Samish Indian Nation

Sea Level Rise Vulnerability Assessment

Report Prepared by the Samish Indian Nation
Department of Natural Resources

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PROJECT OVERVIEW

This report is an addendum to the previously completed Samish Indian Nation Climate Change Vulnerability Report. This report is to be considered a living document, which will be updated as new climate change and sea level rise information, adaptation strategies, etc are identified.

The Samish Indian Nation Sea Level Rise Vulnerability Assessment summarizes the findings of a broad qualitative analysis of sites throughout Samish Traditional Territory. Our goal from the outset of this project was to understand how climate change driven sea level rise will impact the built infrastructure, utility and emergency services (defined as human infrastructure in the report), habitats and cultural resources within that area. Much like the previously completed climate change vulnerability assessment, we opted for a qualitative assessment of the sites in question to provide a general understanding of the shoreline impacts that various sea level rise projections will have within Samish Traditional Territory.

We acknowledge that not all Samish Nation tribal citizens currently live within Samish Traditional Territory yet will undoubtedly still be affected by sea level rise over the course of the next century. However, for the sake of defining the focus and scope of our report, only sites within Samish Traditional Territory were included in the ground truthing site analyses.

As a secondary component of this project, we've developed a sea level rise analysis tool for public use. This tool gives any user the capability to identify how and where sea level rise, at varying IPCC RCPs (Intergovernmental Panel on Climate Change Representative Concentration Pathways), will impact places they've identified as being of concern.

INTRODUCTION

We've identified 35 sites as a test case within Samish Traditional Territory that will be at either minor, moderate or significant vulnerability from sea level rise driven impacts within the next 100 years. Of those 35 sites, 11 have at least one high vulnerability designation planning area. The areas with the highest average vulnerabilities are those places which have multiple high priority planning areas which will be impacted significantly by climate change driven sea level rise. For example, sites that are given a high-risk designation and have two high risk planning areas. I.e. being of significant cultural value while also having a significant amount of built infrastructure in the sea level rise impact zone are overall more vulnerable to the impacts of sea level rise than sites with only one high risk planning area. Thus, those sites will require a greater amount of adaptation or mitigation effort to protect the resources therein. It is important to note that sea level rise has a larger impact than solely inundating land that was previously above the water line. It will affect erosion patterns on soft shorelines throughout Samish Traditional Territory as well as affect access to cultural resources that Samish citizens have been using since time immemorial.

It is also important to note that the sites identified and studied within this document are not an exhaustive list of all culturally significant sites within Samish Traditional Territory. The chosen sites are a representative sample of the much larger number of culturally significant sites existing within Samish Traditional Territory.

We acknowledge that most tribal citizens live beyond the area defined in the assessment and that analyzing the sea level rise driven risk of every culturally significant site within Samish Traditional Territory or in every area where tribe members currently live is beyond our current capability. For this reason, we have only included a list of sites that we feel accurately represent the sea level rise impacts within our area of study and in places at or near significant cultural resources.

This report should be considered a living document that will be updated on an ongoing basis as new information regarding sea level rise impacts to Samish Traditional Territory becomes available.

BACKGROUND

The sea level rise vulnerability assessment focuses on identifying sea level rise impacts to shorelines throughout Samish Traditional Territory and then provides adaptation strategies to address the impacts. The site analyses considered the specific shoreline's exposure and sensitivity to sea level rise and the way that sea level rise will impact the natural habitat profile of the site, the built infrastructure and cultural resources located at or near the site, and the social infrastructure that will be affected by sea level rise. Exposure levels are measured at .4 and 1.5 meters of expected sea level rise in accordance with the most recent IPCC sea level rise predictions based on current greenhouse gas emission trends, while sensitivity considers the site of concern's expected change due to sea level rise impacts. We'd like to note that, at many of the sites, we're concerned about sites along the beach at similar elevations. To that point, many of our site analyses are representative of the entire length of the beach near the site and not solely the site itself. Much of the infrastructure near the sites will also experience significant sea level rise impacts.

This sea level rise vulnerability assessment process allows us to qualitatively consider, on a site by site basis, a location's sensitivity to sea level rise impacts as well as its ability to adapt to or mitigate sea level rise impacts to the shoreline. Our site vulnerability analysis calculates the sensitivity and adaptive capacity of various planning areas identified in the next section to determine the site's overall vulnerability to sea level rise impacts. It also provides a justification for the ranking of those planning areas using the 3x3 sensitivity-adaptive capacity matrix shown in the table below using a one (low) to five (high) vulnerability ranking. Broadly, a site is classified into a high, medium or low sensitivity and adaptive capacity ranking based on the expected impact that sea level rise at either .4 meters or 1.5 meters will have on the site.

Below each site analysis and vulnerability designation we've offered a few mitigation and/or adaptation strategies aimed at either protecting existing resources and infrastructure, or at least monitoring and recording sea level rise rates at the sites in question.

VULNERABILITY = SENSITIVITY x ADAPTIVE CAPACITY

Sensitivity	Adaptive Capacity		
	High	**Medium**	**Low**
High	Medium Vulnerability	Medium-High Vulnerability	High Vulnerability
Medium	Medium-Low Vulnerability	Medium Vulnerability	Medium-High Vulnerability
Low	Low Vulnerability	Medium-Low Vulnerability	Medium Vulnerability

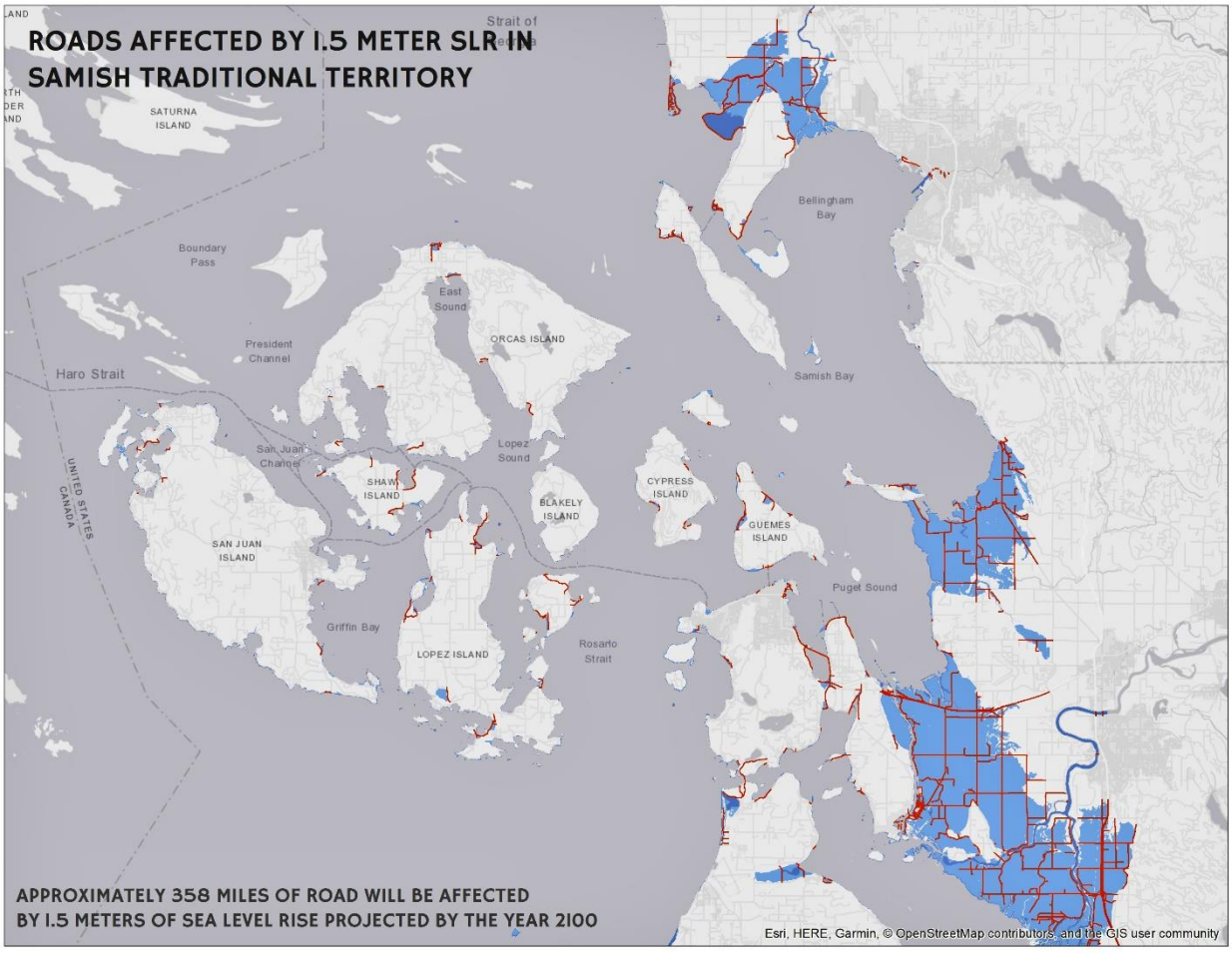
Table 1 Sea Level Rise Site Vulnerability Assessment Sensitivity x Adaptive Capacity Matrix

