Final Report: Identification and mapping of fish habitat within and around Prince Rupert Harbour

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Most especially, we'd like to thank volunteer Cei Sullivan for the all the work she put into this, both in the field and in subsequent data entry.

Introduction

The purpose of this report is to provide an overview of work undertaken by WWF-Canada's Prince Rupert office to ground-truth shoreline habitat data from a 1999 assessment based on aerial photos (Archipelago Marine Research Ltd., based on Borstad Assoc. Ltd's fly-over data, referred to here as the *Borstad data*).

Background

The foreshore area in and around Kaien Island has value for a variety of purposes: foreshore development for commercial or industrial purposes, recreational uses, municipal and regional district values, and, of course, the ecosystem values of habitat for fish and other species groups. Given this density and variety of values, a useful dataset to have available for broad range of users is a general classification of foreshore conditions.

In 1997, aerial mapping work of this area was undertaken by G.A. Borstad Associates using a Compact Airborne Spectographic Imager or CASI (Borstad Assoc. Ltd. 1998). In 1999, subsequent data collection was carried out by Archipelago Marine Research Ltd. using a combination of aerial photo referencing, video imagery, and limited ground truthing. 126 distinct shore units were delineated for the shoreline area including Kaeien Island, Ridley Island, Lelu Island, Flora Bank, Digby Island from Du Vernet Point to Fredrick Point, and the Tsimpsean Peninsula from Inverness Passage partially to Galloway Rapids.

The data from this research was included as a layer on the Prince Rupert Atlas of the Community Mapping Network website at: http://cmnbc.ca/atlas_gallery/prince-rupert-atlas. Similar foreshore mapping has occurred in other regions of B.C. including Nanaimo, Comox, and the Capital Regional District.

A variety of other habitat research – some in significantly higher degrees of detail – has taken place in the region through various initiatives, primarily in relation to environmental assessments for port expansion or other foreshore development. As well, data collection has taken place through the efforts of WWF-Canada's support for community-based monitoring programs (examples include Shorekeepers, NaGISA, and eelgrass mapping). A more complete record of the variety of habitat research undertaken in the area is detailed in the Statement of Work document that defined the work described in this report.

In summer of 2010, DFO Habitat staff approached WWF-Canada. Given that over 10 years had elapsed since the original Borstad work was undertaken, it was considered timely and useful to update the information, and additionally to ground-truth data to confirm the presence/absence of vegetation and substrate types, particularly as previous methodologies entailed a degree of uncertainty in identifying these vegetation types for certain shore units.

WWF-Canada's Prince Rupert office was conveniently situated in that we had both the ability and resource availability to undertake the work required. Additionally, the purpose of enhancing a general understanding of the values supported by the foreshore environment aligns well with

WWF-Canada's work around enabling capacity and resources to engage North Coast communities and stakeholders in a systematic approach to marine use planning.

Methodology

An initial field outing was organized by DFO Habitat staff (Prince Rupert), accompanied by Senior Habitat Inventory Biologist Brad Mason, who is also responsible for maintaining the Community Mapping Network website. During this outing, approach and methodology was discussed, which served as the initial basis to develop the Statement of Work.

Given the limited number of sufficiently low tides remaining in the summer (when peak vegetation cover is evident), it was agreed that the feasibility of completing all 126 shore units be reconsidered after an interim period.

It was agreed that for shoreline units that had retained the range of substrate and vegetation types between what was noted in 1999 and what was seen in 2010, confirmation of the category designation could be done by visual assessment only, with appropriate comments noted on data collection sheets. However, where significant differences in vegetation or substrate types existed between the 1999 and 2010 surveys, more detailed information should be collected; for example: transects from the low tide mark to the treeline and polygons or waypoints for important features (eelgrass beds, infrastructure development, etc.) which were not adequately noted in the 1999 data. For all shoreline units, photos were to be taken, including, where possible, a representation of the riparian area adjacent to the shoreline unit. Essentially, priority for more detailed data collection was to be given to shore units whose status was "borderline".

While it was recognized that there is a degree of subjectivity in the assessment of what constitutes "significant differences", the existing classifications and their associated descriptions still provided a suitable framework to guide the 2010 observations.

It was further agreed that the assessment was *descriptive*, *not prescriptive*. That is, what was being described was *habitat value*. The intent of this work was not to make recommendations based upon habitat value descriptions as to what kind of development should or should not occur in proximity of shoreline units. In other words, a shoreline unit classified as red should not be interpreted as prescription against development, and a unit classified as green should not be interpreted as a "green light" for development. Moreover, the decision-making processes around development options are the responsibility of the relevant government agencies. This work speaks to one data-set, among others, which may be integrated into such processes.

Of the original 126 shoreline units, 104 were physically ground-truthed by WWF staff. Staff were occasionally were joined by volunteers from the Northwest Community College Applied Coastal Ecology program, providing a valuable opportunity for students to relate the subject matter they deal with to a practical application. Additionally, marine transport was arranged to access a number of the shore units through DFO habitat, and through private charters.

For each shore unit, modified field data sheets were used, including a column containing data from the 1999 work, and a blank column for noting any changes. Appendix 1 provides an example of the data sheets used, followed by an explanation of each field. In addition, maps

containing data layers for groups of adjacent shore units were printed and used Appendix 2. These proved quite valuable when seeking to identify specific vegetation types or features that required verification. GPS units were used to verify field positions in relation to map data.

Transects were carried out on 24 shoreline units. For each transect line, a measuring tape was run from the low tide mark to the riparian zone, and data on the start and end points of vegetation and substrate type were noted.

Waypoints and/or polygons were taken for key habitat features, particularly in cases where these features differed from what was noted in the 1999 data. These features included: potential sites for intertidal clam beds, sedge or marsh grass patches, eelgrass beds, and kelp beds.

Back in the office, field data sheets were scanned and the relevant data were transferred to a GIS mapping table compatible with the interface required be the Community Mapping Network.

Shoreline units not physically ground-truthed include the units comprising Flora Bank and the southwest side of Lelu Island. The reason was that bad weather coincided with our last available low tide periods. The Flora Bank area was the subject of other research carried out in 2009 by a WWF eelgrass mapping project. This latter project[1] involved using of underwater camera tows along transects across Flora Bank to determine the extent and characteristics of intertidal and sub-tidal eelgrass beds.

Additionally, mapping of eelgrass beds has been carried out by WWF-staff and volunteers for some key areas around Kaien Island, since 2008. The data collected from this research are also included in the 2010 geodatabase.

WWF staff met with DFO Habitat staff on a periodic basis (approximately once a month) to discuss progress and any adjustments to the workplan.

Results:

Appendix 3 contains a table summarizing all data collected for the 126 shoreline units.

Spatial data reporting

The accompanying CD contains one geodatabase with spatial data in point, line and polygon formats. Large eelgrass beds and large patches of marsh grass are captured in polygon format. Smaller (>5m²) eelgrass, marsh grass, clam beds and kelp beds are captured in point form. Modification and erosion are also captured in point form. Sub-tidal kelp and eelgrass beds are captured by a shoreward line feature. Transects are also captured in line feature form data collected for transects are attached in an attribute table. The form of the 1999 shoreline sections has been maintained and new data collected from last summer's survey efforts have been added to the existing attribute table.

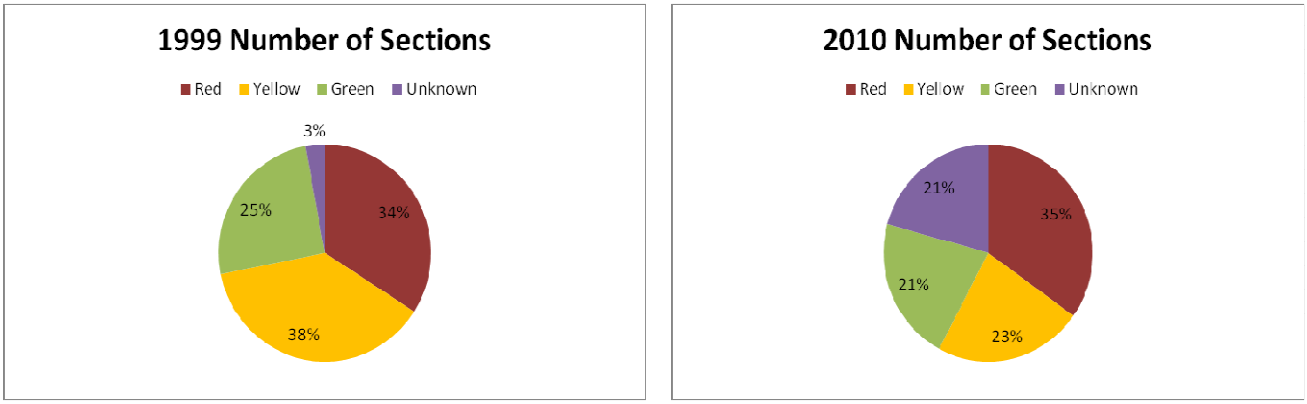
[1] http://www.oceanecology.ca/Flora_bank.htm

For non-spatial data the CD also contains individual folders for each shoreline segment. Within these folders are pictures for most of the sections and features mapped during the 2010 summer survey. Additionally, data sheets for each of the sections mapped are also to be found within the provided folders for each section. The 2010 shoreline sections have been hyperlinked to their respective folders but the photos are not currently geo-referenced.

