3. Fish and Aquatic Resources

The saltwater and estuarine habitats of Grays Harbor—as well as the freshwater habitat within the rivers and streams that feed it—support various fish species, including several species of native salmon and trout. Many of these species are integral parts of the economy and culture of the Pacific Northwest. The local fish populations have been adversely affected by large-scale alteration of fish habitat within Grays Harbor and its tributaries over the last 100 years, as well as by harvest and general watershed changes resulting from human use of the ecosystem. These fish resources might be further affected by the build alternatives being considered for the Pontoon Construction Project. This chapter of the Ecosystems Discipline Report assesses these resources to provide the foundation for evaluating the potential effects of both project build alternatives on fish and other aquatic resources.

Anadromous salmonids (i.e., salmonids that migrate to the ocean) produced in the Hoquiam and Chehalis rivers and other tributaries to Grays Harbor use the areas adjacent to the proposed build alternatives for migration and rearing, as do many other fish species. Therefore, the build alternatives could either positively or negatively affect fish and aquatic resources within the Grays Harbor basin.

3.1 Tribal Fishing

CTC Facility

Commencement Bay is designated as Salmon Management Area 11A and is within the federally adjudicated “usual and accustomed” fishing grounds of the Puyallup Tribe of Indians. WSDOT has been in contact with the Puyallup Tribe and will continue to coordinate with them as the project progresses.

Grays Harbor Build Alternatives

Both Grays Harbor build alternative sites are within the federally adjudicated usual and accustomed fishing area of the Quinault Indian Nation. Their usual and accustomed fishing grounds include Salmon Management Area 28, which is within Grays Harbor and its tributaries. The Quinault Indian Nation has a staff of fisheries biologists and takes an active role in managing salmonids, shellfish, and other finfish within the study area.

The Quinault Indian Nation currently fish for salmon (coho, chum, and Chinook), steelhead, and white sturgeon and harvest Dungeness crab. Two major fishing areas for the Quinault are the Humptulips and Chehalis rivers. Species of concern in the harbor also include numerous forage species. The Quinault conduct drift-net fishing in the waters off of the Aberdeen Log Yard Alternative site and harvest Dungeness crab off of the shores of the Anderson & Middleton site. Tribal fishers are active much of the year because various fishery resources have different harvest seasons spread throughout the year.

Although the Quinault Indian Nation is the only tribe with federally adjudicated rights within the study area, the Confederated Tribes of the Chehalis Reservation and other tribes also have gathering interests in upland areas, most notably the Grays Harbor National Wildlife Refuge in Hoquiam. These interests include habitat areas that might affect salmon migration and salmonid populations on or near the Chehalis River and the collection of sweetgrass (*Schoenoplectus pungens*), or basketgrass, a native estuarine bulrush, which is a member of the sedge family (*Cyperaceae*) and has traditionally been collected and used for basket-weaving. The Cultural Resource Discipline Report (WSDOT 2010c) presents more information on sweetgrass as a cultural resource of interest.

Tribal Coordination

WSDOT is coordinating with interested tribes on natural and cultural resources issues because the Pontoon Construction Project could potentially affect access to affirmed tribal treaty fishing areas, gathering areas, cultural resources, and other issues of concern to tribes. WSDOT began coordinating with tribes potentially affected by the project in early 2006, before the project was formally initiated under NEPA in late 2007. The following tribes expressed interest in the project:

- Confederated Tribes of the Chehalis Reservation
- Hoh Tribe
- Quileute Nation
- Quinault Indian Nation
- Shoalwater Bay Tribe
- Skokomish Tribal Nation

WSDOT has and will continue to coordinate with these tribes throughout the process to ensure that their interests and concerns are considered. Chapter 1 of the Draft EIS discusses the tribal coordination process in greater depth (Cultural Resources Discipline Report, WSDOT 2010c).

3.2 Affected Environment

How did WSDOT collect the information on fish and aquatic resources?

Project analysts collected information on fish species and their distribution and habitat within the study area by reading available literature, such as peer-reviewed articles in scientific journals, technical reports, and data from various state, county, and city agencies. They also visually inspected aquatic habitat conditions within and adjacent to the proposed alternatives.

> What is a salmonid?
>
> A salmonid is a fish of the family Salmonidae, such as salmon, trout, and char.

Biologists conducted habitat surveys of the build alternative sites on May 7 and November 11, 20, and 21, 2008. The primary channelized surface water features and habitats on the sites were visually examined for riparian vegetation, bank stability, bottom material composition, presence of culverts, and in-stream habitat morphology and habitat complexity. Fish use was determined by visual observation and from existing data sources.

Biologists were onsite during low tide and examined and characterized freshwater as well as marine and estuarine nearshore (shallow water) habitats during site visits. The biologists noted habitat features, riparian vegetation, bank stability, bottom sediment composition, aquatic algae, and macrophytes (multicelled aquatic plants) along the Grays Harbor shoreline and channels on the perimeter of the site. Fish usage was determined from existing data provided by local resource agency representatives.

What are the general habitat characteristics of Grays Harbor and associated streams and why are these characteristics important to fish?

Both build alternatives are located in the lower Chehalis River and Grays Harbor basin in Water Resource Inventory Area (WRIA) 22, which includes the Grays Harbor estuary, the lower main stem Chehalis River, streams that drain into the Chehalis River, independent streams that drain into Grays Harbor, and other independent subbasins. Anadromous salmonid production also occurs in WRIA 23 (the upper Chehalis River Basin), and these fish migrate through Grays Harbor during their life cycles.

> What is a water resource inventory area?
>
> Washington state is divided into 62 Water Resource Inventory Areas (WRIAs) for water and aquatic-resource management issues. A WRIA can include more than one watershed. However, the terms "WRIA" and "watershed" are frequently used interchangeably.

Grays Harbor is located on the outer coast of Washington at the mouth of the Chehalis River system, which is responsible for 80 percent of the total flow into Grays Harbor (Miller and Simenstad 1997). Grays Harbor comprises both estuarine and open water (i.e., ocean) habitats (Levinton 1982), is about

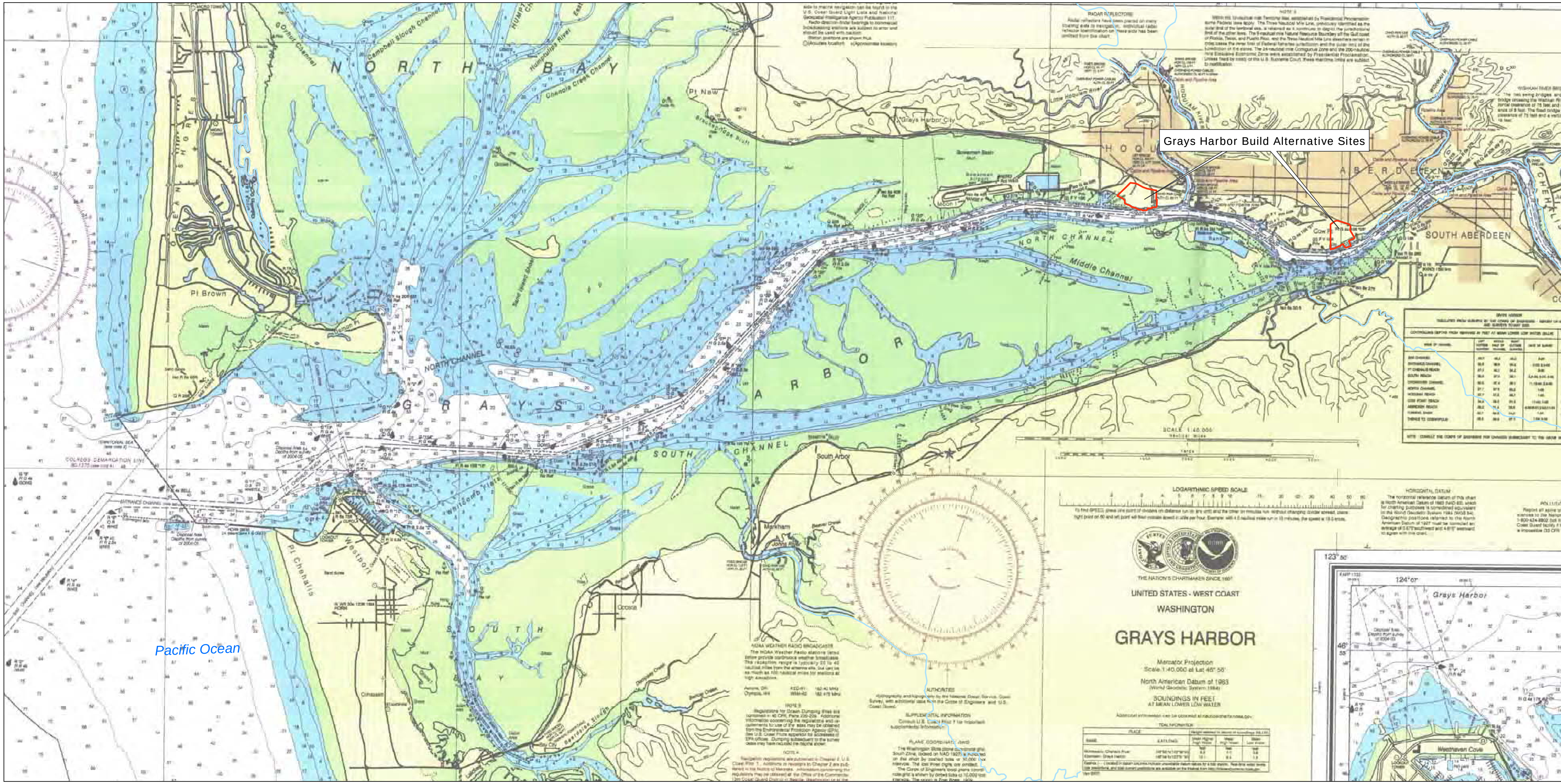
12 miles wide at the widest point, and at high tide, covers about 94 square miles (Exhibit 3-1). The mouth of Grays Harbor is constricted by two sand spits—Point Brown to the north and Point Chehalis to the south—both of which were formed by coastal processes in recent geologic time. A 2-mile-wide channel connects Grays Harbor to the Pacific Ocean. Grays Harbor contains many intertidal (i.e., area of the shore between the highest and lowest tides) mudflats, which are dissected by several navigation channels. Forty-two percent of Grays Harbor is intertidal, consisting primarily of intertidal mudflats and sandflats.

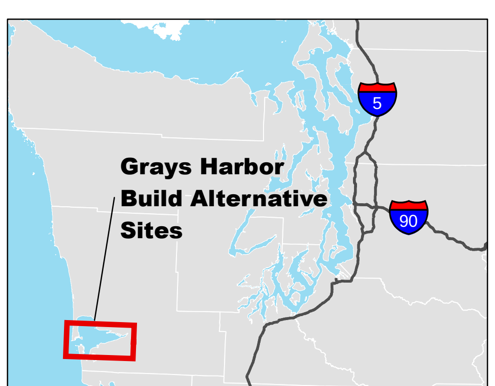
Two major river basins drain into Grays Harbor, which is one of the largest estuarine environments in the western United States. The Chehalis River basin drains 2,200 square miles into the inner harbor, and the Humptulips River basin drains 245 square miles into the north bay of outer Grays Harbor. Several smaller drainages also empty into Grays Harbor, including the Hoquiam, Elk, and Johns rivers and the Newskah and Charlie creeks (Seiler 1989; USACE 1998).

The north bay of Grays Harbor is relatively undeveloped, while the inner harbor, where both build alternatives are located, is heavily industrialized. The habitats of the lower Chehalis River and Grays Harbor have been altered by previous dredging, diking, filling, jetty construction, industrial discharges, and other human activities over the past 100 years. These activities have resulted in the loss of wetland and other intertidal habitats, as well as the conversion of shallow water habitats to deeper water. The inner harbor, which supports the cities of Aberdeen and Hoquiam, is heavily populated and industrialized with pulp mills, landfills, sewage treatment plants, and log storage facilities.

The tides at Grays Harbor are semidiurnal (i.e., twice a day) and have a mean range of about 8 feet and a maximum range of 15 feet (Barrick 1976; Loehr and Collias 1981). Extreme tides in the spring cause expansive mudflats to be exposed in Grays Harbor, with an extensive labyrinth of channels forming at ebb tide (Exhibit 3-1). The predominant physical feature of Grays Harbor is the expansive mudflats, which cover 63 percent of the harbor's surface area at low tide. The surface water area of Grays Harbor ranges from approximately 38 square miles at mean low water to 94 square miles at mean high water (USACE 1998).

Between 1883 and 1956, the tidal flat area decreased by an estimated 22 percent (8,600 acres), and the area below the extreme low-water level increased; as a result, the potential native eelgrass habitat more than doubled (Borde et al. 2003). Native eelgrass provides spawning habitat for numerous forage fish and is a critical nursery area for juvenile salmon seeking protection from larger predator fish (Slocomb et al. 2004).