Built Infrastructure

This area estimates damage to built infrastructure such as roads, businesses and homes. Additionally, we've considered the redundancy of road systems at or near the affected site. For example, how significantly would a .5 or 1.5 M sea level rise affect access to areas inland of/adjacent to the SLR assessment site? If the rising sea level cuts off most/all utility service access routes, or access to crucial built infrastructure then this site should be assessed at a higher vulnerability. Crucial built infrastructure includes energy systems, internet and road access, utility service access such as waste disposal, etc. If there are few roads or accessible ways to provide infrastructure to areas beyond the affected SLR assessment site, and SLR would significantly affect one of the few available roads, a lower adaptive capacity designation should be given. An even lower adaptive capacity would be assessed if there's very little room to move existing roads to adapt to rising sea levels.

If a .4 meter, or higher, sea level rise has significant impact to structures and roads at the site, then the site should be designated highly sensitive. The adaptive capacity designation is defined by the ability to move existing infrastructure to higher locations, or to build mitigating or adaptive infrastructure near the site. Lower vulnerability designations will be assigned if this location has the requisite space to relocate existing built infrastructure.

A significant sea level rise driven concern in Samish Traditional Territory is partial or permanent inundation of roadways. We've identified 358 miles of roadway within our study area as being of significant risk of inundation under IPCC RCP 8.5, given 1.5 meters of sea level rise occurs by 2100. As a significant number of Samish Nation tribal citizens live in or near the affected areas or commute on roads that will be affected by sea level rise, enacting policy that addresses this issue will be crucial in the climate change adaptation planning process. At minimum, approximately 219 tribal citizens living within the study area will be impacted by a 1.5 meter sea level rise.



Cultural Resources

Sites which have remains or midden buried beneath them will almost always be rated as highly vulnerable to sea level rise as shoreline erosion will more than likely affect them regardless of how much sea level rise occurs. These sites are highly sensitive to any shoreline erosion, and their adaptive capacity to the erosional effects of sea level rise is low.

Sites that have culturally significant plants and animals which will be forced to migrate due to sea level rise are to be considered higher sensitivity. Their sensitivity ranking is dependent upon whether their habitat has room to migrate. Factors influencing this migration include the slope of the backshore area, infrastructure in the backshore and upland areas that will be impacted by beach migration.

Social Infrastructure

To determine the vulnerability of the social infrastructure at or near the site, we've identified and ranked the vulnerability of social and utility service access to the site and to the homes and businesses beyond the site. For example, does the affected backshore have roads that run along it that are integral to providing utility and emergency services to people living or working near the site? Sites at which cultural events are held are included in this section.

Habitat Site Profile

The site profile's vulnerability to sea level rise is based on the change in the features at the site, as well as their ability to adapt to changing sea levels. Highly sensitive shoreline habitats are steeper, with a sandy shoreline that will be impacted heavily by the erosional effects of a rising sea. Lower sensitivity will be given to shorelines composed of large rocks, with heavy vegetation that limits shoreline erosion. Highly vulnerable habitats will have a soft, sandy shoreline, with little room to migrate. Lower adaptive capacity rankings will be given to a site that has very little room to migrate, or one in which sea level rise disrupts functions of the existing habitat (e.g. greater inundation or current reducing the capability of shellfish to grow at or near the site of concern). Infrastructure which blocks beach migration also brings down the overall adaptive capacity score for the site.

SLR Impact Planning Areas	**Current Adaptation/Resiliency Factors**	**Ranking/Score 1-5 (1 low to 5 high)**
Built Infrastructure – Identify existing tribal and non-tribal infrastructure in place at or near the site that will be impacted by SLR.	Impacted Infrastructure Road Impact Capacity/ Redundancy Overall impacts of .4 and 1.5 M SLR on local infrastructure	Ranked based on expected damage to site resources at both .4 and 1.5 M SLR. Higher impacts at lower sea level rise predictions will constitute higher vulnerability.
Cultural Resources – Identify cultural resources at or near the site that will be impacted by SLR. This includes archaeological remains, midden, or traditional plants and animals. Ranking here is based on the expected impact to the shoreline profile that either .4 or 1.5 M SLR will have at the site.	Identify cultural resources at the site Rank the value of cultural resources based on the overall value to the tribe. (Discuss ranking classification of these resources with Todd and Jackie)	Ranked based on expected impact to site resources at .4 and 1.5 M SLR

Social Infrastructure – Identify the impacted social services that rely on infrastructure near the site. Broadly identified as either utility services or emergency services.	Crucial utilities infrastructure at/near site Local utilities that rely on roads at/near this site.	Ranked based on expected impact to resources affected by both .4 and 1.5 M SLR
Site Profile (Habitat) – Rank the habitat's vulnerability and adaptive capacity. This includes ranking the habitat based on the expected change to the habitat's backshore are. More significant inundation and erosion, especially at lower SLR predictions, would classify as being of higher concern.	Beach Angle & Substrate Profile Inundation of backshore Loss to existing shoreline	Ranked based on expected impact to site resources at .4 and 1.5 M SLR

SITE MAP


SAMISH TRADITIONAL TERRITORY SEA LEVEL RISE GROUND TRUTH SITES
NORTH PENDER ISLAND
SATURNA ISLAND
21. PATOS N BEACH
31. SUCIA MUD BAY
17. MATIA EAST COVE
Bellingham Bay
20. ORCAS NORTH BEACH
Boundary Pass
1. CLARK W BEACH
30. STUART BEACH AT JOHN'S PASS
19. ORCAS EASTSOUND
East Sound
ORCAS ISLAND
President Channel
Haro Strait
Samish Bay
26. SAN JUAN LONESOME COVE
18. ORCAS DEER HARBOR
8. HENRY OPEN BAY
San Juan Channel
Lopez Sound
22. SAMISH CAMP KIRBY
23. SAMISH EAST BEACH
24. SAN JUAN ENGLISH CAMP
28. SHAW TIFT ROCKS
29. SHAW PICNIC COVE
SHAW ISLAND
3. CYPRESS STRAWBERRY BAY
CYPRESS ISLAND
UNITED STATES
CANADA
12. LOPEZ ODLIN PARK
BLAKELY ISLAND
5. GUEMES NE BLUFF
14. LOPEZ PORT STANLEY
2. CYPRESS SECRET HARBOR
GUEMES ISLAND
10. LOPEZ FLAT POINT
9. HUCKLEBERRY
SAN JUAN ISLAND
15. LOPEZ SPENCER SPIT
7. GUEMES W BLUFF
6. GUEMES SW PEACH PRESERVE
13. LOPEZ OTIS PERKINS PARK
Puget Sound
Griffin Bay
WEAVERLING SPIT SITES
4. DECATUR RIM ISLAND BEACH
LOPEZ ISLAND
25. SAN JUAN JAKLES LAGOON
11. LOPEZ MUD BAY
27. SAN JUAN SOUTH BEACH
16. LOPEZ WATMOUGH BAY
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1. CLARK ISLAND: WEST BEACH

Built Infrastructure

This site has some state park infrastructure (stairs, a sign, etc.), but overall, there's very little in the way of a built environment at this site; and none that will be affected by sea level rise along the shoreline.