Discussion

Of the 126 shoreline units, 104 were physically ground truthed. Of these, we recommend that 14 shore units be considered candidates for re-classification. Recommendations for 4 additional shore units – characterized as having as "insufficient data" in the original Borstad work – are also made.

Fig.1: Percentages of shore units, by color coding, 1999 / 2010



Figs. #2 and #3 show maps of the study area with the 1999 and 2010 classifications respectively. The 2010 map indicates whether or not shore units are candidates for reclassification.

Fig. 2: 1999 Map with color coding of foreshore units

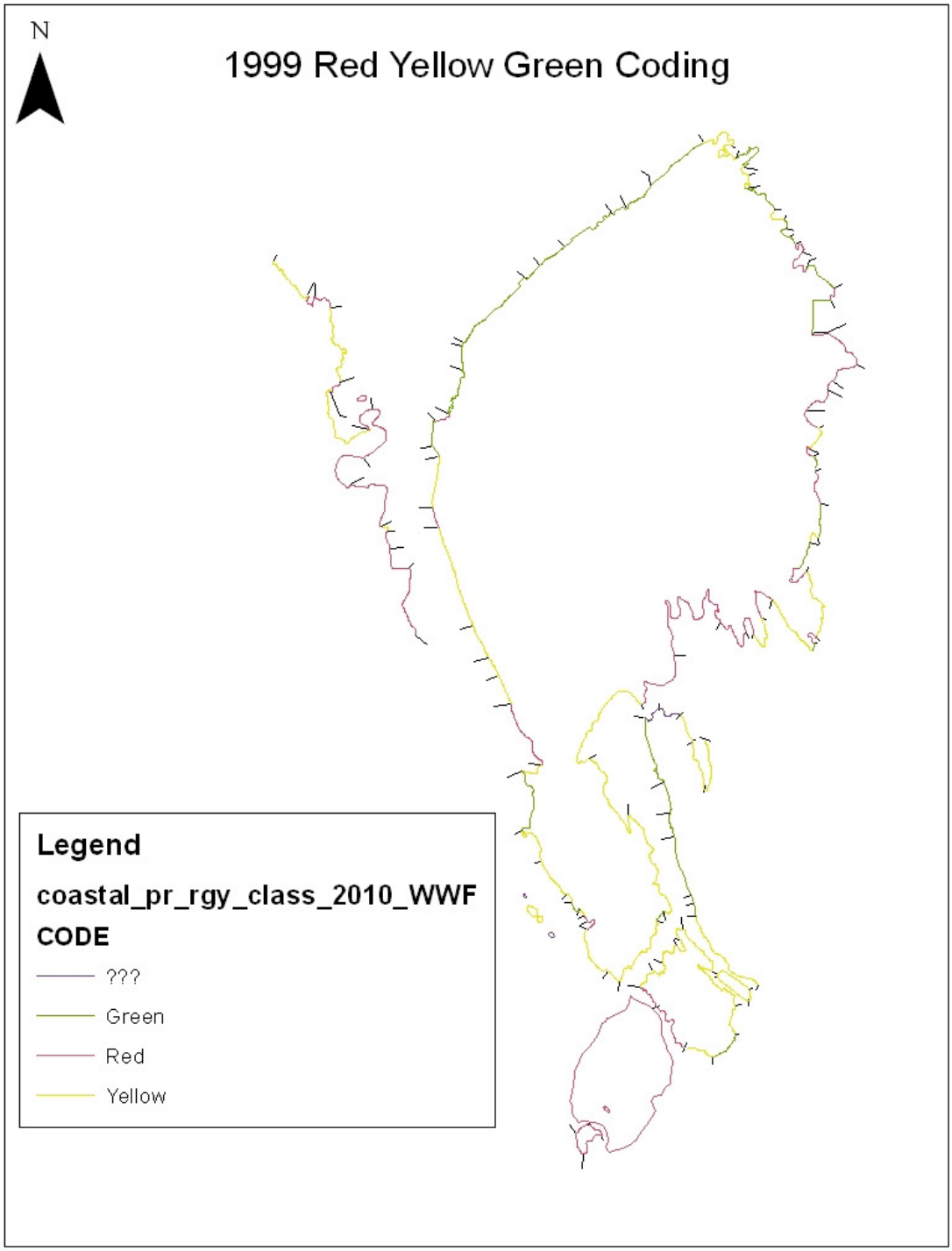
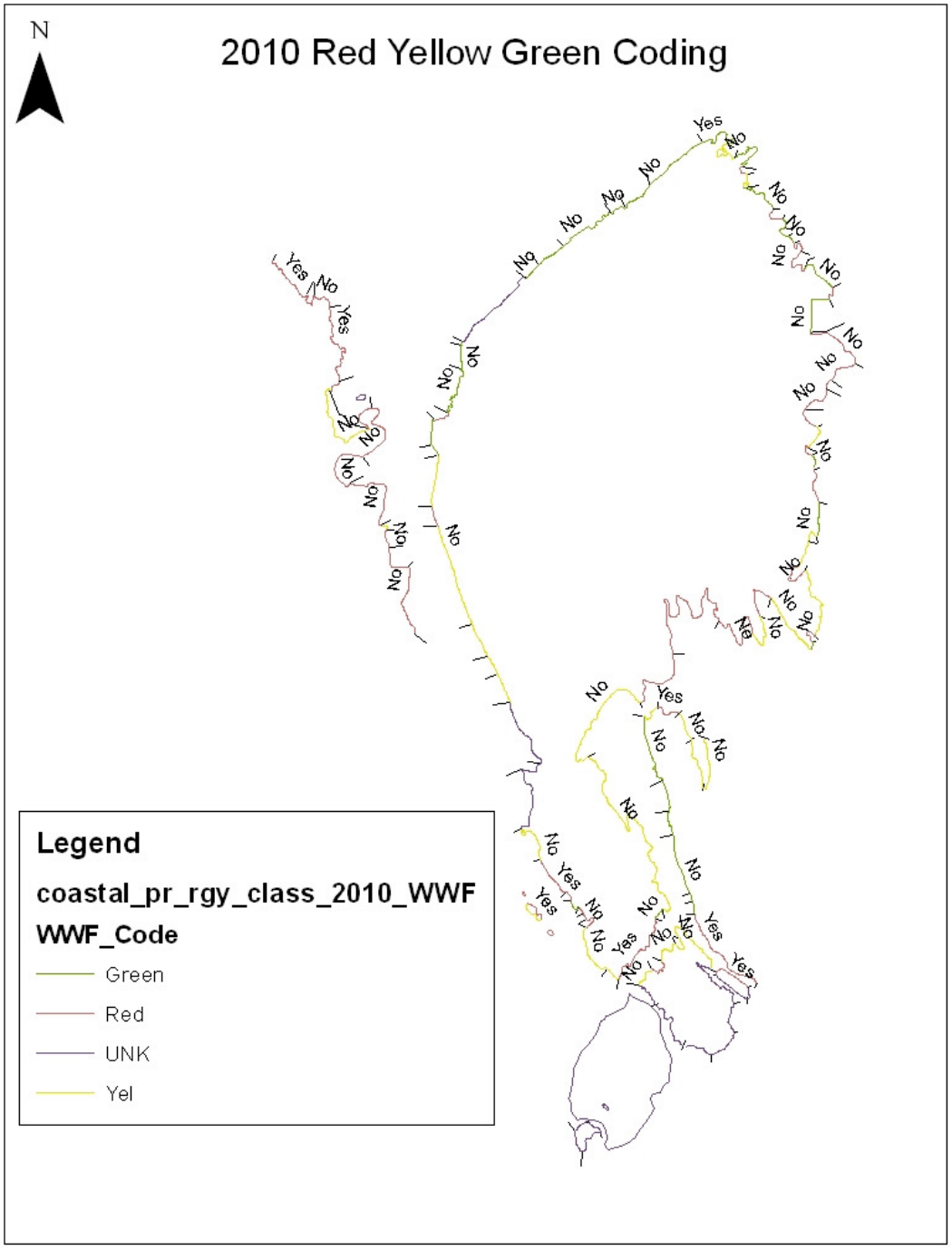


Fig. 3: 2010 Map with color coding of foreshore units



"YES" denotes shore unit where change in coding value is recommended.