Shallow waterway

Mudflat

Build Alternative Site

Note: This Exhibit is included to show the locations of the navigable waterways in the vicinity of the proposed project. Because this exhibit was taken directly from the source cited below, it includes some navigational information that is not related to the discussion in this discipline report.

N

0 0.5 1 2 Miles

Source: NOAA (2007) Nautical Chart 18502 Grays Harbor WA. Horizontal datum for all layers is State Plane Washington South NAD 27; vertical datum for layers is NAVD88.

Exhibit 3-1. **Grays Harbor Channels and Mudflats**

Pontoon Construction Project

Washington State Department of Transportation

Both native and Japanese (dwarf) eelgrasses provide much of the primary production of organic carbon (the source of energy for many organisms), and they contribute to the productivity of the nearshore by stabilizing sediment, reducing sediment resuspension, buffering wave energy and tidal currents, and retaining nutrients and organic matter (Short and Wyllie-Echeverria 1996). Eelgrass is threatened by human activities that increase water turbidity (such as agriculture or road building), block light (dock construction), or disturb the bottom (anchoring or dredging).

The literature indicates that there is preferential use of native eelgrass over nonnative eelgrass. Specifically, Semmens (2008) tracked juvenile Chinook salmon smolts within an estuary and found that smolts had a strong preference for remaining in native eelgrass (*Zostera marina*) but showed no such preference for other structured benthic habitats, such as nonnative eelgrass (*Zostera japonica*), oyster (*Crassostrea gigas*) beds, and nonnative smooth cordgrass (*Spartina alterniflora*).

Merrill (1995) looked at the effect of *Z. japonica* on the growth of *Z. marina* in their shared transitional boundary. *Z. japonica* inhibited the leaf growth and shoot recruitment of *Z. marina* in August, suggesting competitive interaction between the species. Posey (1988) found that the presence of *Z. japonica* changed the physical habitat and, in turn, altered the fauna richness and densities. Furthermore, field measurements indicate that this abundant invasive species could alter ecosystem-level processes, such as decomposition and nutrient cycling (Hahn 2001).

With the exception of the river channels and areas at the mouth of Grays Harbor, eelgrass beds extend over much of the harbor. Ecology documented that the eelgrass beds closest to the Anderson & Middleton Alternative site are roughly 0.25 mile to the south (Ecology 2008). In addition, a recent survey of the Port of Grays Harbor Industrial Development District #1 (IDD #1) property east of the Anderson & Middleton site found six small patches of native eelgrass along the eastern edge of the open bay area, downstream of the outlet to Channel A, which establishes the eastern boundary of the Anderson & Middleton site (WSDOT 2006). Long-term trends in the extent of eelgrass beds have not been monitored, and the areal extent and density of eelgrass beds in Grays Harbor might change yearly as old beds are uprooted and new ones established. In Grays Harbor, eelgrass is generally limited to -3 feet at low tide because of high turbidity (Ecology 2008).

The Chehalis River and several of its subbasins have high sediment loads and discharge suspended sediments at a high annual rate compared with other watersheds in western Washington and Oregon (Kehoe 1982). The inner harbor's channel bottom consists of sediments from the Chehalis

River, while there are ocean-derived sands in the outer harbor. A mixed transition zone occupies a broad band in the central portion of the harbor. Wind-generated waves are common and have a pronounced effect on the suspension and movement of shallow water sediments (USACE 2006). USACE dredges annually to maintain the 24-mile-long Grays Harbor Federal Navigation Channel. Maintenance of the navigation channel, which covers about 1,300 acres, involves dredging selected areas that have developed shoals, as well as maintaining turning basins. The navigation channel, which is located immediately to the south of both the Anderson & Middleton Alternative and the Aberdeen Log Yard Alternative, runs east and west perpendicular to the mouth of the Hoquiam River (Exhibit 3-1).

Grays Harbor is a well-mixed estuary during low-river flows from July through September and a stratified estuary during high-river flows from November through March (Duxbury 1987; Josselyn, Zedler, and Griswold 1990). Mean surface water salinity ranges from 0 to 10 percent near Aberdeen to 20 to 30 percent at the mouth of the harbor. The remaining 4 months might contain at least two periods of intermediate salinity due to spring high-flow events or increased rainfall from April to June. The shallow water column provides more marine influence throughout the estuary due to tidal cycles (Duxbury 1987; Josselyn, Zedler, and Griswold 1990). In the inner estuary, minimum and maximum water temperatures are about 41 degrees Fahrenheit (°F) in January and 64°F in August, respectively.

All anadromous salmonid species use estuarine and nearshore environments at some time during their life cycle because estuaries provide an ideal area for rapid growth. Some salmon species, particularly Chinook and chum salmon, depend heavily on estuaries. Within Grays Harbor, shorelines include low-gradient beaches, tidal flats, and eelgrass beds. These resources provide feeding and transitional habitat important for juvenile salmonids when they leave the rivers to enter saltwater, as well as for adult salmonids when they return to the rivers to spawn.

Estuaries provide food sources that support the rapid growth of salmon smolts (i.e., young salmon when they first leave freshwater and descend to the saltwater). More important, natural habitat features such as eelgrass beds, mudflats, and salt marshes are essential to the estuarine food web (WSCC 2001). Common disruptions to these habitats include dikes, bulkheads, dredging and filling activities, pollution, and alteration of habitat characteristics, such as lack of woody debris and sediment transport.

Within estuaries, zooplankton (i.e., tiny aquatic animals eaten by fish) are important prey for estuarine and nearshore fish, especially juvenile salmonids (Simenstad et al. 1982). The Grays Harbor estuary is an important Dungeness crab *(Cancer magister)* nursery for regional population production and fisheries. Approximately 33 percent of the entire estuary is subtidal habitat, but the amount of subtidal habitat and percentage of strata vary greatly among the lower side channels (4,222 acres or 49 percent), lower main channels (2,775 acres, or 32 percent), and upper estuary (1,548 acres, or 18 percent). Grays Harbor Dungeness crab density was determined to be 1,830 crabs per hectare in the lower side channels, 500 crabs per hectare in the lower main channels, and 275 crabs per hectare in the upper estuary (Armstrong et al. 2003). Within Grays Harbor, crustaceans such as amphipods and copepods are particularly important food for juvenile salmon during their early life in the ocean (Healey 1982; Cordell and Simenstad 1981). Simenstad and Eggers (1981) suggested that open water zooplankton levels limit the population of juvenile salmonids in Grays Harbor. Epibenthic zooplankton that reside just above the substrate in shallow water along the shorelines provide an important food source for juvenile fall Chinook and chum salmon when they first enter estuaries (Healey 1980; Argue et al. 1985; Brennen et al. 2004).

Large woody debris (LWD) in the estuary provides several functions important to the biological food chain support; it collects the fine sediment where macroinvertebrates can grow. Macroinvertebrates, in turn, are an important food source for juvenile salmon. During outmigration, juvenile salmon seek cover in and around the LWD that lines the shorelines. LWD was common before logging and increased settlement of the area, but it is now at very low levels (WSCC 2001).

Thom (1984) investigated the distribution of macroalgae in the channel bed along intertidal areas of Grays Harbor, including two sites within 2 miles of the proposed build alternatives. The study found yellow-green algae, green algae, and red algae within the two study sites, including unattached drift algae and algae attached to boulders, logs, and tree roots. Diatoms (i.e., microscopic, one-celled algae) were also widespread and grew on a variety of surfaces.

Previous studies have indicated that sediment size is a primary influence on the benthic (i.e., sea-bottom) community (Boesch 1973; Mannino and Montagna 1997). This relationship can be complicated by other physical gradients such as salinity, spatial distribution, pore water (i.e., water that fills spaces between sediment particles), and tidal elevation (Braziero 2001). Shoreline modifications, especially bulkhead and riprap armoring, produce many physical alterations such as removing backslope vegetation and large wood, introducing new material that differs from the natural bottom material, and replacing beach substrate with hard and/or vertical surfaces. Consequently, these structures could eliminate or substantially change the natural intertidal zone (Canning and Shipman 1995; MacDonald et al. 1994).

What fish species exist in the study area?

Based on sampling conducted in Grays Harbor, more than 50 fish species inhabit the harbor, including resident and anadromous species (Exhibit 3-2). Most of these species are likely to exist at least occasionally in the study area. Six species of salmonids spawn in WRIAs 22 and 23 and are present within Grays Harbor on a seasonal basis, including Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), and coho (*O. kisutch*) salmon; steelhead (*O. mykiss*); coastal cutthroat trout (*O. clarki clarki*); and native char (*Salvelinus* spp.). Salmonids within WRIAs 22 and 23 are a mix of native and introduced stocks (WDFW 2003). Within these watersheds, there are nine stocks of Chinook salmon, seven stocks of coho salmon, two stocks of chum salmon, and ten stocks of steelhead, with the stocks in varying states of health (Exhibit 3-3) (WDFW 2003). Five species are listed by federal regulatory agencies with jurisdiction under the Endangered Species Act (coastal cutthroat trout, bull trout, green Sturgeon, Pacific lamprey, and river lamprey) and eulachon were proposed for listing in March 2009. Some of the individual species of fish found in Grays Harbor are described in the following subsections.

Chinook Salmon

Timing of entry into estuaries varies considerably for juvenile Chinook salmon (Healey 1991). Chinook salmon have multiple life history patterns, and juvenile Chinook salmon might rear in freshwater for as little as a few days or up to 3 years (Wydoski and Whitney 2003). Most Chinook salmon in WRIAs 22 and 23 are fall Chinook that migrate to saltwater during their first year (Healey 1991; Myers et al. 1998). These Chinook are called "ocean type" due to their short freshwater residence and because they make extensive use of the nearshore marine environment for rearing. Ocean-type Chinook salmon generally migrate downstream in the spring, just months after emerging from the gravel, or during the summer and autumn after a brief period of rearing in freshwater (Healey 1991; Myers et al. 1998).

In Grays Harbor, Brix (1981) found peak catches of Chinook fry (recently hatched or juvenile fish) during mid-June but continued to capture Chinook less than a year old near the mouth of the Hoquiam River from early March through September. Juvenile Chinook can stay in Grays Harbor for up to 29 weeks (Simenstad et al. 1982).

EXHIBIT 3-2
Common and Scientific Names of Fish Species Documented in Grays Harbor

Common Name	Scientific Name	Federal and State Status [a]
Steelhead	*Oncorhynchus mykiss*	None
Coastal cutthroat trout	*O. clarki clarki*	FCo
Chinook salmon	*O. tshawytscha*	None
Coho salmon	*O. kisutch*	None
Chum salmon	*O. keta*	None
Bull trout	*Salvelinus confluentus*	FT, SC
Green sturgeon	*Acipenser medirostris*	FT, SM (Southern DPS) FCo, SM (Northern DPS)
White sturgeon	*Acipenser transmontanus*	None
Saddleback gunnel	*Pholis ornata*	None
Snake prickleback	*Lumpenus sagitta*	None
Rock greenling	*Hexagrammos decagrammus*	None
Kelp greenling	*H. lagocephalus*	None
Lingcod	*Ophiodon elongatus*	None
Pacific herring	*Clupea pallasii*	None
Northern anchovy	*Engraulis mordax*	None
American shad	*Alosa sapidissima*	None
Pacific sand lance	*Ammodytes hexapterus*	None
Pacific sandfish	*Trichodon trichodon*	None
Pacific tomcod	*Microgadus proximus*	None
White seaperch	*Phanerodon furcatus*	None
Shiner perch	*Cymatogaster aggregata*	None
Redtail surfperch	*Amphistichus rhodoterus*	None
Striped seaperch	*Embiotoca lateralis*	None
Pile perch	*Rhacochilus vacca*	None
Silver surfperch	*Hyperprosopon ellipticum*	None
Bay pipefish	*Syngnathus leptorhynchus*	None
Black rockfish	*Sebastes melanops*	None
Pacific staghorn sculpin	*Leptocottus armatus*	None
Buffalo sculpin	*Enophrys bison*	None
Prickly sculpin	*Cottus asper*	None

EXHIBIT 3-2
Common and Scientific Names of Fish Species Documented in Grays Harbor

Common Name	Scientific Name	Federal and State Status [a]
Cabezon	*Scorpaenichthys marmoratus*	None
Surf smelt	*Hypomesus pretiosus*	None
Longfin smelt	*Spirinchus thaleichthys*	None
Eulachon	*Thaleichthys pacificus*	SC, Proposed for FT in Federal Register Vol. 74, No. 48, 3-13-2009
Speckled sanddab	*Citharichthys stigmaeus*	None
Sand sole	*Psettichthys melanostictus*	None
Rock sole	*Lepidopsetta bilineata*	None
English sole	*Parophrys vetulus*	None
Starry flounder	*Platichthys stellatus*	None
Arrow goby	*Clevelandia ios*	None
Pacific lamprey	*Lampetra tridentata*	FCo, SM
River lamprey	*L. ayresii*	FCo, SC
Threespine stickleback	*Gasterosteus aculeatus*	None

