4. Wildlife and Habitat

Wildlife and habitat are important components of ecosystem health and function. Some of the ways in which wildlife affect ecosystems include consuming vegetation, insects, fish, or other wildlife; providing a source of prey and nutrients to other animals; and serving as a mechanism for seed dispersal. In the Grays Harbor area, the diversity of wildlife also helps attract large numbers of visitors, which supports the local economy.

4.1 Affected Environment

How did WSDOT collect the information on wildlife and habitat?

The ecosystems analysts used a combination of existing information and field surveys to gain an understanding of wildlife resources in the study area. The analysts defined the primary study area as the zone within 0.5 mile of each build alternative site; this comprises the area in which the project generally could affect wildlife and habitats. Analysts also collected some information for the Grays Harbor estuary, offsite pontoon moorage location, and areas in the general vicinity of the proposed facilities. These broader areas are not included in the wildlife study area, but information from these broader areas provides relevant background data for species that use extensive aquatic habitats, have large home ranges, or have priority habitats within a distance that could be affected by construction or operation of the proposed project.

Study Area for Wildlife

The wildlife study area is defined as all areas within 0.5 mile of the two build alternative sites.

For the wildlife study area, the ecosystems analysts identified wildlife habitat types and specific wildlife habitat elements within each habitat type. For example, the analysts identified palustrine emergent wetland as a habitat type and further identified the pockets of surface water as an element within this type that provides important functions for wildlife. Analysts also assessed locations of known ecologically sensitive areas and important wildlife occurrences throughout Grays Harbor. The ecosystems analysts obtained information on wildlife and wildlife habitat from the following sources:

- WDFW Priority Habitats and Species (PHS) data (WDFW 2008a)
- Grays Harbor National Wildlife Refuge wildlife data (Grays Harbor Audubon Society 2000)
- WDFW reports on marine mammals (WDFW 2008b)

- Observations of WDFW and other local biologists (Varland 2008)
- Grays Harbor Audubon Society Christmas bird count data (Audubon Society 2008)
- Various published literature (e.g., professional journals, conference proceedings, etc.)

Because limited information was available on species use of specific sites under consideration for pontoon construction, the ecosystems analysts conducted a series of field surveys to document wildlife on a site that was under consideration during the spring of 2008. The site, known as IDD #1, was later eliminated from detailed analysis. Data from these surveys are included in this report because survey information from the IDD #1 site is considered to be representative of species usage of the surrounding area, including the two sites. The site is immediately adjacent to and east of the Anderson & Middleton Alternative and is included in the study area. The analysts surveyed the IDD #1 site on April 3, April 30, and May 12, 2008, by walking the site perimeter and transects spaced throughout the site, recording wildlife signs, and noting important habitat elements. The analysts also viewed the nearby waters and shorelines using spotting scopes and binoculars. The Aberdeen Log Yard Alternative is approximately 2 miles east of IDD #1. WSDOT analysts investigated field conditions at the Anderson & Middleton Alternative and the Aberdeen Log Yard Alternative in November 2008.

What are priority species and priority habitat?

WDFW defines **priority species** as those species that are priorities for conservation and management. Priority species include state endangered, threatened, sensitive, and candidate species; animal aggregations considered vulnerable; and those species of recreational, commercial, or tribal importance that are vulnerable. **Priority habitats** are those habitat types or elements with unique or significant value to a diverse group of species.

The analysts used the information collected to evaluate the wildlife-habitat relationships at the two build alternatives and the occurrence and distribution of wildlife in the project vicinity. The WDFW PHS database (WDFW 2008a) provided information on specific locations of priority species and priority habitat.

The analysts reviewed USFWS information about known or expected occurrences of federally listed species and federal species of concern in Grays Harbor County. Analysts also communicated with federal, state, and local biologists to obtain additional information on species occurrence. To supplement the existing data, the analysts investigated field conditions and reviewed aerial photographs of the study area to categorize the habitat types and to identify habitat elements within each habitat type.

What wildlife habitats and species exist in the study area and surrounding habitats?

Anderson & Middleton Alternative

The information described here was collected within the study area for IDD #1. The data likely represent the species usage at Anderson & Middleton and Aberdeen Log Yard alternatives.

A wide variety of wildlife species use the wildlife study area and surrounding habitats, with the species varying with the season of the year. During April and May 2008, surveys in the study area documented 53 bird species, 1 amphibian, 1 reptile, and 2 mammal species (Exhibit 4-1).

Many sparrows were observed in the emergent wetland and grassland habitat in the study area during May. Numerous other species of migratory passerine birds used the dense riparian forest and shrub habitat along the western and northern perimeter of the site during migration and possibly for nesting. Nonnative European starlings were noted carrying nesting material from the site to nearby areas.

At any one time throughout the year, 100 or more Canada geese and small numbers of ducks forage and loaf in the study area. During spring and fall migration, greater white-fronted geese and snow geese, along with other species of waterfowl, also use the emergent wetland in the study area, particularly the emergent wetland areas offsite to the east. The geese forage primarily on the grasses and rushes that dominate the emergent wetlands on the site. No waterfowl nesting was observed during the visits to the study area in 2008. The emergent wetland and grassland at the IDD#1 site could provide nesting habitat for Canada geese and ducks, but the annual mowing of the vegetation and high level of human activity (e.g., recreational walking and dogs) likely discourages nesting.

Puddle ducks such as mallards and northern pintails also use the seasonally inundated open water areas within the study area wetlands for loafing and for foraging on invertebrates. Geese and ducks that use the study area move between wetlands and other open habitats located near the Grays Harbor Airport, the golf course, and the proposed alternative sites in response to human disturbance. The Grays Harbor National Wildlife Refuge is located approximately 2 to 3 miles to the west of the Anderson & Middleton Alternative site. The refuge and other locations in the vicinity provide additional loafing, foraging, and resting habitat for waterfowl in and around the study area.

EXHIBIT 4-1
Wildlife Species Detected in the Anderson & Middleton Alternative Study Area, April and May 2008

Species	Number of Detections by Survey Date (2008)			
	April 3	April 30	May 12	Total
Birds				
American crow (*Corvus brachyrhynchos*)	14	19	2	35
American goldfinch (*Carduelis tristis*)	2	7	8	17
American robin (*Turdus migratorius*)	7	4	6	17
Anna's hummingbird (*Calypte anna*)		1		1
Bald eagle (*Haliaeetus leucocephalus*)	3	1	1	5
Barn swallow (*Hirundo rustica*)		17		17
Black-capped chickadee (*Poecile atricapillus*)	4	2	6	12
Brown-headed cowbird (*Molothrus ater*)			5	5
Canada goose (*Branta canadensis*)	6	61	33	100
Caspian tern (*Hydroprogne caspia*)		2	1	3
Common loon (*Gavia immer*)		2	1	3
Common yellowthroat (*Geothlypis trichas*)		2	1	3
Double-crested cormorant (*Phalacrocorax auritus*)			3	3
European starling (*Sturnus vulgaris*)	16	23	13	52
Fox sparrow (*Passerella iliaca*)	1			1
Glaucous-winged gull (*Larus glaucescens*)		3		3
Golden-crowned sparrow (*Zonotrichia atricapilla*)	2	2		4
Great blue heron (*Ardea herodias*)	2	5		7
Greater snow goose (*Chen caerulescens*)		2		2
Greater white-fronted goose (*Anser albifrons*)		25		25
Gull spp. (*Larus* spp.)	6	70	2	78
House finch (*Carpodacus mexicanus*)	1			1
House sparrow (*Passer domesticus*)		2	1	3
Hummingbird sp. (Family Trochilidae)			1	1
Killdeer (*Charadrius vociferus*)	1	2	3	6
Mallard (*Anas platyrhynchos*)	8	15	2	25
Mew gull (*Larus canus*)	6	2		8
Northern harrier (*Circus cyaneus*)	1			1
Northern pintail (*Anas acuta*)	6			6
Northwestern crow (*Corvus caurinus*)	1	1	2	4

EXHIBIT 4-1
Wildlife Species Detected in the Anderson & Middleton Alternative Study Area, April and May 2008

Species	Number of Detections by Survey Date (2008)			
	April 3	April 30	May 12	Total
Orange-crowned warbler (*Vermivora celata*)			1	1
Osprey (*Pandion haliaetus*)		2	1	3
Pelagic cormorant (*Phalacrocorax pelagicus*)		1		1
Purple martin (*Progne subis*)			2	2
Red-tailed hawk (*Buteo jamaicensis*)			1	1
Red-winged blackbird (*Agelaius phoeniceus*)	2		1	3
Sandpiper sp. (*Calidris* sp.)		1		1
Savannah sparrow (*Passerculus sandwichensis*)	2	40	15	57
Song sparrow (*Melospiza melodia*)	4	7	6	17
Spotted sandpiper (*Actitis macularius*)			1	1
Swift sp. (Family Apodidae)		3		3
Tree swallow (*Tachycineta bicolor*)		9	1	10
Turkey vulture (*Cathartes aura*)	1	1	1	3
Violet-green swallow (*Tachycineta thalassina*)		6	5	11
White-crowned sparrow (*Zonotrichia leucophrys*)	5	7	1	13
Western grebe (*Aechmophorus occidentalis*)	3	2		5
Western meadowlark (*Sturnella neglecta*)	7			7
Western sandpiper (*Calidris mauri*)			71	71
Whimbrel (*Numenius phaeopus*)		1		1
Wilson's snipe (*Gallinago delicata*)	6	3	4	13
Wilson's warbler (*Wilsonia pusilla*)		7	2	9
Yellow-rumped warbler (*Dendroica coronata*)	4	4	5	13
Yellow warbler (*Dendroica petechia*)	1		6	7
Amphibians, reptiles, and mammals				
Garter snake (*Thammophis* sp.)			1	1
Pacific chorus frog (*Pseudacris regilla*)	1	1		2
Mink (*Mustela vison*)	sign			
Harbor seal (*Phoca vitulina*)			1	1

Waterfowl are present in Grays Harbor year-round, but their numbers are highest during spring and fall migration. Generally, peak waterfowl

numbers occur during October and November (USFWS 1990). American wigeons compose nearly 60 percent of the fall and winter waterfowl; mallards, green-winged teals, and northern pintails are also common during the fall. Diving ducks, such as canvasbacks, are less common.

Swallows and purple martins (a state candidate species), forage for insects above the emergent wetland in the study area. Small numbers of great blue herons, Wilson's snipes, killdeer, and whimbrels forage in the wetland habitat in the vicinity.

Pacific chorus frogs were observed in the emergent wetlands offsite to the east and in the riparian forest in the study area. This species likely breeds in the inundated portions of the wetlands in the study area or in the open water habitats in the study area.

The checklist of birds for Grays Harbor (Grays Harbor Audubon Society 2000) lists 280 species, including 144 species of shorebirds, waterbirds, wading birds, and waterfowl that have been observed in the region. Appendix A provides more detailed information on shorebirds and waterfowl in the region. Migrating shorebirds use Grays Harbor as spring and fall migration stopovers (each bird typically stays 1 to 5 days) to forage on invertebrates available in the intertidal habitats (USFWS 1990). During the 2008 spring migration, shorebird numbers observed at the Grays Harbor National Wildlife Refuge (approximately 2 miles west of the Anderson & Middleton site) peaked in early May, but the timing varies annually depending on conditions. Fall migration typically occurs in September and October.

Although other parts of Grays Harbor provide important high tide roosts and feeding sites for migrating shorebirds (Drut and Buchanan 2000; Warnock et al. 2004; Warnock et al. 2001), the study area lacks such habitat due to the steep shoreline and lack of emergent wetland connected to the estuary. The palustrine emergent wetland in the study area does have open water and areas with short and sparse vegetation where shorebirds can forage; however, use is minimal due to the small size of the suitable habitat and the high level of human activity around the perimeter. The narrow zone of unconsolidated shore habitat at the Anderson & Middleton Alternative, between the north navigation channel of Grays Harbor and the steep rock berm surrounding much of the site, provides some foraging habitat for shorebirds. During most low tides, the exposed shoreline is between 8 and 25 feet wide. An exception is the inlet of Channel A, which is entirely exposed during most low tides (Photo 20). During one observed -3-foot tide event, portions of the intertidal area near the southeast corner of the site were approximately 60 feet wide. On this occasion, as well as during a +1-foot tide in April and May 2008, small

Photo 20. Estuarine unconsolidated shore (intertidal) habitat within the Anderson & Middleton study area.

flocks of western sandpipers were foraging in the intertidal habitats at the site.

At least 11 species of gulls and terns use the Grays Harbor estuary, with western gulls, glaucous-winged gulls, and hybrids of the two species representing the majority of the breeding population (USFWS 1990). During the spring and summer, gull numbers have peaked at approximately 15,000. Gulls and terns were observed using the north navigation channel of Grays Harbor and the mouth of the Hoquiam River. Although they likely perch on the old piles at this site, only one gull was observed in the wetland habitat on the site.

Many bird species use Grays Harbor during the winter, and some might use the build alternative sites as well. Audubon Christmas Bird Count data for a 15-mile-radius circle centered in the middle of the estuary documented 232 species of birds from 1974 to 2008 (Audubon Society 2008). During those years, dunlins represented over 53 percent of the total avian individuals observed. Other common species detected throughout Grays Harbor during the winter, listed in decreasing order of abundance, include the following:

- European starling (*Sturnus vulgaris*)
- Sanderling (*Calidris alba*)
- American wigeon (*Anas americana*)
- Crow (*Corvus brachyrhynchos*)
- Common murre (*Uria aalge*)
- Mallard (*Anas platyrhynchos*)
- Pine siskin (*Carduelis pinus*)
- Gulls
- Canada goose (*Branta canadensis*)
- Northern pintail (*Anas acuta*)
- Bufflehead (*Bucephala albeola*)
- Dark-eyed (Oregon) junco (*Junco hyemalis*)

- Western sandpiper (*Calidris mauri*)
- Song sparrow (*Melospiza melodia*)
- Yellow-rumped warbler (*Dendroica coronata*)
- Black-bellied plover (*Pluvialis squatarola*)
- Golden-crowned kinglet (*Regulus satrapa*)
- House finch (*Carpodacus mexicanus*)
- Red-winged blackbird (*Agelaius phoeniceus*)

Both proposed alternatives and the Grays Harbor National Wildlife Refuge are located within subsection 7B of the 15-mile-radius Grays Harbor Christmas Bird Count survey circle. Although the bird survey results are heavily influenced by the data collected at the refuge, the information does indicate the diversity of species that can use the habitats on and near the alternative sites. From 2002 to 2006, between 74 and 97 species were detected in this subsection each winter. Dunlin was the most commonly observed species in subsection 7B. Annual dunlin numbers ranged from 4,292 to 30,000 (Diane Moore, Grays Harbor Audubon Society. April 3, 2008, personal communication).

Aberdeen Log Yard Alternative

The Aberdeen Log Yard is located farther east than the Anderson & Middleton site, closer to where the Chehalis River intersects the Grays Harbor estuary. Many of the same species that use the Anderson & Middleton site would likely use the Aberdeen Log Yard site. However, because Aberdeen Log Yard is more industrialized, their numbers might be fewer.

Are there any federally protected wildlife species or federal species of concern on or near the Grays Harbor build alternatives?

USFWS identified six federally listed wildlife species and two federal candidate species as potentially occurring in Grays Harbor County (USFWS 2008a) (Appendix B). In addition, harbor seal (*Phoca vitulina*) and bald eagle occur in the county and are federally protected under the Marine Mammal Protection Act of 1972 (16 USC 1361–1407; 50 CFR 216) and the Bald and Golden Eagle Protection Act (16 USC 668-668c) of 1940 (as amended), respectively. Grays Harbor contains suitable habitat for the marbled murrelet, western snowy plover, streaked horned lark, bald eagle, yellow-billed cuckoo, harbor seal, and gray whales (*Eschrichtius robustus*).

