SITKA SEDGE STATE NATURAL AREA

WILDLIFE ASSESSMENT

Stewardship Section

August 2016

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1. INTRODUCTION

Wildlife Assessments (WAs) for Oregon Parks and Recreation Department (OPRD) owned or managed properties provide information on wildlife resources associated with the area. WAs are used by park staff in the development of a Master Plans, projects, grant writing, identifying restoration opportunities, and to assist partners. This WA focuses on Sitka Sedge State Natural Area, and includes:

1) Review of published or archived biological data for the site
2) Identification and mapping of significant habitat based on plant associations
3) Identification and mapping of at-risk wildlife species
4) General presence/absence wildlife surveys
5) Assessment of habitat conditions and conservation ranking of habitat communities present
6) Analysis of potential changes to the estuary and marsh based on hydrological changes
7) Development of desired future condition for wildlife habitat, and management recommendations

Sitka Sedge State Natural Area (Sitka Sedge) curls around the southern side of Sand Lake Estuary, and has long been valued for its natural resources (ODFW 1979, Fisher Environmental Services, LLC 2003, Sears 2005). Encompassing approximately 388 acres, Sitka Sedge is located in Tillamook County and spans T3SR10W Section 31, T4SR10W Section 6, and T4SR11 Section 1 (Figure 1).

At one time, parts of the property were grazed, and an artificial levee with a tide-gate was constructed to cordon off a small part of the estuary. Although the tide-gate is currently damaged, a thriving freshwater wetland has established behind the levee over the decades. At the same time, the artificial levee impedes natural tidal processes and reduces the estuary habitat that was historically present.

The dike offers a travel way that provides views of a saltmarsh on one side and a freshwater wetland on the other, which is an uncommon visitor experience. While this is an artificial development, it offers wildlife a variety of habitats in close proximity, and is a unique situation among OPRD properties

Sand Lake is second to Netart's Bay in having the smallest drainage basin (17 square miles) of Oregon's 21 estuaries. The Sand Lake Estuary contains extensive marshes and is one of only a few remaining examples of intact estuarine systems in Oregon, and presents a unique opportunity to conserve and restore an entire estuary system. In 1977, the Oregon Land Conservation and Development Commission (LCDC) classified Sand Lake as a Natural Estuary, with a management goal to preserve its natural resources and avoid constraint of dynamic processes in the ecosystem.

Sand Lake receives a lot of conservation focus based on the estuary, primarily for salmonid improvements. Other species also benefit from the estuary and ocean beaches, including migrating shorebirds, waterfowl, songbirds, and resident wildlife like the threatened Western snowy plover (*Charadrius nivosus nivosus*). Over 409 species could be using habitats at Sitka Sedge based on habitat alone, and 205 have been documented on site.

Figure 1. Site Location

Oregon Parks & Recreation Dept.
725 Summer St. NE, Suite C
Salem OR, 97301

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0 300 600 Feet

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NMOB-02812 5/3/2016

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1.1 Existing Information

Historic and current wildlife data was retrieved from the ORBIC Natural Heritage Database (ORBIC 2015), Rare, Threatened and Endangered Species of Oregon (ORBIC 2010), eBird (eBird 2016), Oregon Department of Fish and Wildlife (ODFW) Oregon Conservation Strategy (ODWF 2005), All About Birds (Cornell Lab of Ornithology), Wildlife Habitat Relationships (Johnson and O'Neil), Natural Resources of Sand Lake Estuary (ODFW 1979), Pacific Gailes Site Habitat Characterization (Fisher Environmental Services, LLC 2003), Tales of Tierra Del Mar (Sears 2005), ODFW unpublished aquatic habitat assessment data (ODFW unpublished data 2003 and 2014), and personal communications with Michelle Long (ODFW), Matt Strickland (ODFW), Trevor Cornwell (ODFW), and Adriana Morales (USFS).

1.2 Data Collection

Data and analyses for this document were conducted by using remote sensing, existing databases, interviews with park staff, information from other agencies, and field assessments. After potential wildlife species, habitat types, and surrounding landscape data were collected, the site was evaluated for desired habitat (see Section 2.1). This was determined based on rarity of present wildlife species, rarity of wildlife habitat types in the landscape, likelihood of attracting at-risk species, feasibility of restoring habitats, existing site conditions, and locally important management goals. Desired habitat conditions were then used to develop wildlife value ratings (see Section 2.1) for use in the natural resource comprehensive map that directly feeds into the Master Plan for Sitka Sedge State Natural Area.

A list of potential species occurrence was generated based on habitats present as well as species documented on site. Species habitat associations were determined from ORBIC and Johnson and O'Neil datasets. In addition, OPRD biologists collected vegetation data, described in the Vegetation Inventory and Botanical Resource Assessment for the Sitka Sedge State Natural Area (Bacheller 2016). Species were noted as one of the following:

- Present – observed on site
- Vicinity – habitat on site and observed within two miles of the site
- Potential – habitat on site and within the range of the species, but no known observations within two miles
- Unlikely – some habitat on site but low quality for species needs or at range limits of the species

Data collection consisted of walking the existing trails and meandering transects through the site, as well as detection surveys for Western snowy plover following methods outlined in Appendix J of the Western Snowy Plover Recovery Plan (USFWS 2007). Wildlife observations and sign were noted. Vanessa Blackstone (OPRD Wildlife Biologist) conducted site visits on: June 11, 2015; October 13, 2015; January 27, 2016; February 2, 2016; April 7, 2016; April 8, 2016; April 15, 2016; April 26, 2016; and May 2, 2016.

2. FISH AND WILDLIFE HABITAT

2.1 EXISTING HABITAT TYPES

The place where an animal lives is defined as a habitat type, and includes the physical and biotic conditions of the environment. Habitat types are usually defined by the dominant vegetation or a physical feature. Using plant communities identified by OPRD's botanist (Bacheller2016), habitat types for the study area were categorized into broad-level habitat groups (Figure 2) following the Wildlife Habitat Relationships of Oregon and Washington (Johnson and O'Neil 2001) and more specific habitat types adapted from ORBIC (Oregon Biodiversity Information Center). In depth assessments of species associated with these habitats have been performed (Johnson and O'Neil 2001, ORBIC 2016), which allows for wildlife occurrence predictions of Sitka Sedge based on habitat types present. Table 1 lists wildlife habitats and the plant communities found at Sitka Sedge. Additional vegetation information is available in the vegetation assessment (Bacheller 2016). The Oregon Department of Fish and Wildlife's (ODFW) Oregon Conservation Strategy (2005) describes what habitats have experienced the most loss in the Coast Range compared to historic levels, and then selected habitats based on their historic importance, ecological similarity, remaining habitat managed for conservation, limiting factors, and importance to declining wildlife species. Preserving and enhancing Oregon Conservation Strategy habitats is a way to conserve a large number of species and maintain wildlife diversity and healthy wildlife communities (ODFW 2005). Conservation Strategy habitats are noted in Table 1.

2.1 CRITICAL HABITAT

The Endangered Species Act (ESA) requires the United States Fish and Wildlife Service (USFWS) to designate Critical Habitat for listed species. Critical Habitat includes biologically suitable habitat essential to the conservation of the species, regardless of species presence. Portions of Sitka Sedge were designated as critical habitat for Western snowy plover (*Charadrius nivosus nivosus*) in 2012 (USFWS 2012), and the ocean-fronting beach is designated as a Snowy Plover Management Area (SPMA) in OPRD's Habitat Conservation Plan (HCP, see Section 3.1.9). Designated Critical Habitat for marbled murrelet (*Brachyramphus marmoratus*) and Northern spotted owl (*Strix occidentalis*) is adjacent to Sitka Sedge on the south and east. Portions of Sitka Sedge are also critical habitat for the Oregon Cost ESU (*Onchorhynchus kisutch*). Designated in 2008, critical habitat includes both Reneke Creek and Sand Lake Estuary (USFWS 2008). Due to a lack of spatial extents provided from the National Marine Fisheries Service (NMFS), Coho critical habitat is not mapped spatially the way plover, murrelet, and owl critical habitat. The Federal Register defines the estuary boundaries to the high water extent rather than a specific dataset. OPRD has engaged with NMFS to get clarification on what portions of Sitka Sedge are considered critical habitat.

Critical habitat designation impacts OPRD management at Sitka Sedge for any activities that are federally funded or require federal permits. Any action that could directly or indirectly affect critical habitat will require an evaluation of impacts and consultation with USFWS. For example, OPRD has an Incidental Take Permit (ITP) and Habitat Conservation Plan (HCP) for Western snowy plover; the ITP is a federal permit for Ocean Shore management. Actions that impact Western snowy plover critical habitat will therefore require consultation with USFWS.

Table 1. Wildlife Habitat and Plant Communities

Wildlife Habitat Type	Conservation Strategy	Dominant Plant Associations (Labeled "MIDSCALE_N" in Vegetation Assessment Database)
Coastal Dunes and Beaches	Yes	BIGHEADED SEDGE/SAND
		EUROPEAN BEACHGRASS GRASSLAND AND DUNES
		SEMI-NATIVE DUNE
		SPARSELY VEGETATED SAND AND DUNES
Conifer Kinnikinnik Woodland		CONIFER/KINNIKINNIK WOODLAND
		SHORE PINE/KINNIKINNIK WOODLAND
		SHORE PINE-SITKA SPRUCE FOREST AND WOODLAND
		SHORE PINE-SITKA SPRUCE/KINNIKINNIK WOODLAND
Coniferous Forest Wetland Mature Growth	Yes	RED ALDER-SHORE PINE-SITKA SPRUCE DITCH BANK
		RED ALDER-SITKA SPRUCE FORESTED WETLAND
		SHORE PINE FORESTED WETLAND
		SHORE PINE-SITKA SPRUCE FORESTED WETLAND
		SITKA SPRUCE FORESTED WETLAND
		SITKA SPRUCE-SHORE PINE FORESTED WETLAND
		SPRUCE-RED ALDER FORESTED WETLAND
Coniferous Forest Wetland Late-seral	Yes	SITKA SPRUCE FORESTED WETLAND
		SITKA SPRUCE-SHORE PINE FORESTED WETLAND
		SPRUCE-RED ALDER FORESTED WETLAND
Coniferous Forest Wetland Young Growth	Yes	SHORE PINE FORESTED WETLAND
		SHORE PINE-SITKA SPRUCE FORESTED WETLAND
		SITKA SPRUCE FORESTED WETLAND
		SITKA SPRUCE-RED ALDER FORESTED WETLAND
		SITKA SPRUCE-SHORE PINE FORESTED WETLAND
		SPRUCE-RED ALDER FORESTED WETLAND
Developed		BASALT OUTCROPPING

Wildlife Habitat Type	Conservation Strategy	Dominant Plant Associations (Labeled "MIDSCALE_N" in Vegetation Assessment Database)
		DEVELOPED
Dike		DIKE BANKS: DISTURBED WETLAND TO UPLAND VEGETATION GRADIENT
		DISTURBED
Emergent Marsh	Yes	BALTIC RUSH DOMINATED MARSH
		CATTAIL MARSH
		COMMON RUSH DOMINATED MARSH
		MARSH PENNYWORT AQUATIC VEGETATION
		REED CANARYGRASS DEGRADED MARSH
		SITKA SEDGE MARSH
		SLOUGH SEDGE DOMINATED MARSH
		SLOUGH SEDGE-SMALL FRUITED BULRUSH MARSH
		THREE RIBBED ARROWGRASS DOMINATED MARSH
		THREE SQUARE BULRUSH DOMINATED MARSH
		TULE MARSH
		TWINBERRY SHRUBLAND
		WATER PARSELY DOMINATED MARSH
		WATER/MUD
Estuary and Mudflats	Yes	NOT VEGETATED
		WATER/MUD
Inland Dunes		AMERICAN DUNEGRASS GRASSLAND
		AMERICAN DUNEGRASS-EUROPEAN BEACHGRASS GRASSLAND
		EUROPEAN BEACHGRASS GRASSLAND AND DUNES
		SEATHRIFT HERBLAND
		SEMI-NATIVE DUNE
		TUFTED HAIRGRASS-SEATHRIFT HERBLAND
Marine Nearshore		NOT VEGETATED
Mixed Conifer Forest		SHORE PINE FOREST AND WOODLAND

Wildlife Habitat Type	Conservation Strategy	Dominant Plant Associations (Labeled "MIDSCALE_N" in Vegetation Assessment Database)
Mature Growth		SITKA SPRUCE-SHORE PINE FOREST
Mixed Conifer Forest Late seral	Yes	SHORE PINE-SITKA SPRUCE FOREST AND WOODLAND
		SITKA SPRUCE-SHORE PINE FOREST
Mixed Conifer Forest Young Growth		SHORE PINE FOREST AND WOODLAND
		SHORE PINE-RED ALDER DISTURBED FOREST
		SHORE PINE-SITKA SPRUCE FOREST AND WOODLAND
		SITKA SPRUCE-SHORE PINE FOREST
Mixed Conifer-Deciduous Forest Mature Growth		DOUGLAS-FIR FOREST
		MIXED BROADLEAF FOREST
		RED ALDER-SITKA SPRUCE FOREST
Mixed Conifer-Deciduous Forest Late Seral	Yes	RED ALDER-SITKA SPRUCE FOREST
		SPRUCE-RED ALDER FOREST
Mixed Conifer-Deciduous Forest Young Growth		RED ALDER-SITKA SPRUCE FOREST
		SPRUCE-RED ALDER FOREST
Non-native Grassland		NON-NATIVE GRASSLAND
Red Alder Forest		RED ALDER FOREST
Saltmarsh	Yes	BALTIC RUSH DOMINATED MARSH
		BENTGRASS MARSH
		CATTAIL MARSH
		COMMON RUSH DOMINATED MARSH
		LYNGBYE SEDGE DOMINATED MARSH
		PICKLEWEED MARSH
		SALTGRASS MARSH
		SALTGRASS MARSH/MUD
		SEACOAST BULRUSH MARSH
		SILVERWEED DOMINATED MARSH
		SPIKERUSH-BALTIC RUSH MARSH

Wildlife Habitat Type	Conservation Strategy	Dominant Plant Associations (Labeled "MIDSCALE_N" in Vegetation Assessment Database)
		THREE RIBBED ARROWGRASS DOMINATED MARSH
		THREE SQUARE BULRUSH DOMINATED MARSH
		TUFTED HAIRGRASS MARSH
		TULE MARSH
Scrub-shrub Wetland	Yes	RED ALDER-WILLOW SHRUB-SWAMP
		SHRUB SWAMP
		SPIRAEA SHRUB-SWAMP
Scrub-shrubland		DISTURBED SHRUBLAND
		ELDERBERRY-SALMONBERRY SHRUBLAND
		EVERGREEN HUCKLEBERRY-SALAL SHRUBLAND
		MIXED SHRUB/EXOTIC GRASSES
		MIXED SHRUBLAND
Sitka Spruce Forest Mature Growth		SITKA SPRUCE FOREST
Sitka Spruce Forest Late seral	Yes	SITKA SPRUCE FOREST
Westside Riparian Mature Growth	Yes	DISTURBED STREAMBANKS
		RED ALDER FORESTED WETLAND
		RED ALDER/WILLOW SWAMP
Westside Riparian Late seral	Yes	RED ALDER FORESTED WETLAND
Westside Riparian Young Growth	Yes	RED ALDER FORESTED WETLAND

[1] Oregon Conservation Strategy Habitat
[2] Plant Community is derived from Bacheller 2016

Figure 2. Wildlife habitat

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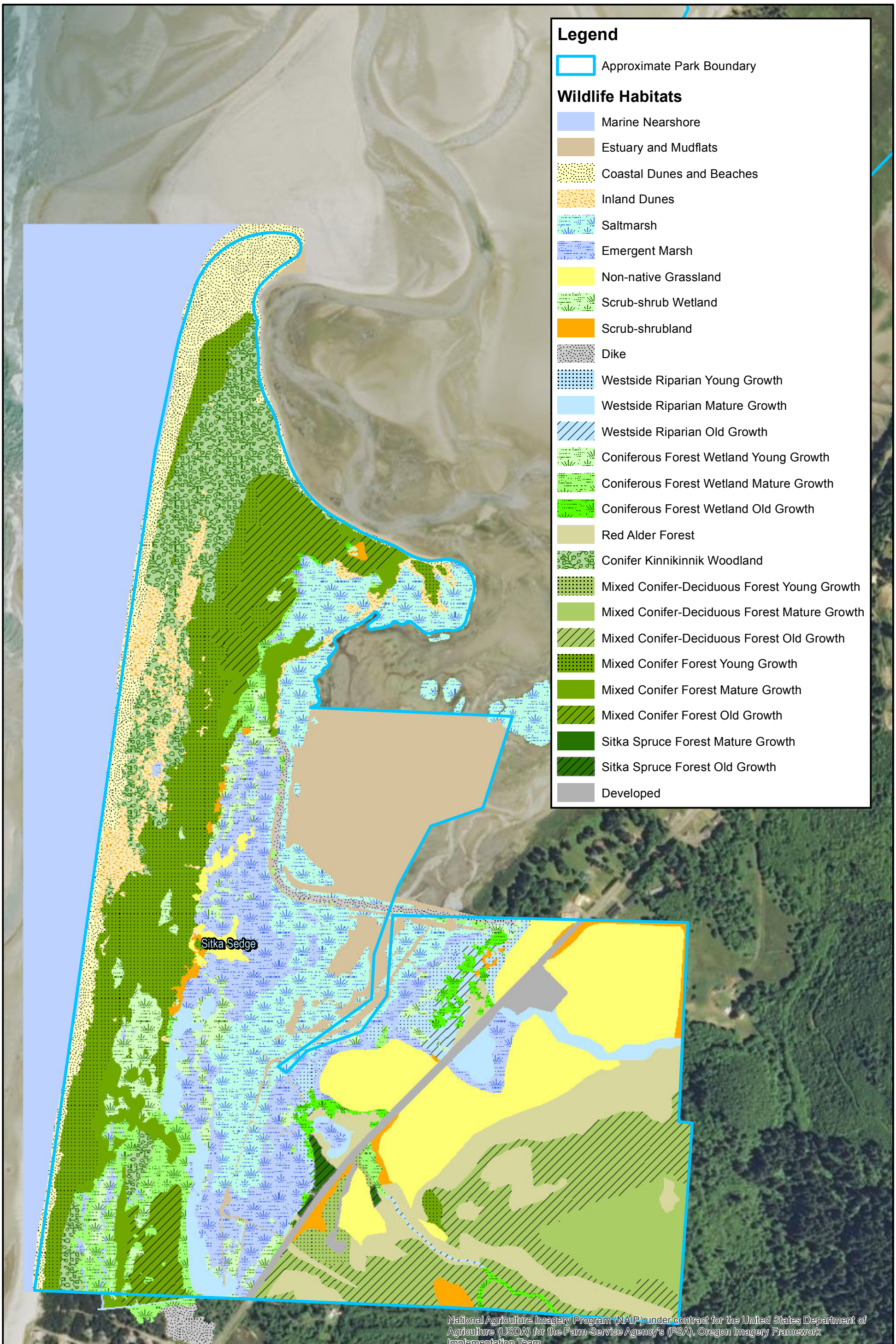
Salem OR, 97301



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2.1 Wildlife Resource Values

To determine areas of the park for prioritizing restoration, preservation, or to inform facility development in appropriate areas, mapped habitat types were assigned wildlife value ratings (WVRs). Determining WVR is a multi-step process. First, habitats are ranked into desired habitats. Second, a wildlife habitat condition is determined. Third, a potential disturbance index is developed. Finally, wildlife habitat condition and potential disturbance index are used to assign WRVs.

2.1.1 Desired Habitat

Determining desired habitat (DH) is a necessary step in developing a management plan. DH establishes goals for natural resource management, from which land management prescriptions are derived. After potential wildlife species, habitat types, and surrounding landscape data were collected, the site was evaluated for desired habitat. Habitat types were ranked based on rarity of present wildlife species, rarity of wildlife habitat types in the landscape, likelihood of attracting at-risk species, feasibility of restoring habitats, existing site conditions, and locally important management goals. Habitats that are **desireable (D)** include those that provide habitat for at-risk species, are uncommon in the local landscape, or are rare regionally. **Neutral (N)** habitats benefit wildlife, but are common locally or regionally**. Disadvantageous (P)** habitats are those that provide little to no benefit to wildlife. Table 2 lists wildlife habitats and their ratings. Note that forested habitats with potential to reach late-seral stages are desireable in this table. Differences in seral stage are incorporated into the Wildlife Resource Values (see Section 2.1). In addition, grasslands are not locally common; however they are not designted as a Conservation Strategy habitat for the Coast Range, and Sitka Sedge offers such small amounts that this habitat is considered neutral for the purposes of this assessment.

Table 2. Sitka Sedge Rated Habitats

Johnson and O'Neil Category	ORBIC Habitat Category	DH
Agriculture, Pasture, and Mixed Environs	Annual/Biannual Farmland	P
	High Structure Agriculture	P
	Pasture	P
Coastal Dunes and Beaches	Coastal Dunes and Beaches	D
	Estuary and Mudflats	D
	Inland Dunes	N
Coastal Headlands and Islets	Rocky Coast	N
Early Successional Habitats	Scrub-Shrublands	N
Herbaceous Wetlands	Emergent Marsh	D
	Saltmarsh	D
	Wet Meadow	D
Marine Nearshore	Marine Nearshore	N
Open Water	Open Water	N
Urban and Mixed Environs	Developed	P
	Dike	P
	Parks/Open Space	N
	Rural Residential	P
	Suburban	P

Johnson and O'Neil Category	ORBIC Habitat Category	DH
	Urban	P
Westside Grasslands	Exotic Grasslands and Annuals	P
	Non-native Grasslands	P
	Westside Grasslands	N
Westside Lowland Conifer-Hardwood Forest	Conifer kinnikinnik Woodland	D
	Early Shrub-Tree	N
	Mixed Conifer-Deciduous Mature Growth	D
	Mixed Conifer-Deciduous Old Growth	D
	Mixed Conifer-Deciduous Young Growth	N
	Red Alder Forest	N
	Shore Pine Forest	N
	Sitka Spruce Forest	D
	West Side Douglas-fir Mixed Conifer Mature Growth	D
	West Side Douglas-fir Mixed Conifer Old Growth	D
	West Side Douglas-fir Mixed Conifer Young Growth	N
Westside Oak and Dry Douglas-fir Forest and Woodland	Oak	N
Westside Riparian-Wetlands	Coniferous Forest Wetland Mature Growth	D
	Coniferous Forest Wetland Old Growth	D
	Coniferous Forest Wetland Young Growth	N
	Scrub-shrub Wetlands	D
	Westside Riparian	D

Priority Habitats

To provide greater benefit to wildlife in the next decade and encourage development of rare habitats, OPRD should manage for the following Oregon Conservation Strategy habitats

Coastal dunes and beaches – Coastal dunes and beaches have been altered dramatically through introduction of European beachgrass (*Ammophila arenaria*). Coastal dunes are a dynamic system, maintained by tides, oceanic storm surges, wind, and river movements. Beachgrass stabilizes dunes, which blocks sand movement and allows plant succession at an accelerated rate: from dune to grassland to shrubland and ultimately shore pine. **Goal:** restore and maintain coastal dune beaches via restoration of natural processes, removal of invasive plant species that stabilize sand, and management techniques to enhance and maintain open, flat sand (see 4.3.2). To better provide long-term presence of this habitat, future restoration goals should incorporate assumptions of sea level rise and tidal changes that may occur if the artificial levee is breached or removed.

Late-seral coniferous forests – Late seral forests once extended across most of the Oregon coast, but are now relatively rare and fragmented across the state. The wet climate and rampant vegetative growth makes the coast a popular and productive location for the timber industry. Thus, while forested acreage is not lacking on the coast, “old growth” forests are exceedingly rare. In addition, there is a diverse mosaic of land ownership and land use, which isolates late-seral forest stands and can often leave them too small to support the wildlife dependent upon them. Recent studies have shown that late-seral forest

microclimates provide a buffer to climate warming at local scales, as they remain a few degrees cooler than younger forest stands (Frey et al. 2016). Maintaining late-seral forests can not only preserve a rare habitat, but also provide microrefugia for wildlife species faced with climate change. **Goal:** utilize forestry actions to facilitate development of late-seral forest structure, including multiple canopies, complex forest floor structure, and downed wood components (see 4.3.13).

Freshwater wetlands, including emergent marsh and wet meadows – Freshwater wetlands are diverse habitats that vary greatly in structure, water level, and the wildlife species that utilize them. Emergent marshes provide breeding grounds for amphibians, marsh birds like sora and marsh wrens, rearing grounds for sensitive salmonids, and stopover points for migrating shorebirds and waterfowl. Wet meadows generally dry up for a portion of the year, but still produce invertebrates that feed a plethora of wildlife. Soil type is strongly associated with wetlands, and "recreating" a functioning wetland is very expensive and difficult. The vegetation assessment (Bacheller 2016) discusses current conditions in detail, including wetlands behind the dike, perched wetlands behind the foredune, and wetlands on the east side of Sand Lake Road. The wetlands behind the dike may function as over-wintering juvenile coho salmon habitat, which is one of the most limited life-stages for the threatened species (NMFS 2015), provided the water quality can sustain them. Wetlands that are connected to floodplains, in addition to other freshwater habitats, are a primary constituent element essential to support Oregon Coast Coho salmon, especially when they provide natural cover, forage, and water quality and is a top priority for Oregon Coast Coho salmon recovery (NMFS 2015). When those freshwater wetlands Depending on the status of the artificial levee and tide box, overall wetlands at Sikta Sedge may decrease in acreage by conversion to mudflats and saltmarsh; concomitant restoration in pasturelands adjacent to riparian areas can offset this loss. **Goal:** maintain freshwater wetlands at Sitka Sedge by enhancing existing wetlands east of Sand Lake Road and restoring additional wetland acreage to offset losses associated with tide box alterations.

