

APPENDIX E

Technical Data Report - Vegetation and Wetland Resources





PACIFIC NORTHWEST LNG

Technical Data Report - Vegetation and Wetland Resources

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EXECUTIVE SUMMARY

This technical data report (TDR) presents the baseline condition of vegetation resources to support the environmental assessment (EA) for the Pacific NorthWest LNG Project (the Project). Vegetation resources considered in this report include:

- Terrestrial and wetland ecosystems
- Communities and species at risk
- Old forest
- Non-native invasive species
- Traditional use plants.

These vegetation resources were documented using a combination of desktop and field studies conducted from August 2012 to July 2013. Desktop studies included a review of existing information about vegetation resources contained in publicly available data sources such as the BC Conservation Data Centre (BC CDC), the North Coast Terrestrial Ecosystem Mapping (TEM) Project, published literature, or other projects' files contained in provincial or federal EA registries. Traditional use plants were identified and documented within existing literature as plants important to the continued practice of treaty and asserted Aboriginal rights of the Metlakatla First Nation, Lax Kw'alaams First Nation, Gitxaala Nation, Kitselas First Nation, and Kitsumkalum First Nation.

Field studies were conducted within the local assessment area (LAA) to ground-truth the ecosystem mapping, as well as to survey for rare plant species, non-native invasive plant species, wetlands and traditional use plants. Terrestrial ecosystem mapping was completed at 1:1,000 scale for the LAA in accordance with provincial standards. This ecosystem mapping provides detailed geospatial data regarding the distribution and abundance of vegetation within the LAA.

Key results and findings include:

- The majority of the LAA (61%) is covered by wetlands (154.3 ha) while 39% of the LAA consists of uplands (98 ha). This pattern of abundance of ecosystems contrasts with the surrounding regional assessment area (RAA) where 34% of the area is covered by wetlands and 51% consists of uplands.
 - Bogs are the dominant wetland class in the LAA; 129 ha out of 154.3 ha of wetlands are bogs.
- The LAA contains 0.1 ha of one red-listed plant community (Coastal Western Hemlock Very Wet Hypermaritime [CWHvh2]/Ed01: tufted hairgrass–meadow barley estuarine meadow), and 27 ha of blue-listed plant communities (CWHvh2/04: western hemlock–Sitka spruce/lanky moss forest, CWHvh2/05: western red cedar–Sitka spruce/sword fern forest, CWHvh2/07: western red cedar–Sitka spruce/devil's club forest and CWHvh2/13 (Ws54): western red cedar–Sitka spruce/skunk cabbage swamp).
- Wetlands in the LAA provide multiple habitat functions including: foraging, nesting and staging habitat for migratory birds (including songbirds and shorebirds), nesting and foraging

habitat for federally-listed species at risk, and two of the wetland communities in the LAA are provincially-listed ecological communities at risk.

- Approximately 60% of the LAA is old forest. Old forest structural stages occur within both uplands and wetlands.
- Six tree species, ten shrub species and three herb species used by First Nations in the region were detected in the LAA.
- No plant species at risk or non-native invasive plant species were detected through surveys.

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ACRONYMS AND ABBREVIATIONS

BC	British Columbia
BC CDC	BC Conservation Data Centre
Bcfd	billion standard cubic feet per day
cm	centimetres
CWH	Coastal Western Hemlock
CWHvh2	Coastal Western Hemlock Very Wet Hypermaritime
EA	environmental assessment
ha	hectares
LAA	local assessment area
LNG	liquefied natural gas
m	metres
m ²	square metres
m ³	cubic metres
MOF	materials off-loading facility
MTPA	million tonnes per annum
NWWG	National Wetlands Working Group
PNW LNG	Pacific NorthWest LNG Limited Partnership
PRPA	Prince Rupert Port Authority
RAA	regional assessment area
RIC	Resources Inventory Committee
SARA	<i>Species at Risk Act</i>
TDR	technical data report
TEK	traditional ecological knowledge
TEM	terrestrial ecosystem mapping
the Policy	<i>The Federal Policy on Wetland Conservation</i>
the Project	Pacific NorthWest LNG Project

1 INTRODUCTION

Pacific NorthWest LNG Limited Partnership (PNW LNG) is proposing to construct and operate a liquefied natural gas (LNG) facility within the District of Port Edward, British Columbia (BC). Pacific NorthWest LNG Project (the Project) would be located on Lelu Island within the lands and waters under the jurisdiction of the Prince Rupert Port Authority (PRPA). The Project would convert natural gas from northeast BC into LNG for export to Pacific Rim markets in Asia.

At full build-out the facility would receive approximately 3.2 billion standard cubic feet per day (Bcfd), or 9.1×10^7 cubic metres (m^3) per day, of pipeline grade natural gas, and produce up to 19.2 million tonnes per annum (MTPA) of LNG. The natural gas would be transported to the Project via a new pipeline from northeast BC (to be owned and operated by TransCanada Pipelines Ltd.). The gas will be shipped to Asia using LNG carriers; the largest ship the marine terminal would be designed to accommodate is the Q-flex LNG carrier.

Components of the Project include: a natural gas reception system, gas pretreatment, three 6 MTPA natural gas liquefaction trains, three full containment 180,000 m^3 LNG storage tanks, a marine terminal with a trestle, trestle control room, two LNG carrier berths, a materials off-loading facility (MOF), an access road and bridge, and pipeline and utility connections (e.g., water and sewer).

This technical data report (TDR) presents the baseline condition of vegetation and wetland resources within the project assessment areas to support the environmental assessment (EA) of the project. vegetation resources considered in this report include terrestrial and wetland ecosystems, communities and species at risk, old forest, non-native invasive species, and traditional use plants. These vegetation resources were documented using a combination of desktop and field studies conducted from August 2012 to July 2013. The detailed methods and results of these baseline studies are described in this TDR.

1.1 Assessment Areas

The baseline conditions of vegetation and wetland resources are presented within two spatial extents, the regional assessment area (RAA) and the local assessment area (LAA).