The Endangered Species Act requires federal agencies to ensure that their actions will not destroy or adversely modify critical habitat of listed species. USFWS has designated critical habitat in Grays Harbor County

for the marbled murrelet, northern spotted owl, and western snowy plover (USFWS 2008b). However, no critical habitat occurs within 5 miles of the Anderson & Middleton site or the Aberdeen Log Yard site. There is designated snowy plover critical habitat on Damon Point, approximately 8 miles west of the Anderson & Middleton site and approximately 10 miles west of the Aberdeen Log Yard site (USFWS 2008b). The most detailed information regarding federally listed species in and around the pontoon moorage location is reflected in the Draft EIS. Exhibit 4-2 lists the federally protected species in Grays Harbor County. Analysts documented only bald eagle and harbor seals in the study area. Species that could use suitable breeding or foraging habitat if it occurred in the wildlife study area are discussed in greater detail below.

Gray whales of the eastern north Pacific stock exist within the waters of Washington state, migrating between 16,000 and 22,000 kilometers from their calving grounds off Baja California to their feeding grounds in the Chukchi and Bering seas (Calambokidis et al. 2002). Northbound whales are present off the Washington coast from late February through June. Observational studies indicate the presence of southbound gray whales off the coast of Washington from November through January (Pike 1962; Darling 1984; Shelden et al. 2000; Rugh et al. 2001). A small portion of the eastern North Pacific stock takes up residency in the Pacific Northwest during the summer feeding season. Although these seasonal residents are known to range from southeast Alaska to northern California, the focal point of the residency seems to be along the Washington coast to central Vancouver Island (Calambokidis and Quan 1999; Gosho et al. 1999; Calambokidis et al. 2002). Gray whales have been observed in Willapa Bay and Grays Harbor (Richardson 1997); Calambokidis et al. (2002) recorded seven individuals in Grays Harbor from late March to early May.

The prey and habitats exploited by the seasonal resident group in the Washington-British Columbia area include herring eggs and larvae, planktonic prey, and benthic prey (Darling et al. 1998). Whales off the coast of Washington generally remain within 5 to 10 kilometers offshore, foraging in waters about 20 meters deep (Green et al. 1995; Calambokidis et al. 2004).

EXHIBIT 4-2
Federally Protected Species in Grays Harbor County

Species	Federal Status	Suitable Habitat Occurrence
Brown pelican (*Pelecanus occidentalis*)	Endangered (delisted November 2009)	Suitable foraging habitat for nonbreeding pelicans occurs in Grays Harbor, primarily in the mid- and outer estuary during summer and fall.
Marbled murrelet (*Brachyramphus marmoratus*)	Threatened	Suitable foraging habitat occurs in Grays Harbor, primarily in the mid- and outer estuary. No suitable nesting habitat occurs within 5 miles of the study area.
Northern spotted owl (*Strix occidentalis caurina*)	Threatened	No suitable mature or old-growth forests occur within 5 miles of the study area.
Oregon silverspot butterfly (*Speyeria zerene hippolyta*)	Threatened	No suitable coastal salt-spray meadows or open-field habitats with larval host plant, western blue violet (*Viola adunca*), occur in study area.
Short-tailed albatross (*Phoebastria albatrus*) (outer coast)	Endangered	Pelagic species that nests on isolated islands. No suitable habitat exists for this species in Grays Harbor.
Western snowy plover (*Charadrius alexandrinus nivosus*)	Threatened	Suitable nesting beaches and known nesting activity at Damon Point (8 to 10 miles from project sites). No suitable nesting habitat within 5 miles of build alternatives.
Streaked-horned lark (*Eremophila alpestris strigata*)	Candidate	Suitable nesting beaches and known nesting activity at Damon Point (8 to 10 miles from project sites). No suitable nesting habitat within 5 miles of build alternatives.
Yellow-billed cuckoo (*Coccyzus americanus*)	Candidate	Potentially suitable nesting habitat exists in the forested and scrub-shrub wetland on Rennie Island. This species no longer breeds in Washington state, however (Smith et al. 1997)
Bald eagle (*Haliaeetus leucocephalus*)	Federal Species of Concern and protected by Bald and Golden Eagle Protection Act	Nesting territory exists on Rennie Island. Bald eagles forage on fish and waterfowl throughout Grays Harbor and perch on natural and built structures. Have been observed perched on piles at both build alternatives.
Harbor seal (*Phoca vitulina*)	Protected under the federal Marine Mammal Protection Act	This species uses the waters of Grays Harbor and the lower Hoquiam and Chehalis Rivers for foraging. Important haulout and pupping sandbars occur throughout mid- and outer estuary. Species is regularly seen just offshore from both alternatives.
Gray whale (*Eschrichtius robustus)*	Protected under the federal Marine Mammal Protection Act	This species uses the waters of Grays Harbor during migration.

Brown Pelican

USFWS removed the brown pelican from the list of endangered and threatened species (74 Federal Register 59443 59472) in November 2009. As a result, the USFWS is proposing to monitor the species between 2010 and 2020. Details of the proposed monitoring plan are currently under

review (74 Federal Register 188:50236-50237). The waters of Grays Harbor represent potential foraging habitat for brown pelicans. On the Pacific coast, pelicans rely heavily on fish such as anchovies and sardines and have also been known to eat crustaceans (USFWS 2008c). Hundreds of brown pelicans have been observed seasonally in Grays Harbor during summer and fall (USFWS 1990). However, this species does not breed in the region.

Marbled Murrelet

The marbled murrelet, a federally threatened species, nests in forests south and north of Grays Harbor and periodically forages for small fish in Grays Harbor. Speich and Wahl (1995) reported that, over a 23-year period, marbled murrelets were recorded in Grays Harbor Channel in every month of the year. The general pattern of occurrence was one of high average densities during the spring, fall, and winter months, with higher densities in habitats closer to shore. No murrelet use has been documented within 1 mile of the study area. However, small numbers of murrelets could periodically forage in waters near either alternative site or near the offsite pontoon moorage.

Bald Eagle

USFWS recently removed the bald eagle from the list of endangered and threatened species (72 Federal Register 130:37346-37372), but it remains a federal species of concern and is protected against “take” (i.e., death, injury, or harassment) under the Bald and Golden Eagle Protection Act. There is one bald eagle nesting territory on Rennie Island (located just offshore between the two build alternatives), with the last known nest located in a cottonwood tree approximately 0.4 mile from the Anderson & Middleton Alternative and approximately 2 miles from the Aberdeen Log Yard Alternative. This territory (designated WDFW #1648) was last surveyed in 2005 and was determined to be unoccupied that year (WDFW 2008c). Several other bald eagle nesting territories are scattered along the Grays Harbor shoreline, but none are near the proposed project. Wintering and breeding bald eagles periodically perch on old piles at both alternative sites and forage for fish and waterfowl in the surrounding waters. One bald eagle was observed adjacent to the Anderson & Middleton site in April 2008. Another bald eagle was observed perching in the central portion of the Aberdeen Log Yard Alternative in January 2009.

Harbor Seal

Harbor seals are protected from take under the Marine Mammal Protection Act (50 CFR 216) but are not designated as a “depleted” population. Harbor seals use shoals and sandbars throughout Grays Harbor as haulout and pupping sites. The *Atlas of Seal and Sea Lion Haul Out Sites in*

Washington (Jeffries et al. 2000) documented 45 harbor seal haulout sites on intertidal mudflats and sandbars throughout Grays Harbor. Nursery areas are located around Whitcomb Flats, Mid-Harbor Flats, Sand Island Shoals, Sand Island, Goose Island, Chenoise Creek channels, and in North Bay (Jeffries et al. 2000). Peak harbor seal abundance occurs during the pupping season (mid-April through June) and the annual molt (July through August).

What is a haulout site?

Haulouts are beaches, rocky areas, floats, and other areas where seals can rest, give birth, and nurse.

The closest known harbor seal haulout area is more than 1 mile west from the Anderson & Middleton Alternative site. The intertidal shoals west of Rennie Island might be used for haulouts but, in general, do not offer the isolation provided by islands in the middle of the harbor. Harbor seals have been observed foraging for fish on several occasions in the waters immediately adjacent to the Anderson & Middleton Alternative, but no large concentrations occur in the immediate vicinity. Harbor seals are opportunistic feeders, with most of their diet consisting of prey species that are seasonally and locally abundant (Lance and Jeffries 2006). Throughout their Washington range, harbor seals are known to feed on a variety of fish and shellfish, including salmon, steelhead, Pacific whiting, herring, mackerel, eulachon, lamprey, codfish, walleye, pollock, spiny dogfish, and squid (WDFW 2008b).

What state-listed or other state priority wildlife species or habitats exist in the study area?

One state-listed endangered species (peregrine falcon) and one species of concern (bald eagle) are known to occur near the study area (WDFW 2008c). In addition, four other state priority species—the western grebe, common loon, great blue heron, and purple martin—have been observed in the project vicinity. The bald eagle is described in the preceding section; occurrence of the other species is provided in Exhibit 4-3 and described in the following sections.

Peregrine Falcon

Peregrine falcons nest on coastal cliffs and rocks (Smith et al. 1997). WDFW mapped both sites, the mouth of the Hoquiam River, and the area around Rennie Island as a peregrine falcon regular concentration area. Peregrine falcons commonly hunt for shorebirds in the intertidal areas of Grays Harbor, including areas near and west of the Anderson & Middleton site. A peregrine falcon eyrie exists in the northcentral portion of Grays Harbor, more than 6 miles from the Anderson & Middleton site. This nesting pair has produced young each year between 2002 and 2007 (Varland 2008). During winter, as many as six peregrine falcons have been observed in Grays Harbor.

EXHIBIT 4-3
Occurrence of State-Listed and State Priority Wildlife Species in the Study Area

Species	State Status	Pontoon Construction Sites
Peregrine falcon (*Falco peregrinus*)	Sensitive	The Anderson & Middleton site, approximately the southern half of the Aberdeen Log Yard site, the mouth of the Hoquiam River, and intertidal habitats associated with Rennie Island are mapped as a regular concentration area for peregrine falcons. The raptors are known to forage in intertidal habitats along the Hoquiam waterfront and perch on trees, piles, and tall structures, including Hoquiam River bridge.
Western grebe (*Aechmophorus occidentalis*)	Candidate	Western grebes occasionally forage for small fish in waters adjacent to both sites. No known breeding sites occur in the study area.
Common loon (*Gavia immer*)	Sensitive	Common loons are regularly observed foraging for fish immediately offshore of the Anderson & Middleton site. They are likely also present offshore of the Aberdeen Log Yard site.
Great blue heron (*Ardea herodias*)	Monitor	An active rookery occurs on Rennie Island. Birds regularly forage in wetlands on the Anderson & Middleton site and in the study area.
Purple martin (*Progne subis*)	Candidate	The purple martin nests in piles within the study area. This species forages for insects over the emergent wetlands in the study area.

Western Grebe and Common Loon

In the winter, western grebes and common loons are associated with the coastal waters of western Washington, including Grays Harbor. Both species forage on fish. Neither species breeds in the study area due to a lack of suitable habitat. Both species were observed foraging in the waters adjacent to the Anderson & Middleton site during April and May 2008 and could use deepwater habitats near where the pontoons would be moored in Grays Harbor.

Great Blue Heron

Great blue herons are associated with both freshwater and saltwater wetlands, seashores, rivers, swamps, marshes, and ditches (WDFW 2008a). This species feeds on aquatic and marine animals in shallow waters and occasionally preys upon mice and voles (Calambokidis et al. 1985; Butler 1995). Nests of these colonial breeders are usually constructed in the tallest trees available at a given site (WDFW 2008a). There is an active rookery with about 50 nests in the forested wetland on Rennie Island, less than 0.5 mile from the Anderson & Middleton Alternative site and within approximately 1 mile of the Aberdeen Log

Yard Alternative site. Small numbers of great blue herons forage in emergent wetlands in the study area.

Purple Martin

According to WDFW PHS data, purple martin breeding areas are located to the east of the Anderson & Middleton Alternative, on Rennie Island, and on the Hoquiam waterfront to the east of the Hoquiam River. At least one of the piles in the study area has cavities that martins might use for nesting. During May 2008, a pair of purple martins was foraging over the emergent wetlands located to the east of the Anderson & Middleton Alternative site.

Other Identified Priority Species and Habitats

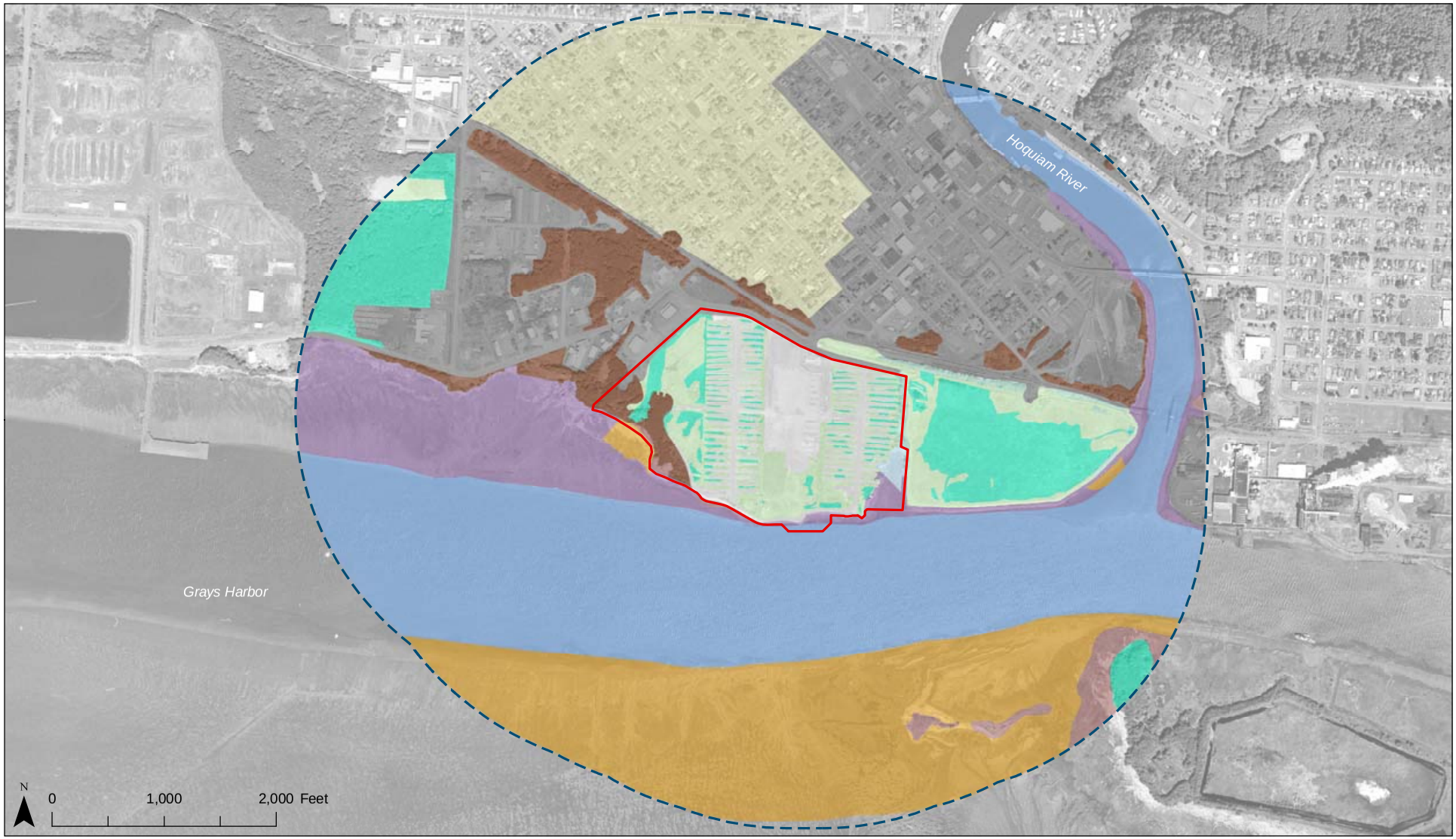
WDFW identifies nonbreeding concentrations of shorebirds and waterfowl as priority species. Large concentrations of these species groups occur throughout the harbor, particularly along shorelines and in intertidal zones. Neither build alternative includes WDFW-mapped large shorebird and waterfowl concentration areas, although there are such areas in the general vicinity, mostly near the Grays Harbor National Wildlife Refuge.

