3.5 Animals

Many animal species inhabit the Grays Harbor area, including aquatic invertebrates, fish, and wildlife. The movements of wildlife (foraging, breeding, refuge, dispersal, and migration) affect and are affected by both the built and natural environments. Wildlife can affect habitat by consuming vegetation, insects, fish, or other animals; providing a source of prey and nutrients to other animals; and serving as a mechanism to disperse seeds. The aquatic habitats of Grays Harbor, including marine, estuarine, and freshwater habitat in the surrounding rivers and streams, support a variety of fish and aquatic species, including several types of native salmon, shellfish, and crab. In the Grays Harbor area, wildlife diversity also supports various aspects of the local culture and economy, including tourism.

This section describes animals in the study area, including invertebrates, fish, marine mammals, birds, and terrestrial wildlife, as well as special-status animal species. It then describes impacts on animals that could result under the no-action alternative or as a result of the construction and routine operation[1] of the proposed action. Finally, this section presents any measures identified to mitigate impacts of the proposed action and any remaining unavoidable and significant adverse impacts.

3.5.1 What is the study area for animals?

The study area for animals consists of animals and habitats (terrestrial and aquatic) on and near the project site that could be affected by construction and routine operations at the project site. The study area also includes animals that could be affected during routine rail transport along the Puget Sound & Pacific Railroad (PS&P)[2] rail line and vessel transport through Grays Harbor out to 3 nautical miles from the mouth of the harbor.

3.5.2 What laws and regulations apply to animals?

Laws and regulations for determining potential impacts on animals are summarized in Table 3.5-1. More information about these laws and regulations is provided in Appendix B, *Laws and Regulations*.

Table 3.5-1. Laws and Regulations for Animals

Laws and Regulations	Description
Federal	
Endangered Species Act (16 U.S.C. 1531–1544)	Established with the intent of providing protections for imperiled species and the ecosystems upon which they depend.
The Magnuson-Stevens Fishery Conservation and Management (16 U.S.C. 1801)	Governs marine fisheries management in federal waters of the United States through the establishment of eight regional fishery management councils that are responsible for preparing fishery management plans.

[1] Chapter 4, *Environmental Health and Safety*, addresses the potential impacts from increased risk of incidents (e.g., storage tank failure, train derailments, vessel collisions) and related incidents (e.g., release of crude oil).
[2] The PS&P rail line refers to the rail line between Centralia and the project site.

Laws and Regulations	Description
Marine Mammal Protection Act of 1972, as amended 2007 (16 U.S.C. 31)	Protects marine mammals from take without appropriate authorization, which may only be granted under certain circumstances by NOAA Fisheries.
Migratory Bird Treaty Act of 1918 (16 U.S.C. 703–709)	Makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations.
Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668 et seq.)	Prohibits the take of bald eagles, including their parts, nests, or eggs without a permit issued by USFWS.
Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended by the National Invasive Species Act of 1996 (16 U.S.C. et seq. 4711)	Establishes and regulations enforced by the U.S. Coast Guard regarding the discharge into U.S. waters of aquatic nuisance species from ship ballast water.
Clean Water Act (33 U.S.C. 1251 et seq.)	Establishes the basic structure for regulating discharges of pollutants into navigable waters of the United States by regulating point pollution sources, such as stormwater discharges, and contains specific provisions related to the accidental release of oil and other hazardous substances into U.S. waters.
Oil Pollution Act of 1990 (33 U.S.C 2701 et seq.)	Establishes provisions that expand the federal government's ability to prevent and respond to oil spills and preserves State authority to establish law governing oil spill prevention and response.
State	
Growth Management Act (RCW 36.70A)	Requires the counties and cities of the state to prepare and adopt comprehensive plans that keep with the Growth Management Act planning goals.
Shoreline Management Act (RCW 90.58)	Establishes regulations for managing the use, environmental protection, and public access of the state's shorelines.
Department of Fish and Wildlife Permanent Regulations (WAC 232-12)	Establishes permanent regulations to manage and protect wildlife listed as endangered, threatened, and candidate species.
Water Resource Act of 1971 (90.54 RCW)	Sets fundamentals of water resource policy for the state to ensure adequate protection and optimal utilization for the people of the state by providing direction to state agencies and local governments.
Water Rights-–Oil and Hazardous Substance Spill Prevention and Response "Oil Spill Act" (RCW 90.56)	Establishes programs to reduce the risk and develop an approach to respond to oil and hazardous substance spills; provides a simplified process to calculate damages from an oil spill and holds responsible parties liable for damages resulting from injuries to public resources.
Oil Spill Natural Resources Damage Assessment (WAC 173-183)	Establishes procedures for convening a resource damage assessment committee, pre-assessment screening of damages, and selecting the damage assessment methodology.
Ballast Water Management Law (RCW 77.120)	Regulates discharge of ballast water into waters of the state for vessels of 300 gross tons or more.
Local	
Critical Areas Ordinance (HMC 11.06 and AMC 14.100)	Sets forth the definitions and process for designating and protecting critical areas within the city limits of Hoquiam and Aberdeen, respectively.
Shoreline Management (HMC 11.04 and AMC 16.20)	Carries out responsibilities imposed by the Shoreline Management Act of 1971.

U.S.C. = United States Code; NOAA = National Oceanic and Atmospheric Administration; USFWS = U.S. Fish and Wildlife Service; RCW = Revised Code of Washington; WAC = Washington Administrative Code; WDFW = Washington Department of Fish and Wildlife; HMC = Hoquiam Municipal Code; AMC = Aberdeen Municipal Code

3.5.3 How were impacts on animals evaluated?

This section describes the sources of information and methods used to evaluate impacts.

3.5.3.1 Information Sources

The Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species database provides comprehensive information on important fish, wildlife, and habitat resources in Washington. It is the principal means by which WDFW provides wildlife and habitat information to public and private entities. Priority habitats are habitat types with unique or significant value to many fish or wildlife species. Priority species are fish and wildlife species that require special efforts to ensure their perpetuation because of their low numbers, sensitivity to habitat alteration, tendency to form vulnerable aggregations, or because they are of commercial, recreational, or tribal importance.

WDFW maintains a priority habitat and species geospatial database that maps locations of priority species occurrences and priority habitats (Washington Department of Fish and Wildlife 2014a). These data were reviewed for documented occurrences of priority species and habitats in the study area. The priority habitat and species database includes Washington State species of concern, which are state-listed endangered, threatened, sensitive, and candidate species; and federally listed threatened, endangered, proposed, and candidate species. The priority habitat and species database also includes state-monitored species, which are not considered special-status but are monitored for status and distribution.

Special-status animal species described in this section are those listed as threatened, endangered, proposed, or candidate species under the federal Endangered Species Act (ESA) or listed as a WDFW species of concern. The U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation online planning tool (2014a) provided a list of federally listed animal species for Grays Harbor, Lewis, and Thurston Counties. The National Oceanic and Atmospheric Fisheries website provided a list of special-status marine species (National Oceanic and Atmospheric Administration 2014a, 2014b, 2014c). In addition, the EIS considers potential impacts on USFWS Birds of Conservation Concern. While these bird species are not special-status species as defined in the EIS, they are migratory nongame birds that, without additional conservation actions, are at high risk of becoming candidates for listing under the federal ESA.

A site visit was conducted in September 2014 at the project site, Grays Harbor National Wildlife Refuge, and along publicly accessible portions of the railroad corridor near Hoquiam.

3.5.3.2 Impact Analysis

The impact analysis for animals considered animals and habitats in the study area, specifically in and within 1 mile of the project site, within 0.5 mile on either side of the PS&P rail line, in and along the shoreline (0.5 mile inland) of Grays Harbor, and in the Pacific Ocean within 3 nautical miles of the entrance to Grays Harbor. Animal species likely to occur in the study area were identified based on known occurrences and the presence of appropriate habitat and geographic range using the information sources described above with a focus on the priority habitat and species database. Potential impacts on animals in the study area were determined by evaluating how construction and operation could affect habitats or disturb animals that may be present in the study area.

3.5.4 What animals are in the study area?

This section describes animals and habitats in the study area that could be affected by construction and operation of the proposed action. This section addresses animals and habitats at the project site, along the PS&P rail line, and in and along the shoreline of Grays Harbor. A complete list of all special-status species and Birds of Conservation Concern known to occur in the study area counties is found in Appendix F, *Special-Status Species*.

3.5.4.1 Project Site

Terrestrial Habitats

The project site is located in an already disturbed industrialized area adjacent to the Grays Harbor shoreline. Of the site's 16 acres, 15 are currently paved with asphalt, supporting no vegetation of any kind and providing no natural habitat for terrestrial species. The 1-acre unpaved portion of the site consists of scattered areas around the periphery of the site that support upland grasses. The project site is entirely fenced, restricting some access to the site. Animals likely to be found at the project site include common rodents, birds, invertebrates, and other small animals that are habituated to developed environments. Similarly, the lands surrounding the project site are largely disturbed and developed with industry, small businesses, and residences, and lack in natural areas that would provide quality habitat for terrestrial animals. Larger and highly mobile mammal species that are habituated to developed environments may also be present in and around the project site, including Columbian black-tailed deer (*Odocoileus hemionus columbianus*), raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*).

The closest undeveloped area to the project site is located approximately 0.75 mile to the north. This area consists of forested land, including evergreen, deciduous, and mixed forests. Animals that are likely to be found in these forested habitats include, in addition to the species named above, black bear (*Ursus americanus*), squirrels, raccoon, owls, and various species of hawks and songbirds.

Shoreline and Aquatic Habitats

The industrialized shoreline of Grays Harbor along Terminal 1 and the project site is armored with rock and riprap. It lacks the intertidal marsh communities that characterize the undeveloped portions of the Grays Harbor shoreline to the west and south of the project site. Along the approximate elevation of mean higher high water line, scattered beach logs are lodged on top of the riprap. Above the mean higher high water line, blackberry (*Rubus armeniacus*, *Rubus laciniatus*) canes are interspersed with the riprap and beach logs. Riprap provides habitat for various invertebrate species that inhabit rocky surfaces, including barnacles, limpets, anemones, seastars, crabs, and snails.

The aquatic habitat adjacent to the shoreline of the project site, referred to as the Cow Point Reach and Cow Point Turning Basin of the Grays Harbor Navigation Channel, provides deepwater habitat. The U.S. Army Corps of Engineers annually dredges the navigation channel and turning basin to maintain a bottom depth of -36 feet mean lower low water and is currently seeking authorization to deepen the navigation channel and turning basin to its authorized depth of -38 feet mean lower low water (U.S. Army Corps of Engineers 2014). Grays Harbor contains approximately 8,088 acres of deepwater habitat (areas with more than 18 feet of water at mean lower low water) that could be

used by multiple species of fish and other aquatic organisms. This includes both natural channel habitats and areas within the maintained navigation channel and turning basins.

Fry Creek is located approximately 600 feet northwest of the project site and provides habitat for aquatic species, including coho salmon and Chehalis coastal cutthroat trout (Washington Department of Fish and Wildlife 2014a) (both state and federal species of concern), and sculpin (*Cottus* spp.), three-spined stickleback (*Gasterosteus aculeatus*), and various invertebrates. Coho and cutthroat trout use the stream for migration and coho rear in the lower portion of the stream. The lower section of the stream is a straight, open channel lacking aquatic species habitat features such as large woody debris, boulders, riffles, and canopy cover. Coho outmigration occurs in the spring, peaking in May. Cutthroat outmigration begins as early as March, peaks from late May to early June, and continues through mid-July (Simenstad and Eggers 1981).