Saltmarsh – Saltmarsh at Sitka Sedge is a tidally influenced marsh with a variety of plant communities and changing salinity. Saltmarsh hosts a unique suite of both marine and freshwater invertebrates, fish, and other wildlife. Anywhere from 50-80% of tidal marsh in Oregon has been lost (Boule and Bierly 1987), making this declining habitat a conservation priority even though it is common locally within Sand Lake Estuary. This habitat type, and restoring the natural tidal processes in the estuary, is regionally important when considering that Sand Lake is one of the few unaltered estuaries remaining in Oregon. Sand Lake estuary is also designated critical habitat for Coho salmon, and the proposed Recovery Plan for the Oregon Coast ESU recommends watershed restoration processes over site-specific, project-level restoration (NMFS 2015). Restoring estuarine processes to increase rearing habitat quality and capacity is one of the Recovery Plan's strategies (NMFS 2015), and removing dikes and levees is called out specifically (NMFS 2015, 6-14). The vegetation assessment (Bacheller 2016) discusses current conditions in detail. Depending on the status of the artificial levee and tide box, this habitat type may increase in acreage through conversion of existing freshwater wetlands. Initially, habitat will convert to mudflats. The long-term habitat is unknown, as sediment deposition, erosion, storms, sea level rise will all play a role in determining the extent of water, mudflat, and saltmarsh that will remain in the area. Beyond addressing restoration potential related to the artificial levee, there are few actions to manage for saltmarsh apart from preservation. **Goal:** enhance saltmarsh at Sitka Sedge in coordination with artificial levee assessments.

Riparian shrublands and forests – Riparian areas, either forest or shrubland, are critical habitats for neotropical migrants, birds that breed north of the Tropic of Cancer (23 °latitude) but winter south of it. These songbirds travel hundreds of miles during migration and heavily utilize riparian corridors, especially habitats with a large canopy and complex understory. Many species of bats rely on riparian

areas, although less research has been conducted on bat use and distribution. Riparian vegetation also provides cooling benefits to streams, a critical function for maintaining salmonids runs. Currently, this habitat type at Sitka Sedge exists in a range of conditions, from poor quality due to invasive plants to high quality (Bacheller 2016). **Goal:** restore existing riparian habitats and encourage development of habitats along Reneke and Beltz Creeks (see Section 4.3.4 and 4.3.5).

2.1.2 WRV Methodology

WVRs are as follows:

1 –Priority wildlife value and conservation status, avoid disturbance and preserve
2 – Medium wildlife value, restoration actions recommended and conserve
3 – Marginal wildlife value, restoration actions possible but may not be efficient
4 – Minimal wildlife value, other land uses are appropriate

Generally speaking, wildlife resource values are a prioritization of habitats, with “1” representing high wildlife value that should be conserved; Critical Habitat and habitats that support endangered or threatened wildlife are “1”. Minimal value areas, “4”, are more compatible for other uses. Special designations beyond critical habitat, such as a registered State Natural Area (ORS 273.561-.591 and OAR 736-045), are captured in the botanical value ratings.

Wildlife Habitat Condition

Wildlife habitat conditions were derived by ranking each mapped vegetation community for desired future condition, the quality of the habitat based on the botanical resource assessment, and seral stage (if applicable). Wildlife condition designations are as follows:

- Condition D (Desired): Habitat type represents the Desired habitat
- Condition F (Feasible): Habitat type will achieve the Desired habitat with some management actions within approximately 10 years
- Condition M (Marginal): Feasible restoration efforts would change the habitat to the Desired habitat within approximately 10 years
- Condition Other (O): Other habitats in good quality that are not a management target
- Condition Poor (P): Desired habitat will not be met within 10 years

Potential Disturbance Index

Potential disturbance index quantifies anthropogenic disturbance across Sitka Sedge. The index was generated using GIS spatial analysis and land use patterns. GIS analysis ranked habitat areas based on adjacent land use and density of travel systems, such as trails, roads, and parking areas. While species have different tolerances to disturbances based on the type of activity, duration, etc., this basic ranking indicates areas furthest from potential sources of disturbance. The resulting output was manually assessed for vegetation and topographical adjustments; for example, a trail that is on an east hillside will have less impact to the area on the west face of that same hillside than a trail that followed the ridgeline.

Table 3. Wildlife condition values based on botanical assessment and desired future conditions

Wildlife Habitat	Excellent, Good *E, G*	Marginal, Poor *M, P*
Coastal Dunes and Beaches	Desired	Feasible
Conifer Kinnikinnik Woodland*	Desired	Feasible
Coniferous Forest Wetland Mature Growth	Feasible	Feasible
Coniferous Forest Wetland Old Growth	Desired	Feasible
Coniferous Forest Wetland Young Growth	Other	Marginal
Developed	Poor	Poor
Dike	Poor	Poor
Emergent Marsh	Desired	Marginal
Estuary and Mudflats	Desired	Marginal
Inland Dunes	Other	Marginal
Marine Nearshore	Desired	Marginal
Mixed Conifer Forest Mature Growth	Feasible	Feasible
Mixed Conifer Forest Old Growth	Desired	Feasible
Mixed Conifer Forest Young Growth	Other	Poor
Mixed Conifer-Deciduous Forest Mature Growth	Feasible	Feasible
Mixed Conifer-Deciduous Forest Old Growth	Desired	Feasible
Mixed Conifer-Deciduous Forest Young Growth	Other	Marginal
Non-native Grassland	Poor	Poor
Red Alder Forest	Other	Marginal
Saltmarsh	Desired	Marginal
Scrub-shrub Wetland	Desired	Feasible
Scrub-shrubland	Other	Marginal
Sitka Spruce Forest Mature Growth	Feasible	Feasible
Sitka Spruce Forest Old Growth	Desired	Feasible
Westside Riparian Mature Growth	Desired	Feasible
Westside Riparian Old Growth	Desired	Feasible
Westside Riparian Young Growth	Desired	Feasible

Final WRV Ranking

Final wildlife values were determined by inputting wildlife habitat condition and the disturbance index according to the matrix in Table 4. Some deviations from the matrix were made due to known wildlife needs. Critical Habitat for Western snowy plover was scored as 1 regardless of habitat condition. Critical habitat for Oregon Coast ESU Coho was not scored as 1 due to ambiguity in the federal data sets. Potential marbled murrelet habitat was also scored as 1. Potential murrelet habitat was assessed via LiDAR by classifying Height Above Ground data into 5 groups and selecting areas with very tall heights (>200) intermixed with tall heights (175+). Tall trees are loosely correlated with limb diameter, and these areas are likely to have 4” diameter limbs that murrelet utilize for nesting. These areas were then ground truthed for potential platforms. No other manual adjustments were made.

Table 4. Wildlife Resource Values Matrix

	Potential Disturbance Index		
Condition	Low	Intermediate	High
Desired (D)	2	2	2
Feasible (F)	2	2	3
Marginal (M)	2	3	3
Other (O)	3	3	3
Poor (P)	4	4	4

2.2 HABITAT CONNECTIVITY

Connectivity is the degree to which a landscape helps or disrupts the ability of an animal to move and acquire resources (Fahrig and Merriam 1985). Assessing habitat connectivity is complex and depends on the needs of individual species. For example, to disperse from one habitat patch to another, a songbird may need to visually see the patch while a salamander may require a corridor of appropriate vegetation between the two patches. Without habitat connectivity individuals may be unable to move between patches, and the population is more susceptible to disease, population pressures, predation, and extirpation from natural events like fires. Climate change and land-use changes make the need for habitat connectivity even more critical, as many species will need to adapt to a changing landscape. The ranges of many songbirds have already begun shifting northward, and ensuring wildlife movement corridors maintain habitat connectivity will be paramount to adjust to climate change.

Sitka Sedge is surrounded by residential uses on the south, residential use and Sand Lake estuary on the north, the ocean on the west, and Siuslaw National Forest and an undeveloped private inholding on the east (Figure 4). Regionally, there is opportunity for both terrestrial and aquatic connectivity to Siuslaw National Forest, Sand Lake Estuary, Sand Creek – Frontal Pacific Ocean watershed, Clay Myers State Natural Area at Whalen Island, Cape Lookout State Park, and properties held by land trusts. Overall, habitat connectivity is good for forest and generalist wildlife, while impediments exist for aquatic and wetland-obligate wildlife.

2.2.1 TERRESTRIAL PASSAGE

Pinched between the ocean and wetlands, the coastal dune and shore pine habitats at Sitka Sedge serve as wildlife destinations rather than movement corridors. Shorebirds will migrate up the coast along the wet sand and shelter from storms in the dunes. Other species will disperse largely from the south, with movement barred by residential development at Tierra Del Mar and Sand Lake Road. On the north, the estuary bottom is exposed during low tides and could be crossed by mesocarnivores, ungulates, and other medium to large-sized mammals, allowing dispersal to Clay Myers and Siuslaw National Forest. It is unlikely reptiles, amphibians, or terrestrial insects would make the trip, but aerial insects, birds, and bats could cross regardless of tidal influences. Waterfowl will utilize the estuary and marshlands as a stopover during migration and staging areas once breeding efforts have finished elsewher.

Roosevelt elk (*Cervus canadensis roosevelti*) frequently cross Sand Lake Road to travel between freshwater wetlands, coastal dunes, riparian scrub-shrub, and pasture lands. As road traffic increases the risk for elk-vehicle collision will also increase.

The forested upland and riparian wetlands on the east side of Sand Lake Road are currently contiguous with habitat that extends to Siuslaw National Forest, and abut critical habitat for marbled murrelet (*Brachyramphus marmoratus*) and Northern spotted owl. Multiple species will utilize this connection, and if they are able to cross Sand Lake Road will continue into the remainder of Sitka Sedge.

Figure 3. Wildlife Resource Values

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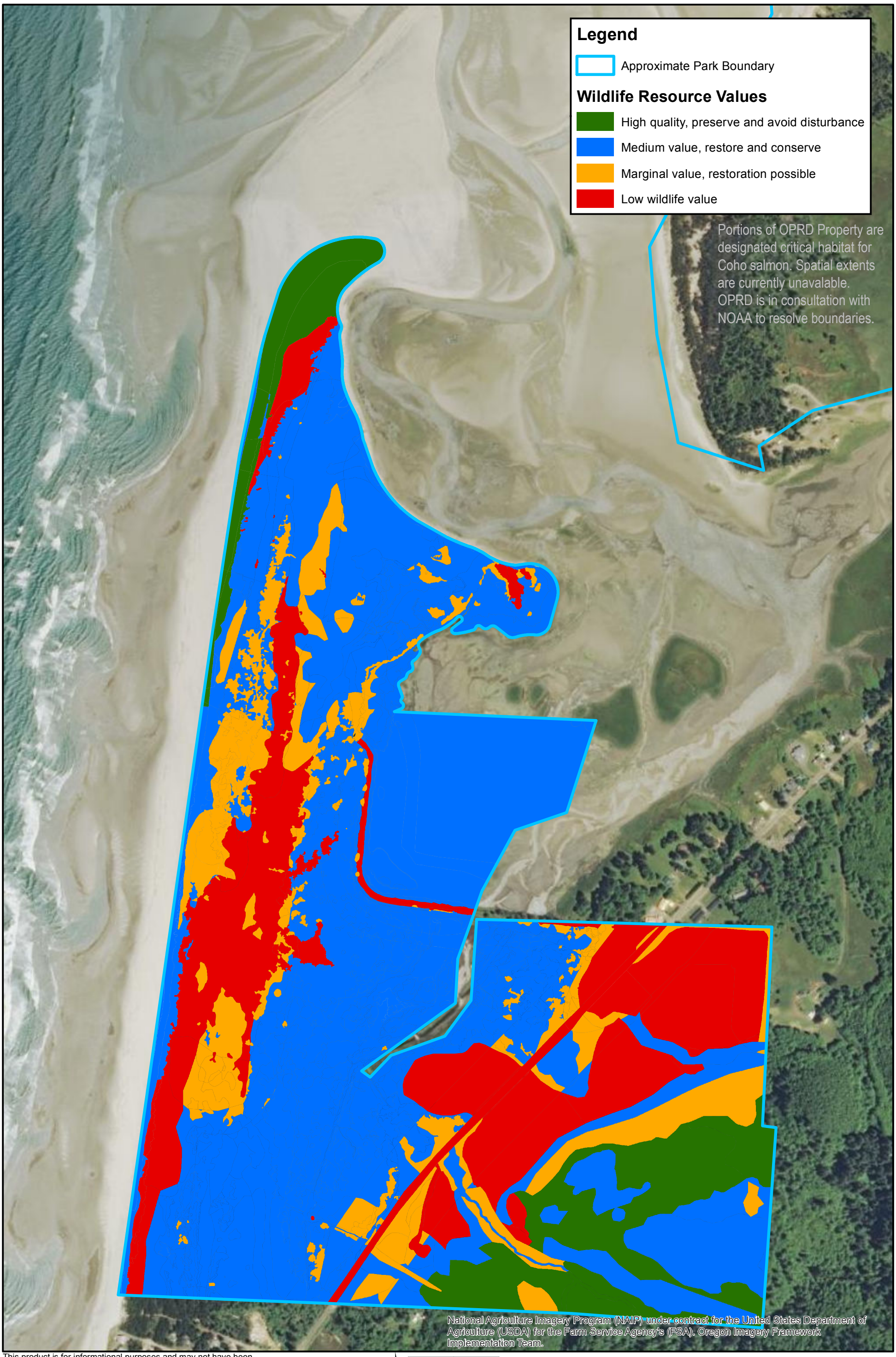

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Figure 4. Habitat Connectivity

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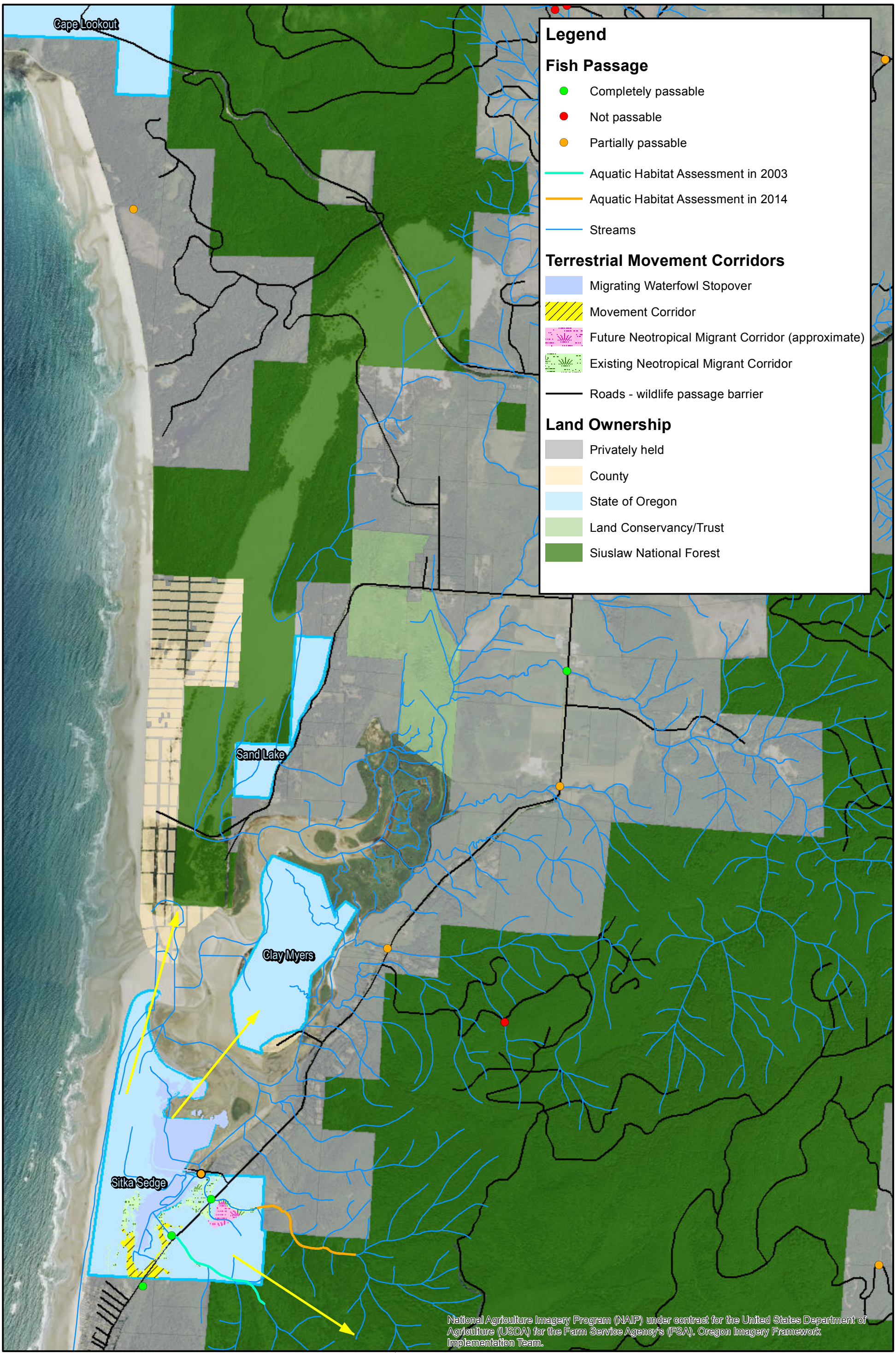

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NAD 1983 2011 Oregon Statewide Lambert Feet

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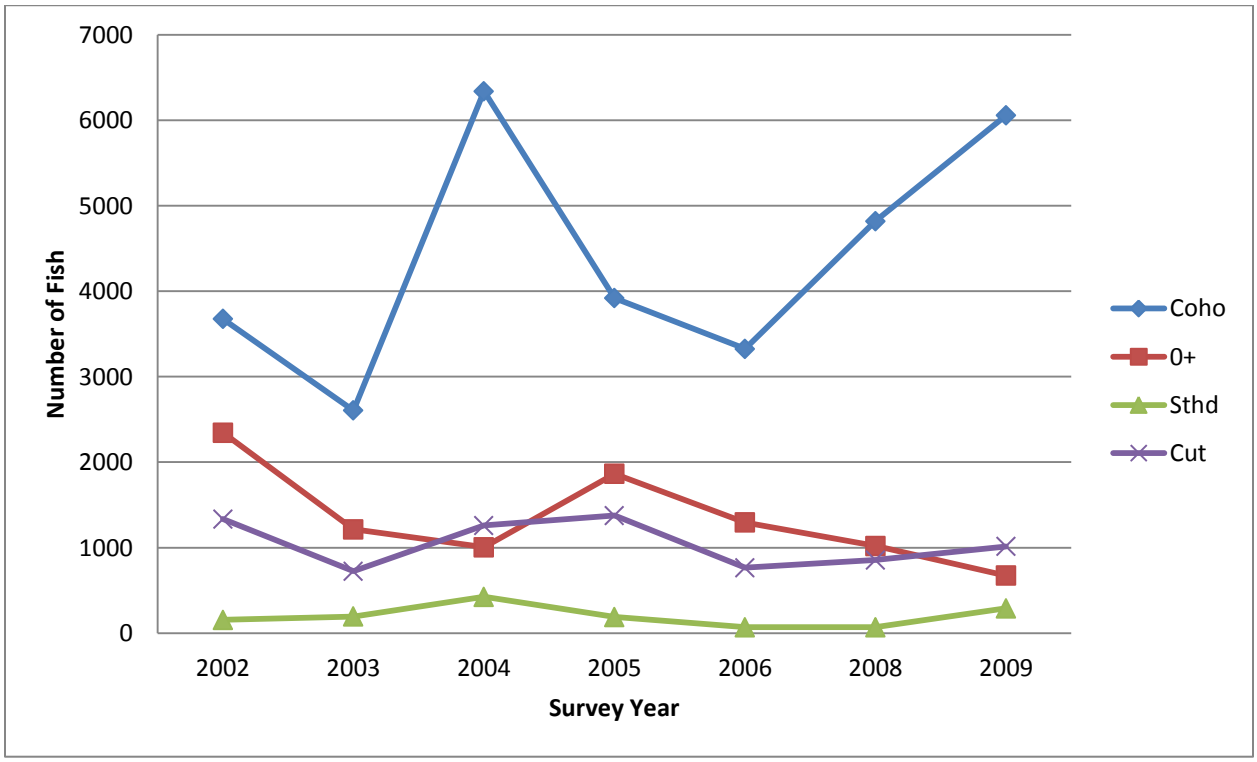
2.2.2 Aquatic Passage – Artificial Levee and Tide Box

Salmonids identified by ODFW within the watershed historically and at present include chum (*Oncorhynchus keta*), fall Chinook (*Oncorhynchus tshawytscha*), winter steelhead (*Oncorhynchus mykiss*), coastal cutthroat (*Oncorhynchus clarki*), and the federally threatened Coho (*Oncorhynchus kisutch*),. Sand Lake watershed provides approximately 9.5 miles of Coho summer rearing habitat. Sand Creek, including Jewel and Andy Creek tributaries, enters the estuary at the northern end and provides the greatest amount of spawning habitat for salmonids in the watershed. In addition, Pacific lamprey (*Entosphenus tridentatus*) and Western brook lamprey (*Lampetra richardsoni*) are also documented in the watershed (M. Long, pers.comm December 2014). Juvenile distribution and abundance surveys were conducted in the Sand Lake watershed during the summers of 2002-2009 (except for 2007) and illustrate juvenile salmonids utilized the watershed (Figure 5).

Figure 5. Estimates of juvenile salmon production in the Sand Lake Watershed



Coho = Coho salmon
0+ = Salmon fry too young to identify to species
Sthd = Steelhead
Cut = Cutthroat trout

In the 1930's, an artificial levee and tide box were put into place, sectioning off a portion of the estuary which then converted to freshwater wetlands. The tide gate is not not currently functioning as originally designed; at least one of the bottom boards is missing which allows tidal flows and aquatic species to pass through the gap. This has resulted in some of the freshwater wetland converting back to saltmarsh. The tide box is low enough for water to flow from the marsh behind the levee into the estuary at low tide. To meet the state's estuarine fish passage requirements, modifications to the tide box will require at least an 18-foot gap in the levee (Waterways, Inc. pers. comm.). This 18-foot gap was determined to meet "cumulative flows or active channel widths, respectively, of all streams entering the estuary above

the artificial obstruction" (OAR 635-412-0020(4)a), which includes Beltz Creek, Reneke Creek, and an unnamed tributary. In addition, OAR 635-412-0020(4) refers back to OAR 635-412-0035(2) and (3). OAR 635-412-0035(2) addresses fish passage via hydraulic calculations. OAR 635-412-0035(3) addresses fish passage through stream simulation methods. There are two criteria that relate to width and velocity; other criteria are related to design specific information, such as height and stream bed conditions. The other criteria will influence any future detailed engineering plans related to the tide box and will be determined after artificial levee options are explored.

Federal fish passage requirements have not been specified, but may exceed state requirements. Removal of fish passage barriers is listed as a strategy for Coho recovery, including tide gates and culverts with a goal of increasing rearing habitat (NMFS 2015). Concerns expressed during the master planning process regarding construction of a breach in the levee include increased risk of flooding to areas inside the dike, changes to the current vegetation, and changes in wildlife habitat. Regarding effects to wildlife, there is an expected reduction in freshwater wetlands and an increase in mudflats (Bacheller 2016), which will benefit some species and be detrimental to others. The long-term viability of freshwater habitat behind the levee is unlikely without maintenance of the levee, and restoration of tidal processes throughout the estuary has value beyond impacts to wildlife. Selecting a way forward will require value judgements on which species, and for Coho which life-stage, will receive benefits. As stipulated in the grant that assisted purchase of the property, a stakeholder group was formed to explore the merits of restoring fish passage to Reneke and Beltz Creeks, which included options for modifying the tide box and improving fish passage to these two creeks. OPRD and USFWS contracted with Waterways, Inc. to determine options for improving fish passage at these three locations. Two options were determined based on preliminary analysis of the estuary: removing the flap of the tide box, creating a permanent 4 ft gap (Scenario 1), and creating an 18-foot breach to meet state criteria for fish passage (Scenario 2).

Current Conditions

Fish passage into Beltz Creek, Reneke Creek, an unnamed tributary, and the freshwater wetlands at Sitka Sedge is inhibited by the artificial levee and tide box. At higher tides, the water velocity through the tide box is too high to allow for juveniles to get through (Waterways, Inc, pers.comm.). Anecdotal reports of large salmonid-looking fish stacked up on the downstream side of the Reneke Creek culvert indicate that some adult fish may be able to pass through the tide box, and an opening in the tide box (1 foot x 4 feet) supports this possibility. Recent reconnaissance by Adriana Morales (USFS) confirmed salmonid presence behind the artificial levee: she discovered Coho smolts, steelhead, and cutthroat behind the artificial levee in pools adjacent to the Sand Lake Road culvert that connects to Reneke Creek. In addition, steelhead and cutthroat fry were located throughout Reneke Creek east of the culvert, which demonstrates that some steelhead and cutthroat spawning are occurring in Reneke Creek. There is an old beaver dam in the central channel that bisects the marsh behind the artificial levee which may affect water quality. No data has been collected to address the dam's presence specifically. However, northern red-legged frogs (*Rana aurora*) breed south of the dam, but no egg-masses were discovered north of the dam. See Bacheller 2016 for more specific information on the beaver dam effects on vegetation.

Fish passage at Sitka Sedge is directly related to two aspects of anadromous fish life cycles: spawning and rearing. Anadromous fish would pass through the tide box enroute to spawning in Beltz and Reneke Creeks. The ODFW Aquatic Inventories Project at the Corvallis Research Lab performed aquatic habitat assessments on the lower reaches of Beltz and Reneke Creeks in 2003 and 2014, respectively (Figure 4). The assessments did not quantify habitat further upstream. The assessment data was inputted into the HabRate model (Burke et al. 2001) and the Habitat Limiting Factors Model (HLFM; Nickelson 1992, Nickelson 1998, updated 2007); model outputs categorize existing habitat quality for Coho and Chinook

as low, and low to moderate for steelhead and cutthroat (M. Strickland, pers. comm 1/20/2016). Observations by A. Morales support these model predictions, as neither Coho nor Chinook were found upstream of the culverts, but both steelhead and cutthroat were. Specifically, the HLFM models show both creeks could support approximately 118 Coho winter parr per kilometer (parr/km, ODFW unpublished data), which estimates parr at a time period of lowest capacity (Jones et al. 2011). Sites that support less than 900 Coho winter parr/km are considered low quality, while high quality sites can support over 1380 Coho parr/km (Jones et al. 2011). The HabRate model reveals limiting factors to be immutable features such as high gradient and narrow active channel width as well as potential restoration opportunities, such as lack of pools and large wood (ODFW unpublished data). If no restoration actions are taken, most salmonid production will continue to come from other streams in the estuary system. Some substandard habitat features (high gradient and narrow active channel width) are unlikely targets for restoration efforts; however, increasing the number and quality of pools and downed wood components are feasible projects. To determine potential salmonid production with restoration efforts, additional stream assessments will be needed (see Section 4.3.3). If there is production taking place in these small creeks, fry/smolts would move out in spring, parr would hang around the tidal brackish water in summer, and parr would reside and move through the lower stream and marshes in fall and winter (T. Cornwell pers. comm December 2015). Under current conditions, opportunities for fish passage into the marsh to reach Beltz, Reneke, or the unnamed tributary is limited based on tidal influence and water velocities, and then inhibited by plugged culverts on both creeks.

