

Appendix C

Salmon Productivity Calculations for Smith Island Restoration Project

May 2011, by Tim Walls, Senior Planner II, Snohomish County Public Works

INTRODUCTION

Calculating gains in returning salmon from one restoration project is a difficult prospect given the uncertainty in multiple variables. While Smith Island Restoration Project is an important component of the *Snohomish River Basin Salmon Conservation Plan*, it is only one element of a recovery strategy that includes harvest, hatchery and habitat improvements implemented by multiple jurisdictions across the watershed. The only way to measure its benefit is through the implementation of an estuary system-wide monitoring strategy. Given these uncertainties, the scientific community cautions against providing such estimates. Nevertheless, decision-makers and the public want information on the fish benefits of a large-scale project such as Smith Island Restoration Project upfront to evaluate the gains relative to the costs. The estimate produced should be viewed as an order-of-magnitude estimate rather than an absolute value.

TIDAL CHANNEL AREA

The area proposed for tidal marsh restoration is approximately *166 hectares* (413 acres). Tidal channel area in marshes is scaled to the size of the marsh and is also likely influenced by other factors such as the size of adjacent tributary or mainstem channel and shape (Hood 2007). For the Smith Island Restoration Project, channel area following restoration is estimated at *11.04 hectares* (27.28 acres). This number is an average of the South Fork and North Fork Skagit River channel densities. It should be noted that given the variability and incomplete understanding of tidal channel scaling, Hood cautions against extrapolating scaling patterns to other river deltas.

SMOLT PRODUCTION

Chinook smolt density in blind tidal channels is highly variable throughout the outmigration, from year to year and from site to site. Smolt density is influenced by population characteristics, site characteristics, food availability, connectivity with other habitats as well as other factors. To develop the estimate, ten regional studies were evaluated that report smolt densities in tidal channels. We selected average maximum density values between March and June to estimate likely densities that would be present at the peak of the outmigration at the Smith Island project area. The average maximum Chinook smolt density from the studies was *0.52 smolts/hectare* (0.21 smolts per acre). Maximum rather than mean values were used because the estimate is already conservative. Specifically, it is based on one group of juveniles occupying the site per season rather than a continuum of juveniles migrating through the site. Chinook salmon exhibiting the ocean-type life history strategy occupy estuary habitat from two weeks to two months.

Likely annual smolt production from the Smith Island Restoration Project was estimated at approximately 43,000 by multiplying channel area by smolt density by an estuarine survival factor of 0.77 calculated in the Skagit River estuary. Given the variability and uncertainty around the density and survival numbers, smolt production estimates should be viewed as an order-of-magnitude estimate rather than an absolute value.

MARINE SURVIVAL

Marine survival is highly variable from year to year depending on ocean conditions. It is also influenced by the quality of estuarine habitat available because fish that reside in the estuary longer grow larger, and thus are more likely to survive in the marine environment. The challenge of calculating a reasonable marine survival estimate is further confounded by harvest (some estimates reported include harvest while others do not) and lack of data on marine survival in wild populations. Most values reported in the literature are for hatchery populations, and these values are much lower than values reported for wild populations. Three studies were evaluated that report marine survival for wild populations pre-harvest. In the Skagit River during a 4 year period, marine survival ranged from 1.6 to 3.9 percent, with a mean value of 2.6 (Beamer et al., 2000). For the estimate of likely returning adults, a figure of 2 percent was selected, the lowest of the marine survival estimates for wild populations. It should be noted that marine survival estimates for Snohomish River basin hatchery Chinook is much lower than the wild stock marine survival estimates.

ADULT SALMON RETURNS

The estimated annual return based on the estimates of channel area, smolt production and marine survival is calculated as follows:

$$\begin{array}{rcl} 110,400 & \text{square meters of blind tidal channel} & \\ \times & 0.52 & \text{Chinook salmon smolts per square meter} \\ \times & 77 & \text{percent estuary survival} \\ \times & 2 & \text{percent marine survival} \\ \hline = & 900 & \text{Chinook salmon per year (884 rounded)} \end{array}$$

Given the uncertainty and variability, this number has significant error bars. This study estimates the low end of the range at approximately 120 Chinook per year and the high end at 3,700 Chinook per year. To calculate the actual range and confidence interval, running a Monte Carlo simulation model is recommended using ranges for each of the three main independent variables: tidal channel area, smolt production and marine survival.

HARVEST VALUE OF SALMON

Calculations for the potential harvest value of salmon produced by the Smith Island Restoration Project are divided into the following steps:

1. Find average retail price of wild Chinook salmon.
2. Calculate number of adult Chinook salmon returning to the Snohomish River basin annually as a result of the Smith Island Restoration Project.
3. Multiply retail price of Chinook (#1 above) by numbers of Chinook (#2 above)

These steps are outlined in more detail below:

AVERAGE RETAIL PRICE OF WILD CHINOOK SALMON

Average retail prices of wild Chinook salmon are extremely difficult to obtain and can vary substantially from year to year. Consider this extract from a comprehensive analysis of salmon fisheries in North America.

“We are unaware of any reliable source of data on “average” U.S. retail prices for fresh and frozen salmon. Although it is easy to go into a store and see what a particular salmon product is selling for in that particular store in that particular week, it is very difficult to determine “average” or even “typical” prices of salmon sold in a particular area—much less the entire country. This is especially the case because quantities sold vary dramatically between different stores and at different times. A store with a high price may be selling far less salmon than a store with a low price” (Knapp 2007).

