Saanich Inlet and Peninsula Atlas of Shorelines 2020

Technical Report

Report by
SeaChange Marine Conservation Society
For the Public and
Districts of North and Central Saanich and the Town of Sidney
August 2020

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Acknowledgments

SeaChange staff would like to acknowledge:

The W̱SÁNEĆ First Nations in whose territory we reside

Dr. John Harper (Geomorphologist, former owner of Coastal & Ocean Resources (CORI), Ian Bruce (Director, Peninsula Streams Society), and Terry Curran (P. Eng.) for advice and data through their service on the SIPAS Technical Committee

Brian Koval, Peninsula Streams Society, for forage fish survey training and the use of sampling equipment.

Keith Erickson, for his time and expertise in GIS.

Anne-Marie Daniel, Roy Group, for providing resources on natural asset management and cost-benefit analysis case studies.

Thank you to our funding contributors: Service Canada and the Victoria Foundation

Report written and edited by: Elise Pullar, Jamie Hargreaves, Nikki Wright and Sarah Verstegen

Executive Summary

The Saanich Inlet and Peninsula Atlas of Shorelines 2020 (SIPAS) provides results of a shoreline inventory conducted from June to August 2020 by the SeaChange Marine Conservation Society. Field data was congregated and mapped in ArcGIS using a customized database. The survey covered 21% of the original SIPAS study area, with 14 km mapped.

SeaChange staff collected this shoreline data based on the view that nearshore marine environments are essential to the social, cultural and economic well-being of the Saanich Peninsula, regardless of jurisdictional demarcations. This information is intended for municipal staff, planners, and land-owners to improve land-use decisions with science-based data. Informed decisions have the potential to preserve and improve the integrity of ecosystems along the Peninsula. As requested by municipal staff of North Saanich, Central Saanich and the Town of Sidney, user-friendly rating systems were created to reflect the overall ecological and anthropogenic attributes of each shore unit.

In 2020, SeaChange survey technicians revisited selected sites in North Saanich, Central Saanich and Sidney. Data collection focused on *shoreline hardening, key lifecycle species, habitat connectivity* and risk to *sea level rise*. Changes in natural and modified shorelines, critical wildlife habitat, sensitive ecosystems, backshore vegetation and foreshore use were compared to the original SIPAS study done in 2007-9.

Project deliverables include GIS layers, an attribute database, maps and a Technical Report summarizing key findings. This information can be used to develop a Tri-Municipal Bioregional approach to shoreline conservation, as well as to amend policies on setbacks, tree removal, habitat connectivity and coastal development approvals.

1.0 Introduction

The original Saanich Inlet and Peninsula Atlas of Shorelines (SIPAS) is a shoreline inventory of the Saanich Peninsula and Inlet that was undertaken from 2007-9 by SeaChange Marine Conservation Society, in collaboration with the Saanich Inlet Protection Society (SIPS) and Peninsula Streams Society (PSS). The study emerged from concerns about seawall construction and overall shoreline development. The survey covered 67 km of shoreline. Field data collection focused on ecological features and anthropogenic disturbances. The purpose of the study was to document natural and modified shorelines, critical wildlife habitat, backshore vegetation and foreshore use to provide data and maps to local municipalities, planners, land-owners and the public.

SIPAS 2020 is a pilot project based on the original study described above. Sites were selected within the three jurisdictional boundaries, based on location and ecological ratings. Both survey results were compared to determine changes in ecological integrity and shoreline development over the past 11 years. The complete area surveyed in 2007-9 will be re-surveyed based on these preliminary methods and results as funding resources become available.

The updated study provides:

1. An analysis of changes to the Peninsula shoreline in the past 11 years;
2. Information to the Tri-Municipalities, planners and developers for science-based decision making;
3. Identification of sensitive habitats that require conservation, and
4. Education and stewardship opportunities for coastal land-owners.

1.1 Objectives and Deliverables

The objectives of this study are:

- To ground-truth shoreline changes including ecological characteristics and anthropogenic disturbances;
- To survey important lifecycle habitats such as eelgrass meadows, forage fish spawning areas and nesting sites;
- To provide ecological and modification shoreline ratings;
- To influence *Development Permit Area (DPA*) Guidelines on setbacks, nearshore development, tree removal and shoreline hardening, and
- To advise home-owners on best practices to mitigate the effects of sea level rise.

The SIPAS 2020 deliverables are:

- GIS layers and an attribute database with all survey data;
- A Technical Report, and
- Meetings with local planners in each of the three municipalities.

2.0 Background

Definitions of words in italics can be found in **Appendix C**.

Backshore development in coastal communities has a significant impact on *shoreline resiliency*. The backshore can act as a dynamic barrier or as a vulnerable area to *rising sea levels*, depending on how it is managed. Washington State has a Shoreline Management Act to coordinate planning and protect the public interest[1]. However, British Columbia does not have one specific law devoted to nearshore habitats. Instead, there are different laws at the federal, provincial and municipal levels, which impact the efficacy of habitat protection. Due to this jurisdictional complexity, *habitat connectivity* - the ability for wildlife and natural processes to function so that biodiversity is conserved - is being lost. Vitally important habitats, such as streams, shorelines and forests across jurisdictional boundaries are not receiving the protection required to support coastal biodiversity and ecosystem services.

However, municipal governments have the power to create resilient coastal communities up to the high-water mark, through informed backshore land-use and zoning decisions; and to enact by-laws concerning riparian setbacks, tree removals, as well as the protection of watercourses and nearshore *forage fish habitats*. However, development approvals continue to occur in key lifecycle habitats and areas at high risk to sea level rise. Additionally, DPA exceptions are often made to allow for excessive tree removal, construction in the intertidal and reduced setbacks.

Changes in the backshore not only impact the immediate area but also affect the intertidal and subtidal zones beyond the high-water mark. For example, when bank vegetation is removed, the nearshore can be inundated with backshore runoff which is loaded with nutrients and sediment. These stressors jeopardized biological processes, functions and diversity in established nearshore habitats.

[1] Washington State Department of Ecology. *Shoreline Management Act.* Retrieved from: https://ecology.wa.gov/Water-Shorelines/Shoreline-coastal-management/Shoreline-coastal-planning/Shoreline-Management-Act-SMA

2.1 Present Municipal Plans

The 2020 North Saanich Strategic Plan reflects the desire to "advance policies to guide marine and shoreline development" which aligns well with SIPAS 2020. It is also noted that the District is committed to "preserve and protect sensitive marine and intertidal habitats, address climate change impacts including sea level rise planning and complete a discussion paper on natural asset management".[2]

The Central Saanich Official Community Plan (OCP) suggests "adopting more detailed and current [sensitive ecosystem] mapping as it becomes available". SIPAS 2020 will fulfill this need on a shoreline level.[3] Central Saanich expresses the desire for "long term integrity and ecological values of the shoreline and associated foreshore and upland areas". This study can be used to identify areas of high ecological value requiring conservation, and low ecological value requiring restoration. For example, critical habitat areas could be protected by establishing Marine Shoreline DPAs to clearly prohibit shoreline modification, protect fish habitat and sensitive aquatic ecosystems.

The Town of Sidney has not highlighted any ecological goals in their most recent OCP. There is hope that Sidney would be compliant with a Bioregional Plan to protect the remaining vulnerable shoreline ecosystems within its jurisdiction and restore degraded sites.

2.2 Survey Location

The study area includes 14 kilometers of shoreline along the Saanich Peninsula, including 15 meters on either side of the high-water mark (foreshore and backshore) for a total study area of approximately 42 hectares.

The survey area is located within the Coastal Douglas Fir moist-maritime ecological subzone (CDFmm). This biogeoclimatic subzone is found nowhere else in Canada. It includes a unique set of ecosystems occurring along the coast of southern Vancouver Island and across the Gulf Islands. The shoreline and backshore areas of the CDFmm have high ecological value, with Garry Oak ecosystems, rocky outcrops, wetlands, and shorelines. Ecosystems throughout the CDFmm are currently listed as critically imperiled in a global context by the B.C. Conservation Data Centre (CDC)[4]. The CDF zone requires active stewardship to maintain its high ecological value. Eighty percent of land in the whole CDF is privately owned. However only 11% is protected, making it the least protected *biogeoclimatic zone* in B.C.

[2] District of North Saanich. (2020). 2020 Strategic Plan. p.1-13.
[3] District of Central Saanich. (2020). Official Community Plan. p.47-51
[4] Madrone Environmental Services Ltd. (2008). Terrestrial Ecosystem Mapping of the Coastal Douglas-Fir Biogeoclimatic Zone. Duncan, B.C.

There is significant concern for the conservation of the CDF zone, as they clean our air and water, absorb carbon from the atmosphere, provide climate change mitigation, and contribute to food resilience by providing pollinator habitat. The CDF zone can also add to property values. Individual properties that are in the vicinity of natural areas and parkland can increase property values by 6% or more[5].

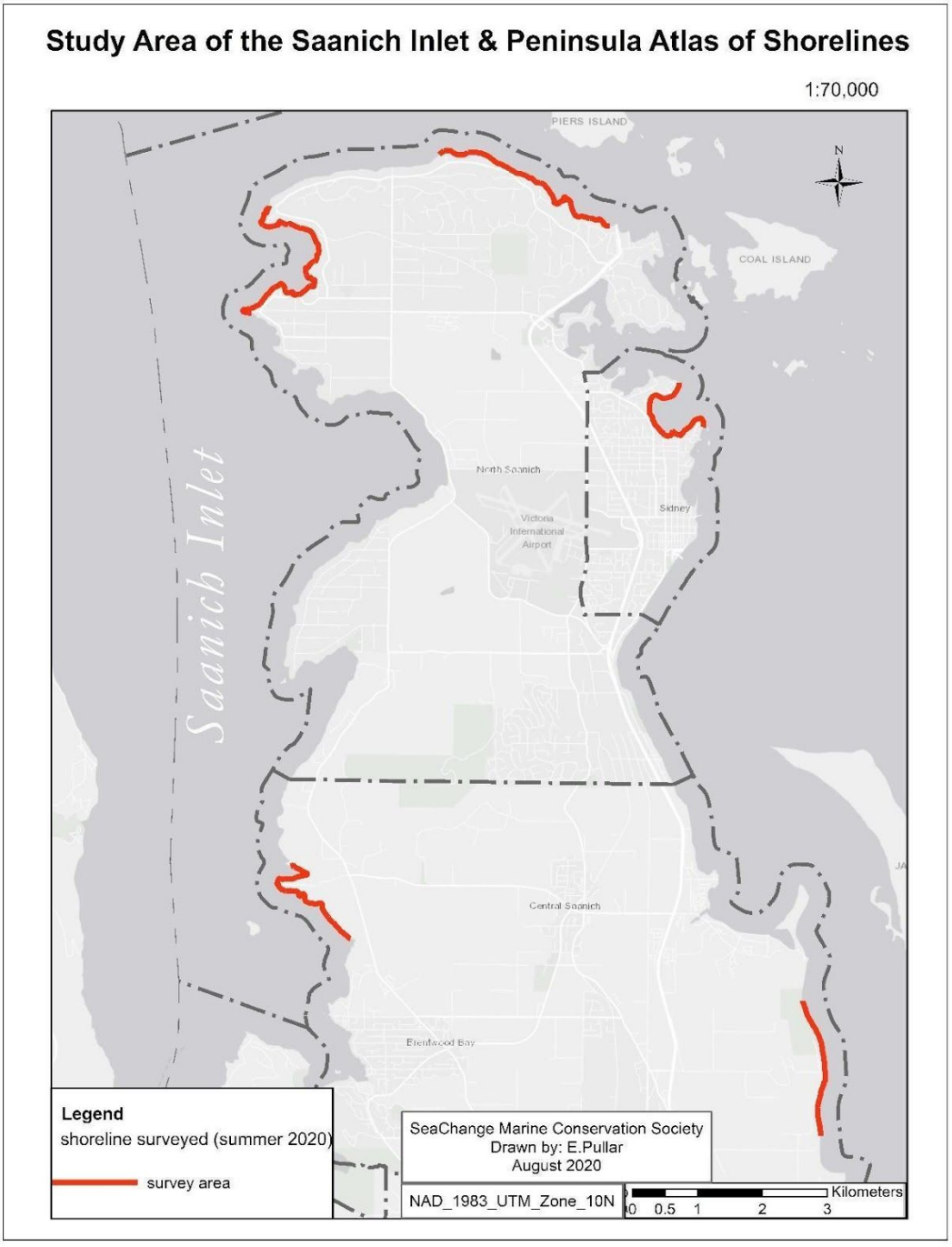

Figure 1. Shoreline surveyed for SIPAS 2020

[5] Coastal Douglas-fir Conservation Partnership. (2018). Conservation Planning in Coastal Douglas-fir Ecosystems: A Quick Guide for Local Government. Victoria, BC.

3.0 Methodology

3.1 Data sources

Data layers for GIS analysis and mapping (base map and boundary layers) were retrieved from the CRD database via their website. The ortho-photos used in the field to identify shore units and estimate various distances were also provided by the CRD.

3.2 ShoreZone Data & Shore Units

SIPAS 2020 used ShoreZone mapping data collected by Parks Canada in 2004/2005. This spatial dataset is a linear representation of the geographic location of the coastline. The dataset was provided in shapefile format with an associated database made up of shore units. Shore units boundaries were defined by a morphological change in physical class. For example, a change from a beach to a rock ledge would define a boundary between shore units. Shore units were applied at a scale of 1:15000 and resulted in lengths ranging from 30 m to 20 km with a median of 485 m. Each shore unit within the ShoreZone dataset has a physical unit identification number that represents the primary key for the dataset. The spatial origin of the shore unit dataset is derived from the Terrain Resource Information Management Program (TRIM).

3.3 Field Form & Map Design

The study criteria and field form have been modified to account for current ecological information on forage fish habitat requirements, habitat connectivity and sea level rise. The following changes were made:

- ➢ Backshore and foreshore slope were distinguished from each other;
- ➢ Addition of Pocket Beach Details section (# beaches, % cover of unit, center UTM, *forage fish* eggs present, photo #);
- ➢ More structure types for nearest permanent structure and other man-made structures, and
- ➢ Addition of a section on the restoration potential for a site

The updated field form can be found in **Appendix A.**

Ortho-maps were used in the field to determine shore unit boundaries and presence of new permanent structures. The maps were at a scale of 1:1000 and displayed the 2007 ortho-photo overlaid with shore unit boundaries and legal property lines. However, Roberts Bay field maps used 2017 ortho images, as this area was not included in the original study. Each shore

unit was labelled with its physical unit ID. A 50m UTM grid was overlaid to reference coordinates and estimate distance in the field. A field map can be found in **Appendix B**.

3.4 GIS Database Design & Data Entry

A geodatabase was built and data transferred from field forms to ArcMap 10.8. Additional fields were added to run queries and create maps based on field data. A separate database was built for subtidal eelgrass data. A data dictionary outlining database attribute fields can be found in **Appendix F.**

3.5 Field Inventory

Nearshore surveying was completed by two SeaChange technicians from June to August 2020. A 20ft wooden freight canoe outfitted with a small motor was used to assess shore attributes, as much of the shoreline is inaccessible by foot. Waypoints and observations were taken from as close to shore as possible. Pocket beach details and forage fish sampling were completed on foot, accessing the shore by boat.

Shorelines with suitable sediments for forage fish (sand lance and surf smelt) spawning were sampled for eggs in partnership with Peninsula Streams Society. Subtidal Eelgrass (*Zostera marina*) was surveyed by boat with an underwater towed camera and depth sounder. A Garmin GPSmap 62s was used to mark waypoints at changes in eelgrass presence/absence. Accuracy ranged from 1 to 3 meters.

Surveying Deep Cove by boat.

3.6 Site Selection Criteria

The following criteria were used to select the sites for SIPAS 2020:

- At least one site from each of the three municipalities in the study area;
- Sites in each of the quadrants of the Peninsula for diverse geographical representation;
- Continuous shore unit sections for efficient data collection;
- 50% or more of the section does not have a very low ecological rating, and
- 50% or more of the section has a very high or high sensitivity to sea level rise.