Special-Status Species

The priority habitat and species database lists no occurrences of terrestrial special-status species in the study area near the project site. However, a pair of nesting peregrine falcons (state-sensitive species and federal species of concern) was recorded in 2006, approximately 0.75 mile from the site (Washington Department of Fish and Wildlife 2014a). According to the priority habitat and species database, the study area also includes breeding and wintering areas for peregrine falcons (Washington Department of Fish and Wildlife 2014a). Peregrine falcons nest on cliff ledges but also use tall, engineered structures such as bridges and power poles. Courtship begins as early as January, eggs are laid in the spring, and hatching occurs about a month later. Human disturbance is most likely to affect peregrines during courtship and incubation (Oregon Department of Transportation 2000: 7). In addition to providing suitable breeding habitat for peregrine falcons, Rennie Island (located 0.3 mile southwest of the project site) provides suitable breeding habitat for two other special-status species: the great blue heron (*Ardea Herodias)* (state monitored) and bald eagles (*Haliaeetus leucocephalus*) (state-listed sensitive species and federal species of concern).

Critical habitat for green sturgeon and bull trout has been designated in Grays Harbor, which overlaps the aquatic portion of the study area. In addition, several fish species and other aquatic animals could occur in the aquatic portion of the study area, including salmonids, sturgeon, forage fish, groundfish, invertebrates, and potentially river otter. For additional information on these species, see Section 3.5.4.3, *Grays Harbor*.

3.5.4.2 PS&P Rail Line

The PS&P rail line between Centralia and the project site extends through four general terrestrial vegetation communities: forests (coniferous, deciduous, and mixed), scrub-shrub, agriculture (cultivated crops, hay, pasture), and developed and barren lands (see Section 3.4.4.2, *Puget Sound & Pacific Railroad*, for descriptions of these vegetation communities). Residential and commercial developments are scattered along the majority of the corridor, with higher concentrations near Centralia and Elma into Aberdeen and Hoquiam (Figure 2-1). The PS&P rail line follows the Chehalis River Valley and in some areas is adjacent to the Chehalis River. Other habitats along the corridor include wetlands and surface waters.

Terrestrial Habitats

Forested habitats are found along much of the northern/eastern portions of the PS&P rail line between approximately Malone-Porter and Oakville, 25 to 30 miles southeast of the project site (Figure 2-1). Common mammal species such as bear, deer, raccoon, and squirrels are found in these areas, as well as owls, hawks, songbirds, reptiles, and invertebrates.

Scrub-shrub habitat is found along portions of the PS&P rail line northwest of Malone-Porter (Figure 2-1). Scrub-shrub wetlands also occur along the PS&P rail line in areas hydrologically influenced by the Chehalis River and its tributaries and in areas influenced by high groundwater conditions. Common species such as songbirds, rodents, and reptiles are found in scrub-shrub habitats. Scrub-shrub and emergent wetlands support large concentrations of wintering waterfowl, cavity nesting ducks, and nesting Canada goose (Washington Department of Fish and Wildlife 2014a).

Agricultural lands are found along several areas of the PS&P rail line, generally in or near the Chehalis River floodplain. These areas typically no longer support a native plant community and consist of cultivated croplands, hay, and pasture. Some of these agricultural lands support high concentrations of wintering waterfowl (Washington Department of Fish and Wildlife 2014a). Areas along the rail line containing cultivated crops include lands south of the rail line between Centralia and Oakville and west of Malone-Porter (Figure 2-1). Areas along the rail line containing hay or pasture include lands south of the rail line between approximately Grand Mound and Oakville and approximately Malone-Porter and Montesano.

Aquatic Habitats

Aquatic habitats along the PS&P rail line include 26 salmon-bearing streams that intersect the rail line (Bilhimer pers. comm.) Tributaries to the Chehalis River (from west to east) include the Wishkah River, Wynoochee River, Satsop River, Black River, and Skookumchuck River, as well as numerous other creeks, drainages, and associated wetlands. The Skookumchuck River is one of the main tributaries to the Chehalis River.

Special-Status Species

Based on priority habitat and species data, special-status species that may occur along the PS&P rail line include northern spotted owl (*Strix occidentalis*), marbled murrelet (*Brachyramphus marmoratus*), and three subspecies of western (Mazama) pocket gopher (*Thomomys mazama* ssp.). USFWS has designated critical habitat for the threatened bull trout (*Salvelinus confluentus*) in four streams either crossed by or adjacent to the PS&P rail line. In addition, USFWS has proposed critical habitat for the threatened Oregon spotted frog (*Rana pretiosa*) near the rail line along the Black River, a tributary to the Chehalis River near Oakville, Washington.

Suitable habitat for northern spotted owl is located within forested habit along the rail line (Washington Department of Fish and Wildlife 2014a), however this habitat is not designated critical habitat under the ESA. The northern spotted owl is a state-listed endangered and federally listed threated species. The owl's range is associated with the presence of coniferous forests and it is strongly associated with structurally complex forests, such as old growth, but also uses mature and some younger forests. Habitat loss is an important threat to spotted owls (Washington Department of Fish and Wildlife 2013: 63-68). Designated critical habitat for the marbled murrelet occurs in a

small area of forested habitat along the rail line, approximately 30 miles southeast of the project site, just east and northwest of Oakville, Washington (Washington Department of Fish and Wildlife 2014a).

Three subspecies of western (Mazama) pocket gopher have recently been listed as threatened under the ESA: Olympia Mazama pocket gopher (*Thomomys mazama pugetensis*), Tenino Mazama pocket gopher (*T. mazama tumuli*), and Yelm Mazama pocket gopher (*T. mazama yelmensis*). These species are known to occur in Thurston County (approximately 10 miles of the PS&P rail line occurs in Thurston County) near Rochester and Grand Mound, Washington (Figure 2-2). However, there is no designated critical habitat in this area of the county.

USFWS has listed the threatened bull trout (*Salvelinus confluentus*) as occurring in streams in Grays Harbor, Lewis, and Thurston Counties, Washington. The rail line crosses several streams with documented bull trout presence, including the Wishkah River, Satsop River, and Wynoochee River, all three of which are designated as critical habitat for the species (Figures 3.3-1 and 3.3-2). In addition, the rail line is adjacent to the Chehalis River in some places, particularly around Porter, Washington, where the rail line is less than 50 feet from the river. The Chehalis River is also designated critical habitat for the species in this area.

USFWS has listed the threatened Oregon spotted frog as occurring or potentially occurring in Thurston County, Washington. The species inhabits emergent wetland habitats in forested landscapes, although it is not typically found under forest canopy (78 *Federal Register* [FR] 53586). USFWS has proposed critical habitat for the Oregon spotted frog near the rail line along the Black River. Based on the USFWS National Wetland Inventory, the proposed critical habitat near the rail line is forested wetland. Final designation of critical habitat may include this proposed area, or USFWS may decide that the area does not provide habitat critical to the species' survival and that it does not contain the primary constituent elements that are the physical and biological features required for species survival and reproduction.

Chehalis River Surge Plain Natural Area Preserve

The Chehalis River Surge Plain Natural Area Preserve (Figure 3.4-1) is located south of and adjacent to the rail line for approximately 5 miles. It is the largest and highest-quality coastal surge plain wetland in Washington State (Washington State Department of Natural Resources 2009: iii). The preserve supports two priority animal species: the bald eagle and the Olympic mudminnow (*Novumbra hubbsi*). Olympic mudminnows are endemic to Washington State and only occur in the southern and western lowland drainages of the Olympic Peninsula, the Chehalis River and Deschutes River drainages, and southern Puget Sound. They have been observed in a portion of the preserve and likely occur throughout the abundant areas of suitable habitat (Washington State Department of Natural Resources 2009: 20).

Most of the preserve provides high-quality nesting and foraging habitat for bald eagles. In addition, the preserve supports at least eight other species recognized by WDFW as conservation priorities in the priority habitat and species database: pileated woodpecker (*Dryocopus pileatus*) state-listed candidate species, Vaux's swift (*Chaetura vauxi*) state-listed candidate species, osprey (*Pandion haliaetus*) state-monitored species, reticulate sculpin (*Cottus perplexus*) state-monitored species, western brook lamprey (*Lampetra richardsoni*) state-monitored and federal species of concern, band-tailed pigeon (*Columbia fasciata*) state priority species, wood duck (*Aix sponsa*) state priority species, and mink (*Mylocheilus caurinus*) state priority species.

The preserve contains important osmoregulation and rearing habitat for anadromous salmonids, including spring and fall Chinook, coho, fall chum, and summer and winter steelhead. The surge plain also forms important winter rearing and refuge habitat for Chinook and coho that may be forced downriver during high winter flows in the river and its tributaries. Seventy-five different species of birds have been documented in the preserve, including 50 species that likely breed there, 16 that could breed there, and nine that are migrants or vagrants. There are several active bald eagle and osprey nests, as well as areas where band-tailed pigeons find important mineral salts early in the breeding season and again in late summer. Mammals observed in the preserve include black bear, beaver, raccoon, deer, river otter, Douglas squirrel, varying (or snowshoe) hare, and harbor seal. No formal amphibian surveys have been completed; however, red-legged frogs are known to occur and garter snakes and other common amphibians and reptiles are likely to be present given the diversity and quality of habitats (Washington State Department of Natural Resources 2009: 22).

3.5.4.3 Grays Harbor

Grays Harbor is a large estuary that supports diverse species of fish, shellfish, benthic invertebrates, marine mammals, shorebirds, and other wildlife that use the study area. Several types of aquatic and intertidal vegetation communities occur in and along the shoreline of Grays Harbor, providing habitat for the various animal species. These vegetation communities are described in Section 3.4, *Plants*. The following description of Grays Harbor species and habitats is primarily based on a recently published analysis (U.S. Army Corp of Engineers 2014).

General Habitats and Associated Animal Species

Washington State considers native eelgrass (*Zostera marina*) beds a saltwater habitat of special concern (Washington Administrative Code [WAC] 220.110.250(3)(a,b)). Eelgrass habitat is important to many species of fish, invertebrates, and birds. Eelgrass provides shelter from predation and foraging areas and is an important nursery for several fish and invertebrate species, including salmonids and Dungeness crab (*Cancer magister*). Pacific herring (*Clupea pallasii*) spawn in eelgrass beds, depositing their eggs on the blades of vegetation. Spawning occurs between mid-January and early April (Washington Department of Fish and Wildlife undated: 1). Eelgrass beds support waterfowl that overwinter in Grays Harbor as well as migrating shorebirds that stop to rest and feed during their annual spring migrations. Expansive beds of eelgrass are found in the north bay; the south bay and Elk River estuary area support smaller beds of eelgrass and herring spawning areas (Figure 3.4-1). Eelgrass is not found in the navigation channel or the Cow Point Turning Basin adjacent to the project site.

Other important habitats surrounding the harbor include intertidal salt marsh, dune grass, and low-elevation freshwater wetlands. Salt marsh habitats provide important resting and foraging habitat for migrating birds and rearing juvenile fishes. Salt marsh habitat is located in the Grays Harbor National Wildlife Refuge, along the northern shoreline of Grays Harbor (including much of the shoreline of the north bay), and along the shoreline of the south bay near the mouth of the Elk River and at the mouth of the Johns River (Figure 3.3-1) (Northwest Area Committee 2013: 6-3, 6-7; Washington Natural Heritage Program 2014). Dune grass habitat is found along the sandy beaches and on the upland sand dunes along the shoreline of Grays Harbor and along the north shore of Damon Point.

Grays Harbor National Wildlife Refuge in located on the northeast corner of Grays Harbor. It is approximately 3 miles from the project site (Figure 3.4-1). The refuge includes approximately 1,500

acres of intertidal mudflats, salt marsh, and uplands and occupies approximately 2% of the estuary's intertidal habitat. Grays Harbor National Wildlife Refuge was established in 1990 to protect shorebird habitat. In 1996, Grays Harbor was designated a hemispheric reserve by the Western Hemisphere Shorebird Reserve Network as a site of international significance. The refuge hosts up to 50% of shorebirds that stage in the estuary (U.S. Fish and Wildlife Service 2014b, 2014c). The Audubon Society has also designated the refuge as an Important Bird Area called Bowerman Basin. Other designated Important Bird Areas the study area are Damon Point/Oyhut, Elk River Estuary, Bottle Beach, Center Islands, and Humptulips Estuary.