[a] FCo = federal species of concern, FT = federally threatened, SC = state candidate species, SM = state monitor species, DPS = distinct population segment

Sources: Deschamps et al. (1971); Brix et al. (1974); Brix (1981); Simenstad and Eggers (1981); Simenstad et al. (2001); Jeanes et al. (2003); Jeanes et al. (2005)

EXHIBIT 3-3
Salmon Stocks that Use Grays Harbor

Species	Stock Name	2002 Stock Status
Chinook	Humptulips fall Chinook	Depressed
	Hoquiam fall Chinook	Depressed
	Chehalis spring Chinook	Healthy
	Chehalis fall Chinook	Healthy
	Wishkah fall Chinook	Healthy
	Wynoochee fall Chinook	Depressed
	Satsop summer Chinook	Depressed
	Satsop fall Chinook	Healthy
	South Bay fall Chinook	Unknown
Chum	Humptulips fall chum	Healthy
	Chehalis fall chum	Healthy
Coho	Humptulips coho	Healthy

EXHIBIT 3-3
Salmon Stocks that Use Grays Harbor

Species	Stock Name	2002 Stock Status
	Hoquiam coho	Healthy
	Wishkah coho	Depressed
	Wynoochee coho	Healthy
	Satsop coho	Healthy
	Chehalis coho	Healthy
	South Bay coho	Healthy
Steelhead	Humptulips summer steelhead	Unknown
	Humptulips winter steelhead	Depressed
	Hoquiam winter steelhead	Depressed
	Chehalis summer steelhead	Unknown
	Chehalis winter steelhead	Healthy
	Wishkah winter steelhead	Healthy
	Wynoochee winter steelhead	Healthy
	Satsop winter steelhead	Depressed
	South Bay winter steelhead	Unknown
	Skookumchuck/Newaukum winter steelhead	Healthy

Source: WDFW (2003).

A smaller percentage of juvenile Chinook salmon enter saltwater as yearlings (called stream-type). Peak migration of yearling stream-type Chinook salmon occurs in late April through early June (Simenstad et al. 1982; Healey 1991). Stream-type Chinook are generally found in deeper saltwater habitats (Healey 1991).

After rearing in the estuary, Chinook salmon typically spend 3 to 4 years in the ocean before returning to spawn. Peak river entry timing for adult spring Chinook salmon returning to spawn in WRIAs 22 and 23 is not well known but is believed to be in January and February. Fall Chinook begin to enter Grays Harbor in early September, with peak entry in October (WDFW 2003).

Chum Salmon

Chum salmon fry emerge from their redds in March and April and quickly outmigrate to the estuary for rearing. Juvenile chum salmon have been captured in upper Grays Harbor near the mouth of the Hoquiam River from early February through mid-June (Deschamps et al. 1971). Juvenile chum

What is a redd?

A “redd” is a spawning nest built by salmonids. The female salmonid uses her tail to dig small depressions in the gravelly beds of streams or lakeshores, where she deposits her eggs.

salmon stay in the estuaries from 5 to 23 weeks (Simenstad et al. 1982). In the estuary, juvenile chum follow prey availability. Smaller chum fry often reside in schools in shallow sublittoral areas (e.g., salt marshes and shallow bays containing eelgrass). Later, as the juvenile chum grow larger than 2 inches, they move offshore to the deeper habitats of Grays Harbor (Healey 1982; Simenstad et al. 1982; Salo 1991).

In Washington, adult chum salmon (i.e., 3 to 5 years old) have three major run types: summer chum adults enter the rivers in August and September and spawn in September and October; fall chum adults enter the rivers in late October through November and spawn in November and December; and winter chum adults enter the rivers from December through January and spawn from January through February. Adult chum typically begin returning from the ocean to Grays Harbor in early October, with peak entry in early November (WDFW 2003).

Coho Salmon

Coho salmon juveniles migrate to saltwater during April and June, after spending 1 year in freshwater habitats (Sandercock 1991; Wydoski and Whitney 2003). One study captured yearling coho in upper Grays Harbor from April through June, peaking in early May (Brix 1981). Coho generally spend less time in shallow water estuarine areas and enter slightly deeper saltwater habitats almost immediately upon entry to the estuary, preferring exposed cobble or gravel beaches (Healey 1982; Simenstad et al. 1982; Sandercock 1991). Coho salmon typically spend about 18 months in saltwater before returning to freshwater to spawn (Sandercock 1991; Wydoski and Whitney 2003). Adult coho return to Grays Harbor from mid- to late September through mid-December (WDFW 2003).

Steelhead and Rainbow Trout

Steelhead, the anadromous form of rainbow trout, spend the first year or several years of their life in freshwater before migrating to saltwater. Steelhead typically return to freshwater to spawn within 2 to 4 years (Busby et al. 1996). Unlike the other Pacific salmon species, steelhead do not die after spawning and can spawn in successive years. Steelhead are divided into two groups: summer (stream-maturing) steelhead enter freshwater in an immature state during late spring and summer months; winter steelhead (ocean-maturing) enter freshwater with well-developed sexual organs in late fall and winter months (Busby et al. 1996). Peak spawning usually occurs in February and March (Busby et al. 1996). Two wild summer and eight wild winter steelhead stocks have been identified in the Grays Harbor watershed (Washington Department of Fisheries et al. 1993).

White Sturgeon

The white sturgeon (*Acipenser transmontanus*) is the largest North American sturgeon. This species is found along the west coast of North America, distributed from Alaska to northcentral California, including Grays Harbor (Scott and Crossman 1973). The white sturgeon is a slow-growing, late-maturing anadromous fish, with reported estimated ages of up to 100 years (CDFG 1992 in EPIC 2001).

The white sturgeon lives on the bottom of slow-moving rivers, bays and estuarine areas, including the brackish water at the mouths of large rivers; older juveniles and adults are commonly found in rivers, estuaries, and marine environments. White sturgeon reside in many of the bays where green sturgeon are found, but they are primarily an estuarine species. Small white sturgeon feed primarily on algae, mysid shrimp, and amphipods, while larger sturgeon feed on a variety of organisms, including crustaceans, annelid worms, mollusks, and fish, including salmonids.

White sturgeon spawn in large rivers, including the Chehalis River, in the spring and summer and remain in freshwater while young. Female white sturgeon are thought to spawn as infrequently as every 5 years, with males spawning more frequently (CDFG 1992 in EPIC 2001). Spawning usually takes place in swift current with a rocky bottom near rapids. Adults apparently broadcast spawn in the water column, and the fertilized eggs sink and attach to the bottom to hatch. Seasonal floods and corresponding changes in temperature, velocity, and turbidity are presumed to provide spawning cues for white sturgeon (Kohlhorst et al. 1991).

Generally, green sturgeon are more abundant than white sturgeon in Willapa Bay (Emmett et al. 1991). The 2008 Grays Harbor non-Indian fall fishery harvested 455 white sturgeon, while the Quinault tribal commercial fishery harvested 44, and the noncommercial fishery harvested 2.

Forage Fish

Critical food (i.e., forage) fish for salmonids occupy areas within Grays Harbor. Simenstad and Eggers (1981) found that seven species of forage fish occur in Grays Harbor: Pacific herring (*Clupea harengus pallasi*), Pacific sand lance (*Ammodytes hexapterus*), northern anchovy (*Engraulis mordax*), surf smelt (*Hypomesus pretiosus*), longfin smelt (*Spirinchus thaleichthys*), whitebait smelt (*Allosmerus elongatus*), and American shad (*Alosa sapidissima*). Northern anchovy were the most commonly distributed species and were represented in all life history stages. Surf smelt were the most common species in the lower estuary, while longfin smelt were restricted to the upper reaches of the estuary. Juvenile Pacific herring were also abundant. Simenstad and Eggers (1981) found forage fish in Grays Harbor to be highly transitory and typically related to influxes of fish into the estuary from offshore sources. The residence time of forage fish appeared to depend on physical processes (e.g., the interaction of ocean currents with the harbor).

Spawning beds for two forage fish species, Pacific herring and Pacific sand lance, have been identified within Grays Harbor, although these species do not spawn within the project vicinity (WSCC 2001; WDFW 2008). WDFW (2008) data indicate that the closest Pacific herring spawning occurs at locations within the south bay of outer Grays Harbor and at the southeast end of Ocean Shores, over 10 miles away from both build alternatives. Larval northern anchovy are found in deeper waters of Grays Harbor and serve as food for Chinook and chum salmon (Simenstad and Eggers 1981). The closest documented sand lance spawning is about 5 miles from the Anderson & Middleton site, while the closest herring spawning is 9.8 miles, and the closest surf smelt spawning is about 12.2 miles (WDFW 2008).

Do any federally listed fish species or federal fish species of concern occur in the study area?

Grays Harbor supports many life stages of bull trout and green sturgeon, which are both listed as threatened under the Endangered Species Act (Exhibit 3-2). Bull trout in Grays Harbor are a part of the Coastal-Puget Sound distinct population segment (DPS) of bull trout listed as threatened under the Endangered Species Act (USFWS 1999).

> What is the Endangered Species Act?
>
> The Endangered Species Act, passed by Congress in 1973, governs how animal and plant species whose populations are dangerously in decline or close to extinction will be protected and recovered.

Coastal Cutthroat Trout

Juvenile coastal cutthroat trout spend an extended time rearing in freshwater before migrating as smolts (Leider 1997). Like steelhead, cutthroat trout can spawn several times during their lifetime. In many cases, resident (nonmigratory), fluvial (freshwater migrants), and anadromous (marine migrants) life history patterns are all present. Although the age at first outmigration to marine waters varies, cutthroat trout in the Chehalis River probably emigrate to the estuary between ages 3 and 5 (Johnston 1982). Most coastal cutthroat return to freshwater the same year they migrate to the ocean, but they might also spawn that year. Based on multiple surveys, the coastal cutthroat trout are believed to be abundant and widespread in the Chehalis River and Grays Harbor (WDFW 2000). Coastal cutthroat trout return to their native streams to spawn from late fall through late winter months, with peak spawning occurring in February (Johnson et al. 1999).

Bull Trout and Dolly Varden

Currently, both bull trout and Dolly Varden are collectively classified as "native char" because they are virtually indistinguishable in the field; likewise, WDFW has combined information on their status and distribution into a common inventory (WDFW 2004). Bull trout and Dolly Varden exhibit numerous life history strategies, including amphidromy (i.e., regular migration between freshwater and seawater at different development stages). This amphidromy is optional (i.e., the survival of individuals does not depend on whether they can migrate to sea), in contrast to obligate anadromous species like pink salmon (*Oncorynchus gorbuscha*) and chum salmon (Pauley 1991). In contrast, resident forms of bull trout spend their entire lives in small streams, while migratory forms live in tributary streams for several years before migrating to larger rivers or lakes. Bull trout life histories are variable and changeable between generations, and juveniles might develop a life history strategy that differs from their parents.

Although WDFW lists a bull trout and Dolly Varden stock in the Chehalis River drainage (WDFW 2004), there is little evidence supporting its presence. A thorough review of the juvenile salmonid literature from the lower Chehalis River and Grays Harbor by Jeanes et al (2003) documented 15 native char captures between 1966 and 2000. The most recent sample, conducted in 2001, resulted in capturing eight native char (beach seines conducted in the Chehalis River estuary during 2001). Although past capture data could reflect a relatively low number of native char in the area, this data might also reflect the difficulty encountered in studying this species in large estuarine environments (Pentec 2002).

USACE conducted native char studies in the Chehalis River and Grays Harbor beginning in 2003. Their fish tracking data indicated that native char reside in this reach of the Chehalis River from mid-February through mid-July when they appear to begin their migration to natal streams, presumably located outside of the Grays Harbor watershed. These fish likely originated from spawning populations of native char in the Quinault or Queets rivers, both located more than 60 miles north of subsequent capture locations in lower Chehalis River and Grays Harbor (Jeanes et al. 2003).

Nonetheless, the marine shoreline of Grays Harbor and the lower main stem Chehalis River have been designated as bull trout critical habitat (USFWS 2005) because they support bull trout prey species (marine forage fish) and represent essential migratory corridors for amphidromous bull trout. The bull trout move from their natal river basin to other rivers and streams as they seek suitable foraging or overwintering habitat.

Green Sturgeon

Green sturgeon likely live as long as 50 to 60 years, they have a complex anadromous life history, and they spend more time in the ocean than any other sturgeon. Most green sturgeon are thought to spawn in the Klamath River, but spawning also occurs in the Sacramento and Rogue Rivers. The first spawning for this species occurs at 15 years for males and 17 years for females. Female green sturgeon are thought to spawn only every 5 years. Adults migrate into rivers to spawn from April to July with a May to June peak. After green sturgeon enter the ocean, they appear to migrate north (Adams et al. 2002).