All sites were surveyed in SIPAS 2007-9, with the exception of Roberts Bay in Sidney. Sidney has been included in the SIPAS 2020 to represent all three municipalities on the Peninsula. Additionally, the newly formed Committee, the *Saanich Peninsula Environmental Coalition (SPEC)* has found that all three municipalities are interested in using this study to make informed development decisions. SPEC is leading the development of a tri-municipal bioregional approach to backshore and foreshore management.

3.7 Sites Selected and Rationale

- Central Saanich (SE) - South of Tsawout Reserve, including Island View Beach, to the last shore unit surveyed in the original SIPAS
    - Meets sea level rise sensitivity and ecological rating criteria, berm impacted by severe weather
- Central Saanich (SW) - Tsartlip boundary at Hagan Creek to Henderson Point
    - Meets sea level rise sensitivity and ecological rating criteria
- North Saanich (NW) - Deep Cove to Moses Point
    - A large and recent clear cut at Moses Point, meets sea level rise sensitivity and ecological rating criteria
- North Saanich (N) - Swartz Ferry Terminal to northern tip of the Peninsula
    - Meets sea level rise sensitivity and ecological rating criteria
- Sidney (NE) - Roberts Bay
    - Entire bay at high risk to sea level rise, no ecological rating reference

3.8 Terrestrial Ecosystem Mapping

The Coastal Douglas-fir moist maritime (CDFmm) Terrestrial Ecosystem Mapping (TEM) project was completed by Madrone Environmental Services (Madrone) in 2007-8 for the Integrated Land Management Bureau (ILMB). TEM data has not been updated since the SIPAS 2007-9 report, which used 2007-2008 data overlaid onto shore unit data. TEM data

was not used in SIPAS 2020 as it has not been updated since 2007-8. Conservation rankings were assigned to shore units in SIPAS 2007-9, using a combination of TEM and collected data. Therefore SIPAS 2020 will not include conservation rankings.

4.0 Rating Process

Land-use planners, municipalities and the public have requested shoreline rating systems to represent data on ecological value and shoreline modification in a user-friendly format. The SIPAS 2020 ecological rating system was modelled after SIPAS 2007-9 criteria, with modifications to reflect updated ecological knowledge. A modification rating system was created to show the level of development in shore units. This new rating system was based on the Mayne Island Shoreline Atlas (MISA)[6]. Ecological and modification ratings were determined using data collected by SeaChange Marine Conservation Society.

4.1 Ecological Rating System using SIPAS Data

This rating system shows the level of ecological value of the Saanich Peninsula shoreline. Areas of high ecological value require protection and low ecological value require restoration.

4.1.1 Limitations to the Ecological Rating System

The ecological rating criteria for shore units have been modified since SIPAS 2007-9 to represent updated ecological knowledge. Changes include an extra point awarded to units with both sensitive ecosystems (riparian and Garry Oak), the addition of one point for presence of a pocket beach within a unit, and the addition of forage fish spawning potential habitat within key lifecycle species. Subtidal eelgrass adjacent to the unit, instead of within 25 meters of it, will receive 5 points. This update is due habitat connectivity, with recognition that eelgrass further than 25 meters adds to the ecological value of the shore unit. Without current *Sensitive Ecological Inventory* (SEI) data, points could not be given for shore units within 15 meters of SEI polygons.

SIPAS 2007-9 used TEM and SEI data to integrate backshore conditions into the ecological rating. This data has not been updated since the original study, and therefore could not be integrated into SIPAS 2020. The updated ecological rating is focused on foreshore ecological features, with backshore ecological considerations limited to habitat cover and backshore land use. The modification rating displays the level of backshore development as viewed

[6] Mayne Island Conservancy Society. (2013). *Mayne Island Shoreline Atlas Report.* Retrieved from: www.seagrassconservation.org. p.1-44

from the water. Therefore, ecological and modification ratings for each shore unit should be compared for a comprehensive view of shoreline health (Figs. 2 & 3).

Some discrepancies in habitat cover data collection have been identified. Shrub and Landscaped habitat were distinguished differently in the 2007-9 and 2020 surveys. Much of what is classified as Shrub in 2020 was classified as Landscaped in 2007-9. Other than Landscaped and Shrub categories, there have been no large changes in habitat cover since 2007-9. For this reason, Shrub will be omitted when comparing ecological ratings. However, shoreline shrubs are a critical ecological feature and have been included in the 2020 stand-alone ecological rating of shore units (Fig. 2). The definition of Shrub and Landscaped habitat should be clearly established for future surveys. See **Appendix C** for a definition of terms.

Table 1. Ecological Rating Criteria

Rating Class	**Value Range**	**Criteria**
Intertidal Features	0-5	If a shore unit has any of the five intertidal features (forage spawning habitat, eelgrass, Fucus, clams or oysters) present in any capacity it receives 1 point for each feature present. A shore unit can receive up to 5 points for this rating class.
Habitat Cover	1-10	If a shore unit has any percentage of habitat cover that falls under the Coniferous, Deciduous, Shrub or Wetland habitat class it receives one tenth of the percent value, i.e. 50% Coniferous = 5; 20% Deciduous = 2, 30% Wetland = 3; Total =10. Any other habitat cover present (Landscaped, Bare Ground, Cultivated Field) receives 0. A shore unit can receive up to 10 points for this rating class.
Wildlife Feature	0-4	If a shore unit has any of the six listed wildlife features present (Nesting Area, Rock Ledge, Undercut Shelter, Artificial, Driftwood Pile or Wildlife Tree) it receives 1 point for each feature present. A shore unit can receive up to 4 points for this rating class. If no wildlife features are present the unit receives 0.
Sensitive Ecosystems	0-2	If a shore unit has a riparian area or Garry oak community present the shore unit receives 1. If it has both, it receives 2 points. If the shore unit has no sensitive features, it receives 0. A shore unit can receive up to 2 points for this rating class.
Key Life Cycle Species	0-5	If a shore unit has abundant or moderate forage spawning potential or intertidal eelgrass habitat, it receives 5 points. If a sub-tidal eelgrass bed is present adjacent to the shore unit it receives 5 points. A shore unit can only receive up to 5 points for this rating class.
Pocket Beaches	0-1	If a shore unit has a pocket beach, it receives 1 point.
Total:	0-27	A shore unit can receive a maximum value of 27

Table 2. Ecological Rating Value

Value	Ecological Value	Description
0-6.0	Very Low	Almost no wildlife activity, habitat diversity/abundance and sensitive ecosystems observed in the shore unit.
6.1-12	Low	Very little wildlife activity, habitat diversity/abundance and sensitive ecosystems observed in the shore unit.
12.1-18	Moderate	Signs of wildlife activity, habitat diversity/abundance, sensitive ecosystem, key life cycle species observed in the shore unit.
18.1-24	High	Presence of wildlife activity, habitat diversity/abundance, sensitive ecosystem, key lifecycle species observed in the shore unit.
24.1-30	Very High	Abundance of wildlife activity, ecosystem diversity, natural vegetation, and key lifecycle species.

4.2 Rating of Shore Unit Naturalness using SIPAS Data

Modification ratings are based on various land-use and development criteria. Low value ratings have more natural shorelines than high value ratings. See **Tables 3&4** below.

Each shore unit received a specific modification and ecological rating. Areas of high ecological rating and high modification were evaluated as being at imminent risk to ecological degradation. Alternatively, areas with high ecological ratings and low modification require protection from development as well as monitoring for degradation.

Development in the intertidal zone.

Table 3. Modification Rating Criteria

Rating Class	Value Range	Criteria
Land use type	5	If a shore unit is Residential, Agricultural, Commercial, Vacant Open Space or Parking Lot it receives 5 points. A unit may receive up to 5 points for this rating class.
% length modified	0-10	If a shore unit has any percentage of the total length modified by a seawall it receives one tenth of the percent value i.e. 50% modified = 5; 20% modified = 2. If there is no modification it receives 0. A unit may receive up to 10 points for this rating class.
Other Man-Made Features	0-8	Wharves, floats/docks, boat ramps, or boat houses- receive 2 points whereas access paths, stairs and concrete receive 1. The difference in points is representative of the greater effect seafloor shading and habitat alteration of the former man-made features. A unit may receive up to 8 points for this rating class.
Polluting Features	0-2	If a shore unit has any of the 4 polluting features (storm outfall, sewer outfall, creosote logs, toxic waste) present it receives 1 point for each polluting feature. If the shore unit has no polluting features, it receives 0. A unit may receive up to 2 points for this rating class.
Nearest Permanent Structure	0-1	If a shore unit has a permanent structure below the high water mark it receives 1 point. A unit may receive up to 1 point for this rating class.
Total:	0-26	A shore unit can receive a maximum value of 26.

Table 4. Modification Rating Value

Value	Modification Value	Description
0-5.2	Very Low	Shore unit is in a natural or almost natural condition.
5.3-10.4	Low	Shore unit is in a semi-natural state with some anthropogenic land use.
10.5-15.6	Moderate	Shore unit is in a semi-natural state with much anthropogenic land use.
15.7-20.8	High	Shore unit has almost no natural state remaining.
20.9-26	Very High	Shore unit has been significantly altered by land-use activities, no natural state remains.

5.0 Results

For a full breakdown of results see **Appendix D&E.**

5.1 Comparisons 2007-9/2020

Only shoreline units surveyed in both the past and present SIPAS were compared. Each parameter was re-calculated from SIPAS 2007-9 to have a comparable subset of the study area surveyed in 2020. Some comparison results have been deemed ecologically insignificant due to discrepancies in field observations. Any ecologically significant changes between 2007-9 and 2020 are addressed in the appropriate sections. Discrepancies may be attributed to the difference in seasons and in interpretation of field definitions. North Saanich and Central Saanich are included in change over time comparisons, but Sidney could not be included as it was not part of the original study; this limits overall survey area comparisons.

5.2 Shoreline Rating Summary

By length, 65% of the study area received a moderate ecological rating, 43 of the 56 units that received a moderate rating are in North Saanich. 13% of the study area received a very low ecological rating; the 5 units with this rating are in Central Saanich. Of the 6 units that received a high ecological rating, 5 are in Central Saanich. 8 of the 10 units with a low ecological rating are in Sidney.

In Central Saanich, shoreline with a high ecological rating decreased by 17% between SIPAS 2007-9 and SIPAS 2020. Shoreline with a high modification rating increased by 24%.

In North Saanich, shoreline with a high ecological rating decreased by 27%, shoreline with a low ecological rating increased by 38% between SIPAS 2007-9 and SIPAS 2020. Shoreline with a high modification rating increased by 13% and shoreline with a very low modification rating decreased by 11%.

For a full breakdown of changes over time see **Appendix D.**

To view and compare ecological and modification rating maps side by side see **Appendix E.** A summary of ecological and modification rating results are provided below:

Table 5. Summary of Overall Survey Area Results

Overall Ecological and Modification Rating	**% of total study area**	Shore Unit Count	Total Length (m)	Total length modified (m)	% modified based on category length
VH - Very High	0	0	0	506	4
H - HIGH	8	6	1075	4128	30
M - MODERATE	65	56	9055	4636	33
L - LOW	14	10	1967	3372	24
VL - VERY LOW	13	5	1851	1306	9
Totals	100	77	13948	13948	100