Special-Status Species

Many of the animals in Grays Harbor are special-status species. Appendix F, *Special-Status Species,* lists the animal species that may occur in or around Grays Harbor and their federal and state statuses.

Aquatic Habitats

Fish

Grays Harbor and its tributaries provide habitat for various fish species, including salmonids, sturgeon, lamprey, groundfish, and forage fish. Table 3.5-2 presents the salmonid species that may occur in Grays Harbor and its tributary streams and lists which are considered special-status species. As noted in the table, several special-status salmonid species are present in Grays Harbor and tributary streams.

The Chehalis River is the largest tributary that drains directly into Grays Harbor. Other tributaries that empty into Grays Harbor are the Humptulips River, Hoquiam River, Johns River, and Elk River. Six species of salmonids are known to migrate and rear in portions of Grays Harbor and its tributaries. The salmon and trout of the Grays Harbor basin spawn in freshwater streams, rear for a portion of their life in their natal streams, emigrate to the marine environment where they rear for months or years depending upon the species, and then return to their natal stream to spawn. Grays Harbor, the Chehalis River, and tributaries to these waters accessible to salmon are designated as essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act for Pacific salmon, including Chinook and coho salmon.

Chum Salmon

Chum salmon found in Grays Harbor belong to the Pacific Coast chum evolutionary significant unit, but National Marine Fisheries Service (2009 in U.S. Army Corps of Engineers 2014: 79) also believes that Lower Columbia River chum evolutionary significant unit juveniles may rear in nearshore areas of Grays Harbor. Adult chum salmon of the Pacific Coast chum evolutionary significant unit migrate into rivers in the fall after the onset of heavy rains. These adults do not generally travel long distances to spawn and select reaches immediately upstream of tidal influence to build nests in gravelly substrate and lay their eggs. Immediately after hatching in the spring, juveniles move downstream into the estuary to rear in the nearshore environment. Their early outmigration to the estuary and the lengthy juvenile rearing that takes place there make chum salmon heavily reliant upon beneficial estuarine conditions.

Coho Salmon

Coho salmon found in Grays Harbor belong to the southwest Washington coho evolutionary significant unit. According to survey data, juvenile coho salmon of this evolutionary significant unit peak in mid-April to late May in the upper estuary near Cow Point and peak in the lower estuary 1 to 2 months later in mid- to late June. Thus, coho spend at least a portion of their juvenile rearing stage in the Grays Harbor estuary (Moser et al. 1991 in U.S. Army Corps of Engineers 2014: 80). Coho salmon adults returning to spawn pass through Grays Harbor from August to October with the peak river entry typically occurring in September.

Chinook Salmon

Chinook salmon found in Grays Harbor belong to the Washington coast Chinook salmon evolutionary significant unit. Two Chinook salmon runs, spring and fall, refer to the timing when adults return to the rivers to spawn. Juveniles of the fall run are typically ocean-type, and emigrate to marine waters as subyearlings. Stream-type juveniles of the spring run rear for a longer time in fresh water and emigrate the following year as yearlings. There are very few reports of yearlings being captured in the estuary (Sandell et al. 2011 in U.S. Army Corps of Engineers 2014: 80), indicating that they move quickly through the system to reach marine waters outside of Grays Harbor. Juvenile Chinook salmon have been captured in the estuary from January through November (Tokar et al. 1970, Simenstad and Eggers 1981 in U.S. Army Corps of Engineers 2014: 80) with peak catches occurring from May to June. There is evidence of Chinook salmon juveniles residing in the estuary nearly year round, but numbers decline rapidly after June (Simenstad and Eggers 1981 in U.S. Army Corps of Engineers 2014: 80).

Fall-run adults return to Grays Harbor as early as mid-August, when they can spend weeks feeding in the estuary prior to moving up into the river system. Adult presence in the estuary can extend through October. River entry can start in early September and last through early November, and spawning in the river system takes place from early October through November (Washington Department of Fish and Wildlife 1994). Spring-run adults pass through Grays Harbor beginning in late January or early February. Spring Chinook salmon spawning typically begins in early September, peaks in late September or early October, and is generally completed by mid-October (Washington Department of Fish and Wildlife 1994).

In addition to the Washington coast Chinook salmon evolutionary significant unit, National Marine Fisheries Service (2009 in U.S. Army Corps of Engineers 2014: 80) believes that juveniles of the Lower Columbia River Chinook salmon evolutionary significant unit and Upper Willamette River Chinook salmon evolutionary significant unit may be present in Grays Harbor at various times of the year depending on prevailing ocean currents.

Steelhead Trout

Steelhead trout are the anadromous form of rainbow trout. Steelhead found in Grays Harbor belong to the Washington coast distinct population segment. Steelhead exhibit a very diverse range of life histories, and can include both anadromous and resident type populations. Anadromous juvenile steelhead leave the freshwater system for marine waters anywhere from 1 to 5 years after hatching. While some steelhead exhibit an anadromous life history, fish of the same population may choose to rear for the entirety of their lives in fresh water (in which case they are not steelhead, but rainbow trout).

Anadromous steelhead in Grays Harbor are winter-run, returning to the Grays Harbor estuary and river system between November and May or early June (Washington Department of Fish and Wildlife 2008). Winter-run steelhead spawn shortly after reaching their spawning grounds, usually between January and March in the Chehalis River, and as late as June in freshwater tributaries to the Chehalis River. Resident steelhead may be found in freshwater tributaries to Grays Harbor and not in the marine or estuarine waters of Grays Harbor.

Bull Trout

Bull trout found in Grays Harbor belong to the coastal/Puget Sound distinct population segment, and Grays Harbor is designated critical habitat for this distinct population segment. No bull trout populations have been documented in the tributaries to Grays Harbor (U.S. Fish and Wildlife Service 2004d in U.S. Army Corps of Engineers 2014: 80), and major tributaries to Grays Harbor do not support bull trout spawning, rearing, or local populations. However, current and historical data indicate the presence of bull trout in Grays Harbor and the lower Chehalis River from mid-February through early July. Nearby Olympic Peninsula rivers support bull trout that are known to use Grays Harbor for foraging as adults. Habitat in Grays Harbor maintains connectivity between the Olympic Peninsula Management Unit's bull trout core areas and local populations (U.S. Fish and Wildlife Service 2014e: 5).

Coastal Cutthroat Trout

Coastal cutthroat found in Grays Harbor belong to the southwestern Washington/Lower Columbia River distinct population segment. Similar to steelhead trout, coastal cutthroat trout have both anadromous and resident life-history forms. Anadromous forms migrate from freshwater areas in late winter and spring to feed in the highly productive nearshore coastal and estuarine environments. In winter, they re-enter fresh waters to feed and spawn. Coastal cutthroat trout may repeat this spawning/rearing cycle multiple times. Resident cutthroat trout may be found in the freshwater tributaries to Grays Harbor but would not be found in the marine or estuarine waters of Grays Harbor.

Table 3.5-2. Salmonid Species in Grays Harbor and Tributary Streams

Salmonid Species	Scientific Name	NOAA Fisheries or USFWS-Designated ESU or DPS	Listing Under the Federal Endangered Species Act	Listing Under Washington State Regulations	Life Stage Likely Found in Grays Harbor
Chum	*Oncorhynchus keta*	Pacific Coast Chum ESU	Not warranted	Not Listed	Outmigrating juveniles, returning adults
		Columbia River Chum ESU	Threatened	Candidate	Rearing juveniles
Coho	*Oncorhynchus kisutch*	Southwest Washington Coho ESU	Not warranted	Not Listed	Outmigrating juveniles, returning adults
Chinook	*Oncorhynchus tshawytscha*	Lower Columbia River Chinook ESU	Threatened	Candidate	Rearing juveniles

Salmonid Species	Scientific Name	NOAA Fisheries or USFWS-Designated ESU or DPS	Listing Under the Federal Endangered Species Act	Listing Under Washington State Regulations	Life Stage Likely Found in Grays Harbor
		Upper Willamette River Chinook ESU	Threatened	N/A	Rearing juveniles
		Washington Coast Chinook ESU	Not warranted	Not Listed	Outmigrating juveniles, rearing juveniles, returning adults
Steelhead trout	*Oncorhynchus mykiss*	Washington Coast DPS	Not warranted	Not Listed	Outmigrating juveniles, returning adults
Bull trout	*Salvelinus confluentus*	Coastal/Puget Sound DPS	Threatened	Candidate	Rearing juveniles, foraging adults
Coastal cutthroat trout	*Oncorhynchus clarkia*	Southwestern Washington/ Lower Columbia River DPS	Species of Concern	Not Listed	Outmigrating juveniles, rearing juveniles, foraging adults, returning adults

Source: U.S. Army Corps of Engineers 2014: 79
NOAA = National Oceanic and Atmospheric Administration; ESU = evolutionary significant unit; DPS = distinct population segment; USFWS = United States Fish and Wildlife Service

Green Sturgeon

The northern and southern populations of green sturgeon are found in Grays Harbor and are federally listed as a threatened species. Both populations originate from large coastal river systems including the Sacramento, Klamath, and Rogue Rivers. Northern and southern green sturgeon occurrence and habitat preferences in Grays Harbor are essentially identical. Subadult and adult green sturgeon are known to regularly use Grays Harbor during the summer and early fall months, primarily May through October. (Lindley et al. 2011 in U.S. Army Corps of Engineers 2014: 195).The green sturgeon does not spawn in Grays Harbor tributaries and only occurs as foraging adults and subadults (National Marine Fisheries Service 2005 in U.S. Army Corps of Engineers 2014: 81). Southern green sturgeon are currently listed as threatened under the ESA, and critical habitat has been designated in the study area, including Grays Harbor and coastal waters offshore to 60 fathoms depth.

White Sturgeon

The white sturgeon is the largest North American sturgeon and a species of interest for the local tribes. It is found along the west coast from Alaska to north-central California, including in Grays Harbor (Scott and Crossman 1973 in U.S. Army Corps of Engineers 2014: 81). White sturgeon is a slow-growing anadromous fish with reported estimated ages of up to 100 years (Environmental Protection Information Center et al. 2001 in U.S. Army Corps of Engineers 2014: 81). White sturgeon are known to occur in Willapa Bay (located just south of Grays Harbor on the Pacific coast of Washington) (Emmett et al. 1991 in U.S. Army Corps of Engineers 2014: 81). Quinault Indian Nation members harvested 3,111 white sturgeon in Grays Harbor in 2008 and 1,107 in 2009 (Jorgensen pers. comm. in U.S. Army Corps of Engineers 2014: 81).

Forage Fish, Groundfish, and Other Fish Species

Grays Harbor and adjacent nearshore marine areas provide habitat for a variety of forage fish, groundfish, and other fish species. Forage fish provide a prey base (forage) for numerous fish, birds, and marine mammals, including several threatened salmonids. The majority of these forage fish and groundfish are protected under the essential fish habitat provisions of the Magnuson-Stevens Act (Pacific Fishery Management Council 2011a, 2011b in U.S. Army Corps of Engineers 2014: 81). A total of eight forage fish, 21 groundfish, and five other fish species are found in Grays Harbor and adjacent coastal nearshore habitats (Table 3.5-3).