Sensitivity: Medium (3)

Adaptive Capacity: High (5)

Vulnerability: Medium-High (4)

Cultural Resources

Unknown

Human Infrastructure (Public Services)

This site is an island and a state park, and so has no public service access points that would be affected by sea level rise in any significant way.

Sensitivity: Low (1)

Adaptive Capacity: High (5)

Vulnerability: Medium (3)

Site Profile (habitat) Impacts

This site is a sandy, low angle beach that leads to a small, heavily vegetated backshore. A lot of small brush, arbutus, and firs grow in the backshore area. Sea level rise will push the beach and backshore into the upland area significantly. However, the beach has room to migrate so changes to the beach and backshore will be significant while overall impacts will be minimal. Factors affecting the sensitivity ranking include the sandy substrate, the low angle of the beach.

Sensitivity: High (5)

Adaptive Capacity: High (5)

Vulnerability Assessment: Medium (3)

Adaptation Strategy Suggestion

- Minimal intervention suggested. We've identified few significant impacts to planning areas at the site.
- Continually monitor shoreline erosion at the site.

2. CYPRESS ISLAND: SECRET HARBOR

Built Infrastructure

There's very little built infrastructure here.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Cultural Resources

Secret Harbor is a cultural site for the Samish people. Midden discovered here indicates evidence of habitation prior to European colonization. Protecting buried cultural resources will be an expensive endeavor.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

N/A

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitats) Impacts

The salt marsh in the backshore area will be pushed back by .4 meters of sea level rise and entirely inundated at 1.5 meters. The stream that empties from the marsh into the sea will be backed up by sea level rise, inundating the rest of the backshore marsh. While the marsh has room to migrate, it will still be heavily impacted by sea level rise at very conservative estimates.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Adaptation Strategy Suggestion

- Continually monitor shoreline erosion at the site.
- Consider protection efforts to preserve cultural resources located at the site.

3. CYPRESS ISLAND: STRAWBERRY BAY

Built Infrastructure

~30 cabins along the backshore area. SLR of any amount will cause flooding on the cabins nearest to the beach. Partial inundation at .4 M SLR. Complete inundation of cabins near the shoreline at 1.5 M SLR. Cabins at slightly higher elevations will avoid inundation. The built environment here is very sensitive to sea level rise due to its proximity to the shoreline. Even the most conservative SLR estimates will partially inundate the built infrastructure at this site.

Sensitivity: High (5)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (3)

Cultural Resources

There are known cultural resources here.

Human Infrastructure (Public Services)

The cabins here are privately owned. There aren't any public ferries that shuttle people to Cypress Island, so sea level rise will have very little effect on the ability to provide public services and emergency services to the people living at this site.

Sensitivity: Low (1)

Adaptive Capacity: High (5)

Vulnerability: Low (1)

Site Profile (habitat) Impacts

The grassy backshore area is very flat and backs up to more forest on Cypress Island. Any SLR higher than .4 M will inundate the backshore and dramatically change the shoreline profile of this site. The current flat, open, grassy field that makes up most of the backshore will be inundated all the way to the hill at the far end of the backshore. While sea level rise will have a significant impact at higher levels, the site's habitat profile will be affected heavily but will be able to migrate with the rising sea level.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium-Low (2)

Adaptation Strategy Suggestion

- Minimal intervention suggested. We've identified few significant impacts to planning areas at the site.
- Continually monitor shoreline erosion at the site.

4. DECATUR ISLAND RIM ISLAND BEACH

Built Infrastructure

There are a few cabins and roads along the shoreline at this site. The backshore is high enough that relocating roads and homes would effectively avoid inundation in the event of even higher sea level rise predictions.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Cultural Resources

Inundation at this site, and along the beach near the analyzed site, will submerge known cultural resources and historic sites.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

Inundation at this site will not significantly affect public service access to homes near the site. There are no roads cut off by inundation that wouldn't also affect the homes around them.

Sensitivity: Medium-Low (2)

Adaptive Capacity: High (5)

Vulnerability: Medium-Low (2)

Site Profile (Habitat) Impacts

The nearshore area of Reads Bay – adjacent to Gerring Beach – is shallow, so sea level rise will impact the nearshore habitat significantly. The backshore is primarily flat, with small grasses that will be inundated at higher sea level rise predictions.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium-Low (2)

Adaptation Strategy Suggestion

- Continually monitor erosional effects of sea level rise on the shoreline near this site.
- Consider adaptation strategies for cultural resources known near the site.

5. GUEMES ISLAND NORTHEAST BLUFF

Built Infrastructure

There is no built infrastructure at the site. The feeder bluff is heavily vegetated. It will erode and slump into the water at a faster rate under both sea level rise scenarios due to undercutting, potentially threatening property atop it in the long term, but the bluff will minimize the impacts of sea level rise directly at the site. However, the houses to the west and east of the site will be inundated in a 1.5 meter sea level rise scenario, and even a .4 meter rise will threaten houses when storms and higher high tides coincide. On either side, houses could be moved inland, but they would have to move a substantial distance because the elevation of the land remains low for up to 0.5 km inland. The assessment for this site will include the low-lying areas east and west of the site.

Sensitivity: High (5)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Cultural Resources

Any clamming and crabbing resources at the site will be impacted—either extirpated or shifted inland. Known midden remnants near the site that will be impacted by a rising sea level.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Human Infrastructure (Public Services)

The road west of the site will be inundated in the 1.5 meter sea level rise scenario and even, at some locations, in the .4 meter sea level rise scenario.

Sensitivity: High (5)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Site Profile (habitat) Impacts

The band of beach along the cliff will become much smaller, and vegetation at the bottom of the cliff will become salt-stressed, leading to death of vegetation and the potential acceleration of erosion.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor erosional effects of sea level rise on the shoreline near this site.
- Build resiliency by relocating built infrastructure in the affected zone.
- Fund soft shoreline armoring efforts for affected tribe member's homes.

6. GUEMES ISLAND SOUTHWEST PEACH PRESERVE

Built Infrastructure

Some houses east of the lagoon at Peach Preserve will be inundated at high tides in both .4 and 1.5 meter sea level rise scenarios, as will small outbuildings near the beach on the west side.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Cultural Resources:

East of Peach Preserve, near the ferry dock on Guemes Island is a historic village site. A 1.5 meter sea level rise will put this site, and the shoreline near it, at risk of significant inundation.

Sensitivity: High (5)

Adaptive Capacity : Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

The road is high enough to escape direct sea level rise impacts. A public trail/park will be impacted in a .4 meter sea level rise scenario and inundated in a 1.5 meter sea level rise scenario. These resources could relocate inland with little effort.

Sensitivity: Medium-Low (2)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium-Low (2)

Site Profile (habitat) Impacts

The dry (seasonal) lagoon parallel to the beach will likely flood at higher high tides in a .4 meter sea level rise scenario, which will stress the vegetation community and prevent use by ground-nesting birds. In a 1.5 meter sea level rise scenario, both the beach and the lagoon will be inundated at high and even moderately high tides. Any animals using the lagoon as habitat will need to relocate and the vegetation community will be greatly reduced. The beach is steep enough that clam resources may persist in the .4 meter sea level rise scenario, as the intertidal habitat is less likely than a shallower location to become entirely subtidal; in the 1.5 meter sea level rise scenario, clam habitat will be impacted.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor sea level rise impacts to the site and the houses near the site.
- Consider shoreline restoration or soft shoreline armoring along the beach.
- Develop a coastal restoration plan to protect homes near the site.