Shore units recommended no change: 109

Shore units recommended a change from higher – lower habitat value: 1

Red – Yellow	**# of units 0**	**Shore units N/A**
Yellow – Green	**# of units 1**	**Shore units 32**

Shore units recommended a change from lower – higher habitat value: 13

Green – Yellow	**# of units 1**	**Shore units 51**
Yellow – Red	**# of units 12**	**Shore units 5,7,8,35,38,74,79,90,97,100,119,86**

Shore units recommended a change from Unidentified habitat value: 4

Yellow	**# of units 1**	**Shore units 125**
Red	**# of units 3**	**Shore units 120, 121, 124**

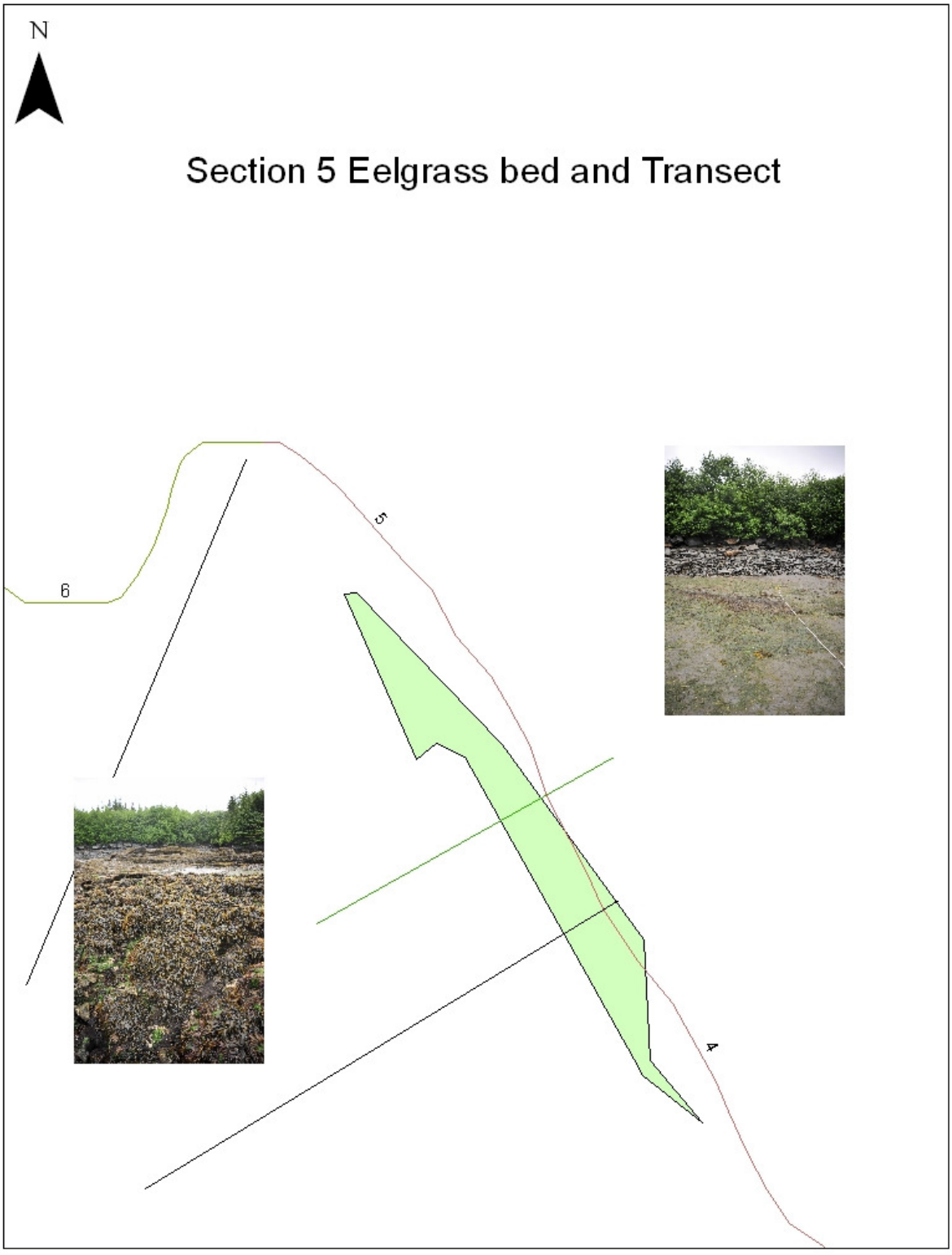
The following table summarizes all shore units where a change in coding is recommended, noting the colour code given in the original data, the code recommended through our field work, and the rationale for any changes.

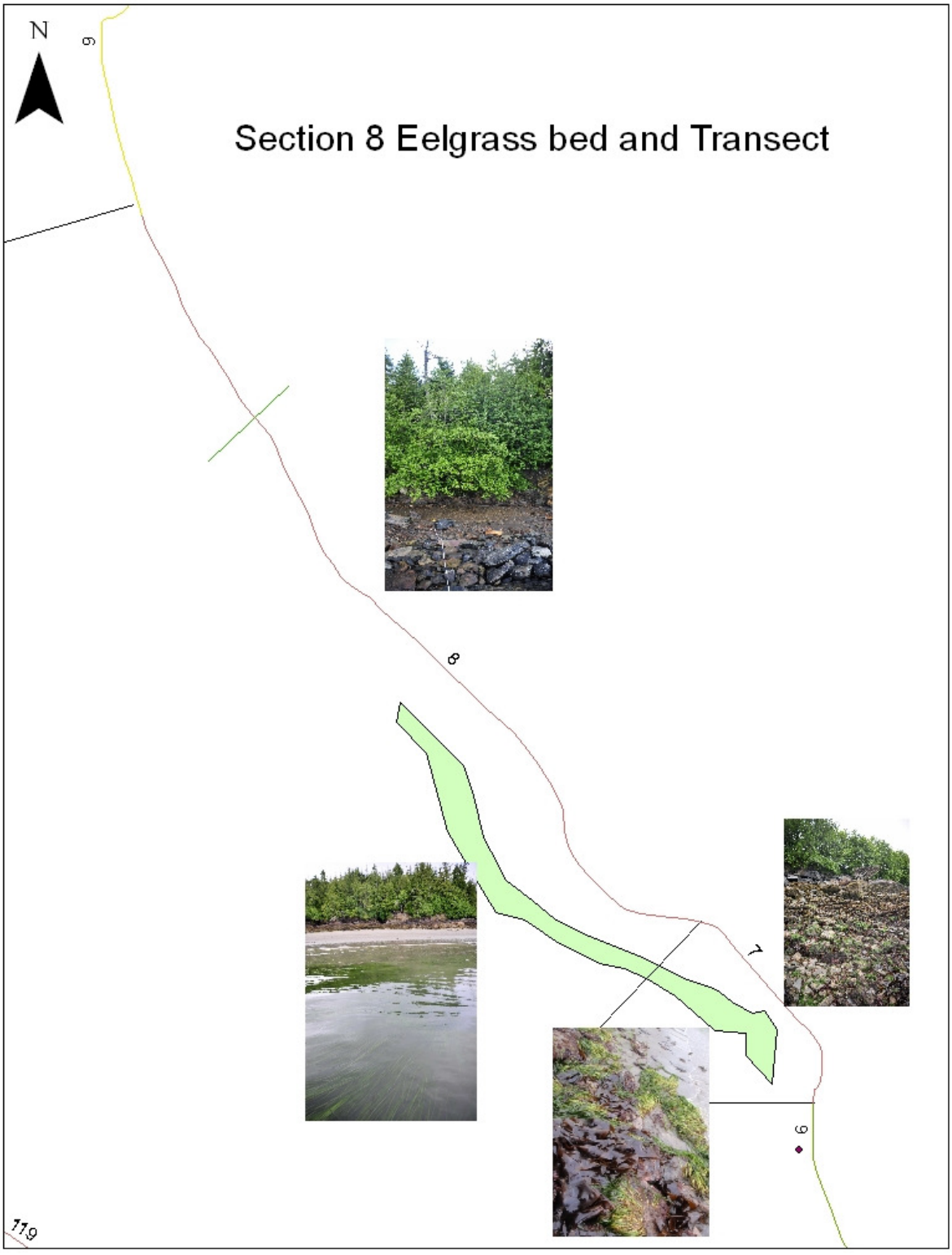
Unit #	1999 Code	2010 code	Notes (ex)
5	Y	R	Consider for upgrade. Development should conserve habitat complexity, verify presence of clam beds, presence of small intertidal eelgrass bed.
7	Y	R	Large subtidal eelgrass bed
8	Y	R	Large subtidal eelgrass bed
32	Y	G	No eelgrass found, kelp still there recent development
35	Y	R	Eelgrass extent mapped but clam bed needs mapping verification
38	Y	R	Some mussels present, eelgrass and clam beds, small signs of erosion
57	G	Y	This unit would normally be coded green but unless broken into two sections should be recoded because of value of bay
74	Y	R	Multiple eelgrass beds along this section, some clam and high complexity of shoreline
79	Y	R	Multiple small eelgrass beds along this section, some clam and high complexity of shoreline
86	Y	R	Eelgrass and Marsh grass part of largest mud flat in region
90	Y	R	Eelgrass and possible fish passage make high value area
97	Y	R	No need to subdivide should all be considered red
100	Y	R	Consider break at Toby Point as shoreline to North has clam and eelgrass beds