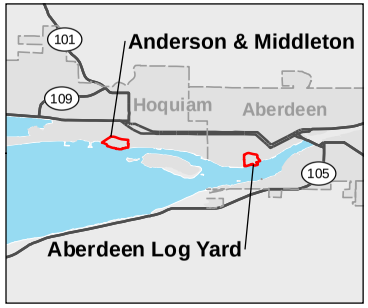
Priority habitats in the project vicinity include estuarine wetlands and freshwater wetlands, estuarine shorelines, and vegetated estuarine habitats (e.g., eelgrass) (WDFW 2008a). The potential freshwater and intertidal wetlands are described in detail in Chapter 2, Wetlands. Additional information on eelgrass habitat is provided in Chapter 3, Fish and Aquatic Resources.

What habitat types are located in the Grays Harbor build alternatives?

Anderson & Middleton Alternative

Ecosystems analysts categorized the study area into 21 habitat types based on similarities in landscape features, extent of development, type of aquatic habitat, and vegetation composition (Exhibit 4-4). For example, areas permanently inundated in the estuary are considered “estuarine subtidal” habitat, while areas with houses are classified as “residential.” These habitat types form the basis of the assessment of wildlife occurrence and use. Analysts identified the estuarine, freshwater wetland, riparian, and upland habitat types listed in Exhibit 4-5 within the study area (i.e., the Anderson & Middleton Alternative plus a 0.5 mile radius).





Wildlife habitat

- Subtidal - unconsolidated bottom
- Intertidal - aquatic bed/ unconsolidated shore
- Intertidal - emergent
- Intertidal - rocky shore
- Intertidal - unconsolidated shore
- Freshwater wetland habitat
- Stormwater drainage features
- Riparian habitat type
- Upland forest
- Upland shrub
- Grassland
- Residential
- On-site industrial
- Off-site industrial
- Study area
- Build Alternative Site

Source: Grays Harbor County (2006) GIS Data (Waterbody and Street). Horizontal datum for all layers is State Plane Washington South NAD 83; vertical datum for layers is NAVD88.

Exhibit 4-4. **Wildife Habitat Anderson & Middleton Alternative**

Pontoon Construction Project

Washington State Department of Transportation

\\JAFAR\PROJ\PARAMETRIX_180171\MAPFILES\PONTOON\ECOSYSTEMS\PON_DR_ECOS_HABITAT.MXD 1/30/2010

EXHIBIT 4-5
Habitat Acreage in the Anderson & Middleton Alternative and Study Area [a]

Habitat Type (Mapping Code)	Acres (percent) within Anderson & Middleton Alternative	Acres (percent) within Anderson & Middleton Alternative Study Area (site plus 0.5 mile)
Estuarine		
Subtidal – Unconsolidated Bottom (E1UBL)	-	289 (22 percent)
Intertidal – Aquatic Bed/Unconsolidated Shore (E2AB/US)	0.1 (less than 1 percent)	178 (14 percent)
Intertidal – Emergent Wetland (E2EM1N)	3.1 (3.7 percent)	40 (3.0 percent)
Intertidal – Rocky Shore (E2RS)	0.5 (less than 1 percent)	2.8 (less than 1 percent)
Intertidal – Unconsolidated Shore (E2US)	1.6 (1.9 percent)	84 (6.5 percent)
Intertidal – Anderson & Middleton – Potential Estuarine Wetland (A&M-PSW)	0.4 (less than 1 percent)	0.4 (less than 1 percent)
Freshwater		
Emergent Wetland (PEM)	-	28 (2.2 percent)
Forested/Shrub Wetland (PFO/SS)	-	38 (2.9 percent)
Scrub-Shrub Wetland (PSS)	-	0.1 (less than 1 percent)
Potential Freshwater Wetland (PW) [b]	8 (10 percent)	8 (less than 1 percent)
Lacustrine Unconsolidated bottom – Lake (L1UBH)	-	3.6 (less than 1 percent)
Riparian		
Riparian Forest (RF)	1.4 (1.8 percent)	3.1 (less than 1 percent)
Riparian Forest/Shrub (RFS)	-	0.6 (less than 1 percent)
Riparian Shrub (RS)	-	1.7 (less than 1 percent)
Upland		
Upland Forest (UF)	5.4 (6.6 percent)	68 (5.2 percent)
Grassland (G)	11 (13 percent)	32 (2.4 percent)
Herb/Shrub (H/S)	19 (23 percent)	19 (1.5 percent)
Park (P)	-	1.9 (less than 1 percent)
Residential (R)	-	178 (14 percent)
Industrial (I)	-	297 (25 percent)
Anderson & Middleton – Industrial (A&M-I)	32 (39 percent)	32 (2.5 percent)
Total	**83 (100** percent**)**	**1,308 (100** percent**)**

[a] The acreage for the wildlife habitat mapping is determined by vegetation or aquatic cover and, therefore, differs from the parcel acreage, as well as estimated wetland area for jurisdictional purposes.

Exhibit 4-4 shows the locations of the habitat types in the study area, and Exhibit 4-5 summarizes the acreage of these habitats on the Anderson & Middleton site and within the 0.5-mile study area. (Acreage for wildlife habitat mapping is determined by vegetative or aquatic cover and,

therefore, might differ from parcel acreage.) Within these habitat types, there are various habitat elements, as described in Exhibit 4-6.

Aberdeen Log Yard Alternative

Ecosystems analysts categorized the Aberdeen Log Yard Alternative vicinity into 16 habitat types based on similarities in landscape features, extent of development, type of aquatic habitat, and vegetation composition (Exhibit 4-7). Analysts identified the estuarine, freshwater wetland, riparian, and upland habitat types listed in Exhibit 4-8 within the study area (i.e., the Aberdeen Log Yard Alternative plus a 0.5 mile radius).

Exhibit 4-7 shows the locations of the habitat types in the Aberdeen Log Yard Alternative study area, and Exhibit 4-8 summarizes the acreage of these habitats. Within these habitat types, there are various habitat elements, as described further in Exhibit 4-9.

4.2 Potential Effects of the Project

How did WSDOT evaluate the project's potential effects on wildlife and habitat?

The ecosystems analysts mapped wildlife habitat at both build alternative sites, on the project site, and within the study area, which was characterized as within 0.5 mile of the project perimeter (see Exhibits 4-4 through 4-9). This is the area within which construction of the casting basin facility could affect wildlife usage. The ecosystems analysts identified basic landscape cover types within each sites' study area and the specific wildlife habitats within each cover type. The classification included estuarine habitats; wetlands; riparian areas; residential, urban, and industrial areas; and upland forests.

Construction effects are effects that would occur while the new casting basin, ancillary and pontoon moorage facilities, and any mitigation features are built.

Operational effects are effects that would occur when the pontoons are being built at the new casting basin facility in Grays Harbor and at the CTC facility in Tacoma.

How would construction of the casting basin affect wildlife?

Anderson & Middleton Alternative

Construction of either alternative would eliminate natural vegetative cover within the building footprint (see Exhibit 1-1). Because the Anderson & Middleton Alternative site, at 95 acres, is larger than the other proposed site, some habitat and existing vegetative cover would be retained in the western portion of the site.

EXHIBIT 4-6
Anderson & Middleton Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Estuarine			
Subtidal - Unconsolidated Bottom	Deepwater habitat that is permanently inundated (subtidal).	High value to marine wildlife. The open water habitat in Grays Harbor and the lower reach of Hoquiam River provides habitat for harbor seals, river otters, and numerous species of waterfowl and waterbirds, including mallards, American coots, scaups, goldeneyes, Canada geese, double-crested cormorants, pied-billed grebes, western grebes, common loons, gulls, and Caspian terns. Ospreys, bald eagles, peregrine falcons, and bat species forage over open water. Brown pelicans and gulls were observed flying over the study area during the initial reconnaissance.	Occupies 22 percent (289 acres) of the study area. Much of the open water in the study area consists of the navigation channel between the Anderson & Middleton Alternative and Rennie Island.
Intertidal - Unconsolidated Shore, Aquatic Bed, and Rocky Shore	Intertidal zone in -3-foot to +12-foot tide range. Unconsolidated shore comprises sand, gravel, and cobble substrate and has sparse macroalgae. Aquatic bed habitat has irregular patches of eelgrass and more coverage of macroalgae. Rocky shore consists of riprap armoring of varying slopes and widths with scattered attached macroalgae.	Very high value to a wide variety of wildlife. Dunlins, spotted sandpipers, least sandpipers, gulls, mink, harbor seals (islands only), greater yellowlegs, and great blue herons use these habitats. These habitats, along with the associated habitat elements in the area (for example, piles), are important for peregrine falcons, bald eagles, and hawks that perch and prey on waterfowl and shorebirds using the unconsolidated shores. Great blue heron, northern harriers, and American crows were observed in flight over the site during the initial reconnaissance. Aquatic beds with eelgrass and macroalgae and unvegetated shores provide a high diversity of invertebrates that are important to foraging shorebirds and waterfowl. Rocky shore (riprap) on the site creates crevices and substrate for macroalgae (e.g., brown algae [*Fucus* spp.]) and invertebrates and opportunities for mink and other species to forage. Unconsolidated shore adjacent to the Anderson & Middleton site is used by western sandpipers, semipalmated sandpipers, and other species. Because the site contains a substantial amount of mudflat within the intertidal zone, it likely offers rearing and feeding opportunities to salmonids. The site is located near the mouth of the Hoquiam River where juvenile salmon use nearshore areas on their outmigration to the marine waters of Grays Harbor. Adult salmonids also use the subtidal and intertidal areas adjacent to the Anderson & Middleton site for migration. The expansive unconsolidated shore habitat in Grays Harbor estuary is known to provide foraging and high tide roosting habitat for upwards of a million shorebirds during their spring migration each year. As such, Grays Harbor is the single most important shorebird feeding area on the Pacific coast. Sand-dominated shoals and islands that are a type of unconsolidated shore habitat are important for harbor seal haulout sites and pup-rearing sites, although the closest known haulout site is located more than 0.5 mile from the Anderson & Middleton site.	Unconsolidated shore without vegetation occupies 84 acres (6.5 percent) of the study area. Unconsolidated shore with some attached aquatic vegetation or macroalgae occupies 178 acres (14 percent) of the study area but less than 1 percent of the Anderson & Middleton site. The largest area of unconsolidated shore with aquatic vegetation is associated with Rennie Island, but there is also an area of 0.7 acre along the western shore of the Hoquiam River as it enters the Grays Harbor channel. Unconsolidated rocky shore exists on about 0.5 acre of the Anderson & Middleton site and about 2.8 acres (less than 1 percent) of the study area.

EXHIBIT 4-6
Anderson & Middleton Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Intertidal - Emergent Wetland	Typically, tidal wetlands dominated by erect, rooted, herbaceous plants.	Most of this habitat type is restricted to Rennie Island. Because the analysts did not visit the island, they cannot describe plant species or habitat values for that area. These transition zones between unconsolidated shore and forested wetland, however, likely provide important habitats for similar wildlife species as the palustrine emergent habitats, but they might have higher diversity. Shorebirds and wading birds require emergent wetlands in estuaries for foraging and high tide roost sites. Dominant plant species identified in the emergent wetland on the Anderson & Middleton site were pickleweed and Lyngby sedge.	Occupies 40 acres (3 percent) of the study area and 3.1 acres (3.7 percent) of the Anderson & Middleton site.
Intertidal – Anderson & Middleton Potential Estuarine Wetland	Estuarine areas in the intertidal zone (-3-foot to +12-foot tide range) that could be classified as wetlands based on periodic (tidal) flooding and exposure and the presence of some estuarine wetland vegetation.	This area likely provides wildlife habitat similar to the intertidal wetland habitats in the study area; therefore, it should have similar wildlife habitat value. The potential estuarine wetlands within the Anderson & Middleton site were identified based on location within the intertidal zone and the presence of some estuarine wetland vegetation. This habitat type is located west of the center bulkhead and extends along the southwest shore of the site, ending near the outlet of drainage Channel D. A 50-foot-wide gravel and small cobble zone lie above a mudflat that extends for about 300 feet. A band of sand, distributed between the mudflat and the cobble zone, is found only in this area of the study area shoreline. Rockweed, a marine macrophyte, is intermittently scattered along the intertidal cobble and mudflat areas and also on the relic piles that extend up to 300 feet into Grays Harbor. Dwarf eelgrass is distributed along the mudflat in a uniform, but not dense, pattern.	Occupies 0.4 acre (less than 1 percent) of the Anderson & Middleton Alternative and study area.
Freshwater			
Emergent Wetland	Characterized by erect, rooted, herbaceous hydrophytes present for most of the growing season in most years.	High wildlife habitat value. Emergent wetlands are dominated by reed canarygrass, slough sedge, and creeping bentgrass. During the spring, much of the wetland is saturated or inundated with very shallow water; however, there are several depressions in the wetland that have up to 8 inches of surface water and pockets of open water among the emergent vegetation. Wildlife such as mink, long-tailed weasels, voles, Canada geese, white-fronted geese, snow geese, mallards, pintails, killdeer, red-winged blackbirds, savannah sparrows, great blue herons, whimbrels, Wilson's snipes, spotted sandpipers, Pacific chorus frogs, and garter snakes use emergent wetlands in the area. Tree swallows, violet-green swallows, barn swallows, and purple martins have been observed foraging over the emergent wetland immediately to the east of the Anderson & Middleton site.	Occupies approximately 28 acres (2.2 percent) of the study area. Of these 28 acres, all occur outside of the Anderson & Middleton site.

EXHIBIT 4-6
Anderson & Middleton Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Forested/Shrub Wetland	Characterized by a mix of woody vegetation, including trees (more than 20 feet tall) and a scrub-shrub layer of true shrubs, young trees, and stunted trees or shrubs (less than 20 feet tall).	This habitat likely supports a high diversity of passerine birds (that is, perching birds and songbirds) during the migrating and breeding seasons due to the structural diversity. This habitat exists in the study area of both build alternatives. A bald eagle nesting territory and a large great blue heron rookery with approximately 50 nests are located in the forested wetland on Rennie Island to the southeast of the Anderson & Middleton site, within Grays Harbor. This bald eagle territory was last surveyed in 2005 and was found to be unoccupied.	Occupies 38 acres (2.9 percent) of the study area; no palustrine forest-shrub wetlands exists within the Anderson & Middleton site. There are 13.4 acres of palustrine forested/shrub wetland on Rennie Island. An additional 24.5 acres of forested/shrub wetland exists to the west and northwest of the industrial area bordering the Anderson & Middleton site.
Scrub-Shrub Wetland	Areas dominated by woody vegetation less than 20 feet tall, including true shrubs, young trees (i.e., saplings), and small or stunted trees or shrubs.	The palustrine scrub-shrub habitat consists of small patches of Hooker's willow contained within the mapped freshwater emergent wetland adjacent to the Anderson & Middleton site. Scrub-shrub wetlands provide habitat for mink, raccoons, song sparrows, Wilson's warblers, yellow warblers, common yellowthroats, American robins, dark-eyed juncos, Anna's hummingbirds, and American goldfinches. Garter snakes are the most likely reptile species to be found using these habitats.	Occupies approximately 0.1 acre (less than 1 percent) of the study area.
Potential Freshwater Wetland	Palustrine areas that could possibly be classified as wetlands based on the presence of wetland vegetation and wetland hydrology indicators, such as surface inundation and saturated soils.	These areas might provide wildlife habitat similar to the wetland habitat in the study area; therefore, they could have similar wildlife habitat value. Potential palustrine wetlands were identified in the Anderson & Middleton site based on surface inundation and presence of some plants adapted to growing in wetland conditions. The prevalent herbaceous vegetation in the wetland areas of the drainage swales was reed canarygrass, slough sedge, and common rush. The prevalent vegetation in the seven western wetlands included soft rush, reed canarygrass, and slough sedge, but one area includes plants more typical of forested wetland, including red alder and salmonberry. The dominant vegetation in the eight small wetlands along the southern portion of the site is slough sedge.	Occupies 8 acres (10 percent) of potential palustrine wetland on the Anderson & Middleton site.
Lacustrine Unconsolidated Bottom (Lake)	Unvegetated, open water with a soft bottom of sand or mud.	Likely supports similar species composition as the estuarine subtidal unconsolidated bottom and estuarine intertidal aquatic bed habitats, but because this lake habitat is restricted to the artificial impoundment on Rennie Island, species occurrence cannot be confirmed.	Occupies 3.6 acres (less than 1 percent) of the study area and is restricted to the artificial impoundment on Rennie Island.