Table 3.5-3. Forage Fish, Groundfish, and other Fish Species in Grays Harbor and Adjacent Coastal Nearshore Habitats

Forage Fish Species		
Pacific sand lance	Pacific herring	Northern anchovy
Market squid	Surf smelt	Pacific sardine
Pacific mackerel	Eulachon	
Groundfish Species		
Arrowtooth flounder	Pacific sanddab	Petrale sole
Pacific cod	Flathead sole	Soupfin shark
Spotted ratfish	Rock sole	Pacific staghorn sculpin
Dover sole	Pacific tomcod	Lingcod
English sole	Starry flounder	Brown rockfish
Sand sole	California skate	Copper rockfish
Black rockfish	Redstripe rockfish	Spiny dogfish
Other Fish Species		
American shad	Arrow goby	Shiner perch
Three-spine sickleback	Surfperch	

Source: U.S. Army Corps of Engineers 2014: 83–84

One forage fish, the southern eulachon distinct population segment, is listed as a threatened species under the ESA. The eulachon is a type of smelt that spawns in fresh water, is transported by river currents to estuarine and marine habitats as larvae, and lives the remainder of its life in the ocean before returning to spawn as an adult. The primary spawning habitats for the southern eulachon distinct population segment are in the lower Columbia River and its tributaries, but they occasionally spawn in river systems to the north of Grays Harbor on the Olympic Peninsula (Gustafson et al. 2010 in U.S. Army Corps of Engineers 2014: 94). Eulachon commonly return to spawn in late winter and early spring, near the seasonal flow minimum (Lewis et al. 2002 in U.S. Army Corps of Engineers 2014: 94). In many rivers, eulachon spawning appears to be timed so that egg hatching will coincide with peak spring river discharge (Flory 2008 in U.S. Army Corps of Engineers 2014: 94). The juveniles are flushed rapidly downstream into the river estuary where they rear for weeks to months prior to entering the Pacific Ocean (Hay and McCarter 2000 in U.S. Army Corps of Engineers 2014: 94). Adult eulachon typically reside in the upper third of the water column, whereas juveniles are found in higher densities near the bottom (Spangler 2002 in U.S. Army Corps of Engineers 2014: 94). McCarter and Hay (2003 in U.S. Army Corps of Engineers 2014: 94-95) note that larval eulachon are typically abundant at depths ranging from 0 to 15 meters (0 to 49 feet) below the surface.

Eulachon are not regularly observed in Grays Harbor or its tributaries and there is sporadic evidence as to their occurrence. Deschamps et al. (1970 in U.S. Army Corps of Engineers 2014: 95) reported the capture of a single adult eulachon in March 1966 and stated that, "It is unlikely that the Chehalis system has a run of any consequence, although strays or feeding fish from other areas probably visit the upper harbor at times." However, Willson et al. (2006 in U.S. Army Corps of Engineers 2014: 95) identified several Grays Harbor tributaries (Humptulips, Chehalis, Aberdeen, and Wynoochee Rivers) as supporting eulachon spawning runs. Eulachon have been reported sporadically in the tributary rivers to Grays Harbor, specifically the Wynoochee River (Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife 2001; Willson et al. 2006 in U.S. Army Corps of Engineers 2014: 95). Simenstad et al. (2001 in U.S. Army Corps of Engineers 2014: 95) recorded eulachon as a rare occurrence in sloughs of the Chehalis River estuary in 1990 and 1995. Their occurrence in Grays Harbor in recent years has been classified as rare (Gustafson et al. 2010 in U.S. Army Corps of Engineers 2014: 94). Based on these studies, eulachon appear to be sporadic visitors to Grays Harbor and to spawn occasionally in the rivers that are tributary to Grays Harbor. Critical habitat is designated for the southern eulachon distinct population segment, but it does not include Grays Harbor or its tributaries.

Invertebrates

A variety of invertebrates uses Grays Harbor, including Dungeness crab (*Cancer magister*), clams, oysters, and a diverse epibenthic community. These invertebrates provide forage for the fish, birds, and other wildlife in Grays Harbor. Commercial harvest of Dungeness crab and farming of oysters provide substantial inputs to the local economy of the communities surrounding Grays Harbor. In addition, the Dungeness crab fishery is important to four coastal tribes, including the Quinault Indian Nation, which has usual and accustomed fishing grounds in Grays Harbor.

Dungeness Crab

The expansive mudflats and dendritic tidal channels of Grays Harbor provide highly productive habitat for juvenile Dungeness crabs, and the structural complexity of eelgrass beds provide cover, rearing, and foraging habitats (Armstrong et al. 2003 in U.S. Army Corps of Engineers 2014: 70). The inner harbor reaches, with more mud and silt, are not as suitable to rearing crabs as the sandier outer harbor reaches. Unstructured littoral habitats are important foraging areas for juvenile and subadult Dungeness crabs (Holsman et al. 2006: 183). Holsman et al. (2006: 193) also suggests that these unstructured habitats, including mud and sandflats in the intertidal areas, may be primary foraging areas critical to crab production. Armstrong et al. (1991 in U.S. Army Corps of Engineers 2014: 69) found that crab abundance in Grays Harbor ranged from about 3 to 28 million crabs, depending on season. Crab populations are highest during mid spring through early summer, and begin to decline toward the end of summer through fall. Trawl surveys in the Grays Harbor Navigation Channel reported an average Dungeness crab density of 678 crabs per hectare (Armstrong et al. 1991 in U.S. Army Corps of Engineers 2014: 69).

Grays Harbor Dungeness crabs are harvested commercially and by the Quinault Indian Nation. WDFW nontreaty commercial Dungeness crab landings data indicate that 9,247 pounds of crab were harvested in Grays Harbor (catch reporting area 60B) in 2013/2014, with an overall average of 91,372 pounds per year between 1997 and 2014 (Washington Department of Fish and Wildlife 2014b; U.S. Army Corps of Engineers 2014: 73). Quinault Indian Nation-reported harvest in the Dungeness crab fishery (2004 to 2013) averaged 2.6 million pounds of crab annually (Resource

Dimensions 2015: 80). Harvest is the large anthropogenic stressor on crab populations in Grays Harbor.

Other Invertebrates

A variety of invertebrates, including worms, nematodes, copepods, amphipods, crustaceans, and mollusks, inhabit Grays Harbor and provide forage for numerous species of birds and fish. Oysters and clams (mollusks) are farmed over 900 acres in Grays Harbor (Green et al 2009 in U.S. Army Corps of Engineers 2014: 76), and Pacific oysters are found in the intertidal or shallow subtidal zones of Grays Harbor attached to hard substrates. Oyster beds are located primarily in the south and central portions of Grays Harbor; there are also some beds in areas of the North Bay (Washington Department of Fish and Wildlife 2014a). Oysters feed on small organisms that they filter from the water column. Spawning occurs annually in July or August when water temperatures rise above 19.5°C. Water temperature greatly influences development rates, but typically, young oysters attach to hard substrate approximately 2 weeks after fertilization, where they will stay attached for the remainder of their lives.

Marine Mammals

Marine mammals are frequently observed in Grays Harbor. California sea lions (*Zalophus californianus*) and harbor seals (*Phoca vitulina*) are the most common species. Harbor seal haulout sites are located throughout the estuary, primarily in the north and central bays (Washington Department of Fish and Wildlife 2014a). Many of the haulouts are used during the pupping season (mid-April through June) when peak abundances occur (Jeffries et al. 2000: vii; Washington Department of Fish and Wildlife 2014a). The harbor seal haulout closest to the navigation channel is located approximately 200 meters away, which is twice the distance recommended by the National Marine Fisheries Service (100 meters) to avoidance disturbance related to vessel traffic. Harbor seal abundance also peaks during the annual molt July through August (Jeffries et al. 2000: 12). Fewer male California sea lions use the estuary seasonally, from the fall through late spring (Jeffries et al. 2000: viii). Steller sea lions (*Eumetopias jubatus*) use the Pacific Ocean near Grays Harbor and may enter the estuary on occasion.

Several ESA-listed whale species may occur off the Washington coast near Grays Harbor. These include blue, fin, and sei whales (*Balaenoptera musculus, B. physalus,* and *B. borealis,* respectively), sperm whale (*Physeter macrocephalus*), and humpback whale (*Megaptera novaengliae*), all of which are federally listed and state-listed as endangered. Killer whale (*Orcinus orca*) also occurs in these waters and includes two types: southern resident killer whales, which are federally listed as endangered, and transient killer whales, which are not listed as threatened or endangered. Other whale species that may occur in the waters off Grays Harbor are the pygmy sperm (*Kogia breviceps*), common minke (*Balaenoptera acutorostrata*), and the state-listed sensitive gray whale (*Eschrichtius robustus)*. The occurrence of these species in the coastal waters of Washington State ranges from exceptionally rare (blue whales) to relatively common (humpback whales) (Carretta et al. 2011 in U.S. Army Corps of Engineers 2014: 88).

With the exception of humpback whales, gray whales, and killer whales, the probability of the whale species listed above occurring in the study area (including Grays Harbor) is remote because these other whale species are rarely seen within 10 miles of shore (Calambokidis et al. 2004; Carretta et al. 2011 in U.S. Army Corps of Engineers 2014: 89). The Orca Network (2013 in U.S. Army Corps of Engineers 2014: 88) reports many sightings of humpback whales travelling along the coast near the

mouth of Grays Harbor but rarely reports humpbacks entering the bay itself, indicating that they infrequently use Grays Harbor. Gray whales pass through Washington waters twice annually, migrating between breeding grounds in Baja California and feeding grounds in Alaska. Gray whale use of Grays Harbor is well documented and they are known to enter Grays Harbor during migrations along the coast (Washington Department of Fish and Wildlife 1997). Their migration peaks during March, April, and May in Washington, when gray whales swim in large numbers close enough to the Washington coastline to be seen from shore (U.S. Army Corps of Engineers 2014: 89). During a 1996 survey, gray whales were seen consistently in Grays Harbor; at least 27 different whales were observed using the harbor, mostly for extended periods (Washington Department of Fish and Wildlife 1997).

Killer whales are also known to occur in Washington coastal waters and near Grays Harbor. These killer whales represent both southern resident killer whales, which feed primarily on salmon, and transient killer whales, which feed primarily on marine mammals. Killer whales are considered only occasional visitors to the waters around Grays Harbor (U.S. Army Corps of Engineers 2014: 89); they have been sighted and tracked in Washington coastal waters near Grays Harbor during March and April (Krahn et al. 2004; National Marine Fisheries Service 2008 in U.S. Army Corps of Engineers 2014: 96), but have not been observed inside Grays Harbor. This is consistent with documented whale sightings in the Orca Network (2016) database, which includes several records of both southern resident and transient killer whales observed within 5 miles offshore of Grays Harbor, but none within the harbor itself.

Other marine mammals common to Grays Harbor include harbor porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), and Pacific white-sided dolphin (*Lagenorhynchus obliquidens*); these species are year-round inhabitants of Grays Harbor and the surrounding coastline. The Orca Network (2013 in U.S. Army Corps of Engineers 2014: 89) reports many sightings of these species in and around Grays Harbor annually. Common dolphin (*Delphinus delphinus*) are occasionally sighted around Grays Harbor but typically frequent warmer waters to the south.

Sea Turtles

Sea turtles that occur in Washington coastal waters include the leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and olive ridley (*Lepidochelys olivacea*) sea turtles (National Oceanic and Atmospheric Administration 2014c). The loggerhead sea turtle is listed as threatened; the remaining species are listed as endangered. All four turtle species occur in Washington waters at varying frequencies but only as adults. They are highly unlikely to occur in Grays Harbor or the nearshore areas.

Leatherback and loggerhead sea turtles are occasionally observed in productive coastal waters, but nearshore sightings are rare in Washington State (Washington Department of Fish and Wildlife 2012; Conant et. al. 2009 in U.S. Army Corps of Engineers 2014: 97). Adults have occasionally been found stranded on the Washington coast (Bowlby et. al. 1994 in U.S. Army Corps of Engineers 2014: 97), but none have been recorded in the last decade (Washington Department of Fish and Wildlife 2012 in U.S. Army Corps of Engineers 2014: 97). Leatherback sea turtle critical habitat has been designated in the coastal marine waters of the study area; this critical habitat includes the prey species essential to the conservation of the species. The critical habitat does not include nesting habitat.