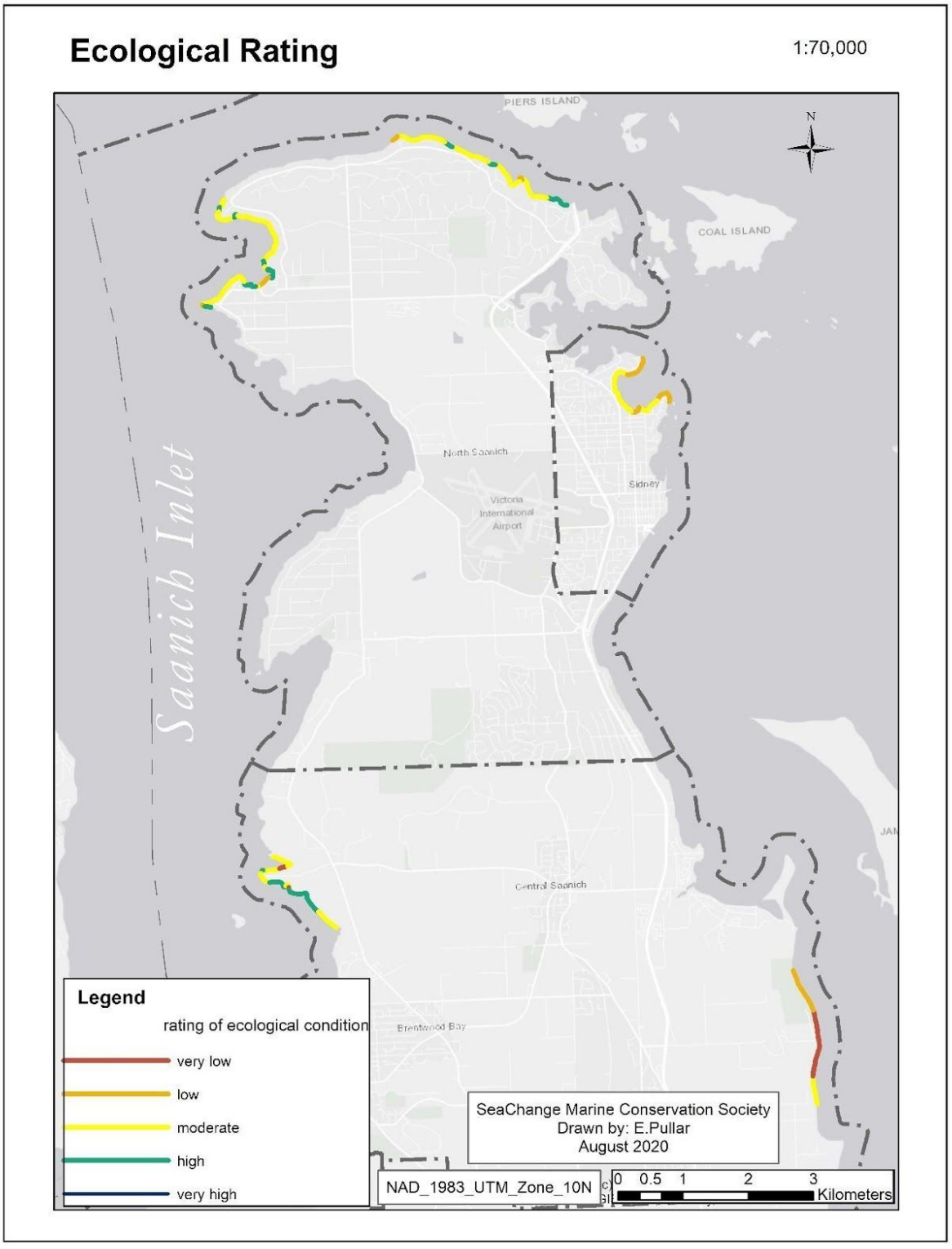

Figure 2. Ecological rating of shoreline

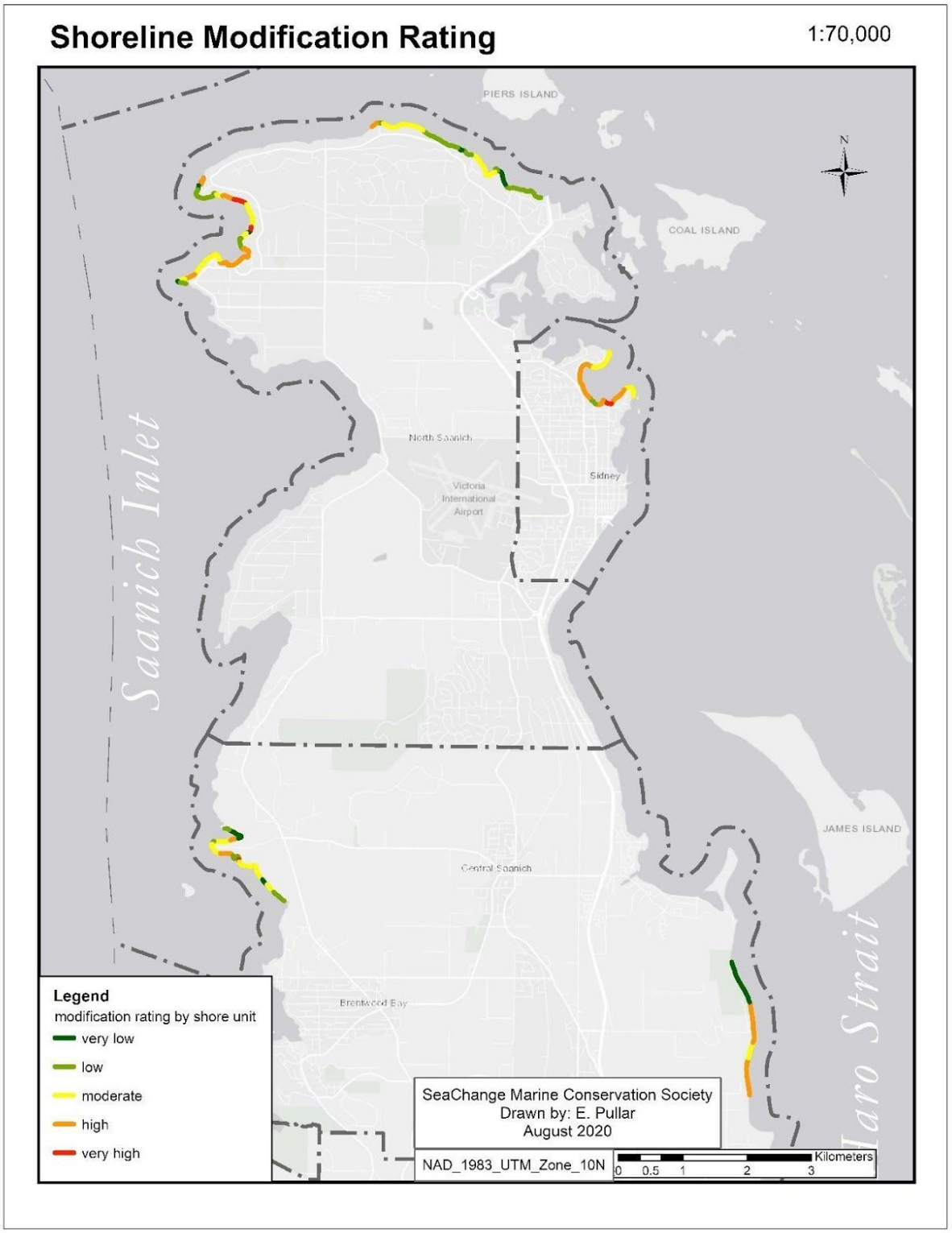

Figure 3. Modification ratings for shore units

5.3 Shoreline Modifications

5.3.1 Seawalls

- Seawalls covered 5.4 km (39%) of the survey area
- 60% of units contains at least 1 seawall
- It is notable that Roberts Bay in Sidney had the highest percentage of seawall coverage of the survey areas with 73% modified.
- The average base elevation of seawalls compared to the HWM in the study area was 0m. The average top elevation was 2 meters.
- 50% of seawalls appear to be in moderate condition, 27% in poor condition and 23% in good condition.

There was an insignificant change (< 3%) in seawall cover from 2007-9 to 2020 in surveyed shorelines of North Saanich and Central Saanich. There was a 25% increase in seawalls classified as poor condition in North Saanich.

Extensive sea walls along the Peninsula shoreline

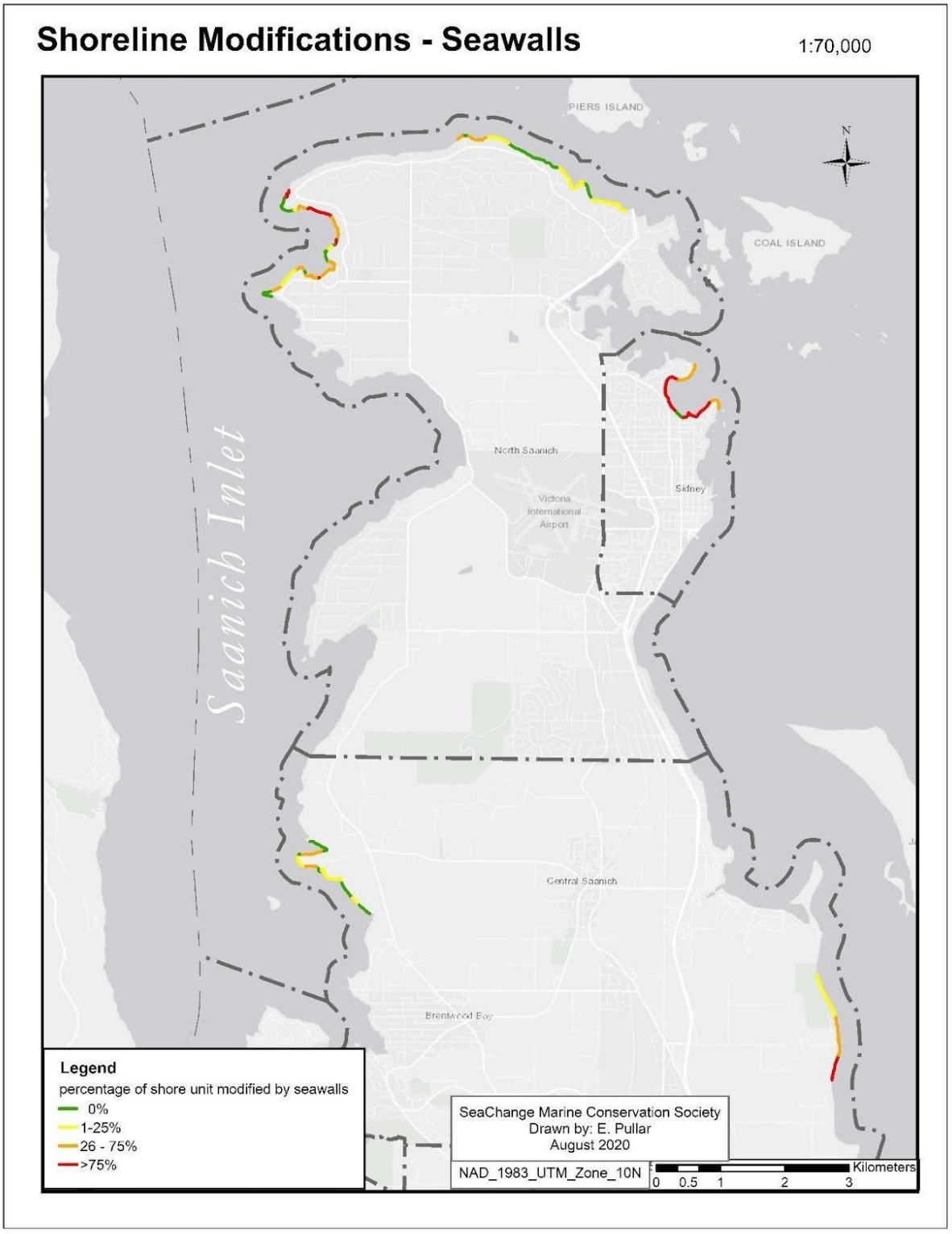

Figure 4. Seawall cover per shore unit

5.3.2 New Visible Structures

Of the 65 new structures observed, 46 (70%) of these were found in North Saanich. New visible structures in this area include houses, docks/floats, stairs, decks, wharves, boathouses and sheds.

Other man-made structures and new visible structures in the nearshore

5.4 Backshore Land Use

The land-use activities occurring in the backshore of each shore unit were recorded and categorized into seven possible land-use classes. A summary of the results for each land-use class has been provided below:

Table 6. Backshore Land-Use

Land-use Class	**% of survey area**
Residential	80
Park	8
Agricultural	5
Natural	4
Parking Lot	2
Vacant	<1
Commercial	<1

These land-use classes reflect observations from a boat nearshore and from ortho-photos. They are not based on zoning classification.

5.5 Habitat Class Percent Cover

Visual estimations of the percent cover of the backshore habitat within 15 meters of the high-water mark were documented. Table 7 provides a summary for each habitat class.

Landscaped and shrub habitat were distinguished differently between 2007-9 and 2020, see **Appendix D** for change in habitat cover and **Appendix C** for term definitions.

Table 7. Percent Cover of Habitat Type in Backshore

Habitat Class	**% Cover of survey area**
Landscaped	19
Coniferous	21
Deciduous	21
Bare Ground	9
Shrub	30
Wetland	<1

5.6 Bank Erosion

Seawalls are designed to slow shoreline erosion caused by wave action. Erosion can be caused by heavy boat traffic, foot traffic, storms, lack of anchoring vegetation and sea level rise. However, seawalls can cause beach erosion, prevent beach nourishment and reduce suitable habitat. More resilient alternatives to addressing erosion include soft shore armouring, backshore revegetation and increased setbacks. A visual judgment of backshore bank erosion was documented and summarized in Table 8.

Severe erosion – Bare ground is evident across a significant change in elevation with gullies or undercutting evident.

Moderate erosion – Bare ground is evident across a significant change in elevation or undercutting of a narrower band of elevation is significant.

Mild erosion – Bare ground is evident along a particular elevation, often at the toe of a seawall.

Table 8: Degree of Erosion Associated with Percent Cover of Shoreline

Survey Area	Length of shoreline displaying erosion (m)	% of shoreline with erosion	% of shoreline with mild erosion	% of shoreline with moderate erosion	% of shoreline with severe erosion
Overall	1233	9	< 1	3	5
North Saanich	611	9	< 1	4	4
Central Saanich	655	14	< 1	2	11
Sidney	35	2	0	1	< 1

Overall 52% of units surveyed displayed some degree of bank erosion. There has been an increase of units with moderate (22%) and severe erosion (11%) in North Saanich and Central Saanich since SIPAS 2007-9. Erosion with the presence of seawalls was lower, overall. This is evident in Roberts Bay (Fig. 5)

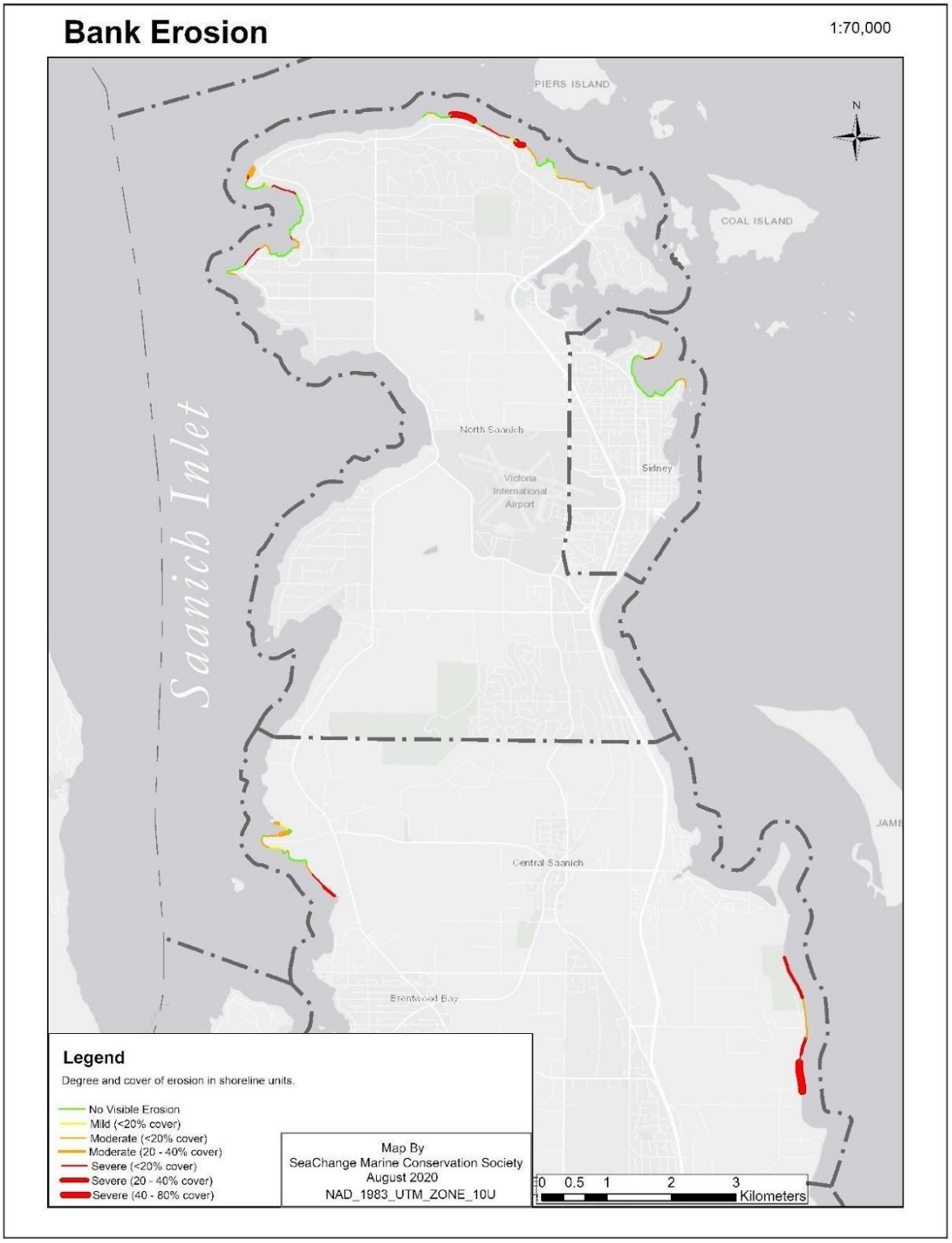

Figure 5. Bank erosion along the shoreline

6.0 Ecological Features

6.1 Sensitive Features

Sensitive features are ecosystems defined as fragile or rare. This study focused on Garry Oak and riparian areas as sensitive features in CDFmm ecosystems. The surveys revealed the following:

- 40 shore units (51%) contained Garry Oak trees
- 5 (6.5%) shore units include a riparian area (stream, wetland, and estuary)
- 3 (4%) shore units include both

There was a 14% decrease in shore units with Garry Oak in Central Saanich since 2007-9.

6.2 Wildlife Features

Wildlife and wildlife habitat features were observed and documented in the field. Features included driftwood piles, haul outs, nesting areas, rock ledge, undercut shelter, wildlife trees, and artificial features, such as bird/bat houses. The following list outlines the results of the wildlife survey:

- 24 shore units have one wildlife feature (31%)
- 25 shore units have at least two wildlife features (32%)
- 19 shore units have at least three wildlife features (25%)
- 6 shore units have at least four wildlife features (8%)

Seal pup found on a beach in North Saanich

6.3 Ecological Values

SIPAS 2020 focuses on habitat connectivity and key marine life cycle species. Habitat connectivity refers to a linked network of habitats that allow for safe movement of wildlife and sufficient gene flow. Habitat connectivity is essential for the varied life stages of some species (e.g. salmon). Organisms benefit from connections of the same habitat type as well as a diversity of habitat types, from the backshore to foreshore to intertidal.

Connectivity is important for biodiversity, conservation and resilience to climate change. Human activity and landscape alterations have caused increasingly fragmented habitats. For example, salmon require connected habitats for survival. Focusing solely on land-based watershed protection can be ineffective, as salmon also rely on estuarine and marine habitats for shelter, growth and foraging. There is a clear need for regional conservation linkages and zoning of ecological networks. Connectivity conservation plans need to be developed at the local, bioregional level.

Key life cycle species provide important ecosystem services such as shelter, food and spawning for other major species, at pivotal points in their cycle of life. In marine ecosystems, forage fish and eelgrass are key lifecycle species and have been a focus of SIPAS.

Forage fish are being highlighted in SIPAS 2020 due to their importance in predatory fish, mammal and marine bird diets. Declines in salmon, marine bird and orca populations are of growing concern. The linkage between these declines and forage fish biomass declines continues to be investigated[7]. Sand lance comprise over 50% of the Chinook salmon diet, with these salmon being a vital food source for Southern Resident killer whales[8,9]. Thus, protecting forage fish spawning habitats, which are vulnerable to shoreline development, must be considered in current planning.

