standards, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore any effects of the pipeline's construction and operation on the soil, water and riparian resources within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented."

The purpose of these two project-level amendments is to make the proposed Pacific Connector pipeline project consistent with the Winema National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to these two amendments are:

- 36 CFR 219.8(a)(2)(ii) – [The plan must include plan components to maintain or restore] "soils and soil productivity, including guidance to reduce soil erosion and sedimentation."

Because the two proposed amendments are "directly related" to this substantive requirement, the Responsible Official must apply the requirements within the scope and scale of the proposed amendments (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the two amendments, it is important to recognize that the applicable sections of 36 CFR 219.8(a) that are described above, requires plan components to "maintain or restore" the soil resources across the entire planning area (i.e., the Winema National Forest). These plan amendments do not alter these LRMP plan requirements for managing the soil resources across 99.99 percent of the Winema National Forest. The proposed pipeline construction corridor including the TEWAs and the UCSAs is approximately 92 acres of the 1,043,547-acre Winema National Forest. Of the 92 acres of pipeline corridor construction it is estimated that approximately 27 to 62 acres would not meet standards for soils described above.

The amendment modifies 2 standards so that in the 92 acres of the project construction area the project need not be in compliance with these standards' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 92 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the two management requirements described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements." The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.8(a) rule requirements within the "scope and scale" of these proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.8(a) requirements are being addressed.

How the Required Mitigation Measures would Maintain or Restore Effects to Soil, Water, and Riparian Resources and Meet the Applicable 36 CFR 219.8(a) Requirements.

The Forest Service has worked with Pacific Connector Gas Pipeline to inventory, analyze, and evaluate the geologic, soil, and hydrologic resources that could be affected by this project. In addition, a third-party consultant for technical support was also utilized in reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's Applicant prepared Plan and Procedures for construction and restoration are enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures, incorporated into amendments for soil, water, and riparian resources are designed to minimize, maintain or restore the potential for soil movement, slope stability, water quality, and to ensure adequate restoration and revegetation. These measures are identified in: the ECRP (Appendix I of the POD); *Right-of-Way Clearing Plan* (Appendix U of the POD); *Wetland and Waterbody Crossing Plan* (Appendix BB of the POD); the *Forest Service Site Specific Stream Crossing Prescriptions* (NSR 2014a); and the *Stream Crossing Risk Analysis* and *Stream Crossing Risk Analysis Addendum* (GeoEngineers2017d, 2018b). Pacific Connector would also follow the FERC's applicant prepared Wetland Procedures and the Best Management Practices for the State of Oregon. To further reduce potential for landslides on steep slopes, the Forest Service, BLM, and FERC are also recommending additional industry best management practices and measures identified from the *Technical Report on Soil Risk and Sensitivity Assessment* (NSR 2014c) be incorporated into Pacific Connector's terms and conditions of the Right-of-Way Grant as described in the POD's identified above. See section 4.2.3.3 of the EIS for a description of soil risk and sensitivity assessment.

Areas with soils rated moderate to very high for risk or sensitivity (28 acres total) would be recommended for more site-specific validation of the risk criteria used in the *Technical Report on Soil Risk and Sensitivity Assessment* (NSR 2014c) to confirm that specific locations merit consideration of the more aggressive soil remediation measures, such as: a 2- to 3-inch organic mulch surface application (80 percent coverage) of woodchips, logging slash, and/or straw; adaptive seed mixes and vegetation to better fit site conditions; deep subsoil decompaction with hydraulic excavators that leave constructed corridor mounded and rough with maximum water infiltration so that water cannot flow downhill for any appreciable distance; more aggressive use of constructed surface water runoff dispersion structures such as closely placed and more pronounced slope dips and water bars, etc.; more aggressive use of constructed surface runoff entrapments such as silt fencing, sediment settling basins, or straw bale structures, etc.; more aggressive placement (100 percent coverage) and depth (3 to 4 inches) of ground cover using woodchips, logging slash, straw bales, wattles (see Appendices U and I of the POD). In efforts to protect soil productivity, topsoil segregation would be required for pipeline construction at wetland and waterbody crossings on NFS lands (Appendix U of the POD).

Some of the required mitigation measures in Appendix BB of the POD and *Forest Service Site Specific Stream Crossing Prescriptions* (NSR 2014a) to protect wetlands and minimize, maintain or restore compaction include: limiting the construction right-of-way width to 75 feet through wetlands; placing equipment on mats; using low-pressure ground equipment; limiting equipment operation and construction traffic along the right-of-way; locating TEWAs more than 50 feet away from wetland boundaries; cutting vegetation at ground level; limiting stump removal to the construction trench; segregating the top 12 inches of soil, or to the depth of the topsoil horizon; using "push-pull" techniques in saturated wetlands; limiting the amount of time that the trench is open by not trenching until the pipe is assembled and ready for installation; not using imported rock and soils for backfill; and not using fertilizer, lime, or mulch during restoration in wetlands. Pacific Connector must also follow the FERC Waterbody and Wetland Construction and Mitigation Procedures. See section 4.3.3.2 of the EIS for a complete list of applicable mitigation measures for pipeline construction at specific waterbody and stream crossings.

In an effort to minimize, maintain or restore the impacts on streams and riparian areas, Pacific Connector adopted route variations to co-locate the proposed construction corridor adjacent to existing roads and along dry ridge tops (see section 3.4.2, EIS). In addition, Pacific Connector has committed to limit construction at waterbody crossings to times of dry weather or low water flow. Pacific Connector would implement the required erosion control measures at the proposed stream crossings to minimize, maintain or restore potential erosion and sedimentation impacts. The applicable mitigation measures and monitoring requirements in the POD relating to water waterbody crossings are included in the *Site Specific Forest Service Stream Crossing Prescriptions* (NSR 2014a) and *Wetland and Waterbody Crossing Plan* (Appendix BB of the POD). In addition, applicable mitigation measures from the FERC approved applicant prepared Procedures for Wetland and Waterbody Crossings would be required.

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to: facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service and BLM are described in the POD (Environmental Briefings and Compliance Plan, Appendix G) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing Right-of-Way Grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to soil, water and riparian resources, are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the Right-of-Way Grant and agreed upon conditions. BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

How the Compensatory Mitigation Actions would help to Maintain or Restore the Ecological Integrity of The Soils and Soil Productivity, including guidance to reduce soil erosion and sedimentation in the Plan Area (36 CFR 219.8(a)(2)(ii)).

Part of the CMP on the Winema National Forest includes proposals to place LWD in-stream for 1.0 miles, repair stream crossings at 25 sites, provide riparian planting for 0.5 miles, provide riparian fencing for 6.5 miles, and decommission approximately 29.2 miles of road.

Placement of LWD in streams adds structural complexity to aquatic systems by creating pools and riffles, trapping fine sediments and can contribute to reductions in stream temperatures over time (Tippery et al. 2010). Placing LWD in streams affects channel morphology, the routing and storage of water and sediment, and provides structure and complexity to stream systems. Complex pools and side channels created by instream wood provide overwintering habitat to stream salmonids and other aquatic organisms (Solazzi et. al. 2000). They also provide cover from predators during summer low flow periods when predation is at its highest. Providing more stream channel structure results in better over wintering habitat, improved summer pool habitat, and more abundant spawning gravels.

Riparian planting is proposed along Spencer Creek just upstream of Buck Lake. This is a meadow site that has lost streamside vegetation and has compacted soils. There is an overall need to restore health and vigor to riparian stands by maintaining and improving riparian reserve habitat. Shade provided by the plantings would contribute to moderating water temperatures in Spencer Creek. Root strength provided by new vegetation would increase bank stability, decrease erosion and sediment depositions to Spencer Creek and provide habitat for species that use riparian habitats. Riparian fencing would serve to divide the Buck Indian Allotment into pastures north and south at

Clover Creek Road. This fence would keep cattle from grazing newly revegetated areas in the construction corridor, including areas where the corridor crosses Spencer Creek, thus helping to ensure that erosion control and revegetation objectives are met. It would also serve to separate anticipated increased cattle grazing of the construction corridor from the highway; greatly reducing a safety hazard for vehicles traveling the Clover Creek road.

Restoring stream crossings reconnects aquatic habitats by allowing the passage of aquatic biota and restoring riparian vegetation. Over time, these actions reduce sediment and restore shade. Restoration of these crossings includes riparian planting as a mitigation which would help offset the impact of shade removal at pipeline crossings. The proposed pipeline would cross Spencer Creek upstream of Buck Lake. It is occupied by redband trout. Spencer Creek has been identified by NMFS as habitat for federally listed Southern Oregon/Northern California Coast Coho salmon. Additionally, once fish passage is provided through the Klamath River hydro facilities, steelhead would re-colonize Spencer Creek. Improving habitat quality at Spencer Creek provides the opportunity to be pro-active in providing quality habitat for SONCC Coho, mitigating for any detrimental effects to other SONCC Coho habitats, while improving habitat for redband trout and other aquatic species. Spencer Creek appears on the ODEQ 303(d) list as water quality impaired from increased sedimentation. Improvements at this location would immediately benefit all downstream aquatic habitats and the species associated with those habitats.