Green sturgeon concentrate in coastal estuaries, particularly the Columbia River estuary and coastal Washington estuaries, including Grays Harbor, during the late summer and early fall (Moyle et al. 1992). Evidence suggests that green sturgeon enter Washington estuaries during summer when water temperatures are more than 5.6°F warmer than adjacent coastal waters (Moser and Lindley 2007a, 2007b). Grays Harbor provides important habitat during the summer for both the northern and southern DPS of green sturgeon. Grays Harbor has been identified as an important area for summer rearing, feeding, aggregations, and holding of multiple year classes (subadults and adults) of the southern DPS (NMFS 2008). Grays Harbor is the northernmost estuary with large concentrations of green sturgeon. The population peaks in August, when tribal and commercial fisheries land around 500 fish per year. In Grays Harbor commercial and sport fisheries, green sturgeon harvest is by-catch (i.e., fish and other animals caught in fishing gear meant for other species) (Adams et al. 2002). Grays Harbor supports this species by providing food resources, water flow, water quality, depth, and migratory corridors that support feeding, migration, aggregation, and holding by green sturgeon adults and subadults (50 CFR Part 226 52084-52110). Adult and subadult green sturgeon in Grays Harbor feed on crangonid shrimp, burrowing thalassinidean shrimp (primarily the burrowing ghost shrimp *Neotrypaea californiensis*), amphipods, clams, juvenile Dungeness crab (*Cancer magister*), anchovies, sand lances (*Ammodytes hexapterus*), lingcod (*Ophiodon elongatus*), and other unidentified fish species (Dumbauld et al. 2008; NMFS 2008).

A large proportion of green sturgeon caught in Grays Harbor might be southern DPS fish; this inference is based on hydroacoustic tracking information (Lindley et al. 2008) and a genetic study indicating that approximately 50 percent of green sturgeon sampled in Grays Harbor belong to the southern DPS.

Eulachon

In March 2009, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries) proposed to list eulachon (*Thaleichthys pacificus*) under the Endangered Species Act. Eulachon, also known as Columbia River smelt, candlefish, or hooligan, range from northern California to southwest Alaska and into the southeastern Bering Sea. Smelt typically spend 3 to 5 years in saltwater before returning to freshwater to spawn in late winter through midspring. If NOAA Fisheries Service decides that listing this species is warranted, then it could become final before or during pontoon construction. The most recent data regarding the proposed listing will be available in the Draft EIS.

Do any state-listed or other state priority fish species occur in the study area?

Priority fish species include all state endangered, threatened, sensitive, and candidate species, as well as species of recreational, commercial, or tribal importance that are considered vulnerable. All fish species with state candidate and state monitor status that exist in the study area also hold a federal designation and have been discussed earlier in this section. No state sensitive, threatened, or endangered fish species exist within the study area of the build alternative sites. Other fish species that are designated as priority species (WDFW 2008) might exist within the study area; these species are chum, sockeye, and kokanee salmon; steelhead and /or rainbow trout; and coastal cutthroat trout. With the exception of those habitats and species discussed previously, no other known saltwater habitats of special concern (e.g., rockfish [*Sebastes* spp.] or lingcod [*Ophiodon elongatus*] settlement and nursery areas) would be affected by casting basin or launch channel construction.

> What are priority species and priority habitat?
>
> The Washington Department of Fish and Wildlife defines priority species as those species that are priorities for conservation and management. Priority species include state endangered, threatened, sensitive, and candidate

What is the aquatic habitat and fish use in the study area?

Both build alternative sites have shorelines that are likely used by juvenile salmon during their rearing migration through Grays Harbor; however, neither site has physical characteristics that indicate it provides preferred habitat for young salmon. The steep, hardened shorelines might be used by young salmon but are less likely to be used than the gently sloped, fine-grained substrate shorelines of much of Grays Harbor. No forage fish spawning habitat occurs at either site.

How did WSDOT collect the information on freshwater and estuarine shoreline habitats?

Anderson & Middleton Alternative

Project biologists conducted habitat surveys in the study area on November 11, 2008, during low tide and examined and characterized freshwater and estuarine intertidal (i.e., shallow water) habitats. They noted habitat features, riparian vegetation, bank stability, bottom sediment composition, and macrophytes along the channelized surface water features on the site, as well as along the Grays Harbor shoreline and channels on the perimeter of the site. Fish usage was determined from existing data provided by local resource agency representatives or by visual observation. In addition, mudflat surveys were conducted at both sites during 2009 summer low tides. Detailed information on sampling results is provided in the Mudflat Technical Memorandum (WSDOT 2009e).

Aberdeen Log Yard Alternative

Biologists conducted a habitat survey of the Aberdeen Log Yard site on October 1, 2008, during low tide. They examined and characterized freshwater and marine and estuarine nearshore (i.e., shallow water) habitats. They noted habitat features, riparian vegetation, bank stability, bottom sediment composition, aquatic algae, and macrophytes within channelized surface water features on the site and along the Grays Harbor shoreline and channels on the site perimeter. Fish use, including feeding and rearing opportunities, was determined from existing data provided by local resource agency representatives, as well as visual observation. The site's mudflats were surveyed during 2009 summer low tides.

What is the condition of the freshwater habitat areas at the site?

Anderson & Middleton Alternative

Approximately 92 small drainage swales throughout the site drain surface water into four larger channels, which convey onsite and offsite drainage to Grays Harbor. The facilities at the Anderson & Middleton site consist of two main paved north-south roads (about 1,000 and 1,400 feet long, respectively), with multiple connected, perpendicular log storage spur roads that range from about 150 to 250 feet long. Depressed drainage swales, many containing potential wetlands (Exhibit 2-7) located between the spur roads convey surface water into four larger channels, which drain into Grays Harbor. The primary surface water drainage features are identified in Exhibit 3-4 as Channels A through D; Channels C and D drain into the harbor through nonfunctional tide gates.

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Exhibit 3-4. **Anderson & Middleton Alternative Shoreline and Drainage Features**

Pontoon Construction Project

Washington State Department of Transportation

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There is tidal inflow through these gates, although the blockage appears significant enough to prevent fish ingress. The tide gates appear to be blocked in a closed position, with sand and debris at the outlet, although water does trickle around the opening; the shoreline is described below.

Aberdeen Log Yard Alternative

Channel A and Tributaries

A single, tidally influenced channel (Channel A) runs along the east side of East Terminal Road and western property boundary and drains water to the south into Grays Harbor (Exhibit 3-5). The channel receives flow from several sources: a roadside ditch on the west side of East Terminal Road, areas presumed to be wetlands located north of the Aberdeen Log Yard Alternative site, and runoff within the site. Channels A-1 and A-2 (Exhibit 3-5) are tributary drainages to Channel A; they are not accessible to fish and do not contain fish habitat. The channelized portion of Channel A is approximately 1,500 feet long. Channel A originates at the northwest corner of the site, immediately south of the intersection of Hood Street and East Terminal Road. A drainage swale (which was dry at the time of the October 2008 site visit) drains water from the east, along Hood Street, while dual 36-inch-diameter steel pipes convey flow under the street from an offsite wet area located to the north. The channel is part of the City of Aberdeen's stormwater system and, therefore, receives upstream discharges from additional roadway runoff.

At the north end of Channel A, the wetted area was approximately 2 feet wide, while the ordinary high water mark (OHWM) was approximately 15 to 18 feet wide. The presence of pickleweed within the OHWM indicates that saltwater extends throughout the length of the channel, although inundation might not occur except for exceptionally high tides. Biologists observed small, unidentified fish within Channel A during the site visit, which occurred at low tide in October 2008, approximately 500 feet downstream of the end of Channel A, near Channel A-1. The fish were approximately 0.8 to 1.2 inches long and did not appear to demonstrate the swimming patterns of juvenile salmonids.

Because the entire reach of Channel A is accessible to fish, particularly at high tides, salmonid use of Channel A cannot be discounted. Based on their habitat requirements and the relatively low quality of suitable habitat, substantial use of the channel by salmonids is not expected. Limited salmonid spawning habitat is present only in the lower reaches between the two access roads. Other fish species, adapted to tolerate lower levels of habitat complexity, higher water temperatures, and potentially degraded water quality conditions (e.g., three-spine stickleback), likely use the channel on a more regular basis.

Parametrix 554-1631-036/AR(06060P) 2/09

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Exhibit 3-5. **Aberdeen Log Yard Shoreline and Drainage Features**

Pontoon Construction Project

Washington State Department of Transportation

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Channel B

The second primary surface water feature at the Aberdeen Log Yard Alternative site is a ditched feature (Channel B) located along the eastern boundary of the site (Exhibit 3-5). This feature, also described in Chapter 2, Wetlands, as a stormwater retention feature, originates in the northeastern portion of the site. Channel B runs along the fence line of the wastewater treatment plant (Photo 10); it terminates at a check dam above the shoreline. An 18-inch plastic pipe, located just below the check dam, conveys the ditch drainage under a berm and off the site to the east into a box culvert. From there, it enters the wastewater treatment site before discharging into Grays Harbor.

Photo 10. View of mouth of Channel B on the Aberdeen Log Yard site, with check dam visible.

Based on review of aerial photographs, the ditch is built and was constructed within the last 10 years. During the site visit, although standing water was observed in an upstream portion of the ditch, no flow was present in the lower portions of the 10-foot-wide ditch. The ditch is densely vegetated with cattails in the upper portion, and it is sparsely vegetated with grasses and a few shrubs in the lower reach. Based on the lack of perennial flows, fish access, and vegetation, this feature does not provide fish habitat.

What is the condition of the shoreline and intertidal areas at the alternative?

Anderson & Middleton Alternative

The biologists walked the entire southern shoreline of the Anderson & Middleton site during low tide. The surveyed shoreline along Grays Harbor is approximately 2,700 linear feet and is a combination of seminatural slopes and hard bank armoring. The shoreline varies in slope and substrate composition, with portions of the shoreline consisting of almost vertical slopes of large boulders and riprap contained behind a series of piles and derelict pier structures. The remainder of the site is more gradually sloped, with substrate consisting of silt, sand, gravel, angular cobbles, and concrete rubble. Concrete rubble, metal waste, and riprap are scattered throughout the entire shoreline. The width of exposed intertidal mudflat at the time of the 2008 site visit (i.e., low tide of about 0.0 feet elevation MLLW) varied from about 0 feet near the middle of the site to about 300 feet on the western edge of the site.

Along most of the shoreline, riparian vegetation is extremely limited, consisting of sparse reed canarygrass and other scattered grass and herbaceous species. In the western portion of the site, the shoreline supports a riparian deciduous forest.

An open bay lies along the eastern boundary of the site (Exhibit 3-4), and it receives drainage from an onsite channel (described below) and is completely inundated at high tides. The length of substrate-covered shoreline widens to about 60 feet at the southwest corner of this bay. Small headlands that are 1 to 2 feet high and covered with salt-tolerant grass species are located above the rock-covered shoreline along much of the east side of the bay (Photo 11).

Photo 11. View of cobbled bay shoreline, looking north, towards the outlet of Channel A, at the Anderson & Middleton Alternative.

A relatively distinct band of the nonnative aquatic species of dwarf eelgrass (*Zostera japonica*) is distributed along the southeastern portion of the open bay (Photo 12). Scattered oysters (*Crassostrea virginica*) and mussels (*Mytilis* spp.) are evident in the upper intertidal zone, and softshell clam (*Mya arenaria*) are evident in the mudflats that characterize the lower intertidal zone west of the launch channel area. The eastern portion of the Anderson & Middleton site was surveyed by divers on September 22 and 26, 2006, in compliance with preliminary eelgrass and macroalgae habitat survey guidelines (WDFW 1999). Additional eelgrass surveys were conducted along the entire shoreline of both build alternative sites during the 2009 field season in compliance with WDFW survey guidelines cited above. No eelgrass was found along either shoreline.

Photo 12. View of dwarf eelgrass (*Zostera japonica*) patch within the open bay at the Anderson & Middleton Alternative.

The 2006 dive surveys were conducted along the eastern portion of the Anderson & Middleton site shoreline for 400 to 500 feet, as well as along the mouth of the open bay area (at the eastern edge of the Anderson & Middleton site). There are several small patches of native eelgrass on the eastern border of the open bay area. The visible band of nonnative eelgrass on the southeast corner of the bay (which occurs near the Anderson & Middleton property line to the east) covered approximately 50 percent of a portion of mudflat measuring 200 feet long and about 30 feet wide. Rockweed is the dominant macroalgae along the east side of the site, and it is scattered on both sides of the armored and mudflat margin of the intertidal zone and grows in small bunches on piles along the shoreline.

Within the open bay, waves have deposited LWD along the shoreline, including stumps and logs. Because much of the LWD is located above the high tide line, it does not offer significant habitat benefits for fish or other aquatic organisms. Abandoned piles are scattered throughout the open bay, but they are more numerous along the shoreline, with most located above the mudflats.