In addition to potential spawning habitat afforded by the two creeks (the unnamed tributary habitat potential is not known), year-round salmonid rearing potential exists in the estuary, tidal channels, and wetlands. Many juvenile salmon would be entering the estuary out of the Sand Creek system during spring and summer, looking for rearing habitat. Smolts likely pass through the tide boxes into Sitka Sedge saltmarsh in late winter/early spring, and parr that have entered the estuary in summer/fall/winter could move into Sitka Sedge saltmarsh and freshwater wetlands and stay weeks to months until they head out into the ocean in spring (T. Cornwell, pers. comm. December 2015). If data from the Salmon River estuary can be applied to Sand Lake, juvenile Coho could be using Sitka Sedge at any time in the year (T. Cornwell, pers. comm. December 2015). These life history patterns will likely depend on passage and water quality.

Water Quality

Drivers of fry/parr migration in and out of the estuary are poorly understood but likely to include catchment density dependent factors, limitations of rearing habitat and high flows, and adapting variable life history strategies (Jones et al. 2014). Salinity, temperature, and dissolved oxygen are variables that may limit the ability of juvenile salmonids to persist at a site. OPRD with assistance from Tillamook Estuaries Partnership and Department of Environmental Quality deployed four sensors to measure salinity, temperature, and dissolved oxygen in June 2015, and another two sensors in August-September 2015 (Figure 6). Data from the latter sensors is limited to August 11-24, as something disturbed the Below Dam sensor placement and generated erroneous data. The reference slough location was in relatively shallow water that was perched during low tide events and only experienced inflows when tides exceeded 6.5 feet, and the sensor outside the tide box may be influenced by water from behind the artificial levee.

Salinity

Salinity in the estuary varies with river flow; all sensor locations in the saltmarsh and the reference slough in the lower bay experience high fluctuations in salinity (Figure 7). In the Salmon River estuary, fry were able to reside in the estuary through the summer even as the salinity exceeded 20 ppt (Jones et al. 2014). Taylor (1990) conducted research on juvenile Chinook that showed Chinook survived in

salinities of 30 ppt, and other studies show they can survive salinities at 35 ppt (Groot and Margolis 1991). Salinity at Sitka Sedge varies drastically, with highs approaching 35 ppt (Figure 7). Typically, salmonids will avoid salinities unfavorable to them if they are able to; the waters behind the dike could function as freshwater rearing habitat in areas of low salinity and as transitional foraging areas for juveniles that have transitioned to higher tolerances for salinity. Salinity data throughout the marsh will help understand how the current conditions function for Coho and other aquatic species, i.e. does the existing marsh provide freshwater rearing habitat and/or estuarine growth and maturation habitat.

Temperature

The daily temperature regime at Sikta Sedge varies considerably both temporally and spatially (Figure 8). The estuary is relatively shallow, and during low tides water stands slack and heats up which results in temperature fluctuations with tidal influence: high tides have cooler temperatures around 9-15° C when cool ocean water floods into the estuary. During low tides temperatures frequently spike above 20° C (Figure 8).

Most studies on thermal stress in salmonids are conducted in field or laboratory settings under freshwater scenarios, which make it difficult to apply them to Sitka Sedge. The following interpretations are made assuming the salinity does not affect thermal stress thresholds. Behavioral changes occur at varying temperatures; for example, juvenile Chinook stop feeding at approximately 19° C (USEPA 1999). Direct mortality from temperature is another consequence of thermal stress, and studies have shown mortality is related to multiple factors: the temperature the fish are acclimated, the temperature itself, as well as the length of time they are exposed. Overall, thermal stress is a complicated ball of string that depends on exposure time, the desired fish response (growth, migration, survival), and other stressors like low oxygen, food limitations, and/or turbidity. Typically, salmonids exhibit avoidance behaviors when temperatures are too high by moving to other areas with cooler temperatures. If no such areas exist or are blocked, mortality ensues.

Table 5 shows the temperature and calculated exposure duration that results in 100% survival for juvenile Chinook acclimated to 15° C. These duration times would indicate that at Sitka Sedge where temperatures exceed tolerable limits for the length of a tidal cycle, mortality would be expected around 24°C. This interpretation must be caveated that thermal stress is cumulative, and mortality increases when thermal stress is combined with other stressors. Thermal stress is also cumulative when fish experience thermal stress repeatedly, such as with daily maximum temperatures in excess of 22° C but average daily temperatures are within thermal tolerance limits. This may explain why salmonids can survive temperatures above 24°C from a single exposure (Table 5), but temperatures ranging from 22-24°C limit salmonid distribution (USEPA 1999).

Table 5. Calculated survival times and temperature ranges for juvenile Chinook

Temperature ° C	100% Survival Duration (hours)
22	62.2
23	18.1
24	5.3
25	1.5

Source: USEPA 1999

The complexity of thermal stress makes it incredibly difficult to predict the effect temperature fluctuations have on salmonids at Sitka Sedge. The Department of Environmental Quality (DEQ) lists 12.7° C and 17.8° C as standard temperatures for spawning and rearing, respectively; temperatures are a

7-day moving average of the daily maximum temperature (ODEQ 1997, but see OAR 340-041-0028). The only sensor location at Sitka Sedge that meets DEQ rearing standards is above the beaver dam (Figure 6); however, the dissolved oxygen (DO) data from this sensor appears to be in error (see below), and the other readings may not be accurate. The 7-day average maximum temperatures at the other 5 sensor locations were in excess of DEQ standards (Table 6).

Table 6. 7-day daily maximum temperature averages at Sitka Sedge

Sensor Location	7-day Average Daily Maximum Temperature Range °C
Outside Levee	21.12 - 25.10[1]
Inside Levee	22.08 – 26.39[1]
Upper Channel	22.31 – 27.83[1]
Below Beaver Dam	23.29 – 25.24[2]
Above Beaver Dam	17.49 – 17.71[2]
Reference Slough	26.81 – 33.52[1]

[1] June 15 through July 23, 2015
[2] August 11 through 24, 2015

In the Salmon River estuary, brackish marshes warmed to over 20° C in the summer, and tidal inputs affected temperature more than freshwater inputs; despite the temperature fluctuations, Coho were regularly caught at temperatures ranging from 18-20° C (T. Cornwell pers. comm May 2016). If estuaries like Salmon River and Sand Lake have cold-water seeps or deep pools, during the summer and fall salmonids may take refuge in them during low tide until water quality improved with incoming tide (T. Cornwell pers. comm May 2016). Pockets of cool water with appropriate DO could exist elsewhere in the marsh where sensors were not deployed. A strategy to address temperature spikes would be to ensure fish have the opportunity to move into cooler waters to self-regulate. If Beltz and Reneke Creek are made passable and their temperatures are within the thermal range for salmonids, these creeks could act as refugia from warm water. Without these refugia, salmonids may need to come through the tide box with incoming high tide and then exit back to the estuary as the tide goes out.

Dissolved Oxygen

In an estuarine system, dissolved oxygen (DO) levels fluctuate with the tides and with vertical stratification in the water column; deeper waters have lower DO at the surface than at the bottom, especially in systems where thermal stratification occurs.

As with temperature, dissolved oxygen thresholds in salmonids are complex. Measuring specific lethal thresholds are heavily influenced by other factors, and in a laboratory setting can be confounded by experimental design that allow for other variables, such as ammonia and dissolved gas levels. DEQ sets DO minimum levels at 11.0 milligrams/liter (mg/l) in areas where salmon and trout spawn, and an absolute minimum of 4.0 mg/l in water bodies providing cold-water aquatic life (OAR 041-0016).

DO at all locations fluctuated with tidal influence, except above the beaver dam (Figure 9). The sensor above the beaver dam may have malfunctioned, as DO levels are less than 0 mg/L. This is an important point, as this sensor was the only location surveyed that had 7-day average daily maximum temperature levels within DEQ standards for rearing salmonids; if this area cannot support fish due to low DO then it is not a suitable refugia from warm temperatures. Additional data must be collected to verify DO levels across the marsh. There are also spikes in the DO at the reference slough that indicate some daily fluctuation that tidal action doesn't seem to explain.

Figure 6. Water quality sensor locations

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NAD 1983 2011 Oregon Statewide Lambert Ft Intl

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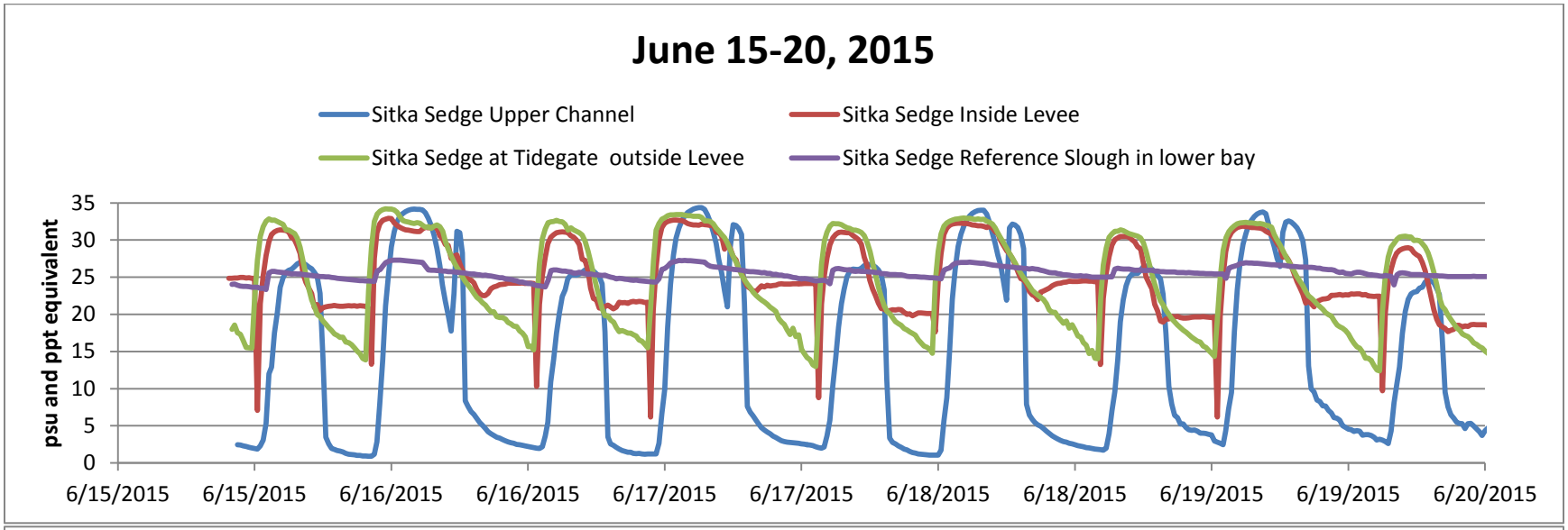
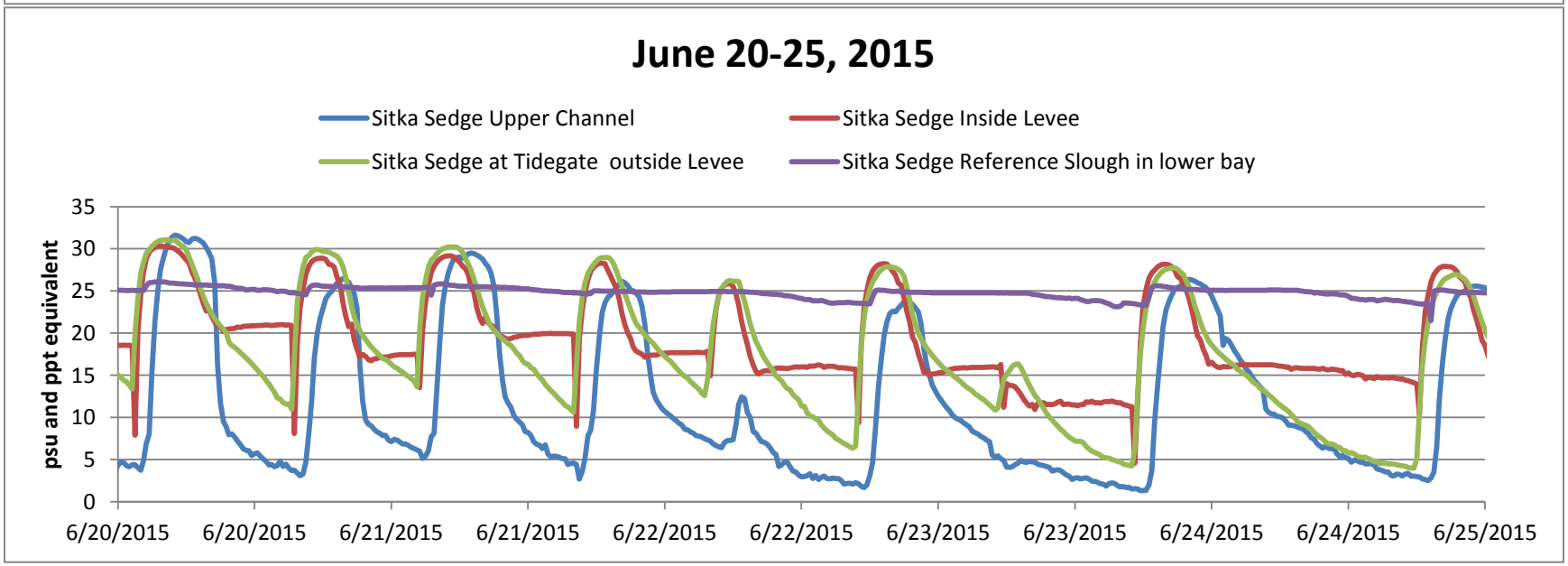
Figure 7. Salinity Measurements at Sitka Sedge





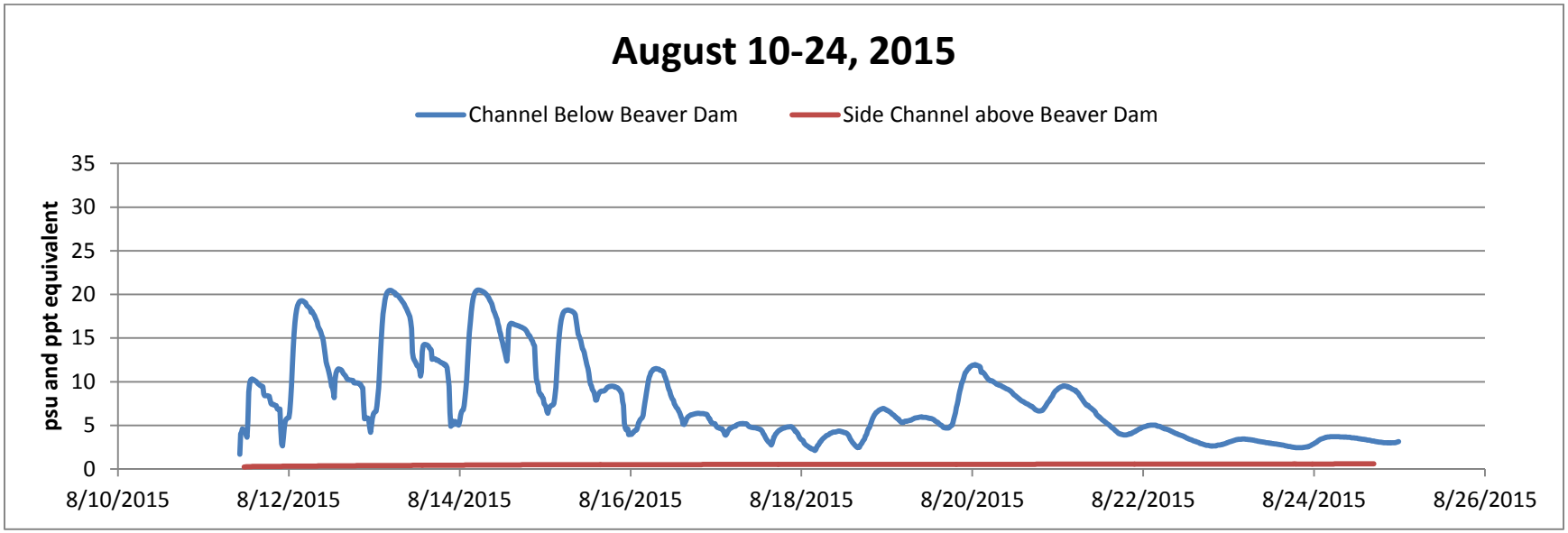
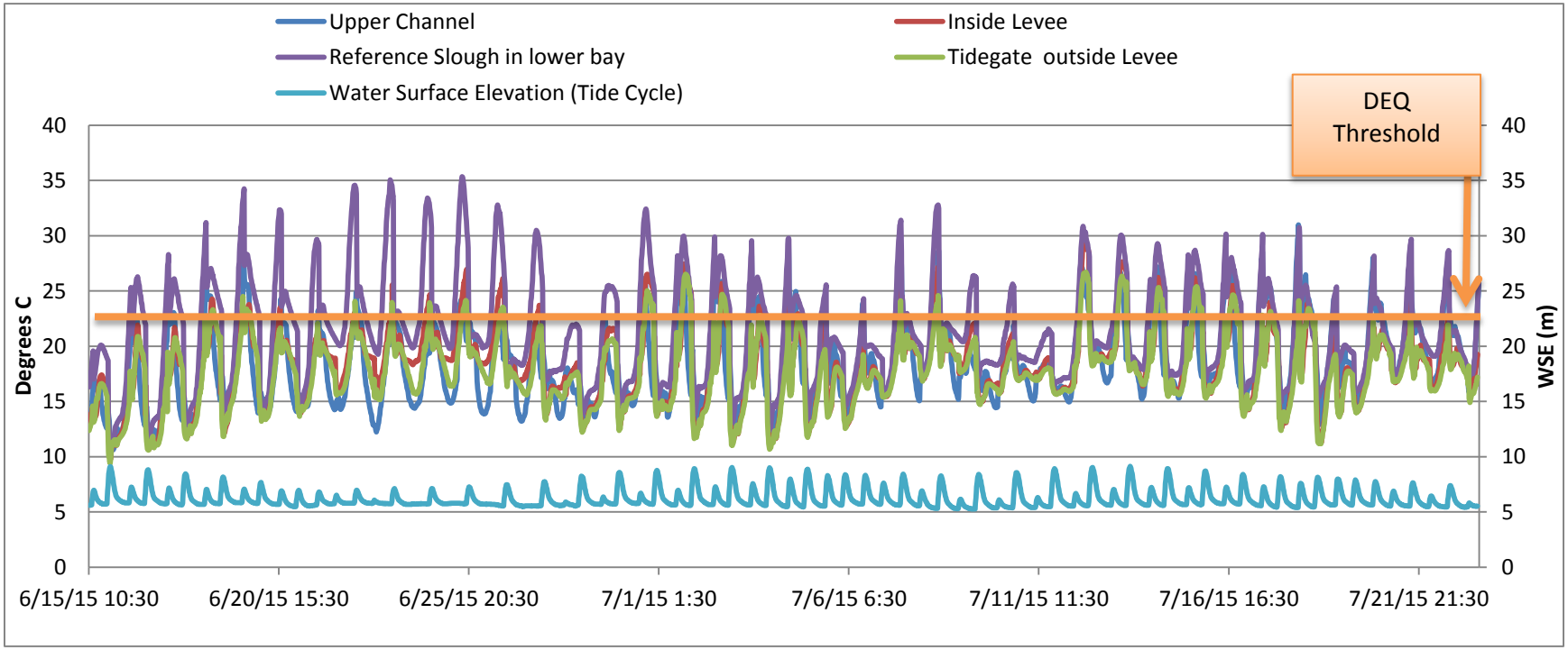

August 10-24, 2015
Channel Below Beaver Dam
Side Channel above Beaver Dam
psu and ppt equivalent
35
30
25
20
15
10
5
0
8/10/2015
8/12/2015
8/14/2015
8/16/2015
8/18/2015
8/20/2015
8/22/2015
8/24/2015
8/26/2015

Figure 8. Water Temperature at Sitka Sedge



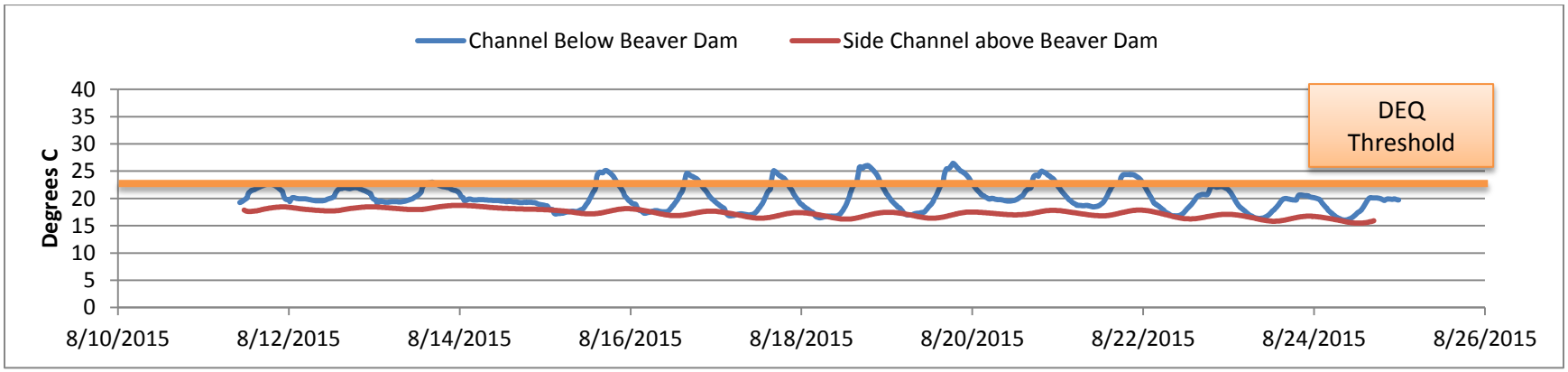
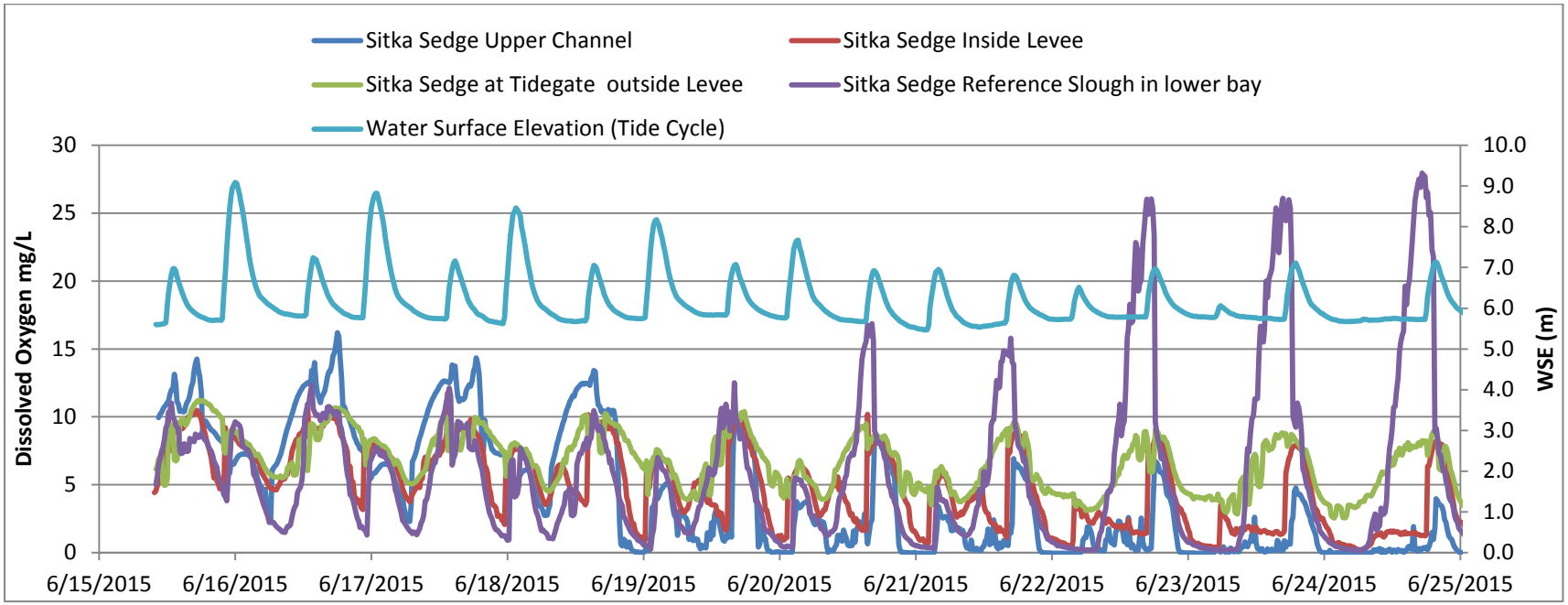
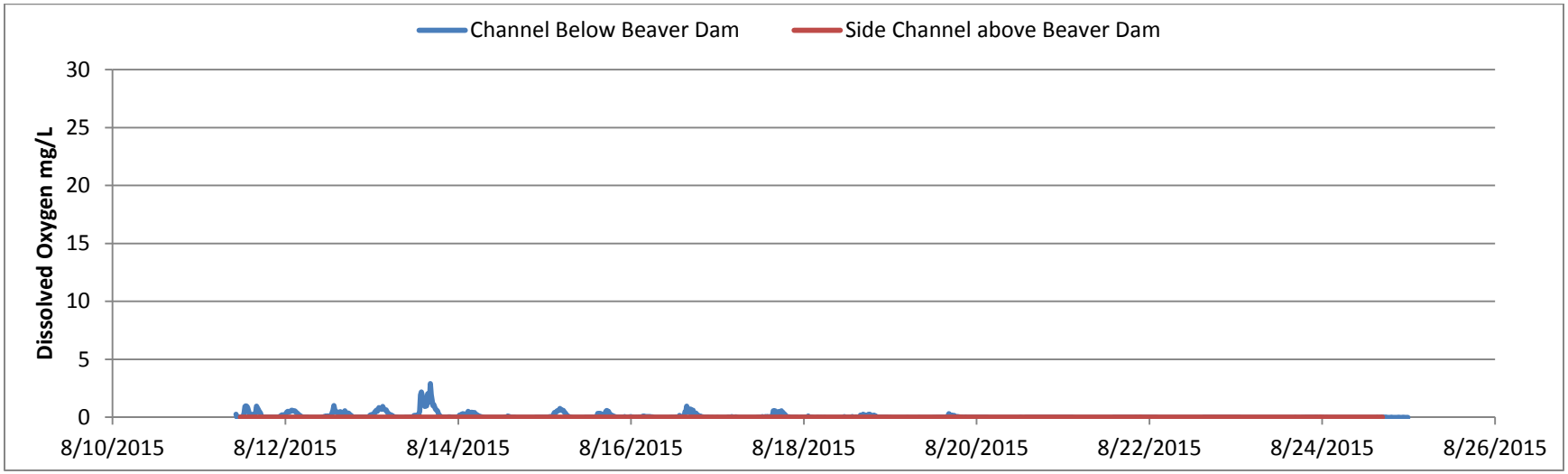


Figure 9. Dissolved Oxygen at Sitka Sedge





METHODOLOGY: TIDE BOX MODIFICATION EFFECTS ON WILDLIFE

Regardless of how the tide box is modified in the future to improve fish passage, climate change and sea level rise will eventually result in a transition of some freshwater and brackish wetlands to salt marsh and tidal mudflats. Tidal estuaries are very dynamic systems, and while initial modeling indicates most conversion will be to mudflats, over time erosion and sediment deposition could alter habitats in ways too complex for modeling to predict. This assessment addresses wildlife impacts based on modeling that shows expected conversions to mudflats (Table 7) in the near term. This will benefit some wildlife species that are associated with tidal mudflats and saltmarsh, have a neutral effect on species that utilize all or none of the three habitats, and negatively affect other species that are associated with freshwater wetlands. A broad categorization of these effects was applied to all 409 species that could occur at Sitka Sedge (Appendix A); note that freshwater invertebrate species lists and associations have not incorporated, which skews results by reducing the number of negatively impacted freshwater aquatic species (e.g., *Odonata*, stone flies, etc.). If a species was closely associated with freshwater wetlands (including emergent marsh and wet meadows) but not associated with saltmarsh or bays (used as proxy for tidal mudflats), the overall effect of habitat transition was determined to be negative. If a species was closely associated with saltmarsh or mudflats, but not freshwater wetlands the overall effect was determined to be positive. If a species was closely associated or not associated with all three habitats the effect was determined to be neutral. This is a simplistic categorization, as some species may associate more with structure of vegetation or water depth rather than specific plant communities. For example, marsh wrens (*Cistothorus palustris*) seek out dense emergent vegetation high enough to support nests rather than saltmarsh or freshwater systems. To further illustrate, wrens will benefit from increased high saltmarsh and freshwater wetlands dominated by cattail and other tall emergent vegetation, but be negatively impacted by low saltmarsh and freshwater wetlands dominated by pickerel weed and low emergent vegetation. Habitat models and species association lists available to OPRD did not address structure, so this intricacy is lost in this assessment. In addition, some species may utilize the habitats at different life stages, and the importance of one habitat compared to another may not be equivalent. Broad categorization provides a snapshot of potential effects rather than a concrete impact analysis.