EXHIBIT 4-6
Anderson & Middleton Alternative Study Area Habitats and Representative Associated Wildlife

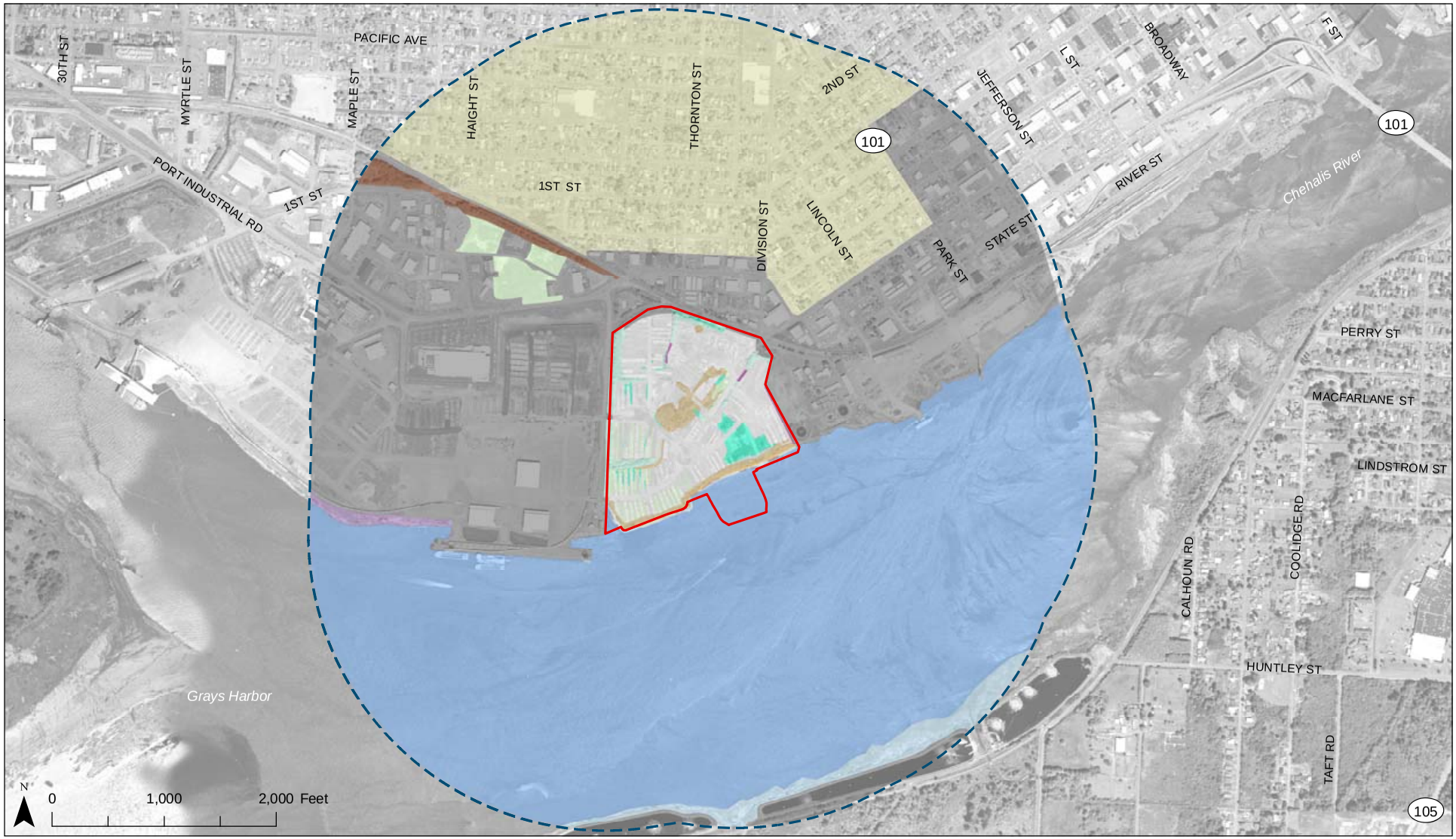
Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Riparian			
Riparian Forest, Riparian Forest-Shrub, and Riparian Shrub	Deciduous trees and shrubs adjacent to water.	High wildlife habitat value due to number of plant species and structural diversity; these areas support high densities of passerine birds in the spring migration and likely support nesting song sparrows, Wilson's warblers, yellow warblers, common yellowthroats, black-headed black-capped chickadees, and grosbeaks. Red-tailed hawks, osprey, and crows perch in these habitats while hunting for food. The drainage ditches in these habitats along the northern and northeastern border of the Anderson & Middleton Alternative might support amphibians, such as Pacific chorus frogs, rough-skinned newts, and long-toed salamanders. Garter snakes, mink, raccoons, voles, and other small mammals might also use riparian habitats. Northern harrier and American crow were observed in flight over the site, and black-tailed deer were observed on the site during the initial reconnaissance.	Occupies about 5.4 acres (less than 1 percent) of the study area. There is 1.4 acres (1.8 percent) of riparian forest habitat along the drainage channel at the eastern boundary of the Anderson & Middleton Alternative. Riparian shrub and forest/shrub habitats were not identified within the site.
Upland			
Upland Forest	Mixed deciduous and coniferous trees without significant human development.	Supports wide variety of wildlife species. Numerous species of passerine birds, crows, hawks, and owls use upland forests for nesting and foraging. Mammals such as raccoons, Douglas squirrels, chipmunks, voles, moles, deer mice, long-tailed weasels, short-tailed weasels, and striped skunks might use upland forests, depending on the patch size and its proximity to other habitats. Northern harrier and American crow were observed in flight over the site during the initial reconnaissance.	Occupies about 68 acres (5.2 percent) of the study area, with scattered patches among the residential and industrial areas; 5.4 acres (6.6 percent) of upland forest habitat exist in the southwest corner of the Anderson & Middleton site.
Grassland	Areas dominated by herbaceous plant species with few shrubs or trees.	Moderately high wildlife habitat value due to limited open space in the study area. Located in the western portion of the Anderson & Middleton site, the herbaceous vegetation consists primarily of upland forbs and grasses, including reed canarygrass. Northern harrier and American crow were observed in flight over the site, and black-tailed deer were observed on the site during the initial reconnaissance. Much of the study area immediately east of the Anderson & Middleton site is dominated by a mixture of grasses and broad-leafed herbs, including tall fescue and common velvet grass. Species observed in grassland habitat on the adjacent area include savannah sparrows, killdeer, Wilson's snipes, American crows, white-crowned sparrows, Canada geese, and European starlings.	Occupies 32 acres (2.4 percent) of the study area and 11 acres (13 percent) of the Anderson & Middleton Alternative site. Nonnative species, including Scot's broom and Himalayan blackberry, have invaded the upland grassland habitat on the Anderson & Middleton site.

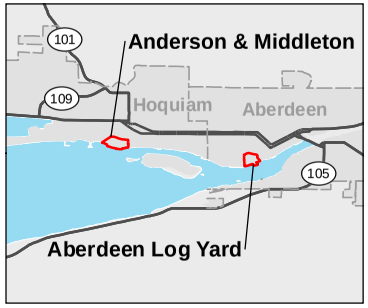
EXHIBIT 4-6
Anderson & Middleton Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Herb/Shrub	Upland areas primarily located around the drainage swales and dominated by herbaceous plant species with a few shrubs.	Moderately high wildlife habitat value due to past disturbances to the site and the limited open space in the study area. The presence of nonnative species (for example, Himalayan blackberry and Scot's broom) lowers the wildlife habitat value. Located around the drainage swales in the log staging areas of the Anderson & Middleton site, the herbaceous vegetation consists primarily of upland forbs and grasses with invasive species, including Himalayan blackberry and Scot's broom. Northern harrier and American crow were observed in flight over the site, and species that use grassland habitat likely use this habitat type also.	Occupies 19 acres (23 percent) of the Anderson & Middleton site but only 19 acres (1.5 percent) of the study area.
Park	Open space with landscaping, trees, and lawn.	Similar wildlife habitat value as residential habitats, but might provide additional habitat because the park space has less human activity and is located along the Hoquiam River shoreline. Species such as Canada geese, mallards, great blue herons, American robins, crows, moles, Douglas squirrels, and various passerine birds use park habitat.	Occupies approximately 1.9 acres (0.001 percent) in the study area. Includes 1.8 acres along 0.2 mile of the eastern shoreline of the Hoquiam River, approximately 0.4 mile upstream (north) of the confluence of the Hoquiam River and the Grays Harbor channel.
Residential	Mix of houses, small utility buildings, concrete and asphalt, ornamental gardens, lawns, and scattered trees.	Limited wildlife habitat available. Deciduous and coniferous native trees provide some habitat for common birds (for example, European starlings, American robins, American crows, black-capped chickadees, and rock doves). Ornamental trees and shrubs in residential lots provide habitat for additional species (for example, Steller's jays, northern flickers, ruby-crowned kinglets, and raccoons). Various mammals, such as deer mice, house mice, pocket gophers, and moles, use lawns and gardens.	Occupies approximately 178 acres (14 percent) of the study area. Residential habitats occur in three areas: one east of the Hoquiam River and two at the northern and western boundaries of the study area.
Industrial	Intensive development generally devoid of vegetation, large areas of impervious surface, and large buildings and other structures.	Extremely limited wildlife habitat available. Tall structures might provide perches for birds, including gulls, American crows, rock doves, and occasionally red-tailed hawks, ospreys, bald eagles, or peregrine falcons. Mammals typically found in industrial areas include opossums, raccoons, mice, and Norway and black rats. Garter snakes might be present, but typically no other amphibians or reptiles occur. Where there are small vegetation patches, they often comprise Himalayan blackberry and other nonnative species that provide low-quality wildlife habitat.	Most abundant habitat type, occupying 297 acres (25 percent) of the study area. Occurs immediately west and northeast of the Anderson & Middleton Alternative. Additional industrial areas in the study area are located on the east side of the Hoquiam River.

EXHIBIT 4-6
Anderson & Middleton Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Anderson & Middleton – Industrial	Somewhat atypical industrial habitat, with intensive use for log staging in the past, but inactive for some time; the gravel paving material used extensively within the site.	Limited wildlife habitat available due to the paved areas and past disturbance. Nonnative species, such as Himalayan blackberry and Scot's broom, on the site also lower the wildlife habitat value.	This is the most abundant habitat type in the Anderson & Middleton site, covering 32 acres (39 percent) of the site and 2.5 percent of the study area. There is one building; a large, central, paved area; and two north-south access roads connected by a perimeter road that runs from the eastern access road along the southern shoreline to the western access road. Spur roads run off the north-south roads, between the drainage swales. All roads are paved.





Wildlife habitat

- Subtidal - unconsolidated bottom
- Intertidal - aquatic bed/ unconsolidated shore
- Intertidal - emergent
- Intertidal - rocky shore
- Intertidal - unconsolidated shore
- Freshwater wetland habitat
- Stormwater drainage features
- Riparian habitat type
- Upland forest
- Upland shrub
- Grassland
- Residential
- On-site industrial
- Off-site industrial
- Study area
- Build Alternative Site

Source: Grays Harbor County (2006) GIS Data (Waterbody and Street). Horizontal datum for all layers is State Plane Washington South NAD 83; vertical datum for layers is NAVD88.

Exhibit 4-7. **Wildlife Habitat Aberdeen Log Yard Alternative**

Pontoon Construction Project

Washington State Department of Transportation

\\JAFAR\PROJ\PARAMETRIX_180171\MAPFILES\PONTOON\ECOSYSTEMS\PON_DR_ECOS_HABITAT.MXD 1/30/2010

EXHIBIT 4-8
Habitat Acreage in the Aberdeen Log Yard Alternative and Study Area [a]

Habitat Type (Mapping Code)	Acres (percent) within Aberdeen Log Yard Alternative	Acres (percent) within Aberdeen Log Yard Alternative Study Area (site plus 0.5 mile)
Estuarine		
Subtidal – Unconsolidated Bottom (E1UBL)	-	396 (41 percent)
Intertidal – Aquatic Bed/Unconsolidated Shore (E2AB/US)	-	13.3 (1.4 percent)
Intertidal – Unconsolidated Shore (E2US)	-	2.7 (less than 1 percent)
Intertidal – Aberdeen Log Yard – Intertidal Aquatic (ALY-Intertidal)	0.9 (1.7 percent)	0.9 (less than 1 percent)
Intertidal – Aberdeen Log Yard – Shoreline (ALY-Sh)	0.7 (1.3 percent)	0.7 (less than 1 percent)
Intertidal – Aberdeen Log Yard – Potential Estuarine Wetland (ALY-PSW)	0.2 (less than 1 percent)	0.2 (less than 1 percent)
Freshwater		
Aberdeen Log Yard – Potential Palustrine Wetland (ALY - PW)	3.1 (5.6 percent)	3.1 (less than 1 percent)
Riparian		
Riparian Forest (RF)	2.3 (4 percent)	2.3 (less than 1 percent)
Riparian Shrub (RS)	2.1 (4 percent)	2.1 (less than 1 percent)
Riparian Herbaceous (RH)	0.3 (less than 1 percent)	0.3 (less than 1 percent)
Upland		
Upland Forest (UF)	-	5.6 (less than 1 percent)
Upland Shrub (S)	5.3 (10 percent)	5.3 (less than 1 percent)
Grassland (G)	3.4 (6 percent)	10.6 (1 percent)
Residential (R)	-	106 (12 percent)
Industrial (I)	-	290 (30 percent)
Aberdeen Log Yard – Industrial	35.4 (66 percent)	35.4 (3.7 percent)
Total	**53.5 (100 percent)**	**955 (100 percent)**

[a] The acreage for the wildlife habitat mapping is determined by vegetation or aquatic cover and, therefore, differs from the parcel acreage.