In determining a suitable price (per pound) for wild Chinook salmon, this study took the average of three advertised retail prices. The approach was conservative in at least two respects:

- Prices were taken from established retailers who are likely to have relatively stable, low prices. To illustrate, two of the retailers are located in Pike Place Market, Seattle, and have been in operation since 1911 and 1965 respectively. These retailers are also “direct” in the sense that they are located geographically close to a harbor and likely have strong ties to fishermen, so their prices may be lower than other retail outlets such as supermarkets.
- Prices were based on the per-pound prices of *whole* salmon, rather than per-pound prices of other salmon products such as boneless skinless fillets. This pricing eliminates the potential effect of price markups on value-added salmon products. In reality, not all Chinook salmon would be sold as whole fish to consumers, and economic measures which count ‘final value’ (i.e. GDP) would likely measure a higher per-pound retail value on average.

The per-pound retail prices for salmon as of February 21, 2011 are as follows:

- \$11.82 per lb. (\$165.50 per 13-14 lbs., head on, gutted).
<http://www.seattleseafoods.com/salmon/alaskan-king-salmon-chinook-salmon/chinook-king-salmon-troll-caught-headed-and-gutted-iqf>
- \$13.99 per lb. (\$279.80 price per 20 pound fish, whole wild troll-caught Chinook salmon).
<http://www.pikeplacefish.com/salmon.html>
- \$15.25 per lb. (9-10 lbs., \$152.50, whole wild Chinook salmon)
<http://www.freshseafood.com/store/detail.aspx?sn=FreshSalmon&id=1&cat=1>

The average of these three values equals $$(11.82 + 13.99 + 15.25)/3 = \13.69 per lb. If the average weight of a harvested Chinook salmon is 15 pounds (Tulalip Tribes, personal communication, 2010), then each whole fish has a retail value of approximately \$205.35.

ESTIMATED ANNUAL CHINOOK RETURNS

Analysis by Snohomish County and the Tulalip Tribes estimates that the proposed project will produce approximately 900 returning Chinook annually.

FINAL HARVEST VALUE OF CHINOOK

Combining the retail value of Chinook with the estimated annual Chinook returns, the salmon harvest value of the Smith Island Restoration Project was estimated:

- 900 Chinook per year embody a retail value of $(900 \text{ Chinook/year} \times \$205.35/\text{Chinook}) = \$184,815.00$ per year

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Tulalip Tribes, personal communication, 2010. 15 pounds per fish, used as an average harvest number by the Pacific Salmon Commission

Appendix D

Current and Future Bird Use of the Project Area

March 2011, by Terri Wentworth-Davis, Planner, Snohomish County Public Works

INTRODUCTION

This section discusses the bird population within the project area located in the northeast corner of Smith Island. The potential changes to avian diversity were identified as an important part of the restoration project. Snohomish County Public Works staff Terri Wentworth-Davis, Paul Marczin, Jed Marshall, Sean Gross, and Beth Larsen worked on various aspects in collecting and assembling data for this discussion. County staff also conducted a fall survey to identify bird species found in the project area. No detailed surveys have been conducted within the project area, however, some information for the bird species has been extrapolated from known sightings at nearby Spencer Island. It is expected that many of the same species would be found in the project area.

Information for the bird species discussion was also collected from the following publications: Washington Department of Fish and Wildlife (WDFW) Priority Habitat and Species Management Recommendations (2000) and WDFW Comprehensive Wildlife Conservation Strategy (2005), the City of Everett Snohomish Estuary Wetland Integration Plan (1997), Breeding Birds of Washington State (1997), Snohomish County Public Works DD6 Restoration plan (1996), Northern Pacific Coast Regional Shorebird Management Plan (2000), USFWS Nisqually National Wildlife Refuge Final Comprehensive Conservation Plan (2005), Nearshore Birds in Puget Sound (2006), International Union for Conservation of Nature (IUCN) Red List (2010) and Fish Assemblages and Juvenile Salmon Diets at a Breached Dike Wetland Site: Spencer Island (2001).

Websites reviewed include the National Audubon Society Christmas Bird Count, Audubon Washington State of the Birds, Partners in Flight, Birdweb, Tweetters, Cornell Lab of Ornithology, and the Washington Ornithological Society (see Reference in this Appendix for full citations). Information was also collected from personal communications with Pilchuck Audubon Society members and individuals knowledgeable of bird use of the area.

The Snohomish River estuary is an important stopover on the Pacific Flyway, which is a regional flight corridor for migratory waterfowl, neotropical migrants, and other avian fauna. The Pacific Flyway extends from Alaska south to Mexico and South America. Smith Island also provides habitat for many resident bird species. Historically, the tidal marshes were interspersed with islands of forested wetlands on Smith Island which provided roosting habitat for shorebirds during high tides and important habitat for many other bird species (City of Everett 1997). Most of the original estuary has been diked and drained eliminating much of this habitat.

Estuaries are one of the most productive ecosystems on Earth, supporting more life per square inch than the richest farmland (NERRS accessed 2011). Breaching the existing dike would restore part of the estuarine tidal marshes and dendritic channels that were historically here and

benefiting vulnerable populations of sandpipers that have declined along the Pacific Coast as well as other species (see Table A, Vulnerable Bird Species in the Project Area; see also Table C, Smith Island Wildlife Population – Birds in Appendix E).

The project area is expected to provide critical wintering habitat, and feeding and resting habitat during migration, benefiting waterfowl, shorebirds, and raptors. Loss of upland habitat such as shrubby areas and patches of trees would affect more common species in the short term including wrens, sparrows, woodpeckers, and warblers. Changes in the habitat may also affect foraging by some raptors and upland birds, such as ring-necked pheasants. However, the trade-off of disturbed upland and wetland habitat for estuarine mudflats and marsh is of regional effect and an overall benefit to shorebirds and waterfowl.