Species were categorized into taxonomic (invertebrate, amphibian, fish, reptile, bird, mammal) and functional groups to assist in broad level snapshot of habitat changes will impact species. Functional groups were determined by life history similarities and family groupings as follows:

- Neotropical migrants – birds that breed in the Pacific Northwest and Alaska and winter south of Oregon
- Shorebirds – taxonomic grouping for birds; usually birds that forage for invertebrates in mudflats, shallow water, or along beaches.
- Seabirds – birds that spend a significant portion of their time in a marine environment
- Wading Birds – herons and their allies
- Resident – songbirds and woodpeckers that spend the entire year at Sitka Sedge
- Waterfowl – ducks and geese
- Winter – birds that spend only the winter at Sitka Sedge
- Marsh – Species reliant on marsh habitat
- Reptiles
- Anadromous fish – fish that transitions from freshwater to saltwater and back as part of its lifecycle
- Freshwater fish – fish that survives in freshwater
- Marine fish – fish that survives in water with high salinity

- Other fish – fish that can survive in a gradient of salinities that is not dependent on life stage
- Marine invertebrate
- Freshwater invertebrate - species lists and associations for this group are not readily available, and freshwater aquatic invertebrates (e.g., *Odonata*, stone flies, etc.) are not represented
- Upland invertebrate
- Terrestrial amphibian – Terrestrial throughout entire life stage
- Stream amphibian – Terrestrial adult breeds in fast moving streams
- Lentic amphibian – Terrestrial adult breeds in slow moving water

Scenario 1 – Remove tide flap

Scenario 1 would involve removing the tide gate on the tide box; this would result in an approximately 4-foot opening in the artificial levee through which ocean water would be able to move freely. This would increase water exchange, and potentially improve dissolved oxygen levels. Temperature is also influenced by tidal action, and maximum temperatures could drop with additional water flow. This action will not meet fish passage standards, but will allow OPRD to gain valuable data on how increased water exchange could affect the neighboring communities and water quality behind the artificial levee.

Juvenile salmonids can pass through water that is moving less than 2 feet/second (ft/s). To determine if Scenario 1 would provide juvenile passage, Waterways, Inc. modeled velocities using a tidal cycle data set from 2005-2015. On a single day, August 16, 2005, velocities of 2 ft/s occurred for 64% of the day and appear to coincide with low flows outside of high tide. Over 10 years, Waterways, Inc. modeling indicates that fish passage velocities would occur 47% of the time. Interestingly, acceptable fish passage velocities appear to occur when water surface elevation is below 5.8 (Figure 10), which can be interpreted as outside of high tide and storm surges. Substandard water quality (high temperature, low DO) under current conditions appears to be correlated with low tide; it appears that fish passage will be possible when juveniles may need to exit the waters behind the levee due to substandard water quality.

Vegetation modeling indicates that Scenario 1 would result in habitat type conversions in freshwater wetlands, scrub-shrub wetlands, forested wetlands, and low saltmarsh into tidally inundated mudflats and high saltmarsh (Table 7, Bacheller 2016). The largest habitat reduction is in freshwater wetlands and scrub-shrub wetlands, while the largest habitat increase is into tidally inundated mudflats. This habitat conversion will benefit shorebirds, seabirds, marine fishes and invertebrates, and potentially salmonids (depending on the level of water quality improvements) but will negatively impact neotropical migrants, resident birds, wintering birds, amphibians, reptiles, and mammals (Table 8). In addition, there is potential for indirect impacts to federal and state threatened western snowy plover. Tidally influenced mudflats will attract more gulls and corvids than current conditions, and the loss of freshwater marsh hunting grounds may push the pair of Northern harrier (*Circus cyaneus*) to hunt the ocean beach with more frequency. Harriers have been shown to depredate western snowy plover adults and eggs, and have become a prominent predator on plover populations in South coastal Oregon.

Figure 10. Modeled stream velocities for two artificial levee conditions on August 16, 2005

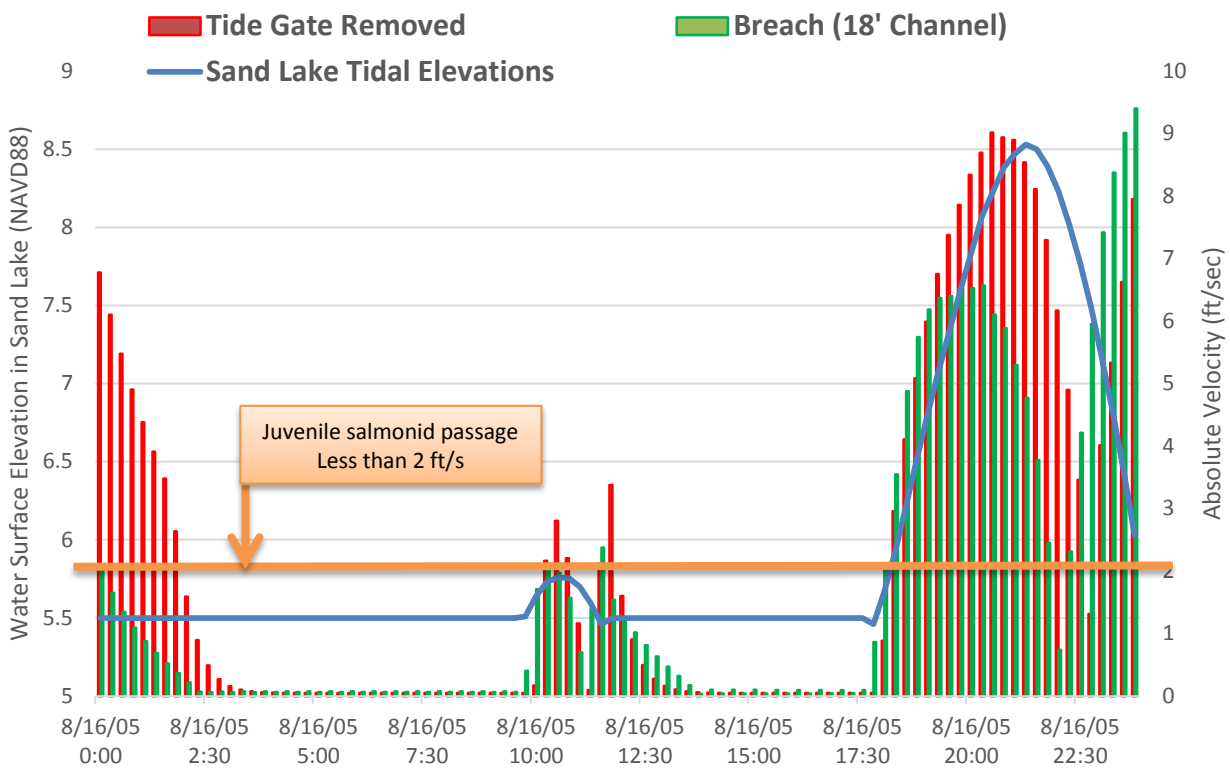


Table 7. Predicted habitat changes

Habitat Type	Current Conditions (sqft)	Scenario 1 Area (sqft)	Scenario 1 % change vs. Current Condition	Scenario 2 Area (sqft)	Scenario 2 % change vs. Current Condition
Freshwater Marsh	1,285,884	481,644	**-63%**	393,012	**-69%**
High Saltmarsh	631,008	782,172	**24%**	418,788	-34%
Low Saltmarsh	325,836	250,884	-23%	230,796	-29%
Scrub-Shrub Weltands (Shrub-swamp)	227,052	94,176	**-59%**	66,204	**-71%**
Mudflats (Water/Mud)	280,224	1,295,100	**+362%**	2,012,544	**+618%**
Forested Wetland	620,568	586,224	-6%	376,200	-39%
Upland	57,168	31,716	-45%	24,372	-57%

Adapted from Bacheller 2016. Note that estuaries are dynamic systems and acrages of mudflats and saltmarsh may shift over time based on sea level rise (more mud flats) and sediment deposition (more saltmarsh).

Table 8. Scenario 1 predicted effects on wildlife groups

Species Groups	Negative	Neutral	Positive
Amphibians	**9**	**3**	
Lentic amphibian	6		
Stream amphibian	1	2	
Terrestrial amphibian	2	1	
Birds	**78**	**94**	**71**
Neotropical Migrant	12	23	3
Resident Bird	35	37	
Seabird	1	16	16
Shorebird	3	2	33
Vagrant	2	5	
Wading Birds	1	2	2
Waterfowl	14	7	17
Wintering Bird	10	2	
Fish		**36**	**25**
Anadromous fish		1	5
Freshwater fish		8	
Marine fish		20	25
Other fish		2	
Invertebrate		**8**	**23**
Marine invertebrate[1]			23
Upland invertebrate		8	
Mammals	**47**	**9**	**1**
Mammal	46	9	1
Reptiles	**5**	**1**	
Reptile	5	1	
Grand Total	**138**	**146**	**125**

[1] Freshwater invertebrates are not part of this analysis, which skews results in favor of marine species.

Scenario 2 – Create an 18' breach

Waterways, Inc. determined that to meet one of two acceptable ODFW fish passage requirements, a minimum 18-foot breach in the levee would be required. This measurement is based on the active channels of Beltz and Reneke Creeks, and would satisfy OPRD obligations to meet state fish passage requirements. This opening in the levee will allow natural processes to function more effectively. Tidal water exchange that could potentially improve water quality (DO and temperature) behind the levee would be greater than under Scenario 1.

As under Scenario 1, to determine if Scenario 2 would provide juvenile passage, Waterways, Inc. modeled velocities using a tidal cycle data set from 2005-2015. On a single day, August 16, 2005, velocities of 2 ft/s occurred for 73% of the day, which is a 9% improvement in fish accessibility over Scenario 1. Over 10 years, Waterways, Inc. modeling indicates that fish passage velocities would occur 59% of the time, which is a 12% improvement over Scenario 2.

Vegetation modeling indicates that Scenario 2 would result in habitat type conversions all modeled habitats into tidally inundated mudflats (Table 7, Bacheller 2016). The largest habitat reduction is in freshwater wetlands, scrub-shrub wetlands, and uplands, while the only habitat increase is into tidally inundated mudflats. This habitat conversion affects species similarly to Scenario 1 in terms of numbers of species (Table 9); overall effect for individual species will be amplied compared to Scenario 1 (i.e., those negatively impacted will be worse off than in Scenario 1, those positively impacted will be better off than in Scenario 2). As with Scenario 1, there is potential for indirect impacts to federal and state threatened western snowy plover. Tidally influenced mudflats will attract more gulls and corvids than current conditions, and the loss of freshwater marsh hunting grounds may push the pair of Northern harrier (*Circus cyaneus*) to hunt the ocean beach with more frequency. Harriers have been shown to depredate western snowy plover adults and eggs, and have become a prominent predator on plover populations in South coastal Oregon. The larger amount of tidal mudflats will increase this indirect impact.

Table 9. Scenario 2 predicted effects on wildlife groups

Wildlife Group	Negative	Neutral	Positive
Amphibians	**9**	**3**	
Lentic amphibian	6		
Stream amphibian	1	2	
Terrestrial amphibian	2	1	
Birds	**79**	**94**	**70**
Neotropical Migrant	12	23	3
Resident Bird	35	37	
Seabird	1	16	16
Shorebird	4	2	32
Vagrant	2	5	
Wading Birds	1	2	2
Waterfowl	14	7	17
Wintering Bird	10	2	
Fish		**31**	**30**
Anadromous fish		1	5
Freshwater fish		8	
Marine fish		20	25
Other fish		2	
Invertebrate		**8**	**23**
Marine invertebrate[1]			23
Upland invertebrate		8	
Mammals	**47**	**9**	
Mammal	47	9	
Reptiles	**5**	**1**	
Reptile	5	1	
Grand Total	**140**	**146**	**123**

[1]Freshwater invertebrates are not part of this analysis, which skews results in favor of marine species.

SCENARIOS NOT EXPLORED

Tide box with mitigator fish passage device

Retrofitting the existing tide box system with a mitigator fish passage device was not pursued in this analysis. ODFW has two methods for calculating size of gaps in artificial structures such as dams and levees. The first, active channel width, is addressed in Scenario 2. The other method involves sizing the gap to ensure appropriate velocities are achieved. As shown in Scenario 1, completely removing the tide box flap results in excessive velocity for some portion of each day. There are no tide box flap designs retaining the existing tide box footprint that could be adapted to achieve velocities that would meet state regulations. Replacing the tide box flap with a fish-friendly version constitutes a trigger of fish passage requirements, and OPRD would need to obtain a fish passage waiver from ODFW that would allow fish entrainment for portions of each day when the tide flaps are closed (high tide). Waterways, Inc. investigated other alternatives for allowing muted tidal influx with decreased water velocity, including culvert baffling and V-shaped fishways as measures to decrease velocities inside the fishway. None of them could attain the 2 ft/s velocity guideance.

Apart from velocity, without the water exchange allowed by tidal water influx, habitat quality for aquatic species behind the levee would likely deteriorate. Increases in water nutrient concentrations (which can lead to algal blooms), turbidity, heavy metal suspension, and decreases in DO and pH would occur (Giannico and Souder 2004). With DO behind the levee already at fish-excluding lows, any additional decrease may result in a completely anaerobic system. Pulses of coliform bacteria (e.g. *E. coli*) may be released into the estuary waters during low tides (Giannico and Souder 2004), which is detrimental to the estuary water quality.

Larger breaches in artificial levee

OPRD's initial interest was to meet fish passage requirements while maintaining some freshwater marsh habitat while minimizing hydrological effects on Tierra Del Mar. Waterways, Inc. indicated that an 18-foot breach would be the minimum size needed to meet one of ODFW's requirements, and that option was adopted as the largest breach for analysis. Waterways, Inc. indicated that other models with larger breaches up to 200 feet still did not meet the 2 ft/s velocity requirements. As the modeled breach increases in size, the model itself begins to break down due to the complexity of variables, and models of breaches over a certain size would not be reliable. OPRD is now working with multiple partners and stakeholders to more closely investigate risk of flooding and habitat restoration options. This work may reveal a better solution than Scenario 1 or Scenario 2.

2.2.3 AQUATIC PASSAGE – CREEK CULVERTS

In addition, two culverts where Sand Lake Road crosses Reneke Creek and Beltz Creek also inhibit fish passage (Figure 4). According to ODFW Geospatial Information Services (GIS) culvert data, both culverts are partially passable. Other reports state that both culverts block fish passage entirely (M. Long pers. comm. December 2014). Removing these barriers may improve freshwater flow into the marsh behind the levee, and could ameliorate some of the water quality challenges under current conditions. In addition, the creeks may act as refugia for fish that do pass through the levee.

RENEKE CREEK

Restoring fish passage into Reneke Creek is a goal sought by many stakeholders interested in Sitka Sedge, and a high priority for Siuslaw National Forest. Funding for restoration opportunities upstream are negatively impacted by the fish barrier, although recent observations by USFS staff indicate steelhead can move through the tide box and culvert into the upper portions of Reneke Creek. There are four options OPRD may consider for fish passage restoration, each with varying benefits to wildlife.

Option 1 – South Crossing Culvert Replacement and Channel Re-alignment

Reneke Creek currently flows to Sand Lake Road where it is blocked by a plugged culvert; it then turns south into a roadside ditch which parallels Sand Lake Road until it reaches a partially blocked 24-inch diameter culvert. Some water passes through the culvert, but fish passage does not meet state regulation, and during rain events Reneke Creek floods over Sand Lake Road.

This option would realign Reneke Creek through pastureland into an existing wetland and replace the south culvert with a culvert that meets fish passage requirements and allows full water flow beneath Sand Lake Road. This option would offer opportunities to create freshwater wetland, scrub-shrub wetland, and riparian wetlands that could mitigate for habitat conversions associated with the artificial levee. This option would also redirect current flow away from the roadside ditch, prevent flooding that currently runs onto Sand Lake Road, and prevent erosion damage to Sand Lake Road. Overall wildlife benefits are greatest with this option, as many species beyond fish would gain habitat.

Option 2 – South Crossing Culvert Replacement

This option would replace the plugged 24” diameter south culvert with a culvert that meets fish passage requirements and can handle flood stage waters. Leaving Reneke Creek in the roadside ditch does increase erosion on Sand Lake Road, and could contribute to future repair costs. There are no wildlife benefits beyond fish passage.

Option 3 – North Crossing Culvert Replacement

Reneke Creek has shifted flow from a plugged culvert of unknown size to a road side ditch along Sand Lake Road. This results in flooding across the road. Replacing the culvert with one that meets fish passage requirements and restores flow beneath Sand Lake Road would reduce flooding and return the roadside ditch to its original function. This option offers no opportunities for improving habitat quality beyond fish passage.

Option 4 – Channel realignment outside of artificial levee

This option would restore flows into the estuary north of the artificial levee, providing fish passage upstream. This option will not improve water quality behind the levee and could further deteriorate it with less freshwater inputs. This option also does not solve the fish passage challenges associated with the levee.

Beltz Creek

Restoration at Beltz Creek is more straightforward than Reneke: replace the existing blocked culvert. Increasing the culvert size will be required to obtain fish passage standards and to ensure full water flow through the culvert during high water events. Increasing the water flow into the marsh behind the levee could also positively impact the low DO and high temperatures in portions of the marsh; this could create refugia for juvenile salmonids within the marsh as well as allowing them passage into Beltz Creek. Restoring fish passage will also increase other restoration opportunity priorities further upstream and open additional grant opportunities.

3. FISH AND WILDLIFE

Potential for wildlife species presence were determined using habitat assessments, historic wildlife data, and field surveys in conjunction with searching existing occurrences in state, federal, and public databases.

3.1 AT-RISK FISH & WILDLIFE

At-risk wildlife species are those experiencing population declines or are otherwise at risk. They include federal endangered, threatened, candidate species and species of concern; state endangered, threatened, and candidate species; state critical and vulnerable species; and NatureServ Conservation Rank S1, S2, and S3 species. Currently, 4 species listed under the federal and/or state Endangered Species Acts, and 57 federal and/or state sensitive species have the potential to occur or do occur in Sitka Sedge (Table 10). Inventories of the property and database searches identified three federal or state threatened and endangered species present in the park (Western snowy plover and marbled murrelet). Assessment timing may not have been appropriate for detecting many of these species; therefore, at-risk species surveys should be performed prior to initiation of development projects.

3.1.1 OREGON SILVERSPOT BUTTERFLY

The federally threatened Oregon silverspot butterfly (*Speyeria zerene hippolyta*) is a small orange fritillary with dark markings. Currently this species is known to occur at only four sites in Oregon (USFWS 2001).The silverspot requires early successional, coastally-influenced grassland that contains the caterpillar host plant early blue violet (*Viola adunca)*, adult nectar sources and courtship areas. The butterfly is not currently known to occupy the park, and recolonization is unlikely without appropriate habitat and reintroduction efforts. *V. adunca* has been found in the park in small quantities along trail edges and surrounded by conifer-kinnikinnick woodland.

Figure 11. Viola adunca at Sitka Sedge

Table 10. At-risk species occurrence at Sitka Sedge

Common Name	Scientific Name	FESA	State Listing	Conservation Rank	Occurrence
Oregon silverspot butterfly	Speyeria zerene hippolyta	FT			Potential
Seaside hoary elfin	Callophyrs polia maritima				Potential
Clouded salamander	Aneides ferreus		SV CS	S3S4	Potential
Coastal tailed frog	Ascaphus truei	SOC	SV CS	S3	Unlikely
Columbia torrent salamander	Rhyacotriton kezeri		SV CS	S3	Potential
Northern red-legged frog	Rana aurora	SOC	SV	S3S4	Present
Western toad	Anaxyrus boreas		SV CS	S5	Present
Western Pond Turtle	Actinemys marmorata marmorata	SOC	SC CS		Potential
Chum salmon (Pacific Coast ESU)	Oncorhynchus keta pop. 4		SC		Vicinity
Coastal cutthroat trout (Oregon Coast ESU)	Oncorhynchus clarki	SOC	CS		Present
Coho salmon (Oregon Coast ESU)	Oncorhynchus kisutch pop. 3	FT	SV CS	S2	Present
Green sturgeon	Acipenser medirostris	SOC		S3	Unlikely
Pacific lamprey	Entosphenus tridentatus	SOC	SV CS	S2	Vicinity
Steelhead (Oregon Coast ESU, winter run)	Oncorhynchus mykiss pop. 31	SOC	SV	S2S3	Present
Western brook lamprey	Lampetra richardsoni		SV CS		Vicinity
Aleutian Canada Goose	Branta canadensis leucopareta	FT	SE		Potential
American Peregrine Falcon	Falco peregrinus anatum		SV CS	S2B	Present
Bald eagle	Haliaeetus leucocephalus		SV CS	S4B,S4N	Present
Band-tailed pigeon	Patagioenas fasciata	SOC	CS	S3B	Present
Black oystercatcher	Haematopus bachmani	SOC	SV CS	S3	Present
Bufflehead	Bucephala albeola			S2B,S5N	Present
Caspian Tern	Sterna caspia		CS		Present
Clark's grebe	Aechmophorus clarkii			S3B,S2N	Vicinity

Common Name	Scientific Name	FESA	State Listing	Conservation Rank	Occurrence
Ferruginous Hawk	Buteo jamaicensis	SOC	SC/SV	S3B	Present
Fork-tailed storm-petrel	Oceanodroma furcata		CS	S2B	Potential
Golden Eagle	Aquila chrysaetos			S3	Potential
Golden-crowned Kinglet	Regulus satrapa			S3	Present
Harlequin duck	Histrionicus histrionicus	SOC		S2B,S3N	Vicinity
Horned grebe	Podiceps auritus			S2B,S5N	Present
Marbled murrelet	Brachyramphus marmoratus	FT	ST CS	S2	Present
Olive-sided flycatcher	Contopus cooperi	SOC	SV CS	S2S3B	Present
Pileated woodpecker	Dryocopus pileatus		SV	S4	Present
Purple martin	Progne subis	SOC	SC	S2B	Present
Red-necked grebe	Podiceps grisegena		SC	S1B,S4N	Present
Rhinoceros auklet	Cerorhinca monocerata		SV	S2B	Present
Rock Sandpiper	Calidris ptilocnemis		CS		Potential
Sandhill Crane	Grus canadensis canadensis			S3N	Potential
Short-eared Owl	Asio flammeus			S3	Potential
Snowy Egret	Egretta thula		SV	S2B	Present
Trumpeter swan	Cygnus buccinator			S1?B,S3N	Potential
Western bluebird	Sialia mexicana		SV	S4B,S4N	Potential
Western grebe	Aechmophorus occidentalis			S3B,S2S3N	Present
Western snowy plover	Charadrius nivosus nivosus	FT	ST		Present
White-tailed kite	Elanus leucurus			S2B,S3N	Potential
Willow Flycatcher	Empidonax traillii adastus	SOC	SV		Present
Yellow-breasted chat	Icteria virens	SOC	SC	S4B	Potential
California myotis	Myotis californicus		SV CS	S3	Potential
Fisher	Pekania pennanti	PS:FC	SC	S2	Unlikely
Fringed myotis	Myotis thysanodes	SOC	SV CS	S2	Potential
Hoary bat	Lasiurus cinereus		SV CS	S3	Potential
Long-eared myotis	Myotis evotis	SOC		S4	Unlikely
Long-legged myotis	Myotis volans	SOC	SV CS	S3	Unlikely

Common Name	Scientific Name	FESA	State Listing	Conservation Rank	Occurrence
Pacific marten	Martes caurina			S1	Potential
Red tree vole	Arborimus longicaudus	PS:FC	SV CS	S3	Potential
Silver-haired bat	Lasionycteris noctivagans	SOC	SV CS	S3S4	Potential
Townsend's big-eared bat	Corynorhinus townsendii	SOC	SC CS	S2	Potential
White-footed vole	Arborimus albipes	SOC		S3S4	Unlikely
Yuma myotis	Myotis yumanensis	SOC		S3	Potential

FE: Federally endangered
FT: Federally threatened
PS:FC: Federal Candidate
SOC: Federal Species of Concern
SE: State endangered
ST: State threatened
SC: State critical
SV: State vulnerable
S1: NatureServ Critically imperiled due to extreme rarity or steep declines in the state
S2: NatureServ Imperiled rarity due to restricted range, few populations, steep declines in the state
S3: NatureServe Vulnerable due to restricted range, fe populations, recent and widespread declines in the state
S3S4: NatureServe either vulnerable or apparently secure; uncertainty about status
S4: Apparently Secure uncommon but nor rare in the state
S5: Secure, common, widespread, and abundant in the state
B: Breeding population
N: Nonbreeding population

3.1.2 Seaside Hoary Elfin

Seaside hoary elfin (*Callophyrs polios maritima*) is a small, brown butterfly similar in appearance to the far more common western pine elfin (*Callophyrs eryphon*). Seaside hoary elfin is not federally or state listed under the Endangered Species Act, but this subspecies has been documented at only three locations throughout its range. Seaside hoary elfin is closely associated with kinnikinnick (*Arctostaphylos uva-ursi*) exposed to sunlight, which serves as the larval host plant. Adults emerge as early as mid-March and fly through May. Never far from kinnikinnick, these subspecies populations are very small and vulnerable to habitat loss; natural plant succession shades out kinnikinnick, and the invasion of weeds like European beach grass and Scotch broom eventually crowds out kinnikinnick. There are likely other limiting factors, as ample patches of kinnikinnick exist along the coast but are devoid of seaside hoary elfin. OPRD is conducting surveys for this butterfly at Sitka Sedge in April and May 2016.