The central 100-foot-long shoreline segment of the site consists of concrete rubble behind a relic bulkhead, with LWD distributed on the sides and top of the bulkhead (Photo 13). To the east of this reach, the shoreline is narrow and consists of large and small cobble and angular degraded riprap, with dozens of derelict piles distributed in rows parallel to the shoreline (Photos 13 and 14). Scattered rockweed and green microalgae are distributed in this zone.

Photo 13. View looking west of the shoreline substrate and derelict pilings at the Anderson & Middleton Alternative.

Photo 14. View looking west at bulkhead and LWD along shoreline of the Anderson & Middleton Alternative.

The far western shoreline—west of the Channel B outlet—has a more natural character, with a lower gradient and a 300-foot-wide exposed mudflat. There are hundreds of derelict piles in a linear arrangement both perpendicular and parallel to the shoreline in this area. These relic piles extend up to 300 feet into Grays Harbor and shoreward to the cobbled portion of the shoreline (Photo 15), which is protected by LWD. A 300-foot-wide riparian forest of red alder (*Alnus rubra*), Himalayan blackberry (*Rubus armeniacus*), and reed canarygrass (Photo 16) grows landward of the shoreline.

Photo 15. View, looking west, at mudflat and derelict piles along the western portion of the Anderson & Middleton Alternative.

Photo 16. View, looking north, of deciduous forest riparian zone along the western portion of the Anderson & Middleton Alternative.

Aberdeen Log Yard Alternative

Biologists walked the entire southern shoreline of the Aberdeen Log Yard site during low tide. The site shoreline along Grays Harbor is approximately 1,700 linear feet with relatively natural, gradual slopes and limited hard bank armoring. The shoreline consists of silt, sand, and angular cobbles. The transition from the intertidal zone to the upland log storage area occurs along a moderately steep vegetated bank that runs east-west, except for a north-south jog of about 100 feet of shoreline that occurs near the middle of the shoreline (about 700 feet east of the western parcel boundary and 1,050 feet west of the eastern boundary) (Exhibit 3-5). West of this area, there is a sunken barge within the derelict piles. In the central portion of the shoreline, where the shoreline juts out to the south, shoreline sediment appears to be composed of wood waste (i.e., saw dust and bark). The shoreline also includes a widened embayment on the southwest corner of the site, which is located at the outlet of a channel (Channel A) that is present along the entire west side of the site (Exhibit 3-6). The entire shoreline contains scattered patches of emergent intertidal wetlands, formed on turflike mats, consisting of pickleweed, tufted hairgrass, and Lyngby sedge . Geese graze heavily in these estuarine emergent wetlands.

The width of exposed intertidal mudflat at the time of the site visit (low tide of about +1 foot elevation MLLW) varied from about 40 feet near the western boundary of the site, to about 120 feet in the middle of the site, to about 80 to 90 feet near the eastern boundary of the site. A band of cobbles, interspersed with a few boulders and small interstitial gravel substrate areas, makes up most of the upper portion of the shoreline (Photo 17); this band is approximately 30 feet wide, with the lower 5 to 15 feet covered with rockweed, a type of brown algae. Rockweed was more widely distributed along the western portion of the shoreline within the intertidal rock substrate (10 to 15 feet wide) than it was along the eastern portion (5 to 8 feet wide). Softshell clam are evident in the mudflats that characterize the lower intertidal zone.

The site is located at the head of Grays Harbor, within the mouth of the Chehalis River estuary. Observation of shoreline conditions did not indicate excessive erosion or wave action. The offshore sediments adjacent to the property are soft, fine silt and muck. At the time of the site visit, the exposed mudflat extended into a large conglomeration of wooden piles, which likely supported a large pier structure in the past.

Parametrix 554-1631-036/AR(06060P) 2/09

Exhibit 3-6. **Aberdeen Log Yard Alternative Southwest Corner Channel A Outlet**

Pontoon Construction Project

Washington State Department of Transportation

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Photo 17. View, looking east, of cobbled shoreline at the Aberdeen Log Yard site.

Hundreds of old wooden piles extend about 5 or 6 feet above the mudline, forming a rectangular grid approximately 1,250 feet long by 220 feet wide. These derelict piles extend into the cobbled portion of the shoreline. In addition, a dolphin pier is located on the west side of the pile grid, about 200 feet south of the shoreline, offshore of the southwest embayment. The lower portions of the piles were densely covered with rockweed.

Two additional rows of piles run parallel to the shoreline, from about the middle of the site to the eastern boundary of the parcel (Exhibit 3-5). There is also a 40-foot-long bulkhead and dozens of piles arranged in a T-shape near the eastern boundary area.

Large and small woody debris occur along the entirety of the site's shoreline. There is a band of woody debris about 10 to 15 feet wide immediately below the toe of the bank, which includes some very large LWD (greater than 5 feet in diameter) (Photo 18). A narrow, irregular-shaped band of scattered grass and sedges is intermixed within the band of woody debris, while invasive Himalayan blackberry predominates on the bank above the toe of the slope. Some native shrub species, including willows, are also sparsely scattered on the 20- to 30-foot-wide vegetated bank. In addition to the band of woody debris, other pieces of woody debris are scattered on the shoreline at lower elevations in the intertidal zone (Photo 19).

Photo 18. View of exposed mudflat, pilings, and LWD on the shoreline located on the eastern portion of the Aberdeen Log Yard site.

Photo 19. View of LWD in the upper intertidal zone of the Aberdeen Log Yard site.

Six large (6 feet wide at the base), triangular-shaped concrete pylons are located on the shoreline immediately east of the north-south shoreline jog. These structures appear to have been abandoned in place some time ago. On the eastern portion of the shoreline, some small patches of scattered concrete rubble are also present. In constrast to the Anderson & Middleton site, the shoreline at this site is relatively unarmored, and the woody debris scattered on the intertidal portion of the site might provide good habitat for aquatic species.

In addition to the woody debris along the intertidal zone, overhanging woody vegetation from the vegetated berm might also provide some overwater cover, although the absence of large trees or shrubs limits this riparian function.

What functions do the shoreline habitats provide?

Anderson & Middleton Alternative

Rockweed and dwarf eelgrass do not provide the full suite of aquatic habitat benefits afforded by some other types of submerged marine vegetation. For example, native eelgrass provides rearing and foraging habitat for commercially important species, such as juvenile salmon (*Oncorhynchus* spp.) and Dungeness crab. However, rockweed is a food source for grazing macroinvertebrates. The macroinvertebrates, in turn, likely provide a prey source for some salmonids and other aquatic organisms.

The middle and lower intertidal elevations of the shoreline support epibenthic and benthic invertebrates that young salmonids and other estuarine fishes consume. Although the steeper slopes and hard substrates are not as productive as unaltered habitat, they continue to function at a lower level.

Juvenile and adult salmonids might use the subtidal and intertidal areas adjacent to the project site for some rearing and migration. Fish rearing and feeding in the intertidal zone likely occurs because the site is located near the mouth of the Hoquiam River and west of the Chehalis River, where juvenile salmon use nearshore areas on their outmigration to the marine waters of Grays Harbor. Because the western portion of the Anderson & Middleton site and the open bay on the east contain mudflat habitat within the intertidal zone, this area likely offers good feeding and rearing opportunities to juvenile salmonids.

Aberdeen Log Yard

Although rockweed does not provide the full aquatic habitat benefits of some other types of submerged marine vegetation—for example, eelgrass, which provides rearing and foraging habitat for commercially important species, such as juvenile salmon and Dungeness crab—it does serve as a food source for grazing macroinvertebrates. These macroinvertebrates, in turn, likely provide a prey source for some salmonids and other aquatic organisms.

Juvenile and adult salmonids likely use the subtidal and intertidal areas adjacent to the Aberdeen Log Yard site for both rearing and migration. Fish rearing and feeding in the intertidal zone likely occurs because the site is located at the mouth of the Chehalis River, where juvenile salmon use nearshore areas on their outmigration to the marine waters of

Grays Harbor. Because the site contains a substantial amount of mudflat within the intertidal zone, it likely offers good feeding opportunities to juvenile salmonids.

3.3 Potential Effects on Fish and Aquatic Resources

How did WSDOT evaluate the project's potential effects on fish and aquatic resources?

Biologists analyzed the potential effects of the Pontoon Construction Project on fish and aquatic resources by reviewing existing information on the fish resources of Grays Harbor and the water courses within the project vicinity. The biologists, along with resource agency representatives, visually inspected the habitat conditions. The biologists also assessed project design data and WSDOT construction practices to identify changes to fish habitat that would likely occur during project construction and operation at either build alternative site.

How would construction of the casting basin affect fish and aquatic resources?

The Anderson & Middleton and the Aberdeen Log Yard alternatives would place new structures within shoreline, intertidal, open water, riparian, and watercourse habitats that support fish and aquatic species in the Grays Harbor watershed. Construction effects at these locations would include displacing and degrading existing aquatic habitats associated with berm modifications, onsite drainage features filling, and construction of launch channel, water intake and treatment systems, and moorage facilities. In addition to these short-term habitat effects, the Grays Harbor build alternatives could kill or injure aquatic species as a result of hydroacoustic (i.e., underwater sound) effects associated with installing upland and in-water piles.

The large amount of excavation and earthwork at the sites and the dredging associated with the launch channel construction could increase the sedimentation in project waters inhabited by fish. In addition, the project would generate stormwater runoff from pollution-generating impervious surfaces and process water from the casting basin. Because this runoff would be treated for metals, pH, and other contaminants before being released into Grays Harbor, and because the project would meet all state water quality standards in effect, the treated discharge would not likely have substantial negative effects (either lethal or sublethal) on aquatic species, including salmonids.

Some construction effects would be offset by onsite and/or offsite mitigation. Constructing the mitigation site(s) could also negatively affect aquatic species in the short term. The estimated intensity and duration of these habitat and water quality effects are described below for the CTC facility, the build alternatives, the No Build Alternative, and the pontoon moorage site.

CTC Facility

Casting basin construction would cause no effects on the CTC site because the site is already fully constructed and permitted.

Anderson & Middleton Alternative

Habitat Alteration

During high tide, there is limited access for fish to enter the stormwater channels within the Anderson & Middleton site, so salmonid use cannot be discounted. However, based on the limited availability of this access, salmon habitat requirements, and the relatively low quality of suitable habitat within the channels, salmonids are unlikely to use the channel.

Anadromous salmonids, as well as many other fish species, use the shoreline area adjacent to the Anderson & Middleton Alternative for migration, rearing, and foraging. Thus, the primary potential effects on fish and fish habitat during facility construction would be in shoreline and nearshore areas; specific project components are discussed below.

Casting Basin

Casting basin construction would not alter the aquatic habitat known to be used by Grays Harbor fish. The casting basin would be constructed within 100 to 200 feet of the shoreline in the middle of the Anderson & Middleton site. The casting basin footprint would be approximately 458,800 square feet, and it would be approximately 40 feet deep. The casting basin would be constructed within a large staging area that was used in the past as a log yard (most of the site is zoned industrial). This area contains limited vegetation and does not provide habitat for fish, although hydroacoustic effects from pile-driving could extend into the nearshore environment. There might also be noise-related behavioral effects on fish within the nearshore environment during casting basin construction, depending on the duration, timing, and species life history factors of fish present.

Launch Channel

Launch channel construction at the Anderson & Middleton Alternative site would alter shoreline aquatic habitat. The launch channel would be excavated from the casting basin to the shoreline, extend approximately

110 feet into Grays Harbor, and be approximately 300 feet wide and 36 feet deep. Construction activities that could affect fish and aquatic habitat include excavation and dredging (Exhibit 3-7).

The launch channel between the casting basin and the shoreline would have a footprint of approximately 72,000 square feet and would require removing approximately 100,000 cubic yards of material, which would consist of existing fill that was used to build the log yard. The launch channel would be constructed within the existing asphalt staging area of the log yard and into the shoreline. The shoreline area within the footprint of the proposed launch channel is currently dominated by a bulkhead with riprap and concrete rubble. Riparian habitat along the shoreline consists of Himalayan blackberry and reed canarygrass, both of which are nonnative. There is also a band of deposited LWD within the riparian area.

The offshore extension of the launch channel would have a footprint of approximately 33,000 square feet and would require excavating approximately 23,000 cubic yards of substrate habitat, which would consist of tidal mudflats and bottom material composed of fine silt and muck. The mudflat area contains a single row of 15- to 20-foot-high derelict piles; these piles would be displaced.

Because the harbor has a high rate of turbidity, dredging activities would not likely substantially increase turbidity levels above existing conditions following construction. However, the Anderson & Middleton site is located within an area that is characterized by high rates of sediment transport from the Chehalis River and other tributaries within the harbor. Because the harbor has a high rate of turbidity, dredging activities would not substantially increase turbidity levels above existing conditions.