Native trees and shrubs will be planted and are expected to reestablish in the project area which will benefit many species in the long term. For more information on birds expected to be present in the project area pre- and post-construction, see Table C, Smith Island Wildlife Population – Birds in Appendix E.

WATERFOWL

It is anticipated that breaching the dike will provide more habitat for waterfowl to forage. Currently, waterfowl use parts of the project area year round with an influx of species during fall migration. Many of these species will stay to winter in the fields and along the shores of Union Slough. Smaller numbers migrate through in the spring. Species found year round in the project area may also nest in the grassy fields and near the slough.

Canada geese and mallards are found year round while Northern pintail*, green-winged teal, Northern shoveler, and American wigeon arrive during fall migration with many wintering over. Blue-winged teal and redhead can be found on occasion during summer months. Gadwall and ring-necked duck* are found on Spencer Island so it is expected they would use the project area too.

Species such as tundra and trumpeter swan may currently use the estuary as a night roost during fall and winter. Swans* and snow geese use may increase as new food supplies become available such as wapato (Cordell 1999). The Spencer Island report found that wapato recolonized the island after breaching the dike. Wapato is a favorite plant of swans as well as a variety of other waterfowl (USDA NRCS 2011). Greater white-fronted geese found on Spencer Island may also start using the project area during winter. Marine species such as goldeneye, bufflehead, and mergansers are expected to increase their use of the project area. Providing more estuarine area will change the use by dabbling ducks such as northern pintails and mallards. They would spend time foraging on the mudflats and in shallow water as opposed to foraging in flooded fields as they currently do. They would also lose nesting habitat in areas adjacent to the slough.

WATERBIRDS AND SEABIRDS

Waterbirds and seabirds tend to be found in or near the slough bordering the dike as well as in the pasture and cattail areas. Waterbirds and seabirds found year-round in the project area include great blue heron*, Virginia rail, double-crested cormorant, glaucous-winged gull, ring-billed gull, and American coot. Other species found on and around the project area seasonally include Western grebe*, sora, and Bonaparte's and mew gull. Soras are generally found during the summer months in the project area, however, they are known to winter here on rare occasions. Based on the habitat types and sightings on Spencer Island, it is also expected that American Bittern*, green heron, and pied-billed grebe would be found in the project area. Virginia rail are found in cattail areas and tall grassy areas, while great blue herons forage in the pastures. Western grebe are expected to continue to use the area.

It is anticipated that most waterbird and seabird species populations would increase in the project area. Restoring the estuarine area will provide more feeding opportunities for great blue heron and most species of waterbirds and seabirds. Sora, Virginia rail, and American bittern may initially lose some nesting habitat, but as cattail cover increases in the project area, this would provide additional habitat for these species.

SHOREBIRDS

It is anticipated that breaching the dike will improve habitat for shorebirds. According to the Washington Department of Fish and Wildlife (WDFW), many shorebirds in Western Washington require tidal estuarine ecosystems for foraging. These include black-bellied plover, dunlin, western sandpiper, and dowitchers that forage on mudflats with high levels of silt. Joseph Buchanan writes, "Shorebirds are specialists with a narrow range of microhabitat condition needs." (WDFW 2000) Estuarine restoration will provide this valuable microhabitat and restore vital wintering and migratory habitat for shorebirds. Trees left in the project area will eventually fall and may provide roosts for shorebirds during high tide. Scattered constructed hummocks may also provide roosting areas for shorebirds.

The Snohomish River estuary is known to support long-billed and short-billed dowitchers*, dunlin*, black-bellied plovers*, western sandpipers* and greater* and lesser yellowlegs* during both spring and fall migration. Neotropical migrants such as Baird's*, sharp-tailed, and pectoral* sandpipers, and Pacific* and American golden plovers* are found on rare occasions during fall migration. It is likely that all of the above species can be found during migration within the project area. Some of these species such as dunlin and plovers also commonly winter in the project area.

Shorebird species that were confirmed to use the project area include killdeer*, Wilson's snipe*, dunlin, pectoral sandpiper, Baird's sandpiper, Black-bellied, American and Pacific golden plovers, and both species of dowitchers and yellowlegs. Wilson's phalarope* have been found in the project area during summer and are rare breeders in Western Washington.

Dowitchers, greater yellowlegs, black-bellied plover, dunlin, western sandpiper, and least sandpiper*use of the project area is expected to increase during migration and winter. These species are found foraging in tidal mud flats and flooded fields. Lesser yellowlegs may utilize the area periodically, however, they primarily forage along shallow ponds and lakes. Killdeer will lose nesting habitat but more foraging opportunities are expected in the mudflats. Wilson's snipe will lose wet meadows for wintering.

Less common species such as golden plovers may increase their use of the project area and forage in mud flats. It is expected that solitary sandpiper and Baird's sandpiper which do not use the area regularly will use other areas as the current habitat changes to estuarine conditions. Wilson's phalarope are a rare breeder and possible migrant to the area. It is expected that if they are breeding in the project area, they would potentially lose this opportunity upon estuarine restoration but may still forage in the shallow water (see Table C in Appendix E).

LANDBIRDS

Landbirds include both resident birds and neotropical migrants. Many neotropical migratory populations have been in decline. Most of these migratory species depend on forested habitat which are limited within the project area. As overall ecological productivity increases it is likely that most landbirds will benefit. The following discussion of landbirds includes raptors, nonpasserines, and passerines.