7. GUEMES ISLAND WEST FEEDER BLUFF

Built Infrastructure:

N/A

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Cultural Resources:

Unknown

Human Infrastructure (Public Services)

N/A

Site Profile (habitat) Impacts

Both sea level rise scenarios will accelerate the feeder bluff's rate of erosion and will make the band of beach significantly narrower even at low tides.

Sensitivity: Medium (3)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor shoreline erosion at this site.
- Minimal intervention suggested. We've identified few significant impacts to planning areas at the site.

8. HENRY ISLAND OPEN BAY

Built Infrastructure

Minimal. Walking paths in the backshore area might survive a .4 meter sea level rise and will be inundated in the 1.5 meter SLR scenario, but the houses are high enough to avoid inundation in both scenarios.

Sensitivity: Medium-Low (2)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-Low (2)

Cultural Resources

Henry Island was an ancestral village site for the earliest ancestors of the Lummi, Samish, Saanich and Songhees nations. This village was part of a larger inter-island community. While few artifacts may survive inundation in a salt marsh, erosion of the surrounding land is likely to lead to archaeological impacts. Animal and plant species, including shorebirds and salt marsh grasses, will be severely impacted in both scenarios. The salt marsh habitat behind the backshore is adapted for moderate levels of tidal inundation, and sea level rise will put it underwater more frequently, at more depth, for longer periods of time. Clam populations have limited potential for migrating up the beach given that it is steep, and the rocks get larger near the top of the slope.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Human Infrastructure (Public Services)

N/A. No roads or public services will be affected.

Site Profile (habitat) Impacts

In a .4 meter sea level rise scenario, the narrow backshore will probably be breached in some places. The backshore and the salt marsh will be entirely inundated in a 1.5 meter sea level rise scenario. The east side of the island will be cut off from the west side at high tides as well, and the salt marsh habitat will succumb to inundation, becoming subtidal.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider a coastal restoration effort to prevent erosion from becoming a more significant concern at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

9. HUCKLEBERRY ISLAND

Built Infrastructure

N/A

Cultural Resources

The archaeological site (which likely eroded down to the beach from the top of the island) will be heavily impacted by .4 meter sea level rise and will be entirely inundated by in the 1.5 meter SLR scenario. Clam resources and eelgrass resources in the intertidal zone will be altered in the .4 meter scenario and will be inundated and possibly extirpated in the 1.5 meter SLR scenario. The trail (used almost exclusively, and rarely, by Samish people and staff) is already eroded enough to be unsafe. This impacts access to cultural site (grassy bald containing camas and other resources.)

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

N/A

Site Profile (habitat) Impacts

The beach is already small and will be reduced in the 0.4 meter SLR scenario and entirely inundated at high tides in the 1.5 meter SLR scenario. Erosion of the bluff will continue and accelerate under both scenarios due to salt stress and death of vegetation and increased exposure to the weathering forces of waves.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider soft shoreline armoring or shoreline restoration projects to prevent beach migration towards the culturally significant site in the backshore.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

10. LOPEZ ISLAND FLAT POINT

Built Infrastructure

The houses on the north side of Flat Point may escape inundation in a .4 meter sea level rise scenario, but any larger sea level rise will inundate them.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Cultural Resources

The Samish name for Flat Point translates to “Ancient Village,” which indicates that it was known as a cultural site even before colonization. A 1.5 meter rise in sea level would inundate all of Flat Point, which would alter and/or erase any traces of cultural activity. The plants in the dune wild rye meadow behind the houses would also be extirpated, and any birds or other species that use Flat Point Lake would lose that fresh(er) water as well as a refuge from the swift, cold waters of Upright Channel.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

A 1.5 meter rise in sea level would inundate the road. However, the road leads only to the houses on Flat Point, which would also be inundated in this scenario. The road could be moved inland together with the houses, but it would have to be by a substantial distance to avoid inundation.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Site Profile (habitat) Impacts

A .4 meter sea level rise scenario would force the beach inland, but the sand and vegetation would likely keep the water from getting too far inland. Under a 1.5 meter SLR scenario, Flat Point would disappear. Flat Point Lake would also flood with saltwater and essentially become part of Upright Channel.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: 4.5

Adaptation Strategy Suggestion

- Continually monitor shoreline erosion at this site.
- Consider soft shore armoring for the beach around flat point.
- Fund protection efforts for existing cultural resources at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

11. LOPEZ ISLAND MUD BAY

Built Infrastructure

Some of the houses close to the shore of Mud Bay will be inundated in the 1.5 meter sea level rise scenario. Even a .4 meter rise in sea level may eat a significant amount out of the land above the beach. Relocation of houses is highly impractical as the most threatened dwellings sit between the shore and a steep, heavily vegetated hill. Only a few houses are highly threatened, however.

Sensitivity: Medium (3)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Cultural Resources

Unknown

Human Infrastructure (Public Services)

No roads or other public infrastructure will be threatened by either sea level rise scenario in Mud Bay.

Sensitivity: Low (1)

Adaptive Capacity: N/A

Vulnerability: Low (1)

Site Profile (Habitat) Impacts

Mud Bay is shallow. Sea level rise will affect the eelgrass bed, possibly extirpating the deeper edges and/or causing it to shift inland; the substrate (mud) should permit an inland shift. The salt marsh habitats inland of the site will also be affected, and a 1.5 meter sea level rise will transform the salt marsh ecosystem into more bay.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor shoreline erosion at this site.
- Consider addressing impacts to known cultural resources at the site.


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12. LOPEZ ISLAND ODLIN PARK

Built Infrastructure

Odlin Park has a public campground with pit toilets, a playground and various outbuildings. A .4 meter sea level rise will not impact infrastructure, but a 1.5 meter sea level rise will flood the ball field and cause significant damage. Moving the infrastructure is possible.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Cultural Resources

Odlin Park is a known cultural site and Samish ancestors were certainly present there prior to colonization. Sea level rise will have a significant impact on the shoreline here, inundating large portions of the park.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

The park is a public area but contains no essential services that would be affected significantly by sea level rise.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

Under a 1.5 meter sea level rise scenario, the intertidal habitat will shift to subtidal and the field will flood, creating the kind of conditions that in other areas favor salt marsh habitat, though the substrate may not be suitable for salt marsh. The edge of the forest that meets the shore will also be impacted.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Monitor sea level rise driven erosion at the site.
- Consider beach nourishment/soft shore armoring to protect the park in the case of higher sea level rise scenarios.

13. LOPEZ ISLAND OTIS PERKINS PARK

Built Infrastructure

Otis Perkins Park is bisected by Bayshore Road, which occupies a very narrow strip of land that connects the peninsula that forms the outside of Fisherman Bay with the rest of Lopez Island. While few of the houses on the peninsula will be inundated in either sea level rise scenario, both scenarios pose a significant threat to the road connecting the peninsula to the rest of the island. See: Human Infrastructure/Public Services.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Cultural Resources

Evidence suggests that the site which once existed in this area has already been entirely eroded and erased.

Human Infrastructure (Public Services)

The road connecting the peninsula that forms the outer shore of Fisherman Bay will be severely undercut by a .4 meter sea level rise and inundated/washed away in a 1.5 meter sea level rise scenario. This will disconnect the peninsula from the rest of Lopez, essentially making it into a small island accessible by foot at low tide or by boat at high tide. This will severely impact anyone living on the peninsula in terms of access to public services.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Site Profile (Habitat) Impacts

Even a .4 meter sea level rise scenario is likely to damage the road and allow more water to enter the shallow, protected south end of Fisherman Bay. The 1.5 meter sea level rise scenario will essentially open Fisherman Bay up on the south end, which will drastically change the ecology of the bay. Migrating bird species that use that protected area, including wading birds that forage in the mud, will likely lose a food source and a refuge. The strip of land which hosts the road is so narrow that adaptive capacity is minimal. In addition, much of the Fisherman Bay Spit Preserve will experience tidal flooding and possibly widen the mouth of Fisherman Bay under a 1.5 meter sea level rise scenario.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Monitor sea level rise driven erosion at the site.
- For any tribal citizens living in areas affected by sea level rise at this site, consider relocating to higher ground.