Green and olive ridley sea turtles are rare visitors to Washington waters (U.S. Army Corps of Engineers 2014: 97). These species are occasionally found stranded on the Washington coast or tangled in nearshore gillnets. The likelihood of these species occurring in Grays Harbor or adjacent nearshore areas is considered remote (U.S. Army Corps of Engineers 2014: 98).

Shorebirds and Waterfowl

Grays Harbor estuary is located along the Pacific Flyway, a migratory flight corridor between Alaska and South America. It is one of four major staging areas for migrating shorebirds in North America, with shorebirds congregating in the mudflats to feed and rest during spring and fall migrations. Approximately 24 species of shorebirds use the Grays Harbor National Wildlife Refuge during migrations, which begin in late April and continue through mid-May. The spring migration is concentrated, with hundreds of thousands of shorebirds arriving for a brief stay during their northern migrations. Fall migrations begin in July and continue through September. The fall migration is less concentrated, as shorebirds leave their breeding grounds at different times. In the winter, lesser numbers of shorebirds can be found at the refuge; dunlin (*Calidris alpina*) is one species that overwinter at the refuge. Waterfowl and raptors are abundant during the winter months (U.S. Fish and Wildlife Service 2014f).

Western sandpiper (*Calidris mauri*) and dunlin are the most abundant shorebird species found at the refuge, with semipalmated plover (*Charadrius semipalmatus*), least sandpiper (*Calidris minutilla*), red knot (*C. canutus*), and black bellied plover (*Pluvialis squatarola*) common during migration. Other birds that commonly use the refuge include the peregrine falcon, bald eagle, northern harrier (*Circus cyaneus*), Caspian tern (*Hydroprogne caspia*), great blue heron, songbirds, and various waterfowl (U.S. Fish and Wildlife Service 2014f).

Marbled murrelet is a seabird that feeds on forage fish in open marine waters. While extensive survey data of marbled murrelets in and around Grays Harbor are lacking, murrelets likely occur in low numbers in the Grays Harbor area throughout the year, particularly during the fall, winter, and spring (Pearson et al. 2011; Speich and Wahl 1995 in U.S. Army Corps of Engineers 2014: 95).

Dune grass habitat around Damon Point is one of three critical nesting habitat areas used by snowy plover (*Charadrius alexandrius nivosus)* in Washington State and is designated as critical habitat under the ESA. Snowy plover is a federally listed threatened and state-listed endangered shorebird with a breeding season that extends from March through September (U.S. Fish and Wildlife Service 2014g).

The streaked horned lark (*Eremophila alpestris strigata*) is a ground-dwelling songbird that is federally listed as threatened and state-listed as endangered. Designated critical habitat includes Damon Point, where a breeding population is located. In Washington, nesting areas for the streaked horned lark include grasslands and sparsely vegetated areas at airports, sandy islands, and coastal spits (Washington Department of Fish and Wildlife 2013: 69-73). The nesting season begins in late March and continues through August (U.S. Fish and Wildlife Service 2014h).

As noted above, peregrine falcon breeding and wintering areas are known to occur in the study area. Additionally, peregrine falcon overwintering areas are located near Grays Harbor, including in Grays Harbor National Wildlife Refuge approximately 4 miles to the west, in the south bay approximately 12 miles to the southwest, and in a large portion of the north bay approximately 10 miles to the northwest (Washington Department of Fish and Wildlife 2014a).

Two priority species habitats were identified near the project site on Rennie Island, but outside of the study area: a great blue heron (*Ardea Herodias*) rookery in 2002 and a bald eagle (*Haliaeetus leucocephalus*) nest in 2005. Great blue herons nest in large groups. Their foraging, breeding, and prenesting habitats are usually close to each other: most colonies are within 1.9 miles of key foraging grounds (Larsen et al. 2004: 3-1 to 3-18). During the breeding season, coastal herons can find most of their required nutrition in eelgrass meadows and other estuarine habitats (Larsen et al. 2004: 3-1 to 3-18). Herons are especially susceptible to human disturbance, predation, and competition for nesting habitat (Larsen et al. 2004: 3-1 to 3-18). Bald eagles are known to feed and nest in and around Grays Harbor and along the Chehalis River near the PS&P rail line. Bald eagle habitat includes estuaries, large lakes, reservoirs, rivers, and some seacoasts. They require nesting sites, perching areas, and a good food base primarily of fish and carrion (U.S. Fish and Wildlife Service 2007).

One additional documented special-status species was identified nearby but outside of the study area: purple martins (*Progne subis*) were documented as nesting near the mouth of the Hoquiam River in 1988. Purple martin is a state-listed species of concern and further identified as a priority for breeding areas. Grays Harbor is a breeding area for purple martins. They nest in natural cavities found in tree snags and crevices and in artificial nest boxes and gourds provided by humans for this purpose (Larsen et al. 2004: 31-1 to 31-4).

Washington State Department of Natural Resources Marine Protected Areas

Five WDNR Marine Protected Areas managed by the Washington State Department of Natural Resources are found in Grays Harbor.

- Whitcomb Flats Natural Area Preserve
- North Bay Natural Area Preserve
- Goose Island Natural Area Preserve
- Sand Island Natural Area Preserve
- Elk River Natural Resources Conservation Area

The Whitcomb Flats Natural Area Preserve is a small accretion island that is seasonally overtopped, and where island sands shift continually. The accretion island supports nesting seabird colonies including western gulls and Caspian terns, as well as nonbreeding bald eagles and black-bellied plover. The Whitcomb Flats Natural Area Preserve protection level is *No Impact*, which allows human access but prohibits all activities that could harm the site's resources or disrupt the ecological or cultural services it provides (Washington State Department of Natural Resources 2015a). The Whitcomb Flats Natural Area Preserve is about one third of a mile south of the navigation channel.

The North Bay Natural Area Preserve contains one of the highest quality coastal freshwater and sphagnum bog systems remaining in Washington, and supports priority habitat features including shorebird and waterfowl concentration areas, harbor seal haulout and pupping areas, and Roosevelt elk and peregrine falcon wintering areas. The North Bay Natural Area Preserve protection level is *No Access*, which restricts human access to prevent potential ecological disturbance (Washington State Department of Natural Resources 2015b). The North Bay Natural Area Preserve is on the north side of Grays Harbor along and in the North Bay and is over 5 miles from the navigation channel.

The Goose Island Natural Preserve Area is a small, sandy accretion island that is seasonally overtopped, and where island sands shift continually. The accretion island supports a large colony of nesting seabirds including gulls, brants, long bill curlew, and historically, Caspian terns. Brown pelicans use the island after breeding season. Following submersion during severe winter storms, the shifting dunes on this island have been recolonized by vegetation and nesting birds as the ecosystem rebuilds (Washington State Department of Natural Resources 2015c). The Goose Island Natural Preserve Area is in the North Bay of Grays Harbor more than 3.5 miles from the navigation channel.

The Sand Island Natural Area Preserve is a small, sandy accretion island that is seasonally overtopped, and where island sands shift continually. The accretion island protects nesting seabird colonies, historically including Caspian terns. Bald eagles, double-crested cormorants, brown pelicans, brants, ring-billed gulls, sandpipers, and many other birds use the island. The island supports sand dune vegetation and provides a haulout site for seals (Washington State Department of Natural Resources 2015d). The Sand Island Natural Area Preserve is in the North Bay of Grays Harbor more than 2.5 miles from the navigation channel.

The Elk River Natural Resources Conservation Area is the largest high-quality estuarine system remaining in Washington. The area supports diverse habitats that include tide flats, sloughs, saltmarsh wetlands, freshwater wetlands, and forested uplands. The shoreline area is an important stopover area for migrating shorebirds and waterfowl, including common loon, tundra swan, and various species of ducks, plovers, and sandpipers. It is estimated that up to 1 million shorebirds utilize the area annually. The habitats also support nesting bald eagles, elk, bear, beaver, river otter, and other mammals (Washington State Department of Natural Resources 2015e). The protection level for the conservation area is *Uniform Multiple Use*, which provides a consistent level of protection and allowable activities, including certain extractive uses, across the entire area. The Elk River Natural Resources Conservation Area is just more than 3 miles south of the navigation channel at its closest point, along the shoreline of South Bay of Grays Harbor.

3.5.5 What are the potential impacts on animals?

This section describes impacts on animals that could occur in the study area. Potential impacts of the no-action alternative are described first, followed by impacts of the proposed action.

3.5.5.1 No-Action Alternative

Under the no-action alternative, impacts on animals from the construction of the proposed action would not occur. The applicant would continue to operate its existing facility as described in Chapter 2, Section 2.1.3.2, *Existing Operations*. Although the proposed action would not occur, it is assumed that growth in the region would continue under the no-action alternative. This growth could lead to development of another industrial use at the project site, which could result in impacts similar to those described for construction and routine operation of the proposed action. However, for the purposes of this analysis, it is assumed that no future development would occur at the project site.

3.5.5.2 Proposed Action

This section describes impacts that could occur in the study area as a result of construction and routine operation of the proposed action. First, this section describes impacts from construction of

the proposed action. It then describes impacts of routine operation at the project site and of routine rail and vessel transport to and from the project site.

Construction

Construction of the proposed action could affect animals at or around the project site by removing habitat, causing animal mortality, increasing noise disturbance, and temporarily causing water quality impacts that would affect aquatic habitat as the result of exposure to contaminated stormwater runoff.

Terrestrial Habitat Impacts and Animal Mortality

Construction of the proposed action would be limited to the project site. No construction activities would occur outside of the project site and construction activities would not remove habitat along or within Grays Harbor or along the existing PS&P rail line. Although project site construction would occur within 200 feet of Grays Harbor, no in-water construction work or shoreline construction work would be required, and no loss of shoreline or aquatic habitat would occur.

Construction would result in the permanent loss of approximately 1 acre of scattered grass and weed areas around the edge of the project site. These areas do not support native plant communities and do not provide valuable habitat to animals. In addition, the project site is surrounded by a chain-link fence with barbed wire along the top, which is a barrier to most animals. Animals that could pass through or over the top of the fence—common rodents, birds, invertebrates, and other small animals—would be displaced to other habitat areas outside the project site if present during construction. However, these animals are already habituated to the developed conditions of the project site and surrounding area, and larger areas of equivalent or higher quality habitat outside of the project site are available and accessible.

Construction activities could also increase the mortality of animals that may get into the project site during construction, resulting from construction equipment collisions. However, animals are mobile and are typically able to avoid construction areas; the risk of this impact would be temporary and would last only the duration of construction. Given the low quality and small amount of habitat that would be removed, the low probability of animals accessing the site, the existence of equivalent or higher quality habitat outside of the site and beyond, and the short-term use of construction equipment, potential construction impacts on animals from land-disturbance activities would not affect species populations or fitness (the ability of a population to maintain or increase its numbers in succeeding generations).

A potential beneficial impact on habitat and animals that would result from the proposed action would be the City of Hoquiam's requirement to provide mitigation for new development in the form of a landscaping plan. Construction of the proposed action would result in the development of the project site, and per the City of Hoquiam's municipal code (10.05.065), mitigation for this new development would be planting a required number of trees based on the gross area of construction. The quantity of trees is based on the requirement to achieve 18 total caliper inches (18 inches of tree trunk diameter—a measure of the size of trees at installation) of new deciduous trees and 18 feet total height of new evergreen trees for every gross acre of construction. This required landscaping would provide a new habitat type and a habitat that would exceed the quality of habitat (1 acre of nonnative grass and weeds) removed during construction. Because the project site would be completely developed, that landscaping plan would be implemented outside of the project site.