3.1.3 Coastal Cutthroat Trout

Oregon Coast ESU of coastal cutthroat trout (*Oncorhynchus clarkii*) is a federal species of concern and state Conservation Strategy species. They come upstream on the first October freshets and continue sporadically through December with stragglers as late as February (M. Long pers.comm December 2014). Coastal cutthroat have a multi-stage migration, first appearing in tidal areas in springtime, concentrating there by July, and likely remaining in tidewater throughout the summer. They move back and forth from estuary to the upper tidal areas and spread over tidal flats during high tides. Coastal cutthroat hold in subtidal channels in late summer prior to fall freshets (Sumner 1953). They concentrate in upper tidewaters towards the end of summer and then move farther upstream with the onset of fall rain (Sumner 1972). Coastal cutthroat tend to spawn in smaller tributaries (ODFW 2014), and express numerous life histories. As with all ocean migrating fish species, the levee and tide box at Sitka Sedge currently provide a fish passage barrier. While the damaged tide box allows some passage, water velocities often exceed juvenile and adult swimming capabilities. USFS staff observed cutthroat fry in Reneke Creek in late summer 2016.

3.1.4 Coho Salmon

The Oregon Coast Evolutionary Significant Unit (ESU) of Coho salmon (*Oncorhynchus kitsutch*) is a federally threatened and state vulnerable Anadromous salmonid that is currently present in the park. Like Chinook, Coho spend most of their adult lives at sea and migrate up river and stream channels to spawn in stable gravel substrates. At Sitka Sedge, adult Coho return to the estuary from mid-September to January and spawn in low gradient streams from October to December and into January with peak spawning in mid-November (M. Long, pers.comm December 2014). Young fry and juveniles feed and grow in streams and wetlands, migrating out to estuaries and ocean in the spring of their second year, and returning as adults in their third year. Recent work (Jones et al. 2014) has illustrated that the life stages are more complex, with much greater variation in juvenile life history and habitat-use patters than previously expected. Estuaries may play a significant role in the life histories of Coho populations.

The Oregon Coast ESU Coho Conservation Plan (ODFW 2007) cites stream complexity and water quality as the two major limiting factors for Coho. Complex stream habitat in the form of overhanging and submerged vegetation, undercut banks, pools, submerged logs and rocks, and connected floodplains provide needed protection to juveniles while they remain in freshwater streams like Beltz and Reneke Creeks. Jones et.al (2014) found that Coho in the Salmon River Estuary grew twice as fast and had significantly higher average growth compared to fish that reared in the catchment in the winter. In addition, estuary reared fish were significantly larger at ocean entry (Jones et al, 2014). As with all ocean migrating fish species, the levee and tide box at Sitka Sedge currently provide a partial fish passage barrier. While the damaged tide box allows some passage, water velocities often exceed juvenile and

adult swimming capabilities. USFS staff confirmed Coho smolt presence where Reneke Creek meets the marsh behind the artificial levee in late summer 2016.

3.1.5 Chum Salmon

The Pacific Coast Evolutionarily Significant Unit (ESU) Chum salmon (*Oncorhynchus keta*)is a state critical species, and early commercial catch records indicate chum were more abundant than they are today (Cleaver 1951). ODFW adult monitoring programs indicate chum is present consistently in a few coastal basins. Chum spawn in lower gradient reaches of mainstem rivers and small floodplain streams. They will also spawn in upper intertidal reaches. Chum salmon return late October to mid-December with peaks in mid-November or December (M. Long, pers.comm), and fry rear in freshwater and estuary habitats. As with all ocean migrating fish species, the levee and tide box at Sitka Sedge currently provide a fish passage barrier. While the damaged tide box allows some passage, water velocities often exceed juvenile and adult Chinook swimming capabilities.

3.1.6 Steelhead

The winter run of the Oregon Coast ESU steelhead (*Oncorhynchus mykiss*) is a federal species of concern and state vulnerable salmonid. Steelhead return to Sand Lake Estuary as early as December with peaks beginning in mid-March through April (M. Long pers.comm December 2014). Steelhead will return to the ocean post-spawning, and some adults will spawn more than once, unlike the majority of *Oncorhynchus* species. Like Coho, steelhead require clear, cool streams with suitable gravel size, depth, and current velocity for spawning. Steelhead can enter streams and arrive at spawning grounds weeks or months prior to spawning, making the adults susceptible to disturbance and predation. Summer rearing takes place primarily in faster parts of pools, and in glides and riffles. Winter rearing occurs at lower densities across a wide range of fast and slow habitats. USFS staff confirmed steelhead smolt presence where Reneke Creek meets the marsh behind the artificial levee and fry in Reneke Creek upstream of the culvert in late summer 2016.

3.1.7 Marbled Murrelet

Marbled murrelet (*Brachyramphus marmoratus*) is a federal and state-threatened species that spends most of its time at sea in open water. Murrelets fly from the ocean to their nests around 65 miles per hour, and have been documented over 50 miles from the ocean. Approximately the size of a robin, this small seabird nests on large diameter limbs in coastal forests. These limbs, covered in moss, form nesting platforms where the birds will lay a single egg. Nest platforms have been found in old growth forests as well as in large, remnant trees in mature forests and on western hemlock trees infested with dwarf mistletoe. Once thought to require old growth forests, research indicates murrelets are attracted to individual trees that fit their nesting requirements rather than a specific forest type. Nesting platforms must be at least 4 inches in diameter, preferably 30 meters above the forest floor. Murrelets prefer vegetative cover around the limb, but also need enough space to skid to a precarious halt at their nest.

Marbled murrelet are declining rapidly across Oregon, Washington, and California. Threats to this species are habitat loss, predation, and potentially declining food quality. Corvids such as American crow (*Corvus brachyrhynchos*) and Steller's jay (*Cyanocitta stelleri*) depredate murrelet nests, and are often attracted to food waste and trash at recreation areas like campgrounds and trails. Recovery of marbled murrelet requires preservation and creation of habitat supporting nest platforms safe from increasing predator populations.

Marbled murrelet protocol surveys have not been conducted at Sitka Sedge. In the absence of survey data, OPRD is assuming presence of marbled murrelet in the upland forests where platform trees exist.

While nesting within the park has not been confirmed, protocol surveys for this species are recommended prior to initiation of development projects that could affect potential habitat.

3.1.8 Northern Spotted Owl

The federal and state threatened Northern spotted owl (*Strix occidentalis caurina*) is a medium sized, dark brown owl with white spots on the breast. Often associated with "old-growth" forests, this owl inhabits forests with structurally complexity most commonly found in mature and late-seral stage stands. Spotted owl pairs tend to occupy the same territory for many years, and invest significantly in parental care. Territory size varies dependent on prey availability, ranging anywhere from 1,000 to 2,000 acres (Zabel et al. 1995).

Sitka Sedge does not currently support any known Northern spotted owl pairs, and does not have sufficient acreage to support a pair in entirety or provide nesting habitat. However, owls could utilize Sitka Sedge for hunting, especially, riparian and mature forests that abut Critical Habitat on Siuslaw National Forest.

3.1.9 Western Snowy Plover

Western snowy plover (*Charadrius nivosus nivosus*) is a small, sparrow-sized shorebird with black bars on the forehead and behind the eye, and an incomplete black neck ring. The coastal population is federally and state threatened, and extends from Washington south to Baja California. Western snowy plover breed in open, dry sand where the male scoops out a small nest scrape in the sand. The female lays her eggs, usually 3, in the scrape of her choice and the pair strives to incubate and protect the eggs from wind, storms, tides, sand, predators, and human disturbance. Extensive habitat loss has pushed the remaining birds into small areas, where disturbance from recreation and high predator densities negatively impact their ability to reproduce. The Oregon population has been extensively monitored since 1990, and most of the population is banded with unique color combinations which makes following individuals possible. Habitat management, predator management, and recreation restrictions by OPRD and other state and federal agencies have allowed the Western snowy plovers to increase from a low of 35 adults in 1993 to over 400 in 2015.

OPRD manages the entire ocean shore in Oregon, and in the course of management Western snowy plovers could be harmed, resulting in take. In 2010, OPRD signed a Habitat Conservation Plan (HCP) with specific conservation measures as part of an Incidental Take Permit (ITP) to account for this loss, protect the state's liability, and to maintain beach access for recreation and beach safety response. The HCP designated 16 areas across Oregon as snowy plover management areas, including South Sand Lake at Sitka Sedge (Figure 12). In 2016, a Western snowy plover nest was discovered (Figure 13), the first known nesting attempt at this site since 1984, a testament to selecting the site for protection and the low levels of disturbance relative to other beaches on the north coast. With habitat restoration, recreation restrictions, and predator management the plovers will hopefully retain their fragile foothold at Sitka Sedge.

Figure 12. Snowy Plover Management Areas in Oregon

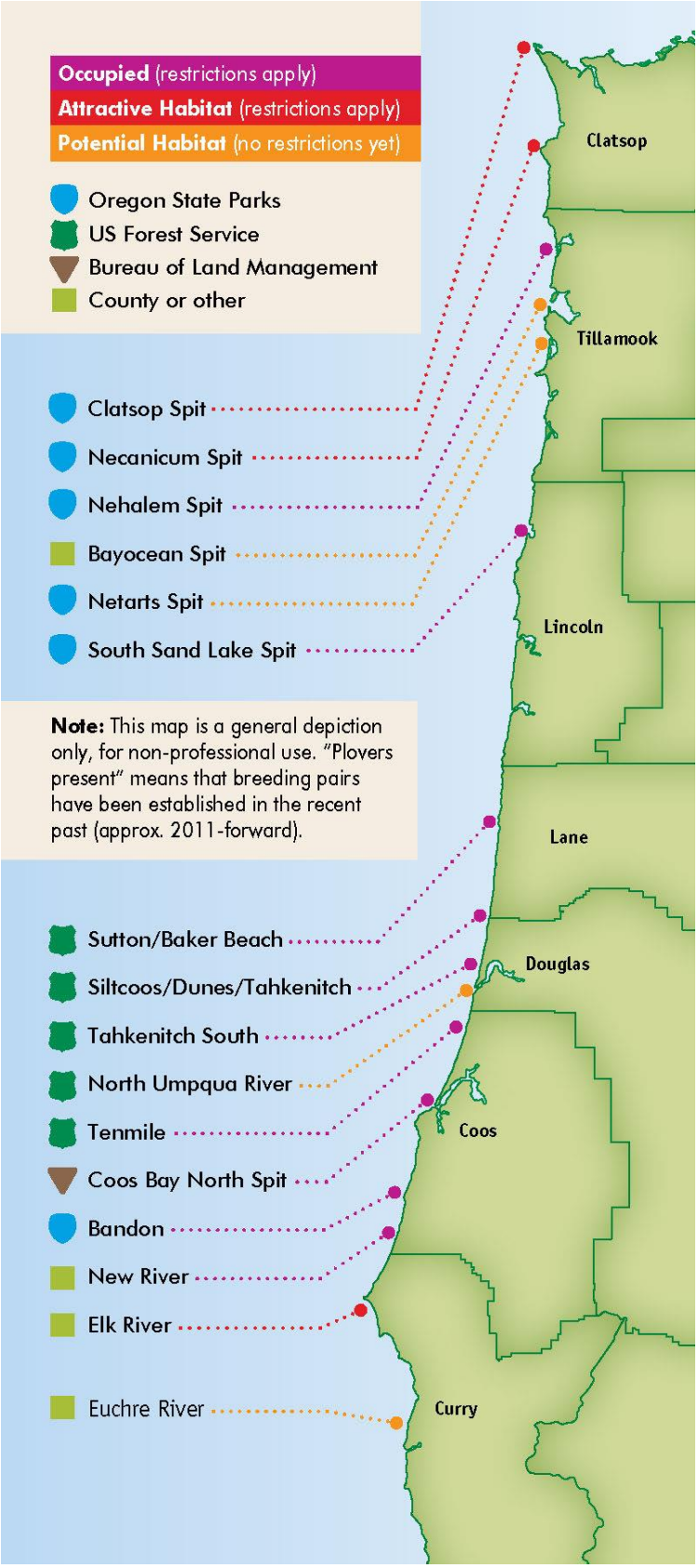


Figure 13. Supernormal western snowy plover nest at Sitka Sedge

3.1.10 Red tree vole

Red tree vole (*Arborimus longicaudus*) is a federal candidate species for listing, a state vulnerable species, and conservation strategy species. Red tree voles live in the upper canopy of late-seral coniferous forests, and are the primary food source for Northern spotted owl. Habitat for this species is sparse at Sitka Sedge, and largely limited to the south eastern corner of the property. Surveys for this species require intensive effort and specialized certifications, including tree climbing. Due to the difficulty in obtaining survey data, assuming presence and avoiding actions detrimental to red tree vole habitat is more cost-effective.

3.1.11 Pacific Marten

The Pacific marten (*Martes caurina*) is a slinky brown cat-like mammal with a teddy bear face. Thought to be a species of old growth forests, recent trapping work in the Oregon Dunes of the Siuslaw National Forest is revealing surprising lifestyles; Pacific marten have been found using shore pine forest and back dune habitats that have completely different structure compared to the old growth forests. Genetic testing is underway to determine the relationship between the coastal population and interior population. With these new data on habitat usage, it is possible Pacific marten are present at Sitka Sedge.

3.2 Additional Species of Interest

3.2.1 Northern Red-legged Frog

Amphibians are often touted as a prime indicator species of wetland health due to their sensitivity to changes in environmental factors, and their role as secondary consumers in the food web. The northern red-legged frog (*Rana aurora*) is a federal species of concern and state vulnerable. Adults utilize upland forests and breed in still ponds. Some adult frogs will travel over 2 miles to locate a pond in which to breed (Hayes 2008). Adults typically move through forested upland habitat, preferring sword fern (Hayes 2008). The close proximity of suitable breeding habitat and upland foraging habitat makes Sitka Sedge an ideal location for this species. Most breeding data is derived from monitoring in the

Willamette Valley, where frogs place egg masses close to the water surface in ponds deeper than 18 inches. However, monitoring data at another coastal location, Beaver Creek State Natural Area, found red-legged frog egg masses consistently in much shallower water and placed on the wetland substrate (OPRD unpublished data). Due to its sensitivity to changes in the environment, monitoring red-legged frog populations can alert park staff to issues related to water quality before it affects most other species, like juvenile salmonids.

In 2003, adults were documented in the forest adjacent to the Beltz quarry pond and in the forest west of the estuary. Egg masses were observed in interdunal wetlands, attached to slough sedge, in 2003 and also in the freshwater marsh south of the beaver dam in 2016. Surveys did not locate any red-legged frog activity north of the beaver dam, which is affected by brackish to saline water due to its tidal influence. Hydrologic models indicate that salt water conditions would be expanded and affect much of the current freshwater habitat if the levee is breached, which could negatively impact red-legged frog habitat.

3.2.2 Chinook

Coastal Chinook Species Management Unit (SMU, *Oncorhynchus tshawytscha*) is a state critical species. The 2014 ODFW Coastal Multispecies Plan groups both the early (returning in spring or summer) and late (returning in fall) runs into the same population as there are few isolating mechanisms between the life history components, and the basins are not naturally conducive to independent spring or summer Chinook populations. Fall run Chinook were historically present in the Sand Lake Estuary (M. Long pers.comm December 2014). Chinook spend most of their adult lives at sea and migrate up river and stream channels to spawn in stable gravel substrates. They are large tributary spawners, and eggs are laid in a depression in the gravel, called a redd. As with all ocean migrating fish species, the levee and tide box at Sitka Sedge currently provide a fish passage barrier. While the damaged tide box allows some passage, water velocities often exceed juvenile and adult Chinook swimming capabilities.

3.2.3 Bald Eagle

The bald eagle *(Haliaeetus leucocephalus)* is a striking, large dark brown eagle with white head and tail feathers and a yellow bill. Once federally endangered, the species has recovered to delisting; the bald eagle remains state threatened and federally protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Bald Eagle nesting territories are associated with lakes, rivers, and reservoirs (USFWS 1986), and adults exhibit strong nest-site and mate fidelity (Jenkins and Jackman 1993). Nests are usually found in large conifers and snags.

No known eagle nests are within the park boundaries, but adults have been observed and to the north east the Siuslaw National Forest has established a bald eagle nesting area. Bald eagles are present year-round (Isaacs and Anthony, 2003). Nesting habitat for bald eagles could be enhanced at Sitka Sedge through forestry actions which encourage and retain large trees suitable for nest platforms.

3.2.4 Roosevelt Elk

Roosevelt elk (*Cervus canadensis roosevelti*) is a subspecies of elk named after Theodore Roosevelt, and roams a variety of habitats from the ocean to the western slopes of the Cascade mountain range. Their numbers were once low across the state, but careful game management resulted in population increases that allowed hunting seasons to open in 1938. Elk sign is common throughout Sitka Sedge, from tracks across the coastal dunes to scat and “elk trails” in the pastures and forest.

3.3 THREATS TO FISH AND WILDLIFE

OPRD management of the property can pose threats to fish and wildlife species through direct mortality, disturbance effects, habitat loss and degradation. The primary threats are described below.

3.3.1 HABITAT DEGRADATION AND LOSS

Development of new facilities, be they trails, structures, or parking areas, reduces available habitat. When new facilities are developed the existing land-use is altered, and higher concentrations of people can cause increased stress and disturbance to wildlife that currently use newly development areas. Direct mortality of wildlife would be limited to initial construction phases of development projects and is expected to be low; however, indirect mortality may increase due to habitat degradation that changes or fragments plant communities (Knight et al. 1995) and soils (Cole 1993). Indirect mortality may also increase due to increased predation from corvids, coyotes, and other species by providing predators easier access to nesting areas (Miller et al. 1998) and by artificially increasing density of predators associated with humans. Increased visitor use can result in human trampling of vegetation from hiking, camping, fishing and nature viewing while impacts to soils include loss of organic horizons, compaction, and increased erosion. These changes in soil characteristics adversely affect the germination, establishment, growth, and reproduction of native plants and can favor non-native invasive species (Cole 1993). Fishing from banks can negatively impact shoreline characteristics, increase sedimentation, alter organic matter content, and alter water chemistry. Each project executed in the park should be evaluated for these impacts and appropriate minimization and mitigation actions should be taken. Existing areas of disturbance should be assessed for actions that can be taken to reverse damage to degraded areas. See Section 4 for specific recommendations.

3.3.2 RECREATIONAL ACTIVITIES

OPRD's mission, to provide and protect outstanding natural, scenic, cultural, historic, and recreational sites for the enjoyment and education of present and future generations, is a balancing act. Providing avenues for recreation often have negative impacts to wildlife. Part of the park planning process involves evaluating and minimizing these impacts in concert with determining facility and trails placement. Section 4 outlines strategies to minimize and mitigate impacts from recreational activities as well as enhancements to existing natural resources.

Recreational activities that are likely to directly impact wildlife at Sitka Sedge are hiking and nature viewing. Recreational activities can negatively impact wildlife by causing direct mortality (such as hunting, fishing, etc.) or indirectly by disturbing wildlife behavior.

Consumptive recreation activities include hunting, fishing, and clamming. Waterfowl hunting is permitted in the estuary north of the dike, and ODFW has requested that waterfowl hunting be allowed at Sitka Sedge. However, t current Oregon Administrative Rules (OAR 736-010-0055) does not list Sitka Sedge as a hunting location; therefore, hunting from the dike or lands under OPRD management is not allowed. The National Coastal Wetlands Conservation Grant administered by USFWS which largely assisted in acquiring this property spelled out specific passive recreation uses that will not compromise the ecosystem integrity (hiking, wildlife viewing, and interpretation), and hunting was not included. To allow hunting, OPRD would need to change state rule as well as consult with USFWS on consistency with the purposes for which the grant was awarded. In addition, allowing hunting, fishing, and shellfishigng access from Sitka Sedge will increase corvid and gull presence, which will negatively affect the federal and state threatened western snowy plover. Overall hHunting opportunities are not locally reduced, as the estuary outside of the levee is not under OPRD's jurisdiction and remains open to hunting per ODFW regulation.

Non-consumptive recreation activities such as hiking and picnicking do not seem like an adverse impact; however, disturbance from these uses can reduce species diversity in mammals (Reed and Merenlender 2008), alter species composition in songbirds (Remacha et al. 2011), negatively affect nest placement in songbirds, and increase the risk of songbird nest predation (Miller et al. 1998). In Eastern Oregon, a hunted population of elk fled when people were within 500 m (1,640 feet) and the number of elk observed was much lower than the herd total (Rocky Mount Elk Foundation, Starkey Day, June 22 2012). Constant disturbance results in elk avoidance of the area; consistent visitor use of trails and facilities could mean elk will be seen less and less frequently. In dense forests these impacts may be reduced, and some elk habituate in populations that are not hunted, but habituation is hard to predict. Nature viewing has a great potential to negatively impact wildlife and repeatedly disturb rare species (Boyle and Samson 1985). Avid wildlife viewers intentionally seek out rare or spectacular species. Because these activities may occur during sensitive times of the year, and because they often involve close approaches to wildlife for the purpose of identification or photography, the potential for negative impacts are large (Knight et al. 1995).

Trails and Wildlife

People come to state parks to recreate, and often that includes walking the trail system. Demand for trails through a variety of plant communities, scenic views, and with multiple difficulty levels is a consistent pressure on natural areas, including state parks. At the same time, hiking trails can foster a sense of appreciation for natural resources in the public that is critical to conservation efforts.

Healthy wildlife populations enrich the visitor experience, and ultimately benefit the operation of the park. However, trails can negatively impact wildlife and care must be taken during trail route planning to reduce or mitigate impacts. Trails alter competitive, symbiotic, and predator-prey relationships (Gutzwiller 1995; Gutzwiller et al. (1994) found that trail proximity decreased bird singing during the breeding season, which directly affects productivity. Birds may be reluctant to establish breeding territories near trails with frequent human use. Proximity to trails has been shown to reduce avian nest success, and nest survival increases with distance from trail (162 nests, Miller 1998). Trail proximity also affects where songbirds place their nests (Smith-Castro 2008, Miller 1998) and nest defense behaviors (Knight and Temple 1986, Keller 1989). Any changes in what a breeding bird is doing has a negative effect on its young – more time chasing things away from its nest means less time finding food for babies.

Trails also alter avian species abundances (Hickman 1990, Van de Zande 1984) within 75 meters (250 feet) of a trail (Miller 1998), due to both habitat changes as well as disturbance. Even trail width can affect species abundance (Holmes and Geupel 2005). For example, spotted towhee, wrentit, and Bewick's wren were less common around wide trails (greater than 2 m or 6.5 feet) than thin trails (less than 2m or 6.5 feet). Species that can tolerate higher disturbance levels will be more prevalent (crows, ravens, robins, etc). To meet conservation goals, Sitka Sedge should provide areas for the species that are not tolerant as well as the ones that are (See Section 4.2). These *wildlife reserves* will benefit many wildlife species within the park, including those sensitive to disturbance. For recreation purposes, ensuring the less tolerant species remain present in the park increases the likelihood visitors may see them when trail use is low.