14. LOPEZ ISLAND PORT STANLEY

Built Infrastructure

Even a .4 meter sea level rise scenario will make the road vulnerable to damage during storms. A 1.5 meter sea level rise scenario will inundate the road and cause significant damage to houses; high tides will flood the lagoon behind the houses as well, causing it to be more of a wetland/saltwater lake than it currently is. Houses could be moved back from the beach, but they would need to move as much as 0.3 km—beyond either of the adjacent roads that border the marshy area.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Cultural Resources

The upland area beyond the beach is a known culturally significant site. A 0.4 meter sea level rise will have a minor impact on the upland area, while a 1.5 meter sea level rise will inundate large sections of the backshore and undoubtedly impact cultural resources existing here.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Human Infrastructure (Public Services)

The road accessing the houses at Port Stanley will be affected by beach migration under .4 meters of sea level rise and inundated in the 1.5 meter sea level rise scenario, rendering the houses inaccessible to services. It is unlikely that the houses would persist in that scenario, however. An alternate route to travel around Port Stanley is available inland of the wetland area and, while it is a less direct route to some destinations, does not provide a significant detour.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Site Profile (Habitat) Impacts

Grassland/freshwater marsh/human habitat will shift to beach/mudflat/salt marsh habitat.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Monitor sea level rise driven erosion at the site.
- Soft shore armoring/beach nourishment could offer limited protection in lower sea level rise scenarios.

15. LOPEZ ISLAND SPENCER SPIT

Built Infrastructure

One State Park facility building is located at the end of the Spit, and it would be inundated by anything higher than the .4 meter sea level rise scenario. There are no permanent dwellings or other major infrastructure features located on Spencer Spit.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium (3)

Cultural Resources

Cultural use plants in the salt marsh will be inundated and the salt marsh habitat extinguished in the 1.5 meter sea level rise scenario.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

Essential public services, and access to them, will not be impacted by the disappearance of Spencer Spit.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

The salt marsh habitat and the entire spit will be inundated at high tides in a 1.5 meter sea level rise scenario; indeed, anything much greater than 0.4 meters will have this effect. Long-term or frequent inundation will destroy the salt marsh habitat.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Adaptation Strategy Suggestion

- Monitor sea level rise driven erosion at the site.
- Efforts to preserve Spencer Spit are likely futile in a moderate to high sea level rise scenario—accept change in this location

16. LOPEZ ISLAND WATMOUGH BAY

Built Infrastructure

There is no built infrastructure in Watmough Bay.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Cultural Resources

Watmough Bay is an important cultural site for Samish people. Soapberry, an important cultural plant, is present in the backshore, along with other culturally relevant species. There may have been a village located nearby, given archaeological evidence found at the site. Clam resources are present in the intertidal zone as well. A 1.5 meter sea level rise will inundate the beach entirely and flood the wetland and low-lying areas behind the beach as well, which will affect plants in the area as well as clam resources. Clam populations may be able to migrate up the beach to some extent.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

There are no public services in Watmough Bay.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

A 1.5 meter sea level rise scenario will flood the wetland and low-lying areas beyond the top of the beach, leading to a reduction in wetland habitat and potential migration and/or degradation of clam resources.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Monitor sea level rise driven erosion at the site.
- Efforts to preserve Watmough Bay are likely futile in a moderate to high sea level rise scenario – the wetland will likely expand with the rising sea level.
- Consider addressing impacts to known cultural resources at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

17. MATIA ISLAND EAST COVE

Built Infrastructure

There is no built infrastructure at the site and very little on Matia in general.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Cultural Resources

The difference between the two sea level rise scenarios is slight at this site. While there are no known archaeological resources on Matia, it is known to have been a camas harvesting site for Samish ancestors.

Sensitivity: Medium-Low (2)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium (3)

Human Infrastructure (Public Services)

No public services are located on Matia. Since it is a wildlife refuge and no humans live there permanently, access to public services is not an issue.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

A 1.5 meter sea level rise will cause undercutting of the land and will reduce the size of the beach, but the steepness of the beach and the land behind it means that the effects will be minimal.

Sensitivity: Medium-Low (2)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Minimal intervention suggested. We've identified few significant impacts to planning areas at the site.

18. ORCAS ISLAND DEER HARBOR

Built Infrastructure

Most of the houses in Deer Harbor are not threatened by even the 1.5 meter sea level rise scenario. The road at the head of the lagoon may flood in some places, but the slope up from the water is generally enough to protect the infrastructure.

Sensitivity: Medium-Low (2)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium (3)

Cultural Resources

The Samish name for Deer Harbor translates roughly to “Place of Aerial Duck Net Hunting.” (Samish hunters would slip a net underwater before dawn. They would then scare the ducks in the appropriate direction and lift it up and over as the ducks were taking off, snaring many at once.) The lagoon bears a prominent Samish name—Cayou—and Samish tribal citizens can trace their history to recent ancestors who lived there. There was a Lummi village there at the time of European contact. Sea level rise would impact the lagoon, making it larger and deeper, and expanding into the salt marsh and field. This may impact fish populations, particularly juvenile fish that seek refuge in the calm lagoon. Known cultural sites exist within the affected area.

Sensitivity: High (5)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

The road may be impacted in low places by a 1.5 meter sea level rise. Alternate, more circuitous routes exist.

Sensitivity: Medium-Low (2)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-Low (2)

Site Profile (Habitat) Impacts

Sea level rise will expand the lagoon out into the field and inundate the salt marsh around the lagoon. The higher the sea level rise, the more the field and marsh will be impacted.

Sensitivity: Medium (3)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Monitor sea level rise driven erosion at the site.
- Consider beach nourishment/soft shore armoring to protect the site in the case of higher sea level rise scenarios.

19. ORCAS ISLAND EASTSOUND

Built Infrastructure

Eastsound is heavily armored and even the surrounding beaches are very rocky. Though sea level rise will put additional strain on armoring, sea level rise will not have immediate effects on the infrastructure at Eastsound.

Sensitivity: Low (1)

Adaptive Capacity: High (5)

Vulnerability: Low (1)

Cultural Resources

Archaeological cultural resources in the area have been impacted heavily by construction and development in Eastsound. This area has a significant amount of culturally significant sites, however, the few sites that are low elevation enough to be impacted by sea level rise are either rocky or have been impacted already.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Human Infrastructure (Public Services)

Eastsound sits just high enough above sea level that it is unlikely to be affected by even a 1.5 meter sea level rise.

Sensitivity: Low (1)

Adaptive Capacity: Low (1)

Vulnerability: Low (1)

Site Profile (Habitat) Impacts

Eastsound is either naturally rocky or built up—armored with riprap or concrete. While these structures will have a shorter lifespan under higher sea levels, the immediate impacts of even a 1.5 meter sea level rise are minimal.

Sensitivity: Low (1)

Adaptive Capacity: Low (1)

Vulnerability: Low (1)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Minimal intervention suggested. We've identified few significant impacts to planning areas at the site.

20. ORCAS ISLAND NORTH BEACH

Built Infrastructure

Houses line the shore at North Beach and, at a 1.5 meter sea level rise prediction, will be inundated as the beach migrates. However, a .4 meter sea level rise poses little threat to the built infrastructure at the site. Road infrastructure will experience similar impacts at the predicted sea level rise estimates; however, few major roadways exist at this site. The houses here could be relocated further inland.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Cultural Resources

Unknown

Human Infrastructure (Public Services)

This site has utility and emergency service access; however, sea level rise at even the highest predictions will have few impacts that can't be mitigated through moving existing infrastructure inland.