Decommissioning roads can substantially reduce sediment delivery to streams (Madej 2000; Keppeler et al. 2007). Proposed road decommissioning and stormproofing would increase infiltration of precipitation, reduce surface runoff, and reduce sediment production from road-related surface erosion in the watershed where the impacts from the Project would occur. Decommissioning roads would restore natural drainage patterns and thereby avoid large volumes of added sediment to the stream network that would be likely to eventually occur. In addition limited road maintenance dollars could be focused on the remaining road systems resulting in more maintenance of culverts and ditchlines resulting in less potential for catastrophic failure. Madej (2000) concluded that by eliminating the risk of stream diversions and culvert failures, road removal treatments significantly reduce long-term sediment production from retired logging roads.

These projects have been designed by an interdisciplinary team of resource professionals on the Winema National Forest with input and coordination with the FWS, NMFS, and State agencies. These projects have been planned within the watersheds that would be affected by the Pacific Connector Pipeline Project. These projects have been proposed by the Applicant as part of their application and would be a requirement of the Right-of-Way Grant. These projects would help maintain and restore soil resources including reducing soil erosion and sedimentation on the Winema National Forest (see tables 2.3.1-3 and 2.3.1-4 and figures 2.3-1 and 2.3-2 in appendix F.2 for additional information).

Forest Plan Amendments Related Visual Resources (WNF -1, WNF-2, WNF-3):

Three Forest Plan standards associated with visual resources would need to be modified so that the proposed construction and operation of the Pacific Connector pipeline can be in compliance with the Winema National Forest LRMP. These standards are:

- Management Area 3, Lands, Standard and Guideline (4) (WNF LRMP 4-103). This management area is an avoidance area for new transportation and utility corridors.

- Management Area 3A, Foreground Retention, Standard and Guideline Scenic (1) (WNF LRMP 4-103 and 104). Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) will not be noticeable one year after the work has been completed.
- Management 3B, Foreground Partial Retention, Standard and Guideline Scenic (1) (WNF LRMP, 4-107). Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) should not be noticeable from two to three years after the work has been completed.

The proposed amendments to these standards are:

- Management Area 3, Lands, Standard and Guideline (4), (WNF LRMP 4-103). This management area is an avoidance area for new transportation and utility corridors, with the exception of the Pacific Connector Pipeline right-of-way. The applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. (Proposed amendment WNF-1)
- Management Area 3A, Foreground Retention, Standard and Guideline Scenic (1) (WNF LRMP 4-103 and 104). Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) will not be noticeable one year after the work has been completed, with the exception of the Pacific Connector Pipeline right-of-way which shall attain the VQO within 10 - 15 years after completion of the construction phase of the project where the pipeline crosses Management area 3A. The applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. (Proposed amendment WNF-2)
- Management 3B, Foreground Partial Retention, Standard and Guideline Scenic (1) (WNF LRMP, 4-107). Evidence of management activities from projects that produce slash (tree harvest) or charred bark (underburning) should not be noticeable from two to three years after the work has been completed, with the exception of the Pacific Connector Pipeline right-of-way, which shall attain the VQO within 10 - 15 years after completion of the construction phase of the project where the pipeline crosses Management area 3B. The applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented. (proposed amendment WNF-3)

While the amendments would provide an exception to meeting these standards, there would also be requirements to do what is appropriate, applicable and feasible to minimize, maintain or restore any effects of the pipeline's construction and operation on the visual resources within the area affected by the pipeline. Consequently, each amended standard includes the requirement that the "applicable mitigation measures identified in the POD and Pacific Connector project design requirements must be implemented."

The purpose of these three project-level amendments is to make the proposed Pacific Connector pipeline project consistent with the Winema National Forest LRMP. Thus, the substantive planning rule requirements that are directly related to these three amendments are:

- 36 CFR 219.10(a)(1) – […the responsible official shall consider: …] "(1) Aesthetic values,… scenery,... viewsheds...".

- 36 CFR 219.10(b)(i) – [the responsible official shall consider] "Sustainable recreation; including recreation settings, opportunities,…and scenic character…"

Because the proposed amendments are "directly related" to these two substantive requirements, the Responsible Official must apply the requirements within the scope and scale of the proposed amendments (36 CFR 219.13 (b)(5)).

In considering the "scope and scale" of the three amendments, it is important to recognize that the applicable sections of 36 CFR 219.10 that are described above, requires plan components to provide for aesthetic values and scenic character across the entire planning area (i.e., Winema National Forest). These plan amendments do not alter these LRMP plan requirements for managing visual resources across 99.99 percent of the Winema National Forest. The proposed pipeline construction corridor including the TEWAs and the UCSAs is approximately 92 acres of the 1,043,547-acre Winema National Forest. Of the 92 acres of pipeline corridor construction it is estimated that approximately 70 of these acres would not meet the standards for visual resources described above.

The amendments modify three standards so that in the 92 acres of the project construction area the project need not be in compliance with these standards' specific requirements but instead, it is the "applicable mitigation measures identified in the POD and the Pacific Connector Project design requirements" that must be implemented. Or stated in another way, for the 92 acres of National Forest lands that would be within the operational right-of-way and construction zone for the Pacific Connector Pipeline, the three management requirements described above would be replaced with the full set of management requirements that comprise the "applicable mitigation measures identified in the POD and Pacific Connector Project Design requirements." The inclusion of these management requirements as a part of the plan component language for the LRMP in this plan amendment, addresses the applicable 36 CFR 219.10 rule requirements within the "scope and scale" of these proposed plan amendments. The sections below describe in more detail how the applicable 36 CFR 219.10 requirements are being addressed.

How the Required Mitigation Measures would Consider, Minimize, Maintain or Restore Effects to Aesthetic Values and Scenic Character and Meet the Applicable 36 CFR 219.10(a) and 36 CFR 219.10(b) Requirements.

The Forest Service has worked to inventory, analyze, and evaluate visual resources, view sheds, and aesthetics that could be affected by this project. Forest Service landscape architect provided technical support to FERC and Forest Service third-party contractors by reviewing the information gathered for the project. The POD is a document developed between the Forest Service, BLM, FERC, and Pacific Connector that contains the design features, mitigation measures, roles and responsibilities, monitoring, and procedures for the construction and operation of the pipeline on NFS lands. In addition, FERC's applicant prepared Plan and Procedures for construction and restoration enforceable, where applicable, for additional design features and mitigation. The design requirements and mitigation measures of the POD would be required by the modified standards and incorporated into BLM's Right-of-Way Grant.

The mitigation measures incorporated into amendments for Visual Quality Objectives are designed to minimize, maintain or restore the potential for long-term impacts on visually sensitive areas. To ensure adequate restoration and revegetation of the right-of-way, design features are identified in the ECRP (Appendix I of the POD), *Right-of-Way Clearing Plan* (Appendix U of the POD), *Leave Tree Protection Plan* (Appendix P of the POD), *Aesthetics Management Plan* (Appendix A of the POD), and *Recreation Management Plan* (Appendix S of the POD).

A visual assessment was conducted to determine the potential effects on visual resources associated with the pipeline. Representative viewpoint points (also referred to as KOPs) were identified within the view shed for the pipeline, defined as the area from which the pipeline would be potentially visible. Photographs of existing visual conditions were used in preparing computerized visual simulations for each KOP. Because the appearance of the pipeline right-of-way would change with time, a series of simulations were prepared to illustrate how the pipeline right-of-way would look at different timeframes following construction. These KOPs would also serve as monitoring points for mitigation.

Pacific Connector produced Appendix A of the POD that outlined measures to reduce visual impacts along its pipeline route. To the extent feasible, Pacific Connector would use revegetation efforts to shape and blend the pipeline easement, enhance the setting, and mimic the natural features of the landscape. These measures would consist of revegetating all disturbed areas and replanting trees in TEWAs and any other areas of the temporary construction right-of-way that were forested prior to construction (see Appendix I of the POD).

On Forest Service lands, Pacific Connector would maintain a cleared 30-foot width centered over the pipe allowing the remainder of the permanent easement to be reforested. This allows trees to naturally reestablish along the edges of the permanent easement at a staggered, more natural-looking interval. Replacing slash in forested areas of the right-of-way during restoration activities would immediately affect the visual contrast in color and texture of the disturbed right-of-way areas. Over time, as the right-of-way revegetates and narrows in width and changes in form, texture and color, potential visual impacts would diminish.

Additionally, a row, or if necessary, clusters of trees and/or shrubs would be planted across the right-of-way to provide visual screens at key road and trail crossings in sensitive view sheds. For all revegetation practices, Pacific Connector and/or its contractors would only use agency-approved tree and plant species, in compliance with management plan objectives and in consultation with agency specialists.