Indirect mortality may also increase due to increased predation from corvids, coyotes, and other species that are attracted to refuse and other human-related disturbance (Gotmark 1992). Predators often use trails as "grocery aisles", walking along them and depredating nests (and adults) within relatively easy reach. Avian nest predators are attracted to open, narrow corridors (Hickman 1990, Rich et al. 1994). This means bird pairs nesting near trails are less likely to successfully raise young. In parks with high trail density, this creates a "sink" situation where birds are attracted to the area by what seems high quality

habitat, and then fail to fledge any young. When the adults die, there are too few young to replace them, and the local population of the species decreases. Reserve areas away from trails helps increase reproductive success in the park and can produce a "source" population where adults produce more than 2 young in their lifetimes. These young disperse out from the park and colonize new areas as they establish territories, ultimately increasing the species population.

Restoring new and existing habitat, siting facilities away from important wildlife areas, developing wildlife viewing blinds, and establishing reserve areas that are kept distant from trails will help mitigate for these negative impacts and provide a positive effect on wildlife populations.

3.3.3 Invasive Fish and Wildlife Species

Invasive species are considered to be one of the primary causes of species becoming threatened and endangered, next to habitat loss (ODFW 2005). Non-native plants are addressed in the Vegetation Inventory and Botanical Resource Assessment for Sitka Sedge State Natural Area (Bacheller 2016). Non-native and invasive wildlife pose a threat to native species by predation and outcompeting for valuable resources. In the Coast Ecoregion there are 29 documented invasive, non-native fish and wildlife species and another 20 non-native, potentially invasive species that have not yet been observed but have the potential to pose a serious threat to native species should they establish populations (Table 11). While not all the species in Table 11 are present in Sitka Sedge, a few are already problematic. Nutria (*Myocastor coypus*) are present and have the potential to damage native vegetation and negatively affect water quality.

Table 11. Invasive Species for the Coast Range

Common Name	Scientific Name	Coast Range Threat level
Asian clam	Corbicula fluminea	Documented
Bluegill	Lepomis macrochirus	Documented
Brook trout	Salvelinus fontinalis	Documented
Brown Bullhead	Ameiurus nebulosus	Documented
Bullfrog	Lithobates catesbeianus	Documented
Carp	Cyprinus carpio	Documented
Channel catfish	Ictalurus punctatus	Documented
Crappie	Pomoxis spp.	Documented
Eastern snapping turtle	Chelydra serpentina serpentina	Documented
European green crab	Carcinus maenas	Documented
European Starling	Sturnus vulgarus	Documented
Fathead minnow	Pimephales promelas	Documented
Feral Swine	Sus scrofa	Documented
Goldfish	Carassius auratus auratus	Documented
Grass carp	Ctenopharyngodon idella	Documented
Griffen's isopod	Orthione griffensis2	Documented
House Sparrow	Passer domesticus	Documented
Japanese mitten crab	Eriocheir japonicus	Documented
Largemouth Bass	Micropterus salmoides	Documented
Mosquito fish	Gambusiaspp.	Documented
New Zealand mudsnail	Potamopyrgus antipodarum	Documented
Norway Rat	Rattus norvegicus	Documented

Common Name	Scientific Name	Coast Range Threat level
Nutria	Myocastor coypus	Documented
Smallmouth bass	Micropterus dolomieu	Documented
Striped bass	Morone saxatilis	Documented
Virginia Opossum	Didelphis virginiana	Documented
Wiper	Morone saxatilis x chrysops	Documented
Yellow Perch	Perca flavescens	Documented
Walleye	Sander vitreus	Documented
Asian Carp (bighead, Silver)	Hypophthalmichthys nobilis, H. molitrix	Potential
Banded killfish	Fundulus diaphanus	Potential
Black Carp	Mylopharyngodon piceus	Potential
Fishhook Waterflea	Cercopagis pengoi	Potential
Chinese mitten crab	Eriocher sinensis	Potential
Japanese oyster drill	Ocinebrellus inornatus	Potential
Leidy's comb jelly	Mnemiopsis leidyi	Potential
Muskelluge and Northen Pike	Esox spp.	Potential
Quagga mussel	Dreissena rostriformis	Potential
Rainwater killfish	Lucania parva	Potential
Round Goby	Neogobius melanostomas	Potential
Ruffe	Gymocephalus cernuus	Potential
Rusty Crayfish	Orconectes rusticus	Potential
Sea Squirt	Didemnum vexillum	Potential
Shimofuri goby	Tridentiger bifasciatus	Potential
Snakehead	Channa spp.	Potential
Spiny waterflea	Bythotrephes cederstroemi	Potential
Threadfin Shad	Dorosoma petenense	Potential
Veined rapa whelk	Rapana venosa	Potential
Zebra mussel	Dreissena polymorpha	Potential

4. MANAGEMENT STRATEGIES

Management strategies should be periodically reviewed and updated in a Natural Resources Management Plan throughout the duration of the Park's use. Management should involve protection of high suitability habitat, enhancement of medium suitability habitat, and restoration of degraded habitat (Figure 3). Existing data provide a loose framework to determine wildlife management strategies; however, additional surveys may be needed for specific strategies. Survey needs will be determined based on adaptive management, focal wildlife species, and consultation with USFWS, ODFW, and other local groups. Restoration projects should conduct baseline surveys for focal species prior to project initiation as well as after the project is completed to assess how the project affected the functioning ecosystem.

Monitoring will be important to assess threats and adaptively react to them in order to protect these resources over the long term. Many species within Sitka Sedge are regulated by ODFW, and OPRD will utilize ODFW management plans and regulations for ODFW-managed species, such as salmonids, elk, deer, beaver, and bear. OPRD will also maintain habitat connectivity within the park as well as to surrounding parcels to the greatest extent possible (Figure 4). The following strategies provide a starting point for adaptive management.

4.1 Reserve Recommendations

Recreation can negatively impact wildlife due to human disturbance effects (Reed and Merenlender 2008; Miller et al. 1998; see Section 3.3.2). Establishing reserve areas could reduce the impacts caused by such disturbance. These reserve areas would give wildlife a safe place to retreat and raise young where disturbance from recreating visitors is lowest in the park. Reserve areas away from sources of disturbance helps increase reproductive success in the park for many species and can produce a "source" population where adults produce more than two young in their lifetimes. These young disperse out from the park and colonize new areas as they establish territories, ultimately increasing the species population within the park as well as in the greater landscape. In general, reserves can be near trails, but should have minimal trails crossing through them. This is not always possible when accommodating other values that also fulfil OPRD's mission; in these situations minimizing disturbance and mitigating effects are recommended.

Based on desired future conditions, existing habitat, and a potential disturbance index (Appendix A), five categories emerge as potential reserves (Figure 14).

4.2 Determining Wildlife Reserves

Recreation can negatively impact wildlife due to human disturbance effects (Reed and Merenlender 2008, Miller et al. 1998, see Section 3.3.2). Establishing a reserve area where disturbance is reduced relative to the surrounding areas would give wildlife a safe place to retreat where disturbance from recreating visitors is lowest in the park. Areas with potential to act as wildlife reserves were evaluated for potential disturbance index, habitat quality, and current wildlife use. Areas with the lowest potential disturbance index were selected as possible reserve areas; habitat quality and current wildlife use were used to refine and prioritize reserve areas.

4.2.1 Shorebird Conservation Area

Critical habitat for Western snowy plover is designated on the spit, and the entire Ocean Shore is an SPMA designated in the HCP. Current management for Western snowy plover encompasses suitable habitat on the north half of the Ocean Shore into the open sand dunes on the spit (Figure 14). A specific site management plan will be developed for Western snowy plover recovery to address recreation restrictions, predator management, and restoration needs. This reserve includes the current management area as well as areas that would be suitable for restoration to coastal dune habitat.

4.2.2 Seaside Hoary Elfin

Kinnikinnick is located sporadically through this reserve. If seaside hoary elfin are discovered at Sitka Sedge, enhancing areas in this reserve for their benefit should be a priority, and trail maintenance should avoid damaging kinnikinnick patches. Restoration work to increase sunlight penetration, especially in the afternoons, would benefit the species.

4.2.3 Neotropical Migrant Corridor

Red alder forest, riparian forest, and scrub-shrublands all provide important habitat for migrating songbirds. The deciduous leaves and moist microclimate support a variety of insects and seeds that voracious migrants need to keep going on their long trip. The current location of this reserve will change with potential changes to the tide-gate system. Increasing the gap at the tide box to meet fish passage requirements will result in increased salinity, and the emergent wetlands and scrub-shrublands will convert to saltmarsh over time. Restoration of pasturelands on the east side of Sand Lake Road (See Section 4.3.3) in combination with restoration of Reneke Creek can offset the loss of this habitat. The reserve location would shift over to this location (Future Neotropical Corridor, Figure 14).

4.2.4 Marbled Murrelet

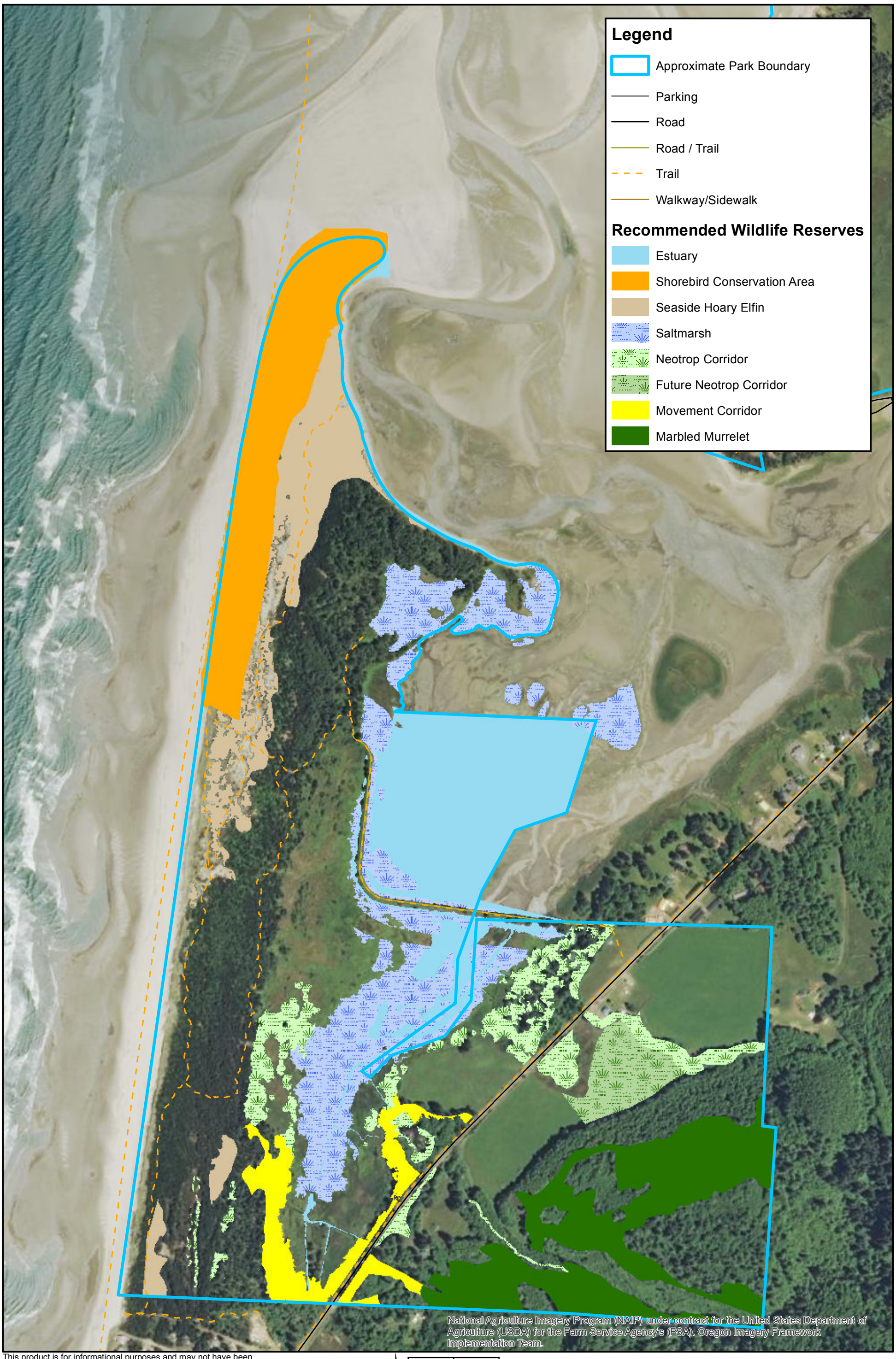
Potential nesting habitat for marbled murrelet is located in the southeast portion of the property. This area should be avoided for development in general. If future needs determine facility development or trails are warranted, surveys for marbled murrelet should be conducted to confirm presence. If murrelets are present below the canopy, then it is highly likely they are nesting on platforms in the vicinity of the observation and no development that could affect their reproductive success should be implemented. This includes actions that would attract corvids, especially Stellar's jay, crows, or ravens.

4.2.5 Saltmarsh and Estuary

The saltmarsh and estuary provide habitat for a vast array of species, from at-risk salmonids up the food web to herons. The saltmarsh is likely to expand with climate change and potential modifications for fish passage (see Section 2.2.2), reducing habitat for some species while increasing it for others. Maintaining both of these areas with minimal disturbance plays a role in the overall conservation of the estuary. Species most likely to be affected by the disturbance of the existing trail across the artificial levee are primarily large birds (herons, waterfowl, raptors). Visual disturbance will cause these species to relocate, moving further away from the artificial levee and interrupting their behavior patterns. By utilizing vegetative screening at a height between 3 and 4 feet this disturbance will be reduced or eliminated.

Figure 14. Wildlife Reserve Recommendations

Oregon Parks & Recreation Dept.
725 Summer St. NE, Suite C
Salem OR, 97301



This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.

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4.3 Specific Actions

4.3.1 Establish Shorebird Conservation Area

Sitka Sedge State Natural Area encompasses the South Sand Lake Snowy Plover Recreation Management Area (SPMA). An SPMA is a portion of the Ocean Shore that is set aside for Western snowy plover conservation, and OPRD's Habitat Conservation Plan for Western Snowy Plover (HCP) delineated 16 Western snowy plover management areas along the coast where these restrictions may take place (ICF International 2010). Western snowy plovers were discovered at this site March 28 2016, with the first nest since 1984 found on April 20, 2016. As a result, OPRD implemented seasonal recreation restrictions which will be in place from March 15 – September 15. These restrictions include:

- No motorized vehicles
- No non-motorized vehicles, including and bicycles
- No kites and drones
- No dogs

The wet sand remains open to beach walking and equestrian use. In order to give the public certainty regarding recreation opportunities at Sitka Sedge, a site management plan for Western snowy plover should be developed. This plan will delineate conservation measures for shorebirds in a way that preserves recreation while enabling shorebird breeding on the northern portion of the beach. Components of the plan should include:

- Establish a Shorebird Conservation Area
- Coastal dune habitat restoration on the north portion of the park, adjacent to the existing open sand
- Predator management strategies to reduce corvid density on the spit
- Public outreach efforts to engage the local community

4.3.2 Coastal Dune Restoration

Current dune habitat at Sitka Sedge amounts to 22 acres, many of which are subject to storm surges and king tides that can destroy Western snowy plover nests. Smaller areas also force plovers into very close quarters, making it easier for predators to locate their nests. To generate resiliency in habitat for Western snowy plover breeding, additional habitat should be restored. Larger nesting areas also give the birds places to nest further away from the wet sand and beachgoers.

Methods for creating coastal dune habitat vary by site but generally involve removal of European beach grass to create more open sand conditions in areas inland of tidally affected areas. Land managers that have been restoring dunes for Western snowy plover from Washington to California are utilizing similar tools which include a combination of bulldozers or disking, herbicide, and prescribed burns. While a successful prescription at Sitka Sedge would take three years to fully implement, restoration at other Oregon sites have had plovers using restored areas the first breeding period after open sand was exposed.

Phase 1

Phase 1 is best conducted in early fall, after the plover breeding period (September 15) but before European beachgrass goes dormant (i.e. while it is still green and will resprout). This is the most cost and time intensive phase.

- Remove the top thatch of beachgrass
- Lower the foredune edge to a slope plover chicks are able to navigate

- Flatten the top of foredune and fill the back dune to create a large flat terrace where plovers could nest
- Apply an herbicide consisting of imzapyr, surfactant, and dye to beachgrass and areas mechanically treated

PHASE 2

Phase 2 is a follow-up to ensure 100% kill of European beachgrass and consists of applying the same herbicide mix utilized in Phase 1. Application should occur in fall the year after Phase 1 treatment. The area that will need to be covered will depend on how much beachgrass is resprouting, and could be applied via aerial spray, boom spray, atv, or backpack sprayer based on what is most cost-effective and palatable to the public.

PHASE 3

Once an area is restored, annual inspections are needed to detect and eliminate European beachgrass that is creeping back into the areas. Spot treatment with backpack sprayers is an effective, low-cost, and low-toxicity method of maintaining a restored area once the initial beachgrass cover is eradicated. Timing, again, is in fall while beachgrass is still actively growing.

4.3.3 ARTIFICIAL LEVEE AND TIDE BOX

Section 2.2.2 summarizes existing conditions and two options for future management of the artificial levee. There are considerable data gaps in determining how these options will impact fish passage through the system and fish use of the wetlands, Beltz Creek, and Reneke Creek. While the management of the levee is an interdisciplinary decision that touches on recreation and aesthetic values as well as flood protection of Tierra Del Mar, the following data gaps will answer some questions that will help clarify benefits to fish.

- To better understand fish migration potential, refugia potential, and fry rearing habitat, deploy water sensors to gather data on dissolved oxygen, water temperature, water surface elevation, salinity, and pH at the following locations during the same time frame (summer into fall). Sensors should be placed low enough in the water column to note if fish close to the bottom will be within acceptable water quality thresholds.
    1. Beltz Creek upstream of Sand Lake Road
    2. Reneke Creeks upstream of Sand Lake Road
    3. Outside the tide box
    4. Inside the levee
    5. Upper channel
    6. Above the beaver dam
    7. Below the beaver dam
    8. In the estuary where water coming through the tide box will not influence measurements
- Upstream habitat assessments to clarify restoration opportunities regarding the limiting factors of pools and downed wood components. Assessments should focus on opportunities for increasing numbers of pools and downed wood components in order to run multiple iterations of the HabRate model to determine if restoration actions will be able to generate over 900 Coho winter parr/km, the ODFW threshold for low quality habitat, or 13X, the threshold for good quality habitat.

- Determine stream velocities through the existing tide box to understand current limitations to fish passage

4.3.4 Beltz Creek Culvert Replacement

Enhancing fish passage under Sand Lake Road to Beltz Creek will provide provide salmonids refugia from substandard water quality conditions, and potentially increase availability of spawning habitat for fish.

4.3.5 Reneke Creek Restoration

Of the four options presented in Section 2.2.3, Option 1 to reroute Reneke Creek through pastureland and create freshwater wetlands and scrub-shrub wetland habitat is the only option that not only corrects flooding and fish passage issues, but also converts low quality wildlife habitat into an ODFW Conservation Strategy habitat. Ultimately, restoration of Reneke will be dependent on what actions are taken related to the estuary, and will need to be developed concurrently.

4.3.6 Create Riparian Scrub-Shrub Habitat

Potential modifications to the tide box and sea level rise will likely result in a reduction of freshwater marsh and surrounding riparian scrub-shrub habitat. Reneke Creek, which may be re-routed to address erosion, fish passage, and flooding along Sand Lake Road, presents an opportunity to create new freshwater marsh and scrub-shrub habitat along Reneke's new meander.

4.3.7 Terrestrial Habitat Connectivity

Sand Lake Road represents a significant human-created wildlife movement barrier at Sitka Sedge. Two perched culverts allow minimal aquatic passage beneath the road, but all terrestrial wildlife must cross the pavement. For some species like plethodont salamanders and terrestrial invertebrates this is unlikely; for others the crossing includes risk of vehicle mortality.

- Elk already cross Sand Lake Road; as more vehicle traffic inevitably comes to the road the risk of collision between elk and vehicles increases. Addressing elk crossing will require cooperation between OPRD and Oregon Department of Transportation.
- Reneke and Beltz culverts serve as a partial fish migration barrier and should eventually be replaced with enhanced crossings that allow multiple aquatic and terrestrial wildlife species to pass beneath Sand Lake Road. ODFW provides specific criteria for fish passage. Adding ledges to the sides that allow mammals, reptiles, and amphibians to cross will improve wildlife connectivity within the park as well as dispersal to Siuslaw National Forest.

4.3.8 Vegetative Screening and Blinds Along Trails

On trails that are visually apparent to wildlife in the estuary and the coastal dunes, efforts to maintain or create vegetative screening will minimize human disturbance. Currently, use of the trail system is low. When the park opens, the increase in human use traveling along trails could negatively impact wildlife. Many species could habituate to the increased use, but others may avoid the area entirely. Creative use of vegetation and trail placement can reduce this disturbance while retaining views of the habitat. At dead-end trails used for viewsheds, viewing blinds, or other design features can provide a destination for visitors while disguising their presence to wildlife. This will also result in enhanced recreational experience, as visitors will be able to view a wider array of wildlife.

4.3.9 Trails

Trails are an integral part of recreation at State Parks, as they take visitors on a journey through the special places OPRD preserves for the public. Trails can also be a source of disturbance to wildlife,

interrupting their behaviors and causing avoidance of otherwise good quality habitat. To mitigate the disturbance, the following actions are recommended:

- Pedestrian paths to the estuary should be routed along the existing artificial levee. From there, trails should remain in the uplands or utilize a boardwalk to avoid trampling vegetation or impacting the macroinvertebrates and crustaceans.
- Trails should be designed to dissuade use of the Shorebird Conservation Area (SCA) by placing beach access south of the SCA and providing a clearly marked "destination" at the estuary, or some other method to guide visitors away from the SCA.
- Appropriate wayfinding signage will help visitors understand the trail system and minimize shortcutting or other off trail use.

4.3.10 Kinnikinnick Restoration and Enhancement

If seaside hoary elfin is discovered at Sitka Sedge, kinnikinnick will become a higher priority habitat component for restoration. Areas with documented elfin should be left in place, even if they are within the coastal dune restoration footprint, until restoration elsewhere is shown to successfully support the butterfly. Restoration of kinnikinnick and coastal dune could be phased so that as the kinnikinnick is expanded inland additional coastal dune can be restored in areas with kinnikinnick. Transplanting kinnikinnick after the flight period of the elfin will allow any elfin eggs to remain on the site and hatch onto live plants.

4.3.11 Streamline Fencing

Historical agricultural uses of Sitka Sedge have left a legacy of old fencing. Known fencing borders Sand Lake Road on both sides, but additional fencing could be on other portions of the property. Gaps in this fencing allow some wildlife passage, but fence presence affects how wildlife, especially larger species like elk, utilize the park. Removing barbed wire fencing entirely will allow more fluid wildlife movement as well as increase the viewshed's aesthetic. In places where fencing is desired for park operations, existing fence should be retrofitted to accommodate large ungulate passage either by adjusting rail heights or by creating gaps.

- Top rail no higher than 40 inches
- Bottom rail no lower than 18 inches – allows calves too small to jump over the fence to go underneath the fence
- Avoid use of barbed wire
- If smooth wire is used, place visibility markers on the top and bottom rails to alert wildlife of the fence's presence. This may be as simple as PVC pipe placed over the wire, or more complicated based on the fence's purpose and design.

4.3.12 Remove or Cap Old Pipes

The water system for the Tierra Del Mar community traverses Sitka Sedge on the west side of the road. This system is in various states of repair, with broken pipe that is no longer in use left in place. These pipes are wildlife death traps. Vertical pipes and those at an incline are too slippery for animals that crawl inside to get out, and too narrow for them to turn around. Cavity nesting birds will go inside these pipes looking for potential nesting cavities; reptiles and amphibians may look for shelter or food sources, and even small mammals can become trapped inside these pipes. Most wildlife can escape from horizontal pipes, however it is difficult to know if the pipe that is horizontal on the surface slopes or turns below ground. To prevent wildlife mortality, these pipes should be capped with a concrete plug or irremovable screen, or removed entirely.

4.3.13 Manage for Late- Seral Forest

Marbled murrelet populations are in sharp decline, with the majority of breeding habitat in state and private ownership. Opportunities to provide habitat for this species are limited, and Sitka Sedge offers an opportunity to protect and enhance habitat in the forested areas on the east side of Sand Lake Road. These forested areas abut adjacent Siuslaw National Forest lands which include large tracts of mature Sitka spruce dominated forest. The Siuslaw National Forest staff are managing forest health to benefit marbled murrelet, and additional habitat at Sitka Sedge will complement USFS efforts by bringing the most seaward habitat into appropriate management. Managing for marbled murrelet, in general, has little impact on recreation. Therefore, providing as much habitat for this species as possible to offset the habitat loss across Oregon is recommended. For details on what constitutes marbled murrelet habitat, see 3.1.7.

- Protect potential marbled murrelet nesting habitat by siting recreation areas outside of potential habitat. Short spans of trails or spur trails to bring visitors into murrelet habitat for educational purposes would complement OPRD's mission and aid in murrelet recovery through outreach; however, trails for transit or other recreational experiences should not intrude into potential murrelet nesting habitat.
- Encourage forest structure that will result in marbled murrelet nesting habitat. Trees with 4-inch diameter limbs approximately 30 meters above the forest floor should be left unless they pose an imminent hazard.
- Utilize forestry techniques to create late seral structure.

4.3.14 Conserve and Enhance Native Pollinators

Pollinators are declining across the country due to pesticides and indirect effects of agricultural practices. Providing habitat and safe, non-contaminated food sources for this guild of insects is simple, yet has far-reaching benefits to the surrounding community, especially farming. To better aid pollinators, pollinator "way stations" can be implemented in proposed development areas at Sitka Sedge, including the parking lot, along trails, and at signs. Pastureland that is not converted to riparian habitats could instead be restored to upland prairie. Methods to assist pollinators include:

- Group nectar source plants of the same species together into foraging areas for efficiency.
- Install pollinator foraging areas 500 feet apart or less to allow for the needs of the smallest bees.
- Use a diversity of species, 10 or more, with different heights, flower color, and bloom periods. Select plants with a range of bloom periods (early spring through late fall) to ensure adequate nectar throughout the season.
- Avoid removing bee nests until bees emerge in the spring.
- Create/enhance overwinter and nesting sites away from public use areas.
- Revitalize existing overwinter sites with rotted logs during the summer.
- Leave snags for nesting sites.
- Leave untilled and partially bare ground or woody vegetation for ground nesting bees in areas away from visitor day use areas.
- Leave abandoned rodent burrows and bird houses to serve as nesting areas.
- Place rocks in the vicinity of nests to provide basking sites.
- Retain leaf litter, root balls of wind-blown trees, and grass tussocks for overwinter shelter.
- Tunnel nesting bees (mason bees) utilize snags, bee nest blocks, and stems from elderberry.