Sensitivity: Medium-Low (2)

Adaptive Capacity: High (5)

Vulnerability: Medium-High (4)

Site Profile (Habitat) Impacts

North beach is low angle and sandy with minimal vegetative cover which increases its overall sensitivity to sea level rise driven shoreline erosion. The beach will migrate inland and, except for the houses in the backshore, it will face few

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium-Low (2)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider beach nourishment/soft shore armoring to protect the site in the case of higher sea level rise scenarios.


PRIVATE
PROPERTY

21. PATOS ISLAND NORTH BEACH

Built Infrastructure

The only infrastructure on Patos Island is the lighthouse on the northwest end, which is at the opposite end of the island from our site analysis location and high enough to avoid inundation in either sea level rise scenario. Sea level rise will expand the lagoon out into the field and inundate the salt marsh around the lagoon. The higher the sea level rises, the more the field and marsh will be impacted.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Cultural Resources

The Samish name of Patos Island translates to “Place of Harvesting Oysters.” Dramatic sea level rise will impact shellfish and shift the intertidal zone higher, where it may or may not have the correct substrate for a given species. Little is known about current shellfish resources on Patos Island. The steepness of the beach will limit the impact of sea level rise on the land and will possibly allow clam populations to migrate upland for a limited distance. The sites existing on Patos Island will be impacted, however the steepness of the beach will limit significant impacts in all but the highest sea level rise prediction scenarios.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Human Infrastructure (Public Services)

N/A

Site Profile (Habitat) Impacts

The substrate at Patos Island’s north beach is steep and composed of small rocks. Sea level rise impacts at the site will be relatively minor as the beach has room to migrate without impacting the habitat profile of the site significantly.

Sensitivity: Low (1)

Adaptive Capacity: High (5)

Vulnerability: Low (1)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

22. SAMISH ISLAND CAMP KIRBY

Built Infrastructure

The summer camp cabins, kitchen and other camp infrastructure will sustain some damage in the .4 meter sea level rise scenario and will be inundated in the 1.5 meter sea level rise scenario. The buildings cannot be moved upland very much because the hill behind them is very steep.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Cultural Resources

The Samish name for Camp Kirby means "Deep water point." While this site hasn't been surveyed for archaeological resources, it's a known cultural site for Samish citizens and is the site of an annual gathering for an otherwise dispersed nation.

Sensitivity: High (5)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-Low (2)

Human Infrastructure (Public Services)

Since the camp is on a point that is surrounded on three sides by water, no essential public services are accessed through Camp Kirby.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

The point of land that comprises much of Camp Kirby's beach sticks out into Padilla Bay. Even a .4 meter sea level rise would inundate the point; the higher the sea level rise, the more likely that buildings, infrastructure, and more of the ecology will be damaged.

The spit is formed and maintained by the dynamic equilibrium of currents pushing and pulling from both sides. Presumably, if the water consistently rose above spit, the sediment dynamics could change, which could impact the eelgrass resources on either side of the spit, as well as accelerate change. There is nowhere for the spit to go except into the water; even the most conservative estimates of sea level rise indicate will lead to significant change.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Adaptation Strategy Suggestion

- Monitor sea level rise driven erosion at the site.
- Consider relocating built infrastructure at this location – sea level rise will cause significant impacts to this site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

23. SAMISH ISLAND EAST BEACH

Built Infrastructure

The east side of Samish Island is heavily developed, with houses sitting along the beach. Any sea level rise will have significant impacts, with even the most conservative sea level rise predictions expecting inundation of houses and roads near the beach. There's very little redundancy to the road system leading to Samish Island. The sole road providing access to the island is very low elevation, and rising sea levels will likely inundate it on a semi-frequent basis.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Cultural Resources

This beach and the backshore area were, historically, a village site prior to European colonization. As such, any archaeological resources located at or near the site are of significant cultural importance and will undoubtedly be impacted by even the most minimal sea level rise impacts.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

This site receives utility and emergency services, however emergency service access is reliant on access through Samish Island Road, a low elevation roadway at the southeast corner of the island. The road along this section of island is as low lying as the adjacent houses and will be inundated lightly by a .4 meter sea level rise, and completely inundated at a 1.5 meter sea level rise.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Site Profile (Habitat) Impacts

The existing shoreline and backshore are very flat and sandy. Sea level rise will force the existing shoreline habitat to migrate inland a considerable distance, as the backshore is flat and at moderate inundation risk from even the lowest sea level rise predictions.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider addressing impacts to known cultural resources at the site.
- Consider relocating built infrastructure at this location – sea level rise will cause significant impacts to this site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

24. SAN JUAN ISLAND ENGLISH CAMP

Built Infrastructure

Accelerated erosion from even a .4 meter sea level rise will endanger the park infrastructure (re-created old military buildings.) A 1.5 meter sea level rise scenario will inundate the buildings at high tides.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Cultural Resources

This site has significant archaeological value. Under both scenarios, sea level rise runs the risk of eroding the existing shoreline and exposing culturally significant resources. Any archaeological resources are at risk of exposure/loss under both sea level rise scenarios, as are archaeological resources from more recent (colonial) history.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

The buildings at the site are not permanently inhabited and no critical resources are located at English Camp.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

A .4 meter sea level rise scenario will lead to increased erosion; the beach is narrow and any sea level rise will cut into the grassy field above it. A 1.5 meter sea level rise will erode the beach and inundate the buildings and the field at high tides. The beach is very narrow and steep, and any sea level rise will have a significant impact.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider addressing impacts to known cultural resources at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

25. SAN JUAN ISLAND JAKLES LAGOON

Built Infrastructure

There is no built infrastructure at Jakles Lagoon.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Cultural Resources

Jakles Lagoon contains sizable populations of culturally important plants. It is also important habitat for ducks and other culturally important water birds. An 0.4 meter sea level rise will flood the lagoon more frequently, and a 1.5 meter sea level rise will completely inundate the lagoon, killing off vegetation and essentially making it part of the saltwater at high tides. The beach has room to migrate, however the lagoon will be inundated at higher exposure levels.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

No essential human services are located at, or accessed via, Jakles Lagoon.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

The 0.4 meter sea level rise scenario will result in more flooding of the lagoon, and the 1.5 meter sea level rise will inundate it entirely at high tides, essentially Converting it into intertidal habitat.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Minimal infrastructure and cultural resources at this site mean that adaptation strategies are relatively unneeded.

26. SAN JUAN ISLAND LONESOME COVE

Built Infrastructure

The .4 meter sea level rise scenario will do minimal damage to infrastructure. The 1.5 meter sea level rise scenario will damage the dock and adjacent boathouse and cause accelerated erosion which will threaten the other houses in the backshore.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Cultural Resources

Lonesome Cove is an old village site. Any sea level rise poses a risk of exposure and loss of archaeological material in the low bluff that defines the edge of the current beach.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

No essential human services are located at, or accessed via, Lonesome Cove. The road in is not particularly vulnerable, as it is above the highest sea level rise projections.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

The shoreline here is rocky and steeply angled. Sea level rise will push the existing beach inland, however there will be little impact overall to the site's habitat profile. Most of the shoreline here is rocky, so overall erosional impacts will be limited. The backshore has plenty of room to migrate.