- The RAA consists of the Kaien Landscape Unit, which is the Landscape Unit in which the Project is located (see Figure 1). The RAA includes approximately 50,000 ha and provides the landscape-scale context for the distribution and abundance of vegetation resources included for consideration within the Project's EA. The spatial extent of the RAA was selected based on the Landscape Unit which has been defined for the purposes of provincial land use planning in accordance with principles of ecosystem management (BC Ministry of Agriculture and Lands 2009). Land use plans for the Kaien Landscape Unit include specific objectives pertaining to vegetation resources that are pertinent to the assessment of potential effects (Ministry of Agriculture and Lands 2009).
- The LAA includes Lelu Island and portions of the adjacent mainland located within 150 m of project features (see Figure 1). The 150 m buffer is an area where potential changes to sunlight and soil properties may occur as a result of clearing of vegetation during development (Voller 1998).

Vegetation resources located below the mean high water mark of shorelines within either the RAA or LAA (i.e., eelgrass beds and other sub-tidal communities) are included within the TDR for marine resources.

1.2 Vegetation Setting

The Project is within the Pacific Maritime ecozone, which extends along the coast of BC northward to Alaska. The regional landscape is characterized by steep fjords and channels where mountains meet the ocean. The Project's LAA for vegetation is entirely within the Coastal Western Hemlock Very Wet Hypermaritime (CWHvh2) biogeoclimatic subzone (Pojar et al. 1991). The Coastal Western Hemlock (CWH) receives, on average, more precipitation than any other region in BC and experiences cool summers and mild winters. In general, the CWH is characterized by low to mid elevation forests dominated by western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), and western red cedar (*Thuja plicata*).

Lelu Island has gentle topography, with moderate slopes around the perimeter rising to an extensive central plateau area of about 40 m elevation. The sloping terrain around the perimeter of Lelu Island is dominated by moderately productive forests including western red cedar and western hemlock; however, most of Lelu Island is characterized by open woodland or shrub-dominated bogs. These bogs are mostly dominated by dwarfed shore pine (*Pinus contorta* var *contorta*) and yellow-cedar (*Chamaecyparis nootkatensis*).

The dominant surficial material on Lelu Island is organic (veneers and blankets of sphagnum/sedge peat or forest humus) occurring directly over bedrock. Occasionally there is a thin (approximately 10 cm) mantle of weathered rock overlying the bedrock. Metamorphic bedrock, consisting of schists, gneisses, and quartzite of amphibolite grade characterizes the island (Hutchison et al 1979). This is in contrast to much of CWHvh2, which is characterized by harder, relatively nutrient-poor igneous rocks.

Lelu Island is located within the North Coast Forest District and is federal crown land under the management jurisdiction of the PRPA.

2 METHODS

The scope of this study was based on consultation with government agencies, stakeholders, the public and the study team's professional judgment. The study included a review of relevant traditional ecological knowledge (TEK) reports, relevant literature, publically-available datasets, terrestrial ecosystem mapping (TEM) and field studies to characterize the baseline existing condition of vegetation within the assessment areas.

2.1 Definitions

The vegetation resources described in this report include:

- Ecological communities at risk
- Wetlands

- Old forests
- Plant species at risk
- Traditional-use plants.

This report also addresses presence of noxious weeds in the vicinity of the Project, following definitions from the *Weed Control Act* and associated Regulation (Government of BC 2013), as well as invasive plants identified as being of management concern according to the Northwest Invasive Plant Council.

Ecological communities at risk are those listed as Red or Blue by the BC Conservation Data Centre. Ecological communities at risk are a conservation priority because they may be either sensitive to disturbance and/or limited in distribution and extent within the province. The *Species at Risk Act* (SARA) currently does not track rare ecological communities at the federal level.

Wetlands are areas that are saturated long enough during the growing season to influence vegetation and soils, as indicated by hydric soils, hydrophytic vegetation, and biological activity adapted to the wet environment (MacKenzie and Moran 2004).

Old forests in the CWH biogeoclimatic zone are those stands with an average mature tree age of at least 250 years (BC MOFR BC MOE 2010).

Plant species at risk (i.e., rare plants) are defined as vascular plants species occurring:

- On the provincial Red or Blue lists developed and maintained by the British Columbia Conservation Data Centre (BC CDC 2013)
- On Schedule 1 of the Federal SARA (Government of Canada 2013).

Traditional-use plants are species identified and documented by the Metlakatla First Nation, Lax Kw'alaams First Nation, Gitxaala Nation, Kitselas First Nation, and Kitsumkalum First Nation as plants important to the continued practice of asserted Aboriginal rights.

2.2 Review of Existing Data

A review of current literature and references was conducted for the vegetation resources addressed in this TDR. In addition, provincially available datasets were reviewed for the general characteristics of the vegetation communities in a broad region around the Project.

2.2.1 Regional Vegetation

The vegetation data for the RAA were published as part of the North Coast TEM completed March 2013 (Ecora Resource Group Ltd. 2013). The North Coast TEM was developed consistent with standard methods for TEM at a scale of 1:45,000, and a Survey Intensity Level R, with an approximate 2% inspection rate by Ecora Resource Group Ltd. for the BC Ministry of Environment (Resources Inventory Committee [RIC] 1998; Ecora Resource Group Ltd. 2013). The average polygon size was approximately 20 ha, with a minimum polygon size of 0.5 ha (Ecora Resource Group Ltd. 2013).

Sixty distinct vegetated ecosystem units were identified within the RAA (see Table 1), including 25 forested units, 17 wetland units, and 18 alpine/sub-alpine units. Non-vegetated and anthropogenic units also occur and include features such as deep open water, talus slopes or bedrock outcrops (see Table 1). Despite the relatively complex landscape physiognomy within the Kaien Landscape Unit (see Figure 1), the RAA is dominated by four ecosystem units that comprise 55% of the total area:

- CWHvh2/01 western red cedar–western hemlock/salal at 23%
- CWHvh2/11 (Wb) western red cedar–yellow-cedar/goldthread at 12%
- CWHvh2/04 western hemlock–Sitka spruce/lanky moss at 11%
- CWHvh2/12 (Wb53) shore pine–yellow-cedar/sphagnum at 9% (see Table 1).

Approximately 51% of the landscape within the RAA is forested and 34% is wetland (see Table 1).

Structural stages provided below follow conventions in the *Field Manual for Describing Terrestrial Ecosystems* (BC MOFR BC MOE 2010), and a complete legend of map codes and ecosystem descriptions for the North Coast TEM data set is available from Ecora (Ecora Resource Group Ltd. 2013).