Site Specific Crossing Prescriptions:

<u>Clover Creek Road (intersection of Dead Indian Memorial Highway and Clover Creek Road).</u> Viewsheds in this area are managed for Foreground and Middleground Retention and Partial Retention, but also contain areas of private lands with recently harvested timber and several clusters of rural residential homes. The proposed alignment would cross the Dead Indian Memorial Highway perpendicularly in a thick forest foreground setting (at MP 168.83). Pacific Connector would implement the mitigation recommendations detailed in sections 3.2 and 3.3 and further described in Appendix I of the POD. These pipeline restoration efforts would include regrading to the approximate original contours, reseeding, scattering slash across the right-of-way, and replanting, which would minimize, maintain or restore visual contrast of the right-of-way. During restoration, Pacific Connector would plant trees within forested areas to within 15 feet of the Pipeline, which would allow a strip of trees to establish along the easement and between the Pipeline and the road in this area. Because the Pipeline was recommended to abut the road and to eliminate the strip of trees between the road and the Pipeline easement, the Forest Service and

BLM would specify if tree planting would occur on federal lands between the centerline and Clover Creek Road (but not within 15 feet of the pipeline). Pacific Connector would also implement the mitigation recommendations in the Federal Lands Scenery Management Analysis at this location which include:

During construction of the Project, Compliance Monitors representing FERC are present on a full-time basis to inspect construction procedures and mitigation measures and provide regular feedback on compliance issues to FERC and the Forest Service. Objectives of the Compliance Monitoring program are to: facilitate the timely resolution of compliance issues in the field; provide continuous information to FERC regarding noncompliance issues and their resolution; and review, process, and track construction-related variance requests. Changes to previously approved mitigation measures, construction procedures, and construction work areas due to unforeseen or unavoidable site conditions would require various levels of regulatory approval from the applicable land management agencies. FERC would have the authority to stop any activity that violates an environmental condition of the FERC authorization issued to Pacific Connector.

Additionally, environmental compliance oversight responsibilities for Pacific Connector, FERC, Forest Service and BLM are described in the POD (*Environmental Briefings and Compliance Plan*, Appendix G) that would apply to the construction, operation, and maintenance of the project specifically on NFS lands. The Forest Service Authorized Officer would coordinate with the BLM in administering and enforcing Right-of-Way Grant provisions and would have stop-work authority. The Forest Service Authorized Officer's designated representatives would ensure that the stipulations and mitigation measures included in the POD that are designed to minimize, maintain or restore the effects to visual resources and recreational resources are adhered to during project construction, operation, and maintenance. The BLM Authorized Officer would coordinate with the Forest Service to ensure the work is being conducted in accordance with the right-of-way grant and agreed upon conditions. BLM and the Forest Service would have stop-work authority. Field variance requests would be coordinated with the Authorized Officers.

How the Compensatory Mitigation Actions would help to Provide for Aesthetic Values and Scenic Character in the Plan Area (36 CFR 219.10(a)(1), 36 CFR 219.10(b)(i)).

Part of the CMP on the Winema National Forest includes a proposal to reduce stand densities on 114 acres in a way that would help soften the visual impact of the Pacific Connector Project. The Pacific Connector pipeline would create a hard line along the timbered edge of the corridor that does not fit with the visual objectives for the Clover Creek Road or the Dead Indian Memorial Highway. Thinning and fuels treatments can be used to soften the edge to a more natural appearing texture by restoring stand density to more natural levels and creating small openings that are consistent with the landscape. This proposal would restore stand density, species diversity, and structural diversity more characteristic under a natural disturbance regime.

This project has been designed by an interdisciplinary team of resource professionals on the Winema National Forest with input and coordination with the FWS, NMFS, and State agencies. It was planned within the watersheds that would be affected by the Pacific Connector pipeline project. It is a component of the Pacific Connector application and would be a requirement of the Right-of-Way Grant. This project would help to restore visual resources on the Winema National Forest (see tables 2.3.1-3 and 2.3.1-4 and figures 2.3-1 and 2.3-2 in appendix F.2 for additional information).

4.7.3.5 Resource Values and Conditions on Federal Lands: The Aquatic Conservation Strategy on National Forest System Lands

Introduction

This section summarizes Final EIS appendix F.4, Aquatic Conservation Strategy (ACS) Technical Report, which contains the full text of the independent Forest Service analysis. Those who seek additional information should review the applicable section in appendix F.4. Section, figure, and table numbers that refer to sections in appendix F.4 are so noted.

Background of the Aquatic Conservation Strategy

The ACS was developed as an element of the NWFP to "restore and maintain the ecological health of watersheds and aquatic ecosystems on public lands contained within them" within the range of the NSO (Forest Service and BLM 1994a, 1994b). The ACS applies on the Umpqua, Rogue River – Siskiyou National Forests and portions of the Winema National Forest within the range of the NSO. The ACS does not apply to lands managed by the BLM.[175]

The ACS established Riparian Reserves and Key Watersheds as land allocations on NFS lands. The ACS also established watershed assessment requirements, management objectives and special standards and guidelines for management and protection of aquatic resources. Forest Service line officers must determine whether activities that occur on NFS lands retard or prevent attainment of the ACS objectives on their respective national forests (Forest Service and BLM 1994a, 1994b;). Projects that retard or prevent attainment of the ACS objectives would not be consistent with the ACS. In making the ACS consistency finding (Goodman et al. 2007), the decision maker must:

- Review projects against the ACS objectives at the project or site scale, rather than only at the watershed scale.
- Evaluate the immediate (short-term) impacts, as well as long-term impacts of an action.
- Provide a description of the existing watershed condition, including the important physical and biological components of the 5th field watershed.
- Provide written evidence that the decision maker considered relevant findings of watershed analysis.

Appendix F.4 and this summary provide the basis for Forest Supervisors of the Rogue River, Umpqua and Winema National Forests to independently determine whether the Pacific Connector Pipeline Project would retard or prevent attainment of ACS objectives or otherwise be inconsistent with the ACS objectives.

Overview of the Project

The Pacific Connector Pipeline Project would traverse approximately 31 miles of NFS lands and 47 miles of BLM lands on its 232 -mile route from Malin to Coos Bay, Oregon. This assessment and appendix F.4 apply only to the portion of the Pacific Connector Project on NFS lands.

[175] The ACS also applied to BLM lands managed under the BLM's 1995 Resource Management Plans (RMP) as amended. The ACS was replaced by Riparian Management Areas in BLM RMPs in 2016 when those RMPs were revised. As a result, the ACS is no longer applicable on BLM lands.

Table 4.7.3.5-1 provides a breakdown of provinces, river basins and fifth field watersheds on NFS lands where the ACS applies.

TABLE 4.7.3.5-1

Provinces, River Basins and Watersheds on NFS Lands Subject to the ACS

Province	River basin	Fifth field Watershed	Hydrologic Unit Code	Key Water-shed	Total Miles All Owners	Umpqua NF Miles	Rogue River NF Miles	Winema NF Miles	Total Forest Service Miles
Klamath Siskiyou	Umpqua	Days Cr.-S. Umpqua	1710030205	Yes	19.15	1.56	0.00	0.00	1.56
Klamath Siskiyou — Western Cascades	Umpqua	Elk Cr.-S. Umpqua	1710030204	Yes	3.26	2.67	0.00	0.00	2.67
Klamath Siskiyou — Western Cascades	Umpqua	Upper Cow Cr.	1710030206	No	5.25	4.48	0.00	0.00	4.48
Western Cascades	Upper Rogue	Trail Cr.	1710030706	No	10.68	2.09	0.00	0.00	2.09
Western Cascades — High Cascades	Upper Rogue	Little Butte Cr.	1710030708	Yes	33.05	0.00	13.87	0.00	13.87
High Cascades	Upper Klamath	Spencer Cr.	1801020601	Yes	15.13	0.00	0.00	6.05	6.05
Total Project Miles where the ACS Applies					**—**	**9.80**	**13.87**	**6.05**	**30.52**

Ecological Provinces Crossed by the Pacific Connector Pipeline Project

<u>Klamath-Siskiyou Province MP 47–105, 118–153</u>

The Klamath-Siskiyou Province encompasses the Klamath and Siskiyou Mountains and lies between the Coast Range and the Cascades, south of the Willamette Valley. The Project would traverse the northeast corner of the Klamath-Siskiyou Province for approximately 93 miles (appendix F.4, figure 1-1). It includes parts of the Umpqua and Rogue River National Forests. This landscape is typified by deeply dissected valleys and jutting ridges and foothills. Much of this province lies within a rain shadow sheltered from the Pacific maritime influences by the mountains of the Coast Range. The region has a rugged landscape, with high peaks and deep canyons. Elevations range from about 1,000 to 7,000 feet above MSL.