RAPTORS

Raptors using the project area include a variety of owl and hawk species. All of these species have varied life histories and use the project area differently. Resident raptors observed in the project area include short-eared owl*, barn owl, great horned owl, bald eagle*, northern harrier, red-tailed hawk, Cooper's hawk, sharp-shinned hawk, merlin, and peregrine falcon*. Turkey vultures have been observed flying over the project area during fall migration.

Osprey nest in nearby Port Gardner Bay and hunt the slough in the project area during summer months. Rare winter raptors seen in the project area include snowy owl, Northern goshawk*, gyrfalcon, and golden eagle*. Based on the habitat types, it is expected that Western screech owls may occur in the evergreen trees and American kestrels may occur in the pastures. Both of these species would occur in the project year-round.

It is anticipated that peregrine falcons, merlins, and gyrfalcons will benefit from the increase in food sources provided by increasing numbers of shorebirds and waterfowl. Buteos, such as red-tailed hawks, and accipiters, such as Cooper's hawks, will lose foraging habitat in the short term. As the old dike becomes forested, habitat for these raptors would return. Bald eagles will benefit from the increasing numbers of waterfowl and fish.

Osprey-use of the project area is expected to significantly increase as more fish become available. Golden eagles are a rare winter visitor and are not known to forage in the project area. If so, they may lose the opportunity to forage since they primarily feed on small mammals.

Northern harriers nest in cattail marshes so they may eventually benefit from the increase in cattails. They would lose the ability to forage for small mammals but gain in their ability to forage for ducks. Northern goshawks and snowy owls are uncommon winter visitors that may lose foraging opportunities.

It is anticipated that owl species will decline due to the loss of forested habitat and open areas. The trees left in the project area to be inundated will create snags providing temporary roosting or nesting areas. Short-eared owls and barn owls would lose foraging areas. Trees on the old dike and hummocks will provide limited roosting and nesting habitat in the long term.

NONPASSERINES

A variety of nonpasserines are found in the project area. Snags provide nesting and feeding opportunities for woodpeckers as well as smaller birds. Shrubby areas and nearby flowering trees provide food and shelter for hummingbirds. Mourning doves are found during fall and winter in the meadow areas and belted kingfishers hunt in Union Slough.

Species found in the project area include rufous hummingbird, mourning dove, belted kingfisher, pileated woodpecker*, red-breasted sapsucker, Northern flicker, and downy woodpecker. Black and Vaux's swifts forage for flying insects over the project and adjacent areas during the summer months. Pasture and meadow areas provide habitat for ring-necked pheasants.

It is anticipated that woodpeckers would benefit in the short term by the increased number of dead and dying trees in the project area. Once these trees fall, they would lose foraging habitat. As trees mature on the old dike and hummocks, new habitat will be created in the long term. Rufous hummingbirds would lose foraging and nesting habitat as the shrubs and trees die. They will gain some of this lost habitat back as planted shrubs and trees mature. Black and Vaux's swifts will benefit from the increase in flying insects over the estuary. Mourning doves would lose foraging habitat in pastures and meadows. The project will increase foraging opportunities for belted kingfishers.

PASSERINES

Cattails, shrubby areas, evergreen tree patches and deciduous trees provide habitat for a variety of passerine species. The deciduous trees in the nursery provide cover during the spring and summer nesting season.

Resident passerines commonly found in the project area include American crow, Stellar's jay, song sparrow, spotted towhee, American robin, red-winged blackbird, marsh wren, Bewick's wren, Pacific wren, black-capped and chestnut-backed chickadee, bushtit, dark-eyed junco, cedar waxwing, purple finch, and golden-crowned and ruby-crowned kinglet. European starling, brown-headed cowbird, and brewer's blackbird are found in the pasture areas. Fox sparrow, white-crowned sparrow, golden-crowned sparrow, yellow-rumped warbler, orange-crowned warbler, and purple finch are also found in the project area. Brown creepers forage on the bark of the

evergreen trees. It is expected that American goldfinch would be found in the project area year-round.

Neotropical migrant passerines, commonly found in the project area, include cliff, tree, and barn swallows and common yellowthroat. Small numbers of Western meadowlarks winter in the fields and savannah sparrows summer in the project area. Other neotropical migrants expected to be found include olive-sided flycatcher*, black-headed grosbeak, western tanager, yellow warbler, and Wilson's warbler.

Several uncommon species are seen regularly in small numbers. Western kingbird are a rare migrant and eastern kingbird are a rare breeder. Lazuli bunting* have been seen on occasion in the fall and spring. Lincoln's sparrow are uncommon in the project area; rare sparrows found include swamp sparrow and Harris's sparrow.

It is anticipated that swallows would benefit by the increase in insect forage over the water. Red-winged blackbirds and marsh wrens would benefit by increases in insects and cattail marsh habitat. Sparrow numbers will fall initially but as shrubs grow on the old dike and on the scattered hummocks, it is expected that this will provide habitat for them.

Many passerines that rely on shrubby or forested areas would lose foraging and nesting habitat in the project area. Birds such as flycatchers would lose nesting areas and chickadees and kinglets would temporarily lose foraging areas. Vireos, warblers, finches, and wrens would also lose nesting and foraging areas. Small numbers of the displaced species may return as native trees and shrubs recolonize the area on the old dike. Native shrubs and trees will also be planted on the old dike and the manmade hummocks will provide increased habitat areas for many passerine species in the long term.