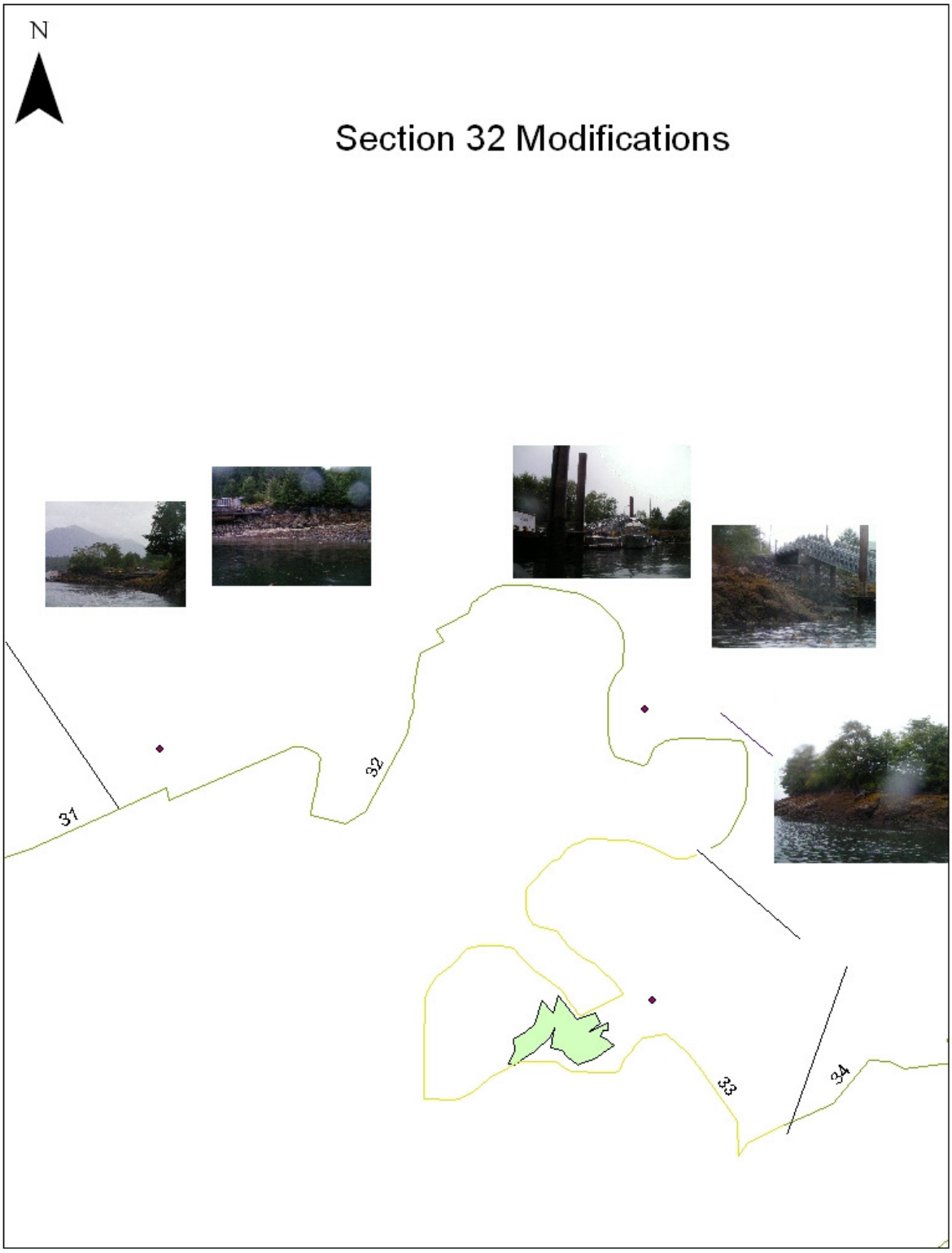
119	Y	R	Diverse rocky shore, a few patches of sand & cobble, presence of extensive eelgrass, fringing kelp
120	-	R	Red for whole island, very healthy and abundant kelp & brown algaes
121	-	R	Red for whole island, very healthy and abundant kelp & brown algaes
124	-	Y	High tidal flow area
125	-	Y	High tidal flow area

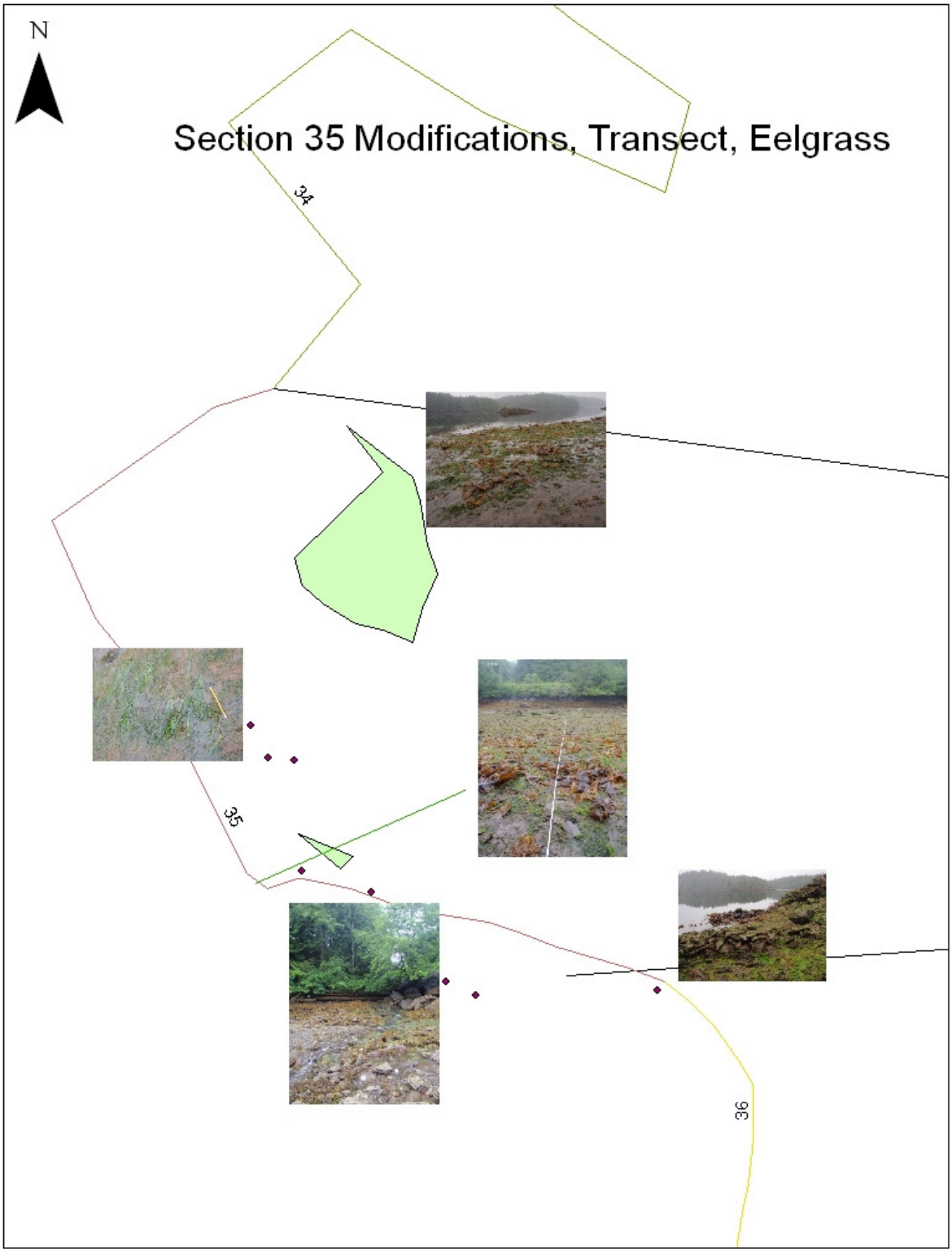
Justification for changes in shorezone ranking will require confirmation by qualified biologist. Where we have identified shorezone ranking changes, we consider these as *candidates warranting re-classification*.