The Klamath-Siskiyou Province is known for its highly complex geology. Most of the area is composed of highly deformed volcanic and marine sedimentary rocks with some metamorphic terranes. Also included are deformed pieces of oceanic crust and granitic intrusive bodies. Bedrock is often intensely metamorphosed and fractured. Well-developed floodplains and terraces near major rivers give way to highly dissected mountains with high-gradient streams. Many streams in this province flow only intermittently because of high gradients and low summer precipitation.

Erosional processes in the Klamath-Siskiyou Province are dominated by mass wasting associated high-intensity rainfall events. Erosional processes are accelerated where these rainfall events overlap with large, high severity stand-replacing fires. Precipitation gradients decrease from west to east, so landslide frequency decreases with decreased precipitation. Hydraulic mining during the 19th century dramatically altered landscapes and downstream channels where this activity occurred.

Western Cascades Province MP 105-113

Approximately eight miles of the pipeline corridor cross the north-south trending Western Cascades Province (appendix F.4, figure 1-1). This province, which drains westward to the Pacific Ocean, reaches elevations of 4,400 feet above MSL in watersheds crossed by the Pacific Connector Pipeline Project. Portions of the Upper Cow Creek and Trail Creek fifth-field watersheds are in the Western Cascades Province.

The landforms in the Western Cascades Province are distinguished from the High Cascades by older volcanic activity and longer glacial history. Ridge crests at generally similar elevations are separated by steep, deeply dissected valleys. Complex volcanoclastic formations juxtapose relatively stable volcanic deposits that weather to thick soils and are subject to earthflows. Unconsolidated alluvial and glacial deposits are subject to streambank erosion and landslides. Tributary channels flow at large angles into wide, glaciated valleys. Stream gradients are typically moderate to high (2 to 30 percent).

High Cascades Province MP 153-180

Approximately 23 miles of the Project corridor would be in the High Cascades Province (appendix F.4, figure 1-1). This Province consists of one north-south trending mountain chain that drains both westward to the Pacific Ocean and eastward into Klamath and Columbia Basins (see appendix F.4, figure 1-1). The High Cascades Province reaches a peak elevation of 9,493 feet MSL at the summit of Mt. McLoughlin. Portions of the Little Butte Creek and Spencer Creek fifth-field watersheds are in this province.

The province consists of volcanic landforms with varying degrees of historic glaciation. Lava flows form relatively stable plateaus, capped with pumice and ash deposits by the recent Cascade volcanoes. Drainages are generally not yet well developed or otherwise disperse into highly permeable volcanic deposits. Geologically recent volcanic pumice and ash deposits are subject to large debris flows when saturated by snowmelt. This province is composed primarily of approximately 3 million year old volcanic material, primarily andesite and basalt that were subsequently glaciated. Mountains in this province are moderately dissected. Headwater streams have medium to high gradients and are often associated with large meadow-spring complexes. Expansive pumice plateaus associated with the eruption of Mt. Mazama about 5,000 years ago (Dead Indian Plateau, Clover Creek) with droughty soils characterized by high snowmelt infiltration and low summer water retention fill valley floors adjacent to volcanic peaks.

Watersheds Crossed by the Pacific Connector Pipeline Project

The Project would cross portions of 19 fifth-field watersheds, six of which include NFS lands where the ACS applies. Figure 4.7-4 (reproduced from figure 1-1 in appendix F.4) shows watersheds and aquatic provinces crossed by the Pacific Connector Pipeline Project.

Table 4.7.3.5-2 summarizes (1) the number and acreage of Riparian Reserves of perennial and intermittent streams and forested wetlands that would be “crossed” by the pipeline NFS lands, and (2) the number and acreage of Riparian Reserves that would be “clipped” where a portion of the Riparian Reserve is impacted without the pipeline trench crossing a waterbody or wetland.

Table 4.7.3.5-3 shows the age-class structure of vegetation that would be cleared within the proposed Pacific Connector right-of-way. Most of the Pacific Connector Pipeline Project is routed on ridge tops to avoid stream and riparian-area crossings. To the degree possible, Project routing has avoided late-successional and old-growth forest in Riparian Reserves. Of the vegetation cleared in the construction corridor and TEWAs, approximately 71 percent or about 16.4 acres of the 23.02 acres are in in mid or early seral vegetation while approximately 26 percent or 6.04 acres are in late-successional or old-growth forest.

Table 4.7.3.5-4 (table 2-3 from appendix F.4) summarizes forest plan land allocations for the watersheds crossed by the Pacific Connector.

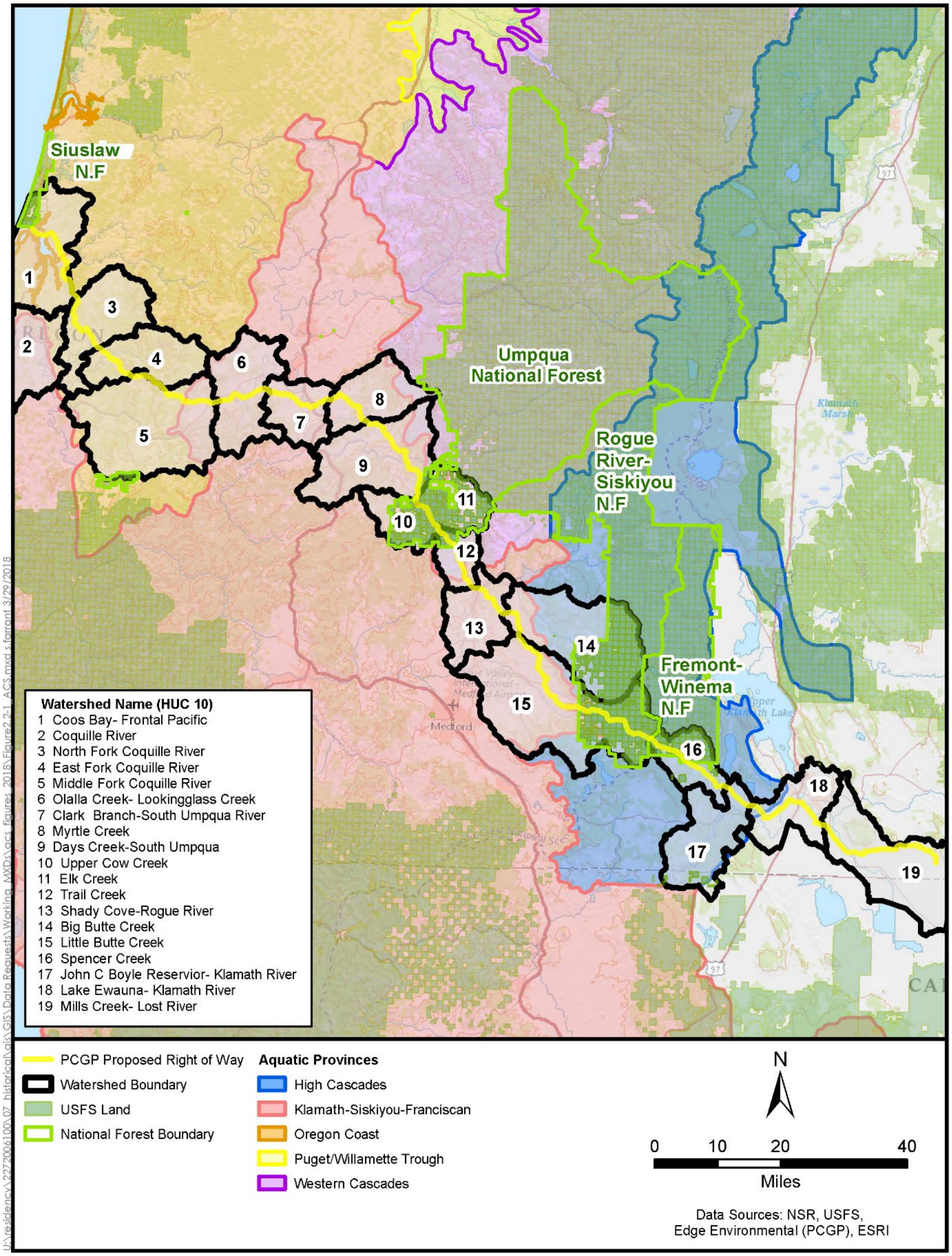


Figure 4.7-4. Provinces, and Watersheds Crossed by the Pacific Connector Pipeline Project

TABLE 4.7.3.5-2

Summary of Riparian Reserves, Stream Channels and Wetlands Crossed by the Pacific Connector Pipeline on NFS Lands by Administrative Unit