Noise

While animals in and around the project site are already habituated to noise levels associated with industrial and developed areas, noise would increase above ambient levels for the duration of the construction activity. The Federal Railroad Administration provides guidance for characterizing the potential impacts on the people and terrestrial animals that may be exposed to increased noise levels. The threshold above which noise would disturb wildlife is 100 A-weighted decibels (dBA) sound exposure level. Construction noise associated with all activities other than pile driving is anticipated to fall below this threshold within 50 feet of the activities; therefore, construction noise is not likely to affect animals present in the surrounding area.

As indicated in Section 3.7, *Noise and Vibration*, noise from pile driving is anticipated to be greater than 100 dBA sound exposure level within 0.85 mile of the project site. However, as indicated in the discussion of the affected environment (Section 3.5.4), no special-status species has been recently documented in the study area and although there is suitable habitat for the bald eagle, blue heron, and peregrine falcon, it is unlikely that these species would be found near the project site. Regardless, if any terrestrial animals are present near the site during pile driving, they could be affected during construction.

An animal's reaction to elevated noise levels could range from mild annoyance to escape behavior, causing it to expend energy, or to move into a new, less-familiar area, which can lead to a greater exposure to predation and other risks. However, noise impacts would be short-term and temporary, lasting only the duration of project construction. Given that the species present near the project site are already habituated to noise levels associated with industrial areas and are generally mobile, and given that any elevated noise would be temporary, it is anticipated that noise impacts would not affect species populations or fitness.

Pile driving on land and near water can result in high underwater sound pressures. The mechanism for fish injury is related to high pressures created when a pile is struck with an impact pile driver. The repeated exposure of fish to cumulative sound energy over the course of a day is also thought to result in injury. When the pile is struck, the pile vibrates and radiates sound energy directly into the water. Energy is also imparted into the ground and sound energy is radiated into the water from the ground. Aquatic species, including bull trout, green sturgeon, eulachon, and chum and Chinook salmon could be affected by noise from pile driving. Although occurrence of these species is limited to certain times of the year and in some cases may be rare, if any aquatic animals are present near the site during pile driving, there is a potential for impact.

Guidance issued by the Fisheries Hydroacoustic Working Group[3] indicates peak and accumulated noise thresholds greater than 206 decibels peak or 183 dBA sound level exposure (as measured underwater) have the potential to harm fish. The peak threshold refers to the maximum sound level produced by any single strike. The accumulative thresholds refer to the accumulated sound energy associated with a series of pile strikes for a 24-hour period. The peak threshold is not predicted to be exceeded beyond 33 feet. The 183-dBA threshold would be exceeded at 210 feet. Because the closest waterbody, the Chehalis River, is located approximately 235 feet away from the nearest pile, underwater noise from pile driving is not anticipated to be an issue and no mitigation is required.

[3] The Hydroacoustic Working Group was established in 2000 to direct research, develop analysis methods, and develop thresholds for injury. Participants include Washington, Oregon, and California departments of transportation, the National Marine Fisheries Service, and the Federal Highway Administration.

Aquatic Habitat Impacts

No in-water construction would be required, but ground-disturbing activities, equipment and material use, and hydrostatic testing could result in contaminants reaching nearby surface waters and affecting aquatic habitat (see Section 3.3, *Water*, for description of pathways of contaminant discharge to surface waters). These potential impacts would be completely avoided or reduced through the requirements of the grade and fill permits that would be needed for construction. Compliance with these permits would require implementation of a stormwater drainage control plan, temporary erosion and sedimentation control plan, and best management practices (BMP) to reduce the potential for water quality and associated biological impacts resulting from soil disturbance. This would also require developing and implementing a spill prevention, control, and countermeasures plan, an oil spill prevention plan, and a site-specific construction stormwater pollution prevention plan that includes BMPs for material handling and construction waste management would reduce the potential for impacts from these sources.

Although unlikely given the conditions and requirements to obtain this permit, any contaminant that reaches a surface water body could affect aquatic habitat and aquatic animals near the contaminant discharge. These contaminants could have toxic acute or subacute impacts on aquatic organisms and could affect photosynthesis, oxygen exchange, and the respiration, growth, and reproduction of aquatic species. These impacts would be short-term and temporary, lasting only the duration of construction.

Operations

This section describes impacts that would occur as a result of routine operations at the project site, rail transport along the PS&P rail line, and vessel transport through Grays Harbor.

Impacts on animals could occur as direct disturbance or exposure to contaminants, as discussed below. Potential impacts of exposure to crude oil spills[4] are addressed in Chapter 4, *Environmental Health and Safety*.

Onsite

Routine operations at the project site could affect animals as a result of increased noise and spills or leaks. Increased noise could affect animals in a manner similar to increased construction noise by causing disturbance and avoidance behaviors. Spills or leaks could affect water quality and aquatic habitat in and around the Grays Harbor shoreline. Both of these impacts are discussed below.

Operations of the proposed action would result in noise that could affect animals near the project site. Although additional activity (related to the transfer of bulk materials) would occur under the proposed action, as discussed in Section 3.7, *Noise and Vibration*, noise levels are anticipated to be similar to existing operations. Additionally, as noted above, animals in the area are already habituated to noise levels associated with industrial areas. For these reasons, operational noise related to the proposed action is not anticipated to affect animals in or surrounding the project site.

[4] All oil or hazardous material spills must be reported by the spiller, who must respond appropriately. Under Washington Water Rights—Oil and Hazardous Substance Spill Prevention and Response law (Revised Code of Washington [RCW] 90.56.370), anyone responsible for spilling oil into state waters is liable for damages resulting from injuries to public resources, including plants. The process for determining damages for an oil spill is called a Natural Resource Damage Assessment, as defined in WAC 173-183.

As discussed in Section 3.3, *Water*, the proposed action could slightly increase the potential for water quality impairment related to routine operations. Stormwater runoff could contain contaminants associated with routine operations (e.g., chemicals used to operate and maintain vehicles and equipment, tire and brake dust, exhaust particulates, and small spills or leaks of crude oil associated with the bulk loading transfer facility). However, as discussed in Section 3.3, *Water*, the proposed design features, including containment structures and the oil/water separator, and the implementation of prevention and control measures and stormwater BMPs required by state and federal law and applicable permits, would ensure that impacts from contaminated stormwater would be low and would present a very low risk to animals likely to be present along the shoreline near the project site.

Requirements for facility spill prevention and response is described in Chapter 4, *Environmental Health and Safety*. The potential for larger spills during terminal (onsite) operations (e.g., storage tank failure) to directly affect animals and the related environmental consequences (e.g., release of crude oil) are addressed in Section 4.4, *Environmental Risks—Terminal (Onsite)*. Potential impacts from such spills are presented in Section 4.7, *Impacts on Resources*.

Rail

Operation of the proposed action at maximum throughput would add 458 unit train trips[5] per year (1.25 trips per day on average) along the PS&P rail line, compared to the approximately 1,100 train trips per year (three trips per day on average) under the no-action alternative (Section 3.15, *Rail Traffic*). This increased traffic and the associated routine operational activities could affect animals along the PS&P rail line as the result of increased noise, increased potential for animal mortality (collisions with moving trains), and increased exposure to pollutants (leaks and spills).

Noise

Operational noise (primarily train horns at PS&P rail line grade crossings) could affect animals along the PS&P rail line during rail operations. As with any sound in the atmosphere, the intensity of noise and the distance it travels can vary and depends on many factors, including atmospheric conditions (e.g., wind, temperature, humidity) at the time of rail operations. While animals along the PS&P rail line are already habituated to noise levels associated with existing train operations, increased train traffic would increase the frequency of train noise. Increased noise frequency from train operations could displace animals that may be in or around the rail corridor during operations. A species' reaction to operations noise could range from mild annoyance to escape behavior, causing it to expend energy or to move into a new area that is less familiar, which can lead to a greater exposure to predation and other risks.

However, rail operation noise impacts would be short-term, lasting only the duration of the train passing. In addition, the distances from the track where rail noise reaches the Federal Railroad Administration wildlife noise disturbance threshold (100 dBA sound exposure level) are estimated to be small: 50 feet for wayside noise (locomotive and car/wheel noise) and between 100 and 200 feet from grade crossings where horns are sounded. The species along the rail line are already habituated to noise levels associated with rail operations and are generally mobile. Furthermore, the noise and short distances from the tracks where the Federal Railroad Administration's wildlife noise disturbance threshold would be reached would be temporary. Therefore, the noise impacts from the additional trains would likely be imperceptible and would not affect species populations or fitness.

[5] A trip represents one-way travel; in other words, an inbound trip and an outbound trip are counted as two trips.

Animal Mortality

Additional rail trips on the PS&P rail line could increase mortality of animals because of collisions with trains and increased predation risk. This potential impact would be more likely to occur in areas where high-value habitat intersects the rail line (e.g., a riparian corridor); however, much of the rail line in the study area travels through developed areas (e.g., agricultural lands, developed areas) and along and adjacent to other transportation corridors (e.g., U.S. Route 12 [US 12] and Monte Elma Road). While animals along the PS&P rail line may be habituated to the movement of existing trains, increased train traffic would be expected to proportionally increase strikes on animals. Animals that feed on carrion, use the rail line as a movement corridor, or use habitats adjacent to the rail line could have an increased incidence of collision mortality. A potential secondary effect of animal collision mortality is the loss of any dependent offspring. While the risk of animal mortality is expected to increase compared to the no-action alternative, the proportional increase in rail traffic on the existing rail line is not likely to measurably alter species populations or fitness.

Leaks and Spills

An increase in leaks and spills of petro-chemicals used in routine rail operations could occur due to the increased frequency of rail traffic and associated maintenance, and would be slightly greater than the no-action alternative. Diesel fuel, oils, grease, and other petrochemicals required for rail operation and maintenance could reach vegetation along the rail line through a spill or dripping from the train. These materials could be carried short distances by precipitation or surface waters to more sensitive areas such as streams and wetlands through the openings on bridges and trestles.

As noted in Section 3.3, *Water*, the potential for leaks and spills to occur would be minimized by regularly inspecting and maintaining railroad engines and rail cars and by implementing standard good housekeeping BMPs. Additionally, impacts from a minor spill would be expected to be localized to the area of the spill adjacent to the rail line and would not be expected to spread across a wide area and would be likely captured in the underlying ballast rock. Although the proposed action would result in a slight increase in leaks and spills of petrochemicals due to the increased frequency of rail traffic and maintenance activities compared to the no-action alternative, the overall impacts on animals are anticipated to remain low. The potential for larger spills to occur during rail transport that could directly affect animals is addressed in Section 4.5, *Environmental Health Risks—Rail Transport*. Potential impacts from such spills are presented in Section 4.7, *Impacts on Resources*.

Vessel

Operation of the proposed action at maximum throughput would add 238 tank vessel trips per year (0.7 trip per day on average) along the navigation channel to projected large commercial vessel[6] trips under the no-action alternative—between 338 and 436 large commercial vessel trips per year in 2017 and 2037, respectively, or approximately one trip per day on average (Section 3.17, *Vessel Traffic*). This increased traffic and associated routine operations could result in water quality concerns related to ballast water and biofouling, propeller wash and vessel wake, vessel shading, vessel strikes, increased noise disturbance, and leaks and spills. These impacts would be similar to but somewhat greater compared with the no-action alternative.

[6] The term *large commercial vessels* refers collectively to tank and cargo vessels.

Ballast Water and Biofouling

As noted in Section 3.3, *Water*, tank vessels calling at the Terminal 1 berth would be required to discharge ballast water during the loading process. Ballast water is carried by empty vessels to provide stability during transit. As a vessel is loaded with cargo, ballast water is discharged to balance the weight of the new cargo. Vessels calling at Terminal 1 can also transport biofouling organisms (e.g., algae and invertebrates) that settle onto submerged surfaces (e.g., vessel hulls) between waters.