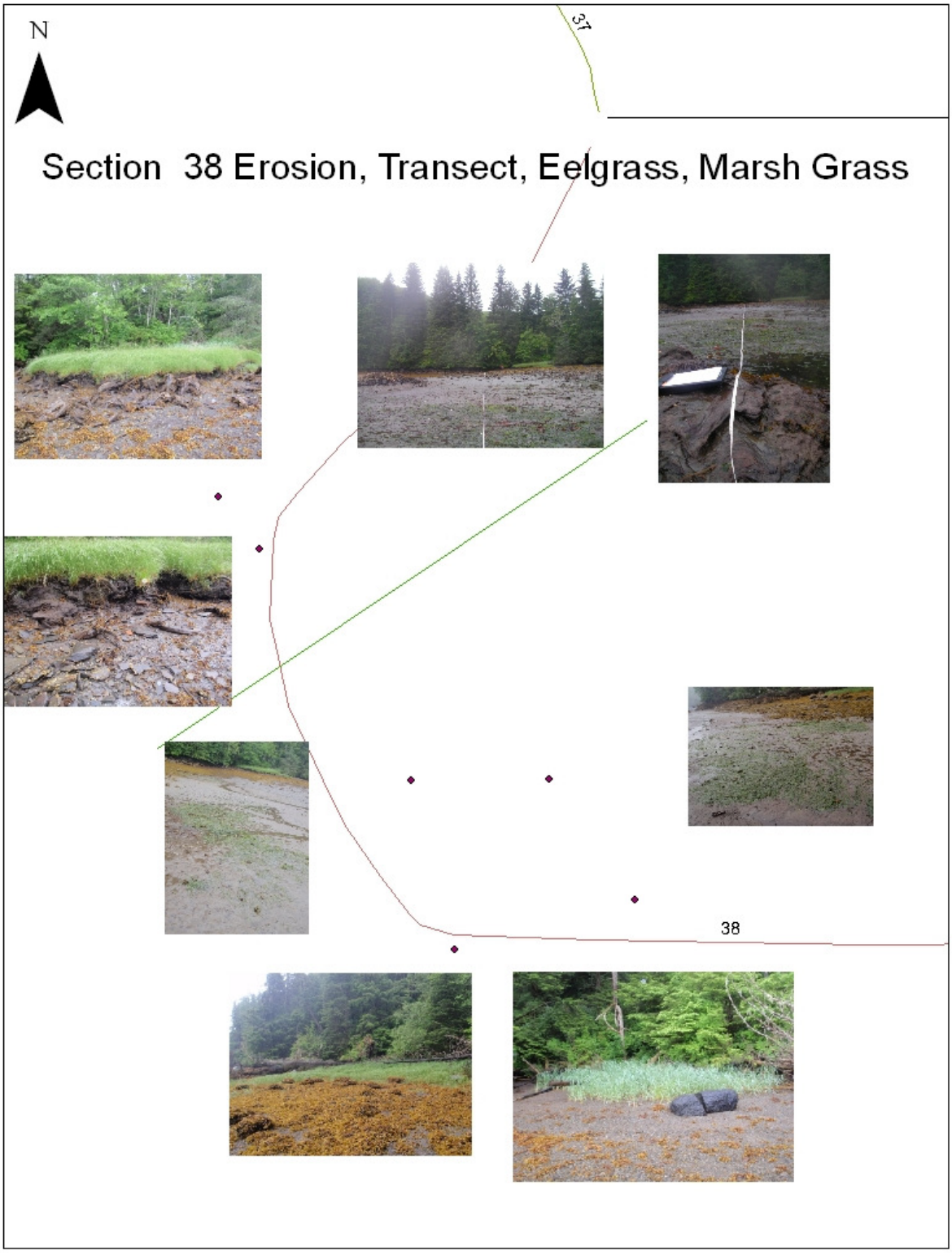
Maps of each these sections with photo inlay corresponding to notable habitat value features follow.