EXHIBIT 4-9
Aberdeen Log Yard Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Estuarine			
Subtidal – Unconsolidated Bottom	Deepwater habitat that is permanently inundated (subtidal)	High value to marine wildlife. The open water habitat in Grays Harbor and the lower reaches of the Chehalis River provide habitat for harbor seals, river otters, and numerous species of waterfowl and water birds, including mallards, American coots, scaups, goldeneyes, Canada geese, double-crested cormorants, pied-billed grebes, western grebes, common loons, gulls, and Caspian terns. Ospreys, bald eagles, peregrine falcons, and bat species forage over open water. Brown pelicans and gulls were observed flying over the study area during the initial reconnaissance.	Most abundant habitat type, occupying 396 acres, or 41 percent, of the study area; much of the open water in the study area consists of the navigation channel of the Chehalis River.
Intertidal – Aquatic Bed/ Unconsolidated Shore – Wetland Unconsolidated Shore – Wetland Intertidal – Aberdeen Log Yard Intertidal Aquatic and Aberdeen Log Yard – Shoreline	Intertidal zone in -3-foot to +12-foot tide range. Aquatic bed habitat has irregular patches of eelgrass as well as more coverage of macroalgae. Unconsolidated shore is composed of sand, gravel, and cobble substrate and has sparse macroalgae.	Very high value to a wide variety of wildlife. Dunlins, spotted sandpipers, least sandpipers, gulls, mink, harbor seals (islands only), greater yellowlegs, and great blue herons use these habitats. These habitats and the associated habitat elements in the area (e.g., piles) are important for peregrine falcons, bald eagles, and hawks that perch and prey on waterfowl and shorebirds on the unconsolidated shores. Aquatic beds with macroalgae (and possibly eelgrass, though not along the site shoreline) and unvegetated shores provide a high diversity of invertebrates that are important to foraging shorebirds and waterfowl. The site has many piles extending into the intertidal area, and the pile bottoms are densely covered by rockweed. Great blue herons, northern harriers, and American crows were observed in flight over the site during the initial survey. The site's cobble, gravel, and sand shore creates crevices and substrate for macroalgae and invertebrates and opportunities for mink and other species to forage. Because the site contains a large amount of mudflat within the intertidal zone, it likely offers feeding opportunities to juvenile salmonids. Fish rearing and feeding in the intertidal zone might occur because the site is located near the mouth of the Chehalis River where juvenile salmon use nearshore areas on their outmigration to the Grays Harbor marine waters. Adult salmonids likely use the subtidal and intertidal areas next to the Aberdeen Log Yard site for migration.	Unconsolidated shore with some attached aquatic vegetation or macroalgae occupies 13 acres (1.4 percent) of the study area. The largest area of unconsolidated shore with aquatic vegetation is located on Grays Harbor's southeastern shore across the channel from the Aberdeen Log Yard site. Unconsolidated shore with no vegetation occupies slightly more than 2.7 acres (less than 1 percent) of the study area. The intertidal aquatic area of the Aberdeen Log Yard site occupies about 0.9 acre (1.7 percent) of the site. The Aberdeen Log Yard site shoreline occupies about 0.7 acre (1.3 percent) of the site. The shoreline comprises sand, gravel, and cobble and includes areas without vegetation.
Intertidal – Aberdeen Log Yard Potential Estuarine Wetland	Estuarine areas in the intertidal zone (-3-foot to +12-foot tide range) that could be classified as wetlands based on periodic (tidal) flooding and exposure and the presence of some	These areas might provide wildlife habitat similar to the intertidal wetland habitats in the study area; therefore, they should have similar wildlife habitat value. The potential estuarine wetlands within the Aberdeen Log Yard site were identified based on location within the intertidal zone and the presence of estuarine wetland vegetation. They are intermittently scattered along the intertidal areas of the shoreline and are dominated by rockweed, a marine macrophyte (*Fucus* spp.]).	Occupies 0.2 acre (less than 1 percent) of the Aberdeen Log Yard site and the study area.

EXHIBIT 4-9
Aberdeen Log Yard Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
	estuarine wetland vegetation.		
Freshwater			
Freshwater – Aberdeen Log Yard – Potential Palustrine Wetland	Palustrine areas that could be classified as wetlands based on the presence of wetland vegetation and wetland hydrology indicators, such as surface inundation and saturated soils.	These areas might provide wildlife habitat similar to the other wetland habitat already in the study area; therefore, they could have similar wildlife habitat value. Potential palustrine wetlands were identified within the Aberdeen Log Yard site based on surface inundation and presence of some plants adapted to growing in wetland conditions. The herbaceous vegetation in the potential palustrine wetland areas is dominated by cattails, reed canarygrass, and common rush, but there are some areas that include plants more typical of scrub-shrub and forested wetlands, including salmonberry, red alder, and willows.	Occupies approximately 3.1 acres (less than 1 percent) of the study area. All potential freshwater wetland acres in the study area exist on the Aberdeen Log Yard site, occupying 5.6 percent of the site.
Riparian			
Riparian Forest and Riparian Shrub Riparian Herbaceous	Deciduous trees and shrubs adjacent to water; herbaceous plants adjacent to water at the edges of ditches and ponded areas.	High wildlife habitat value due to number of plant species and structural diversity; these areas support high densities of passerine birds during spring migration and likely support nesting song sparrows, Wilson's warblers, yellow warblers, common yellowthroats, black-headed black-capped chickadees, and grosbeaks. Red-tailed hawks, osprey, and crows perch in these habitats while hunting for food. The drainage ditches in these habitats on the Aberdeen Log Yard site might support amphibians such as Pacific chorus frogs, rough-skinned newts, and long-toed salamanders. Garter snakes, mink, raccoons, voles, and other small mammals might also use riparian habitats. Northern harrier and American crow were observed in flight over the site, and black-tailed deer were observed on the site during the initial survey. The herbaceous vegetation in is dominated by cattails, reed canarygrass, and common rush. The dominant plants include salmonberry, red alder, and willows in the scrub-shrub areas and red alder and salmonberry in the forested areas. Nonnative species (such as Himalayan blackberry, Japanese knotweed, and Scot's broom) have invaded the edges of the riparian herbaceous and shrub habitats.	Occupies approximately 4.7 acres (8.8 percent) of the Aberdeen Log Yard site but less than 1 percent of the study area. Riparian forest, shrub, and herbaceous habitat occur along the stormwater drainage ditches at the northern, northwestern, and southeastern borders of the site, as well as along some ditches that extend into the Aberdeen Log Yard site from the stormwater drainage ditches bordering the site.
Upland			
Upland Forest	Mixed deciduous and coniferous trees without significant human development.	Supports wide variety of wildlife species. Numerous species of passerine birds, crows, hawks, and owls use upland forests for nesting and foraging. Mammals such as raccoons, Douglas squirrels, chipmunks, voles, moles, deer mice, long-tailed weasels, short-tailed weasels, and striped skunks	Occupies about 5.6 acres (less than 1 percent) of the study area, with scattered patches among the residential and industrial areas. All of

EXHIBIT 4-9
Aberdeen Log Yard Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
		might use upland forests, depending on the size of the patch and proximity to other habitats. Northern harrier and American crow were observed in flight over the site during the initial reconnaissance.	the upland forest acres in the study area occur outside of the Aberdeen Log Yard site.
Upland Shrub	Areas dominated by woody vegetation less than 20 feet tall. Species include true shrubs and young trees (i.e., saplings).	Moderate wildlife habitat value due to disturbance by heavy machinery and the presence of nonnative species such as Himalayan blackberry, Scot's broom, and Japanese knotweed that lower the wildlife habitat value because they provide relatively low-quality wildlife habitat. These areas probably get some use by passerine birds during spring migration and might contribute some support to nesting song sparrows, Wilson's warblers, yellow warblers, common yellowthroats, black-headed black-capped chickadees, and grosbeaks. Red-tailed hawks, osprey, and crows might use these habitats while hunting for food. Northern harrier and American crow were observed in flight over the site during the initial reconnaissance.	Second-most abundant habitat type on the Aberdeen Log Yard site, occupying 5.3 acres (10 percent) of the site. However, this habitat type occupies less than 1 percent of the study area.
Grassland	Areas dominated by herbaceous plant species with few shrubs or trees.	Moderately high wildlife habitat value due to limited open space in the study area. Much of the area on the Aberdeen Log Yard site not described as riparian herbaceous or potential wetland is dominated by a mixture of upland forbs and grasses. Western sword fern and common velvet grass were present in some areas.	Occupies only 10.6 acres (1 percent) of the study area but 3.4 acres (6 percent) of the Aberdeen Log Yard site. Nonnative species, such as Himalayan blackberry and Scot's broom, have invaded the upland grassland habitat on the site.
Residential	Mix of houses, small utility buildings, concrete/ asphalt, ornamental gardens, lawns, and scattered trees.	Limited wildlife habitat available. Deciduous and coniferous native trees provide some habitat for common birds (e.g., European starlings, American robins, American crows, black-capped chickadees, rock doves). Ornamental trees and shrubs in residential lots provide habitat for additional species (e.g., Steller's jays, northern flickers, ruby-crowned kinglets, raccoons). Various small mammals such as deer mice, house mice, pocket gophers, and moles use lawns and gardens.	Occupies approximately 106 acres (12 percent) of the study area. Residential habitat occurs to the north and northwest of the Aberdeen Log Yard site; it is separated from the site by industrial habitat.
Industrial	Intensive development generally devoid of vegetation, large areas of impervious surface, and large buildings and other structures.	Extremely limited wildlife habitat available. Tall structures might provide perches for birds, including gulls, American crows, rock doves, and occasionally red-tailed hawks, ospreys, bald eagles, and peregrine falcons. Mammals typically found in industrial areas include opossums, raccoons, mice, and Norway and black rats. Garter snakes might be present, but typically no other amphibians or reptiles occur. Where there are small patches of vegetation, they are often composed of Himalayan blackberry and other nonnative species that provide relatively low-quality wildlife habitat.	Second most abundant habitat type in the study area, occupying 290 acres (30 percent) of the study area. Occurs immediately north, east, and west of the Aberdeen Log Yard site.

EXHIBIT 4-9
Aberdeen Log Yard Alternative Study Area Habitats and Representative Associated Wildlife

Cover Type	Description	Habitat Value and Representative Associated Wildlife	Comments
Aberdeen Log Yard – Industrial	Somewhat atypical industrial habitat, intensive use; highly disturbed by heavy machinery, log piles cover some areas, no impervious areas or large structures	Limited wildlife habitat available due to intensive use and disturbance by heavy machinery. Nonnative species, such as Himalayan blackberry, Scot's broom, and Japanese knotweed on the site also lower the wildlife habitat value.	The most abundant habitat on the Aberdeen Log Yard site, occupying 35.4 acres (66 percent) of the site and 3.7 percent of the study area.

Approximately 40 or more acres of the Anderson & Middleton site would not be directly affected by construction. All of the existing vegetative cover would be eliminated at the Aberdeen Log Yard Alternative.

Thirty-two acres of the Anderson & Middleton site is mapped as industrial for the purposes of wildlife habitat identification; this is the largest habitat area on the site. It is located in the central portion of the site, and it is currently an unused log storage area. This area would become the pontoon casting basin and launch channel. The area around the proposed casting basin would be used as a laydown area during construction, as indicated in Exhibit 1-1. For the purposes of wildlife habitat, coverage of the site would change from passive industrial to active industrial. Wildlife using this portion of the site, such as amphibians, passerine birds, waterfowl, small mammals, or raptors, would be displaced to other habitat on- or offsite.

The second largest wildlife habitat area at the Anderson & Middleton Alternative site is dominated by herbaceous and shrub areas and encompasses 17 acres of the site; much of this area is on the western portion of the Anderson & Middleton Alternative and would not be directly affected by construction of the casting basin facility. This area would remain available for use as habitat by amphibians, passerine bird species, small mammals, and raptors. However, these species could avoid the area during construction due to noise, lighting, and disturbance associated with construction activities.

Grass cover dominates approximately 11 acres (13 percent) of the site; most of this habitat type is on the western portion of the site and would not be directly affected by construction. There is potential wetland area in the central portion of the site; approximately 4.8 acres of potential wetland would be eliminated by construction of the casting basin facility. Approximately 4.1 acres of potential wetland on the western portion of the site would not be directly affected by construction. The shoreline and intertidal area in the central portion of the site would be eliminated by construction of the casting basin facility and launch channel. The high-quality estuarine wetland on the western portion of the site would not be directly affected by construction activities.

Noise and human activity associated with construction of a new casting basin and ancillary facilities could disturb wildlife. The degree of disturbance would depend on noise level, timing, and duration of construction activities, as well as the sensitivity of the individual animals. In general, most wildlife found in areas adjacent to the Anderson & Middleton site are adapted to urban conditions, including loud noises, vehicular traffic, and the presence of humans. Pile-driving and other

especially loud construction activities, however, could temporarily displace some animals or prevent them from using suitable habitat in areas adjacent to the build site. In extreme cases, birds could abandon their nests in response to noise disturbance.

Lighting associated with nighttime construction could also disturb wildlife. Based on the proximity of the Anderson & Middleton site to other industrial activity, areas where existing light levels are relatively low are likely scarce. Species that rely on low nighttime light levels are likely to avoid this area under current conditions, and developing a new casting basin and ancillary facilities would unlikely result in new disturbance.

In the marine environment, pile-driving for permanent and temporary mooring dolphins might result in underwater noise levels high enough to disturb or even injure marine mammals and diving seabirds. Appropriate and available best management practices, such as pile-driving during low tide and during approved work windows (as specified by WDFW, NOAA Fisheries, and/or USFWS to protect fish species), would be used during construction to minimize sound pressure generation and transmission from pile-driving. Sound energy associated with impact pile-driving could negatively affect the survival of wildlife near the activity. Therefore, in-water noise from project-related pile-driving would have to be assessed and minimized as much as practicable.

Aberdeen Log Yard Alternative

Constructing either alternative would eliminate natural vegetative cover within the building footprint (see Exhibit 1-1). Sixty-six percent of the Aberdeen Log Yard site is mapped as existing, active industrial area. At 5.3 acres (10 percent), the next largest wildlife habitat area on the site is upland forest. At full buildout, the entire Aberdeen Log Yard site would likely be developed, which would eliminate existing vegetative cover and a portion of the existing shoreline habitat. Total vegetative cover at the Aberdeen Log Yard Alternative (not including shoreline) is 16.5 acres, and if this alternative is selected, this area would be converted to built structures and impervious surfaces. Total estuarine shoreline area at the Aberdeen Log Yard site is approximately 1,700 linear feet, and approximately 300 linear feet of shoreline habitat would be eliminated to build the launch channel for the casting basin.

Based on the location of the Aberdeen Log Yard in an urban area near industrial sites, the effects of noise and human activity would be identical to those described above for the Anderson & Middleton site. In the marine environment, the location, duration, and intensity of pile-driving would be the same for the Aberdeen Log Yard Alternative as for the Anderson &

Middleton Alternative; therefore, the effects of pile-driving would not differ under the two build alternatives.

How would pontoon-building operations affect wildlife and habitat?

Both sites are currently zoned industrial, and the Aberdeen Log Yard site is actively used as a log sorting yard. Casting basin construction and operation at either site would likely eliminate passive use of the site by many wildlife species because existing vegetation would be removed and replaced with built structures and impervious surfaces. Wildlife species in the area are likely to avoid an active industrial site because of disturbance created by noise and human use and the lack of suitable habitat at either site.

Anderson & Middleton Alternative

Pontoon construction at the new casting basin facility would take place over 2 years. During this time, noise and human activity associated with operation of the casting basin and ancillary facilities would likely disturb wildlife. Similar to construction-related effects, the degree of disturbance would depend on noise level, timing, and duration of activities, as well as the sensitivity of the individual animals. Animals near the proposed casting basin would adapt to the noise and human activity associated with active industrial sites. Additional industrial activity at the Anderson & Middleton site unlikely would cause any additional behavioral disruption.

Aberdeen Log Yard Alternative

Based on the location of the Aberdeen Log Yard in an urban area near industrial sites, the effects of noise and human activity associated with project operation would be identical to those described above for the Anderson & Middleton site.

How would the project affect wildlife and habitat in the long term?

If the site remains in active use, then long-term effects would likely be similar to those anticipated during operation of the casting basin facility in that wildlife would likely avoid use of an active industrial site. However, wildlife species in the area have access to other habitats, both terrestrial and aquatic, which provide greater opportunities for loafing, foraging, nesting, and dispersal than the existing habitats at either site. In particular, Grays Harbor National Wildlife Refuge is located approximately 2 miles west of the Anderson & Middleton site and 4 miles west of the Aberdeen Log Yard site. The wildlife refuge is actively used by a wide variety of wildlife species, as is Grays Harbor itself.

How would the alternatives compare in their effects on wildlife and habitat?

Effects on wildlife would be similar at either site. Both sites would convert areas of wildlife habitat to active industrial use. However, the Anderson & Middleton Alternative, because it is larger, would retain approximately 40 acres or more of existing grass, shrub, and forested habitat, including wetland areas, that would not be affected by project construction. The Aberdeen Log Yard Alternative would require use of the entire site to build the casting basin facility and associated ancillary facilities (see Exhibit 1-1) and would affect a larger area of wildlife habitat within the shoreline environment because of dredging required to extend the launch channel to meet the navigation channel.