*Vulnerable Bird Species (see Table A).

TABLE A – VULNERABLE BIRD SPECIES IN THE PROJECT AREA

Species Name	WDFW CWCS ¹	WDFW PHS or Listed Species ²	USFWS Birds of Conservation Concern ³	US Shorebird Plan priority ⁴	USFWS ESA listed	Audubon WA State of the Birds ⁵	Audubon/American Bird Conservancy Watch list ⁶	IUCN Red List ⁷
Brant	Y	Migratory stopovers						
Trumpeter swan	Y	Regular concentrations					Yellow-rare	
Cinnamon teal						Low risk		
Northern pintail	Y							
Canvasback						Moderate risk		
Ring-necked duck						Moderate risk		
Greater scaup	Y							
Lesser scaup	Y					Moderate risk		
Common goldeneye						Low risk		
Hooded merganser						Moderate risk		
Ruddy duck						Moderate risk		
Western grebe	Y	Candidate-Regular winter concentrations, migratory stopovers				High risk		
American bittern						Moderate risk		
Great blue heron	Y	Breeding areas						
Bald eagle	Y	Sensitive-Breeding, regular concentrations	Breeding		Species of concern			
Northern goshawk	Y	Candidate-Breeding area				Moderate risk		

Species Name	WDFW CWCS ¹	WDFW PHS or Listed Species ²	USFWS Birds of Conservation Concern ³	US Shorebird Plan priority ⁴	USFWS ESA listed	Audubon WA State of the Birds ⁵	Audubon/American Bird Conservancy Watch list ⁶	IUCN Red List ⁷
Golden eagle	Y	Candidate-Foraging areas						
Peregrine falcon	Y	Sensitive-Breeding areas, regular occurrences	Breeding		Species of concern			
Virginia rail						Moderate risk		
Sora						Moderate risk		
Black bellied plover				M and W high concern		Low risk		
American golden plover						Low risk	Yellow-declining	
Pacific golden plover						Low risk		
Semipalmated plover						Moderate risk		
Killdeer				M, W high concern				
Greater yellowlegs				M, W high concern		Low risk		
Lesser yellowlegs			Non-breeding	M low priority		Low risk		
Solitary sandpiper			Non-breeding	M low priority				
Western sandpiper				M, W high concern		Low risk	Yellow-rare	
Least sandpiper				M, W moderate concern		Low risk		
Baird's sandpiper						Low risk		
Pectoral sandpiper						Low risk		
Dunlin				M, W high concern				
Short billed dowitcher			Non-breeding	M high concern		High risk		

Species Name	WDFW CWCS ¹	WDFW PHS or Listed Species ²	USFWS Birds of Conservation Concern ³	US Shorebird Plan priority ⁴	USFWS ESA listed	Audubon WA State of the Birds ⁵	Audubon/American Bird Conservancy Watch list ⁶	IUCN Red List ⁷
Long billed dowitcher				M, W moderate concern		Moderate risk		
Wilson's snipe				M, W, B high concern		Moderate risk		
Wilson's phalarope						Moderate risk		
Heermann's gull								NT
Short-eared owl							Yellow-declining	
Vaux's swift	Y	Candidate-Breeding areas, communal roosts						
Pileated woodpecker	Y	Candidate-Breeding areas						
Olive-sided flycatcher							Yellow-declining	NT
Willow flycatcher						Moderate risk		

- 1 WDFW Comprehensive Wildlife Conservation Strategy. 2005. Identifies species of greatest conservation needs in Washington State.
- 2 WDFW Priority Habitats and species. 2010.
- 3 US Fish and Wildlife Service. Division of Migratory Bird Management. 2008.
- 4 Northern Pacific Coast Regional Shorebird Management Plan conservation priority species. 2000. See report for details of definitions.
- 5 Audubon Washington State of the Birds Report. 2009. Annual list of species of concern. Moderate risk/low risk as it relates to the threat of climate change and habitat changes.
- 6 Comprehensive analysis of all of the bird species in the United States that reveals those in greatest need of immediate conservation attention. Yellow rare- population is stable; may not be facing extreme threats but have small ranges and small populations/Yellow declining- currently widespread & relatively abundant but facing significant threats & undergoing population declines. 2007.
- 7 International Union for Conservation of Nature Red List of Threatened Species. Version 2010.4. IUCN list is a comprehensive, objective global approach for evaluating the conservation status of plant and animal species. NT- near threatened.

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Appendix E

Current and Future Wildlife Use of the Project Area

March 2011, by Terri Wentworth-Davis, Planner, Snohomish County Public Works

The following matrix of wildlife species was used to evaluate how the project may impact species that currently may be present in the project area post-breaching of the dike. Many species-occurrences have been extrapolated from known sightings in adjacent areas, are known to be in the project area, or are based on existing habitats. This is not an exhaustive list.