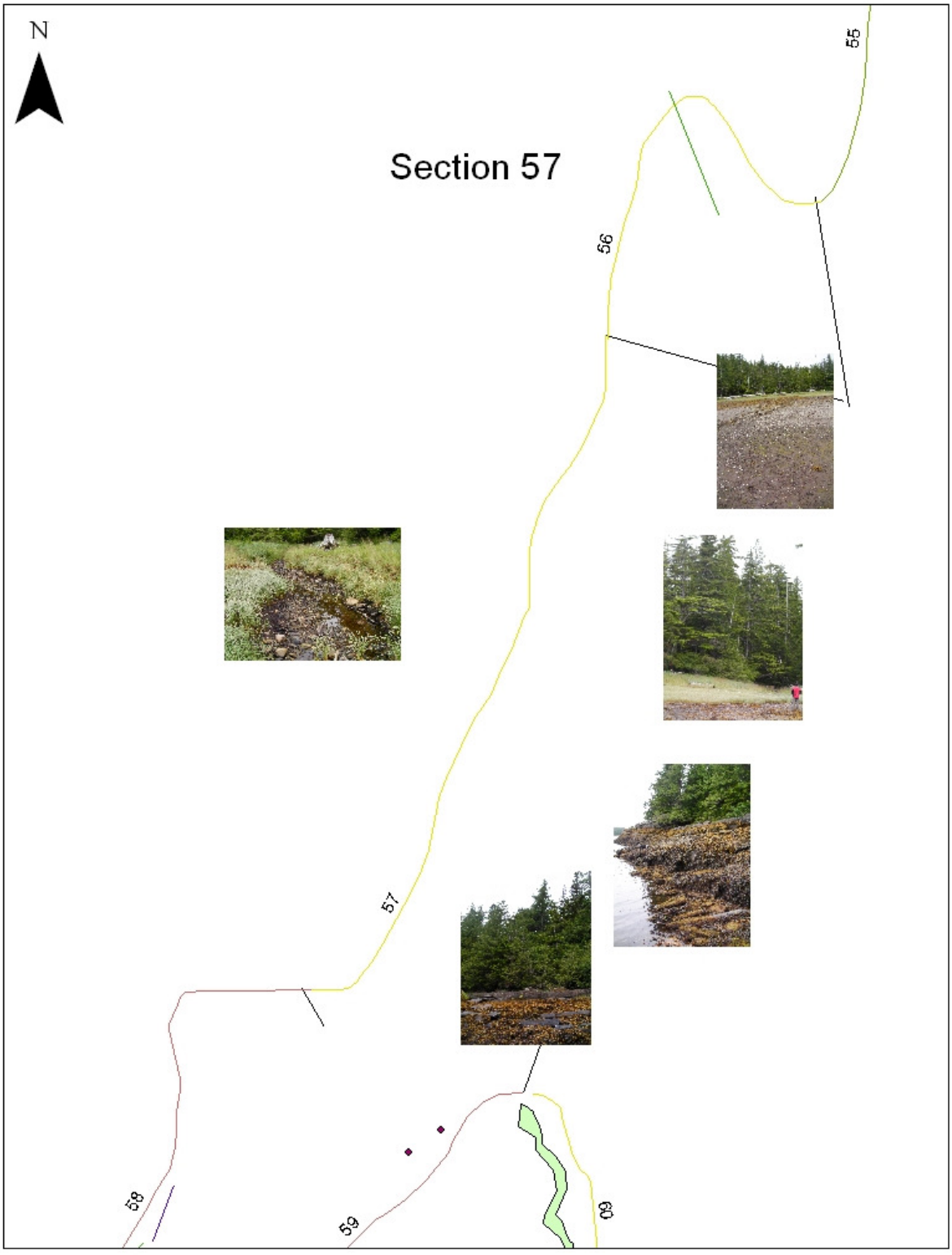

N
Section 5 Eelgrass bed and Transect
6
5
4

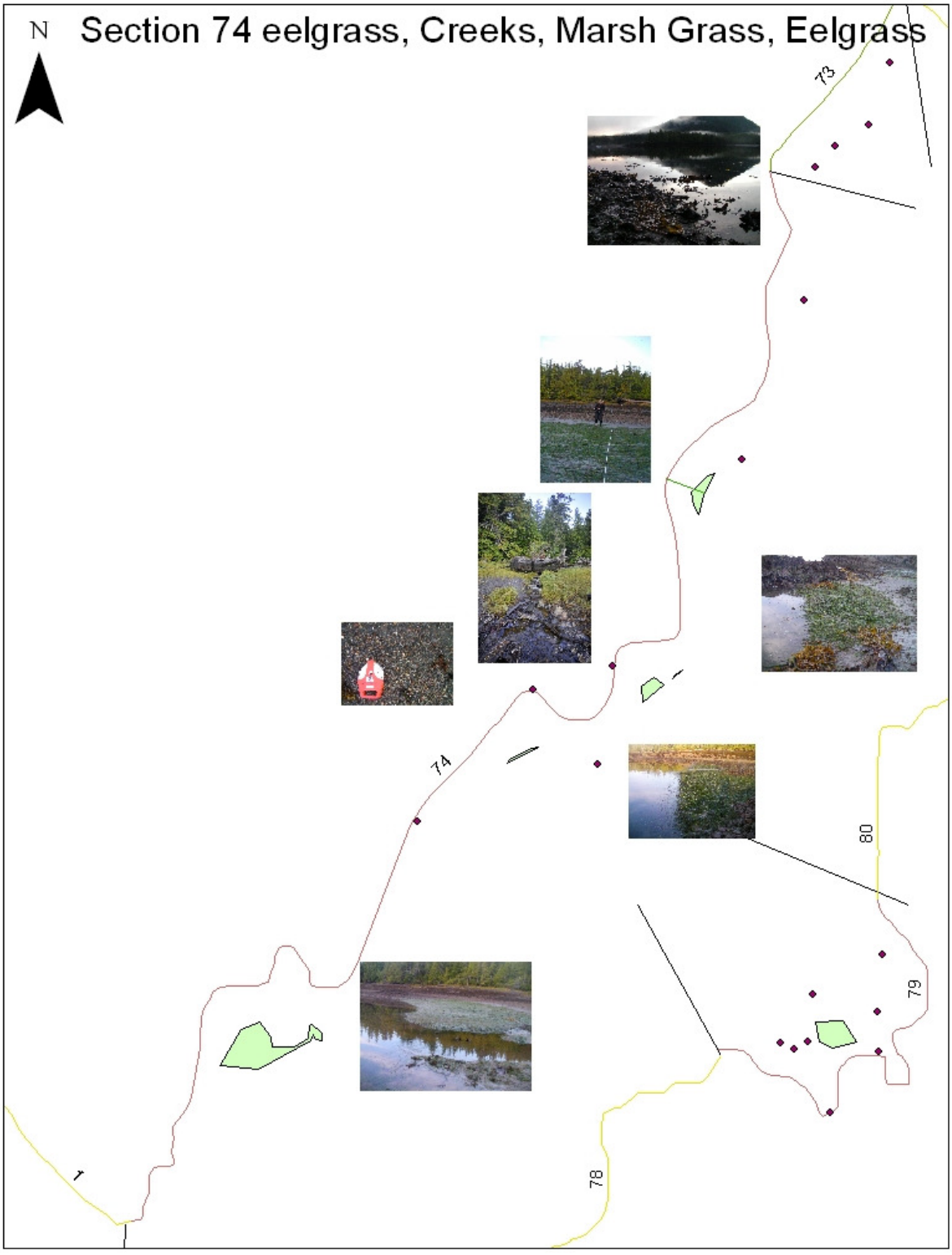

N
Section 8 Eelgrass bed and Transect
6
8
7
9
119

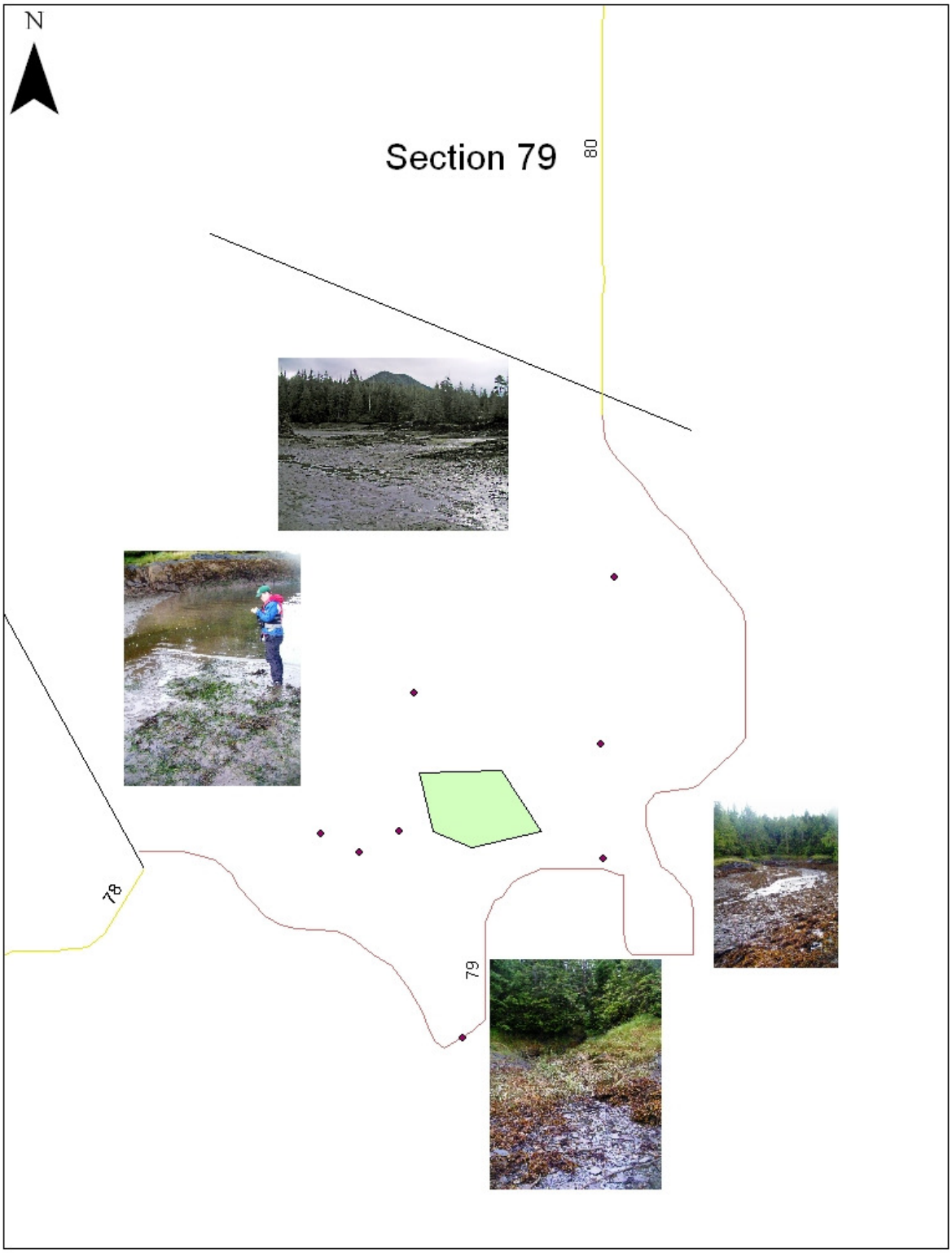

N
Section 32 Modifications
31
32
33
34

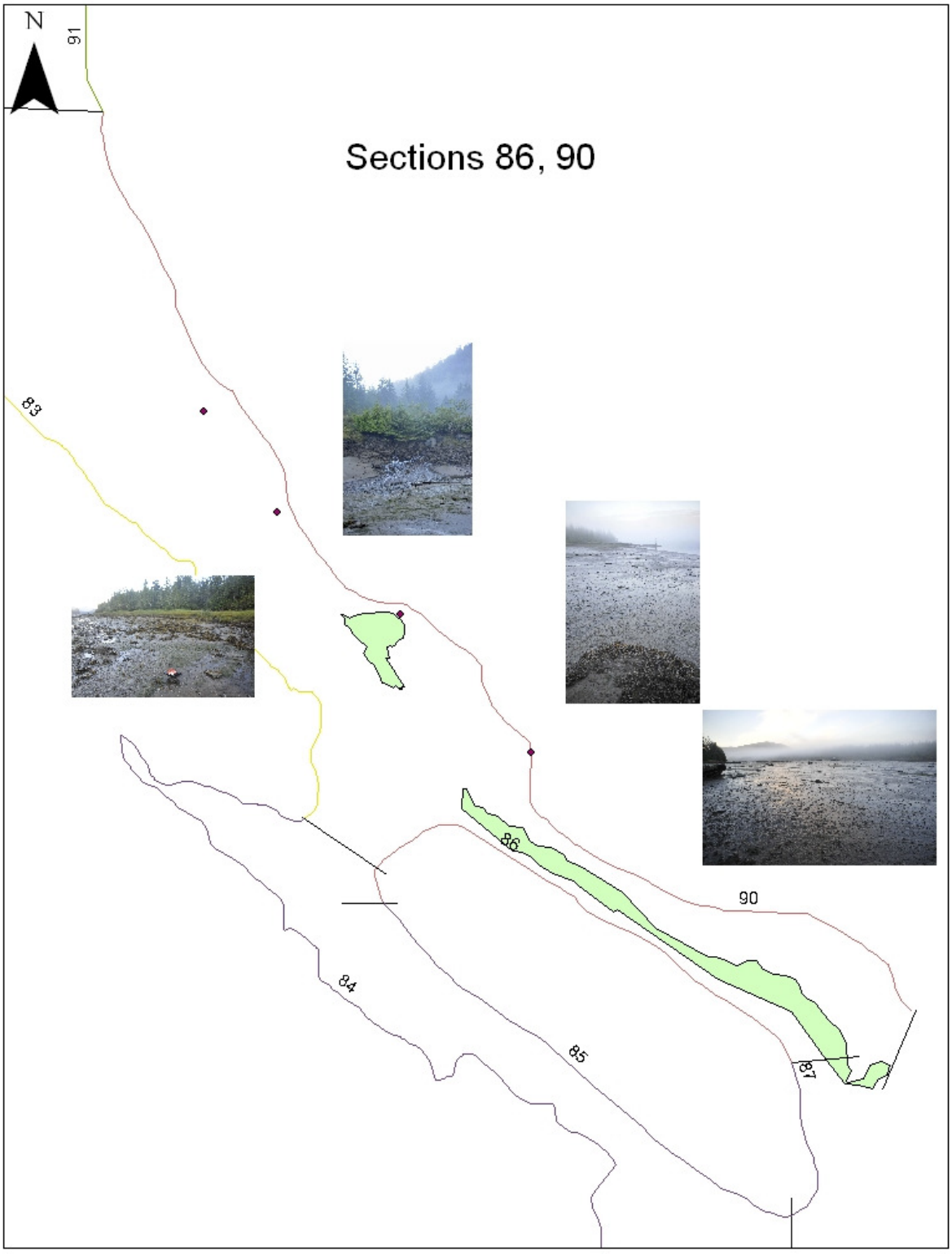

N
Section 35 Modifications, Transect, Eelgrass
34
35
36

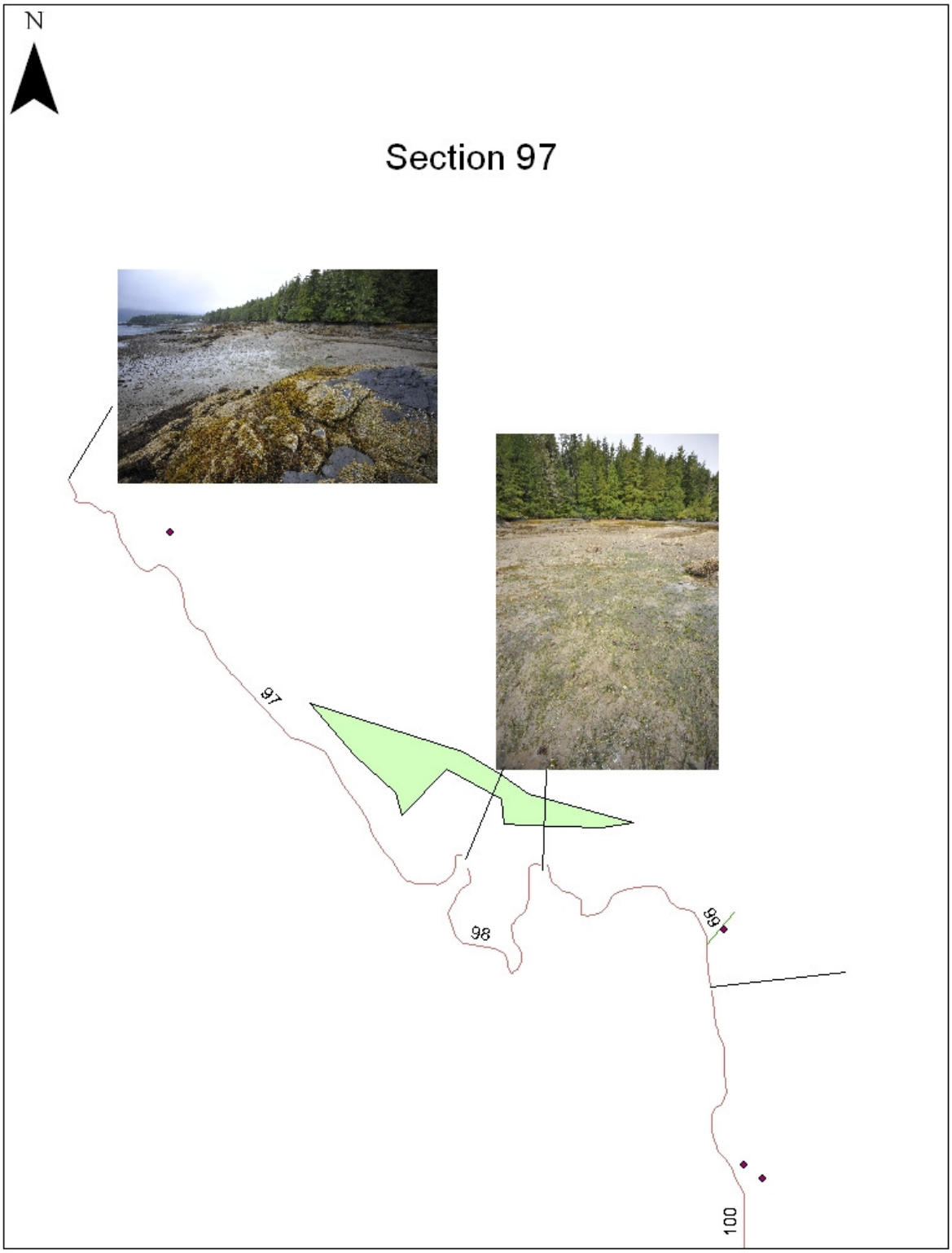

N
37
Section 38 Erosion, Transect, Eelgrass, Marsh Grass
38

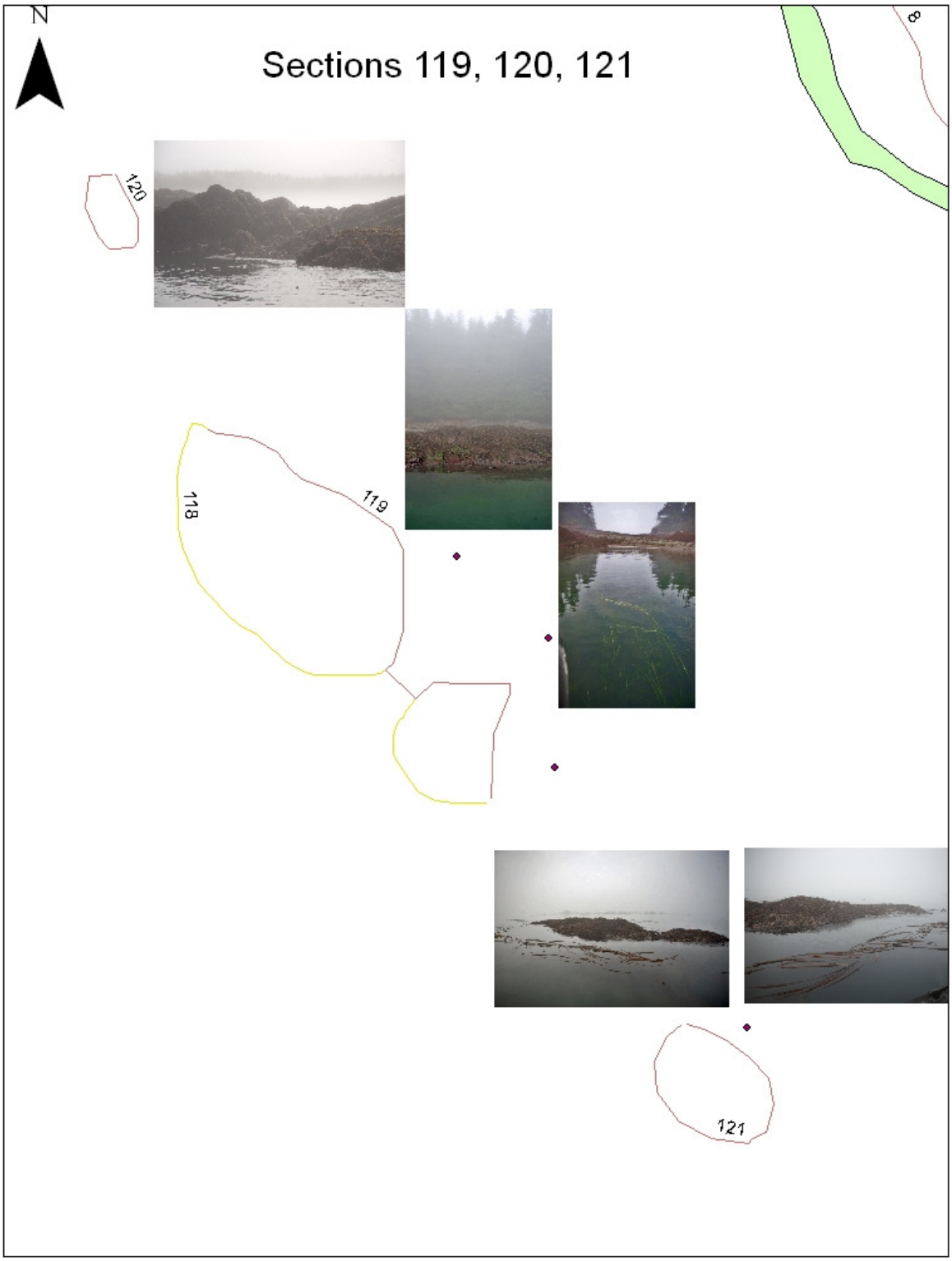

N
Section 57
55
56
57
58
59
60

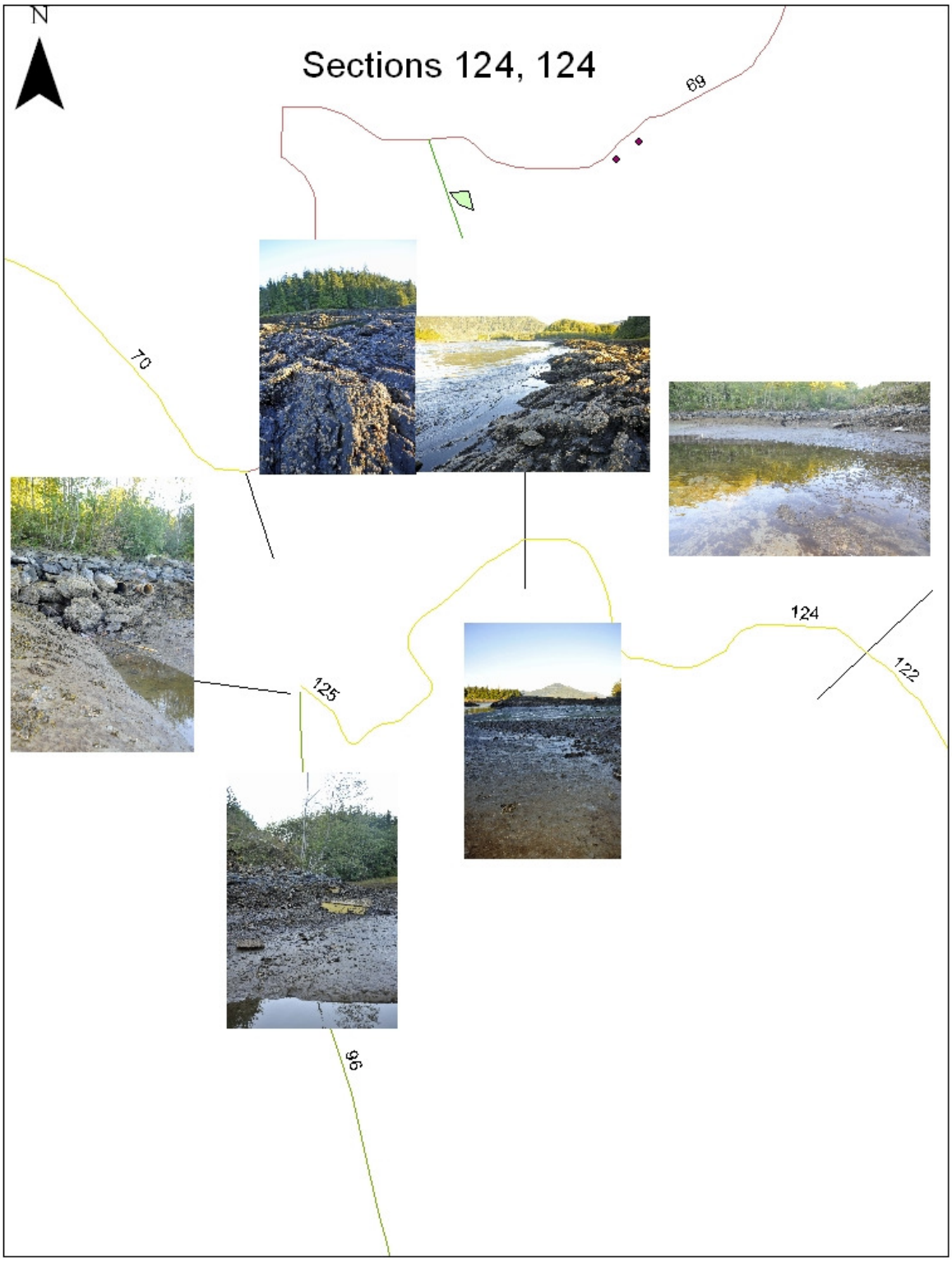

N
Section 74 eelgrass, Creeks, Marsh Grass, Eelgrass
73
74
80
79
78
1


N
Section 79
80
78
79


N
91
Sections 86, 90
83
86
90
84
85
87


N
Section 97
97
98
99
100


N
Sections 119, 120, 121
120
118
119
121


N
Sections 124, 124
69
70
124
122
125
96

In a number of cases our observations of shoreline unit habitat types differed from what was indicated in the 1999 data, but the overall ranking was the same. For example, certain shoreline units classified in 1999 as red (high value habitat) were still recommended to be classified as red by our 2010 survey, but with additional information regarding the presence or absence of certain habitat types. This applies to yellow- and green- classified units as well. These differences can be noted by comparing the field notes between the 2 survey sets. Otherwise no attempt was made to quantify the degree of change between observations for shore units.

Limitations / Observations

Waypoints have been used to identify possible surf smelt/sand lance spawning areas and intertidal clam beds. Verifying the presence of these species, however, is beyond the resource and time constraints of the project. With eelgrass, marsh grasses, anthropogenic features, and creeks, verification is possible.

Creation of polygons to capture kelp habitat was a challenge as it requires more extensive boat work. Approximately 20% of shoreline units featured some kelp. While presence of kelp beds can be noted, systematic shapefiles for each bed are not feasible within budget and time constraints.

It is recognized that without a standardized, indicator-based methodology, a degree of subjectivity is involved in the categorization of shoreline units in a project such as this. The downside of employing a more intensive methodology, of course, is the resource commitment (both field work and time) required to undertake a more rigorous study. As such, this work represents a "coarse grain" analysis of habitat values, which needs to be augmented by finer-grain analyses of specific foreshore areas, as the need arises. Such studies are generally undertaken within the scope of specific environmental assessment processes, although the data generated are generally bound within proprietary agreements between project actors. This work is intended to address a need for *publicly-accessible* data about the *general foreshore habitat values* in the region.