[7] de Graaf, R.C. (2013). North and South Pender Islands Beach Spawning Forage Fish Habitat Assessments. *Emerald Sea Biological*. p. 1-29.
[8]Government of British Columbia. (2014). Environmental guidelines for urban and rural development in BC. Retrieved from: https://www2.gov.bc.ca/assets/gov/environment/natural-resource-stewardship/best-management-practices/develop-with-care/fact-sheet-21-forage-fish.pdf
[9] DFO. (2020) 2020 management measures to protect Southern Resident killer whales. Retrieved from: https://www.pac.dfo-mpo.gc.ca/whales-baleines/srkw-measures-mesures-ers-eng.html

6.4 Forage Fish

6.4.1 Forage fish spawning potential

Surf smelt and Pacific sand lance spawn in the intertidal zone of pebble/sand beaches. Moderate slope, substrate size and shading are required for suitable spawning habitat[10, 11]. Due to these specific requirements, shoreline development can degrade forage fish habitats and threaten the viability of these species. Specifically, shoreline alterations, pollution, and removal of marine riparian vegetation can alter suitable spawning beaches into unsuitable habitat. A decline in forage fish populations could result in an ecological cascade, affecting the survival of salmon, orcas and seabirds[12]. Future research to understand forage fish life history, distribution and habitat preference is required[13].

Of shore units surveyed, 36% were flagged for potential forage fish spawning. Though half of these shore units have scarce potential for forage fish (see Fig. 6). A coastal land-owner observed large schools of surf smelt in the nearshore of shore unit #0150 in July 2020.

Eight sites were sampled for spawn between June and August 2020. Beaches were selected based on suitable substrate. Protocols were followed based on training by Peninsula Streams Society. Samples were collected by SeaChange field technicians and analyzed by Brian Koval, Peninsula Stream Society, for eggs. Based on previous research and understanding of forage fish life cycles, eggs are unlikely to be found in summer months and more likely in the winter. Current research indicates that surf smelt spawn all year round; sand lance in the winter months (November - February) during high tides[14].

No forage fish eggs were found at the sampled sites at this time of year. In SIPAS 2007-9, forage fish eggs were found at a shore unit in Henderson Point.

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[10] Ostrand, W., Gotthardt, T., Howlin, S., & Robards, M. (2005). Habitat Selection Models For Pacific Sand Lance In Prince William Sound, Alaska. Northwestern Naturalist, 86(3), 131-143. doi:10.1898/1051-1733(2005)086[0131:smfpsl]2.0.co;2

[11] Penttila, D.(2002). Effects of shading upland vegetation on egg survival for summer-spawning surf smelt on upper intertidal beaches in Puget Sound. In Puget Sound Research- 2001 Conference Proceedings. p.9

[12] Islands Trust Conservancy. (2019). Forage Fish Habitat Assessment. Retrieved from: http://www.islandstrustconservancy.ca/initiatives/marineconservation/foragefish/.

[13] Gunther, K. (2018). Characterizing age and growth patterns of Pacific sand lance across local populations and latitudinal gradients from the San Juan Archipelago to the Chukchi Sea. University of Washington. doi: 10.13140/RG.2.2.34711.93602.

[14] Pierce K., Pentilla D., Benson B., Krueger K., Quinn T., and Price D.(2012). Patterns of Surf Smelt, *Hypomesus pretiosus*, Intertidal Spawning Habitat Use in Puget Sound. Washington State Estuaries and Coasts 35:1214–1228. doi: 10.1007/s12237-012-9511-1

Forage fish beach seining field set-up

6.4.2 Pocket Beaches

Pocket beaches are defined as small beaches, less than 100 meters long, formed between headlands in coves of rocky shorelines. They can be composed of mixed boulders, pebbles, sand and mud and therefore have the attributes of a combination of shoreline type. Pocket beaches provide important isolated habitats for a variety of plants and animals. For example, species that require sediment to settle and grow may find appropriate habitat in a pocket beach along a shoreline composed predominantly of bedrock. They are vulnerable to shoreline development, as they have not been adequately recognized as an ecological asset.

Our study surveyed pocket beaches for forage fish spawning potential, in collaboration with Peninsula Streams Society. All pocket beaches in the survey area have been mapped, with suitable substrate contributing to potential spawning ratings. When the site tested negative for eggs or was not sampled due to unsuitable substrate, “no eggs present” was noted.

- 23 shore units contain pocket beaches
- 12 of the sites have pocket beaches covering <30% of the unit
- 15 of the sites have pocket beaches covering 31-60% of the unit
- 2 of the sites have pocket beaches covering >90% of the unit

Pocket beach nested within bedrock in North Saanich

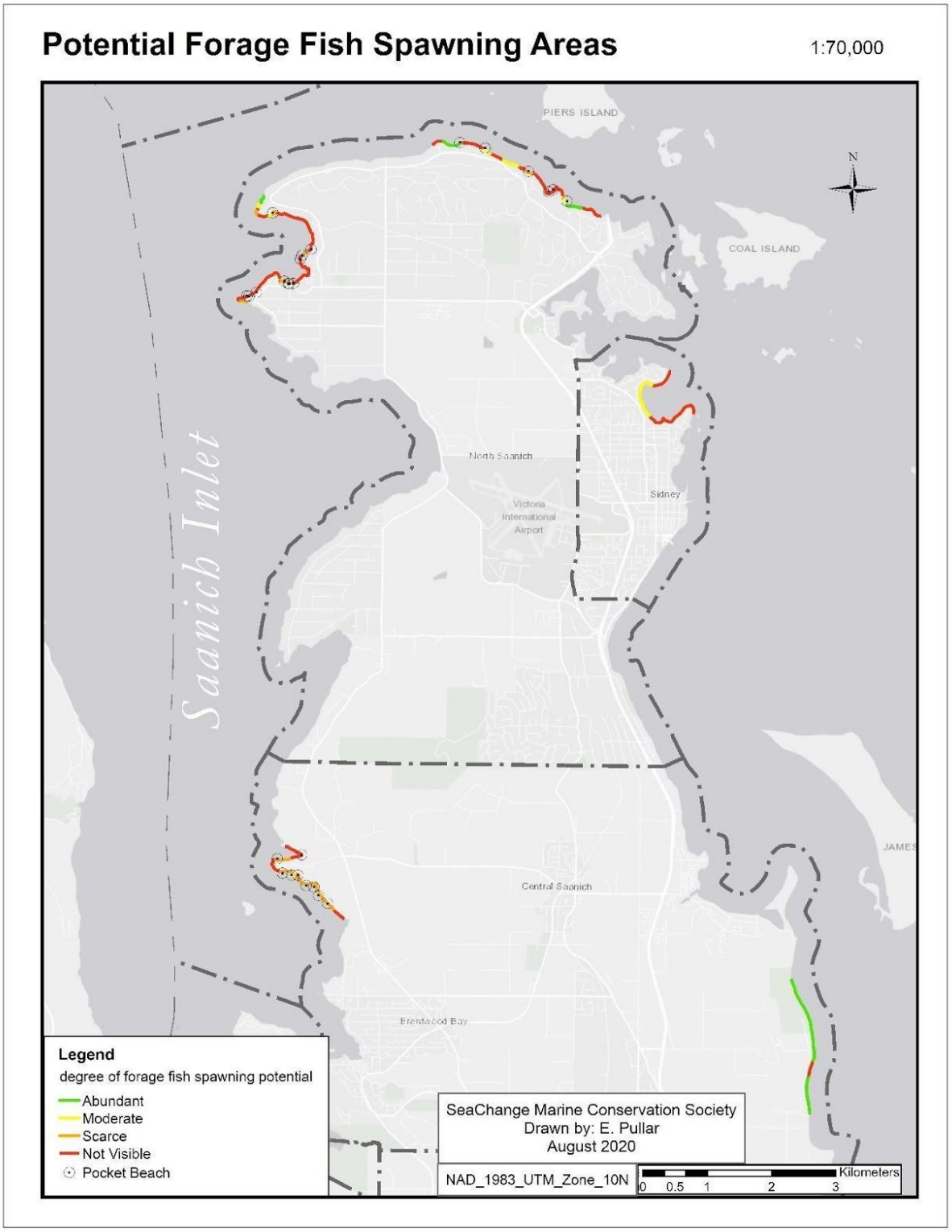

Figure 6. Forage fish spawning potential on shorelines. Circles indicate pocket beaches.

6.4.3 Overhang Vegetation of intertidal

Table 9. Overhang Vegetation of Intertidal Overview

Survey Area	% of survey area
Overall	33
North Saanich	49
Sidney	27
Central Saanich	12

Overhang vegetation refers to shrubs or trees that overgrow a bank and hang above the intertidal zone. This provides shade for organisms, maintains cooler temperatures and prevents desiccation during emersion. For example, forage fish eggs have a much higher chance of surviving low tide if they are located under overhanging vegetation, where they can remain cool and moist[15].

North Saanich showed a 240% increase in overhang and Central Saanich showed a 323% increase in overhang. These drastic changes could be attributed to the difference in field seasons between 2007-9 and 2020. Field surveys in 2007-9 occurred during the winter months, with less leaves and sun. Field surveys in 2020 occurred during the summer, when the presence of leaves and sun made the overhang easier to estimate.

[15] Pentilla, D. (2002). Effects of shading upland vegetation on egg survival for summer-spawning surf smelt.

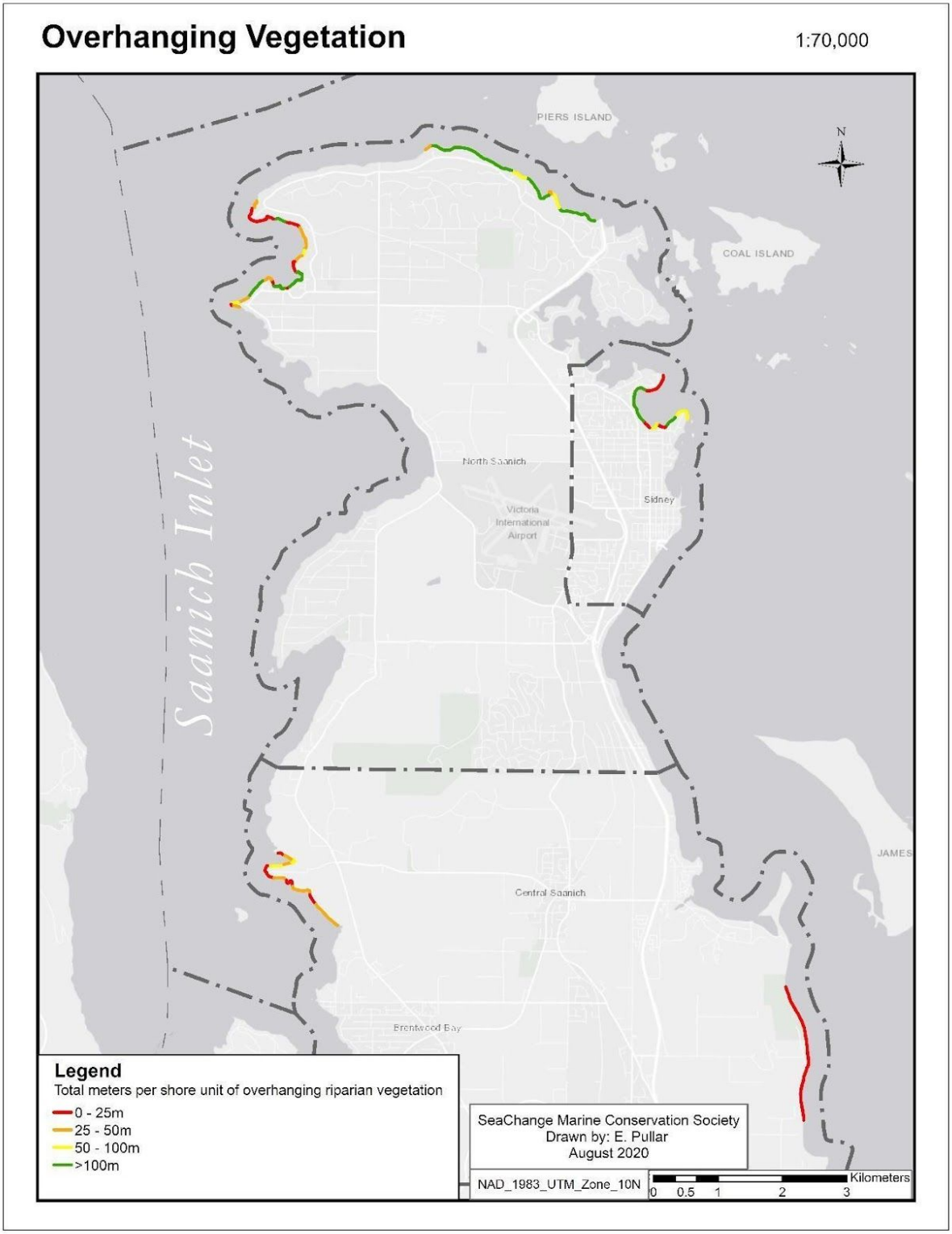

Figure 7. Overhang of vegetation along the shoreline

6.5 Eelgrass Meadows (*Zostera marina*)

Eelgrass facilitates a safe transition for salmonids between freshwater streams and the open ocean. These nutrient rich ecosystems host an abundance of invertebrate species and provide an important haven for many juvenile marine organisms. Eelgrass, kelp and saltmarshes are vital in sustaining migratory routes for five species of Pacific salmon (see Fig. 8). Eelgrass also provides crucial habitat for other commercially important fish species, birds, mammals, and invertebrates.

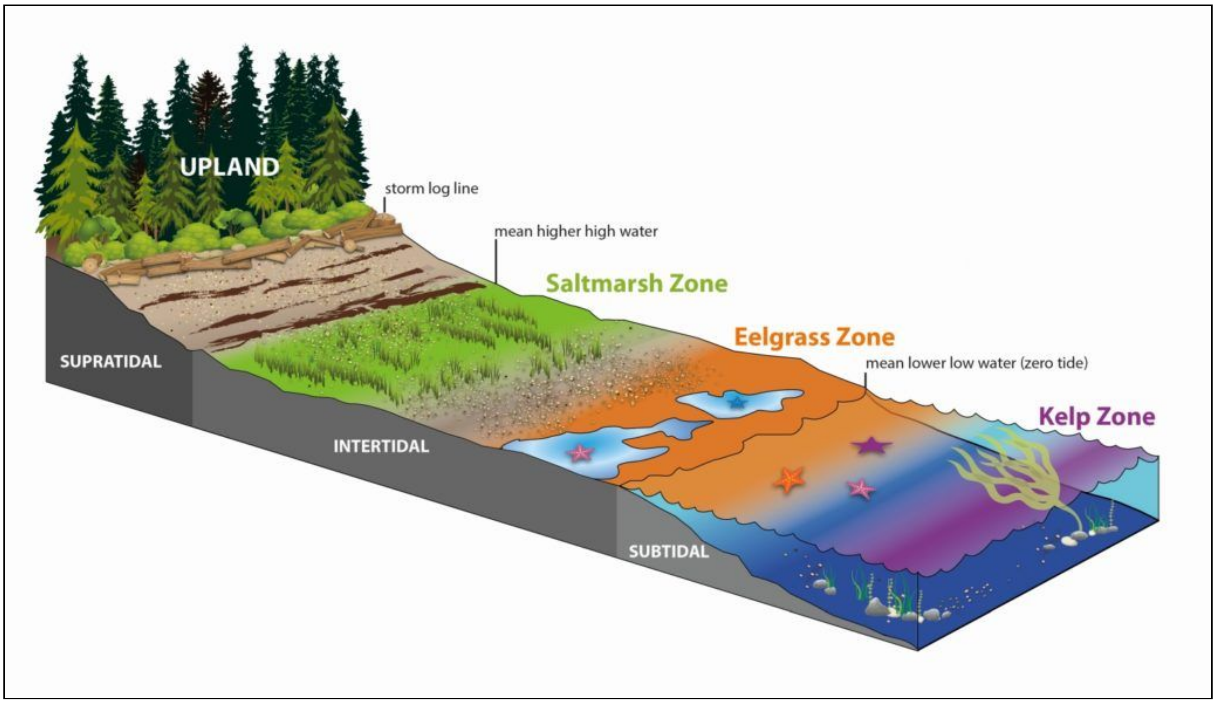

Figure 8. Shoreline Habitat Zones. Retrieved from: https://projectwatershed.ca/2020/03/16/creating-habitat-connectivity/

Intertidal eelgrass was observed in 6 shore units (8%). All intertidal eelgrass was observed in North Saanich. Subtidal eelgrass was observed parallel to 36 shore units (46%).