4.3 Mitigation

What measures does WSDOT proposed to reduce negative project effects on wildlife and habitat?

By proposing the casting basin facility at existing industrial zoned sites, high-quality wildlife habitats have been avoided and effects have been minimized.

How could the project compensate for unavoidable negative effects on wildlife?

Effects on vegetative cover on either site can be quantified and standard mitigation measures for effects on wildlife habitat can be assessed as appropriate in cooperation with the tribes and the regulatory agencies at the local, state, and federal level.

5. References

5.1 Wetland References

Brinson, M.M. 1993. A Hydrogeomorphic Classification for Wetlands. Technical Report WRP-DE-4. NTIS No. AD A270 053. Prepared for the U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

City of Aberdeen. 2001. City of Aberdeen Comprehensive Land Use Plan.

City of Aberdeen. 2008a. Shoreline Master Program, Title 16, Chapter 16.20 Shorelines. Aberdeen, WA.

City of Aberdeen. 2008b. Critical Areas Ordinance. http://aberdeeninfo.com/com_dev/CAO_draft_2008.pdf. Accessed July 26, 2009.

City of Hoquiam. 1996. Comprehensive Plan Update, May 13, 1996. Hoquiam, WA.

City of Hoquiam. 2007. Shoreline Master Program, Hoquiam City Code, Chapter 11.04 Shoreline Management. Hoquiam, WA.

City of Hoquiam. 2008. Critical Areas Ordinance, Hoquiam Municipal Code, Chapter 11.06, Title 11. Hoquiam, WA.

City of Hoquiam. 2008. City of Hoquiam Comprehensive Land Use Plan. September.

City of Hoquiam. 2008. Hometown Hoquiam Phase 2, Economic Development Strategic Action Plan: 2008-2012, Final Review Draft, April 4, 2008. Prepared by Berk & Associates, Seattle, Washington.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Government Printing Office, Washington, DC.

Ecology. 1997. Washington State Wetland Identification and Delineation Manual. Publication No. 96-94. Washington State Department of Ecology, Olympia, WA.

Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. NTIS No. AD A176 912. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Grays Harbor County. 1974. Shorelines Management Master Program. Updated April 2002.

Grays Harbor County. 1986. Estuary Management Plan. Grays Harbor County Regional Planning Commission, Estuary Management Planning Task Force, Montesano, Washington.

GretagMacbeth. 1994. Munsell Soil Color Charts. New Windsor, NY.

Hruby, T. 2004. Washington State Wetland Rating System for Western Washington—Revised. Publication No. 04-06-025. Washington State Department of Ecology, Olympia, WA.

Johnson, A., and R. Coots. 1989. Survey of Chemical Contaminants in the Bottom Sediments of Grays Harbor Estuary. Washington Department of Ecology, Environmental Investigation and Groundwater Monitoring Section, Olympia, WA.

Kauffmann, J.B., M. Mahrt, and W.D. Edge. 2001. Wildlife of Riparian Habitats (Chapter 14). In: Wildlife-Habitat Relationships in Oregon and Washington. Eds. D.H. Johnson and T.A. O'Neil. Oregon State University Press, Corvallis, OR.

Mitsch, W.J., and J.G. Gosselink. 2000. Wetlands. Third Edition. John Wiley and Sons, Inc.

NOAA Fisheries. 2008. Tides and Currents, Station 9441187, Aberdeen, Washington, 2008. http://tidesandcurrents.noaa.gov/station_retrieve.shtml?type=Historic+Tide+Data. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Parametrix, Inc. 2006. Wetland Delineation Report—Port of Grays Harbor Industrial Development District Property #1. Prepared for the Washington State Department of Transportation, Urban Corridors Office, Seattle, WA.

Parametrix, Inc. 2008. Addendum to the Wetland Delineation Report—Port of Grays Harbor Industrial Development District Property #1. Prepared for the Washington State Department of Transportation, Urban Corridors Office, Seattle, WA.

Reed, P.B., Jr. 1997. Revision of the National List of Plant Species that Occur in Wetlands. U.S. Department of Interior, Fish and Wildlife Service, Washington DC.

Richter, K.O. 1997. Criteria for Restoration and Creation of Wetland Habitats of Lentic-Breeding Amphibians in the Pacific Northwest. In: Wetland and Riparian Restoration: A Broader View. Eds. K.B. McDonald and F. Weinmann. U.S EPA 910-97-007. U.S. Environmental Protection Agency, Region 10, Seattle, WA.

Sheldon, D., T. Hruby, P. Johnson, K. Harper, A. McMillan, S. Stanley, and E. Stockdale. 2003. Freshwater Wetlands in Washington State. Volume 1: A Synthesis of the Science—Draft. Publication No. 03-06-016. Washington State Department of Ecology, Olympia, WA.

U.S. Army Corps of Engineers. 2008. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region. Eds. J. S. Wakeley, R. W. Lichvar, and C. V. Noble. ERDC/EL TR-08-13. U.S. Army Engineer Research and Development Center, Vicksburg, MS.

WDFW. 1999. Eelgrass/Macroalgae Habitat Survey Guidelines. Habitat and Land Services, Washington Department of Fish and Wildlife, Olympia, WA.

WSDOT. 2009a. Water Resources Discipline Report. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2009b. Pontoon Mooring Site Selection Memorandum. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2010a. Description of Alternatives and Construction Techniques Discipline Report. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2010b. Indirect and Cumulative Effects Technical Memorandum. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

5.2 Fish References

Adams, P.B., C.B. Grimes, J.E. Hightower, S.T. Lindley, and M.L. Moser. 2002. Status Review for the North American Green Sturgeon. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, Santa Cruz, CA.

Argue, A. W., B. Hillaby, and C. D. Shepard. 1985. Distribution, timing, change in size, and stomach contents of juvenile Chinook and coho salmon caught in Cowichan estuary and bay, 1973, 1975, 1976. Canadian Technical Report of Fisheries and Aquatic Sciences No. 1431.

Armstrong, D.A., C. Rooper, and D. Gunderson. 2003. Estuarine production of juvenile Dungeness Crab (Cancer magister) and contribution to the Oregon–Washington Coastal Fishery. Estuaries 26(4B):1174-1188.

Barrick, R.C. 1976. Hydrodynamics of Grays Harbor Estuary, Washington (Appendix A). Maintenance Dredging and the Environment of Grays Harbor, Washington. U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

Beamesderfer, R.C.P., and M.A.H. Webb. 2002. Green Sturgeon Status Review Information. S.P. Cramer and Associates, Gresham, OR.

Boesch, D.F. 1973. Classification and community structure of macrobenthos in the Hampton Roads area, Virginia. Marine Biology 21:226-244.

Borde, A.B., R.M. Thom, S. Rumrill, and L.M. Miller. 2003. Geospatial habitat change analysis in Pacific Northwest coastal estuaries. Estuaries 26:1104–1116.

Braziero, A. 2001. Relationship between species richness and morphodynamics in sandy beaches: what are the underlying factors? Marine Ecology Progress Series 224:35-44.

Brennen, J. S., K. F. Higgins, J. R. Cordell, and V. A. Stamatiou. 2004. Juvenile salmon composition timing, distribution, and diet in the marine nearshore waters of central Puget Sound in 2001-2002. King County Department of Natural Resources and Parks, Seattle, WA.

Brix, R. 1981. Data Report of Grays Harbor Juvenile Salmon Seining Program, 1973-1980. Progress Report No. 141. State of Washington Department of Fisheries, Olympia, WA.

Brix, R., G.J. Husby, G. Roberts, and B. Ward. 1974. 1974 Data Report of Juvenile Salmonid Seining in Grays Harbor and Tributary Rivers and Electrofishing and River Seining in the Chehalis River in the Vicinity of Washington Public Power Supply System's Project No. 3 and 5. Prepared for State of Washington Department of Fisheries, Management and Research Division, Olympia, WA.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1996. Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Canning, D.J., and H. Shipman. 1995. Coastal Erosion Management Studies in Puget Sound, Washington, Executive Summary. Washington State Department of Ecology, Olympia, WA.

CDFG. 2000. California Department of Fish and Game green sturgeon files. Produced by Dave Kohlhorst in response to a California Public Records Act

request. Available from the California Department of Fish and Game, Sacramento, CA.

Cordell, J.R., and C.A. Simenstad. 1981. Community Structure and Standing Stock of Epibenthic Zooplankton at Five Sites in Grays Harbor, Washington. Final Report to Seattle District U.S. Army Corps of Engineers. FRI-UW-8120. Fisheries Research Institute, University of Washington, Seattle, WA.

Deschamps, G., S.G. Wright, and R.E. Watson. 1971. Fish Migration and Distribution in the Lower Chehalis River and Upper Grays Harbor. Technical Report 7. Washington Department of Fisheries, Olympia, WA.

Dumbauld, B.R., D.L. Holden, and O.P. Langness. 2008. Do sturgeon limit burrowing shrimp populations in Pacific Northwest estuaries? Environmental Biology of Fishes, DOI 10.1007/s 10641-008-9333-y.

Duxbury, A.C. 1987. The physical processes in estuaries: An introduction. The Northwest Environmental Journal 3(1) 1-19.

Ecology. 2008. Washington Coastal Mapper. https//fortress.wa.gov/ecy/coastalatlas/viewer.htm. Accessed June 18, 2008. Washington State Department of Ecology, Olympia, WA.

Emmett, R. L., S. A. Hinton, S. L. Stone, and M. E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries. Volume II: Species Life Histories Summaries. ELMR Report No. 8. National Ocean Service/National Oceanic and Atmospheric Administration, Environmental Assessment Division, Rockville, MD.

EPIC, Center for Biological Diversity, and Waterkeepers Northern California. 2001. Petition to list the North American green sturgeon (Acipenser medirostris) as an endangered or threatened species under the Endangered Species Act. Environmental Protection Information Center.

Goetz, F.A., E. Jeanes, and E. Beamer. 2004. Bull Trout in the Nearshore (preliminary draft report). U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

Hahn, D.R. 2001. Changes in decomposition and alteration of microbial community composition caused by an invasive intertidal eelgrass, Zostera japonica, in a Washington estuary. Presented at the Second International Conference on Marine Bioinvasions, April 9-11, 2001, New Orleans, LA.

HDR Engineering, Inc. 2008. Informal ESA Consultation for Impacts to Aquatic and Terrestrial Listed Species and Designated/Proposed Critical Habitat from Port of Grays Harbor Terminal 2 Piling Repairs. Olympia, WA.

Healey, M. C. 1980. Utilization of the Nanaimo River estuary by juvenile Chinook salmon, Oncorhynchus tshawytscha. Fishery Bulletin 77:653-668.

Healey, M.C. 1982. Juvenile Pacific salmon in estuaries: the life support system. In: Estuarine Comparisons. Ed. V. S. Kennedy. Academic Press. New York, NY.

Healey, M.C. 1991. Life History of Chinook Salmon. In: Pacific Salmon Life Histories. Eds. C. Groot and L. Margolis. University of British Columbia Press, Vancouver, BC.

Houston, J.J. 1988. Status of green sturgeon, Acipenser medirostris, in Canada. Canadian Field-Naturalist 102: 286-290.

Jeanes, E.D., C.M. Morello, and M.H. Appy. 2003. Native Char Utilization, Lower Chehalis River and Grays Harbor Estuary, Aberdeen, Washington. Prepared for the U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

Jeanes, E.D., C.M. Morello, and M.H. Appy. 2005. Half Moon Bay Baseline Fish Survey, Grays Harbor, Washington. Prepared for the U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

Johnson, O.W., M.H. Ruckelshaus, W.S. Grant, F.W. Waknitz, A.M. Garrett, G.J. Bryant, K. Neely, and J.J. Hard. 1999. Status Review of Coastal Cutthroat Trout from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-37. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Johnston, J.M. 1982. Life histories of anadromous cutthroat trout with emphasis on migratory behavior. In: Salmon and Trout Migratory Behavior Symposium. Eds. E.L. Brannon and E.O. Salo. University of Washington School of Fisheries. Seattle, WA.

Josselyn, M., Zedler, J., and Griswold, T. 1990. Wetland mitigation along the Pacific Coast of the United States. In: Wetland Creation and Restoration: The Status of the Science. Eds. J.A. Kusler and M.E. Kentula. Island Press, Washington, DC.

Kehoe, D.M. 1982. Grays Harbor and Chehalis River Improvements to Navigation Environmental Studies: Sources of Sediment to Grays Harbor Estuary. Prepared for the U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

Kohlhorst, D. W., L. W. Botsford, J. S. Brennan, and G.M. Cailliet. 1991. Aspects of the structure and dynamics of an exploited central California population of white sturgeon (Acipenser transmontanus). Acipenser: Actes du premier colloque international sur 1'esturgeon. Ed. P. Williot, editor. Centre

National du Machinisme Agricole du Genie Rural des Eaux et des Forsts, Bordeaux, France.

Leider, S.A. 1997. Status of sea-run cutthroat trout in Washington. In: Sea-Run Cutthroat Trout: Biology, Management, and Future Conservation. Eds. J.D. Hall, P.A. Bisson, and R.E. Gresswell. American Fisheries Society, Corvallis, OR.

Levinton, J.S. 1982. Marine Ecology. Prentice-Hall Inc., Upper Saddle River, NJ.

Lindley, S.T., M.L. Moser, D.L. Erickson, M. Belchik, D.W. Welch, E. Rechisky, J.T. Kelly, J.C. Heublein, and A.P. Klimley. 2008. Marine migration of North American green sturgeon. Transactions of the American Fisheries Society 137:182-194.

Loehr, L.C., and E.E. Collias. 1981. A Review of Water Characteristics of Grays Harbor 1938-1979 and an Evaluation of Possible Effects of the Widening and Deepening Project upon Present Water Characteristics. AD AO95390. U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

MacDonald, J.S., D. Simpson, B. Paulsen, J. Cox, and J. Gendron. 1994. Shoreline Armoring Effects on Physical Coastal Processes in Puget Sound, Washington. Washington State Department of Ecology, Olympia, WA.

Mannino, A., and P.A. Montagna. 1997. Small-scale spatial variation of macrobenthic community structure. Estuaries 20:159-173.

Merrill, G.G. 1995. The effect of Zostera japonica on the growth of Zostera marina in their shared transitional boundary. Padilla Bay National Estuarine Research Reserve Technical Report No. 12. Mount Vernon, WA.

Miller, J.A., and C.A. Simenstad. 1997. A Comparative Assessment of a Natural and Created Estuarine Slough as Rearing Habitat for Juvenile Chinook and Coho Salmon. Estuaries 20:4.

Moser, M. and S. Lindley. 2007. Use of Washington estuaries by subadult and adult green sturgeon. Environmental Biology of Fishes 79:243-253.

Moser, M., and S. Lindley. 2007. Use of Washington estuaries by sub-adult and adult green sturgeon. Environmental Biology of Fishes. DOI 10.1007/s10641-006-9028-1.

Moyle, P.B., P.J. Foley, and R.M. Yoshiyama. 1992. Status of Green Sturgeon, Acipenser medirostris, in California. Final report submitted to National Marine Fisheries Service. University of California-Davis.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Mainwright, W.S. Grant, F.K. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. Technical Memorandum NMFS-NWFSC-35. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

NMFS. 2008. Proposed designation of Critical Habitat for the Southern Distinct Population Segment of North American Green Sturgeon:Draft Biological Report. Southwest Region Protected Resources Division, Long Beach, CA. September 2008.

NOAA Fisheries. 2006. Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of North American Green Sturgeon. Federal Register. Vol. 71, No. 67. pp. 17757-17766. National Oceanic and Atmospheric Administration, National Marine Fisheries Service.

Parametrix. 2006. Port of Grays Harbor Industrial Development District Property #1: Eelgrass/Macroalgae Survey. Prepared for Washington State Department of Transportation, Urban Corridors Office, Olympia, WA.

Pauley, G. 1991. Anadromous trout. Pages 96-104. In: Trout. J. Stolz and J. Schnell, eds. Stackpole Books, Harrisburg, PA.