Table 1: Ecosystems within the RAA

Ecosystem Name	TEM Map Code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Forested Units					
Western hemlock–amabilis fir/blueberry	AB	CWHvm1/01	6-7	18.2	< 1
		CWHvm2/01	7	1.1	< 1
Amabilis fir–western red cedar/foamflower	AF	CWHvm1/05	7	0.8	< 1
Amabilis fir–western red cedar/salmonberry	AS	CWHvm1/07	7	1.2	< 1
Western hemlock–amabilis fir/deer fern	HD	CWHvm1/06	6-7	4.1	< 1
		CWHvm2/06	7	0.3	< 1
Western hemlock–Sitka spruce/lanky moss	HM	CWHvh2/04	3-7	5,427.5	11
Western red cedar–western hemlock/salal	HS	CWHvh2/01	3-7	11,311.5	23
Western hemlock–western red cedar/salal	HS	CWHvm1/03	7	4.6	< 1
Shore pine–yellow-cedar/rhacomitrium	LR	CWHvh2/02	3a-3b	6.9	< 1
Mountain hemlock–Sitka spruce/blueberry	MB	MHwh1/01	3a-7	2,362.8	5
		MHwh1p/01	3b	6.2	< 1
Mountain hemlock–amabilis fir/blueberry	MB	MHwhp/00	3b-7	445.1	1
Mountain hemlock–yellow-cedar/deer cabbage	MD	MHwh1/06	3b-7	498.6	1
		MHwh1p/06	7	3.8	< 1

Ecosystem Name	TEM Map Code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Mountain hemlock–yellow-cedar/mountain-heather	MM	MHwh1/02	3a-7	180.1	< 1
Sitka spruce-mountain hemlock/reedgrass	MR	MHwh1/03	3b-7	3.6	< 1
Western red cedar–Sitka spruce/sword fern	RF	CWHvh2/05	6-7	203.4	< 1
Western red cedar–yellow-cedar/salal	RS	CWHvh2/03	3-7	553.3	1
Western red cedar–Sitka spruce/devil's club	SD	CWHvh2/07	3-7	1,430.0	3
Western red cedar–Sitka spruce/foamflower	SF	CWHvh2/06	3-7	2,319.2	5
Sitka spruce/salal	SS	CWHvh2/14	7	0.7	< 1
Yellow-cedar–mountain hemlock/skunk cabbage	YC	MHwh1/09	3b-7	42.7	< 1
Yellow-cedar–mountain hemlock/hellebore	YH	MHwh1/07	3b-7	105.6	< 1
Yellow-cedar–mountain hemlock/twistedstalk	YT	MHwh1/05	6-7	395.1	1
Subtotal Forested Units				25,322.7	51
Wetland Units					
Bog Units					
Shore pine–yellow-cedar/sphagnum	LS	CWHvh2/12 (Wb53)	3b	4,434.1	9
Shore pine/sphagnum	LS	CWHvm1/13	3b	0.8	< 1
Bog wetland class	Wb	CWHvh2/00 MHwh1/00	2a-7	1,604.9	2
			2b-3a	721.1	1
Western red cedar–yellow-cedar/goldthread	YG	CWHvm1/12 CWHvh2/11 (Wb)	6-7	9.9	< 1
			3b-7	5,900.2	12
Mountain hemlock–yellow-cedar/goldthread	YG	MHwh1/04 MHwh1p/	3b-7	855.1	2
			7	8.8	< 1
Mountain hemlock–yellow-cedar/sphagnum	YS	MHwh1/08	3b-7	1,635.4	3
Fen Units					
Fen wetland class	Wf	CWHvh2/00	2b	53.9	< 1
Floodplain Units					
Low bench flood class	FI	CWHvh2/00	2a-3a	45.9	< 1
Marsh Units					
Marsh wetland class	Wm	CWHvh2/00 CWHvm1/00	2b	58.3	< 1
			2b	13.8	< 1
Shallow Open Water Units					
Shallow open water wetland class	Ww	CWHvh2/00	2c	1.7	< 1

Ecosystem Name	TEM Map Code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Swamp Units					
Western red cedar-Sitka spruce/skunk cabbage	RC	CWHvh2/13 (Ws54)	3-7	1,493.5	3
Swamp wetland class	Ws	CWHvh2/00	3b	3.8	< 1
Unclassified Wetland Units					
Alpine wetland class	Wa	MHwhp/00	2b	2.0	< 1
Subtotal Wetland Units				16,843.2	31
Alpine/Subalpine					
Alpine heath class	Ah	CMAunp/00 MHmmp/00 MHwhp/00	2d	3.0	< 1
			2d	3.6	< 1
			2d-3a	1,063.0	2
Alpine nivation (late snowbed) class	As	CMAunp/00 MHwhp/00	1	5.2	< 1
			1-2a	89.9	< 1
Lichen–mountain hemlock parkland	LM	MHwhp/00	3b-7	88.0	< 1
Mountain hemlock–mountain heather parkland	MH	MHwhp/00	3b-7	1,053.2	2
Subalpine Krummholz class	Sk	MHwhp/00	3b	14.5	< 1
Sedge parkland meadows	Ss	MHwhp/00	3a	207.8	< 1
Avalanche herb meadow class	Vh	MHwhp/00	2d	82.6	< 1
Avalanche shrub thicket class	Vs	CWHvh2/00 MHwh1/00 MHwhp/00	3a-3b	79.4	< 1
			3a-3b	131.4	< 1
			3a	55.8	< 1
Avalanche treed class	Vt	CWHvh2/00 MHwh1/00 MHwhp/00	3a-3b	115.1	< 1
			3b	278.8	1
			3b	106.2	< 1
Yellow cedar/rhacomitrium bluffs	YR	MHwh1/00 MHwhp/00	3b	19.8	< 1
			3a-3b	73.3	< 1
Subtotal Alpine/Subalpine Units				3,470.6	7
Non-vegetated Units					
Beachland class	Bb	CWHvh2/00 CWHvm1/00	1	0.7	< 1
				3.4	< 1
Blank	Blank	CWHvh2/	3a	18.6	< 1
Lake	LA	CWHvh2/00		1,359.6	3
Pond	PD	CWHvh2/00 MHwh1/00 MHwhp/00		283.1	< 1
				31.9	< 1
				33.8	< 1
Rock group cliff class	Rc	CWHvh2/00	1	35.5	< 1