	Perennial Streams Crossed a/		Intermittent Streams Crossed		Wetlands Crossed b/		Total Stream Channels or Wetlands Crossed		Riparian Reserves Clipped without Stream or Wetland Crossings c/		Total d/	
Agency a/	**Stream Channels Crossed e/ (number)**	**Riparian Reserves Cleared (Acres)**	**Stream Channels Crossed (number)**	**Riparian Reserves Cleared (Acres)**	**Wetlands Crossed (number)**	**Riparian Reserves Cleared (Acres)**	**Total Crossed (number)**	**Total Riparian Reserves Cleared (Acres)**	**Riparian Reserves Clipped (number)**	**Total Riparian Reserves (Acres)**	**Affected Riparian Reserves (number)**	**Cleared (Acres)**
Umpqua National Forest	4	7.23	3	6.27	1	2	8	15.50	3	1.44	11	17
Rogue River National Forest	2*	2.45	1	1.64	0	0.00	3	4.09	2	0.64	4	4.73
Winema National Forest	0	0.00	2	3.28	2	2.48	4	5.76	4	2.55	8	8.31
Total Forest Service	5	9.68	6	11.19	3	4.48	19	25.35	9	4.63	28	30.04

Data Source: Resource Report 3, table 2A-3A and FS Riparian Reserve Assessment, database.

a/ "Crossed" means that the pipeline trench (cleared or modified land) crosses the stream channel or delineated wetland area.

b/ "Wetlands" refers to delineated wetland areas that are not already counted as streams. Where the Riparian Reserve of a wetland is fully encompassed in the adjacent Riparian Reserve of a stream channel, the acres are counted as part of the stream channel to avoid double counting and are shown as 0 in this table.

c/ "Clipped" means that the Riparian Reserve associated with a stream channel or wetland was cleared as part of the construction corridor, Temporary Extra Work Area (TEWA) or Hydrostatic Test, but the pipeline trench did not cross the stream channel or delineated wetland area.

d/ This table includes only areas where vegetation is cleared in the construction corridor, hydrostatic test sites, and TEWAs. An additional 11.71 acres of Riparian Reserves are used as Uncleared Storage Areas (UCSA) where habitat may be modified but vegetation is not removed.

e/ Irrigation ditches or other man-made water conveyances are crossed by the Project, but they do not create Riparian Reserves and are not subject to the requirements of the ACS

* Crossing at MP 167.67 in the Little Butte Creek Watershed would be constructed with a boring method underneath the existing perennial stream and therefore no Riparian Reserves would be cleared as a result of the project right-of-way.

TABLE 4.7.3.5-3

Vegetation Age Class Structure of Riparian Reserves Cleared in Construction Corridor and TEWAs by Administrative Unit, Forest Service

		LSOG (>80 Years) Forest Cleared (Acres)				Mid Seral (40-80 Years) Cleared (Acres)				Early Seral (0-40 Years) Cleared (Acres)							
Administrative Unit	**Waterbody Type**	**Conifer Forest**	**Hardwood Forest**	**Mixed Conifer and Hardwood Forest**	**Total LSOG Cleared**	**Conifer Forest**	**Hardwood Forest**	**Mixed Conifer and Hard-wood Forest**	**Total Mid-Seral Cleared**	**Conifer Forest**	**Mixed Conifer and Hardwood Forest**	**Shrub or Brush-field**	**Grass-lands and Non-forest**	**Total Early Seral Cleared**	**Total All Vegetation Classes (Acres)**	**Stream Channel or Wetland Area within Corridor (Acres)**	**Total within Cleared Area (Acres)**
Umpqua NF	Perennial Stream	1.56			1.56	1.54			1.54	3.4				3.4	6.5	0.19	6.69
	Intermittent Stream					3.04			3.04	0.47				0.47	3.51	0.05	3.56
	Wetland					1.56			1.56						1.56		1.56
	Total	1.56			1.56	6.14			6.14	3.87				3.87	11.57	0.24	11.57
Rogue River NF	Perennial Stream	1.33			1.33					1.04				1.04	2.37	0.04	2.41
	Intermittent Stream					0.12			0.12	0.72			0.19	0.91	1.03	0.1	1.13
	Wetland	0.13			0.13					0.39				0.39	0.52		0.52
	Total	1.46			1.46	0.12			0.12	2.15			0.19	2.34	3.92	0.14	4.06
Winema NF	Perennial Stream																
	Intermittent Stream	2.2			2.2					1.91				1.91	4.11	0.1	4.21
	Wetland	0.91			0.91	0.58	0.26		0.84	1.01			0.17	1.18	2.93	0.01	2.94
	Total	3.11			3.11	0.58	0.26		0.84	2.92			0.17	3.09	7.04	0.11	7.15
Total Forest Service	Perennial Stream	2.89			2.89	1.54			1.54	4.44				4.44	8.87	0.23	9.1
	Intermittent Stream	2.2			2.2	3.16			3.16	3.1			0.19	3.29	8.65	0.25	8.9
	Wetland	1.04			1.04	2.14	0.26		2.4	1.4			0.17	1.57	5.01	0.01	5.02
	Total	6.04			6.04	6.84	0.26		7.1	8.94			0.36	9.3	22.53	0.49	23.02

Note: Minor rounding differences may result in totals across rows tallying to slightly different totals than column totals and subtotals. These differences are on the order of hundredths of an acre and are not significant.

TABLE 4.7.3.5-4

Fifth-Field Watersheds and Land Allocations Crossed by the Pacific Connector Gas Pipeline Corridor Right-of-Way on NFS Lands

	Designated LSR b/				Matrix				Riparian Reserves c/			
	Project Area (acres)		% of Total LSR on NFS Land		Project Area (acres)		% of Total Matrix on NFS Land		Project Area (acres)		% of Total Riparian Reserves on NFS lands	
Unit	Cleared	Modified	Cleared	Modified	Cleared	Modified	Cleared	Modified	Cleared	Modified	Cleared	Modified
Days Cr.-S. Umpqua	9.81	18.55	0.35	0.66	11.01	13.03	2.84	3.36	0.15	1.56	0.02	0.16
Elk Cr.-South Umpqua	21.23	0.00	0.15	0.00	7.43	1.20	0.04	0.01	0.54	0.00	<0.01	0.00
Upper Cow Creek	36.70	0.00	1.56	0.00	37.05	1.34	0.19	0.01	10.00	0.26	0.13	<0.01
Trail Creek	0.00	0.00	0.00	0.00	41.28	8.99	1.05	0.23	0.00	0.00	0.00	0.00
Little Butte Creek	208.13	71.53	0.39	0.14	0.00	0.00	0.00	0.00	7.66	2.56	0.09	0.03
Spencer Creek	0.00	0.00	0.00	0.00	71.06	10.05	0.70	0.10	8.63	1.35	0.52	0.08
Total	257.87	90.08	0.36	0.12	167.83	24.61	0.57	0.12	26.98	5.73	0.05	0.01

Source: Appendix F.4, table 2-3
a/ All data derived from Stantec-based GIS layers.
b/ Includes mapped and unmapped LSR on NFS lands.
c/ Riparian Reserve acres overlap with LSR and Matrix land allocations.

The proposed Pacific Connector pipeline route would follow ridgelines and existing rights-of-way, such as powerlines and roads, wherever possible. To the extent possible, route location avoided crossing or modifying Riparian Reserves. In 30.73 miles of right-of-way on NFS lands, approximately 32.71 acres or 0.06 percent of Riparian Reserves on NFS lands in the affected watersheds would be cleared or modified by the Pacific Connector (appendix F.4, table 2-3).

Project impacts on aquatic habitats at stream crossings are generally comparable to construction of a road crossing with a culvert installation. Possible short-term impacts could include sediment transport to waterbodies where construction at stream crossings causes surface erosion, disturbance of banks and stream bottoms, and minor increases in water temperature from removal of effective shade.

Removal of mid and late seral forest vegetation at stream crossings would result in a long-term change in vegetative condition at the site scale. Early seral vegetation removed would recover as early seral vegetation and is less of a change in condition. Use of roads, including standards for reconstruction, would be subject to applicable ACS standards and guidelines. In order to minimize potential adverse impacts on fish, timing of instream work in streams with flowing water would be tied to work windows established by the ODFW. These time periods were established to avoid the vulnerable life stages of potentially affected fish species, including migration, spawning, and rearing.

The ACS is intended to prevent long-term adverse impacts on riparian dependent resources (Forest Service and BLM 1994c, p. 3.4-69). This summary and appendix F.4 show that other than change in vegetative condition, impacts on NFS Riparian Reserves and aquatic habitats would be temporary or minor in scale in any given fifth-field watershed or sixth-field subwatershed. Changes in vegetation at stream crossings are a long-term effect because the 50-foot-wide maintenance corridor for the Pacific Connector pipeline must be kept in low-growing vegetation.

This would not prevent attainment of the ACS objectives because the widely dispersed nature of crossings and the small amount of vegetation removed at each site. See appendix F.4 for a complete discussion and analysis of environmental consequences.