Pentec Environmental. 2002. Bull trout monitoring in the Snohomish River during historical periods of hydraulic dredging. Draft report prepared for the U.S. Army Corps of Engineers, Seattle District, Seattle, Washington.

Posey, M. H. 1988. Community changes associated with the spread of an introduced seagrass, Zostera japonica. Ecology. 69(4) 974-983.

Salo, E.O. 1991. Life history of chum salmon (Oncorhynchus keta). Pages 231-310. In: Pacific Salmon Life Histories. C. Groot and L. Margolis, eds. UBC Press, Vancouver, BC.

Sandercock, F.K. 1991. Life history of coho salmon (Oncorhynchus kisutch). Pages 395- 446. In: Pacific Salmon Life Histories. C. Groot and L. Margolis, eds. UBC Press, Vancouver, BC.

Scott, W. B. and E. J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 90-91.

Seiler, D. 1989. Differential survival of Grays Harbor Basin anadromous salmonids: water quality implications. Pages 123-135. In: Proceedings on the National Workshop on Effects of Habitat Alteration on Salmonid Stocks. C.D.

Levings, L.B. Holtby, and M.A. Henderson, eds. Canadian Special Publication of Fisheries and Aquatic Sciences 105. Ottawa, Ontario.

Semmens, B.X. 2008. Acoustically derived fine-scale behaviors of juvenile Chinook salmon (Oncorhynchus tshawytscha) associated with intertidal benthic habitats in an estuary. Can. J. Fish. Aquat. Sci. 65: 2053–2062.

Short, F.T., and S. Wyllie-Echeverria. 1996. Natural and human induced disturbance of seagrasses. Environmental Conservation 23(1) 17-27.

Simenstad, C.A., A.J. Wick, J.R. Cordell, R.M. Thom, and G.D. Williams. 2001. Decadal Development of a Created Slough in the Chehalis River Estuary: Year 2000 Results. Report to the U.S. Army Corps of Engineers, Seattle District. Seattle, WA.

Simenstad, C.A., and D.M. Eggers. 1981. Juvenile Salmonid and Baitfish Distribution, Abundance, and Prey Resources in Selected Areas of Grays Harbor, Washington. Prepared by the Fisheries Research Institute, University of Washington. Prepared for U.S. Army Corps of Engineers, Seattle District, Seattle, WA. FRI-UW-8116.

Simenstad, C.A., K.L. Fresh, and E.O. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific salmon: an unappreciated function. Pages 343-364. In: Estuarine Comparisons. V.S. Kennedy, ed. Academic Press. New York, NY.

Slocomb, J., S. Buffum-Field, S. Wyllie-Echeverria, J. Norris, I. Fraser, and J. Cordell. 2004. San Juan County Eelgrass Survey Mapping Project Final Report, Friday Harbor, WA. Friends of the San Juans.

Thom, R.M. 1984. Composition, habitats, seasonal changes and productivity of macroalgae in Grays Harbor Estuary, Washington. Estuaries 7(1):51-60.

USACE. 1998. Point Chehalis Revetment Extension, Westport, Grays Harbor County, Washington, Final Environmental Assessment. Prepared by U.S. Army Corps of Engineers, Seattle District, Seattle, WA.

USACE. 2006. Biological Evaluation. Fiscal Years 2007-2011 Maintenance Dredging and Disposal, Grays Harbor and Chehalis River Navigation Project, Grays Harbor County, Washington. U.S. Army Corps of Engineers, Seattle District, Seattle, WA. August 2006.

USFWS. 1999. Endangered and Threatened Wildlife and Plants: Determination of Threatened Status for Bull Trout in the Coterminous United States. Final rule November 1, 1999. Federal Register 64 (210): 58910-58933. U.S. Fish and Wildlife Service.

USFWS. 2005. Endangered and threatened wildlife and plants; Designation of critical habitat for the bull trout; Final Rule. September 26, 2005. U.S. Fish and Wildlife Service. Federal Register 70(185):56212–56311.

Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory (SaSSI): Summary Report. Washington Department of Fisheries, Olympia, WA.

WDFW. 1999. Eelgrass/Macroalgae Habitat Survey Guidelines. Habitat and Land Services. Washington Department of Fish and Wildlife, Olympia, WA.

WDFW. 2000. Washington State Salmonid Stock Inventory Coastal Cutthroat Trout. http://wdfw.wa.gov/fish/sassi/cutthroat.htm. Washington Department of Fish and Wildlife, Olympia, WA.

WDFW. 2003. 2002 Washington State Salmon and Steelhead Stock Inventory (SaSSI). Washington Department of Wildlife, Olympia, WA.

WDFW. 2004. Changes to the Bull Trout and Dolly Varden Stock Inventory in 2004. Washington Department of Fish and Wildlife, Olympia, WA.

WDFW. 2008. Priority Habitats and Species Data. Washington Department of Fish and Wildlife, Olympia, WA.

WDFW. 2009. 2008 Willapa Bay and Grays Harbor Fall Commercial Non Indian and Tribal Salmon Landing Data. http://wdfw.wa.gov/fish/regs/ commregs/ landings_coast.htm. Washington Department of Fish and Wildlife, Olympia, WA.

WSCC. 2001. Habitat Limiting Factors and Reconnaissance Assessment Report: Chehalis Basin and Nearby Drainages (Water Resource Inventory Area 22 and 23). Washington State Conservation Commission, Olympia, WA.

WSDOT. 2006. Port of Grays Harbor Industrial Development District Property #1 Eelgrass/Macro Algae Survey. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2008. Highway Runoff Manual. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2009e. Final Mudflat Surveys for Pontoon Construction. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2009f. Hydrology and Water Quality Technical Report. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2009g. Conceptual Stormwater Design Report. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

WSDOT. 2010c. Cultural Resources Discipline Report. Pontoon Construction Project, SR 520 Bridge Replacement and HOV Program. Washington State Department of Transportation, Olympia, WA.

Wydoski, R.S., and R.R. Whitney. 2003. Inland Fishes of Washington. 2nd edition. American Fisheries Society, Bethesda, Maryland, and University of Washington Press, Seattle, Washington.

5.3 Wildlife References

Audubon Society. 2008. Christmas Bird Counts. http://audubon2.org/cbchist/count_table.html. Accessed April 2, 2009.

Butler, R.W. 1995. The Patient Predator: Foraging and Population Ecology of the Great Blue Heron (Ardea herodias) in British Columbia. Occasional Paper Number 86. Canadian Wildlife Service, Ontario, Canada.

Calambokidis, J. G.H. Steiger, D.K. Ellifrit, B.L. Troutman, and C.E. Bowlby. 2004. Distribution and abundance of humpback whales (Megaptera novaeagliae) and other marine mammals off the northern Washington coast. Fishery Bulletin, U.S., 102:563-580.

Calambokidis, J., and J. Quan. 1999. Photographic Identification Research on Seasonal Resident Whales in Washington State. Unpublished Document Submitted to the Workshop to Review the Status of the Eastern North Pacific Stock of Gray Whales, March 16-17, 1999. Seattle, WA.

Calambokidis, J., J.D. Darling, V. Deecke, P. Gearin, M. Gosho, W. Megill, C.M. Tombach, D. Goley, C. Toropova, and B. Gisborne. 2002. Abundance, Range and Movements of a Feeding Aggregation of Gray Whales (Eschrichtius robustus) from California to Southeastern Alaska in 1998. Journal of Cetacean Research and Management 4(3): 267–276.

Calambokidis, J., S.M. Speich, J. Peard, G.H. Steiger, J.C. Cubbage, D.M. Fry, and L.J. Lowenstine. 1985. Biology of Puget Sound Marine Mammals and Marine Birds: Population Health and Evidence of Pollution Effects. Technical Memorandum No. OMA 18. National Oceanic and Atmospheric Administration.

Darling, J.D. 1984. Gray whales off Vancouver Island, British Columbia. In: The Gray Whale Eschrichtius robustus. Eds. Jones, M.L., S.L. Swartz, and S. Leatherwood. Academic Press, Inc., Orlando, FL.

Darling, J.D., Keogh, K.E. and Steeves, T.E. 1998. Gray Whale (Eschrichtius robustus) Habitat Utilization and Prey Species off Vancouver Island, B.C. Marine Mammal Science 14(4): 692-720.

Drut, M.S., and J.B. Buchanan. 2000. U.S. Shorebird Conservation Plan: Northern Pacific Coast Regional Shorebird Management Plan. U.S. Fish and Wildlife Service, Portland, Oregon, and Cascadia Research Collective, Olympia, WA.

Gosho, M.E., P.J. Gearin, J. Calambokidis, K.M. Hughes, L. Cooke, L. Lehman, and V.E. Cooke. 1999. The Summer and Fall Distribution of Gray Whales in Washington Waters. Unpublished Document Submitted to the Workshop to Review the Status of the Eastern North Pacific Stock of Gray Whales, March 16-17, 1999. Seattle, WA.

Grays Harbor Audubon Society. 2000. The Checklist of Birds for Grays Harbor.

Green, G.A., J.J. Brueggeman, R.A. Grotefendt, and C.E. Bowlby. 1995. Offshore distances of gray whales migrating along the Oregon and Washington coasts, 1990. Northwest Science 69:223-227.

Jeffries, S.J., P.J. Gearin, H.R. Huber, D.L. Saul, and D.A. Pruett. 2000. Atlas of Seal and Sea Lion Haul Out Sites in Washington. Washington Department of Fish and Wildlife, Wildlife Science Division, Olympia, WA.

Lance, M.M., and S.J. Jeffries. 2006. Estimating Importance of Rockfish, Lingcod and Other Bottomfish in the Diet of Harbor Seals in the San Juan Islands. Contract Report to SeaDoc Society Research Agreement No. K004431-22. Washington Department of Fish and Wildlife, Olympia, WA.

Pike, G.C. 1962. Migration and feeding of the gray whale (Eschrichtius gibbosus). Journal of the Fisheries Research Board of Canada 19:815-838.

Richardson, S. 1997. Washington State Status Report for the Gray Whale. Washington Department of Fish and Wildlife. Olympia, WA.

Rugh, D.J., K.E.W. Shelden, and A. Schulman-Jainger. 2001. Timing of the southbound migration of gray whales. Journal of Cetacean Research and Management 3(1): 31-39.

Shelden, K.E.W., D.J. Rugh, J.L. Laake, J.M. Waite, P.J. Gearin, and T.R. Wahl. 2000. Winter observations of cetaceans off the northern Washington coast. Northwestern Naturalist 81:54-59.

Smith, M.R., P.W. Mattocks, Jr., and K.M. Cassidy. 1997. Breeding Birds of Washington State. Volume 4. In: Washington State Gap Analysis – Final

Report. K. Cassidy, C.E. Grue, M.R. Smith, and K.M. Dvornich, eds. Seattle Audubon Society Publications in Zoology No. 1, Seattle, WA.

Speich, S.M. and T.R. Wahl. 1995. Marbled murrelet populations of Washington -- marine habitat preferences and variability of occurrence. In: Ecology and conservation of the Marbled Murrelet. Eds. C.J. Ralph, G.L. Hunt, M.G. Raphael, and J.F. Piatt. General Technical Report PSW-152. Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture, Albany, CA.

USFWS. 1990. Management and Development Plan for Grays Harbor National Wildlife Refuge, Hoquiam, Washington. U.S. Fish and Wildlife Service).

USFWS. 2004. Species Assessment and Listing Priority Assignment Form, Streaked Horn Lark (Eremophila alpestris strigata). U.S. Fish and Wildlife Service, Region 1, Portland, OR.

USFWS. 2008a. Listed and Proposed Endangered and Threatened Species and Critical Habitat; Candidate Species; and Species of Concern in Grays Harbor County. Revised November 1, 2007. http://www.fws.gov/westwafwo/speciesmap/GRYAS%HARBOR.html. Accessed April 21, 2008. U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office.

USFWS. 2008b. Critical Habitat for Threatened and Endangered Species. Available at: http://crithab.fws.gov/. Accessed April 21, 2008. U.S. Fish and Wildlife Service.

USFWS. 2008c. Brown pelican Web page. http://www.fws.gov/species/species_accounts/bio_plcn.html, accessed June 22, 2008. U.S. Fish and Wildlife Service.

Varland, D. 2008. Wildlife Biologist, ITT Rayonier, Hoquiam, Washington, personal communication with R. Tressler, Parametrix, Inc. March 30.

Warnock, N., J.Y. Takekawa, and M.A. Bishop. 2004. Migration and stopover strategies of individual dunlin along the Pacific coast of North America. Can. J. Zool. 82:1687-1697.

Warnock, N., M.A. Bishop, and J.Y. Takekawa. 2001. Spring Migration of Dunlin and Dowitchers along the Pacific Flyway. Unpublished Progress Report. Point Reyes Bird Observatory, Stinson Beach, CA.

WDFW. 2008a. WDFW Priority Habitats and Species Web site. http://www.wdfw.wa.gov/hab/phspage. Accessed June 20, 2008. Washington Department of Fish and Wildlife, Olympia, WA.

WDFW. 2008b. WDFW Bald Eagle Territory History Web site. http://wdfw.wa.gov/wlm/diversty/soc/baldeagle/territory/ index.htm. Accessed May 7, 2008. Washington Department of Fish and Wildlife, Olympia, WA.

WDFW. 2008c. California Sea Lion Fact Sheet. http://wdfw.wa.gov/wlm/ sealions/facts.htm. Accessed June 22, 2008. Washington Department of Fish and Wildlife, Olympia, WA.

5.4 GIS References

Grays Harbor County. 2006. Road GIS data download. http://www.ghc-gis.org/ info/GIS/download.html. Accessed December 22, 2006. Grays Harbor County, Geographic Information Systems, Montesano, WA.

Grays Harbor County. 2006. Street GIS data download. http://www.ghc-gis.org/ info/GIS/download.html. Accessed December 22, 2006. Grays Harbor County, Geographic Information Systems, Montesano, WA.

Grays Harbor County. 2006. Waterbody GIS data download. http://www.ghc-gis.org/ info/GIS/download.html. Accessed December 21, 2006. Grays Harbor County, Geographic Information Systems Department, Montesano, WA.

NOAA. 2007. Grays Harbor Nautical Chart 18502 GIS data. http://www.charts.noaa.gov/OnlineViewer/18502.shtml. Accessed March 4, 2008. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coast Survey, Silver Spring, MD.

USDA-FSA. 2006. Pierce County aerial photograph. http://rocky2.ess.washington.edu/data/raster/naip2006/Pierce/. Accessed September 2009. U. S. Department of Agriculture, Farm Services Agency, Aerial Photography Field Office, Salt Lake City, UT.

WSDOT. 2005. Aberdeen graving dock orthophotograph. Accessed May 29, 2008. Washington State Department of Transportation Aerial Photography Branch, Olympia, WA.

WSDOT. 2006. SR 101 City of Aberdeen orthophotograph. Accessed May 29, 2008. Washington State Department of Transportation Aerial Photography Branch, Olympia, WA.

ATTACHMENT A

Grays Harbor Shorebird and Waterfowl Background Information

Grays Harbor Shorebirds

The checklist of birds for Grays Harbor (Grays Harbor Audubon Society 2000) lists 280 species that have been observed in the region. Among these species are 144 species of shorebirds, waterbirds, wading birds, and waterfowl.

Migrating shorebirds use Grays Harbor as spring and fall migration stopovers due to the abundance of invertebrates available in the intertidal habitats (USFWS 1990). Grays Harbor is used by more than 1 million shorebirds during spring (Herman and Bulger 1981). Grays Harbor is a Western Hemisphere Shorebird Reserve Network (WHSRN) site of hemispheric importance, due in part to the important high tide roost and feeding site that the Grays Harbor National Wildlife Refuge (NWR) (also known as Bowerman Basin) provides to shorebirds on migration (Drut and Buchanan 2000). Also, large numbers of shorebirds that forage in Grays Harbor (and Willapa Bay) make daily flights to roosting areas along the outer beaches (Copalis/Ocean Shores, Grayland, and North [Long Beach] beaches) (Drut and Buchanan 2000).