Threats to eelgrass meadows along the Peninsula include shading, nutrient loading and sedimentation. Shading from docks, wharves and boats inhibits light from reaching the plants. Nutrient loading from fertilizers and agricultural run-off increases algal growth on the blades and blocks sunlight. Sedimentation from the removal of riparian vegetation causes erosion and smothers the eelgrass shoots.

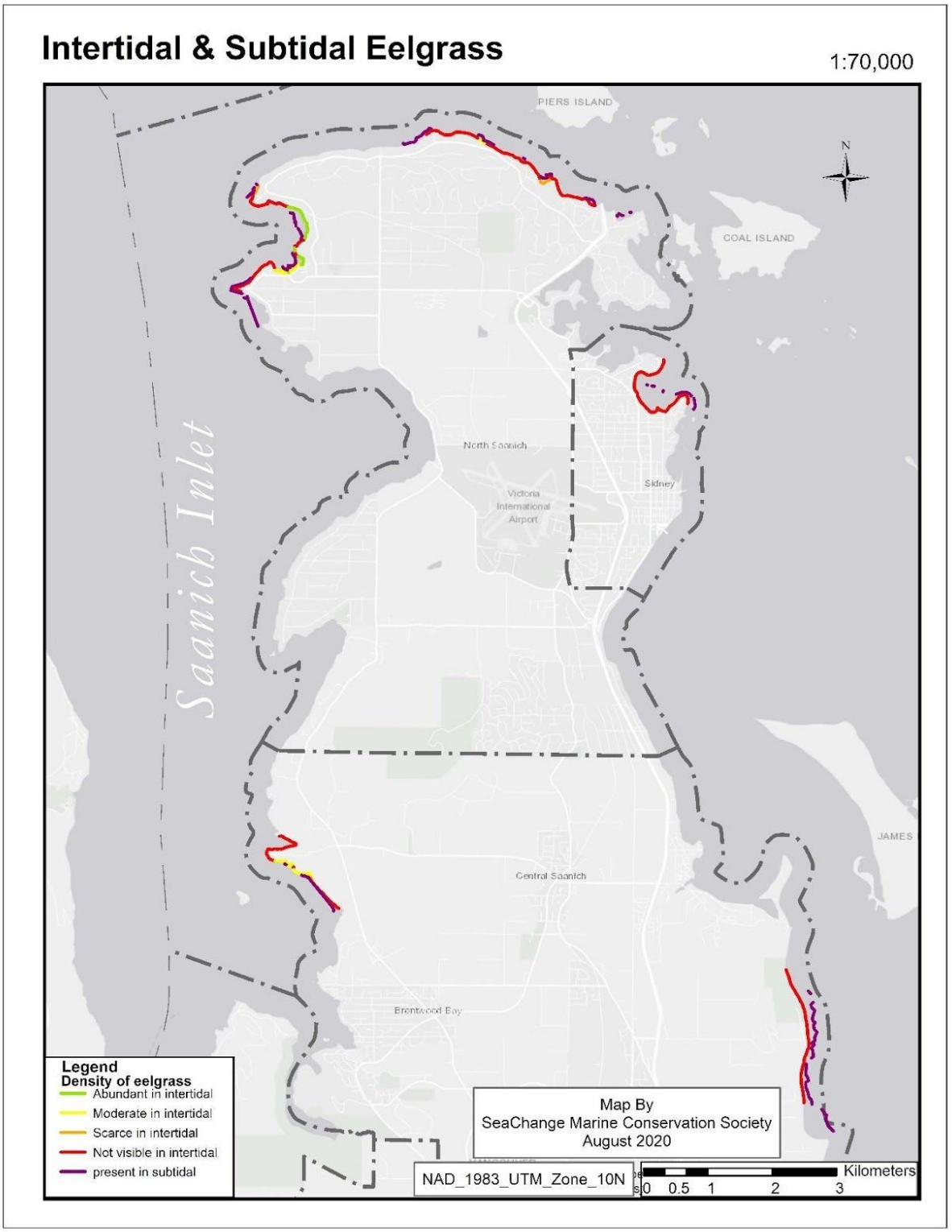

Figure 9. Intertidal and subtidal eelgrass presence and density

6.6 Polluting Features

Polluting features are an important factor to consider when evaluating the ecological integrity of shore units. The main polluting features impacting shoreline health include stormwater outfalls, sewer outfalls, creosote logs and toxic waste. Toxic waste refers to chemical pollutants in the marine environment, such as fertilizer from agricultural runoff, or solvents, oils, sewage, and paints from marinas /moored vessels. Storm outfalls sporadically inundate nearshore habitats with freshwater, decreasing biodiversity both onshore and nearshore. Pollutants carried in stormwater from roads and backshore properties have deleterious effects on marine plants and animals. Creosote-treated logs can leach into marine sediment, releasing toxins harmful to organisms. A maximum of two polluting features were recorded for each unit, with more than two per shore unit being rare (Fig. 10). Each of these features contributes to the degradation of shoreline ecosystems.

Example of a creosote-treated log polluting feature and a sea wall in poor condition.

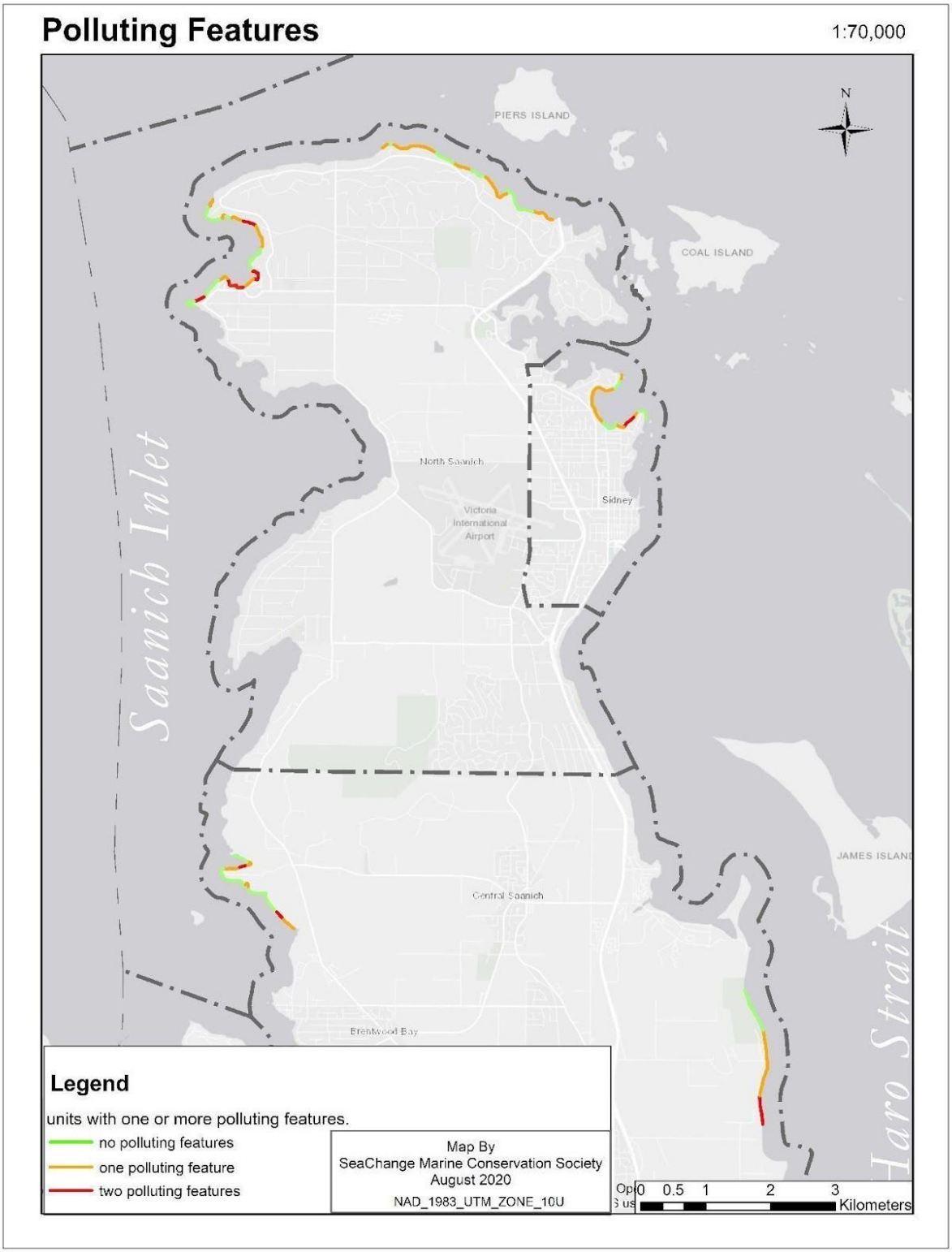

Figure 10. Number of polluting features in each shore unit. Polluting features include creosote, sewage outfalls, storm water outfalls, and toxic waste.

7.0 Restoration Potential

Beach nourishment - Shoreline modifications can alter the beach substrate, with fine sediments in front of modified structures washing away as a result of wave refraction. The addition of sand can restore the landscape to a pre-modification state. Beach nourishment is suggested in 16% of the survey area.

Backshore revegetation- If the backshore has been heavily landscaped, with trees and shrubs removed, revegetation can provide soil stability and add resilience against erosion. Backshore revegetation is suggested in 60% of the survey area.

Invasive removal- If English ivy is prevalent in the shore unit, it can damage or kill trees while invading areas where native vegetation could grow. Ivy was often present on tree trunks. Invasive removal is suggested in 13% of the survey area.

Backshore permeability- If the land surface in the backshore has been hardened by the addition of an asphalt driveway or parking lot, run-off during rain events can cause erosion and decrease the water table (subsurface water reserve). A decrease in permeable surfaces was found in 5% of the survey area.

Debris removal- Large debris such as cement blocks, creosote logs and derelict vessels which require machinery to remove was found in 25% of the survey area. Significant debris was observed in south Deep Cove, south Henderson and south Island View.

8.0 Field Observations

This section is intended for subjective observations made by the survey technicians during the survey period.

8.1 Areas of Concern

1. Moses Point Clear Cut

A property on Lands End Road has been clear cut, with scarce vegetation remaining on site. The lot is to be divided into 4 simple fee lots. Below the clear cut are two pocket beaches, which had potential for forage fish spawning. The addition of an 8m tall seawall at one of the beaches has altered the habitat suitability (see photo below). Without overhanging riparian vegetation to provide bank stabilization and shade, this shore unit will lose significant ecological value.

Newly clear cut site on Lands End Road

2. Large-scale coastal development at Henderson Point

A subdivision application was received from the property owner Feb 7, 2020 to consolidate the two subject lots and subdivide into 4 lots in the RE-3 zone. Land surveying is complete and the site is at-risk of imminent development. This area is currently a natural rocky bluff, Garry Oak ecosystem. Important wildlife features include nesting cliff swallows, wildlife trees, and intertidal keystone species such as sea stars. Sensitive ecosystem features include Garry Oak trees. Garry Oak associated ecosystems support the highest plant diversity of any terrestrial ecosystem in coastal British Columbia.

Current intact Garry Oak ecosystem at risk of development

3. **Changes over time**
    a. Seawall condition: Comparison between surveys in 2007-9 and 2020 indicate clear degradation of seawall condition in North Saanich. Seawalls classified in poor condition increased by 25%. This is an indicator of notable seawall degradation occurring within a decade. Green shore solutions may benefit homeowners by increasing resilience of their shore with intensifying storms and rising sea levels. This will also re-introduce habitat connectivity to these shorelines and benefit the surrounding ecosystem, without the cost of seawall repair.
    b. Oysters: Abundance of oysters increased by 308% and 700% in North Saanich and Central Saanich respectively. The cause of this increase is not known. Further monitoring and research is recommended.
    c. Land-use: North Saanich had a 12% increase in residential land use and an 88% decrease in natural land-use classification since the last survey in 2007-9. Based on field observations and data analysis, North Saanich has the most new developments of the three municipalities. In Deep Cove, survey technicians observed several new houses built on previous natural land and rebuilds on residential land. There is concern about the ecological integrity of the shoreline.

8.2 Ecological Events

In early July, a red tide was observed between Tod Inlet and Henderson Point. In late July, a green algae bloom was observed in Roberts Bay.

8.3 Species-Rich Ecosystems

Field observations included sightings of Eagles and nests, Great Blue Herons and heronries, Cormorants and nests with chicks, Sea Lions, Harbour Seals, River Otters, Kingfishers, Osprey, Rhinoceros Auklets, Oystercatchers and Black Guillemots. Intertidal species observed include Opalescent Squid and eggs, Dungeness Crabs, Rock Crabs, Kelp Crabs, large schools of small fish, Ochre sea stars, Leather Stars, Sea Cucumbers, Moon Snails and an abundance of casings .

Locations:

- Cormorant nesting area along northern ferry dock at Swartz Bay
- Great Blue Heron heronries in Roberts Bay Migratory Bird Sanctuary
- Abundance of small fish in front of Shore Units 0023, 0024, 0025 in Deep Cove
- Abundance of juvenile Dungeness Crabs in Deep Cove
- Rhinoceros Auklets offshore from Island View Beach
- Black Guillemots near Swartz Bay ferry terminal
- Abundance of Invasive S*argassum* in the nearshore waters of the North Peninsula and Island View Beach

Cormorant nesting site in North Saanich

9.0 Recommendations

1. **Larger setbacks**

Shoreline properties on the Peninsula are facing an increased risk of flooding and property damage due to rising sea levels, as well as the higher occurrence and severity of storms. Larger setbacks will benefit homeowners, insurance brokers, ecosystems and fisheries in the long-term. This is the most effective and least labour intensive option for protecting shoreline habitat and increasing habitat connectivity. Additionally, implementing larger buffers between coastal infrastructure and the ocean will increase property resiliency to sea level rise

and storm surges. Larger setbacks may be implemented under a *Local Government Act* zoning bylaw that takes risk to sea level rise, slumping and erosion into account.

2. **Greater restrictions on tree removal (coastal clear cutting)**

Maintaining vegetation on shorelines will benefit homeowners, insurance brokers, ecosystems and fisheries in the long-term. Complex root systems of trees and shrubs provide soil stability to prevent erosion, protecting properties from sea level rise and storm surges. These root systems also slow freshwater infiltration to the shore, filter toxins and absorb extra nutrients running off from lawns, gardens, asphalt driveways and roads. Vegetation reduces the impacts of human disturbances to shoreline ecosystems. Maintaining shoreline vegetation also decreases the need for armoured shorelines, especially when combined with larger setbacks. Restricting tree removal on shorelines will conserve habitat diversity, protect nesting trees and support carbon sequestration. This could look like a zoning bylaw under a *Local Government Act* that restricts all tree removal and tree topping in Marine DPAs and/or within 30m of the high water mark.

3. **Incentives for green shores over hard shore armouring**

Green shores will enhance shoreline resiliency and mitigate impacts of sea level rise. This method is more cost effective than repairing/replacing seawalls and more beneficial ecologically. Green shores protect against storm surges, slumping and erosion, while also providing valuable ecosystem services and habitat. The Stewardship Centre for BC Green Shores program is an excellent resource for home-owners and local governments assisting with this transition[16]. For incentivization, the Islands Trust Area Natural Area Protection Tax Exemption program is leading the way.

4. **Bioregional conservation approach**

North Saanich, Central Saanich and Sidney are all part of the interconnected Saanich Peninsula bioregion. With this in mind, the most efficient planning and decision-making would take place through collaboration. Local government representatives could contribute to the Saanich Peninsula Environmental Coalition (SPEC) Bioregional Framework, amend DPA Guidelines, form a tri-municipality environmental advisory council, and host community consultations with coastal land-owners. There is also a need to create local legislation aligned with recommendations for a BC Coastal Protection Act.

[16] Stewardship Centre for British Columbia.(2016). Green Shore Policy and Regulatory Tools for Local Governments. Retrieved from: https://www.retooling.ca/_Library/ReTooling_Resource_Library/GreenShores_Policy_and_Regulatory_Tools_for_Local_Government.pdf

9.1 Future Research

1. Include kelp forests in field data collection as a key life cycle habitat and/or wildlife feature. Kelp forests provide habitat for a diversity of species and act as carbon sinks.
2. Re-survey pocket beaches with potential for forage fish spawning in the winter months.