4.3.15 Mow with Wildlife in Mind

Very little area at Sitka Sedge is planned for turf; any areas that are planted to turf should follow these guidelines. In addition, vegetation maintenance along trails is often performed with mowing equipment.

- Minimize ornamental lawns; if the lawn serves no recreational purpose convert the area to native vegetation such as shrubland that can be maintained with annual mowing. Potential locations for turf include the day use area around the parking lot and pasture lands.
- Avoid vegetation mowing and removal of grasses and shrubs, including invasive species like Scotch broom and blackberry, during the height of songbird and waterfowl nesting season and flowering season, April 1 through July 31
- When mowing tall vegetation along trails and in the pastures, use a flushing bar to reduce direct mortality of wildlife. Flushing bars encourage small mammals, reptiles, and birds to flee away from the mower.
- Mow slowly (<8mph) to allow animals to move out of the mowing path. When mowing a large area, mow in a circular pattern beginning at the center and moving concentrically outward to allow animals to escape into adjacent habitats.
- Prior to the winter season, maintain a high minimum cutting height (12-16”) to leave overwinter vegetation for pollinators *except where in conflict with invasive plant removal, such as blackberry.* Mow areas of flowering plants in phases, no more than 1/3 of the area at a time, ensuring floral resources are available for native bees *except where in conflict with invasive plant removal, such as blackberry.*

4.3.16 Additional Actions

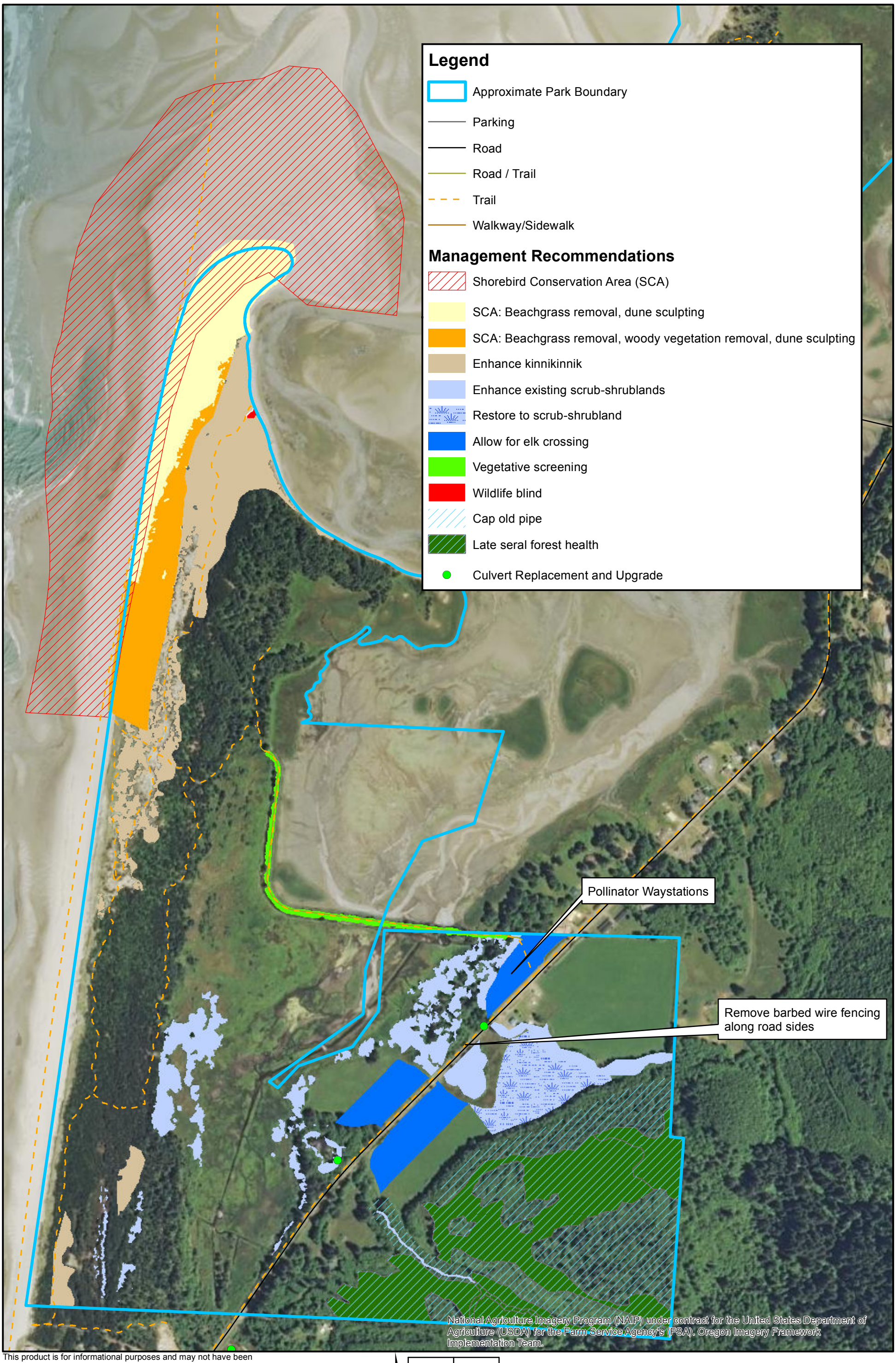
- Increase the population of yellow sand-verbena to provide habitat for Oregon plant bug.
- Utilize citizen-science based volunteer groups to monitor avian diversity and abundance. Continued monitoring of established points will illustrate how restoration efforts are affecting songbird populations.
- Utilize citizen-science based volunteer groups to monitor amphibian breeding populations in emergent marsh habitats; integrate with the interpretive program. As the saltmarsh expands with changes to the tide box, these data will build a picture of wildlife response.
- Preserve snags, especially large snags, unless they pose an imminent hazard.
- Increase forest floor complexity by retaining downed limbs and snags.

4.4 Recommended Work Periods

Recommended Work Periods	Avoid Disturbance
Ground Vegetation Removal September – February	Songbird nesting season: April – July Pollinator nesting: March – August
Tree and snag removal October – January	Raptor and owl nesting season: January – August Bat roosting and breeding: Ending October 1
Stream In-water Work Period July 1-September 15	Salmonid spawning and migration
Esturary In-water Work Period November 1 – February 15	Salmonid life history

Figure 15. Wildlife Management Actions

Oregon Parks & Recreation Dept.
725 Summer St. NE, Suite C
Salem OR, 97301



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6. APPENDIX A

Table 12. Potential species' response to changes in wetlands

Wildlife Group	Common Name	Scientific Name	FESA	State Listing	State Rank	Occurrence	Tidal Mudflats	Salt Marsh	Freshwater Wetland	Scenario 1 Effects	Scenario 2 Effects
Lentic amphibian	Long-toed Salamander	*Ambystoma macrodactylum*				Present	0	0	1	Negative	Negative
Lentic amphibian	Northern red-legged frog	*Rana aurora*	SOC	SV	S3S4	Present	0	0	1	Negative	Negative
Lentic amphibian	Northwestern Salamander	*Ambystoma gracile*				Potential	0	0	1	Negative	Negative
Lentic amphibian	Pacific Chorus (Tree) Frog	*Pseudacris regilla*				Present	0	0	1	Negative	Negative
Lentic amphibian	Rough-skinned Newt	*Taricha granulosa*				Present	0	0	1	Negative	Negative
Lentic amphibian	Western toad	*Anaxyrus boreas*		SV CS	S5	Present	0	0	1	Negative	Negative
Stream amphibian	Coastal tailed frog	*Ascaphus truei*	SOC	SV CS	S3	Unlikely	0	0	0	Neutral	Neutral
Stream amphibian	Columbia torrent salamander	*Rhyacotriton kezeri*		SV CS	S3	Potential	0	0	0	Neutral	Neutral
Stream amphibian	Pacific Giant Salamander	*Dicamptodon tenebrosus*				Present	0	0	1	Negative	Negative
Terrestrial amphibian	Clouded salamander	*Aneides ferreus*		SV CS	S3S4	Potential	0	0	1	Negative	Negative
Terrestrial amphibian	Dunn's Salamander	*Plethodon dunni*				Potential	0	0	0	Neutral	Neutral
Terrestrial amphibian	Ensatina	*Ensatina eschscholizii*				Potential	0	0	1	Negative	Negative
Neotropical Migrant	Bank Swallow	*Riparia riparia*				Potential	0	0	1	Negative	Negative
Neotropical Migrant	Barn Swallow	*Hirundo rustica*				Present	1	0	1	Positive	Positive
Neotropical Migrant	Black-crowned night-heron	*Nycticorax nycticorax*				Potential	0	0	1	Negative	Negative
Neotropical Migrant	Black-headed Grosbeak	*Pheucticus melanocephalus*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Black-throated Gray Warbler	*Dendroica nigrescens*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Bullock's Oriole	*Icterus bullockii*				Potential	0	0	0	Neutral	Neutral
Neotropical Migrant	Cassin's Vireo	*Vireo cassinii*				Vicinity	0	0	0	Neutral	Neutral
Neotropical Migrant	Chipping Sparrow	*Spizella passerina*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Cliff Swallow	*Petrochelidon pyrrhonota*				Present	1	0	1	Positive	Positive
Neotropical Migrant	Common Yellowthroat	*Geothlypis trichas*				Present	0	1	1	Negative	Negative
Neotropical Migrant	Hammond's Flycatcher	*Empidonax hammondii*				Vicinity	0	0	0	Neutral	Neutral
Neotropical Migrant	Hermit Thrush	*Catharus guttatus*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Hermit Warbler	*Dendroica occidentalis*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	House Wren	*Troglodytes aedon*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Lazuli Bunting	*Passerina amoena*				Potential	0	0	0	Neutral	Neutral
Neotropical Migrant	MacGillivray's Warbler	*Oporornis tolmiei*				Vicinity	0	0	0	Neutral	Neutral
Neotropical Migrant	Nashville Warbler	*Vermivora ruficapilla*				Potential	0	0	1	Negative	Negative

Neotropical Migrant	Northern Rough-winged Swallow	*Stelgidopteryx serripennis*				Present	1	1	1	Neutral	Neutral
Neotropical Migrant	Olive-sided flycatcher	*Contopus cooperi*	SOC	SV CS	S2S3B	Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Orange-crowned Warbler	*Vermivora celata*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Pacific-slope Flycatcher	*Empidonax difficilis*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Purple martin	*Progne subis*	SOC	SC	S2B	Present	1	1	1	Neutral	Neutral
Neotropical Migrant	Rufous Hummingbird	*Selasphorus rufus*				Present	0	0	1	Negative	Negative
Neotropical Migrant	Savannah Sparrow	*Passerculus sandwichensis*				Present	0	1	1	Negative	Negative
Neotropical Migrant	Sora	*Porzana carolina*				Present	0	1	1	Negative	Negative
Neotropical Migrant	Swainson's Thrush	*Catharus ustulatus*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Swamp Sparrow	*Melospiza georgiana*				Potential	0	1	1	Negative	Negative
Neotropical Migrant	Townsend's Warbler	*Dendroica townsendi*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Tree Swallow	*Tachycineta bicolor*				Present	1	1	1	Neutral	Neutral
Neotropical Migrant	Vaux's Swift	*Chaetura vauxi*				Potential	1	0	1	Positive	Positive
Neotropical Migrant	Violet-green Swallow	*Tachycineta thalassina*				Present	1	1	1	Neutral	Neutral
Neotropical Migrant	Warbling Vireo	*Vireo gilvus*				Potential	0	0	0	Neutral	Neutral
Neotropical Migrant	Western Tanager	*Piranga ludoviciana*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Western Wood-pewee	*Contopus sordidulus*				Present	0	0	0	Neutral	Neutral
Neotropical Migrant	Willow Flycatcher	*Empidonax traillii adastus*	SOC	SV		Present	0	0	1	Negative	Negative
Neotropical Migrant	Wilson's Warbler	*Wilsonia pusilla*				Present	0	0	1	Negative	Negative
Neotropical Migrant	Yellow Warbler	*Dendroica petechia*				Present	0	0	1	Negative	Negative
Neotropical Migrant	Yellow-rumped Warbler	*Dendroica coronata*				Present	0	0	1	Negative	Negative
Resident Bird	American coot	*Fulica americana*				Present	1	1	1	Neutral	Neutral
Resident Bird	American crow	*Corvus brachyrhynchos*				Present	0	1	1	Negative	Negative
Resident Bird	American Dipper	*Coccyzus americanus*				Potential	0	0	1	Negative	Negative
Resident Bird	American goldfinch	*Carduelis tristis*				Present	0	1	1	Negative	Negative
Resident Bird	American kestrel	*Falco sparverius*				Present	0	1	1	Negative	Negative
Resident Bird	American Peregrine Falcon	*Falco peregrinus anatum*		SV CS	S2B	Present	1	1	1	Neutral	Neutral
Resident Bird	American robin	*Turdus migratorius*				Present	0	1	1	Negative	Negative
Resident Bird	Anna's hummingbird	*Calypte anna*				Present	0	0	0	Neutral	Neutral
Resident Bird	Bald eagle	*Haliaeetus leucocephalus*		SV CS	S4B,S4N	Present	1	1	1	Neutral	Neutral
Resident Bird	Band-tailed pigeon	*Patagioenas fasciata*	SOC	CS	S3B	Present	0	0	0	Neutral	Neutral
Resident Bird	Barn Owl	*Tyto alba*				Present	0	0	1	Negative	Negative
Resident Bird	Barred Owl	*Strix varia*				Potential	0	0	0	Neutral	Neutral
Resident Bird	Belted Kingfisher	*Ceryle alcyon*				Present	1	1	1	Neutral	Neutral
Resident Bird	Bewick's Wren	*Thryomanes bewickii*				Present	0	0	0	Neutral	Neutral
Resident Bird	Black Phoebe	*Sayornis nigricans*				Present	0	0	1	Negative	Negative
Resident Bird	Black-capped Chickadee	*Poecile atricapilla*				Present	0	0	0	Neutral	Neutral
Resident Bird	Brewer's Blackbird	*Euphagus cyanocephalus*				Present	0	1	1	Negative	Negative
Resident Bird	Brown Creeper	*Certhia americana*				Present	0	0	0	Neutral	Neutral
Resident Bird	Brown-headed Cowbird	*Molothrus ater*				Present	0	1	1	Negative	Negative

Resident Bird	Bushtit	*Psaltriparus minimus*			Present	0	0	0	Neutral	Neutral
Resident Bird	California Quail	*Callipepla californica*			Potential	0	0	1	Negative	Negative
Resident Bird	Cedar Waxwing	*Bombycilla cedrorum*			Present	0	0	0	Neutral	Neutral
Resident Bird	Chestnut-backed Chickadee	*Poecile rufescens*			Present	0	0	0	Neutral	Neutral
Resident Bird	Common nighthawk	*Chordeiles minor*			Potential	0	1	1	Negative	Negative
Resident Bird	Common Raven	*Corvus corax*			Present	0	1	1	Negative	Negative
Resident Bird	Cooper's Hawk	*Accipiter cooperii*			Present	0	0	1	Negative	Negative
Resident Bird	Dark-eyed Junco	*Junco hyemalis*			Present	0	0	1	Negative	Negative
Resident Bird	Downy Woodpecker	*Picoides pubescens*			Present	0	0	0	Neutral	Neutral
Resident Bird	Evening Grosbeak	*Coccothraustes vespertinus*			Potential	0	0	0	Neutral	Neutral
Resident Bird	Golden-crowned Kinglet	*Regulus satrapa*		S3	Present	0	0	0	Neutral	Neutral
Resident Bird	Gray Jay	*Perisoreus canadensis*			Present	0	0	0	Neutral	Neutral
Resident Bird	Great Horned Owl	*Bubo virginianus*			Present	0	1	1	Negative	Negative
Resident Bird	Hairy Woodpecker	*Picoides villosus*			Present	0	0	0	Neutral	Neutral
Resident Bird	House Finch	*Carpodacus mexicanus*			Present	0	0	1	Negative	Negative
Resident Bird	Hutton's Vireo	*Vireo huttoni*			Present	0	0	0	Neutral	Neutral
Resident Bird	Lesser goldfinch	*Spinus psaltria*			Present	0	0	1	Negative	Negative
Resident Bird	Marsh Wren	*Cistothorus palustris*			Present	0	1	1	Negative	Negative
Resident Bird	Merlin	*Falco columbarius*			Present	0	0	0	Neutral	Neutral
Resident Bird	Mourning Dove	*Zenaida macroura*			Present	0	0	1	Negative	Negative
Resident Bird	Northern Flicker	*Colaptes auratus*			Present	0	0	1	Negative	Negative
Resident Bird	Northern Harrier	*Circus cyaneus*			Present	1	1	1	Neutral	Neutral
Resident Bird	Northern Pygmy-owl	*Glaucidium gnoma*			Vicinity	0	0	0	Neutral	Neutral
Resident Bird	Northern Saw-whet Owl	*Aegolius acadicus*			Present	0	0	0	Neutral	Neutral
Resident Bird	Osprey	*Pandion haliaetus*			Present	1	1	1	Neutral	Neutral
Resident Bird	Pacific Wren	*Troglodytes pacificus*			Present	0	0	1	Negative	Negative
Resident Bird	Pileated woodpecker	*Dryocopus pileatus*	SV	S4	Present	0	0	0	Neutral	Neutral
Resident Bird	Pine Siskin	*Carduelis pinus*			Present	0	0	0	Neutral	Neutral
Resident Bird	Purple Finch	*Carpodacus purpureus*			Present	0	0	0	Neutral	Neutral
Resident Bird	Red Crossbill	*Loxia curvirostra*			Present	0	0	0	Neutral	Neutral
Resident Bird	Red-breasted Nuthatch	*Sitta canadensis*			Present	0	0	0	Neutral	Neutral
Resident Bird	Red-breasted Sapsucker	*Sphyrapicus ruber*			Present	0	0	0	Neutral	Neutral
Resident Bird	Red-tailed Hawk	*Buteo jamaicensis*			Present	0	0	1	Negative	Negative
Resident Bird	Red-winged Blackbird	*Agelaius phoeniceus*			Present	0	1	1	Negative	Negative
Resident Bird	Ring-necked Pheasant	*Phasianus colchicus*			Potential	0	0	0	Neutral	Neutral
Resident Bird	Rock Pigeon	*Columba livia*			Present	0	0	1	Negative	Negative
Resident Bird	Sandhill Crane	*Grus canadensis canadensis*		S3N	Potential	0	0	1	Negative	Negative
Resident Bird	Sharp-shinned Hawk	*Accipiter striatus*			Present	0	0	0	Neutral	Neutral
Resident Bird	Sharptail snake	*Contia tenuis*			Present	0	0	1	Negative	Negative
Resident Bird	Song Sparrow	*Melospiza melodia*			Present	0	1	1	Negative	Negative

Resident Bird	Spotted Towhee	*Pipilo maculatus*				Present	0	0	1	Negative	Negative
Resident Bird	Steller's Jay	*Cyanocitta stelleri*				Present	0	0	0	Neutral	Neutral
Resident Bird	Turkey Vulture	*Cathartes aura*				Present	0	0	0	Neutral	Neutral
Resident Bird	Virginia Rail	*Rallus limicola*				Present	0	1	1	Negative	Negative
Resident Bird	Western Meadowlark	*Sturnella neglecta*				Present	0	0	1	Negative	Negative
Resident Bird	Western Screech-Owl	*Megascops kennicottii*				Potential	0	0	0	Neutral	Neutral
Resident Bird	Western Scrub-Jay	*Aphelocoma californica*				Present	0	0	1	Negative	Negative
Resident Bird	Western snowy plover	*Charadrius nivosus nivosus*	FT	ST		Present	0	0	0	Neutral	Neutral
Resident Bird	White-crowned Sparrow	*Zonotrichia leucophrys*				Present	0	1	1	Negative	Negative
Resident Bird	White-tailed kite	*Elanus leucurus*			S2B,S3N	Potential	0	1	1	Negative	Negative
Resident Bird	Wild Turkey	*Meleagris gallopavo*				Potential	0	0	1	Negative	Negative
Resident Bird	Wood Duck	*Aix sponsa*				Potential	0	0	1	Negative	Negative
Resident Bird	Wrentit	*Chamaea fasciata*				Present	0	0	0	Neutral	Neutral
Seabird	Arctic Tern	*Sterna paradisaea*				Potential	1	0	0	Positive	Positive
Seabird	Black Scoter	*Melanitta nigra*				Present	0	0	0	Neutral	Neutral
Seabird	Black-legged Kittiwake	*Rissa tridactyla*				Present	0	0	0	Neutral	Neutral
Seabird	Bonaparte's Gull	*Larus philadelphia*				Present	1	0	0	Positive	Positive
Seabird	Brandt's Cormorant	*Phalacrocorax penicillatus*				Present	1	0	0	Positive	Positive
Seabird	Brown Pelican	*Pelecanus occidentalis*				Present	1	0	0	Positive	Positive
Seabird	California Gull	*Larus californicus*				Present	1	0	1	Positive	Positive
Seabird	Caspian Tern	*Sterna caspia*		CS		Present	1	1	0	Positive	Positive
Seabird	Cassin's Auklet	*Ptychoramphus aleuticus*				Present	0	0	0	Neutral	Neutral
Seabird	Common murre	*Uria aalge*				Present	0	0	0	Neutral	Neutral
Seabird	Common Tern	*Sterna hirundo*				Present	1	0	0	Positive	Positive
Seabird	Double-crested Cormorant	*Phalacrocorax auritus*				Present	1	1	1	Neutral	Neutral
Seabird	Elegant Tern	*Sterna elegans*				Vicinity	1	0	0	Positive	Positive
Seabird	Forester's tern	*Sterna forsteri*				Potential	0	0	1	Negative	Negative
Seabird	Fork-tailed storm-petrel	*Oceanodroma furcata*		CS	S2B	Unlikely	0	0	0	Neutral	Neutral
Seabird	Glaucous Gull	*Larus hyperboreus*				Potential	1	0	0	Positive	Positive
Seabird	Glaucous-winged Gull	*Larus glaucescens*				Present	1	1	0	Positive	Positive
Seabird	Heermann's Gull	*Larus heermanni*				Present	1	0	0	Positive	Positive
Seabird	Herring Gull	*Larus argentatus*				Present	1	0	0	Positive	Positive
Seabird	Marbled murrelet	*Brachyramphus marmoratus*	FT	ST CS	S2	Present	0	0	0	Neutral	Neutral
Seabird	Mew Gull	*Larus canus*				Present	1	0	0	Positive	Positive
Seabird	Parasitic Jaeger	*Stercorarius parasiticus*				Vicinity	0	0	0	Neutral	Neutral
Seabird	Pelagic Cormorant	*Phalacrocorax pelagicus*				Present	0	0	0	Neutral	Neutral
Seabird	Pigeon Guillemot	*Cepphus columba*				Present	0	0	0	Neutral	Neutral
Seabird	Pomarine Jaeger	*Stercorarius pomarinus*				Vicinity	0	0	0	Neutral	Neutral
Seabird	Rhinoceros auklet	*Cerorhinca monocerata*		SV	S2B	Present	0	0	0	Neutral	Neutral
Seabird	Ring-billed Gull	*Larus delawarensis*				Present	1	0	0	Positive	Positive

Seabird	Sabine's Gull	*Xema Sabini*				Vicinity	0	0	0	Neutral	Neutral
Seabird	Sooty Shearwater	*Puffinus griseus*				Present	0	0	0	Neutral	Neutral
Seabird	Surf Scoter	*Melanitta perspicillata*				Present	0	0	0	Neutral	Neutral
Seabird	Thayer's Gull	*Larus thayeri*				Present	1	0	0	Positive	Positive
Seabird	Western Gull	*Larus occidentalis*				Present	1	1	0	Positive	Positive
Seabird	White-winged Scoter	*Melanitta fusca*				Present	0	0	0	Neutral	Neutral
Shorebird	American avocet	*Recurvirostra americana*				Potential	1	0	1	Positive	Positive
Shorebird	American golden-plover	*Pluvialis dominica*				Potential	1	0	0	Positive	Positive
Shorebird	American pipit	*Anthus rubescens*				Present	1	0	1	Positive	Positive
Shorebird	Baird's Sandpiper	*Calidris bairdii*				Present	1	0	1	Positive	Positive
Shorebird	Black oystercatcher	*Haematopus bachmani*	SOC	SV CS	S3	Present	0	1	0	Positive	Negative
Shorebird	Black Turnstone	*Arenaria melanocephala*				Present	1	0	0	Positive	Positive
Shorebird	Black-bellied Plover	*Pluvialis squatarola*				Present	1	0	0	Positive	Positive
Shorebird	Black-necked Stilt	*Himantopus mexicanus*				Present	1	0	1	Positive	Positive
Shorebird	Common Snipe	*Gallinago gallinago*				Present	1	0	1	Positive	Positive
Shorebird	Dunlin	*Calidris alpina*				Present	1	0	0	Positive	Positive
Shorebird	Greater Yellowlegs	*Tringa melanoleuca*				Present	1	0	1	Positive	Positive
Shorebird	Killdeer	*Charadrius vociferus*				Present	0	1	1	Negative	Negative
Shorebird	Lapland Longspur	*Calcarius lapponicus*				Present	1	0	0	Positive	Positive
Shorebird	Least Sandpiper	*Calidris minutilla*				Present	1	0	0	Positive	Positive
Shorebird	Lesser Yellowlegs	*Tringa flavipes*				Present	1	0	1	Positive	Positive
Shorebird	Long-billed Dowitcher	*Limnodromus scolopaceus*				Present	1	0	1	Positive	Positive
Shorebird	Marbled Godwit	*Limosa fedoa*				Present	1	0	0	Positive	Positive
Shorebird	Pacific Golden-Plover	*Pluvialis fulva*				Potential	1	0	0	Positive	Positive
Shorebird	Pectoral Sandpiper	*Calidris melanotos*				Potential	1	0	1	Positive	Positive
Shorebird	Red Knot	*Calidris canutus*				Present	1	0	0	Positive	Positive
Shorebird	Red Phalarope	*Phalaropus fulicarius*				Present	1	0	0	Positive	Positive
Shorebird	Red-necked Phalarope	*Phalaropus lobatus*				Present	1	0	0	Positive	Positive
Shorebird	Rock Sandpiper	*Calidris ptilocnemis*		CS		Potential	0	0	0	Neutral	Neutral
Shorebird	Ruddy Turnstone	*Arenaria interpres*				Potential	1	0	0	Positive	Positive
Shorebird	Ruff	*Philomachus pugnax*				Potential	1	0	0	Positive	Positive
Shorebird	Sanderling	*Calidris alba*				Present	1	0	0	Positive	Positive
Shorebird	Semipalmated Plover	*Charadrius semipalmatus*				Present	1	0	0	Positive	Positive
Shorebird	Semipalmated Sandpiper	*Calidris pusilla*				Present	1	0	0	Positive	Positive
Shorebird	Short-billed Dowitcher	*Limnodromus griseus*				Present	1	0	0	Positive	Positive
Shorebird	Solitary Sandpiper	*Tringa solitaria*				Potential	0	0	1	Negative	Negative
Shorebird	Spotted Sandpiper	*Actitis macularia*				Present	1	1	1	Neutral	Neutral
Shorebird	Stilt Sandpiper	*Calidris himantopus*				Present	1	0	0	Positive	Positive
Shorebird	Surfbird	*Aphriza virgata*				Present	1	0	0	Positive	Positive
Shorebird	Wandering Tattler	*Heteroscelus incanus*				Potential	1	0	0	Positive	Positive