It is our hope that enhanced coordination / communication between decision-making bodies (Port Authority, DFO, Municipalities, First Nations) will enable this data to be used successfully within land and marine use planning efforts.

During the course of carrying out the fieldwork, we had ample time to consider a variety of factors that would add value to the data collected here. In concluding this report, we offer the following laundry list of items that may be considered as potential supplementary projects to complement this work and further enhance the understanding of foreshore habitat in and around Kaien Island:

1) The section of shoreline along Wainwright Basin between Wolf Creek and Galloway Rapids was not covered in either the 1999 or 2010 surveys. As this stretch is

contiguous with other sections and easily accessible, it would be a good candidate for inclusion in this dataset.

2) Other stretches that would make sense to add include: Digby Island from Delusion Bay to Lima Point, Kinahan Islands, the shoreline opposite Prince Rupert on the Tsimpsean Peninsula, from Shreiber Point to Pillsbury Cove. In part, these are adjacent to the current shore units, but moreover, they are the areas most likely to be affected by changes in marine health.
3) This data could equally be situated within the scope of the Skeena R. estuary and its influence, which would suggest extending the scope of inquiry South towards the estuary.
4) It has to be kept in mind that the entire region is a dynamic ecosystem. Issues of connectivity, tidal currents, and other oceanographic features need to be integrated into any understanding of habitat values.
5) Given the potential for further foreshore development in the region, there is a possibility of investing in restoration / remediation work in the area as part of the environmental assessment processes that would be undertaken. This data could be used to inform a priority plan for Prince Rupert / Port Edward, such that efforts could be leveraged in a more coordinated fashion and linked to the aspirations of relevant planning frameworks (for example, Official Community Plans, Harbour Land Use Plan, Marine Use Plans).

Appendix 1: Sample Data Sheet / Field Description

Meta Data			
Form Number: 2010-Sec-	125		
Location:	Zenard Rapids		
Date:	Sep 21 | 2010		
Primary Field Surveyor:	Mike Ambach.		
Crew:			
Start Time:	6:50 PM	End Time:	7:05 PM
Tide Height at Start:	3.07 m	Tide Height at Finish:	2.90m
Reference for Tide height:	CHTide 32		
Geographic or Projection:	Projection		
Specifics of Projection (UTM, Albers, Zones):	UTM Zone 9 / Nad 83		
Make and Model of GPS:	Garmin Etrex Vista		

Section Transacts			
Form Number:	Start Time:		End Time:
Tide Height:			
Photo Tags:			
Habitat Types in cm.			

	Rock	Cobble	Sand	Mud	Fucus	Ulva	Kelp	Mixed	Eelgrass	Marsh
S										
E										

Backshore Habitat Types Y/N								