Ecosystem Name	TEM Map Code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
		MHwh1/00	1	115.7	< 1
		MHwhp/00	1	316.3	1
River	RI	CWHvh2/00		21.2	< 1
Unknown	RM	CWHvh2/	3b	5.7	< 1
Rock outcrop class	Ro	CMAunp/00	1	15.4	< 1
		CWHvh2/00	1	14.5	< 1
		MHmmp/00	1	12.5	< 1
		MHwh1/00	1	21.7	< 1
		MHwhp/00	1	450.1	1
Talus class	Rt	MHwhp/00	1	27.3	< 1
Subtotal Non-vegetated Units				2,767.0	9
Anthropogenic Units					
Gravel pit	GP	CWHvh2/00		20.7	< 1
Rural	RW	CWHvh2/00	2-7	229.4	< 1
		CWHvm1/00	3a	4.8	< 1
Road surface	RZ	CWHvh2/00		87.1	< 1
Urban/suburban	UR	CWHvh2/00	2a-6	1,245.3	2
		CWHvm1/00		4.1	< 1
Subtotal Anthropogenic Units				1,591.4	3
Total				49,998.5	100

2.2.2 Ecosystems and Species at Risk

Prior to conducting project-specific rare plant and TEM surveys, the BC CDC Species and Ecosystem Explorer database was queried for potential ecological communities and species at risk that could occur in the North Coast Forest District and CWHvh2 subzone (BC CDC 2013). Schedule 1 of the federal SARA (Government of Canada 2013) was also consulted to identify any federally designated plant species that may occur near the Project. These searches produced a list of 6 Red-listed and 16 Blue-listed ecological communities (see Table 2), and 37 Red- or Blue-listed rare plant species (see Table 3) with potential to occur near the Project. The latter category comprises 20 vascular species, 16 bryophyte species, and 1 species of lichen. Oldgrowth specklebelly (*Pseudocypbellaria rainierensis*) was the only SARA-listed plant species with potential to occur in the area. This information was used to focus field surveys targeting ecological communities and plant species at risk.

The BC CDC Internet Mapping Service was also consulted to identify any known occurrences of ecological communities at risk or plant species at risk within the project LAA; no occurrences were found according to this source (BC CDC 2013).

Table 2: Ecological Communities at Risk with Potential to Occur in the RAA

Site Series Code	Scientific Name	English Name	BC List	Global Status
CWH/Ed01	<i>Deschampsia cespitosa</i> ssp. <i>beringensis</i> – <i>Hordeum brachyantherum</i>	Tufted hairgrass–meadow barley estuarine meadow	Blue	G3
CWH/Ed02	<i>Deschampsia cespitosa</i> ssp. <i>beringensis</i> – <i>Symphotrichum subspicatum</i>	Tufted hairgrass–Douglas' aster estuarine meadow	Blue	G3
CWH/Em01	<i>Ruppia maritima</i>	Beaked ditch-grass estuarine marsh	Red	GNR
CWH/Em04	<i>Plantago maritima</i> – <i>Puccinellia pumila</i>	Sea plantain–dwarf alkaligrass estuarine marsh	Red	G2
CWH/Em05	<i>Carex lyngbyei</i>	Lyngbye's sedge estuarine marsh	Blue	GNR
CWHvh2	<i>Glyceria borealis</i> fen	Northern mannagrass fen	Blue	G4
CWHvh2/04	<i>Tsuga heterophylla</i> – <i>Picea sitchensis</i> / <i>Rhytidiadelphus loreus</i>	Western hemlock–Sitka spruce/lanky moss	Blue	GNR
CWHvh2/05	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Polystichum munitum</i>	Western red cedar–Sitka spruce/sword fern	Blue	G3?
CWHvh2/07	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Oplopanax horridus</i>	Western red cedar–Sitka spruce/devil's club	Blue	GNR
CWHvh2/08	<i>Picea sitchensis</i> / <i>Maianthemum dilatatum</i>	Sitka spruce/false lily-of-the-valley	Red	G2G3
CWHvh2/09	<i>Picea sitchensis</i> / <i>Trisetum canescens</i>	Sitka spruce/tall trisetum	Red	G1G2
CWHvh2/10	<i>Alnus rubra</i> / <i>Rubus spectabilis</i> / <i>Equisetum arvense</i>	Red alder/salmonberry/common horsetail	Blue	GNR
CWHvh2/13	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	Western red cedar–Sitka spruce/skunk cabbage	Blue	G3?
CWHvh2/14	<i>Picea sitchensis</i> / <i>Gaultheria shallon</i>	Sitka spruce/salal	Blue	GNR
CWHvh2/15	<i>Picea sitchensis</i> / <i>Eurhynchium oregonum</i>	Sitka spruce/Oregon beaked-moss	Blue	GNR
CWHvh2/16	<i>Picea sitchensis</i> / <i>Calamagrostis nutkaensis</i>	Sitka spruce/Pacific reedgrass	Blue	G3G5
CWHvh2/17	<i>Picea sitchensis</i> / <i>Polystichum munitum</i>	Sitka spruce/sword fern	Blue	G3
CWHvh2/18	<i>Picea sitchensis</i> / <i>Carex obnupta</i>	Sitka spruce/slough sedge	Blue	G2G3
CWHvh2/19	<i>Picea sitchensis</i> / <i>Malus fusca</i>	Sitka spruce/Pacific crab apple	Blue	GNR
CWHvh2/Wf51	<i>Carex sitchensis</i> / <i>Sphagnum</i> spp.	Sitka sedge/peat-mosses	Red	G2
CWHvh2/Wf52	<i>Myrica gale</i> / <i>Carex sitchensis</i>	Sweet gale/Sitka sedge	Red	G3
CWHvh2/Wm50	<i>Carex sitchensis</i> – <i>Oenanthe sarmentosa</i>	Sitka sedge–Pacific water-parsley	Blue	G3

Table 3: Plant Species of Conservation Concern with Potential to Occur in the RAA

Family	Scientific Name	English Name	Global Status	BC List	SARA-listed
Vascular Plants					
<i>Asteraceae</i>	<i>Arctanthemum arcticum</i> ssp. <i>arcticum</i>	Arctic daisy	G5TNR	Red	
<i>Asteraceae</i>	<i>Arnica chamissonis</i> ssp. <i>incana</i>	Meadow arnica	G5T3T5	Blue	
<i>Callitrichaceae</i>	<i>Callitriche heterophylla</i> var.	Two-edged water-	G5T5	Blue	