Ballast water discharge and vessels supporting biofouling organisms could transfer a variety of materials into Grays Harbor that could harm aquatic ecosystems. Primary among these contaminants are invasive marine plants and animals, bacteria, and pathogens that could displace native populations and harm aquatic life. Should an introduced species become a successful invader in a new environment, it can cause a range of ecological impacts. These include competing with native species and altering environmental conditions (e.g., increased water clarity due to mass filter-feeding), altering food web and the overall ecosystem and displacing native species, reducing native biodiversity and even causing local extinctions (Ibrahim and El-Naggar 2012). These aquatic system impacts can also lead to economic and public health impacts.

Although the total number of vessel arrivals and the related volume of ballast water discharged are important components of the risk, vessel numbers may not be a directly proportional indicator of risk of nonindigenous species invasion (Verling et al. 2005; Cordell et al. 2015). Other factors include the densities of organisms surviving in ballast water (Verling et al. 2005), which is influenced by the geographic source, season, and environmental conditions during transport; increased mortality with increased voyage length; and population dynamic differences within and between different taxonomic groups of organisms (Verling et al. 2005; Marine Invasions Research Lab 2012). The risks are also influenced by environmental factors independent of the number of individuals discharged into the receiving water, such as availability of suitable habitat, patch size, and seasonal conditions at time of discharge (Verling et al. 2005). Similarly, the risk of introduction of nonindigenous organisms through biofouling is influenced by factors such as vessel design (e.g., surface complexity), vessel maintenance (e.g., age of antibiofouling paint, maintenance methods and frequency), and vessel voyage pattern (Davidson et al. 2014).

Shorter, coastwise voyages where survival is more variable and final densities are higher may pose a greater risk of successful establishment of a nonindigenous species from ballast water discharge (Marine Invasions Research Lab 2012; Verling et al. 2005). This risk is greater if ballast water held for a short duration is discharged into waters and environments with similar conditions, such as can occur during coastwise transport. Cordell et al. (2015) found that coastwise transport in oil tankers traveling relatively short distances between California ports and Puget Sound had densities of zooplankton in their ballast water that would place them in the higher risk category relative to the U.S. Coast Guard's density standards for retained organisms. Similarly, Verling et al. (2005) found that plankton survival was inversely correlated with voyage duration (i.e., shorter voyages resulted in greater survival in the ballast water).

As noted in Section 3.3, *Water*, vessels calling at Terminal 1 related to the proposed action are required to comply with the federal and state regulatory requirements listed in Section 3.6.2. However, although midocean exchange of ballast water is an accepted (and required) method to limit the introduction of nonindigenous aquatic species into Washington State waters, it is not 100% effective. This is due to variations in vessel design, density of the plants and animals present in the intake water, ballast water age or duration of voyage, and exchange procedures (Verling et al. 2005;

Minton et al. 2005; Ruiz and Smith 2005; Cordell et al. 2015). Research indicates that midocean exchange of ballast water, when correctly implemented, removes more than 80% of coastal zooplankton from a ballast tank, depending on ship type, duration of the voyage, density of zooplankton in the intake water, and ballast tank design (Minton et. al. 2005; Ruiz and Smith 2005). Studies in Puget Sound indicate that oil tankers are one of the vessel types for which ballast water exchange can be highly effective, but also that tug barges and tankers retain the highest densities of nonindigenous zooplankton, particularly those that travel over relatively short distances up or down the coast from heavily invaded estuaries in California (Cordell et al. 2015). Such vessels can pose a substantial risk for introducing nonindigenous species into receiving waters such as Grays Harbor. WDFW requires and monitors ballast water discharges and conducts inspections of vessel ballast water for vessels operating in Washington State waters.

Similarly, although vessel maintenance and cleaning to remove biofouling organisms is required under federal law, specific requirements are largely undefined with little enforcement of these requirements in the United States or in Washington State (Davidson et al. 2014). In Washington, WDFW and Washington State Department of Ecology (Ecology) require vessel operators to receive approval for in-water hull cleaning (Washington Department of Fish and Wildlife 2015).

While following the ballast water requirements and maintenance procedures to reduce biofouling would reduce the potential for impacts on aquatic plants (and animals), the increase in the number of vessels related to the proposed action (a maximum of 119 per year) and the likely use of short-distance coastal transit of oil tankers between California ports and Terminal 1 would increase the risk of introducing invasive aquatic plants and other organisms. Because the consequences of such an event would affect the native ecosystems and animals in Grays Harbor, additional monitoring requirements have been recommended, as described in Section 3.5.7.1, *Applicant Mitigation*.

Propeller Wash and Vessel Wake

Section 3.1, *Earth*, describes how vessel activity related to operation of the proposed action could increase the potential for erosion within and along the harbor as a result of vessel wake and propeller wash. The location and extent of these effects would depend on a variety of factors, including climatic conditions, tidal conditions, vessel type, vessel location, and vessel speeds.

Wakes generated by vessels related to the proposed action could reach shoreline areas and potentially affect nearshore aquatic species, especially juvenile fish, by washing them ashore and stranding them on the shoreline. Juvenile fish tend to reside in nearshore waters where warmer water and food as well as cover from higher velocity flows and predation in the harbor are abundant (Vehanen et al. 2000 in Irvine et al. 2014: 1). Consequently, this puts young fish at risk of being stranded on shallow, sloped beaches, in isolated pools, or in the open spaces of dry substrate by sudden changes in water levels, such as the wake waves generated by passing vessels.

The U.S. Army Corps of Engineers (USACE) studied vessel-induced juvenile salmon stranding along three shallow, sloped Columbia River beaches. USACE considered 19 variables that could affect fish stranding due to vessel wakes, including tidal stage, tidal height, river flow, current velocity, ship type, ship direction, ship condition (loaded/unloaded), ship speed, ship size, and ship kinetic energy. Different types of vessels were found to produce wakes leading to different patterns of drawdown and run-up on the shore. USACE observed fish strandings from four vessel types (bulk carriers, container ships, tankers, and car carriers), but not tug boats. The frequency of stranding events differed by vessel type; the order from highest frequency was tanker, container ship, car carrier, and

bulk carrier. USACE observed various fish species stranded along the study beaches, with Chinook salmon the predominant stranded species (U.S. Army Corps of Engineers 2006: 47).

The impacts on a stranded fish vary and would depend on several factors (e.g., the species of fish, stranding location, tide cycle). When a fish strands, it can either succumb to mortality through direct effects of stranding, such as drying (Bradford et al. 1995 in Irvine et al. 2014: 1), or be rewetted (Beck and Associates 1989 in Irvine et al. 2014: 1). Those fish that do not incur mortality may suffer nonlethal stress effects such as decreased growth (Korman and Campana 2009 in Irvine et al. 2014: 1) or depletion of energy reserves (Cunjak et al. 1998 in Irvine et al. 2014: 1; Scruton et al. 2008 in Irvine et al. 2014: 1), or may habituate to the stress of the fluctuating environment (Taylor et al. 2012 in Irvine et al. 2014: 1). A stranded fish may also make easy prey for bird species that feed on fish, especially certain raptors or shoreline and sea birds.

Vessels approaching Terminal 1 would operate in the North Channel Reach of the navigation channel. Several small islands and mudflats occur throughout Grays Harbor, and, depending on the tide, could be exposed to wave action and could be locations for fish strandings. The nearest island to the navigation channel is Whitcomb Flats (about 800 feet south of the navigation channel), which is a small but growing sandy island. Should small fish be present in areas exposed to vessel wakes, fish could be washed ashore (on a mud flat or other shallow shoreline area) and become stranded. However, as discussed in Section 3.17, *Vessel Traffic*, incoming and outgoing vessels would most likely transit the harbor when tidal heights are at least 5 feet above the mean lower low waterline. Outgoing loaded vessels may wait until the tide is even higher for safety purposes (higher tides would provide deeper waters for heavier vessels that would be traveling lower in the water). This would reduce the potential for fish strandings because of the reduced exposure of mud flat and shallower sloped beach areas where stranding would most likely occur. In addition, any speed restrictions for vessels would reduce the size of the vessel wake. Based on the USACE study (2006:111), tugboat wakes would be expected to generate wakes that would not result in fish strandings.

As described in Section 3.1, *Earth*, there would be a small, incremental increase in the potential for impacts associated with wake and propeller wash compared with the no-action alternative.

Vessel Shading

Docked large vessels can increase shading in the aquatic environment beneath and adjacent to existing berthing structures (e.g., docks, trestles). This can result in changes to productivity as well as fish behavior, predation, and migration. As reviewed in Carrasquero (2001), shading from overwater structures in freshwater environments can lead to lowered primary productivity (phytoplankton and macrophyte producers; e.g., eelgrass and macroalgae). Reduced primary productivity, including reduced stock of algae and macrophytes, can in turn influence the epibenthic community on which fish and other aquatic organisms depend, particularly the epibenthic communities prevalent in shallow-water habitats.

The existing Terminal 1 dock generates shade in shallow-water habitat immediately adjacent to the shoreline, but the degree of shading is limited because the dock has a small footprint and is elevated over the water surface, allowing light to penetrate beneath it. Due to the dock's primarily east-west orientation, most of the shading occurs in the shallow area between the dock and the shoreline and does not extend into the deepwater habitat of the adjacent navigation channel and turning basin. As described in Section 3.4.4.3, *Grays Harbor*, eelgrass habitat does not occur under the dock or along the adjacent shoreline. Neither eelgrass nor macroalgae occur in the deepwater habitat of the

navigation channel. Macroalgae on derelict pilings and boulder riprap armoring the shoreline would not be affected by vessel shading because these substrates are not located beneath the dock where the vessels would be berthed.

Vessels berthed at the dock increase the shading of both shallow habitat closer to the dock and shoreline, and deepwater habitat under the vessel in the navigation channel. The extent of this increased shading is determined by the size of the vessel and the length of time it is docked. Under the proposed action, tank vessels calling at Terminal 1 would be either tank barges or tankers (Section 3.17, *Vessel Traffic*). The typical 550-class tank barge that is approximately 512 feet in length with a maximum width of 78 feet and a tug that is approximately 127 feet long with a maximum width of 42 feet, adding a total of approximately 45,270 square feet (1.04 acres) of overwater surface area over deepwater habitat.[7] With a maximum overall length of up to 950 feet and maximum width of approximately 106 feet, Panamax class tankers would add approximately 100,700 square feet (2.31 acres) of overwater shading area above deepwater habitat. The operational assumption is that a tank vessel would occupy the berth for 24 hours and a tanker would occupy the berth for 48 hours (WorleyParsons 2014). At the maximum proposed annual throughput, the applicant would have a tank vessel docked at Terminal 1 approximately 119 days per year.

Although some reduction in primary productivity from vessel shading is possible, the combination of tidal currents and the flow of the Chehalis River at Terminal 1 continually circulate water along the shoreline, around berthed vessels and the dock, and within the navigation channel and large body of Grays Harbor. As noted in Section 3.5.4.1, *Project Site*, approximately 8,088 acres of deepwater habitat are present within Grays Harbor, including the navigation channel and turning basin. Under the proposed action, the largest vessel size (Panamax) would create shade over 0.03% of the deepwater habitat in Grays Harbor. Deepwater habitats generally have lower primary production potential due to reduced penetration of sunlight with depth and increased turbidity. Therefore, the proposed action would not reduce primary productivity.