LEGEND

Present Status	
c	common - certain to be seen in suitable habitat
u	uncommon - present but not certain to be seen
o	occasionally or infrequently seen
r	rare - known to be present, but not every year
h	hypothetically present - known to occur in similar habitat in Western WA; presence not confirmed in project area

Status After Breach (benefit to the species as a whole and not specific to the project area)	
*	neutral or no net benefit to species
+	net benefit to species
-	net detriment to species

Rationale (expresses the rationale for inferring species status after breach)	
1	water regime change - from seasonal winter flooding to daily tidal flooding
2	increased productivity and food chain support - results from tidal flooding
3	physical changes in habitat - water salinity, vegetation and structural
4	relatively neutral to above changes

TABLE A – SMITH ISLAND WILDLIFE POPULATIONS – REPTILES

Species	Present Status	Post Breach	Rationale	Comments
Northwestern garter snake	u	-	1 & 3	Found around forest edges and roadside ditches. Generally avoids water.
Common garter snake	c	-	1 & 3	Generally found near water

TABLE B – SMITH ISLAND WILDLIFE POPULATIONS – AMPHIBIANS

Species	Present Status	Post Breach	Rationale	Comments
Northwestern salamander	h	-	1 & 3	Need permanent freshwater including ditches. Generally found in older forests.
Long-toed salamander	h	-	1 & 3	Rarely seen - nocturnal and subterranean much of year. Also can be found in freshwater ditches.
Ensatina	u	-	1 & 3	Found in forests under logs and stumps.
Western redback salamander	u	-	1 & 3	Found in forests with rocks, forest litter, sword ferns.
Roughskin newt	u	-	1 & 3	Only salamander routinely active during day. Uses freshwater ditches.
Western toad	h	-	1 & 3	Breed in permanent or temporary with shallow sandy bottoms. Disperse to damp forest.
Pacific tree frog	c	-	1	Does best in isolated water bodies -vulnerable to bullfrog predation
Red-legged frog	c	-	1	Found in forest, damp meadows, ponds, marshes, lakes, and streamsides.
Bullfrog	c	-	1	Introduced pond breeder

TABLE C – SMITH ISLAND WILDLIFE POPULATIONS – MAMMALS

Species	Present Status	Post Breach	Rationale	Comments
Virginia opossum	c	-	3	Upland areas-- introduced
Pacific water shrew	h	*	4	
Dusky shrew	h	-	3	
Trowbridge's shrew	r	-	3_	
Vagrant shrew	c	-	3	Possibly most common shrew
American shrew-mole	c	-	3	Lives mostly in forest duff
Coast mole	u	-	3	Occurs in wooded areas
Townsend's mole	c	-	3	
Big brown bat	c	+	2	May roost in trees and snags on site
Hoary bat	u	+	2	Roosts in nearby conifer forest
Silver-haired bat	h	+	2	May roost in trees and snags on site
California myotis	h	+	2	May roost in trees and snags on site
Long-eared myotis	h	+	2	May roost in trees and snags on site
Little brown myotis	h	+	2	May roost in trees and snags on site
Long-legged myotis	h	+	2	May roost in trees and snags on site
Townsend's big-eared bat	h	+	2	May roost in trees and snags on site
Coyote	c	+	2	
Red fox	o	+	2	This lowland population is introduced
Black bear	o	+	2	
Northern raccoon	c	+	3	
River otter	c	+	2 & 3	
Western striped skunk	u	+	2	
Spotted skunk	r	+	2	
Short-tailed weasel (ermine)	u	+	2	
Long-tailed weasel	c	+	2	
Mink	u	+	2	
Mountain lion	o	+	2	1990 sighting on Ebey I.

TABLE D – SMITH ISLAND WILDLIFE POPULATIONS – BIRDS

Species	Present Status	Post Breach	Rationale	Comments
Greater white-fronted goose	o	*	4	Winter visitor in flocks of Canada geese
Snow goose	o	+	1 & 3	Winter visitor
Brant	o	*	4	Needs eelgrass
Canada goose	c	+	2	Nests in estuary
Trumpeter swan	h	+	2	Winters in flooded fields in Snohomish watershed
Tundra swan	h	+	2	Winters in small numbers in flooded fields in Snohomish watershed
Wood duck	u	-	3	Nests in forests near ponds.
Gadwall	c	+	1	Nests in estuary. Large numbers in winter.
American wigeon	c	+	1 & 3	Graze terrestrial and emergent veg.
Eurasian wigeon	r	+	1 & 3	Graze terrestrial and emergent veg.
Mallard	c	+	1 & 2	Most common year-round duck--nests in estuary
Blue-winged teal	u	+	1 & 2	Nests in estuary
Cinnamon teal	u	+	1 & 2	Nests in estuary
Northern shoveler	c	+	1	Limited nesting in estuary. Winter
Northern pintail	c	+	1	Very common especially in winter
Green-winged teal	c	+	1, 2 & 3	Extensive winter feeding on intertidal mud flats
Canvasback	r	+	2	Small to moderate numbers winter in Port Gardner Bay
Redhead	r	+	2	Infrequently seen in Port Gardner Bay
Ring-necked duck	c	*	4	Common migration and winter.
Greater scaup	u	+	1 & 2	Prefers saltwater
Lesser scaup	c	-	1 & 2	Prefers freshwater
Surf scoter	o	+	2 & 3	Migration and winter. Prefer rocky substrates.
White-winged scoter	o	+	2 & 3	Late summer, fall, winter. Prefer deep water.
Black scoter	o	+	2 & 3	Winters generally on coastlines.
Bufflehead	c	+	1 & 2	Prefer shallow bays and inlets. Fall and winter.
Common goldeneye	u	+	1 & 2	More common in river channel
Barrow's goldeneye	u	+	1 & 2	More common in river channel
Hooded merganser	u	-	4	More likely seen in winter. Nests in forested areas near freshwater ponds
Common merganser	u	+	1 & 2	Use estuaries in winter. Otherwise found on freshwater.
Red-breasted merganser	c	+	1 & 2	Prefers saltwater areas.