Family	Scientific Name	English Name	Global Status	BC List	SARA-listed
	<i>heterophylla</i>	starwort			
Cornaceae	<i>Cornus suecica</i>	Dwarf bog bunchberry	G5	Blue	
Cyperaceae	<i>Carex glareosa</i> var. <i>amphigena</i>	Lesser saltmarsh sedge	G4G5T3T5	Blue	
Cyperaceae	<i>Carex gmelinii</i>	Gmelin's sedge	G4G5	Blue	
Cyperaceae	<i>Eleocharis kamtschatica</i>	Kamchatka spike-rush	G4	Blue	
Dryopteridaceae	<i>Polystichum setigerum</i>	Alaska holly fern	G3	Blue	
Hippuridaceae	<i>Hippuris tetraphylla</i>	Four-leaved mare's-tail	G5	Blue	
Juncaceae	<i>Juncus arcticus</i> ssp. <i>alaskanus</i>	Arctic rush	G5T4T5	Blue	
Juncaceae	<i>Juncus stygius</i>	Bog rush	G5	Blue	
Juncaginaceae	<i>Lilaea scilloides</i>	Flowering quillwort	G5?	Blue	
Juncaginaceae	<i>Triglochin concinna</i>	Graceful arrow-grass	G5	Blue	
Orchidaceae	<i>Malaxis brachypoda</i>	White adder's-mouth orchid	G4Q	Red	
Orchidaceae	<i>Malaxis paludosa</i>	Bog adder's-mouth orchid	G4	Blue	
Orchidaceae	<i>Piperia candida</i>	White-lip Rein orchid	G3	Red	
Polemoniaceae	<i>Polemonium boreale</i>	Northern Jacob's-ladder	G5	Blue	
Ranunculaceae	<i>Caltha palustris</i> var. <i>radicans</i>	Yellow marsh-marigold	G5TNR	Red	
Rosaceae	<i>Sanguisorba menziesii</i>	Menzies' burnet	G3G4	Blue	
Saxifragaceae	<i>Micranthes nelsoniana</i> var. <i>carlottae</i>	Dotted saxifrage	G5T3?	Blue	
Bryophytes					
Brachytheciaceae	<i>Bryhnia hultenii</i>		G4	Red	
Dicranaceae	<i>Dicranodontium asperulum</i>		G4G5	Blue	
Pottiaceae	<i>Didymodon leskeoides</i>		G2G4	Red	
Buxbaumiaceae	<i>Diphyscium foliosum</i>		G5	Blue	
Entodontaceae	<i>Entodon concinnus</i>		G4G5	Blue	
Amblystegiaceae	<i>Hageniella micans</i>		G3G5	Blue	
Hypnaceae	<i>Isopterygiopsis muelleriana</i>		G5	Red	
Bartramiaceae	<i>Philonotis yezoana</i>		G2G3	Blue	
Pleuroziopsidaceae	<i>Pleuroziopsis ruthenica</i>		G3	Blue	
Bryaceae	<i>Pohlia columbica</i>		G3G5	Blue	
Bryaceae	<i>Pohlia sphagnicola</i>		G2G3	Blue	

Family	Scientific Name	English Name	Global Status	BC List	SARA-listed
<i>Sphagnaceae</i>	<i>Sphagnum aongstroemii</i>		G3G4	Blue	
<i>Sphagnaceae</i>	<i>Sphagnum contortum</i>		G5	Blue	
<i>Sphagnaceae</i>	<i>Sphagnum obtusum</i>		G3G5	Red	
<i>Sphagnaceae</i>	<i>Sphagnum subobesum</i>		G3G5	Blue	
<i>Tetraphidaceae</i>	<i>Tetradontium brownianum</i>		G3G4	Blue	
Lichens					
<i>Lobariaceae</i>	<i>Pseudocyphellaria rainierensis</i>	Oldgrowth specklebelly	G3G4	Blue	Yes

2.2.3 Wetlands

The Canadian Wetland Classification System (National Wetlands Working Group [NWWG] 1997) recognizes five wetland classes in Canada:

- Bogs are organic wetlands formed of Sphagnum peat, which generally receive their water from precipitation and are virtually unaffected by runoff waters or groundwater.
- Fens are organic wetlands formed of decomposed sedge or brown moss peat, which are characterized by a fluctuating water table due to connection with groundwater and surface water movement.
- Swamps are treed or tall shrubby wetlands that generally occur on mineral soils but can have an accumulation of well decomposed wood-rich peat, and are influenced by groundwater.
- Marshes are wetlands dominated by graminoid vegetation including rushes, reeds, grasses and sedges, which occur on mineral soils and have shallow surface water that fluctuates dramatically
- Shallow open water wetlands are transitions between the other four wetland classes and permanent, deep water bodies (i.e., lakes), characterized by standing or flowing water less than 2 m deep in mid-summer.

The TEM for the RAA indicates that approximately 34% of the area is wetland (see Table 1). There are several types of wetlands found within the RAA, but the most common are bog, which comprise almost the entire wetland area (see Table 1).

2.2.4 Old Forest

Old forests are in a climax seral stage characterized by high levels of structural complexity with canopy gaps; trees of various sizes, species, and age class; and abundant coarse woody debris on the forest floor or as snags. The age at which forests are classified as old is based on the natural disturbance regime of the region, which is based on the average return interval of major stand-initiating disturbances (mainly wildfire and defoliating insects). Due to infrequent major disturbance, old forests in this region have a time-since-disturbance of greater than 250 years (BC MOFR BC MOE 2010).

2.2.5 Weeds

Provincially noxious weeds listed in the *Weed Control Act* and associated Regulation (Government of BC 2011) are listed below (see Table 4).