Project Effects Related to the ACS in Affected Watersheds on NFS Lands

Umpqua River Basin, Days Creek–South Umpqua River Watershed, HUC 1710030205, Umpqua National Forest

Discussions of watershed analysis recommendations, natural disturbances, range of variability and other elements of the ACS are found in appendix F.4. Table 4.7.3.5-5 (table 2-11 from appendix F.4) compares the Project effects against the objectives of the ACS. The Project does not cross any stream channels in this watershed. It affects approximately 1.71 acres of the Riparian Reserves of which 0.15 acres would be cleared and 1.56 acres would be modified. All affected Riparian Reserves are associated with isolated forested wetland swales on or near the watershed divide between Stouts Creek and Corn Creek that have no apparent surface connection to drainages.

TABLE 4.7.3.5-5

Compliance of the Project with ACS Objectives, Days Creek–South Umpqua River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are landscape-scale features that would be affected by the Project. The Project ROW would impact 2.2% of the NFS land in the Days Creek–South Umpqua River watershed. Approximately 0.15 acre of Riparian Reserves would be cleared. All of the vegetation cleared would be mid seral. While the cutting of trees where the Project ROW intersects two localized Riparian Reserves would result in a long-term change in vegetation condition, it would be minor in scale and well within the range of natural variability for vegetative change, given the fire history of the Days Creek–South Umpqua River watershed. The application of BMPs and erosion control measures, use of native vegetation, and the anticipated rapid revegetation of disturbed areas would likely further reduce Project impacts. The level of impacts is well within the range of natural variability for disturbance processes described by Everest and Reeves (2007) and Agee (1993) and as documented in the South Umpqua Watershed Assessment (BLM 2001). The NFS lands in the Days Creek–South Umpqua River watershed are approximately 32% LSOG.
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The Project is not expected to affect spatial or temporal connectivity on NFS lands in the Days Creek–South Umpqua River watershed. No streams would be crossed and impacts in Riparian Reserves would be minimal. Any residual levels of disturbance are anticipated to be well within the range of natural variability.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The Project would have no discernible impact on streambanks or bottoms in the Days Creek–South Umpqua River watershed because no stream channels would be crossed. The few impacts in Riparian Reserves are associated with near ridge-top intermittent streams or ridge top (wetland) swales that have no apparent surface connectivity to the drainage system. Therefore, there would be little influence on the physical integrity of the aquatic system.

TABLE 4.7.3.5-5 (continued) Compliance of the Project with ACS Objectives, Days Creek–South Umpqua River Watershed	
ACS Objective	**Project Impacts**
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Sediment impacts are expected to be as described in appendix F.4, section 1.4.1. Minor amounts of sediment would be mobilized during construction, but these impacts are expected to be short term and limited to the immediate Project area. Connectivity to aquatic systems is limited since no stream channels would be crossed. With application of the ECRP and BMPs, no long-term impacts associated with sediment transport are anticipated. No impacts on water temperature are expected because the two waterbodies that would be crossed are isolated and not connected to an intermittent or perennial stream and no effective shade would be removed.
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in Project routing. There would be no stream channels crossed in the watershed because the route lies on a ridge top and connections to aquatic systems that would transport sediment do not exist. Sediment fluxes are expected to be minor, short-term, and well within the range of natural variability for the Klamath-Siskiyou Province with implementation of the erosion control measures in ECRP and BMPs as well as the anticipated rapid revegetation that is characteristic of the province. Erosional impacts are, therefore, expected to be consistent with those described in appendix F.4, section 1.4.1)
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	It is highly unlikely that the Project would affect flows because there is no connectivity between the two isolated wetlands to any drainage system. The Project routing is on a ridge top in the watershed and would not cross any stream channels. The watershed is hydrologically recovered (BLM 2001:143) and the Project would affect less than 0.5% of the watershed (appendix F.4, table 2-6) so changes in peak flows as a result of construction are highly unlikely.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	Two small forested wetlands would be crossed in or near a ridge top swale in the Stouts Creek subwatershed at MP 102.1 and 102.2. Trench plugs would be installed on each side of these wetlands to block subsurface flows and maintain water table elevations, as required by FERC's Wetland and Waterbody Construction and Mitigation Procedures. By restricting crossings to the dry season (July 1 to Sept. 15), possible impacts on water tables of these wetland areas are expected to be minor and short-term. These features appear to have no surface connectivity with the Stouts Creek drainage network.
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; and 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.	Approximately 0.15 acre or less than 0.01% of Riparian Reserves in the watershed would be cleared by the Project. All affected Riparian Reserves are located at or near ridge tops and contribute little to the thermal regulation, nutrient filtering, bank erosion, and channel stability of the drainage networks in the watershed. Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Replanting with native species would facilitate recovery of vegetation communities. These restoration and off-site mitigation efforts would contribute to the maintenance and restoration and physical functions of the Riparian Reserves in the watershed.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Impacts on Riparian Reserves would be minimal. All of the Riparian Reserves are located at or near ridge tops. To maintain riparian habitat, construction BMPs would be implemented. Revegetation would be encouraged by planting of native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by Project construction and operation in the watershed (see appendix F.5).

Source: Appendix F.4, table 2-11

It is highly unlikely that construction and operation of the Project would prevent attainment of ACS objectives due to the relatively small portion of NFS lands affected, the relative lack of intersections with waterbodies, and the small acreage of Riparian Reserve affected in the Days Creek-South Umpqua River watershed. No Project impacts relevant to the ACS have been identified that are outside of the range of natural variability for disturbance processes in the watershed (appendix F.4, table 2-17). The proposed amendment to the Umatilla National Forest LRMP to waive protection measures for Survey and Manage species would not prevent attainment of ACS objectives because the Project does not threaten the persistence of any riparian-dependent Survey and Manage species. Mitigations associated with the Project are responsive to watershed assessment recommendations and would improve watershed conditions where they are applied (appendix F.4, table 2-10).

Umpqua River Basin, Elk Creek–South Umpqua River Watershed, HUC 1710030204, Umpqua National Forest

Discussions of watershed analysis recommendations, natural disturbances, range of variability and other elements of the ACS are found in appendix F.4. Table 4.7.3.5-6 (table 2-21 in appendix F.4) and this section shows Project effects compared to each of the nine ACS objectives. The Project does not cross any stream channel or clip any riparian reserve on NFS lands.

TABLE 4.7.3.5-6

Compliance of the Project with ACS Objectives, Elk Creek–South Umpqua River Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are landscape-scale features that are affected by the Project. The Project affects (cleared and modified) 0.09% of the NFS land in the Elk Creek-South Umpqua River watershed (appendix F.4, table 2-12). No Riparian Reserves are crossed or clipped in the Elk Creek watershed since the Project is routed on a ridgetop. The application of BMPs and erosion control measures, use of native vegetation, and the anticipated rapid revegetation of disturbed areas would likely further reduce Project effects. The level of impact is well within the natural range of variability for disturbance processes described by Everest and Reeves (2007) and Agee (1993) and as documented in the South Umpqua Watershed Assessment (Forest Service 1996b).
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The project is not expected to impact spatial or temporal connectivity on NFS lands in the Elk Creek–South Umpqua River watershed. No streams are crossed, and no riparian reserves are clipped. Aquatic system connectivity would be enhanced by restoring five stream crossings within the watershed. Any residual levels of disturbance are anticipated to be well within the range of natural variability (see appendix F.4, table 2-17).
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	The Project would have no discernible impact on streambanks or bottoms in the Elk Creek–South Umpqua River watershed because no stream channels are crossed. Off-site mitigations involving LWD within Riparian Reserves would help restore physical integrity and complexity (appendix F.4).
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Minor amounts of sediment would be mobilized during construction, but these effects are expected to be short-term and limited to the immediate Project area. Connectivity to aquatic systems is limited since no stream channels are crossed. With application of the ECRP and BMPs, there should be no long-term effects associated with sediment transport and delivery. No impacts on water temperature are expected because no channels are crossed, and no effective shade is removed. Any sediment transport to aquatic systems that may occur would be offset by off-site road drainage enhancement, surface upgrade, and storm-proofing mitigation Projects.