Species	Present Status	Post Breach	Rationale	Comments
Ruddy duck	c	+	1 & 2	Winter
Ring-necked pheasant	u	-	3	Introduced. May be found in grassy areas
Ruffed grouse	o	-	3	Prefers forested areas
California quail	u	-	3	Introduced.
Red-throated loon	o	+	2 & 3	Winter
Common loon	r	+	2 & 3	Winters in Port Gardner Bay
Pied-billed grebe	c	-	3	Common in small numbers in nearby ponds and lakes.
Horned grebe	o	+	2 & 3	Winter
Red-necked grebe	o	*	2 & 3	Winter
Western grebe	u	+	2 & 3	Winter
Clark's grebe	o	*	2 & 3	Winter
Double-crested cormorant	c	+	1 & 3	Year-round
American bittern	u	+	3	Prefers cattail stands
Great blue heron	c	+	1	Year-round
Green heron	u	+	1	Summers in estuary--increasing
Turkey vulture	u	*	4	Seen flying over in summer months and during migration
Osprey	c	+	1, 2 & 3	Numerous nests in Port Gardner Bay
Bald eagle	c	+	1, 2 & 3	Winters. Several nests in area
Northern harrier	c	+	1	Forages over fields
Sharp-shinned hawk	u	*	1 & 3	Year-round
Cooper's hawk	u	*	1 & 3	Year-round
Northern goshawk	o	*	1 & 3	winter
Red-shouldered hawk	o	-	1	Seen infrequently
Red-tailed hawk	c	-	1 & 3	Year-round
Rough-legged hawk	r	-	1 & 3	Winter only
Golden eagle	o	+	1 & 3	Seen in winter
American kestrel	u	-	1 & 3	Probably year-round
Merlin	u	+	2	Year-round
Gyrfalcon	r	+	2	Winter
Peregrine falcon	u	+	2	Year-round
Virginia rail	c	+	3	Year-round in cattail stands
Sora	u	+	3	Summers in cattail stands. Infrequent winter.
American coot	c	+	1 & 3	Winter
Black-bellied plover	u	+	1, 2 & 3	Seen nearby in small numbers; winter and migration.
American golden plover	u	+	1, 2 & 3	Fall migrant
Pacific golden plover	u	+	1, 2 & 3	Fall migrant

Species	Present Status	Post Breach	Rationale	Comments
Semi-palmated plover	r	+	1, 2 & 3	Spring migrant
Killdeer	c	*	4	Breeds locally
Greater yellowlegs	c	+	1, 2 & 3	Migrant and winter.
Lesser yellowlegs	r	+	1, 2 & 3	Migrant and winter.
Solitary sandpiper	r	-	1, 2 & 3	Migrant; prefer freshwater
Spotted sandpiper	u	+	1, 2 & 3	Breeds locally
Whimbrel	o	+	1, 2 & 3	Spring migrant
Sanderling	r	+	1, 2 & 3	Migrant and year-round.
Semipalmated sandpiper	o	-	1, 2 & 3	Migrant; prefer freshwater
Western sandpiper	u	+	1, 2 & 3	Migrant and winter
Least sandpiper	u	+	1, 2 & 3	Migrant and winter
Baird's sandpiper	r	-	1, 2 & 3	Fall migrant
Pectoral sandpiper	r	+	1, 2 & 3	Fall migrant
Sharp-tailed sandpiper	o	+	1, 2 & 3	Fall migrant
Dunlin	c	+	1, 2 & 3	Most common winter shorebird and migrant
Stilt sandpiper	o	*	4	Summer migrant. Prefers freshwater areas.
Short-billed dowitcher	u	+	1, 2 & 3	Migrant and winter
Long-billed dowitcher	u	+	1, 2 & 3	Migrant and winter
Wilson's snipe	c	-	1, 2 & 3	Breeds locally
Wilson's phalarope	o	+	1, 2 & 3	Spring migrant --seen at various estuary locations. Rare breeder in Western Washington.
Franklin's gull	r	+	2	During migration
Bonaparte's gull	c	+	2	Common overhead during fall, winter, spring.
Heermann's gull	r	+	2	Summer and fall
Mew gull	c	+	2	Fall, winter, spring
Ring-billed gull	c	+	2	Fall, winter, spring. Breeds elsewhere
California gull	c	+	2	Fall, winter, spring. Breeds elsewhere.
Herring gull	u	+	2	Fall, winter, spring. Breeds elsewhere.
Thayer's gull	r	+	2	Fall, winter, spring. Breeds elsewhere
Western gull	u	+	2	Year-round
Glaucous-winged gull	c	+	2	Year-round
Caspian tern	c	+	2	Seen flying overhead spring, summer, fall.
Common tern	r	+	2	Seen flying overhead fall, winter, spring.
Forster's tern	r	+	2	Summer migrant
Rock pigeon	c	*	4	Introduced. Year round
Band-tailed pigeon	o	-	3	More common spring and summer. Populations decreasing