10.0 Conclusion

Through municipal partnerships, this Technical Report may inform future decisions related to nearshore development, ecological degradation and sea level rise. Significant results will be presented to tri-municipal councils, mayors and staff. Notable changes include an increase in shoreline modifications and a decrease in ecological condition of shoreline. Since the original study, the overall condition of seawalls has decreased. Natural shorelines are proven to be more resilient than hard armoured, developed shorelines. Concentrated efforts towards soft shore protection and coastal ecosystem restoration, instead of new seawall construction will provide long-term ecological health and economic savings. Actionable items could include the implementation of incentive programs such as the Stewardship Centre for BC Green Shores initiative[17], tax exemptions similar to Islands Trust Area Natural Area Protection Tax Exemption program[18], as well as amendments to Official Community Plans and Development Permit Areas.

Sea level rise poses an imminent threat to the communities of the Peninsula. It is vital that governments, businesses and individuals work together to create more resilient shorelines. SIPAS 2020 provides valuable data to inform conscious shoreline development and conservation efforts. The full survey would provide information to support a bioregional environmental protection strategy, as suggested by SPEC.

It would be beneficial to include First Nations territories in the complete study. We have not been granted permission to assess nearshore environments in these territories for the pilot project but recommend approaching W̱SÁNEĆ members for permission to include their territories in future surveys. This would allow for a comprehensive understanding of shoreline health and modification on the Peninsula and in the Inlet.

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[17] Stewardship Centre for British Columbia.(2020). Green Shores for Homes. Retrieved from: https://stewardshipcentrebc.ca/green-shores-home/

[18] Islands Trust Conservancy. (2018). Property Tax Incentives. Retrieved from: http://www.islandstrustconservancy.ca/i-am-a/local-government/property-tax-incentives/

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Appendix A: SIPAS 2020 data sheet (p.1)

GPS Unit: ____ Physical Unit ID: _____

Date:	Start UTM: WP#:____	X: Y:		End UTM: WP#:____	X: Y:	
Crew Initials:	Start Time:	End Time:		Backshore Slope: Foreshore Slope:		Substrate: ☐Rock ☐Rock & Sediment ☐Sediment ☐Anthropogenic
	Photo #(s):					
Shore Unit Characteristics/Features						
[S2] Lowest Overhanging Branch Elev: _____m			[S3] Overhang of Intertidal Zone: _____m			
Intertidal Features						
[I1] Forage Fish Spawning Pot. ☐ Abundant ☐ Moderate ☐ Scarce ☐ Not Observed			[I2] Fucus ☐ Abundant ☐ Moderate ☐ Scarce ☐ Not Observed			[I3] Eelgrass ☐ Abundant ☐ Moderate ☐ Scarce ☐ Not Observed
[I4] Shore Crabs ☐ Abundant ☐ Moderate ☐ Scarce ☐ Not Observed			[I5] Oysters ☐ Abundant ☐ Moderate ☐ Scarce ☐ Not Observed			[I6] Clams ☐ Abundant ☐ Moderate ☐ Scarce ☐ Not Observed
Intertidal Comments:						

1

Appendix A: SIPAS 2020 data sheet (p.2)

GPS Unit: ____ Physical Unit ID: _____

Backshore Characteristics/Features

B1 Land Use:	B2 Length:	B3 Habitat:	B4 % Cover:
☐ Residential	_____m	☐ Coniferous Forest	_____%
☐ Commercial	_____m	☐ Deciduous Forest	_____%
☐ Agricultural	_____m	☐ Shrub	_____%
☐ Industrial	_____m	☐ Bare Ground	_____%
☐ Park	_____m	☐ Landscaped	_____%
☐ Parking Lot	_____m	☐ Wetland	_____%
☐ Vacant Open Space	_____m		
☐ Natural	_____m		

B5 Bank Erosion	% Coverage:	B6 If banks are eroding, please describe:	Number of new visible structures:
☐ Severe	_____%		
☐ Moderate	_____%		_____
☐ Mild	_____%		
☐ N/A			

B7 Wildlife Feature:		B8 Sensitive Feature:	Notes:
☐ Nesting Area (whitewash)	☐ Artificial	☐ Garry Oak	
☐ Rock Ledge	☐ Driftwood Pile	☐ Old Growth Forest	
☐ Undercut Shelter/Den	☐ Wildlife Tree	☐ Riparian Area	
☐ Haul Out Area	☐ Pocket Beach		
	☐ _____		

Pocket Beach Details:	Center of Beach UTM:	Eggs Present?	Photo #:
Number of Pocket Beaches:_____	X: _____ Y: _____ WP#: ____	☐ Yes ☐No	_____
Percent Cover of Unit:_____	X: _____ Y: _____ WP#: ____	☐ Yes ☐No	_____
	X: _____ Y: _____ WP#: ____	☐ Yes ☐No	_____

Backshore Comments:

Anthropogenic Modifications

A1 *Primary Seawall Occurring within the Unit*	Start UTM: WP#: ____	X: Y:	End UTM: WP#: ____	X: Y:

Type:	Length:	Condition:	Base Elev. Relative to HWM:	Top Elevation Relative to HWM:	Distance from HWM:
☐ Boat Ramp	_____m	☐ New/Good			
☐ Concrete	_____m	☐ Moderate			
☐ Landfill	_____m	☐ Poor			
☐ Sheet Pile	_____m	☐ _____	_____m	_____m	_____ m
☐ RipRap	_____m				
☐ Wooden	_____m				
☐Masonry	_____m				

2

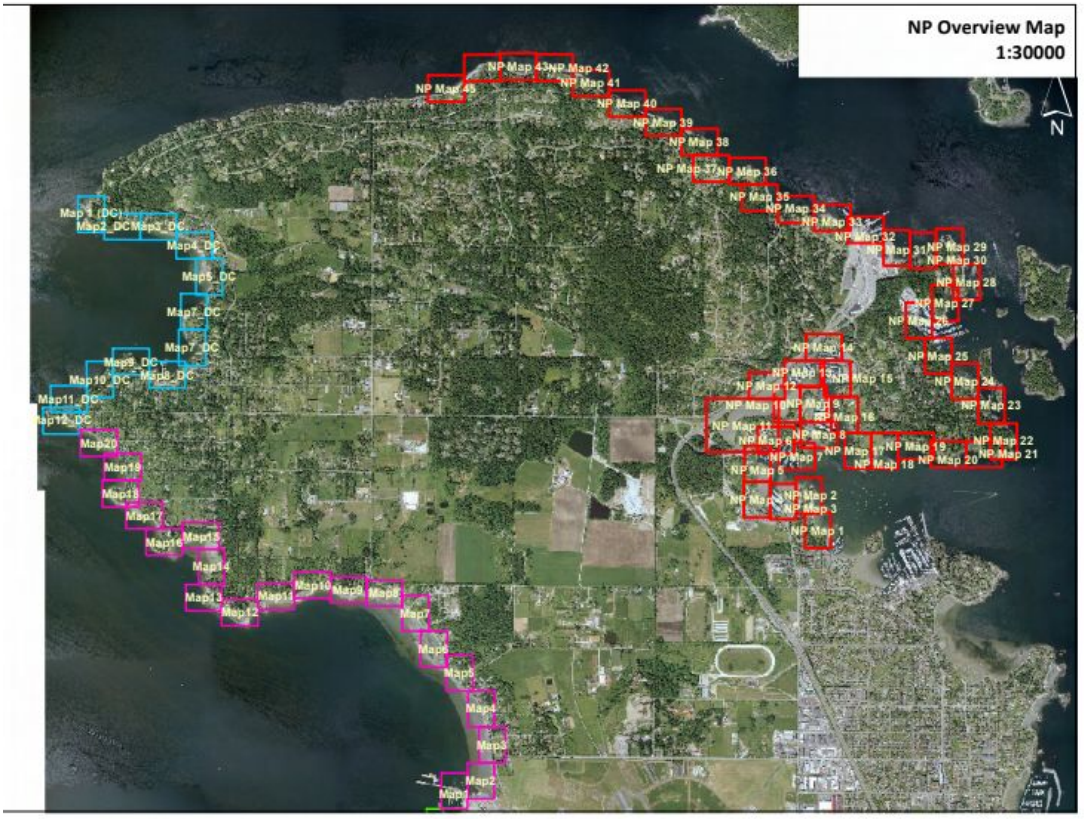
Appendix A: SIPAS 2020 data sheet (p.3)

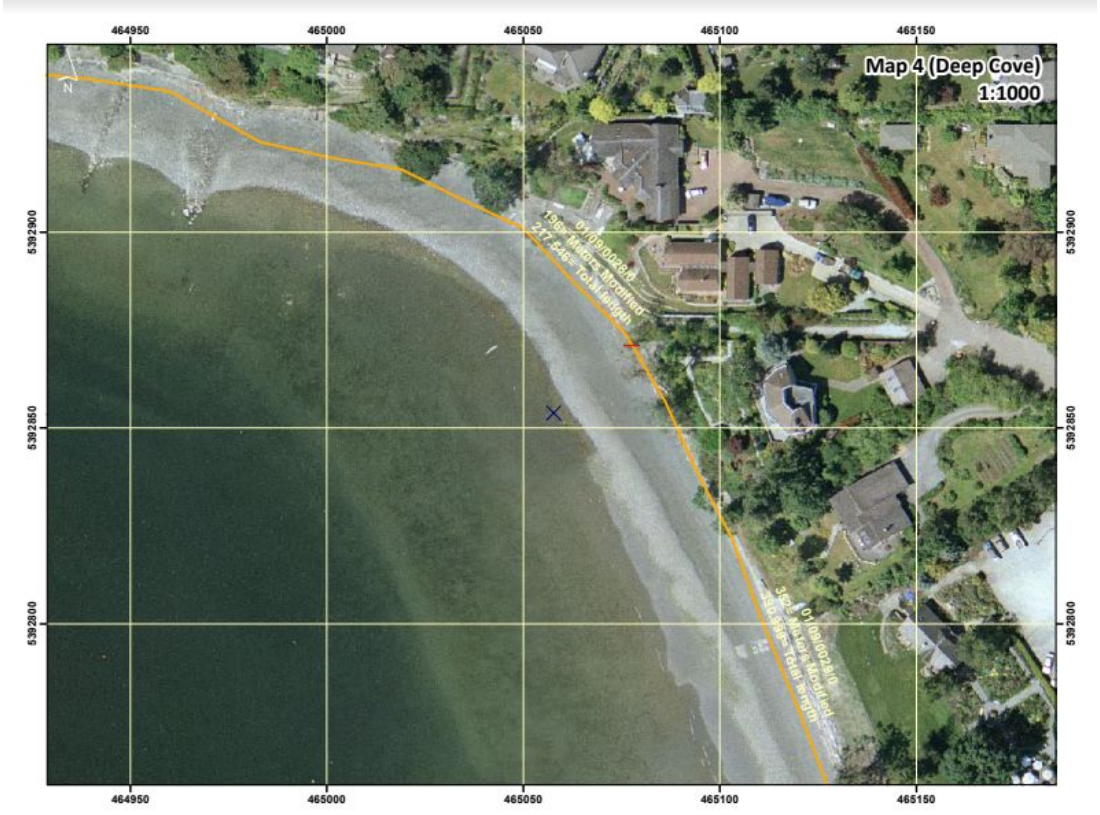
GPS Unit: ____ Physical Unit ID: _____

A2 *Secondary Seawall Occurring within the Unit*		Start UTM: WP#: ____	X: Y:	End UTM: WP#:____	X: Y:		
Type: ☐ Boat Ramp ☐ Concrete ☐ Landfill ☐ Sheet Pile ☐ RipRap ☐ Wooden ☐Masonry	Length: _____m _____m _____m _____m _____m _____m _____m	Condition: ☐ New/Good ☐ Moderate ☐ Poor ☐ _____		Base Elev. Relative to HWM: _____m		Top Elevation Relative to HWM: _____m	Distance from HWM: _____ m
A3 *Tertiary Seawall Occurring within the Unit*		Start UTM: WP#: ____	X: Y:	End UTM: WP#: ____	X: Y:		
Type: ☐ Boat Ramp ☐ Concrete ☐ Landfill ☐ Sheet Pile ☐ RipRap ☐ Wooden ☐Masonry	Length: _____m _____m _____m _____m _____m _____m _____m	Condition: ☐ New/Good ☐ Moderate ☐ Poor ☐ _____		Base Elev. Relative to HWM: _____m		Top Elevation Relative to HWM: _____m	Distance from HWM: _____ m
A4 Est. Nearest Perm Structure: _____(m)		A5 Structure Type: ☐ Pilings ☐Floats/Docks ☐ Boat House ☐ Shed ☐ Wharf ☐ Access path ☐Concrete ☐ Deck ☐ Boat Launch ☐ House ☐ Stairs ☐ Other					
A6 Other Manmade Structures Present: ☐Pilings ☐ Wharves ☐ Floats/Docks ☐ Access Path ☐ Stairs ☐ _____		Notes:					
A7 Polluting Features Present: ☐ Storm Outfall ☐ Sewer Outfall ☐ Creosote Logs ☐ Toxic Waste ☐ _____		A8 Restoration Potential:					
		Beach nourishment ☐ Yes ☐ No	Backshore revegetation ☐ Yes ☐ No	Invasive removal ☐ Yes ☐ No	Increase Backshore Permeability ☐ Yes ☐ No	Debris removal ☐ Yes ☐ No	

3

Appendix B: example field maps





Appendix C: Data Sheet Definitions

Foreshore Slope
Slope of intertidal/splash zone
Backshore Slope
Slope of immediate backshore behind the splash zone up to 30m back. If there is a short steep bank that levels off onto a level landscaped area then the slope of the more level area was recorded.
Lowest Overhanging Branch Elevation
The lowest living tree or shrub branch overhanging the shore. Elevation is measured from the high water mark.
Shrub - Shrub habitat consists of unmanicured shrub species distributed in a natural growth pattern. These may include native or non-native species but are predominantly composed of native species.
Landscaped - Landscaped habitat consists of manicured grounds including (planted) trees, shrubs and grass. Gardens, shaped bushes, cut grass and ornamental trees are good indicators of landscaped habitat.
Pocket Beach - Pocket beaches are small beaches, less than 100m long that are formed between headlands in coves of rocky shorelines. They can be composed of a mix of boulders, pebbles, sand and mud and therefore have the attributes of a combination of shoreline types. Pocket beaches provide important isolated habitats for a variety of plants and animals. If "No" is checked for eggs present, it means the site tested negative for eggs or it was not sampled due to unsuitable substrate. Check the data sheet for "forage fish spawning potential" to see if the substrate is suitable.
Nearest Permanent Structure - The structure closest to the high water mark designed for long-term use.
Beach nourishment - If shoreline modifications have altered the substrate of the beach (e.g. seawall creating a high energy area that sweeps small sediment away) and it could use replacement of fine sediment to return it to its original state.
Backshore revegetation - If the backshore has been heavily landscaped and trees and bushes have been removed; revegetation may provide soil stability and add resilience against erosion.
Invasive removal- Predominantly, if Ivy is prevalent in the unit and creating harming native vegetation, e.g. ivy overtaking a tree trunk.
Increase backshore permeability- If the backshore has been hardened (e.g. addition of parking lot) and facilitates runoff that may increase erosion.
Debris removal
Large debris that needs outside assistance for removal. Small debris that homeowners have the ability to dispose of themselves is not applicable.
Backshore - the zone of the shore lying above the high-water mark
Foreshore - *the* zone from the low water mark to the high-water mark
Nearshore - the area extending from the swash zone to the start of the offshore zone, around 20m in depth
Shoreline resiliency - the ability of natural and socio-economic systems in coastal environments to adapt while maintaining key functions, as disturbances brought on by sea level rise, extreme weather events, and human impacts increase.
Sea level rise - rising water level due to melting ice sheets and glaciers, as well as the thermal expansion of warming seawater
Forage fish - small fish that travel in groups called "schools" and are an important food source for larger fish and marine mammals. This study focuses on Surf Smelt (*Hypomesus pretiosus*) and Pacific Sand Lance (*Ammodytes americanus*).
Forage fish habitat - located in the intertidal/nearshore, forage fish spawn on gravel/sand beaches up to the high-water mark. Forage fish find refuge to feed and grow in eelgrass meadows close to shore. Overhanging vegetation is important for these habitats, to shade eggs on the beach and provide insects as a food source for

juvenile fish.