Shading could affect fish migration, prey capture, or predation. The extent to which an increase in shading may alter the predator-prey relationship is unknown, but it is assumed that the relationship would change and an increase in predation would be likely. Vessels would be located over deepwater habitat and could provide shaded habitat for larger predatory fishes (e.g., bass and northern pikeminnow) as well as roosting sites for piscivorous birds (Carrasquero 2001). Salmon fry tend to migrate along the edges of shadows rather than penetrate them (Simenstad et al. 1999). Studies in the northwest have documented this behavioral tendency to use shadow edges for cover during migration (Shreffler and Moursund 1999). Salmon fry are also known to use darkness and turbidity for refuge. The underwater light environment could affect the ability of fishes such as bass to see and capture their prey, which could include juvenile salmonids. Foraging opportunities for most juvenile fish are generally associated with shallow-water habitat (above -20 feet), which provide more benthic organisms than deepwater habitat (below -20 feet). Juvenile salmon primarily migrate in shallow-water habitat, although larger juvenile salmon do migrate in deepwater habitat. Juvenile salmon migrating in deepwater habitat are likely migrating relatively quickly and not rearing for extended periods in any particular area.

[7] This estimate is slightly high as the total length of the coupled tank vessel is less than the collective lengths of the barge and tug.

Vessel Strikes

Collisions with ships are one of the primary threats to marine mammals, particularly large whales, along the U.S. west coast, and around the world. There is some potential for vessels related to the proposed action to strike marine animals in the study area, particularly during transits outside the mouth of the harbor. Depending on the circumstances (i.e., vessel speeds, vessel type, type of animal, animal behavior), the impacts could vary widely, but could include bone fractures, organ damage, and internal hemorrhages (National Oceanic and Atmospheric Administration 2008a: 4). There are cases in which small marine mammals survived strikes but sustained injuries and disfigurement to dorsal fins and other body parts (National Oceanic and Atmospheric Administration 2008a: 17). In Sarasota Bay, Wells and Scott (1997 in National Oceanic and Atmospheric Administration 2008a: 17) documented four cases of vessel strikes on bottlenose dolphins in which all four animals survived the strike.

Marine mammals that occur more commonly in the study area—humpback whales, gray whales, killer whales, sea lions, seals, porpoises, and dolphins—would be at risk from vessel strikes, which can result in injury or death. However, the number of marine mammal collisions with vessels reported along the West Coast makes up a very small percentage of the populations of many marine mammals (National Oceanic and Atmospheric Administration 2015). For example, the gray whale population is estimated to be around 20,125 whales and the number of vessel strikes reported over a 5-year period along the West Coast was approximately 10 whales (or two whales per year). The potential for strikes in the study area would be slightly greater compared with the no-action alternative because of the increase in vessel trips, but the likelihood of vessel strikes and the potential for population-level impacts would remain low.

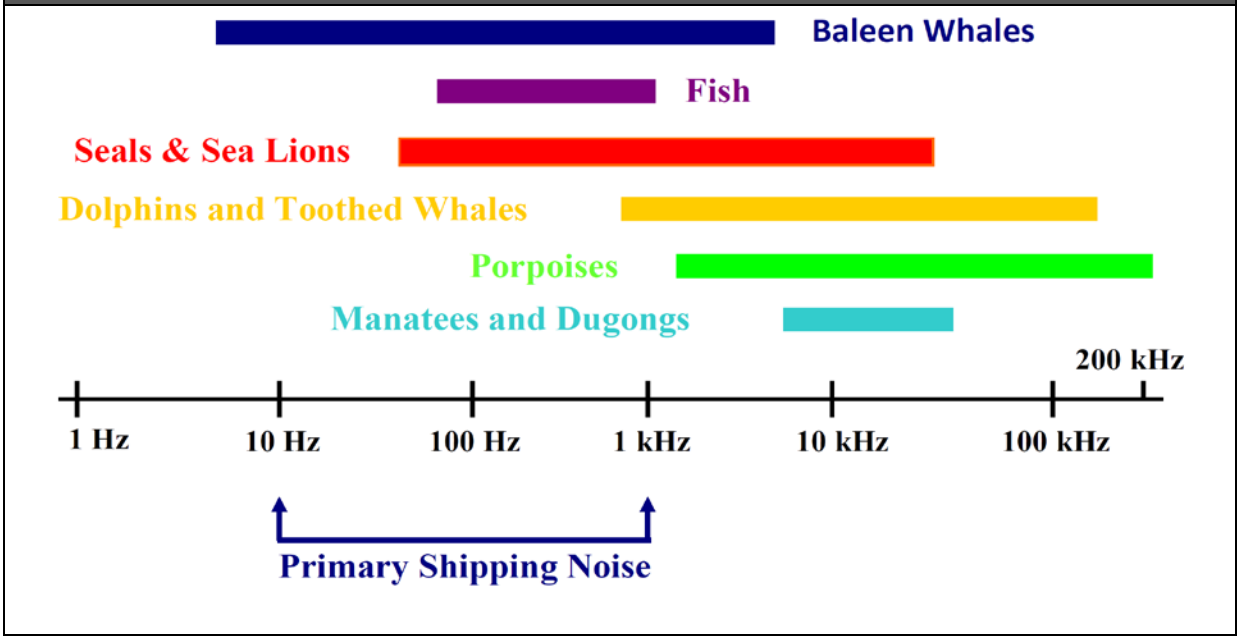
Underwater Vessel Noise

Increased vessel traffic related to the proposed action would generate increased underwater noise that could affect aquatic animals, especially marine mammals because they rely on sound as a means of communication, for finding food and mates, and for detecting predators. Increasing background noise levels decrease communication ranges, and may modify behavior and induce stress responses (Wright 2008: 13). The effects of increased noise associated with vessel trips would depend on many factors, including vessel type, size of vessel, species of animal, vessel location, and location of animal relative to vessel and the intervening environment. Complex behavioral responses to the same noise source can range from mild to severe and can vary dramatically among species and individuals, making it challenging to broadly characterize impacts of shipping noise on marine mammal species (Ellison et al. 2012 in Joint Working Group on Vessel Strikes and Acoustic Impacts 2012: 9). The potential for impacts in the study area would increase somewhat under the proposed action, as a result of increased vessel trips.

Underwater noise levels associated with vessels are typically between 10 Hertz (Hz) and 1 kilohertz (kHz) (Wright 2008: 6). Tankers, such as those likely to be used for the proposed action, exhibit noise frequencies at the lower end of the spectrum (40 Hz) compared to bulk carriers (100 Hz). Additionally, tank barges with tugs, the vessels most likely to be used under the proposed action, typically produce less near-surface sound than other vessels. This is not because they are quieter but because the propellers of the typical tug are recessed to protect the propeller from damage in case of grounding. With the propeller in this position, propeller noise is blocked by the ship's hull. Thus, the propeller noise cannot be heard ahead of the tug and barge (University of Rhode Island 2013).

As shown in Figure 3.5-1, many marine animals, including those listed in Section 3.5.4, *What animlas are in the study area?* hear within a range of a higher frequency than vessel-generated underwater noise, including the killer whale. Killer whales produce a variety of sounds including clicks, whistles, and pulsed calls. Individual clicks have been estimated to range in frequency from 8 kHz to 80 kHz; whistles from 500 Hz to 10.2 Hz; and pulsed calls from 1 kHz to 10 kHz (National Oceanic and Atmospheric Administration 2008b: 6). With respect to vessel noise, NOAA Fisheries (2008b: 49, 52) has described the relevant frequency range of killer whale hearing from 1kHz to 100 kHz, which is outside of the range of primary shipping noise (Figure 3.5-1). Marine mammals have also adapted to varying levels of natural sound, and the adaptive mechanisms may allow them to function normally in the presence of many anthropogenic sounds. The unknown variable is when introduced sounds exceed the adaptive capacity of marine mammals and pose a threat to individual animals or their populations (Marine Mammal Commission 2007: 12).

Figure 3.5-1. Frequency Relationship between Marine Animals Sounds and Sounds from Shipping



Source: Wright 2008: 6.

Effects of underwater noise exposure on marine organisms have been generally characterized by the following range of physical and behavioral responses (Richardson et al. 1995 in BOEM 2012: 87).

- **Behavioral reactions.** Range from brief startle responses to changes or interruptions in feeding, diving, or respiratory patterns, to cessation of vocalizations, to temporary or permanent displacement from habitat.
- **Masking.** Reduction in ability to detect communication or other relevant sound signals due to elevated levels of background noise.
- **Temporary threshold shift.** Temporary, recoverable reduction in hearing sensitivity caused by exposure to sound.

- **Permanent threshold shift.** Permanent, irreversible reduction in hearing sensitivity due to damage or injury to ear structures caused by prolonged exposure to sound or temporary exposure to very intense sound.
- **Nonauditory physiological effects.** Effects of sound exposure on tissues in nonauditory systems either through direct exposure or because of changes in behavior (e.g., resonance of respiratory cavities or growth of gas bubbles in body fluids).

Leaks and Spills

Diesel fuel, oils, grease, and other fluids required for the operation and maintenance of vessels could be deposited onto vessel surfaces where precipitation and storm flows could carry them into adjacent surface waters and wetlands where they could adversely affect animals. However, the potential for these types of leaks and spills to occur would be reduced by regular inspections and by implementing standard good housekeeping BMPs. These releases would be limited to minor drips and leaks from equipment located within contained areas of the vessel such that there would be limited risk of exposing animals to contaminated stormwater. Although the proposed action would result in a slight increase in leaks and spills of petrochemicals due to the increased frequency of vessel traffic and maintenance activities compared to the no-action alternative, the overall impacts on animals are anticipated to remain low. The potential for larger spills to occur during vessel transport that could directly affect animals are addressed in Section 4.6, *Environmental Health Risks—Vessel Transport.* Potential impacts from such spills are presented in Section 4.7, *Impacts on Resources*.

3.5.6 What required permits and plans apply to animals?

The following permit conditions and required plans are expected to reduce impacts on animals. Additional requirements specific to the handling, storage, and transport of crude oil are discussed in Chapter 4, *Environmental Health and Safety*.

- City of Hoquiam and City of Aberdeen Critical Areas Review for fish and wildlife habitat and geologically hazardous areas
  - Critical area review report
  - Buffer establishment and protection requirements
  - Buffer mitigation and monitoring requirements
  - Buffer activity limits and restrictions
- City of Hoquiam Shoreline Substantial Development Permit
  - Consistency with the Shoreline Management Master Program
  - Protection of shoreline resources and functions
- Washington State Department of Ecology National Pollutant Discharge Elimination System Construction Stormwater General Permit
  - Discharge/effluent limit requirements
  - Monitoring, sampling, and reporting requirements
  - Onsite spill control material provision requirements

- Stormwater pollution prevention plan preparation requirement
- Stormwater BMP development and implementation

- Washington State Department of Ecology National Pollutant Discharge Elimination System Industrial Stormwater Permit
  - Discharge/effluent limit requirements
  - Monitoring, sampling, and reporting requirements
  - Operations and maintenance plan
  - Stormwater pollution prevention plan
  - Onsite spill control material provision requirements
  - Spill prevention control and countermeasures plan preparation requirement
  - Industrial discharge BMP development and implementation

3.5.7 What mitigation measures would reduce impacts on animals?

This section describes applicant mitigation measures that would reduce impacts on animals from construction and routine operation of the proposed action. Mitigation measures to reduce potential impacts related to increased risk of incidents and related consequences are presented in Chapter 4, *Environmental Health and Safety*.

3.5.7.1 Applicant Mitigation

The applicant will implement the following mitigation.

- To reduce the potential for impacts on sensitive aquatic animals from the increase in ballast water discharges during bulk liquid operations, the applicant will prepare an invasive species monitoring plan in consultation with WDFW and will implement the plan prior to the start of the proposed operations.

3.5.8 Would the proposed action have unavoidable and significant adverse impacts on animals?

Compliance with the applicable regulations and permits along with implementation of the mitigation measure described above is expected to reduce impacts on animals. There would be no unavoidable and significant adverse impacts from construction and routine operation. Potential impacts related to increased risk of incidents and related consequences are addressed in Chapter 4, *Environmental Health and Safety*.