Species	Present Status	Post Breach	Rationale	Comments
Mourning dove	u	-	3	Year round
Barn owl	c	-	3	Nests in area
Western screech-owl	u	-	3	Year round
Great horned owl	c	-	3	Year round
Snowy owl	r	+	2	Winter
Northern pygmy owl	r	-	3	Year round
Barred owl	u	-	3	Populations increasing
Short-eared owl	h	+	3	More frequent winters
Northern saw-whet owl	h	-	3	Year round
Common nighthawk	u	+	2	Observed flying overhead throughout estuary in summers
Black swift	u	+	2	Observed flying high overhead summers
Vaux's swift	u	+	2	Observed flying overhead summers
Anna's hummingbird	u	-	3	Uncommon year round
Rufous hummingbird	c	-	3	Breeds in estuary
Belted kingfisher	c	+	2	Year round
Red-breasted sapsucker	r	-	3	Year round
Downy woodpecker	c	-	3	Year round
Hairy woodpecker	u	-	3	Year round
Northern flicker	c	-	3	Year round
Pileated woodpecker	u	-	3	Year round
Olive-sided flycatcher	u	*	3	Spring and summer
Western wood-peewee	u	*	3	Spring and summer
Willow flycatcher	c	*	3	Spring and summer
Hammond's flycatcher	u	*	4	Spring and summer
Dusky flycatcher	o	*	4	Spring and summer
Pacific slope flycatcher	c	*	4	Spring and summer
Western kingbird	u	*	4	Spring and summer migrant
Eastern kingbird	u	*	4	Rare breeder
Northern shrike	r	*	2	Winter
Cassin's vireo	o	-	3	Prefers coniferous forest. May be more common. Spring/summer
Hutton's vireo	r	-	3	Year round. Found in mixed forests.
Warbling vireo	r	-	3	Spring and summer. May be more common
Steller's jay	c	-	3	Year round. Prefers forested areas.
American / northwestern crow	c	+	2	Year round
Common raven	u	*	4	Year round

Species	Present Status	Post Breach	Rationale	Comments
Pallid Horned lark	o	-	3	Winter. Prefers grassy areas.
Purple martin	r	+	2	Spring and summer
Tree swallow	c	+	2	Spring and summer
Violet-green swallow	c	+	2	Spring and summer
Northern rough-winged swallow	u	+	2	Spring and summer
Bank swallow	o	+	2	Spring and summer
Cliff swallow	c	+	2	Spring and summer. Nests on nearby bridges and buildings
Barn swallow	c	+	2	Spring and summer
Black-capped chickadee	c	-	3	Year round
Chestnut-backed chickadee	c	-	3	Year round
Bushtit	c	-	3	Year round
Red-breasted nuthatch	c	-	3	Year round
Brown creeper	u	-	3	Year round
Bewick's wren	c	-	3	Year round
Pacific wren	u	-	3	Year round
Marsh wren	c	+	2 & 3	Year round
Golden-crowned kinglet	c	-	3	Year round
Ruby-crowned kinglet	c	-	3	Year round
Townsend's solitaire	u	*	4	Migrant
Swainson's thrush	c	-	3	Summer
Hermit thrush	r	-	3	Migrant
American robin	c	-	3	Year round
Varied thrush	u	-	3	Winter
European starling	c	-	3	Introduced. Year round
American pipit	r	*	4	Winter only
Cedar waxwing	c	-	3	Year round
Orange-crowned warbler	u	-	3	Spring, summer, fall
Yellow warbler	u	+	3	Prefers shrubby willow habitat
Yellow-rumped warbler	c	-	3	Summer
Black-throated gray warbler	u	-	3	Spring and summer
Townsend's warbler	u	-	3	Spring and summer, irregular winter
MacGillivray's warbler	r	-	3	Prefers shrubby undergrowth
Common yellowthroat	c	+	2	Breeds in wetlands. Spring and summer
Wilson's warbler	c	+	3	Spring and summer
Western tanager	u	-	3	Migrant

Species	Present Status	Post Breach	Rationale	Comments
Spotted towhee	c	-	3	Year round
Chipping sparrow	r	-	3	Spring and summer
Savannah sparrow	c	-	3	Spring and summer
Fox sparrow	u	-	3	Winter
Song sparrow	c	-	3	Year round
Lincoln's sparrow	u	-	3	Winter
Swamp sparrow	r	+	3	Winter
White-throated sparrow	r	-	3	Winter
Harris' sparrow	r	-	3	Winter
White-crowned sparrow	c	-	3	Spring and summer
Golden-crowned sparrow	c	-	3	Winter and spring
Dark-eyed junco	c	-	3	Year round
Black-headed grosbeak	u	-	3	Summer
Lazuli bunting	o	-	3	Summer only
Red-winged blackbird	c	+	2 & 3	Year round
Western meadowlark	u	-	3	Winter
Yellow-headed blackbird	o	+	2 & 3	Migrant
Brewer's blackbird	c	-	3	Year round
Brown-headed cowbird	c	-	3	Year round
Bullock's oriole	r	-	3	Summer
Purple finch	u	-	3	Year round
House finch	c	-	3	Year round
Red crossbill	r	-	3	Irregular
Pine siskin	c	-	3	Year round
American goldfinch	c	-	3	Year round
Evening grosbeak	u	-	3	Year round
House sparrow	c	-	3	Introduced

Appendix F

DEIS Distribution List

TRIBES

- The Tulalip Tribes
- Stillaguamish Tribe
- Snoqualmie Tribe

FEDERAL AGENCIES

- Federal Emergency Management Agency, Region X
- National Marine Fisheries Service
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service

STATE AGENCIES

- Department of Archaeology and Historic Preservation
- Department of Ecology
- Department of Fish and Wildlife
- Department of Natural Resources
- Department of Transportation
- Natural Resources Conservation Service

LOCAL AGENCIES

- Snohomish County Parks and Recreation
- Snohomish County Planning and Development Services
- City of Everett Department of Public Works
- City of Everett Planning and Community Development

OTHER

- Burlington Northern Santa Fe Railway
- Diking District 5
- Puget Sound Energy
- Snohomish Conservation District
- Other agencies, interest groups, landowners within 1000' of the proposed project, and citizens who have participated in an earlier SEPA process have been notified of the availability of the DEIS and scheduled public hearing. A list is available upon request.