Shoreline hardening - the installation of engineered-shore structures to (a) stabilize sediment and prevent erosion and/or (b) provide flood protection. Shoreline hardening was most commonly seen as sea walls made of concrete, rip rap or rock masonry.

Key life cycle species - Species that play an irreplaceable role in the life cycle of another species. For example, eelgrass provides essential rearing habitat for juvenile fish.

Habitat connectivity - the degree to which separate patches of habitat are connected and facilitate or impede animal movement and other ecological processes, such as seed dispersal.

Biogeoclimatic zone - A geographic area that has similar patterns of energy flow, vegetation and soils as a result of a broadly homogenous macroclimate.

Saanich Peninsula Environmental Coalition (SPEC) - SPEC is formed from a collection of independent environmental groups (Friends of Shoal Harbour, SeaChange Marine Conservation Society, Peninsula Streams Society, WWF Canada, Roberts Bay Residents, Tsechum Harbour Task Force, WSANEC Leadership Council, Friends of North Saanich Parks, and Climate Justice Advocacy) who came together in 2020 to help conserve and ensure the future environmental health of the natural assets of the Saanich Peninsula – including the shoreline, beach, harbour, forest, wetland and stream habitats. SPEC intends to act as an informal, collaborative, advisory group working closely with the current MLA.

Local Government Act - The primary legislation for regional districts and improvement districts, setting out the framework for structure and operations, as well as the main powers and responsibilities. It also covers important authorities for both municipalities and regional districts, such as planning and land use powers and statutory requirements for administering elections.

Sensitive Ecosystem Inventory (SEI) - A project that identified the remnants of rare and fragile terrestrial ecosystems in the lower west coast of BC to encourage land-use decisions which will ensure their continued ecological integrity.

Development Permit Area (DPA) - A set of development regulations pertaining to a specific area as specified by the Official Community Plan. Any proposed building and subdivision within a DPA requires the issuance of a development permit. The authority for local governments to establish DPAs is set out in the Local Government Act, Sections 919.1 and 920.

Appendix D: Full Data Analysis Results

2020 Results

SURVEY AREA BREAKDOWN

Survey Location	Meters Surveyed	Percent of total Survey Area
Overall	13949	100
North Saanich	7177	51.5
Deep Cove	3860	27.7
North Peninsula	3316	23.8
Central Saanich	4631	33.2
Henderson Point	2465	17.7
Island View	2166	15.5
Sidney (Roberts Bay)	2141	15.3

ECOLOGICAL AND MODIFICATION RATING

Summary of Central Saanich Survey Area Results

Overall Ecological and Modification Rating - Central Saanich	**% of Central Saanich study area**	Shore Unit Count	Total Length (m)	Total length modified (m)	% modified based on category length
VH - Very High	0	0	0	41	<1
H - HIGH	18	5	827	1559	34
M - MODERATE	40	11	1879	1436	31
L - LOW	2	1	73	802	17
VL - VERY LOW	40	5	1852	793	17
Totals	100	22	4631	4631	100

Summary of North Saanich Survey Area Results

Overall Ecological and Modification Rating - North Saanich	**% of North Saanich study area**	Shore Unit Count	Total Length (m)	Total length modified (m)	% modified based on category length
VH - Very High	0	0	0	317	5
H - HIGH	3	1	248	1390	19
M - MODERATE	95	43	6816	2531	35
L - LOW	2	1	112	2425	34
VL - VERY LOW	0	0	0	513	7
Totals	100	45	7176	7176	100

Summary of Sidney Survey Area Results

Overall Ecological and Modification Rating - Sidney	**% of Sidney study area**	Shore Unit Count	Total Length (m)	Total length modified (m)	% modified based on category length
VH - Very High	0	0	0	149	7
H - HIGH	0	0	0	1179	55
M - MODERATE	17	2	359	669	31
L - LOW	83	8	1782	144	7
VL - VERY LOW	0	0	0	0	0
Totals	100	10	2141	2141	100

HABITAT COVER

Survey Location	**Conifer**	**Deciduous**	**Shrub**	**Wetland**	**Bare ground**	**Landscaped**
Overall	20.8%	20.8%	29.8%	0.31%	9.7%	19.2%
North Saanich	26.7%	24.6%	27.7%	0.11%	4.2%	18.1%
Central Saanich	15.8%	23.1%	35.9%	0%	21.5%	3.6%
Sidney	12.1%	3.2%	23.4%	1.7%	1.8%	57.8%

SEAWALL COVER

Overall:

38.72816% seawall cover
30 out of 77 (39%) units contain no seawalls
47 out of 77 (61%) units contain at least 1 seawall
28 out of 77 (36%) units contain at least 2 seawalls
17 out of 77 (22%) units contain at least 2 seawalls
5402m of the 13948.5m surveyed contains seawall

North Saanich:

26.80921604% seawall cover
21 of 45 (46.6%) units contain no seawalls
24 out of 45 (53.3%) units contain at least 1 seawall
15 out of 45 (33%) units contain at least 2 seawalls
9 out of 45 (20%) units contain at least 3 seawalls
1924m of 7177m surveyed contain seawall

Sidney:

73.23431953% seawall cover
1 of 10 (10%) units contain no seawalls
9 out of 10 (90%) units contain 1 or more seawalls
7 out of 10 (70%) units contain 2 or more seawalls
6 out of 10 (60%) units contain 3 or more seawalls
1568m of 2141m surveyed contain seawall

Central Saanich:

37.55293% seawall cover
8 of 22 (36%) units contain no seawalls
14 of 22 (64%) units contain at least 1 seawall
6 of 22 (27%) units contain at least 2 seawalls
2 of 22 (9%) units contain at least 3 seawalls
1739m of 4630.8 m surveyed contained seawall

SEAWALL ELEVATION

Survey Area	Average Base Elevation	Average Top Elevation
Overall	-0.064	1.797
North Saanich	-0.120	1.115
Sidney	0.398	1.966
Central Saanich	-0.463	1.863

SEAWALL CONDITION

Survey Area	% walls in good condition	% walls in moderate condition	% walls in poor condition
Overall	22	51	27
North Saanich	21	50	29
Sidney	32	54	14
Central Saanich	18	46	36

NEW STRUCTURES

Overall:
65 new structures observed overall
35 (44%) of 77 units had at least one new structure

North Saanich:
46 new structures observed in North Saanich
24 of 45 (53%) of units in North Saanich contain at least 1 new structure

Sidney:
11 new structures observed in Sidney
4 of 10 (40%) of units in Sidney contain at least 1 new structure

Central Saanich:
8 new structures observed overall in CS
7 of 22 (32%) units contain at least 1 new structure

BACKSHORE LAND-USE

Overall:

Land-use Type	**Length (m)**	**% of survey area**
Residential	11179	**80**
Park	1154	**8**
Agricultural	764	**5**
Natural	530	**4**
Parking Lot	258	**2**
Vacant	30	**<1**
Commercial	20	**<1**

North Saanich:

Land-use Type	**Length (m)**	**% of survey area NS**
Residential	6849	**95**
Park	0	**0**
Agricultural	0	**0**
Natural	68.5	**1**
Parking Lot	18	**<1**
Vacant	30	**<1**
Commercial	20	**<1**

Sidney:

Land-use Type	**Length (m)**	**% of survey area Sidney**
Residential	2085	**97**
Park	0	**0**
Agricultural	0	**0**
Natural	34	**2**
Parking Lot	20	**1**

Vacant	0	**0**
Commercial	0	**0**

Central Saanich:

Land-use Type	**Length (m)**	**% of survey area CS**
Residential	2245	**48**
Park	1154	**25**
Agricultural	764	**16**
Natural	298	**6**
Parking Lot	220	**5**
Vacant	0	**0**
Commercial	0	**0**

OVERHANG OF INTERTIDAL

Survey Area	**Length (m)**	**% of survey area**
Overall	4655	33
North Saanich	3498	49
Sidney	585	27
Central Saanich	572	12

Sensitive features

Location	**Number of Units with Garry Oak**	**Number of Units with Riparian area**
Overall	35	5
North Saanich	22	2
Central Saanich	12	2
Sidney	6	1

Pocket Beaches

23 shore units contain pocket beaches (9 in Central Saanich, 14 in North Saanich)
19 have 1 pocket beach (9 in Central Saanich, 10 in North Saanich)
2 have 2 pocket beaches (All in North Saanich)
2 have 3 pocket beaches (All in North Saanich)

12 of the shore units have pocket beaches covering <30% of the unit
11 of the shore units have pocket beaches covering >30% of the unit
4 of the shore units have pocket beaches covering >60% of the unit
2 of the shore units have pocket beaches covering >90% of the unit

None of the sampled pocket beaches were confirmed to have forage fish eggs at this time of year.

WILDLIFE FEATURES

Overall:

	No features	**1 feature**	**2 features**	**3 features**	**4 features**
# of Units	3	24	25	19	6
% of Units	4	31	32	25	8

North Saanich:

	No features	**1 feature**	**2 features**	**3 features**	**4 features**
# of Units	0	14	17	9	5
% of Units	0	31	38	20	11

Sidney:

	No features	**1 feature**	**2 features**	**3 features**	**4 features**
# of Units	0	0	4	6	0
% of Units	0	0	40	60	0

Central Saanich:

	No features	**1 feature**	**2 features**	**3 features**	**4 features**
# of Units	3	10	4	4	1
% of Units	14	45	18	18	5

EROSION

Erosion by unit

Survey Area	% of units with erosion	% of units with mild erosion	% of units with moderate erosion	% of units with severe erosion
Overall	52	7	31	14
North Saanich	49	7	31	11
Central Saanich	68	9	27	32
Sidney	40	0	30	10

Erosion by length

Survey Area	Length of shoreline displaying erosion (m)	% of shoreline with erosion	% of shoreline with mild erosion	% of shoreline with moderate erosion	% of shoreline with severe erosion
Overall	1302	9	<1	3	6
North Saanich	611	9	<1	4	4
Central Saanich	655	14	<1	2	11
Sidney	35	2	0	1	<1

Change over Time Results

Change in abundance of intertidal features for North Saanich

Intertidal feature	% change
Oysters	+307.69%
Fucus	-7.29%
Clams	+89.28%
Eelgrass	+36.84%
Forage Fish Spawning Potential	-34.21%

Change in abundance of intertidal features for Central Saanich

Intertidal feature	% change
Oysters	+700%
Fucus	+52.38%
Clams	0%
Eelgrass	+450%
Forage Fish Spawning Potential	-15.38%

Change in seawall cover

North Saanich
23.82731779% seawall cover - 2007-9
26.80921604% seawall cover - 2020

3% increase in seawall cover

Central Saanich
39.38746089% seawall cover - 2007-9
41.46155% seawall cover - 2020

1.6% increase in seawall cover

This difference in sea wall cover is practically insignificant and likely due to varying estimates of seawall length.

Change in overhang of intertidal

North Saanich
239.9% increase

Central Saanich
323.2% increase

Important for sand lance and surf smelt egg shading.

** Based on the small changes in habitat cover, the extreme increase in overhang of intertidal may be due to difference in seasons between surveys. SIPAS 2007-9 was conducted in the winter (no leaves on trees and less sun makes it harder to tell what areas are shaded), SIPAS 2020 was conducted in the summer when leaves and sun were more present thus estimating overhang and shading was easier.

Change in backshore land-use

North Saanich

Land-use Type	**% change**
Residential	+12.1%
Park	0%
Agricultural	0%
Natural	-88.86%
Parking Lot	+18%
Vacant	-91.69%
Commercial	-78.02%

Change in backshore land-use in Central Saanich

Land-use Type	**% change**
Residential	-8.18%
Park	+316.61%
Agricultural	-22.28%
Natural	-60.84%
Parking Lot	+37.5%
Vacant	0%
Commercial	0%

* Increase in park is due to difference in land-use classification at Island View in unit 0674. 687m was classified as Residential in 2007-9 and as Park in 2020.

Change in Sensitive Ecosystem Presence

4.76% increase shore units containing Garry Oak in North Saanich (1 more SRU contains GO)
14.29% decrease in shore units containing Garry Oak in Central Saanich (2 SRU less)
Riparian areas have remained the same

Change in habitat cover

North Saanich

Habitat Cover	**% change**
Conifer	-2.16843%
Deciduous	+3.53535
Shrub	+18.58633
Wetland	+0.108964
Bareground	+0.757217
Landscaped	-19.5038

Central Saanich

Habitat Cover	**% change**
Conifer	-5.50164
Deciduous	+0.36159
Shrub	+25.042
Bareground	+3.50364
Landscaped	-23.40557

*Differentiating between landscaped and shrub cover. The 2020 study considered shrub what the 2007-9 study considered landscaped.

Change in Wildlife Features

North Saanich

	No features	**1 feature**	**2 features**	**3 features**	**4 features**
# of Units	-7	-3	+3	+2	+5
% of Units	-16	-7	+7	+5	+11

Central Saanich

	No features	1 feature	2 features	3 features	4 features
# of Units	-2	+4	-6	+3	+1
% of Units	-9	+18	-27	+13	+5

Change in Seawall Condition

Survey Area	Difference of % walls in good condition	Difference of % walls in moderate condition	Difference of % walls in poor condition
North Saanich	-33	+9	+24
Central Saanich	+9	-6	-3

*Changes in seawall condition in Central Saanich are practically insignificant and could be due to different visual classification between survey years.

Change in Erosion

Survey Area	% of units with erosion	% of units with mild erosion	% of units with moderate erosion	% of units with severe erosion
North Saanich	+18	-13	+22	+12
Central Saanich	-9	-37	+23	+11

Change in Ecological and Modification Rating

Ecological ratings for comparison do not include shrub habitat cover to account for discrepancies in data collection and make ratings comparable between years.