Shorebird	Western Sandpiper	*Calidris mauri*				Present	1	0	1	Positive	Positive
Shorebird	Whimbrel	*Numenius phaeopus*				Present	1	0	0	Positive	Positive
Shorebird	Willet	*Catoptrophorus semipalmatus*				Potential	1	0	1	Positive	Positive
Shorebird	Wilson's Snipe	*Gallinago delicata*				Present	0	0	1	Negative	Negative
Vagrant	Clay-colored Sparrow	*Spizella pallida*				Vicinity	0	0	0	Neutral	Neutral
Vagrant	Curlew Sandpiper	*Calidris ferruginea*				Present	0	0	0	Neutral	Neutral
Vagrant	Ferruginous Hawk	*Buteo jamaicensis*	SOC	SC/SV	S3B	Present	0	0	0	Neutral	Neutral
Vagrant	Red-shouldered Hawk	*Buteo lineatus*				Present	0	0	1	Negative	Negative
Vagrant	Snow Bunting	*Plectrophenax nivalis*				Unlikely	0	0	0	Neutral	Neutral
Vagrant	Western bluebird	*Sialia mexicana*		SV	S4B,S4N	Potential	0	0	0	Neutral	Neutral
Vagrant	Yellow-breasted chat	*Icteria virens*	SOC	SC	S4B	Potential	0	0	1	Negative	Negative
Wading Birds	American bittern	*Botaurus lentiginosus*				Potential	0	0	1	Negative	Negative
Wading Birds	Great Blue Heron	*Ardea herodias*				Present	1	1	1	Neutral	Neutral
Wading Birds	Great Egret	*Ardea alba*				Present	1	1	1	Neutral	Neutral
Wading Birds	Green Heron	*Butorides virescens*				Present	1	0	1	Positive	Positive
Wading Birds	Snowy Egret	*Egretta thula*		SV	S2B	Present	1	0	1	Positive	Positive
Waterfowl	Aleutian Canada Goose	*Branta canadensis leucopareta*	FT	SE		Potential	0	0	0	Neutral	Neutral
Waterfowl	American wigeon	*Anas americana*				Present	0	0	1	Negative	Negative
Waterfowl	Blue-winged Teal	*Anas discors*				Potential	0	1	1	Negative	Negative
Waterfowl	Brant	*Branta bernicla*				Present	0	0	0	Neutral	Neutral
Waterfowl	Bufflehead	*Bucephala albeola*			S2B,S5N	Present	1	0	1	Positive	Positive
Waterfowl	Cackling Canada Goose	*Branta hutchinsii minima*				Present	0	0	1	Negative	Negative
Waterfowl	Canada Goose	*Branta canadensis*				Present	0	1	1	Negative	Negative
Waterfowl	Canvasback	*Aythya valisineria*				Potential	1	0	1	Positive	Positive
Waterfowl	Cinnamon Teal	*Anas cyanoptera*				Potential	0	1	1	Negative	Negative
Waterfowl	Clark's grebe	*Aechmophorus clarkii*			S3B,S2N	Vicinity	1	0	1	Positive	Positive
Waterfowl	Common Goldeneye	*Bucephala clangula*				Present	1	0	1	Positive	Positive
Waterfowl	Common Loon	*Gavia immer*				Present	1	0	1	Positive	Positive
Waterfowl	Common Merganser	*Mergus merganser*				Present	1	1	1	Neutral	Neutral
Waterfowl	Eared Grebe	*Podiceps nigricollis*				Vicinity	1	0	1	Positive	Positive
Waterfowl	Eurasian Wigeon	*Anas penelope*				Present	1	0	1	Positive	Positive
Waterfowl	Gadwall	*Anas strepera*				Present	0	0	1	Negative	Negative
Waterfowl	Greater Scaup	*Aythya marila*				Present	1	0	0	Positive	Positive
Waterfowl	Greater White-fronted Goose	*Anser albifrons*				Present	1	0	1	Positive	Positive
Waterfowl	Green-winged Teal	*Anas crecca*				Present	0	0	1	Negative	Negative
Waterfowl	Harlequin duck	*Histrionicus histrionicus*	SOC		S2B,S3N	Vicinity	1	1	1	Neutral	Neutral
Waterfowl	Hooded Merganser	*Lophodytes cucullatus*				Present	1	0	1	Positive	Positive
Waterfowl	Horned grebe	*Podiceps auritus*			S2B,S5N	Present	0	0	1	Negative	Negative
Waterfowl	Lesser Scaup	*Aythya affinis*				Potential	1	0	1	Positive	Positive
Waterfowl	Mallard	*Anas platyrhynchos*				Present	1	1	1	Neutral	Neutral

Waterfowl	Northern Pintail	*Anas acuta*				Present	1	1	1	Neutral	Neutral
Waterfowl	Northern Shoveler	*Anas clypeata*				Present	0	0	1	Negative	Negative
Waterfowl	Pacific Loon	*Gavia pacifica*				Present	1	0	0	Positive	Positive
Waterfowl	Pied-billed Grebe	*Podilymbus podiceps*				Vicinity	1	1	1	Neutral	Neutral
Waterfowl	Red-breasted Merganser	*Mergus serrator*				Present	1	0	0	Positive	Positive
Waterfowl	Redhead	*Aythya americana*				Potential	0	0	1	Negative	Negative
Waterfowl	Red-necked grebe	*Podiceps grisegena*		SC	S1B,S4N	Present	0	0	1	Negative	Negative
Waterfowl	Red-throated Loon	*Gavia stellata*				Present	1	0	0	Positive	Positive
Waterfowl	Ring-necked Duck	*Aythya collaris*				Vicinity	0	0	1	Negative	Negative
Waterfowl	Ruddy Duck	*Oxyura jamaicensis*				Vicinity	1	0	1	Positive	Positive
Waterfowl	Snow Goose	*Chen Ccaerulescens*				Potential	0	0	1	Negative	Negative
Waterfowl	Trumpeter swan	*Cygnus buccinator*			S1?B,S3N	Potential	0	0	1	Negative	Negative
Waterfowl	Tundra Swan	*Cygnus columbianus*				Present	1	0	1	Positive	Positive
Waterfowl	Western grebe	*Aechmophorus occidentalis*			S3B,S2S3N	Present	1	0	1	Positive	Positive
Wintering Bird	Fox Sparrow	*Passerella iliaca*				Present	0	0	1	Negative	Negative
Wintering Bird	Golden Eagle	*Aquila chrysaetos*			S3	Potential	0	0	1	Negative	Negative
Wintering Bird	Golden-crowned Sparrow	*Zonotrichia atricapilla*				Present	0	0	1	Negative	Negative
Wintering Bird	Horned lark	*Eremophila alpestris*				Present	0	0	1	Negative	Negative
Wintering Bird	Lincoln's Sparrow	*Melospiza lincolnii*				Present	0	0	1	Negative	Negative
Wintering Bird	Long-eared Owl	*Asio otus*				Potential	0	0	1	Negative	Negative
Wintering Bird	Northern Shrike	*Lanius excubitor*				Potential	0	0	1	Negative	Negative
Wintering Bird	Rough-legged Hawk	*Buteo lagopus*				Potential	0	0	1	Negative	Negative
Wintering Bird	Ruby-crowned Kinglet	*Regulus calendula*				Present	0	0	1	Negative	Negative
Wintering Bird	Short-eared Owl	*Asio flammeus*			S3	Potential	0	0	1	Negative	Negative
Wintering Bird	Varied Thrush	*Ixoreus naevius*				Present	0	0	0	Neutral	Neutral
Wintering Bird	White-throated Sparrow	*Zonotrichia albicollis*				Present	0	0	0	Neutral	Neutral
Anadromous fish	Chinook salmon (Oregon Coast ESU, fall run)	*Oncorhynchus tshawytscha*				Present	1	1	1	Positive	Positive
Anadromous fish	Chum salmon (Pacific Coast ESU)	*Oncorhynchus keta pop. 4*		SC		Vicinity	1	1	1	Positive	Positive
Anadromous fish	Coastal cutthroat trout (Oregon Coast ESU)	*Oncorhynchus clarki*	SOC	CS		Present	1	1	1	Positive	Positive
Anadromous fish	Coho salmon (Oregon Coast ESU)	*Oncorhynchus kisutch pop. 3*	FT	SV CS	S2	Present	1	1	1	Positive	Positive
Anadromous fish	Pacific lamprey	*Entosphenus tridentatus*	SOC	SV CS	S2	Vicinity	1	1	1	Neutral	Neutral
Anadromous fish	Steelhead (Oregon Coast ESU, winter run)	*Oncorhynchus mykiss pop. 31*	SOC	SV	S2S3	Present	1	1	1	Positive	Positive
Freshwater fish	Coast range sculpin	*Cottus aleuticus*				Vicinity	0	0	0	Neutral	Neutral
Freshwater fish	longnose dace	*Rhinichthys cataractae*				Potential	0	0	0	Neutral	Neutral
Freshwater fish	northern pikeminnow	*Ptychocheilus oregonensis*				Potential	0	0	0	Neutral	Neutral
Freshwater fish	Reticulate sculpin	*Cottus preplexus*				Vicinity	0	0	0	Neutral	Neutral

Freshwater fish	Riffle sculpin	*Cottus gulosus*		Vicinity	0	0	0	Neutral	Neutral
Freshwater fish	speckled dace	*Rhinichthys osculus*		Potential	0	0	0	Neutral	Neutral
Freshwater fish	Torrent sculpin	*Cottus rhotheus*		Potential	0	0	0	Neutral	Neutral
Freshwater fish	Western brook lamprey	*Lampetra richardsoni*	SV CS	Vicinity	0	0	0	Neutral	Neutral
Marine fish	Bay pipefish	*Sygnathus grisiolineatus*		Potential	0	0	0	Neutral	Neutral
Marine fish	Black rockfish	*Sebastes melanops*		Potential	0	0	0	Neutral	Neutral
Marine fish	Brown Irish lord	*Hemilepidotus spinosus*		Potential	0	0	0	Neutral	Neutral
Marine fish	Buffalo sculpin	*Enophrys bison*		Vicinity	1	0	0	Positive	Positive
Marine fish	Cabezon	*Scorpaenichthys marmoratus*		Potential	0	0	0	Neutral	Neutral
Marine fish	Copper rockfish	*Sebastes caurinus*		Potential	0	0	0	Neutral	Neutral
Marine fish	English sole	*Parophrys vetulus*		Potential	1	0	0	Positive	Positive
Marine fish	Fluffy sculpin	*Oligocottus snyderi*		Potential	0	0	0	Neutral	Neutral
Marine fish	High cockscomb	*Anoplarchus purpurescens*		Potential	0	0	0	Neutral	Neutral
Marine fish	Jacksmelt	*Atherinopsis californiensis*		Potential	1	0	0	Positive	Positive
Marine fish	Kelp greenling	*Hexagrammos decagrammus*		Potential	1	0	0	Positive	Positive
Marine fish	Lingcod	*Ophiodon elongates*		Unlikely	0	0	0	Neutral	Neutral
Marine fish	Northern anchovy	*Engraulis mordax*		Potential	1	0	0	Positive	Positive
Marine fish	Pacific sanddab	*Citharichthys sordidus*		Unlikely	0	0	0	Neutral	Neutral
Marine fish	Pacific sandlance	*Ammodytes hexapterus*		Potential	1	0	0	Positive	Positive
Marine fish	Pacific staghorn sculpin	*Leptocottus armatus*		Vicinity	1	0	0	Positive	Positive
Marine fish	Pacific tomcod	*Microgadus proximus*		Potential	1	0	0	Positive	Positive
Marine fish	Padded sculpin	*Artedius fenestralis*		Potential	1	0	0	Positive	Positive
Marine fish	Penpoint gunnel	*Adodichthys flavidus*		Potential	0	0	0	Neutral	Neutral
Marine fish	Pile perch	*Rhacochilus vacca*		Unlikely	0	0	0	Neutral	Neutral
Marine fish	Pricklebreast poacher	*Stellerina xyosterna*		Potential	1	0	0	Positive	Positive
Marine fish	Prickly sculpin	*Cottus asper*		Potential	1	0	0	Positive	Positive
Marine fish	Red Irish lord	*Hemilepidotus hemilepidotus*		Unlikely	0	0	0	Neutral	Neutral
Marine fish	Redtail surfperch	*Amphistichus rhodoterus*		Potential	1	0	0	Positive	Positive
Marine fish	Rock greenling	*Hexagrammos lagocephalus*		Unlikely	0	0	0	Neutral	Neutral
Marine fish	Saddleback gunnel	*Pholis ornate*		Potential	1	0	0	Positive	Positive
Marine fish	Sand sole	*Psettichthys melanostictus*		Potential	1	0	0	Positive	Positive
Marine fish	Scalyhead sculpin	*Artedius harringtoni*		Unlikely	0	0	0	Neutral	Neutral
Marine fish	Sharpnose sculpin	*Clinocottus acuticeps*		Potential	1	0	0	Positive	Positive
Marine fish	Shiner perch	*Cymatogaster aggregata*		Vicinity	1	0	0	Positive	Positive
Marine fish	Silver surfperch	*Hyperprosopon ellipticum*		Potential	1	0	0	Positive	Positive
Marine fish	Snake prickleback	*Lumpenus sagitta*		Potential	1	0	0	Positive	Positive
Marine fish	Speckled sanddab	*Citharichthys stigmaeus*		Potential	1	0	0	Positive	Positive
Marine fish	Starry flounder	*Platichthys stellatus*		Vicinity	1	0	0	Positive	Positive
Marine fish	Striped seaperch	*Embiotoca lateralis*		Unlikely	0	0	0	Neutral	Neutral
Marine fish	Surf smelt	*Hypomesus pretiosus*		Potential	1	0	0	Positive	Positive

Marine fish	Threespine stickleback	*Gasterosteus aculeatus*			Potential	1	0	0	Positive	Positive
Marine fish	Tidepool sculpin	*Oligocottus maculosus*			Unlikely	0	0	0	Neutral	Neutral
Marine fish	Topsmelt	*Atherinope affinis*			Potential	1	0	0	Positive	Positive
Marine fish	Tubenose poacher	*Pallasina barbata*			Potential	0	0	0	Neutral	Neutral
Marine fish	Walleye surfperch	*Hyperprosopon argenteum*			Potential	1	0	0	Positive	Positive
Marine fish	White seaperch	*Phanerodon furcatus*			Potential	1	0	0	Positive	Positive
Marine fish	Whitebait smelt	*Allosmerus elongates*			Unlikely	0	0	0	Neutral	Neutral
Marine fish	Whitespotted greenling	*Hexagrammos stelleri*			Unlikely	0	0	0	Neutral	Neutral
Marine fish	Wolf-eel	*Anarrchichthys ocellatus*			Unlikely	0	0	0	Neutral	Neutral
Other fish	Green sturgeon	*Acipenser medirostris*	SOC	S3	Unlikely	0	0	0	Neutral	Neutral
Other fish	Prickly sculpin	*Cottus asper*			Vicinity	0	0	0	Neutral	Neutral
Marine invertebrate	Baltic macoma	*Macoma balthica*			Vicinity	1	0	0	Positive	Positive
Marine invertebrate	Bay mussel	*Mytilus edulis*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Bedega tellin	*Tellina bodegensis*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Bent-nose macoma	*Macoma nasuta*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Butter clam	*Saxidomus giganteus*			Potential	1	0	0	Positive	Positive
Marine invertebrate	California softshell	*Cryptomya californica*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Cockle	*Clincocardium nuttallii*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Dungeness crab	*Cancer magister*			Vicinity	1	0	0	Positive	Positive
Marine invertebrate	Gaper clam	*Tressus capax, Tresus nuttallii*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Geoduc	*Panope generosa*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Irus macoma	*Macoma irus*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Manila littleneck	*Tapes semidecussata*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Native littleneck	*Protothaca staminea*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Native oyster	*Ostrea lurida*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Pacific oyster	*Crassostrea gigas*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Piddock	*Zirfaea pilsbryi and Penitella penita*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Razor clam	*Siliqua patula*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Ringed lucina	*Lucinoma annulata*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Sand macoma	*Macoma secta*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Sea mussel	*Mytilus californianus*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Small cockle	*Clinocardium nuttalli*			Vicinity	1	0	0	Positive	Positive
Marine invertebrate	Softshell	*Mya arenaria*			Potential	1	0	0	Positive	Positive
Marine invertebrate	Thin shell littleneck	*Protothaca tenerrima*			Potential	1	0	0	Positive	Positive
Upland invertebrate	Anise swallowtail	*Papilio zeliacaon*			Present	0	0	0	Neutral	Neutral
Upland invertebrate	Echo Blue	*Celastrina argiolus*			Present	0	0	0	Neutral	Neutral
Upland invertebrate	Margined White	*Pieris marginalis*			Present	0	0	0	Neutral	Neutral
Upland invertebrate	Oregon silverspot butterfly	*Speyeria zerene hippolyta*	FT		Potential	0	0	0	Neutral	Neutral
Upland invertebrate	Painted Lady	*Vanessa cardui*			Present	0	0	0	Neutral	Neutral
Upland invertebrate	Pine elfin	*Callophrys eryphon*			Present	0	0	0	Neutral	Neutral

Upland invertebrate	Red Admiral	*Vanessa atalanta*			Present	0	0	0	Neutral	Neutral
Upland invertebrate	Seaside hoary elfin	*Callophyrs polia maritima*			Potential	0	0	0	Neutral	Neutral
Mammal	American beaver	*Castor canadensis*			Potential	0	1	1	Negative	Negative
Mammal	Baird's Shrew	*Sorex bairdi*			Potential	0	0	1	Negative	Negative
Mammal	Big Brown Bat	*Eptesicus fuscus*			Potential	0	1	1	Negative	Negative
Mammal	Black Bear	*Ursus americanus*			Present	0	0	1	Negative	Negative
Mammal	Black Rat	*Rattus rattus*			Unlikely	0	0	1	Negative	Negative
Mammal	Black-tailed Deer	*Odocoileus hemionus columbianus*			Present	0	1	1	Negative	Negative
Mammal	Bobcat	*Lynx rufus*			Potential	0	0	1	Negative	Negative
Mammal	Brush Rabbit	*Sylvilagus bachmani*			Present	0	1	1	Negative	Negative
Mammal	Bushy-tailed Woodrat	*Neotoma cinerea*			Potential	0	0	0	Neutral	Neutral
Mammal	California Ground Squirrel	*Spermophilus beecheyi*			Potential	0	0	1	Negative	Negative
Mammal	California myotis	*Myotis californicus*	SV CS	S3	Potential	0	0	1	Negative	Negative
Mammal	Coast Mole	*Scapanus orarius*			Present	0	0	1	Negative	Negative
Mammal	Common Porcupine	*Erethizon dorsatum*			Potential	0	0	1	Negative	Negative
Mammal	Cougar	*Puma concolor*			Present	0	0	1	Negative	Negative
Mammal	Coyote	*Canis latrans*			Potential	0	1	1	Negative	Negative
Mammal	Creeping Vole	*Microtus oregoni*			Potential	0	0	1	Negative	Negative
Mammal	Deer Mouse	*Peromyscus maniculatus*			Potential	0	1	1	Negative	Negative
Mammal	Douglas' Squirrel	*Tamiasciurus douglasii*			Present	0	0	0	Neutral	Neutral
Mammal	Ermine	*Mustela erminea*			Potential	0	1	1	Negative	Negative
Mammal	Fisher	*Pekania pennanti*	PS:FC	SC	S2	Unlikely	0	0	1	Negative	Negative
Mammal	Fog Shrew	*Sorex sonomae*			Potential	0	0	1	Negative	Negative
Mammal	Fringed myotis	*Myotis thysanodes*	SOC	SV CS	S2	Potential	0	0	1	Negative	Negative
Mammal	Hoary bat	*Lasiurus cinereus*		SV CS	S3	Potential	0	0	1	Negative	Negative
Mammal	Little Brown Myotis	*Myotis lucifugus*				Potential	1	1	1	Neutral	Neutral
Mammal	Long-eared myotis	*Myotis evotis*	SOC		S4	Unlikely	0	0	1	Negative	Negative
Mammal	Long-legged myotis	*Myotis volans*	SOC	SV CS	S3	Unlikely	0	0	1	Negative	Negative
Mammal	Long-tailed Vole	*Microtus longicaudus*				Potential	0	0	1	Negative	Negative
Mammal	Long-tailed Weasel	*Mustela frenata*				Potential	0	1	1	Negative	Negative
Mammal	Mink	*Mustela vison*				Potential	0	1	1	Negative	Negative
Mammal	Mountain Beaver	*Aplodontia rufa*				Potential	0	1	0	Positive	Negative
Mammal	Muskrat	*Ondatra zibethicus*				Vicinity	0	1	1	Negative	Negative
Mammal	Northern Flying Squirrel	*Glaucomys sabrinus*				Potential	0	0	0	Neutral	Neutral
Mammal	Northern Pocket Gopher	*Thomomys talpoides*				Potential	0	0	1	Negative	Negative
Mammal	Pacific Jumping Mouse	*Zapus trinotatus*				Potential	0	0	1	Negative	Negative
Mammal	Pacific marten	*Martes caurina*			S1	Potential	0	0	0	Neutral	Neutral
Mammal	Pacific Shrew	*Sorex pacificus*				Potential	0	0	1	Negative	Negative
Mammal	Pacific Water Shrew	*Sorex bendirii*				Potential	0	1	1	Negative	Negative
Mammal	Raccoon	*Procyon lotor*				Present	0	1	1	Negative	Negative

Mammal	Red tree vole	*Arborimus longicaudus*	PS:FC	SV CS	S3	Potential	0	0	0	Neutral	Neutral
Mammal	River otter	*Lontra canadensis*				Present	0	1	1	Negative	Negative
Mammal	Roosevelt Elk	*Cervus elaphus roosevelti*				Present	0	1	1	Negative	Negative
Mammal	Shrew-mole	*Neurotrichus gibbsii*				Potential	0	0	1	Negative	Negative
Mammal	Silver-haired bat	*Lasionycteris noctivagans*	SOC	SV CS	S3S4	Potential	0	0	1	Negative	Negative
Mammal	Striped Skunk	*Mephitis mephitis*				Potential	0	0	1	Negative	Negative
Mammal	Townsend's big-eared bat	*Corynorhinus townsendii*	SOC	SC CS	S2	Potential	0	0	1	Negative	Negative
Mammal	Townsend's Chipmunk	*Tamias townsendii*				Present	0	0	0	Neutral	Neutral
Mammal	Townsend's Mole	*Scapanus townsendii*				Potential	0	0	1	Negative	Negative
Mammal	Townsend's Vole	*Microtus townsendii*				Potential	0	0	1	Negative	Negative
Mammal	Trowbridge's Shrew	*Sorex trobridgii*				Potential	0	0	1	Negative	Negative
Mammal	Vagrant Shrew	*Sorex vagrans*				Potential	0	1	1	Negative	Negative
Mammal	Virginia Opossum	*Didelphis virginiana*				Present	0	1	1	Negative	Negative
Mammal	Western Pocket Gopher	*Thomomys mazama*				Potential	0	1	1	Negative	Negative
Mammal	Western Red-backed Vole	*Clethrionomys californicus*				Potential	0	0	0	Neutral	Neutral
Mammal	Western Spotted Skunk	*Spilogale gracilis*				Potential	0	1	1	Negative	Negative
Mammal	White-footed vole	*Arborimus albipes*	SOC		S3S4	Unlikely	0	0	0	Neutral	Neutral
Mammal	Yuma myotis	*Myotis yumanensis*	SOC		S3	Potential	0	1	1	Negative	Negative
Reptile	Common Garter Snake	*Thamnophis sirtalis*				Potential	0	1	1	Negative	Negative
Reptile	Gopher snake	*Pituophis catenifer*				Potential	0	0	1	Negative	Negative
Reptile	Northern Alligator Lizard	*Elgaria coerulea*				Potential	0	0	0	Neutral	Neutral
Reptile	Northwestern Garter Snake	*Thamnophis ordinoides*				Potential	0	0	1	Negative	Negative
Reptile	Racer	*Coluber constrictor*				Potential	0	0	1	Negative	Negative
Reptile	Western Pond Turtle	*Actinemys marmorata marmorata*	SOC	SC CS		Potential	0	0	1	Negative	Negative