TABLE 4.7.3.5-6 (continued)

Compliance of the Project with ACS Objectives, Elk Creek–South Umpqua River Watershed

ACS Objective	Project Impacts
Maintain and restore the sedimentary erosion, transportation and deposition regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	Areas of unstable soils have been avoided in Project routing. There are no stream channels crossed in the watershed and the route lies on a ridge top; therefore, connections to aquatic systems that would transport sediment do not exist. As a result, sediment fluxes are expected to be minor and short-term and well within the range of variability for the Klamath–Siskiyou Province due to implementation of the erosion control measures in ECRP, BMPs, and the anticipated rapid revegetation that is characteristic of the province. As a result, erosional effects are expected to consistent with those described in section 1.4.1. Road decommissioning and storm proofing would help reduce sediment effects in the watershed and move the sediment regime closer to the desired condition (appendix F.4).
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. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	It is highly unlikely that the Project would impact flows because of the lack of connectivity to aquatic systems. The Project routing is on a ridge top in the watershed and does not cross any stream channels. The watershed is hydrologically recovered, and the Project affects 0.07% of the watershed (appendix F.4, table 2-13). In addition, analysis by FERC showed that the Project was highly unlikely to contribute to increases in peak flows because of the small area affected by the Project as a proportion of the watershed (FERC 2009).
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The Project would not affect floodplains and water table elevations in meadows because these features are not crossed by the Project in the Elk Creek–South Umpqua River watershed.
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; and 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.	No vegetation in Riparian Reserves is removed. Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Replanting with native species would facilitate recovery of vegetation communities. LWD placement within 26 acres of Riparian Reserves would help to enhance physical complexity of the aquatic habitats (appendix F.4). These restoration efforts, along with the limited effects to which they are directed, would maintain and restore biological and physical functions of the Riparian Reserves in the watershed.
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Existing herbaceous and brush cover would be maintained to the extent practicable. To maintain riparian habitat, construction BMPs would be implemented. LWD placement within 26 acres of Riparian Reserves would help to enhance physical complexity of the aquatic habitats (appendix F.4). Revegetation would be encouraged by planting of native riparian species. The Project would waive application of Management Recommendations for Survey and Manage species in the watershed but would not threaten the persistence of riparian-dependent Survey and Manage species or prevent attainment of the ACS objectives (see appendix F.5).

Source: Appendix F.4, table 2-21

It is highly unlikely that the Project construction and operation would prevent attainment of ACS objectives on NFS land in the Elk Creek–South Umpqua River watershed based on the Project's ridgetop location and the lack of intersection with waterbodies or riparian reserves. Amendments of the Umatilla National Forest LRMP to waive protection measures for Survey and Manage species would not prevent attainment of ACS objectives because the Project does not threaten the persistence of any riparian-dependent species (appendix F.5). No Project effects relevant to the ACS have been identified that are outside of the range of variability for disturbance processes in the watershed (see appendix F.4, table 2-17).

Umpqua River Basin, Upper Cow Creek Fifth Field Watershed, HUC 1710030206, Umpqua National Forest

Discussions of watershed analysis recommendations, natural disturbances, range of variability and other elements of the ACS are found in appendix F.4. Table 4.7.3.5-7 (table 2-35 in appendix F.4) and this section evaluates Project effects against each of the ACS objectives. National Forest System lands where the ACS applies comprise about 51 percent of the Upper Cow Creek watershed (appendix F.4, table 2-22). Timber harvest and removal of LWD from creek channels has reduced structural complexity of the aquatic habitat and its ability to retain sediments. Chronic, fine-grained sediment deposition, primarily related to roads, has negatively affected aquatic habitats. The presence of roads has segregated some stream reaches from upslope habitats that are needed for replenishment of LWD (appendix F.4). A total of 10.0 acres or 0.13 percent of the Riparian Reserves in the (appendix F.4, table 2-25) watershed would be cleared on:

- Four perennial stream channel crossings,
- Two intermittent stream channel crossings,
- One forested wetland crossing,
- One intermittent stream and six forested wetlands where Riparian Reserves are clipped, but the associated waterbodies are not crossed by the Project.

TABLE 4.7.3.5-7

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Upper Cow Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations, and communities are uniquely adapted.	Riparian Reserves are watershed-scale features that would be affected by the project. There would be four perennial and two intermittent stream crossings in the South Fork Cow Creek subwatershed. [Note that Hydrofeature N at MP 111.01 is a perennial stream but, because of an upstream diversion, it is dry in the summer. It is counted here as an intermittent stream since that it is its current condition]. One small shrub-dominated wetland is also crossed. Riparian Reserves associated with one perennial stream and six forested wetlands are clipped. The project right-of-way is located primarily in early or mid-seral forests and largely on or near ridge tops to minimize impacts on aquatic habitats. The project right-of-way would affect 75.06 acres or about 0.31% of NFS lands in the Upper Cow Creek watershed and about 10 acres or 0.13% of the Riparian Reserves within the watershed. Impacts on aquatic systems are expected to be short-term and minor and limited to the project scale because of application of BMPs and erosion control measures. LWD cleared in construction of the corridor would be used to stabilize and restore stream crossings. Off-site mitigation measures including road decommissioning and installation of fish-friendly culverts are expected to improve watershed conditions in the Upper Cow Creek watershed (appendix F.4, table 2-33). While there are long-term changes in vegetation in Riparian Reserves from construction clearing of the corridor, these would be minor in scale and well within the range of natural variation given the disturbance history of the Upper Cow Creek watershed (see appendix F.4).

TABLE 4.7.3.5-7 (continued)

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Upper Cow Creek Watershed

ACS Objective	**Project Impacts**
Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life-history requirements of aquatic and riparian-dependent species.	The Project is not expected to affect spatial or temporal connectivity in the Upper Cow Creek watershed except during the construction period because the pipeline would be buried in all aquatic habitats crossed, consistent with the requirements of the Wetland and Waterbody Crossing Plan. In the short-term, connectivity would be disrupted during construction. At each crossing, the corridor would be narrowed down to 75 feet wide. Bed and bank disturbances associated with equipment and trenching are small (<15 feet wide). After construction, all disturbed areas would be returned to their approximate original contours to restore preconstruction contours and drainage patterns. The temporary construction ROW would be restored and revegetated with native grasses, forbs, conifers, and shrubs, as outlined in the ECRP. After construction, key habitat components such as LWD and boulders would be restored onsite and the bed and banks would be returned to preconstruction conditions. By implementing these measures, lateral and longitudinal connectivity at the site scale would be maintained, although in the short-term during construction, connectivity may be disrupted. Except for a few days during the construction of the crossing, access to areas necessary for life-histories of aquatic- and riparian-dependent species would not be obstructed. By restricting stream crossing operations to the ODFW in-stream work window, possible impacts on sensitive life stages of aquatic biota would be minimized. Connectivity would be improved by installation of fish-friendly culverts at six sites that currently preclude passage of aquatic organisms (see appendix F.4 table 1-14). The residual levels of disturbance are anticipated to be well within the range of natural variability in the Klamath–Siskiyou Province.
Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.	Impacts on the beds and banks of aquatic features would be minor and limited to the site of construction because the pipeline would be buried, and the actual area of bank and stream bottom disturbance associated with equipment crossing and trenching is small at each crossing (<15 feet wide). After construction, key habitat components such as LWD and boulders would be restored onsite and the beds and banks would be returned to preconstruction conditions, consistent with the POD requirements. By implementing these measures, the physical integrity of the aquatic system at the site scale would be maintained, although in the short-term (during construction), elements of the aquatic system could be disturbed. This level of disturbance is well within the range of natural variability for the watersheds of the Klamath-Siskiyou Province.
Maintain and restore water quality necessary to support healthy riparian, aquatic, and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.	Mercury from abandoned mercury mines in the South Fork Cow Creek subwatershed is a known issue. Broeker (2010) and GeoEngineers (2013a) assessed the potential risk of release of mercury from disturbance of affected sediments. Mercury concentration of 0.29 parts per million (ppm)), which is in exceedance of the ODEQ threshold of 0.1 ppm, was detected in soil and stream sediment samples at one site. Special measures including maintenance of 100% effective ground cover have been adopted as recommended by ODEQ. As a result, the presence of inorganic mercury is not anticipated to cause any health risk. Minor amounts of sediment would be mobilized during construction, particularly during the dry open-cut and dam and pump crossing of the East Fork Cow Creek and its perennial tributaries (GeoEngineers 2013e). Water quality impacts from sediment are expected to be short-term and limited to the general area of construction (appendix F.4, section 1.4.1.2). No long-term impacts on water quality are expected because of application of the ECRP, including maintenance of effective ground cover (appendix F.4, section 1.4.1) and BMPs during construction. A site-specific shade analysis conducted by Pacific Connector (NSR 2009, NSR 2015b, and Stantec 2019) showed minor temperature increases were possible at the project scale but no impacts would occur beyond the immediate area of construction; there were no temperature impacts at the stream-network scale. Water quality is expected to remain within the range that supports aquatic biota.