Although the Grays Harbor NWR contains only 2 percent of the total intertidal habitat in the estuary, approximately 50 percent of the shorebird use occurs there (USFWS 1990). Dunlins at the refuge feed on a variety of invertebrates, but cumaceans (*Leptocuma* sp. and *Leucon* sp.) comprised 70 percent and the amphipod *Corophium salmonis* constituted 24 percent of the total food remains in a study by Brennan et al. (1990). At Bowerman Basin, Brennan et al. (1985) found that dunlins typically arrived from the southeast, south, or southwest. Dunlins forage along the edge of the ebbing water in the center of the basin and west in the area between Bowerman Basin and Moon Island. Dunlins disperse south and west to other feeding and roosting areas in Grays Harbor.

Dunlins show a significant preference for marine tidal habitats, but more than 80 percent of individuals also use terrestrial habitats, particularly large fields and pastures with short vegetation, usually during high tide and primarily at night (Shepherd and Lank 2004). During diurnal high tides, dunlins roost in fields, salt marshes, mudflats, and on log rafts (Brennan et al. 1985). A lack of suitably located high tide roosts can limit the access of shorebirds, including dunlins and sandpipers, to foraging areas (Dias et al. 2006).

Western sandpipers stay an average of 2.4 ± 1.2 days at Grays Harbor (Warnock et al. 2004). In 2001, dowitchers stayed an average of up to 5 days (Warnock et al. 2001). Dunlins likely stay for similar time periods

as sandpipers and dowitchers. These authors theorized that the short stay at Grays Harbor might be due to the fact that the estuary has a relatively low biomass of invertebrates (Warnock et al. 2004).

Priority shorebird management activities in the Northern Pacific Coast plan area include the following:

1. Effectively eliminate and otherwise control exotic species in essential shorebird habitats.
2. Improve oil spill-prevention strategies and spill-response efficiency.
3. Restore degraded habitats (Buchanan 2005).

This highlights the need to focus on restoring estuarine habitats for shorebirds in Grays Harbor.

Grays Harbor NWR has been surveying for smooth cordgrass (*Spartina alterniflora*) and other exotic plants that reduce shorebird stopover habitat. The USFWS, Grays Harbor County Weed Board, and Washington State Department of Transportation (WSDOT) have been actively controlling invasive plants such as common reed (*Phragmites australis*), reed canarygrass (*Phalaris arundinacea*), and Japanese knotweed (*Polygonum cuspidatum*) on the refuge and planting native vegetation on shared property lines.

Grays Harbor Waterfowl and Waterbirds

Although waterfowl are present year-round, Grays Harbor estuary is particularly important for waterfowl during migration. Generally, peak waterfowl numbers occur during October and November (USFWS 1990). American wigeons comprise nearly 60 percent of the fall and winter waterfowl; mallards, green-winged teals, and northern pintails are also common during these months. Diving ducks, such as canvasbacks, are less common. Canada geese and black brant are common goose species, although snow geese (*Chen caerulescens*) and white-fronted geese (*Anser erythropus*) also use emergent wetlands and pastures in Grays Harbor.

At least 11 species of gulls and terns use the Grays Harbor estuary, with western gulls, glaucous-winged gulls, and hybrids of the two species representing the majority of the breeding population (USFWS 1990). During the spring and summer, peak gull numbers have been approximately 15,000. During spring and fall migration, ring-billed, California, Bonaparte's, and Heermann's gulls are common; in winter, the new gull is common (USFWS 1990).

In the mid-1970s, Whitcomb Island in Grays Harbor supported the largest Caspian tern *(Sterna caspia)* breeding colony in Washington, with approximately 1,200 nests; 700 nests were also found on Sand Island (Smith and Mudd 1978). They previously nested on Goose Island in the estuary. Islands in Grays Harbor had an estimated 3,590 pairs in 1987 (Suryan et al. 2004). Caspian terns do not currently nest in Grays Harbor.

Anthropogenic habitat modification has been influential in determining the distribution of breeding Caspian terns along the Pacific coast, with artificially improved or maintained nesting habitats supporting the largest numbers (Shuford and Craig 2002).

The most numerous fish in Caspian tern diets were the shiner perch (*Cymatogaster aggregata*), chum salmon (*Oncorhynchus keta*), and Pacific staghorn sculpin (*Leptocottus armatus*). Five other species, white seaperch (*Phanerodon furcatus*), whitebait smelt (*Allosmerus elongarus*), snake prickleback (*Lumpenus sagitta*), cutthroat trout (*Salmo clarki*), and longnose dace (*Rhinichthys cataractae*), occurred in smaller amounts.

Grays Harbor is near the approximate midpoint of the zone inhabited by glaucous-winged/Western hybrid gulls (Good 2002). Within the estuary, Goose Island, Sand Island, and No Name Island in the northern bay and Whitcomb Flats in the southern bay have been used by nesting gulls and double-crested cormorants (*Phalacrocorax auritis*). The small sandbar islands (Goose and Whitcomb Flats) have sparse vegetation, primarily American searocket (*Cakile edentula*) and seabeach sandwort (*Honkenya peploides*), whereas the larger islands (Sand and No Name islands) had dense patches of dunegrass (*Elymus mollis*) and beachgrass (*Ammophila arenaria*), with patches of Pacific willow (*Salix lucida*) and stands of common reed (Good 2002).

Marine Mammals

Jeffries et al. (2003) reported that harbor seal abundance in Washington as of 1999 had increased threefold since 1978 and seven- to tenfold since 1970. Approximately 45 harbor seal haulout sites have been documented on intertidal mudflats and sand bars throughout Grays Harbor (Jeffries et al. 2000). Nursery areas are located around Whitcomb Flats, Mid-Harbor Flats, Sand Island shoals, Sand Island, Goose Island, Chenoise Creek channels, and in North Bay (Jeffries et al. 2000). Peak harbor seal abundances occur during the pupping season (mid-April through June) and the annual molt (July through August).

Aquatic Resources

The Grays Harbor estuary is an important Dungeness crab *(Cancer magister)* nursery for regional population production and fisheries. Approximately 33 percent of the entire Grays Harbor estuary is subtidal habitat, but the amount and percentages vary greatly among three strata (Exhibit A-1). Grays Harbor Dungeness crab density was determined to be 1,830 crabs/hectare in the lower side channels, 500 crabs per hectare in the lower main channels, and 275 crabs/hectare in the upper estuary.

Since the late 1800s, tidal flats have decreased in Grays Harbor, but potential eelgrass habitat has increased (Borde et al. 2003). The lower depth limit of eelgrass was estimated to be at approximately the extreme low water level for the estuary (1.2 meters mean lower low water) (Borde et al. 2003).

EXHIBIT A-1
Subtidal Habitat in Grays Harbor

Habitat Strata	Subtidal Area (acres)	Percent of Strata	Total Area (acres)
Lower Main Channels	2,775	32	8,672
Lower Side Channels	4,222	49	8,616
Upper Estuary	1,548	18	8,600
Total Estuary	8,545	33	25,888

Source: Armstrong et al. (2003).

Anecdotal observations indicated that some flats in the outer (South Bay) area of Grays Harbor were eroded shortly after the navigation channel was deepened in the early 1990s (Borde et al. 2003). Dredging of navigation channels has changed circulation, physical processes, and bathymetry in the systems. The role of deeper channels in altering the elevation and habitats of adjacent shallow areas is not known, but it is suspected that slumping of flats might occur soon after channel deepening.

The construction of two jetties at the mouth of Grays Harbor in the early 1900s and the subsequent raising in the 1930s and 1940s have restricted the amount of sediment entering the harbor (Buijsman 2002 cited in Borde et al. 2003). Further studies are being conducted to determine whether Grays Harbor is still receiving Columbia River sediment or if the supply has ceased (Gelfenbaum and Kaminsky 2002 cited in Borde et al. 2003).

Mean sea level can increase as much as 30 centimeters over the long-term average during a strong E1 Niño event (Komar 1998). These events, in combination with sea level rise, could explain some of the increases in

potential eelgrass habitat in Grays Harbor, where mean sea level is rising approximately 1.5 millimeters per year (Shipman 1989).

In the outer portions of Grays Harbor, a shell project was implemented to mitigate the effects of channel dredging on Dungeness crab. As a result, shell has replaced functional tideflat and, to a lesser degree, eelgrass habitat (Armstrong et al. 1991). This structurally complex shell hash is preferentially chosen by crab megalopae for settlement, and it provides increased refuge, food, and survival over mudflat habitats. As the shell gradually sank, and the shell plot reverted to former bare mudflat conditions, the eelgrass eventually declined to former abundance levels.

References

Armstrong, D.A., K.A. McGraw, P.A. Dinnel, R.M. Thom, and O. Iribarne. 1991. *Construction Dredging Impacts on Dungeness Crab (*Cancer magister*) in Grays Harbor, Washington and Mitigation of Losses by Development of Intertidal Shell Habitat.* FRI-UW-9110. Fisheries Research Institute, School of Fisheries, University of Washington, Seattle, Washington.

Armstrong, D.A., C. Rooper, and D. Gunderson. 2003. Estuarine production of juvenile Dungeness Crab (*Cancer magister*) and contribution to the Oregon–Washington Coastal Fishery. *Estuaries* 26(4B):1174-1188.

Borde, A.B., R.M. Thom, S. Rumrill, and L.M. Miller. 2003. Geospatial habitat change analysis in Pacific Northwest coastal estuaries. *Estuaries* 26(4B):1104-1116.

Brennan, L.A., J.B. Buchanan, S.G. Herman, and T.M. Johnson. 1985. Interhabitat movements of wintering dunlins in western Washington. *The Murrelet* 66:11-16.

Brennan, L.A., M.A. Finger, J.B. Buchanan, C.T. Schick, and S.G. Herman. 1990. Stomach contents of dunlins collected in western Washington. *Northwestern Naturalist* 71:99-102.

Buchanan, J.B. 2005. *Priorities for Implementation of the Northern Pacific Coast Regional Shorebird Management Plan*. USDA Forest Service General Technical Report. PSW-GTR-191.

Dias, M.P., J.P. Granadeiro, M. Lecoq, C.D. Santos, J.M. Palmeirim. 2006. Distance to high tide roosts constrains the use of foraging areas by dunlins: Implications for the management of estuarine wetlands. *Biological Conservation* 131:446-452.

Drut, M.S., and J.B. Buchanan. 2000. *U.S. Shorebird Conservation Plan: Northern Pacific Coast Regional Shorebird Management Plan*. U.S. Fish and

Wildlife Service, Portland, Oregon, and Cascadia Research Collective, Olympia, Washington.

Good, T.P. 2002. Breeding success in the western gull x glaucous-winged gull complex: the influence of habitat and nest-site characteristics. *Condor* 104:353-365.

Grays Harbor Audubon Society. 2000. *Checklist of Grays Harbor Birds.*

Herman, S.G., and J.B. Bulger. 1981. *The Distribution and Abundance of Shorebirds during the 1981 Spring Migration at Grays Harbor, Washington.* U.S. Army Corps of Engineers, Contract report DACW67 -81-M-0936. Seattle, Washington.

Jeffries, S.J., P.J. Gearin, H.R. Huber, D.L. Saul, and D.A. Pruett. 2000. *Atlas of Seal and Sea Lion Haul Out Sites in Washington.* Washington Department of Fish and Wildlife, Wildlife Science Division, 600 Capitol Way North, Olympia WA.

Jeffries, S., H. Huber, J. Calambokidis, and J. Laake. 2003. Trends and status of harbor seals in Washington State: 1978-1999. *Journal of Wildlife Management* 67:207-218.

Komar, R.D. 1998. *Beach Processes and Sedimentation*. 2nd edition. Prentice Hall, Upper Saddle River, New Jersey.

Shepherd, P.C., and D.B. Lank. 2004. Marine and agricultural habitat preferences of dunlin wintering in British Columbia. *Journal of Wildlife Management* 68:61-73.

Shipman, H. 1989. *Vertical Land Movements in Coastal Washington: Implications for Relative Sea Level Changes.* Shorelands and Coastal Zone Management Program, Washington State Department of Ecology, Olympia, Washington.

Shuford, W.D., and D.P. Craig. 2002. *Status Assessment and Conservation Recommendations for the Caspian Tern (*Sterna caspia*) in North America.* USDI, Fish and Wildlife Service, Portland, Oregon.

Smith, J.L., and D.R. Mudd. 1978. Food of the Caspian tern in Grays Harbor, Washington. *The Murrelet* 59:105-106.

Suryan, R.M., D.P. Craig, D.D. Roby, N.D. Chelgren, K. Collis, W.D. Shuford, and D.E. Lyons. 2004. Redistribution and growth of the Caspian tern population in the Pacific coast region of North America, 1981-2000. *Condor* 106:777-790.

USFWS (U.S. Fish and Wildlife Service). 1990. *Management and Development Plan for Grays Harbor National Wildlife Refuge, Hoquiam, Washington.*

Warnock, N., M.A. Bishop, and J.Y. Takekawa. 2001. *Spring Migration of Dunlin and Dowitchers along the Pacific Flyway.* Unpublished Progress Report, Point Reyes Bird Observatory, Stinson Beach, California.

Warnock, N., J.Y. Takekawa, and M.A. Bishop. 2004. Migration and stopover strategies of individual dunlin along the Pacific coast of North America. *Canadian Journal of Zoology* 82:1687-1697.

ATTACHMENT B

List of Federal Listed Wildlife Species Occurring in Grays Harbor County

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN IN GRAYS HARBOR COUNTY AS PREPARED BY THE U.S. FISH AND WILDLIFE SERVICE WESTERN WASHINGTON FISH AND WILDLIFE OFFICE

(Revised November 1, 2007)

LISTED

Brown pelican (*Pelecanus occidentalis*) [outer coast]

Bull trout (*Salvelinus confluentus*)

Marbled murrelet (*Brachyramphus marmoratus*)

Northern spotted owl (*Strix occidentalis caurina*)

Oregon silverspot butterfy (*Speyeria zerene hippolyta*)

Short-tailed albatross (*Phoebastria albatrus*) [outer coast]

Western snowy plover (*Charadrius alexandrinus nivosus*)

Major concerns that should be addressed in your Biological Assessment of project impacts to listed species include:

1. Level of use of the project area by listed species.
2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.
3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

DESIGNATED

Critical habitat for bull trout

Critical habitat for the marbled murrelet

Critical habitat for the northern spotted owl

Critical habitat for the western snowy plover

http://www.fws.gov/westwafwo/speciesmap/GRAYS%20HARBOR.html 4/21/2008

PROPOSED

None

CANDIDATE

Streaked horned lark (*Eremophila alpestris strigata*)
Yellow-billed cuckoo (*Coccyzus americanus*)

SPECIES OF CONCERN

Aleutian Canada goose (*Branta canadensis leucopareia*)
Bald eagle (*Haliaeetus leucocephalus*)
Cascades frog (Rana cascadae)
Coastal cutthroat trout (*Oncorhynchus clarki clarki*) [southwest Washington DPS]
Columbia torrent salamander (Rhyacotriton kezeri)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Makah=s copper (butterfly) (*Lycaena mariposa charlottensis*)
Newcomb=s littorine snail (*Algamorda newcombiana*)
Northern goshawk (*Accipiter gentilis*)
Northern sea otter (*Enhydra lutris kenyoni*)
Olive-sided flycatcher (*Contopus cooperi*)
Olympic torrent salamander (*Rhyacotriton olympicus*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend=s big-eared bat (*Corynorhinus townsendii townsendii*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Tailed frog (*Ascaphus truei*)
Tufted puffin (*Fratercula cirrhata*)
Van Dyke=s salamander (*Plethodon vandykei*)
Western gray squirrel (*Sciurus griseus griseus*)
Western toad (*Bufo boreas*)
Aster curtus (white-top aster)
Cimicifuga elata (tall bugbane)
Dodecatheon austrofrigidum (frigid shootingstar)
Sanicula arctopoides (footsteps of spring; bear's-foot sanicle)