Table 4: Noxious Weeds and Invasive Species

Scientific Name	Common Name	Provincially Noxious ^A	NWIPC ^B
<i>Abutilon theophrasti</i>	Velvetleaf	Yes	
<i>Aegilops cylindrica</i>	Jointed goatgrass	Yes	
<i>Aegopodium podagraria</i>	Bishop's Goutweed		Yes
<i>Arctium minus</i>	Common burdock		Yes
<i>Aruncus dioicus</i>	Goat's-beard		Yes
<i>Artemisia absinthium</i>	Wormwood/Absinthium		Yes
<i>Berteroa incana</i>	Hoary alyssum		Yes
<i>Cardamine hirsuta</i>	Hairy bittercress		Yes
<i>Carduus acanthoides</i>	Plumeless thistle		Yes
<i>Carduus nutans</i>	Nodding thistle		Yes
<i>Centaurea cyanus</i>	Bachelor's button		Yes
<i>Centaurea diffusa</i>	Diffuse knapweed	Yes	Yes
<i>Centaurea jacea</i>	Brown knapweed		Yes
<i>Centaurea maculosa</i>	Spotted knapweed	Yes	Yes
<i>Centaurea montana</i>	Mountain bluet		Yes
<i>Centaurea nigra</i>	Black knapweed		Yes
<i>Centaurea scabiosa</i>	Greater knapweed		Yes
<i>Centaurea solstitialis</i>	Yellow starthistle	Yes	
<i>Chenopodium sp</i>	Lamb's-quarter		Yes
<i>Chichorium intybus</i>	Chicory		Yes
<i>Chondrilla juncea</i>	Rush skeletonweed	Yes	
<i>Chrysanthemum leucanthemum</i>	Oxeye daisy		Yes
<i>Cirsium arvense</i>	Canada thistle	Yes	Yes
<i>Cirsium palustre</i>	Marsh plume thistle		Yes
<i>Cirsium vulgare</i>	Bull thistle		Yes
<i>Crepis tectorum</i>	Narrowleaf hawk's-beard		Yes
<i>Crupina vulgaris</i>	Common crupina	Yes	
<i>Cuscuta spp.</i>	Dodder	Yes	
<i>Cynoglossum officinale</i>	Hound's-tongue	Yes	Yes
<i>Cyperus esculentus</i>	Yellow nutsedge	Yes	
<i>Cyperus rotundus</i>	Purple nutsedge	Yes	

Scientific Name	Common Name	Provincially Noxious^A	NWIPC^B
<i>Cytisus scoparius</i>	Scotch broom		Yes
<i>Daucus carota</i>	Wild carrot		Yes
<i>Digitalis purpurea</i>	Purple foxglove		Yes
<i>Echium vulgare</i>	Blueweed		Yes
<i>Eonothera biennis</i>	Evening primrose		Yes
<i>Erucastrum gallicum</i>	Dog mustard		Yes
<i>Euphorbia cyparissias</i>	Cypress spurge		Yes
<i>Euphorbia esula</i>	Leafy spurge	Yes	Yes
<i>Euphrasia nemorosa</i>	Eyebright		Yes
<i>Fallopia japonica</i>	Japanese knotweed		Yes
<i>Fallopia sachalinensis</i>	Giant knotweed		Yes
<i>Galeopsis tetrahit</i>	Hemp-nettle		Yes
<i>Gypsophila paniculata</i>	Baby's-breath		Yes
<i>Hedera helix</i>	English ivy		Yes
<i>Heracleum mantegazzianum</i>	Giant hogweed		Yes
<i>Hieracium aurantiacum</i>	Orange hawkweed	Yes	Yes
<i>Hieracium pretense</i>	Yellow hawkweed	Yes	Yes
<i>Humulus lupulus</i>	Common hops		Yes
<i>Hypericum perforatum</i>	St John's-wort		Yes
<i>Ilex aquifolium</i>	English holly		Yes
<i>Impatiens glandulifera</i>	Himalayan balsam		Yes
<i>Iris pseudacorus</i>	Yellow flag iris		Yes
<i>Knautia arvensis</i>	Field scabious		Yes
<i>Lamium galebdolon</i>	Yellow archangel		Yes
<i>Lappula echinata</i>	Western bluebur		Yes
<i>Linaria dalmatica</i>	Dalmatian toadflax	Yes	Yes
<i>Linaria vulgaris</i>	Common toadflax	Yes	Yes
<i>Lycopsis arvensis</i>	Small bugloss		Yes
<i>Lythrum salicaria</i>	Purple loosestrife		Yes
<i>Madia glomerata</i>	Tarweed		Yes
<i>Matricaria maritima</i>	Scentless chamomile	Yes	Yes
<i>Matricaria matricarioides</i>	Pineapple weed		Yes
<i>Medicago lupulina</i>	Black medic		Yes
<i>Persicaria wallichii</i>	Himalayan knotweed		Yes
<i>Polygonum convolvulus</i>	Wild buckwheat		Yes
<i>Potentilla recta</i>)	Sulphur cinequefoil		Yes

Scientific Name	Common Name	Provincially Noxious ^A	NWIPC ^B
<i>Rubus discolor</i>	Himalayan blackberry		Yes
<i>Rumex crispus</i>	Curled dock		Yes
<i>Salsola kali</i>	Russian thistle		Yes
<i>Sedum acre</i>	Mossy stone crop		Yes
<i>Senecio jacobaea</i>	Tansy ragwort	Yes	Yes
<i>Senecio vulgaris</i>	Common groundsel		Yes
<i>Silene cucubalus</i>	Bladder campion		Yes
<i>Silene latifolia</i>	White cockle		Yes
<i>Silene noctiflora</i>	Night-flowering catchfly		Yes
<i>Sinapis arvensis</i>	Wild mustard		Yes
<i>Sisymbrium officinale</i>	Hedge mustard		Yes
<i>Sisymbrium sp</i>	Tumble mustard		Yes
<i>Sonchus arvensis</i>	Perennial sowthistle	Yes	Yes
<i>Sonchus oleraceus</i>	Annual sowthistle	Yes	
<i>Symphytum officinale</i>	Comfrey		Yes
<i>Tanacetum vulgare</i>	Common Tansy		Yes
<i>Thlapsi arvense</i>	Stinkweed/Pennycress		Yes
<i>Trifolium aureum</i>	Hop-clover		Yes
<i>Ulex europaeus</i>	Gorse	Yes	Yes
<i>Verbascum thapsus</i>	Mullein		Yes
<i>Vicia cracca</i>	Tufted vetch		Yes

NOTES:

A *Weed Control Act* [RSBC 1996] c. 487 and 66/85: *Weed Control Regulation*

B Listed on Northwest Invasive Plant Council's 2013 Target Invasive Plant Species list

2.2.6 Traditional Ecological Knowledge on Traditional Use Plants

Five First Nations groups have asserted traditional use of Lelu Island and the area surrounding it: Metlakatla First Nation, Lax Kw'alaams First Nation, Gitxaala Nation, Kitselas First Nation, and Kitsumkalum First Nation have identified a number of plants that provide food, material and medicinal resources within the LAA (see Table 5). These included 8 tree, 24 shrub, 10 herb, and 1 fern species (Compton 1993; MacDonald 2005).