Some of the juvenile salmon moving from the Chehalis River basin to the Grays Harbor estuary migrate along both the Aberdeen Log Yard site and the Anderson & Middleton site shorelines. Because these two sites are on the same side of the river’s north channel within a short distance of each other at the upper end of the estuary, the same fish likely migrate past each site.

Juvenile salmon use of either build alternative site is likely influenced by salinity, fine sediment deposition, and river currents. Salinity at both sites is low, with a strong influence from the river’s freshwater discharge. Middle and lower intertidal substrates are covered with fine sediment (silt-clay) apparently deposited by the river’s suspended sediment load. The combined sediment and freshwater influences severely limit macroalgae and diatom production at both sites. No eelgrass exists in the intertidal portion of either site.

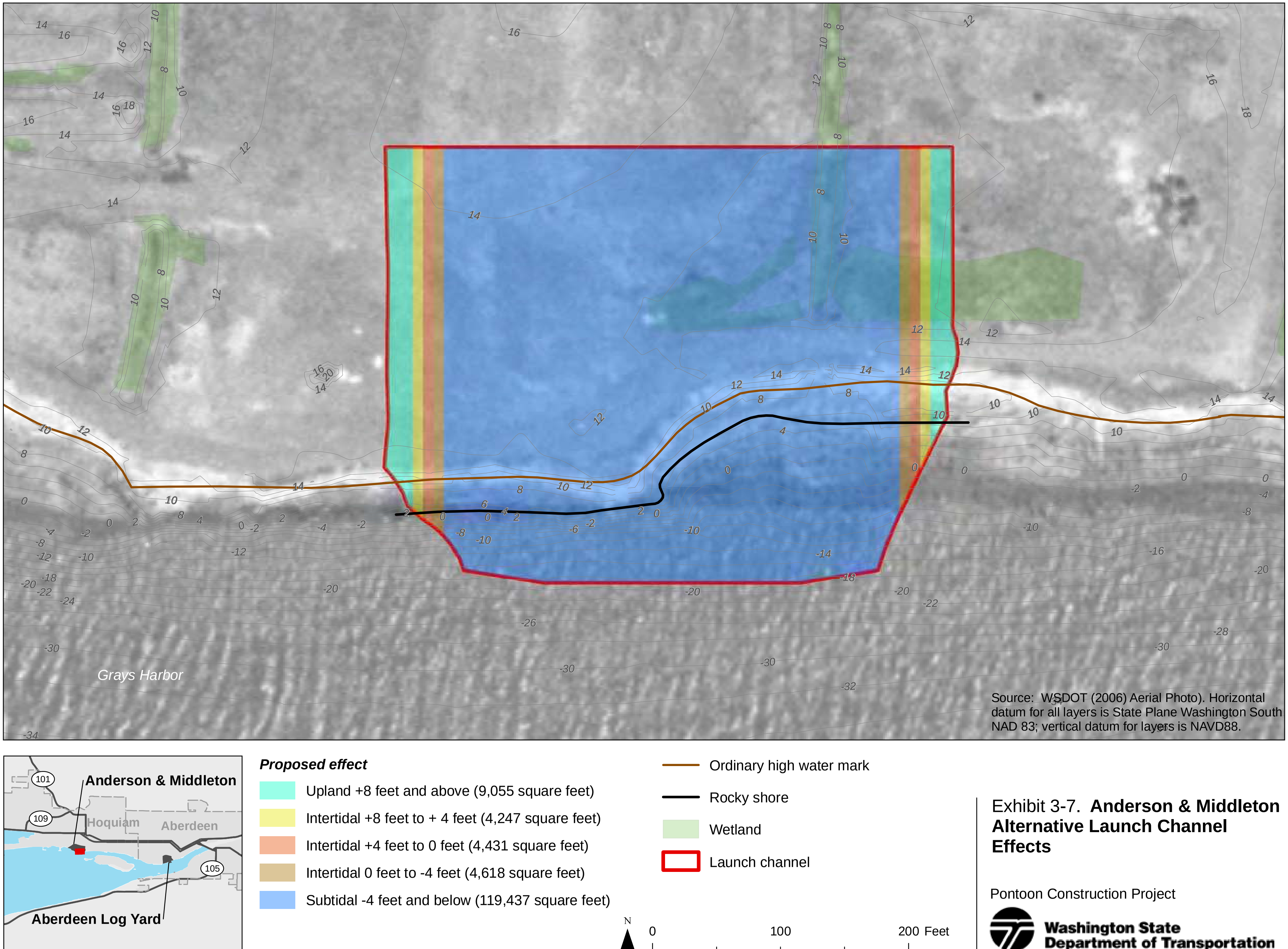

Exhibit 3-7. **Anderson & Middleton Alternative Launch Channel Effects**

Pontoon Construction Project

Washington State Department of Transportation

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The proposed launch channel portion of the Anderson & Middleton site has two habitat types. The downstream half is filled to above the high tide level with a timber bulkhead located at the edge of the dredged navigation channel at about -1 foot MLLW. The upstream half of the launch channel shoreline is modified with derelict, creosote-treated timber piles and quarry spall type rock fill. The rock is covered with fine silt of increasing depth at lower tidal elevations from about + 3 to 4 feet MLLW to the edge of the dredged channel at about -1 foot MLLW.

At both sites, the high sedimentation of fine silt at the middle and lower intertidal elevations appears to severely limit diatom production. This limitation likely restricts the production of epibenthic zooplankton (diatom grazers) that would provide a prey resource for juvenile salmon.

Juvenile salmon likely migrate rapidly past the two build alternative sites because of the absence of physical and biological habitat features that tend to attract juvenile salmon during their early estuarine residence. Deepening a small length of the shoreline by constructing a launch channel at either site would not likely measurably delay migration of young salmon along the shoreline.

Shoreline Armoring

Shoreline armoring for the launch channel would consist of approximately 2,470 cubic yards of riprap below the OHWM and 16,930 cubic yards of riprap above the OHWM. The shoreline area to be armored currently consists of riprap and concrete rubble. The concrete rubble includes some large (greater than 100-square-foot) pieces; thus, shoreline habitat functions would not be diminished. Any pieces of large wood, including trees greater than 12 inches in diameter at breast height, stumps, logs, or large rocks would be retained on site following construction. If any such habitat features existed within the launch channel construction area, then they would be removed and repositioned along the onsite shoreline.

Pile-Driving

At either site, 2,300 deep piles would be used if deep piles are selected as the preferred foundation construction method. Deep piles consist of steel casing driven to a bearing layer and filled with concrete and rebar. However, shallow timber piles could be used as the foundation construction method, while deep piles would be used to support the crane rails and casting basin gate. In this case, 16,000 timber piles and 600 deep piles would be used for either alternative. Shallow timber piles are short piles driven based on available pile length (30 to 40 feet).

Pile-driving activities would involve installing up to eight temporary mooring dolphins and up to four permanent monopile dolphins within the launch channel, as well as up to 12 temporary mooring dolphins outside of the launch channel. The exact number, material type, and installation technique of the dolphins would be determined during the final design. The numbers mentioned above provide a likely range of the number of dolphins that might be used. Monopile dolphins would be used to protect the basin and provide the barge and pontoons with something to turn against. The monopile dolphins would be 2 to 3 feet in diameter, and the dolphins would be 10 square feet supported by three 2-foot-diameter piles. The piles would likely be steel and driven into the substrate with an impact hammer.

Most piles would be installed during low tide within substrate dominated by soft silt and mud, which would cause less acoustic effect than installing the piles in deeper water within a hard substrate. 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 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 fish survival near the activity. Therefore, in-water noise from pile-driving associated with the proposed project would have to be assessed and minimized to the degree practicable.

WSDOT will follow the Interagency Agreement for Interim Criteria for Injury to Fish from Pile-Driving Activity (Jan 12, 2008) and is further developing best management practices—in cooperation with the appropriate agencies—by conducting ongoing research related to pile-driving and minimizing sound energy associated with impact pile-driving at the following studies:

- **State Route (SR) 520 Test Pile Project: WSDOT** will drive up to nine test piles into the underwater substrate at critical locations along the proposed SR 520 bridge alignment. Driving methods will include vibratory and impact driving. Three underwater noise attenuation devices will be tested, including an unconfined bubble curtain, a confined bubble curtain, and a temporary noise attenuation pile. Additionally, the airborne noise will be monitored, and a noise blanket or shroud will be tested on the pile hammer itself. The data collected for this project will be used to develop the Biological Assessment (for

Endangered Species Act compliance) for the upcoming I-5 to Medina: Bridge Replacement and HOV Project.

- **Vashon Ferry Terminal Test Pile Project:** WSDOT and the University of Washington Applied Physics Lab is testing a new modified temporary noise attenuation pile, which could provide underwater noise attenuation of up to 30 decibels. The temporary noise attenuation pile consists of a 1-inch-thick, steel-walled casing, which fits around the pile. The casing interior has a 2-inch-thick foam lining, and inside of that is a bubble ring. The temporary noise attenuation pile was tested late November 2009.

Ancillary Facilities

Constructing each alternative would require ancillary facilities, such as an access road, concrete batch plant, large laydown areas, water handling and treatment areas, office space, a rail spur, and designated parking areas for workers. Constructing the ancillary facilities on the Anderson & Middleton site would mainly affect dozens of small symmetrical rows of earthen depressions that drain stormwater into Channels A, B, C, and D, which in turn convey onsite and offsite drainage to Grays Harbor. These small rows of built depressions do not represent stream habitat and do not contain features capable of supporting fish. Minimal disturbance would occur to riparian, shoreline, and intertidal habitat when constructing the ancillary facilities.

Water Quality

Fish species depend on clean water habitats to live. Pollutants that wash off construction areas during storms are a major contributor to poor water quality. Pollutants typically generated from construction activities include fuel, oil, grease, heavy metals, and small particles from erosion, which turn waterways turbid. Stormwater system design and placement can affect how these pollutants are treated or released into the environment.

Potential sources of runoff are likely during casting basin and ancillary facility construction. Although specific stormwater treatment designs have not yet been finalized, detention ponds, such as a pH holding pond and a sediment pond, as well as bioswales and/or underground vaults, would be constructed to capture construction site-related runoff (more detailed and technical discussions can be found in the Hydrology and Water Quality Technical Report [WSDOT 2009f], the Conceptual Storm Water Design Report [WSDOT 2009g], and the Water Resources Discipline Report [WSDOT 2009a]). Detention ponds and bioswales would be designed to allow water to infiltrate into the ground rather than discharging directly into waterways. Soil and vegetation within these types of structures act to filter many of the pollutants in the runoff and can help to control flow during storm events.

Grays Harbor is on the state of Washington's 303(d) list for fecal coliform. Sampling in various areas of the harbor indicates that water temperature, dissolved oxygen, and pH standards are also violated at times. Because stormwater and construction-related runoff from the pontoon construction area would be treated, project activities would not degrade water quality beyond the existing baseline conditions.

Other potential construction effects on water quality might include the spill of hazardous materials (for example, oil and gasoline), chemical contaminants, nutrients, or other materials into waters near the project. Controlling hazardous materials is a standard provision in construction contracts and permits and would be addressed with best management practices. The contractor would be required to submit and comply with a spill prevention and response plan before starting work.

Aberdeen Log Yard Alternative

Habitat Alteration

Presently, no fish exist within the Aberdeen Log Yard site, but during high tide there is limited access to a stormwater channel on the western boundary of the property (i.e., Channel A). Because the channel is accessible to fish, salmonid use cannot be discounted. However, based on habitat requirements and the relatively low quality of suitable habitat within the channel, salmonids are unlikely to use the channel.

Anadromous salmonids, as well as many other fish species, likely use the shoreline area adjacent to the Aberdeen Log Yard Alternative for migration, rearing, and foraging. Thus, the primary potential effects on fish and fish habitat during construction of the facility would be within shoreline and nearshore areas. Specific components of the project are discussed below.

Casting Basin

The casting basin would not significantly alter any aquatic habitat known to be used by Grays Harbor fish. The casting basin would be constructed approximately 100 feet from the shoreline in the middle of the site. The footprint of the casting basin would be approximately 458,800 square feet. The casting basin would be constructed within an area that contains numerous log piles, remnant built structures, and less than 3 acres of highly disturbed potential emergent wetlands that have formed under log piles and roadside depressions. The wetland features are completely inaccessible to fish and do not provide riparian habitat to fish-bearing waterways.

Because the casting basin would be approximately 39.5 feet deep and constructed approximately 100 feet from the shoreline and on dry land, pile-driving to construct the foundation of the casting basin would likely have little measurable effect on fish species.

Launch Channel

The launch channel would alter shoreline habitat, which includes previously altered intertidal shoreline, mudflat, and subtidal habitat. The launch channel would be excavated from the casting basin to the shoreline and would extend approximately 420 feet into Grays Harbor. The launch channel would be approximately 300 feet wide and 34 feet deep (see Exhibit 3-8). Construction activities with the potential to affect fish and aquatic habitat would include excavation and dredging.