TABLE 4.7.3.5-7 (continued)

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Upper Cow Creek Watershed

ACS Objective	Project Impacts
Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.	The Upper Cow Creek watershed sediment regime was historically characterized by pulse-type disturbances (Forest Service 1995a, Everest and Reeves 2007). The East Fork Cow Creek, a drainage in the South Fork Cow Creek subwatershed, is characterized in the Cow Creek watershed analysis as being “in balance” for sediment transport and deposition. The Project is not likely to alter these conditions. Eighty percent (3.73 of 5.26 miles) of the Project in the Upper Cow Creek watershed is on ridge tops with little or no aquatic connectivity. Site-specific field reviews by geologists show the Project is unlikely to cause landslides or activate currently stable earth-flow terrains because unstable areas have been avoided (GeoEngineers 2009b; Hanek 2011; Koler 2012). Surface erosion and sediment transport to streams would be minimized because the Project would maintain 100% effective ground cover, effective sediment barriers, and other erosion control measures as needed (see the sediment discussion at the beginning of this section). Sediment generated during construction is expected to be minor and to be limited to the general area of construction using dry dam-and-pump measures that isolate the crossing from flowing water during construction (section 1.4.1). The Project is not expected to alter the balance of sediment transport and storage in the East Fork Cow Creek. The Project is not expected to alter either the pulse-type disturbance or surface erosion sediment regimes of the Upper Cow Creek watershed (appendix F.4, section 1.4.1.2). A pulse of sediment could be observed following the first seasonal rain, but this is likely to dissipate within a few hundred feet and would be indistinguishable from background levels.
Maintain and restore instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.	Instream flows would be interrupted for a short time during installation of dams during dam and pump crossings. The area of construction that is between upstream and downstream dams would be dewatered during the actual crossing construction. During construction, water would be pumped around the construction site to maintain downstream flows. It is possible that there would be local increases in runoff from canopy removal but, at the watershed scale, flow regimes would not be altered by the Project because of the small scale of the Project relative to the watershed, the relatively high proportion (85%) of the watershed that is hydrologically recovered, and the lack of connectivity of most of the route to any stream network. See the discussion of peak flow processes in appendix F.4 for additional information.
Maintain and restore the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands.	The Project ROW clips the Riparian Reserve of six forested wetlands and crosses one delineated wetland. Trench plugs would be installed on each side of these wetlands as needed to block subsurface flows and maintain water table elevations, as required by FERC’s Wetland and Waterbody Construction and Mitigation Procedures. Regardless, Project construction may have short-term impacts on water tables in these isolated forest wetlands. These site-specific impacts would be minor (i.e., limited to the general area of construction) and are not connected to larger wetland areas; they may also be regulated under Section 404 of the Clean Water Act. By restricting crossings to the dry season (July 1 to Sept. 15), possible impacts on water tables of these wetland areas are expected to be minor and short-term.
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; and 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.	Project impacts on riparian vegetation in the Upper Cow Creek watershed would be minor. In the short term, all vegetation would be removed from the Project ROW. About 3.73 acres of the Riparian Reserves to be cleared in the Project ROW are LSOG (table 2-25). Existing herbaceous and brush cover would be maintained in Riparian Reserves to the extent practicable. Overall, Project construction would affect ~0.13% of the Riparian Reserves in the watershed (table 2-25). Following construction, replanting with native species would facilitate reestablishment of vegetation communities. LWD and boulders from the corridor would be returned to disturbed riparian areas. These restoration efforts, along with the limited impacts on which they are directed, would maintain and restore biological and physical functions of the Riparian Reserves in the watershed.

TABLE 4.7.3.5-7 (continued)

Compliance of the Pacific Connector Pipeline Project with ACS Objectives, Upper Cow Creek Watershed

ACS Objective	Project Impacts
Maintain and restore habitat to support well-distributed populations of native plant, invertebrate and vertebrate riparian-dependent species.	Project impacts on riparian vegetation in the Upper Cow Creek watershed would be minor (10.0 acres, or 0.13%, of the Riparian Reserves in the watershed) (table 2-25). Existing herbaceous and brush cover within the Project clearing limits would be maintained to the extent practicable. Consistent with the requirements of the POD, LWD and boulders removed from the corridor during construction would be replaced to restore and stabilize channel crossings. Revegetation would be accomplished using native riparian species. The persistence of riparian-dependent Survey and Manage species would not be threatened by Project construction and operation in the watershed. See appendix F.5.

Source: Appendix F.4, table 2-35

Through application of the ECRP BMPs and the FERC Wetland and Waterbody plans, sediment transport would be minimized, and instream flow regimes would be maintained (appendix F.4, section 1.4.1). No known riparian-related Survey and Manage species would be affected by Project construction and operation (see appendix F.5).

The South Fork Cow Creek subwatershed has four perennial stream crossings within one mile. This is the highest number of perennial stream crossings in one subwatershed on NFS lands. Construction of the Project in the Upper Cow Creek watershed has high potential for impacts that could prevent attainment of ACS objectives particularly as related to sediment, water temperature and mobilization of naturally occurring mercury (see appendix F.4, p. 2-70-84). The Project has addressed these issues as follows:

- **Project Routing**—Approximately 80 percent of the route in the Upper Cow Creek watershed is on a ridgetop with little or no connectivity to aquatic habitats or Riparian Reserves. Between MPs 109 and 110 in the South Fork Cow Creek subwatershed, the route has been selected and modified to avoid potentially unstable areas. The Forest Service has participated extensively in routing of the Project and concurs that the location is unlikely to trigger mass wasting or excessive surface erosion.
- **Implementation of Water Quality Best Management Practices**—A site-specific BMP implementation plan based on construction impact and site-response risk has been prepared that is expected to maintain water quality (GeoEngineers 2013b). Within Riparian Reserves for all hydrologic features crossed by the pipeline between MPs 109 and 110, the Project would provide 100 percent post-construction ground cover on all disturbed areas. Wood fiber is the preferred material. In addition, the Project would construct water bars at 50-foot intervals. Other erosion control measures would be used as needed to prevent surface erosion associated with stream crossings or to prevent sediment transport and deposition that may affect riparian systems.
- **Mitigation of Potential Impacts on Stream Temperature**—A temperature analysis on perennial stream crossings showed the Project may have minor temperature impacts (~

0.1°C) at the project scale (NSR 2009, NSR 2015, Stantec 2019).[176] Although the analysis showed there would be no impact at the next downstream reach below the crossings because of ground water discharge, flow volumes and existing shade, the Project would transplant larger conifers to riparian areas and use logs and slash to provide shade at perennial crossings in the East Fork Cow Creek to mitigate for temperature impacts at the project scale. Temperatures are expected to remain below those specified by the State of Oregon for streams in the Umpqua basin.

- **Mercury—**The Forest Service contracted with a professional consulting geologist with extensive local experience to collect soil and stream sediment samples for analytical testing and reporting of mercury and other naturally-occurring minerals along a 2,000-foot section of the proposed pipeline route between MP 109 and the East Fork Cow Creek (Broeker 2010b; GeoEngineers 2013a). Geochemical analysis of the soil and stream sediment samples have been determined to have very low to nominal concentrations of naturally occurring mercury mineralization. The mercury level at one of the stream sediment sites was 0.29 part per million, which was above the Level II screening level value of 0.1 part per million for invertebrates (ODEQ 1998, cited in GeoEngineers 2013c). In order to prevent this naturally-occurring mercury from mobilizing during and after construction, additional erosion control measures and monitoring would be conducted at these sites. The proposed pipeline construction activities by Pacific Connector within the East Fork Cow Creek watershed are not anticipated to disturb and expose soils and bedrock strata that contains more than low amounts of natural occurring mercury mineralization; and any sediment that is generated is not likely to reach the aquatic environment due to implementation of short-term and permanent mitigation measures outlined in Pacific Connector's ECRP and as listed in GeoEngineers (2013a).

There are approximately 7,849.12 acres of Riparian Reserves (NFS lands only) in the Upper Cow Creek watershed (appendix F.4, table 2-22) of which approximately 3,313.66 acres are LSOG. Approximately 10.0 acres of Riparian Reserves or 0.13 percent of the Riparian Reserves on NFS lands in the watershed would be cleared (appendix F.4, table 2-3, 2-24). Of this, approximately 3 acres are LSOG (appendix F.4, table 2-25). This is about 0.13 percent of the LSOG in Riparian Reserves on NFS lands in the Upper Cow Creek watershed. Early and mid-seral forest vegetation constitutes the remaining 7 acres of the affected Riparian Reserve vegetation. LSOG and mid-seral vegetation (approximately 13.5 acres) cleared in the corridor would be a change in vegetation condition that is long-term but well within the range of natural variability for the Upper Cow Creek watershed considering its history of disturbance from stand replacement fire and subsequent landslides (appendix F.4). Federal lands are currently 35.20 percent LSOG and exceed minimum watershed thresholds for LSOG forest after consideration of Pacific Connector Pipeline Project impacts (appendix F.4).

Four site-specific proposed amendments of the Umatilla National Forest LRMP are required to make provision for the Pacific Connector Project. These proposed amendments are not expected to prevent attainment of the ACS in the Upper Cow Creek watershed (appendix F.4; table 2-32):

[176] A temperature increase of this scale is so small that may be outside the confidence limits of the model for precise predictions. In other words, this is possibly "noise" in the metrics, and may not actually occur in the field. Even if the predicted temperature increase does occur, it would quickly dissipate because of downstream shade, hyporheic flows and input from other streams (NSR 2009).