Sensitivity: Low (1)

Adaptive Capacity: High (5)

Vulnerability: High (5)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider addressing impacts to known cultural resources at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

27. SAN JUAN ISLAND SOUTH BEACH

Built Infrastructure

Pit toilets and parking lot will be inundated in the 1.5 meter sea level rise scenario, and even the .4 meter sea level rise scenario may result in flooding at higher tides. These things could be moved with significant effort.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Cultural Resources

South Beach was the site of a semi-permanent camp. Archaeological data is unavailable, but since it is a known village site, it is possible that sea level rise could erode the land behind the beach and result in the reveal and loss of cultural resources.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

No essential human services are located at, or accessed via, South Beach.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

The current beach is flat and sandy, with a large accumulation of driftwood. Even the .4 meter sea level rise scenario will move the beach back into the land, and the 1.5 meter sea level rise will flood all of the low area behind the beach, in addition to changing the beach profile (the land rises more steeply as it goes inland.) Additionally, the feeder bluff southeast of the site will erode faster under higher sea level conditions.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

28. SHAW ISLAND COVE AT TIFT ROCKS

Built Infrastructure

There is no built infrastructure at Tift Rocks. A private dock at the mouth of the bay may be impacted.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Cultural Resources

The shoreline at this site has evidence of habitation by Samish peoples. Culturally significant resources will be impacted heavily by a 1.5 meter sea level rise.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

No essential human services are located at, or accessed via, Shaw Island at Tift Rocks.

Sensitivity: N/A

Adaptive Capacity: N/A

Vulnerability: N/A

Site Profile (Habitat) Impacts

The beach is gently sloping and pebbly, with a substantial wrack of large driftwood on the upper edge. Behind the driftwood, the land slopes down again into a thick forest. The 0.4 meter sea level rise scenario will make the beach narrower and may cause limited flooding of the forest at very high tides. The 1.5 meter sea level rise scenario, however, will flood the forest frequently, causing the death of trees and other terrestrial vegetation and the migration of the beach back into the forest, possibly creating a lagoon or shallow slough full of snags. Additionally, the 1.5 meter sea level rise scenario will reduce the above-water availability of Tift Rocks, which provide important habitat for marine mammals and birds.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.


CST

29. SHAW ISLAND PICNIC COVE

Built Infrastructure

The houses west of Picnic Cove will be inundated in the 1.5 meter sea level rise scenario, and even a .4 meter sea level rise could result in some flooding and water damage when high tides and storms coincide.

Sensitivity: High (5)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Cultural Resources

There are few cultural resources here, however Indian Cove adjacent to this site has a large cultural significant which will face significant impacts in the event of any amount of sea level rise.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

A .4 meter sea level rise will have minimal effect on access to public services. A 1.5 meter sea level rise, however, will cut off road access to Indian Cove Road. Alternate routes are available.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium (3)

Site Profile (Habitat) Impacts

The .4 meter sea level rise scenario will have minimal effects—some minor flooding of the salt marsh may occur, and the beach will become narrower and push slightly up into the driftwood wrack. The 1.5 meter sea level rise scenario will inundate the fragile salt marsh habitat behind the beach, leading to reduced habitat for birds and other wildlife. The houses and their associated septic systems also pose a risk to habitat in the case of drastic sea level rise and associated flooding. The eelgrass in the shallow embayment has some room to migrate inland on appropriate (muddy) substrate; whether it will do so is uncertain. Some of the forest habitat will also be flooded, and the forested knob that protects the west side of Picnic Cove will be cut off from the rest of Shaw at high tide.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.


CST

30. STUART ISLAND BEACH AT JOHN'S PASS

Built Infrastructure

The 0.4 meter sea level rise scenario will push the wrack line up into the driftwood and potentially cause occasional minor flooding but impacts from this scenario generally will be minimal. The 1.5 meter sea level rise scenario will flood the houses, the arterial road and part of the airfield, as well as cutting one house off from the rest of the island at high tides. The houses could be moved, but they would need to move upland substantially, and movement is restricted by the placement of the airfield.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Cultural Resources

Culturally significant site along the Tombolo at the north end of the beach will be impacted by any amount of sea level rise.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Human Infrastructure (Public Services)

Johns Island is accessed via air or private boat exclusively. The airfield, as well as part of the main arterial road, will be inundated in a 1.5 meter sea level rise scenario. The road could be rebuilt elsewhere, but it is uncertain whether planes would have a long enough area in which to slow down after landing should the existing airfield be compromised.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium-High (4)

Site Profile (Habitat) Impacts

The shallow bay is host to eelgrass habitat resources, which will be impacted minimally by a 0.4 meter sea level rise and drastically by a 1.5 meter sea level rise. The eelgrass has limited room with appropriate substrate to migrate inland; whether it will do so is uncertain. Any clam resources in the area are in a similar condition, though the larger rocks further up the beach are not hospitable clam habitat. Pockets of salt marsh, an important habitat, will be inundated in the 1.5 meter sea level scenario, as well as bird habitat on the upper reaches of the beach.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.

31. SUCIA ISLAND MUD BAY

Built Infrastructure

N/A

Cultural Resources

The Samish name for Sucia, Lhewqemeng, means 'Place of Harvesting Mussels'. Harvest of shellfish is an important cultural practice for the Samish tribe. A .4 meter sea level rise would permanently inundate Mud Bay at low tide, and at high tide would cut off large portions of the existing shoreline. A 1.5 meter sea level rise would entirely inundate Mud Bay and the other low angle, flat beaches around Sucia Island. The shoreline of Mud Bay is a small Isthmus, affected by the sea on both its north and south sides. Many of the other low elevation beaches on Sucia Island are very flat with steep hills along their perimeters that will severely limit the beach's capability to migrate with a rising sea level.

Sensitivity: Medium-High (4)

Adaptive Capacity: Low (1)

Vulnerability: Medium-High (4)

Human Infrastructure (Public Services)

There is very little infrastructure here and public services to the site are only available by boat, thus sea level rise presents no impacts that aren't already addressed by existing services.

Sensitivity: Low (1)

Adaptive Capacity: High (5)

Vulnerability: Low (1)

Site Profile (Habitat) Impacts

This site is a low angle beach, with a substrate composed primarily of small pebbles and shell remnants. The intertidal zone on the north side of the isthmus is low angle and is composed almost entirely of short salt grass that extends into a shallow bay. Sea level rise

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.

32. WEAVERLING SPIT END

Built Infrastructure

None

Cultural Resources

This site has significant cultural importance. Since time immemorial this place has been used for cultural events, as well as for food processing and harvest. Any sea level rise will heavily impact this site and affect cultural connection here. Due to the drastic impact that even the lowest expected SLR will have, this site should be classified as highly sensitive. This site is very low elevation, with a flat, sandy profile and any sea level rise will inundate the site. For that reason, it should be given a low adaptive capacity ranking.

This site was used for clam harvesting and fishing prior to colonization. The value in this place is how shallow it is and thus sea level rise presents a threat to future harvest of traditional foods here. Presently, many cultural events continue to be held here.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Social Infrastructure

Cultural events are held here, however this site does not have any other social infrastructure, public services, utilities, etc. Impacts to this planning area will be limited, even though the site will be heavily affected by sea level rise.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Site Profile (habitat) Impacts

This site sits up against the RV park and thus has very little room to migrate. The value of this site, culturally, was how protected and shallow it is and thus allows for easy food harvest in the bay around it. As the sea level rises, that value will disappear as the surrounding bay gets deeper.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider addressing impacts to known cultural resources at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

33. WEAVERLING SPIT RV PARK

Built Infrastructure

Significant infrastructure exists here. It is also a very high risk and high vulnerability site. The convention center, parking lots, and campsites with built in electric and plumbing, are all at significant risk from SLR. Any SLR will lead to either occasional flooding during high tide events or permanent inundation at higher levels of sea level rise. Due to the expected costs associated with adapting the infrastructure here to climate change driven sea level rise and the expected inundation that even minor SLR will cause, this site's adaptive capacity should be considered very low.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Cultural Resources

The RV park is on a culturally significant site. Prior to colonization this site was a site that's been occupied for at least 1,500 years. It's been a space for harvesting and processing fish and shellfish, as well as various ceremonies and events. This place is very culturally significant and sits at a very low elevation, thus any SLR will have a large impact on cultural resources at the site. This includes remains under the park, midden that would be exposed as sea levels rise, etc. Risk to the site is very high due to its elevation, and the low adaptive capacity as there is midden and remains here that will be exposed or washed away as sea level rise occurs.