The launch channel between the casting basin and the shoreline would have a footprint of approximately 69,000 square feet and would require removing approximately 112,000 cubic yards of material; the excavated material would consist of existing fill on which the log yard was built. The launch channel portion of the Aberdeen Log Yard site is filled with a type of quarry spall rock from the upper intertidal zone to about the +2.5 feet MLLW elevation. A natural mudflat extends from this elevation to about the 0 to 1-foot MLLW elevation. The Aberdeen Log Yard site has narrow bands of saltmarsh vegetation at the higher intertidal elevations; this vegetation likely supports production of juvenile salmon prey resources. Macroalgae is very sparse, and there is no eelgrass in the intertidal portion of the site to the edge of the dredged navigation channel.

The shoreline area within the footprint of the channel consists of silt, sand, and angular cobbles. The transition from the intertidal zone to the upland log storage area occurs along a moderately steep vegetated bank. Riparian habitat along the shoreline consists predominantly of nonnative Himalayan blackberry, reed canarygrass, and sparse areas of native shrub species. As a result, there is minimal habitat for fish species. There is a band of deposited LWD, which provides good fish habitat, along the shoreline. This LWD would be repositioned along the shoreline to continue to provide habitat functions.

The offshore extension of the launch channel would have a footprint of approximately 126,000 square feet and would require excavating approximately 93,000 cubic yards of substrate habitat. Substrate habitat within this area consists of tidal mudflats and bottom material composed of fine silt and muck. The mudflat extends into a large conglomeration of wooden piles, which likely supported a large pier structure in the past. These old wooden piles extend about 5 or 6 feet above the mudline.

Exhibit 3-8. **Aberdeen Log Yard Alternative Launch Channel Effects**

Pontoon Construction Project

Washington State Department of Transportation

Native eelgrass does not exist within the study area, but there are patches of rockweed along the shoreline; rockweed is also abundant on the offshore piles. Although rockweed does not provide the full aquatic habitat benefits of some other types of submerged marine vegetation (for example, eelgrass, which provides rearing and foraging habitat for many commercially important species such as juvenile salmon), it does serve as a food source for grazing macroinvertebrates. These macroinvertebrates, in turn, provide a prey source for some salmonids and other aquatic organisms. Habitat functions that the existing piers might provide would be replaced with standard and monopile dolphins. Rockweed likely would quickly recolonize on the standard and monopile dolphins within the disturbed areas.

Juvenile salmon likely migrate rapidly through this site because of the absence of physical and biological habitat features that tend to attract juvenile salmon during their early estuarine residence. Deepening a small length of the shoreline by constructing a launch channel at either site would not likely measurably delay migration of young salmon along the shoreline.

Dredging the launch channel would result in short-term, localized increases in turbidity. However, the Aberdeen Log Yard site is located within an area that is characterized by high rates of sediment transport. Thus, dredging activities would not likely substantially increase turbidity levels above existing conditions. Standard construction best management practices would be in place to mitigate the potential effects of construction-related turbidity.

To prevent sloughing of the finished sideslopes within the launch channel, they would be protected with approximately 9,730 cubic yards of riprap below the OHWM and 17,070 cubic yards of riprap above the OHWM. This equates to an approximately 2 to 3 feet deep layer of riprap protecting the stability of the sideslopes. These quantities include placing riprap in the area in front of the launch channel gates to prevent undermining of the gate area during maintenance dredging. The flat channel bottom—from the launch channel gate to the navigation channel—would remain unarmored subtidal native substrate to a depth of approximately -18 feet MLLW.

Shoreline Armoring

Riprap would only be used to protect the sideslopes of the launch channel (to prevent slippage and sloughing as described above); shoreline armoring would not be necessary along the rest of the shoreline at this site.

Pile-Driving

Pile-driving activities, the number of piles installed, and effects of pile-driving at the Aberdeen Log Yard site would be similar to the proposed Anderson & Middleton Alternative.

Ancillary Facilities

Constructing the ancillary facilities would mainly affect highly disturbed potential emergent wetlands on the site (see Chapter 2, Wetlands). These wetlands have formed between log piles and in roadside depressions; they do not have a surface connection to fish-bearing waterways and do not provide habitat for fish.

Two primary stormwater drainage channels are located on or adjacent to the site. The main drainage Channel A, which runs offsite along the western boundary of the site, would not be affected by construction activities. Construction activities would affect a secondary drainage ditch, which originates in the northeastern portion of the site. A portion of this ditch would be located within the footprint of a laydown area and possibly the casting basin. The ditch is built and sparsely vegetated with grasses and shrubs. Based on the lack of perennial flows, fish access, and quality vegetation, the ditch does not represent fish habitat. Minimal disturbance would occur to riparian, shoreline, and intertidal habitat during the construction of ancillary facilities.

Water Quality

Effects on water quality from construction activities and minimization measures at the Aberdeen Log Yard site would be similar to the Anderson & Middleton Alternative.

No Build Alternative

With the No Build Alternative, the Pontoon Construction Project would not be constructed. Therefore, producing pontoons for the catastrophic failure of the Evergreen Point Bridge would not occur in Grays Harbor.

How would pontoon-building operations affect fish and aquatic resources?

CTC Facility

The CTC site is already fully constructed and operational, and no new work would occur beyond that permitted. Operations would be similar between the CTC site and the Anderson & Middleton and Aberdeen Log Yard alternatives, except that the constructed pontoons at the CTC site would be floated out of the casting basin with auxiliary buoyancy tanks during high tide. At the Anderson & Middleton and Aberdeen Log Yard sites, constructed pontoons would be towed from the casting basin through the casting basin access gates, which open to the launch channel and harbor.

Grays Harbor Build Alternatives

Project operations would be similar at both build alternative sites, and the analysis presented below applies to each alternative site.

Habitat Alteration

A short-term disturbance to soft sediment and an increase in turbidity, caused by propeller wash from tugboats, might occur when the pontoons are removed and transported. Transporting the pontoons out of the casting basin would likely occur a maximum of twice per year. Tug propeller wash would likely be directed towards either the launch channel or the existing navigation channel.

Both build alternative sites are located in areas with a high existing baseline for sedimentation. In planned operation, the tugboat propeller wash would be directed mostly towards the launch channel or the existing navigation channel. Care would be needed to avoid directing propeller wash towards adjacent shorelines and/or mudflats outside of the launch channel. Tugboat traffic likely would not substantially increase turbidity levels above existing conditions. Both build alternative sites are adjacent to the Grays Harbor shipping channel; thus, removing and transporting the pontoons (at a maximum towing rate of twice per year) would likely have a minimal effect on fish and aquatic habitat compared to existing vessel traffic.

Fish Stranding or Entrainment

During pontoon construction, the casting basin access gates would be closed. All pumps or outlets, if used to convey water to and/or from the site to fish-bearing waters, would be screened according to NOAA Fisheries standards.

When a set of pontoons is complete, the basin would be flooded in a controlled manner with water entering the facility through a hydraulic control structure designed to avoid potential effects to fish. The maximum intake velocity of flow through the hydraulic control structure for flooding the casting basin would be 0.4 foot per second. After the basin is flooded, the access gates within the casting basin would be opened and the pontoons would be towed out by tugboat.

Fish potentially could enter the casting basin each time the access gates open to the harbor (the access gates would be open for up to three days during removal of the pontoons). The dock would be designed to facilitate removing any fish that might be retained after the gates closed. Trenches would run along the basin perimeter to provide channels by which fish could be collected and released back into open water outside of the closed casting basin. Stranded fish would be crowded along the 2-foot-wide by 3-foot-deep channels extending along each side of the lower section of the graving dock into two sumps that are 4 feet wide by 8 feet long and 3 feet deep.

Each sump would have a steel box equipped with a 2- by 3-foot watertight door connecting to the channel. These boxes would be equipped with removable screened tops, lifting loops, and a detachable aeration system. This configuration would allow the boxes containing entrained fish to be lifted by crane and placed in the bay, where they would be released.

Water Quality

When a set of pontoons is complete, the work area would be thoroughly cleaned and pressure washed. Wash water would be collected and treated within the water quality facilities before being discharged to receiving waters.

Stormwater from impervious surfaces associated with the casting basin and ancillary areas would increase pollutant loading and flow. At each site, approximately 1,317,000 square feet (30 acres) of impervious surfaces would be present. Sediment ponds and biofiltration swales would capture stormwater from the site.

As with construction, potential operational effects on water quality could include the spill of hazardous materials (e.g., oil and gasoline), chemical contaminants, nutrients, or other materials into waters in the project vicinity. Controlling hazardous materials is a standard provision in construction contracts and permits and would be addressed with best management practices. The contractor would be required to submit a spill prevention and response plan before starting operations. Also, if an oil or contaminant spill were to occur from the tugboat and/or barge during the removal and transport of the pontoons, U.S. Coast Guard regulations would be implemented.

All water collected onsite would be handled and treated according to state water quality requirements. Water handling and treatment systems would be designed to keep project waters separate (i.e., the water used during pontoon construction would be separate from stormwater) and treat them as appropriate for sediment and pH according to the *Highway Runoff Manual* (WSDOT 2008) for water quality. All features would accommodate a 10-year design storm event.

No Build Alternative

With the No Build Alternative, the Pontoon Construction Project would not be constructed. Therefore, effects from operation on fish and aquatic resources would not occur.

How would the project affect fish and aquatic habitat in the long term?

Long-term effects of the project could result from the new casting basin and ancillary facilities that would remain in place after pontoon production is complete, those associated with pontoon moorage over an indefinite period of time, and those associated with mitigation efforts expected to continue beyond construction.

CTC Facility

The CTC site is already fully constructed and operational, and no new work would occur above what was permitted. Long-term effects at the CTC site would be similar to those occurring at the existing site.

Grays Harbor Build Alternatives

Long-term effects of the project would be similar at both alternative sites. The analysis presented below applies to each alternative. Long-term effects of the facility remaining in place after pontoon construction would be minimal because both existing sites are already disturbed and lie within industrial areas. In addition, both sites were tidal mudflats and wetlands that were previously bermed and filled for industrial use.

Pontoon Storage

The Draft EIS includes the most recent analysis of the pontoon moorage location. The constructed pontoons would be stored until they are needed in the event of catastrophic failure or as part the Evergreen Point Bridge replacement project. For storage, the pontoons would be breasted together in rafts of three or four. Because of their large size—each pontoon could be up to 75 feet wide, 360 feet long, and 35 feet high—the rafts would be anchored at deepwater sites in the harbor. The pontoons would have a draft of about 15 feet in water, leaving 20 feet above water.

Storing pontoons likely would not directly affect Grays Harbor eelgrass resources because the pontoons would be stored in 25- to 50-foot-deep waters where light is insufficient to allow growth of eelgrass. This conclusion is supported by the absence of eelgrass at the moorage location during September 2009 videography.

The pontoons would be temporarily kept in areas in which the large rafts would minimally affect tidal exchange, currents, or substrate distribution.

These pontoons would provide a hard structure to serve as aquatic habitat for invertebrates and fish. This process (biofouling) could be positive or negative, depending on whether the pontoons attracted native or nonnative invasive species (such as green crabs).

The stored pontoons could provide artificial habitat for piscivorous birds, such as terns, which might use the pontoons for roosting, perching, or possibly nesting. The pontoons would be exposed to wind, wave, and weather conditions, and they would provide no refuge from the elements. As such, they would not likely provide attractive perching, roosting, or nesting habitat. Because the pontoons could be moved under the emergency replacement scenario at any time, WSDOT would proactively discourage such use of the pontoons. WSDOT might cover them with some type of material, such as chicken wire, which might discourage any use of the pontoon structures by migratory birds and waterfowl. In addition, moored pontoons could be periodically monitored for any bird use, and further deterrent measures could be implemented if warranted. WSDOT is currently coordinating with the USFWS regarding specific pontoon management, maintenance, and monitoring consistent with the Migratory Bird Treaty Act. More information on this process will be provided as it becomes available.

Biofouling involves establishing biological organisms on wetted structures. The biofouling community would likely consist of species that ordinarily exist in the area and that commonly grow on other submerged hard surfaces within Grays Harbor, such as plants and animals, including, for example, mussels, barnacles, and sea anemones. This type of community was documented as occurring on the piles located within the moorage area during September 2009 videography.

To ensure that nonnative invasive species, such as green crab, are not inadvertently transported out of Grays Harbor via the pontoons, WSDOT would inspect and monitor them as the biofouling community develops. The pontoons might be cleaned, removing invasive and native biofouling communities as needed, before they are transported out of Grays Harbor. To anticipate which organisms might become established, WSDOT is conducting a plate study, which involves placing cement plates at varying depths and locations within Grays Harbor to identify which organisms are likely to become established on the wetted portion of the pontoons. This study will help to inform biofouling community maintenance and monitoring at the pontoon moorage location. WSDOT anticipates that cleaning the pontoons (to remove whatever biofouling community might become established and to eliminate the possibility of transporting invasive species) before transporting out of Grays Harbor would be necessary.