Rock	Sand	Soil	Meadow	Deciduous	Coniferous	Mixed Forest	Shrub	Marsh or Pond

Total Length:
Comments:

C.S. Scan

PHY_UNIT	125	125
LENGTH	0	0
SENSITIVIT		Low
COMMENT		/
UNCOMMON		Yes
RU_COMMENT		reversing tidal rapids
COMPLEXITY		Medium
HC_COMMENT		Rock ramp, tidepools, fucus, brown algae, high tidal flow.
VALUE		Medium
COMMENT0		/
MODIFICATI		~~50% backshore fill~~ No.
COMMENT1		/
POTENT		No.
RP_COMMENT		/
CODE		Yellow
COMMENT2		high tidal flow area
HOTLINK	forms/rf125.gif	/
RECNO	116	/
PHOTO		Sec 125_DSC7258 Sec 125_DSC7259
		↳ kelp way point : Kelp_125

Description of Fields

Field name	Description	Allowable Values
PHY_UNIT	Shoreline Unit #	#
LENGTH	Length of shoreline unit	Numeric, calculated from GIS software
SENSITIVIT	Is the shoreline substrate/vegetation of a type that would be sensitive to physical disturbance	Y/N
COMMENT	Comment explaining a Y value in SENSITIVITY field	Text
UNCOMMON	Is the shoreline unit atypical for the region.	Y/N
RU_COMMENT	Comment explaining a Y value in UNCOMMON field	Text
COMPLEXITY	A relative estimate of the complexity of the vegetation and substrate type[2]	High, Med, Low
HC_COMMENT	Comment explaining a value in COMPLEXITY field	Text
VALUE	A relative estimate of the habitat value represented by the vegetation and substrate type	High, Med, Low
COMMENT0	Comment explaining a value in VALUE field	Text
MODIFICATION	Does the shoreline unit show evidence of any anthropogenic / other disturbance?	Y/N
COMMENT1	Comment explaining a value in MODIFICATION field	Text
POTENT[3]	Is the shoreline unit a potential site for restoration?	Y/N
RP_COMMENT	Comment explaining a value in POTENT field	Text
CODE	Recommended colour coding	Red / Yellow / Green
COMMENT2	Comment explaining a value in CODE field	Text
HOTLINK	Reference to data in Geo-database	Link
RECNO	Reconnaissance No. (?) – A hold-over from the 1999 survey. We were unsure of the function of this field, same as PHY_UNIT in 95% of cases.	Numerical, generally same as shoreline unit #
PHOTO	A new field from this fieldwork – references photos taken in the shoreline unit	Name of photo file

[2] We used descriptors following the example set by the 1999 survey. This range of descriptors differs from other shoreline assessment protocols (eg: Shorekeepers). A recommendation for the future is to harmonizing the methodology for this work with other existing methodologies, keeping in mind resource limitations.

[3] Where evidence of restoration efforts was still present from the 1999 survey, we carried these observations over. However, we did not add any recommendations to this field in the 2010 survey because the objective was to *characterize habitat values*, not to make recommendations as to priority areas for restoration. Such an assessment could still be informed by this data, but would equally require consideration of other factors beyond the scope of this survey.

Appendix 2: Sample field map