Table 5: Traditional Use Plants with Potential to Occur in the LAA

Species	Latin Name	First Nation Use
Trees		
Hemlock	<i>Tsuga species</i>	Food (cambium)
Pacific silver fir	<i>Abies amabilis</i>	Food (cambium)

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Species	Latin Name	First Nation Use
Pacific crabapple	<i>Malus fusca</i>	Food
Sitka spruce	<i>Picea sitchensis</i>	Food (cambium)
Western red cedar	<i>Thuja plicata</i>	Material
Western yew	<i>Taxus brevifolia</i>	Material
Yellow cedar	<i>Chamaecyparis nootkatensis</i>	Material
Shrubs		
Alaska blueberry	<i>Vaccinium alaskaense</i>	Food
Black crowberry	<i>Empetrum nigrum</i>	Food
Black mountain berry		Food
Black raspberry	<i>Rubus leucodermis</i>	Food
Blueberry	<i>Vaccinium sp</i>	Food
Bog cranberry	<i>Oxycoccus oxycoccos</i>	Food
Copper-bush	<i>Elliottia pyroliflora</i>	Medicine
Devil's club	<i>Oplopanax horridus</i>	Medicine (bark)
Highbush cranberry	<i>Viburnum edule</i>	Food
Gooseberry	<i>Ribes sp</i>	Food
Hazelnut	<i>Corylus cornuta</i>	Food
Kinnikinnick	<i>Arctostaphylos uva-ursi</i>	Food
Labrador tea	<i>Rhododendron groenlandicum</i>	Medicine, food
Low-bush cranberry	<i>Viburnum edule</i>	Food
Mountain huckleberry	<i>Vaccinium sp.</i>	Food
Raspberry	<i>Rubus sp</i>	Food
Red elderberry	<i>Sambucus racemosa</i>	Food
Red huckleberry	<i>Vaccinium parvifolium</i>	Food
Salal	<i>Gaultheria shallon</i>	Food
Salmonberry	<i>Rubus spectabilis</i>	Food
Saskatoon berry	<i>Amelanchier alnifolia</i>	Food
Soapberry	<i>Shepherdia canadensis</i>	Food
Stink currant	<i>Ribes bracteosum</i>	Food
Thimbleberry	<i>Rubus parviflorum</i>	Food
Herbs		
Bunchberry (western cordillera)	<i>Cornus unalaschkensis</i>	Food
Hellebore	<i>Veratrum viride</i>	Medicine
Lily root		Food
Pacific Clover root		Food
Skunk cabbage	<i>Lysichiton americanus</i>	Food

Species	Latin Name	First Nation Use
Solomon's seal	<i>Maianthemum racemosum</i>	Medicine
Strawberry	<i>Fragaria</i> sp	Food
Sylvan goat's beard	<i>Aruncus dioicus</i>	Medicine
Water parsley	<i>Oenanthe sarmentosa</i>	Medicine
Wild onion	<i>Allium</i> sp	Food
Ferns		
Licorice fern	<i>Polypodium glycyrrhiza</i>	Medicine

2.3 Terrestrial Ecosystem Mapping

Initial mapping of the LAA was completed prior to field work to inform the field surveys. Final mapping was confirmed following field surveys (see Figure 2). Ecosystem polygons were delineated and attributed according to established methods described in the provincial *Standard for Terrestrial Ecosystem Mapping in British Columbia* at 1:1,000 scale (RIC 1998). Polygons were attributed following the site series for the CWHvh2 within *A Field Guide to Site Identification and Interpretation for the Prince Rupert Forest Region* (Banner et al. 1993) and additional wetland classifications were applied based on *Wetlands of British Columbia* (MacKenzie and Moran 2004). There are 22 site series described for the CWHvh2 in Banner et al. (1993), including five site series that represent wetland ecosystems also described in MacKenzie and Moran (2004). Each polygon was assigned up to two site series and structural stage. Site modifiers were used infrequently because site series generally exhibited typical site conditions that were adequately characterized in the site series descriptions.

2.4 Field Surveys

Baseline vegetation conditions were documented through field surveys whose objectives were to:

- Ground truth preliminary TEM data
- Identify ecological communities at risk
- Describe and classify wetlands in the study area
- Identify plant species at risk (rare plants)
- Identify stands of old forest
- Record abundance and distribution of traditional-use plants
- Collect information on the abundance and distribution of weeds.

Initial field surveys were conducted over six days from August 11 to 16, 2012. A second field survey was conducted over six days from May 2 to May 7, 2013.

The field sampling for the ecosystem mapping included three inspection types: visual inspections, ground inspections, and full plots (RIC 1998). Visual inspections consisted of a location and notes indicating the site series and other observations. Ground inspections collected basic site and soil

information and a full species list, using the Site Inspection Form (BC MOFR BC MOE 2010). Full plots were similar to the ground inspections, but included a soil profile description. The TEM standards (RIC 1998) recommend a polygon inspection ratio of 80:17:3 for visual/ground/full inspections for the survey intensity level (SIL 2) applied to this map product.

Rare plant surveys were completed within the full range of ecosystems. At these plots, a full species list and basic habitat data were collected. Generally, plots were surveyed at the same locations as the ecosystem mapping field survey sites; however, searches for plant species at risk were completed during foot traverses of the island as well. If a potential rare plant species could not be identified in the field, it was collected and identified at a later time using microscope and an identification key. Plants collected were either identified at the end of the field day, or were dried and/or pressed for identification using microscopes and the identification keys and descriptions in the appropriate floras (Douglas et al. 1998a, 1998b, 1999a, 1999b, 2000, 2001a, 2001b, 2003; Flora North America 2012, Bryophyte Flora North America 2012, Goward et al. 1994; Goward 1999; Hultén 1968). Del Meidinger identified the vascular plant and lichen collections; Terry McIntosh identified the bryophyte collections.