Access to traditional foods will be impacted heavily by sea level rise at/near this site. The salt estuaries, eelgrass beds, tidal flats, and salt marshes that grow here will be inundated by even minor SLR. The natural resources and traditional foods that exist here will be impacted and won't be able to adapt or migrate due to the road behind the site stopping the beach from moving. Low adaptive capacity. This site is highly sensitive to change, and sea level rise will cause significant change to the surrounding ecosystem.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Social Infrastructure

Public services to this site will be affected lightly by SLR. There is only one road that leads to this site and it will not be inundated at the maximum SLR prediction. However, there is still a risk during king tide events that the road may flood and prevent public service access to the site. This could be mitigated with medium cost solutions, e.g. moving the road upslope, building flood barriers, etc. There's room to migrate the road or build flood barriers, and for that reason I'm assigning this spot a medium adaptive capacity. Low-Medium risk.

Sensitivity: High (5)

Adaptive Capacity: Low (1)

Vulnerability: High (5)

Site Profile (habitat) Impacts

The site habitat profile is of significant concern because of how sea level rise will affect the profile of the Fidalgo bay aquatic reserve behind the RV park. Rising sea levels will change how, and if, the salt estuaries, eelgrass beds, tidal flats, and salt marshes grow in this area. Also, this area's ability to migrate is very limited by highway 20 that runs parallel to the shore. The site profile of the RV park will also be affected heavily, but has some room to migrate, so is not as large of a concern. Due to the low adaptive capacity of the Fidalgo bay aquatic reserve's and its high impact sensitivity, I'd categorize this area as a Medium-High vulnerability.

Sensitivity: High (5)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider addressing impacts to known cultural resources at the site.
- Consider relocating park infrastructure to the upland areas of the existing spit.

34. WEAVERLING SPIT FIELD

Built Infrastructure

Impacts here will affect the RV park's infrastructure. 1.5 M sea level rise will cause permanent inundation at this site which will cut off access to the Tommy Thompson trail, road access to the RV park, and inundate existing camp sites, causing damage to the waste pump out system and electrical systems at RV park.

Sensitivity: High (5)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Cultural Resources

This site will only partially be inundated by SLR. A Significant portion of the backshore will be inundated, however most of the backshore will be well above the waterline. The primary concern is the effect that sea level rise driven erosion will have on archaeological resources that are currently buried. A rising sea level risks exposing these resources. Steps should be taken to either mitigate shoreline erosion or move archaeological resources to somewhere that will be unaffected by SLR.

Sensitivity: High (5)

Adaptive Capacity: Medium (3)

Vulnerability: Medium-High (4)

Human Infrastructure

Impacts here will be shared by impacts to the RV park and convention center further down Weaverling Spit. Thus, protecting public service access to Weaverling spit will likely include SLR mitigation efforts at this site. This site has very little infrastructure that would inhibit mitigation efforts.

Sensitivity: Medium (3)

Adaptive Capacity: Medium (3)

Vulnerability: Medium (3)

Site Profile (habitat) Impacts

This site is a low angle beach composed primarily of small rocks, shells and sand. As it reaches the backshore it becomes heavily vegetated before clearing into a grass field with a primarily sandy substrate that becomes dirt and grass as it reaches the backshore.

Sensitivity: Medium (3)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium-High (4)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider addressing impacts to known cultural resources at the site.
- Regular archaeological surveys and appropriate repatriation upon discovery of culturally sensitive resources at the site.

35. WEAVERLING SPIT HIDDEN BEACH

Built Infrastructure:

N/A

Cultural Resources:

Weaverling spit is a historic cultural site for the Samish Indian Nation. Sea level rise impacts at Hidden Beach correspond with impacts throughout the spit and will inundate and erase valuable cultural resources.

Sensitivity: Medium-High (4)

Adaptive Capacity: Medium-Low (2)

Vulnerability: Medium (3)

Human Infrastructure (Public Services):

N/A

Site Profile (habitat) Impacts:

Hidden beach backs directly up to a small hill on Weaverling spit. Thus, while the beach will migrate in as the sea level rises, the overall habitat profile of this site will remain largely intact. The forest in the backshore will remain relatively lightly impacted.

Sensitivity: Medium (3)

Adaptive Capacity: Medium-High (4)

Vulnerability: Medium (3)

Adaptation Strategy Suggestion

- Continually monitor sea level rise driven erosion at the site.
- Consider addressing impacts to known cultural resources at the site.

36. VULNERABILITY DESIGNATIONS (COMPILED)

Site	Built Infrastructure	Cultural Resources	Human Infrastructure	Site Profile (Habitat)
Clark Is. W Beach	Medium-High (4)	Unknown	Medium (3)	Medium (3)
Cypress Is. Secret Harbor	N/A	High (5)	N/A	High (5)
Cypress Is. Strawberry Bay	Medium (3)	Unknown	Low (1)	Medium-Low (2)
Decatur Is.	Medium (3)	Unknown	Medium-Low (2)	Medium-Low (2)
Guemes Is. NE Bluff	Medium-High (4)	Medium (3)	Medium-High (4)	Medium (3)
Guemes Is. Peach Preserve	Medium (3)	High (5)	Medium-Low (2)	Medium (3)
Guemes Island W Bluff	N/A	Unknown	N/A	Medium (3)
Henry Is. Open Bay	Medium-Low (2)	Medium (3)	N/A	Low (1)
Huckleberry Is.	N/A	High (5)	N/A	Medium-High (4)
Lopez Is. Flat Point	Medium-High (4)	Medium-High (4)	Medium-High (4)	Medium-High (4)
Lopez Is. Mud Bay	Medium (3)	Unknown	Low (1)	Medium (3)
Lopez Is. Odlin Park	Medium-High (4)	Medium-High (4)	N/A	Medium (3)
Lopez Is. Otis Perkins Park	Medium-High (4)	Unknown	Medium-High (4)	Medium-High (4)
Lopez Is. Port Stanley	Medium (3)	Medium (3)	High (5)	Medium-High (4)
Lopez Is. Spencer Spit	Medium (3)	Medium-High (4)	N/A	High (5)
Lopez Is. Watmough Bay	N/A	High (5)	N/A	Medium (3)
Matia Is. E Cove	N/A	Medium (3)	N/A	Medium (3)
Orcas Is. Deer Harbor	Medium (3)	Medium-High (4)	Medium-Low (2)	Medium (3)
Orcas Is. Eastsound	Low (1)	Unknown	Low (1)	Low (1)
Orcas Is. North Beach	Medium (3)	Unknown	Medium-High (4)	Medium-Low (2)
Patos Is. North beach	N/A	Medium (3)	N/A	Low (1)
Samish Is. Camp Kirby	High (5)	Medium-Low (2)	N/A	High (5)
Samish Is. East Beach	High (5)	Unknown	High (5)	Medium-High (4)
SJI English Camp	Medium (3)	High (5)	N/A	Medium (3)
SJI Jakles Lagoon	N/A	Medium-High (4)	N/A	Medium-High (4)
SJI Lonesome Cove	Medium-High (4)	Medium-High (4)	N/A	High (5)
SJI South Beach	Medium-High (4)	Medium-High (4)	N/A	Medium-High (4)
Shaw Is. Tift Rocks	N/A	Medium-High (4)	N/A	Medium (3)
Shaw Is. Picnic Cove	Medium-High (4)	High (5)	Medium (3)	Medium-High (4)
Stewart Is.	Medium-High (4)	High (5)	Medium-High (4)	Medium (3)
Sucia Is. Mud Bay	N/A	Medium-High (4)	Low (1)	High (5)
Weaverling Spit End	N/A	High (5)	High (5)	High (5)
Weaverling Spit RV Park	High (5)	High (5)	High (5)	Medium-High (4)
Weaverling Spit Field	Medium-High (4)	Medium-High (4)	Medium (3)	Medium-High (4)

Weaverling Spit Hidden Beach	N/A	Medium (3)	N/A	Medium (3)