WSDOT analysts are gathering site-specific detail regarding potential pontoon moorage effects, including analyzing the effects of in-water structures (anchors and chains), the effects of overwater structures (shading and pontoon moorage configuration themselves), effects on fish and aquatic organisms, effects on bird and marine mammal interactions, and effects of invasive species, maintenance, and monitoring. This analysis will be forthcoming as it becomes available.

No Build Alternative

With the No Build Alternative, the Pontoon Construction Project would not be constructed at either the Anderson & Middleton site or the Aberdeen Log Yard site. Therefore, long-term effects on fish and aquatic resources from the facility would not occur.

How would the alternatives compare in their effects on fish and aquatic resources?

The Grays Harbor built alternative sites (excluding the CTC site, which is already permitted) would have similar effects but at different magnitudes on fish resources and aquatic habitat. The Anderson & Middleton and Aberdeen Log Yard sites share the following general features:

- The alternative sites are both within Grays Harbor and near each other.
- The alternative sites are both within industrial areas.
- The casting basin and ancillary facilities design would be similar at both alternative sites.
- Operations at both alternative sites would be similar.

Although there are similarities to the design of the facilities at each site, there would be differences in the footprints, as depicted on Exhibits 3-7 and 3-8.

Disturbance would occur to nearshore and intertidal habitat at both alternative sites. However, as shown in Exhibit 3-9, the launch channel footprint at the Aberdeen Log Yard Alternative would be larger and extend farther into the harbor than the Anderson & Middleton Alternative launch channel, which would result in substantially more disturbance to nearshore and intertidal fish habitat.

EXHIBIT 3-9
Comparisons of Fish and Aquatic Resources Effects

	Anderson & Middleton	Aberdeen Log Yard
Casting basin		
Footprint and/or extent of casting basin excavation	565 x 810 feet = 458,800 square feet	565 x 810 feet = 458,800 square feet
Depth of casting basin excavation	40 feet	39.5 feet
Volume of casting basin excavated material	713,200 cubic yards	803,100 cubic yards
Volume of concrete for casting basin	57,500 cubic yards	57,500 cubic yards
Casting basin foundation [a]		
Number of piles	Alternative 1: 2,300 deep piles Alternative 2: 16,000 timber piles and 600 deep piles	Alternative 1: 2,300 deep piles Alternative 2: 16,000 timber piles and 600 deep piles
Pile diameter	Alternative 1: deep piles = 24 inches Alternative 2: timber piles = 14 inches; deep piles = 24 inches	Alternative 1: deep piles = 24 inches Alternative 2: timber piles = 14 inches; deep piles = 24 inches
Pile length	Alternative 1: deep piles = unknown at this time (assumed to be 130 feet or less) Alternative 2: timber piles = 30 to 40 feet; deep piles = unknown at this time (assumed to be 130 feet or less)	Alternative 1: deep piles = unknown at this time (assumed to be 130 feet or less) Alternative 2: timber piles = 30 to 40 feet; deep piles = unknown at this time (assumed to be 130 feet or less)
Pile type (wood or steel)	Alternative 1: all deep piles (steel) Alternative 2: mostly timber piles, some deep (steel)	Alternative 1: all deep piles (steel) Alternative 2: mostly timber piles, some deep (steel)
Pile-driving method	Alternative 1: impact Alternative 2: impact	Alternative 1: impact Alternative 2: impact
Launch channel		
Footprint and/or extent of launch channel excavation	Inshore: 240 x 300 feet = 72,000 square feet Offshore: 110 x 300 feet = 33,000 square feet	Inshore: 230 x 300 feet = 69,000 square feet Offshore: 420 x 300 feet = 126,000 square feet
Depth of launch channel excavation	36 feet	34 feet
Volume of launch channel excavated material	Inshore: 100,000 cubic yards Offshore: 23,000 cubic yards	Inshore: 112,000 cubic yards Offshore: 93,000 cubic yards
Shoreline and/or armoring		
Cubic yards of riprap	Assume that the berm would all be above the OHWM (25,200 cubic yards total)	Not likely to be used on this site, except inside launch channel. Total riprap quantity (channel only): 12,936 cubic yards

EXHIBIT 3-9
Comparisons of Fish and Aquatic Resources Effects

	Anderson & Middleton	**Aberdeen Log Yard**
Quantity of riprap in-water (below OHWM)	2,470 cubic yards (channel only)	9,730 cubic yards (channel only)
Quantity of riprap out-of-water (above OHWM)	16,930 cubic yards (channel and berm)	17,070 cubic yards (channel only)
In-water construction		
Volume of dredge material	See launch channel quantities above. Assume that basin would be constructed in dewatered excavation from dry land. USACE would dredge shipping channel adjacent to these sites.	See launch channel quantities above. Assume that basin would be constructed in dewatered excavation from dry land; USACE would dredge shipping channel adjacent to these sites.
Number of dolphins	To be determined	To be determined
Size of dolphins	Monopile dolphins: 2 to 3 feet in diameter Dolphin plan size: 10 square feet supported by three 2-foot-diameter piles.	Monopile dolphins: 2 to 3 feet in diameter Dolphin plan size: 10 square feet supported by three 2-foot-diameter piles.
Length of in-water pile	Assume piles to extend to same depth as basin foundation, or less, as needed to resist horizontal loads.	Assume piles to extend to same depth as basin foundation, or less, as needed to resist horizontal loads.
Pile type (wood or steel)	Steel	Steel
Pile-driving method	Vibratory	Vibratory
Sewage disposal		
Sanitary sewage disposal method (sewer connection or portable toilets)	Sewer connection	Sewer connection
Pontoon floatout and moorage		
Number of floatouts	Up to six cycles for dual basins; cycles are anticipated to be completed a maximum of twice per year.	Up to six cycles for dual basins; cycles are anticipated to be completed a maximum of twice per year.
Intake velocity	0.4 feet per second	0.4 feet per second
Time to fill each basin	Up to 24 hours	Up to 24 hours
Amount of time the gate would be open during floatout	Up to 3 days	Up to 3 days
Number of tugboats	Two small and two to three large	Two small and two to three large
Size of tugboats (horsepower)	Largest tugs would be 2,000 to 5,000 horsepower	Largest tugs would be 2,000 to 5,000 horsepower
Amount of time to move the pontoons from the casting basin to the moorage location	Up to 6 hours	Up to 6 hours

EXHIBIT 3-9
Comparisons of Fish and Aquatic Resources Effects

	Anderson & Middleton	Aberdeen Log Yard
Amount of time pontoons might be stored at temporary moorage locations (if anticipated)	Up to 6 months	Up to 6 months
Amount of time to drain the casting basin after pontoon float-out	Up to 48 hours	Up to 48 hours
Velocity of water during basin drainage	0.4 feet per second	0.4 feet per second

[a]WSDOT evaluated two possible alternatives at both sites (referred to as Alternative 1 and Alternative 2), but final design might result in some changes to existing information.

The footprint of the facilities at the Anderson & Middleton site would negatively affect the existing eastern stormwater drainage channel. Fish do not have access to this channel during high tide, and it provides limited fish habitat.

The footprint of the facilities at the Aberdeen Log Yard site would not negatively affect fish habitat at the site because fish habitat does not exist and is highly degraded, and/or fish do not have access to potential habitat. The launch channel at Aberdeen Log Yard, however, would extend farther into the nearshore environment than the launch channel at the Anderson & Middleton site. Constructing the launch channel at the Aberdeen Log Yard Alternative would require more dredging than at the Anderson & Middleton Alternative as summarized above.

3.4 Mitigation

What measures does WSDOT propose to reduce negative project effects on fish and aquatic resources?

WSDOT has designed each Grays Harbor build alternative to include similar features that minimize the construction and operation effects of the proposed alternatives. Best management practices used to mitigate potential effects to fish species and fish habitat would be the same for each alternative.

Project best management practices would be used to control pollution, sediment, and erosion during construction activities. Erosion and sediment control measures might include but would not be limited to the following: mulching, matting, netting, filter fabric fencing, and sediment traps. Negative effects on water quality would be unlikely if erosion-control best management practices and spill-containment measures were properly implemented, monitored, and maintained during construction. Even with best management practices, however, some temporary, short-term effects on water quality would be possible. A temporary erosion and sediment control plan would be prepared and implemented to minimize and control pollution and erosion from stormwater.

The use of best management practices should eliminate or reduce any direct effects on fish species. The following potential best management practices might be implemented and/or adhered to during project activities:

- Runoff from newly created impervious surfaces would be treated for water quality.
- Concrete would be sufficiently cured prior to contact with water to avoid leaching, and fresh concrete would not come in contact with waters of the state, as required by WAC 110-220-070(1)(g).
- The potential effects of pile-driving would be minimized by several methods, such as using air bubble cushions; best management practices for sound pressure attenuation during pile-driving would reduce the transmission of energy to the surrounding water, thus minimizing levels that would potentially injure fish.
- In-water work would take place only during designated work windows, as identified by the appropriate agencies (i.e., WDFW, NOAA Fisheries, and USFWS).
- Construction limits would be clearly defined with stakes before starting ground-disturbing activities. No disturbance would occur beyond these limits. Temporary construction fencing would be installed where necessary.
- The active work areas would be isolated, to the greatest extent possible, from waterways with sandbags, cofferdams, or similar structures.
- Construction best management practices would be implemented to control dust and limit effects to air quality, including the following:
  - Wet down fill material and dust onsite.
  - Remove excess dirt, dust, and debris from roadway.
  - Revegetate disturbed soil as soon as practicable.
- Measures to minimize noise during construction would be implemented, including the following:

- Turn off equipment when not in use.

- Use only well-maintained and properly functioning equipment and vehicles.

- Stormwater runoff control best management practices would be implemented, including the following:

  - Install temporary sediment control devices, such as filter fabric fences or sediment traps.

  - Minimize soil disturbance, and reseed disturbed areas as soon as practicable.

- A spill containment plan would be developed, and the necessary materials would be onsite before and during construction. Examples of content within the spill containment plan include the following:

  - All construction equipment would be maintained in good working order to minimize the risk of fuel and fluid leaks or spills.

  - If equipment leaks occur during in-water work, the maintenance project manager would ensure that the equipment was immediately removed from within the waterway to a location where pollutants could not enter any waterway. The equipment would not be allowed within the waterway until all leaks were corrected and the equipment cleaned. Upland areas where the leaking equipment is stored also would be cleaned or remediated before project completion.

  - An oil-absorbing, floating containment boom would be available onsite during all phases of in-water and/or bank work.

  - Equipment used for in-water work would be cleaned before operations. External oil and grease would be removed, along with dirt and mud. No wash and rinse water would be discharged into local waters or wetlands without adequate treatment.

  - Refueling activities would be conducted within designated refueling areas away from water bodies and wetland areas.

  - All vehicles operated within 150 feet of any water body would be inspected daily for fluid leaks before leaving the vehicle staging area. Any leaks detected would be repaired before the vehicle resumed operation. When not in use, vehicles would be stored in the vehicle staging area.

  - Equipment would be stored in designated staging areas, which would be located outside all wetlands, streams, and their buffers.
  - No wet or curing concrete, including washout of equipment, would enter project waters.

- The intensity of an area illuminated by nighttime lighting would be kept to the minimum necessary for the intended purpose. Lights would be directed onto the work areas and away from the water, where applicable.

How could WSDOT mitigate for unavoidable negative effects to fish and aquatic resources?

The project would compensate for effects on fish and aquatic habitat caused by any of the build alternatives. In cooperation with resource agencies and tribes, WSDOT would develop plans for habitat improvements, restoration, or construction to mitigate the effects of pontoon site construction and pontoon storage and the associated shoreline and/or open water habitat disturbances. Specific plans would be included in permit applications for construction of the Pontoon Construction Project.

Habitat restoration might include enhancing shoreline areas onsite, or elsewhere in the basin, with appropriate substrate and vegetation or installing complex habitat components, such as LWD. Mitigation could include removing existing derelict piles or existing construction rubble and debris along the shoreline at the preferred site.

WSDOT would address shoreline effects to satisfy the requirements of local critical areas regulations and to enhance marine fish habitat to the maximum extent practicable. One approach to mitigating effects on riparian vegetation within the buffers of Grays Harbor would involve revegetation along the harbor or tributary fish-bearing streams outside of the project site. This approach has several advantages as outlined below.

- Mitigation could be concentrated along a shoreline segment where salmonid use is confirmed and where the existing shoreline reaches have been identified as lacking in shoreline substrate (e.g., gravels and sand), habitat complexity (e.g., LWD), riparian vegetation, or bank stability.
- Revegetation and shoreline improvements could cover sufficient area to improve important riparian processes in a meaningful and measurable way.

- Maintenance, monitoring, and adaptive management techniques would be more efficient and effective on one or two large parcels than on multiple small parcels.