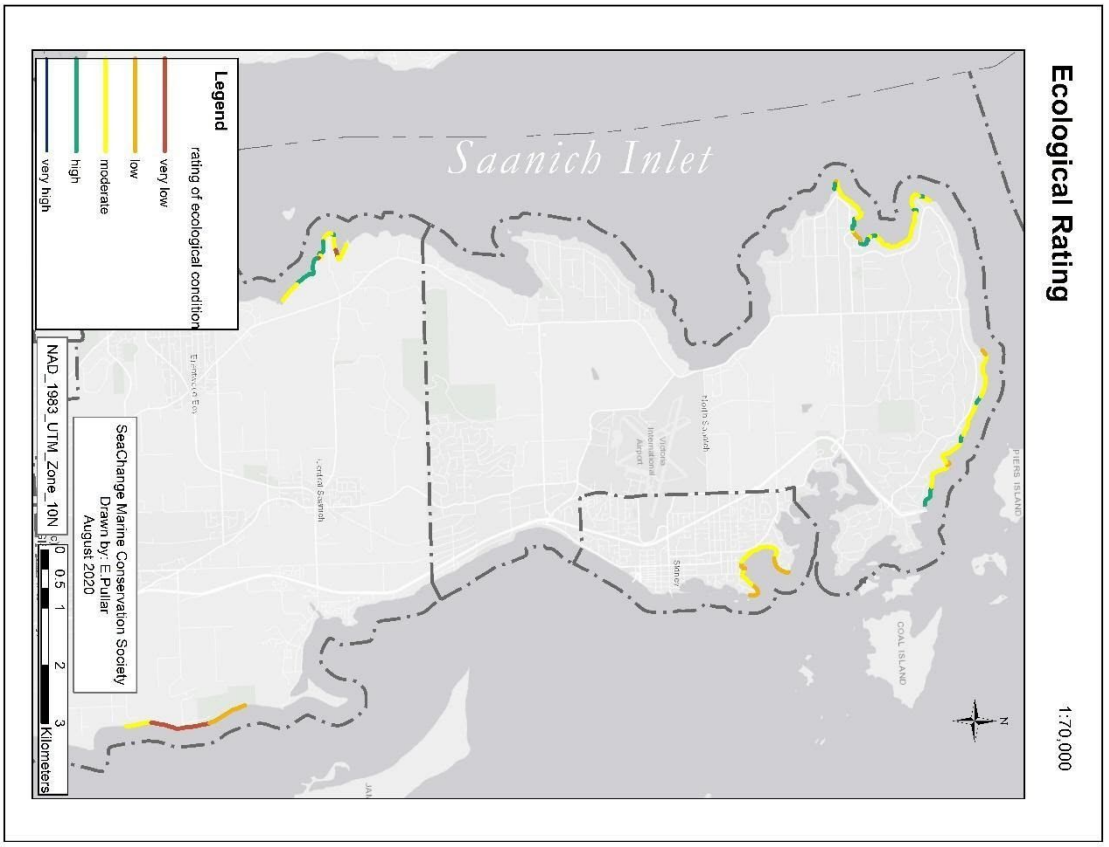
Summary of Change in Central Saanich Survey Area

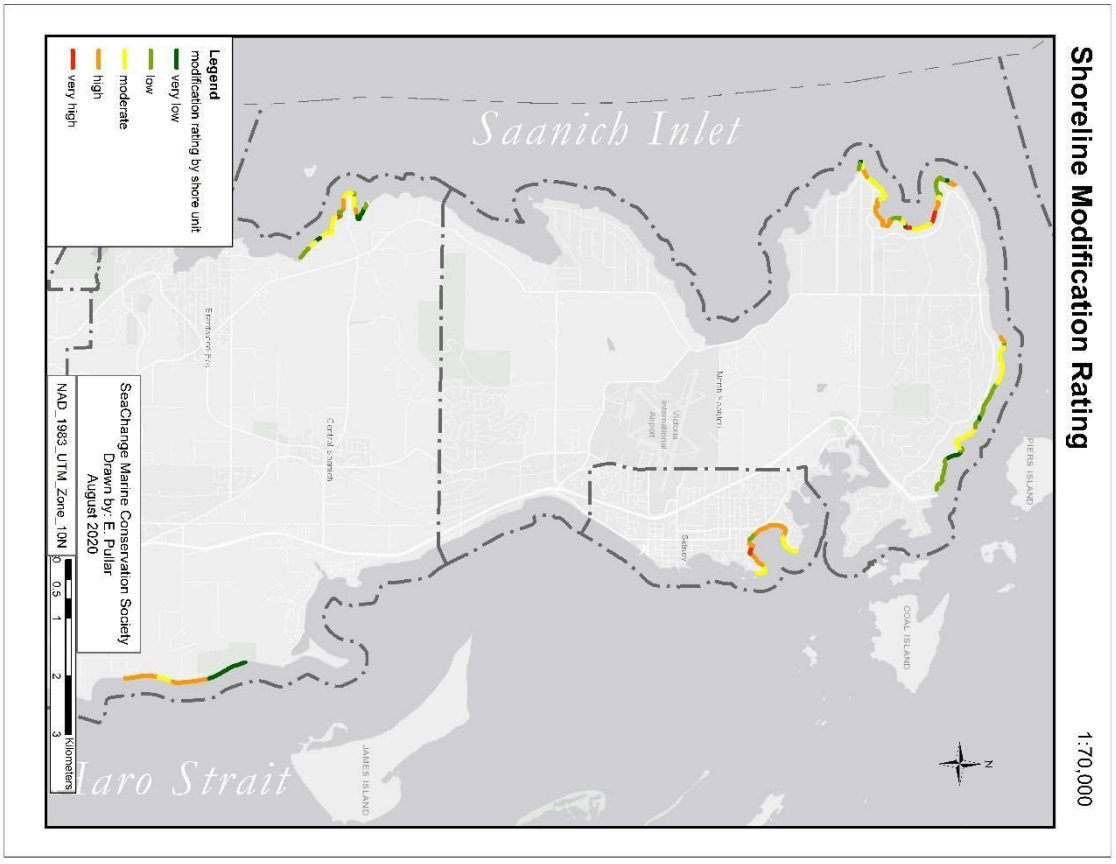
Overall Ecological Rating - Central Saanich	**% of Central Saanich study area**	Shore Unit Count	Total Length (m)	Total length modified (m)	% modified based on category length
VH - Very High	0	0	0	+41	+1
H - HIGH	-17	-5	-775	+1120	+24
M - MODERATE	+8	+4	+320	-508	-11
L - LOW	+3	+1	+157	-1057	-23
VL - VERY LOW	+6	+2	+298	+404	+9

Summary of Change on North Saanich Survey Area

Overall Ecological Rating - North Saanich	**% of North Saanich study area**	Shore Unit Count	Total Length (m)	Total length modified (m)	% modified based on category length
VH - Very High	0	0	0	+317	+5
H - HIGH	-27	-12	-1971	+943	+13
M - MODERATE	-7	0	+2001	-393	-6
L - LOW	+38	+14	+269	-227	-3
VL - VERY LOW	-4	-2	-299	-667	-11

Appendix E: Ecological and Modification Rating Maps and Tables for Comparison





Summary of overall survey area ecological and modification ratings

Overall		
Rating Type	**Modification Rating - % of total study area**	**Ecological Rating - % of total study area**
VH - Very High	4	0
H - HIGH	30	8
M - MODERATE	33	65
L - LOW	24	14
VL - VERY LOW	9	13
Totals	100	100

Summary of Central Saanich survey area ecological and modification ratings

Central Saanich		
Rating Type	**Modification Rating - % of Central Saanich study area**	**Ecological Rating - % of Central Saanich study area**
VH - Very High	<1	0
H - HIGH	34	18
M - MODERATE	31	40
L - LOW	17	2
VL - VERY LOW	17	40
Totals	100	100

Summary of North Saanich survey area ecological and modification ratings

North Saanich		
Rating Type	**Modification Rating - % of North Saanich study area**	**Ecological Rating - % of North Saanich study area**
VH - Very High	5	0
H - HIGH	19	3
M - MODERATE	35	95
L - LOW	34	2
VL - VERY LOW	7	0
Totals	100	100

Summary of Sidney survey area ecological and modification ratings

Sidney		
Rating Type	**Modification Rating - % of Sidney study area**	**Ecological Rating - % of Sidney study area**
VH - Very High	7	0
H - HIGH	55	0
M - MODERATE	31	83
L - LOW	7	17
VL - VERY LOW	0	0
Totals	100	100

Appendix F: Database Dictionary (p.1)

Field Name	Type	Length	Description	Domain Values
OBJECTID	OBJECT ID	4	Default ArcGIS ID field	
PHY_IDENT	TEXT	12	Unique alphanumeric identifier, also the primary key for the dataset	
PHY_UNIT	TEXT	4	Physical shore unit number adopted from Parks Canada ShoreZone mapping data	
FIELD_DATE	DATE	8	The date that data was collected (mm/dd/yyyy)	
NOTES	TEXT	2	The initials of the field crew member that recorded notes	
START_X	LONG	4	UTM Coordinate (Easting) representing the start of the shore unit	
START_Y	LONG	4	UTM Coordinate (Northing) representing the start of the shore unit	
END_X	LONG	4	UTM Coordinate (Easting) representing the end of the shore unit	
END_Y	LONG	4	UTM Coordinate (Northing) representing the end of the shore unit	
START_TIME	DATE	8	The time of day that data collection was initiated	
END_TIME	DATE	8	The time of day that data collection was completed	
PHOTOS	TEXT	20	Reference numbers for photos taken of the shore unit	
SUBSTRATE	TEXT	2	A code indicating substrate class	**Substrate Class** R – Rock RS – Rock and Sediment S – Sediment A - Anthropogenic
LOW_BR	FLOAT	4	A measurement of the lowest overhanging branch from the tip of the branch to the sea level	
OVER_INT	FLOAT	4	A measurement of the shore unit length that a branch overhangs the intertidal zone	
FORAGE FISH	TEXT	2	A code indicating the potential for or existence forage fish habitat in the shore unit	**Intertidal Habitat Class** A – Abundant M – Moderate S – Scarce

				NV – Not Visible
FUCUS	TEXT	2	A code indicating the amount of Fucus present in the shore unit	**Intertidal Habitat Class**
EELGRASS	TEXT	2	A code indicating the amount of intertidal eelgrass present in the shore unit	**Intertidal Habitat Class**
OYSTERS	TEXT	2	A code indicating the amount of oysters present in the shore unit	**Intertidal Habitat Class**
CLAMS	TEXT	2	A code indicating the amount of clams present in the shore unit	**Intertidal Habitat Class**
BS_LU1	TEXT	3	A code indicating the dominant land use activity occurring in the backshore	**Land Use Class** RES – Residential COM – Commercial AGR – Agricultural IND – Industrial PAR – Park LOT – Parking Lot VAC – Vacant Open Space NAT –Natural
BS_LENGTH1	FLOAT	4	An along shore measure of the length that BS_LU1 occurs	
BS_LU2	TEXT	3	A code indicating the second land use activity occurring in the backshore	**Land Use Class**
BS_LENGTH2	FLOAT	4	An along shore measure of the length that BS_LU2 occurs	
BS_LU3	TEXT	3	A code indicating the third land use activity occurring in the backshore	**Land Use Class**
BS_LENGTH3	FLOAT	4	An along shore measure of the length that BS_LU3 occurs	
BS_LU4	TEXT	3	A code indicating the fourth land use activity occurring in the backshore	**Land Use Class**
BS_LENGTH4	FLOAT	4	An along shore measure of the length that BS_LU4 occurs	
BS_HAB1	TEXT	3	A code indicating the dominant backshore habitat existing in the shore unit	**Backshore Habitat Class** CON – Coniferous DEC – Deciduous SHR – Shrub BAR – Bare Ground LAN – Landscaped WET – Wetland
BS_HAB1_PERCENT	SHORT	2	A percentage of the estimated amount of BS_HAB1 habitat cover	

BS_HAB2	TEXT	3	A code indicating the second backshore habitat existing in the shore unit	**Backshore Habitat Class**
BS_HAB2_PERCENT	SHORT	2	A percentage of the estimated amount of BS_HAB2 habitat cover	
BS_HAB3	TEXT	3	A code indicating the third backshore habitat existing in the shore unit	**Backshore Habitat Class**
BS_HAB3_PERCENT	SHORT	2	A percentage of the estimated amount of BS_HAB3 habitat cover	
BS_HAB4	TEXT	3	A code indicating the fourth backshore habitat existing in the shore unit	**Backshore Habitat Class**
BS_HAB4_PERCENT	SHORT	2	A percentage of the estimated amount of BS_HAB4 habitat cover	
BANK_ERO	TEXT	3	A code indicating the estimated severity of erosion occurring in the shore unit	**Bank Erosion Class** SEV - Severe MOD - Moderate MIL - Mild N/A – Not Applicable
WILD1	TEXT	2	A code indicating a wildlife feature present in the shore unit	**Wildlife Feature Class** NA – Nesting Area RL – Rock Ledge US – Undercut Shelter AR – Artificial DP – Driftwood Pile WT – Wildlife Tree NV – None Visible
WILD2	TEXT	2	A code indicating a second wildlife feature present in the shore unit	**Wildlife Feature Class**
WILD3	TEXT	2	A code indicating a third wildlife feature present in the shore unit	**Wildlife Feature Class**
WILD4	TEXT	2	A code indicating a fourth wildlife feature present in the shore unit	**Wildlife Feature Class**
SENS_ECO	TEXT	2	A code indicating a sensitive ecosystem present in the shore unit	**Sensitive Ecosystem** GO – Garry Oak RI – Riparian Area NV – None Visible
MM1_S_X	LONG	4	UTM Coordinate (Easting) representing the start of the primary seawall occurring in the shore unit	
MM1_S_Y	LONG	4	UTM Coordinate (Northing) representing the start of the primary seawall occurring in the shore unit	
MM1_E_X	LONG	4	UTM Coordinate (Easting) representing the end of the primary seawall occurring in the shore unit	

MM1_E_Y	LONG	4	UTM Coordinate (Northing) representing the end of the primary seawall occurring in the shore unit	
MM1_TYPE	TEXT	2	The type of primary seawall occurring in the shore unit	**Seawall Type** BR – Boat Ramp CO – Concrete LF – Land filling SP – Sheet Pile RR – Rip Rap WD – Wooden RM – Rock Masonry CP – Creosote Pilings MM – Mixed Materials
MM1_LENGTH	FLOAT	4	The calculated length in meters of the primary seawall type	
MM1_COND	TEXT	1	The observed condition of the primary seawall	**Seawall Condition** N – New M – Moderate P - Poor
MM1_BASE_ELEV	FLOAT	4	The base elevation of the primary seawall in meters relative to the HWM	
MM1_TOP_ELEV	FLOAT	4	The top elevation of the primary seawall in meters relative to the HWM	
MM1_HWM	FLOAT	4	The measure in meters from the primary seawall to the HWM	
MM2_S_X	LONG	4	UTM Coordinate (Easting) representing the start of the secondary seawall occurring in the shore unit	
MM2_S_Y	LONG	4	UTM Coordinate (Northing) representing the start of the secondary seawall occurring in the shore unit	
MM2_E_X	LONG	4	UTM Coordinate (Easting) representing the end of the secondary seawall occurring in the shore unit	
MM2_E_Y	LONG	4	UTM Coordinate (Northing) representing the end of the secondary seawall occurring in the shore unit	
MM2_TYPE	TEXT	2	The type of secondary seawall occurring in the shore unit	**Seawall Type**
MM2_LENGTH	FLOAT	4	The calculated length in meters of the secondary seawall type	
MM2_COND	TEXT	1	The observed condition of the secondary seawall	**Seawall Condition**
MM2_BASE_ELEV	FLOAT	4	The base elevation of the secondary seawall in meters relative to the HWM	

MM2_TOP_ELEV	FLOAT	4	The top elevation of the secondary seawall in meters relative to the HWM	
MM2_HWM	FLOAT	4	The measure in meters from the secondary seawall to the HWM	
MM3_S_X	LONG	4	UTM Coordinate (Easting) representing the start of the tertiary seawall occurring in the shore unit	
MM3_S_Y	LONG	4	UTM Coordinate (Northing) representing the start of the tertiary seawall occurring in the shore unit	
MM3_E_X	LONG	4	UTM Coordinate (Easting) representing the end of the tertiary seawall occurring in the shore unit	
MM3_E_Y	LONG	4	UTM Coordinate (Northing) representing the end of the tertiary seawall occurring in the shore unit	
MM3_TYPE	TEXT	2	The type of tertiary seawall occurring in the shore unit	**Seawall Type**
MM3_LENGTH	FLOAT	4	The calculated length in meters of the tertiary seawall type	
MM3_COND	TEXT	1	The observed condition of the tertiary seawall	**Seawall Condition**
MM3_BASE_ELEV	FLOAT	4	The base elevation of the tertiary seawall in meters relative to the HWM	
MM3_TOP_ELEV	FLOAT	4	The top elevation of the tertiary seawall in meters relative to the HWM	
MM3_HWM	FLOAT	4	The measure in meters from the tertiary seawall to the HWM	
PERM_STRUCT	FLOAT	4	A measure in meters from the shore unit to the nearest permanent man-made structure	
STRUCT_TYPE	TEXT	25	A description of the type of structure	
OTHER_MM1	TEXT	3	A code indicating other man-made features occurring in the shore unit	**Man-made Structures** PIL - Pilings WHA – Wharves/Floats PAT – Access Path STA - Stairs BOA – Boat Launch
OTHER_MM2	TEXT	3	A code indicating other man-made features occurring in the shore unit	**Man-made Structures**
POLL_FEAT1	TEXT	3	A code indicating polluting features occurring in the shore unit	**Polluting Features** STO – Storm Outfall SEO – Sewer Outfall

				CRE – Creosote Logs TOX – Toxic Waste
POLL_FEAT2	TEXT	3	A code indicating polluting features occurring in the shore unit	**Polluting Features**
REST_POT	TEXT	200	A recommendation of restoration activities that could be done to improve the ecological quality of the shore unit	
COMMENTS	TEXT	250	Additional notes and comments provided by note takers	
SHAPE_LENGTH	DOUBLE	8	A measure in meters of the total length of the shore unit	
ECO_ER	FLOAT	4	A number indicating the overall ecological condition of the shore unit	
MOD_MR	FLOAT	4	A number indicating the overall modification level of the shore unit	