3 RESULTS

On Lelu Island, 197 polygons were delineated in the final mapping, 107 of which were sampled on the ground (55%). For the portions of the LAA on the adjacent mainland, 37 polygons were delineated and 24 were sampled on the ground (65%), achieving an overall sample intensity of 56% see Figure 3). Forty three percent (43%) of the polygons are mapped as pure units (containing only one ecosystem unit) and the others are complexes of two ecosystem units.

Sixteen CWHvh2 units, including five forests, nine wetlands and two anthropogenic units were mapped within the LAA (see Table 6). Within the LAA, four ecosystem units were dominant and comprised 82% of the total assessment area (see Table 6).

Table 6: Ecosystems within the LAA

Ecosystem Code	TEM Map Code	Ecosystem Name	Structural Stage	Area (ha)	Area (%)
Forested Units					
CWHvh2/01	HS	Western red cedar–western hemlock/salal	5-7b	81.5	32
CWHvh2/04	HM	Western hemlock–Sitka spruce/lanky moss	6-7b	10.5	4
CWHvh2/05	RF	Western red cedar – Sitka spruce/sword fern	5-6	2.0	< 1
CWHvh2/07	SD	Western red cedar – Sitka spruce/devil’s club	5-6	2.3	< 1
CWHvh2/06	SF	Western red cedar–Sitka spruce/foamflower	4-7b	1.2	< 1
Wetland Units					
Bog Units					
CWHvh2/32 (Wb52)	JR	Common juniper/tufted club-rush/hoary rock moss bog	3a	19.3	7.6
CWHvh2/12 (Wb53)	LS	Shore pine–yellow cedar/sphagnum bog	3b	55.9	22
CWHvh2/31 (Wb51)	TS	Shore pine/black crowberry/tough peat moss bog	2b-3a	0.5	< 1
CWHvh2/11	YG	Western red cedar–yellow cedar/goldthread bog forest	5-7b	53.4	21
Estuarine Units					
CWHvh2/Ed01	Ed	Tufted hairgrass–meadow barley estuarine meadow	2b	0.1	< 1
CWHvh2/00	Em	Estuarine marsh class	2b	1.0	< 1
CWHvh2/00	Et	Estuarine tidal flat class	1a	9.4	4
Shallow Open Water Units					
CWHvh2/Wa	OW	Shallow open water	2c	1.4	< 1
Swamp Units					
CWHvh2/13 (Ws54)	RC	Western red cedar–Sitka spruce/skunk cabbage swamp	7a-7b	13.4	5
Anthropogenic Units					
CWHvh2/00	RR	Rural residential	3b	0.1	< 1
CWHvh2/00	UR	Urban		2.8	1
Total				254.7	100

3.1 Ecosystem Unit Descriptions

Descriptions of ecosystem units occurring in the LAA are based on plot data collected during the mapping/rare plant field work and include comments on how the Lelu Island ecosystems compare to published site unit descriptions for the CWHvh2. The proportional data from the LAA are also compared to the data from the RAA (Kaieen Landscape Unit). Since the RAA mapping was conducted at a different scale for different objectives than the mapping of the LAA, some units that are present in the LAA do not appear in the RAA data set.

3.1.1 Forested Units

CWHvh2/01: western red cedar–western hemlock–salal (Banner et al. 1993)

TEM Code: HS

LAA Area Mapped: 81.5 ha (32% of mapped area)

RAA Area Mapped: 11,312 ha (23% of mapped area)

Site Series Description: “Zonal” western red cedar-western hemlock, lower productivity forests are common on the gentle to moderate slopes around the perimeter of Lelu Island. Old-growth forest canopies, 18 to 25 m in height, are moderately open mixtures of western red cedar and western hemlock, often with a yellow-cedar component. Mountain hemlock and shore pine may be scattered throughout the less productive examples of this site series. Spike-topped cedars are typical. Understory shrub layers are dominated by tree regeneration (mostly hemlock) and salal (*Gaultheria shallon*). Blueberries/huckleberries (*Vaccinium sp.*) and false azalea (*Menziesia ferruginea*) are also typical. Some examples of this site series are very open (less than 20% tree cover) with very well-developed understory shrub layers.

Herb layers are poorly to moderately developed and dominated by bunchberry (*Cornus canadensis*), deer fern (*Blechnum spicant*), false lily-of-the-valley (*Maianthemum dilatatum*), twinflower, five-leaved bramble (*Rubus pedatus*), and scattered skunk cabbage (*Lysichiton americanus*). Bracken fern (*Pteridium aquilinum*) occurs on some sites. Lanky moss (*Rhytidiadelphus loreus*) and step moss (*Hylocomium splendens*) dominate the bryophyte layer with patches of *Sphagnum rubiginosum*. Soils have moderate to imperfect drainage and are dominated by thick humus horizons (typically 50 cm thick but up to 100 cm). Fine loamy mineral horizons, 10 to 15 cm, thick might underlie the organic horizons; these mineral horizons are derived from weathering of the underlying bedrock. Folisols are the most common soils; podzols are less common.

Most examples of this CWHvh2/01 site series found on Lelu Island are similar to those occurring elsewhere on the north coast but some stands are considerably more open than is typical. On the more productive examples of this unit, close to tidewater, there is evidence of old hand logging (mid-1900s) with scattered, moss covered cedar stumps.

CWHvh2/04: western hemlock–Sitka spruce–lanky moss (Banner et al. 1993)

TEM Code: HM

LAA Area Mapped: 10.5 ha (4% of mapped area)

RAA Area Mapped: 5,428 ha (11% of mapped area)

Site Series Description: This more productive forest unit is restricted in occurrence on the island. It occurs on sites with improved soil drainage and nutrient status, mainly on steeper colluvial slopes and some flat or gently sloping gravelly beach deposits. Polygons of CWHvh2/04 occur along the west and north coast of Lelu Island. This site series is provincially blue-listed (BC CDC 2012).



Photo 1: CWHvh2/04: western hemlock–Sitka spruce–lanky moss (TEM Code: HM); Lelu Island

Forests are relatively closed (compared to the CWHvh2/01), often greater than 30 m tall and dominated by western red cedar and western hemlock. Most have a minor Sitka spruce component—this site series and the CWHvh2/06 are the only units on the island supporting good growth of Sitka spruce. A red alder (*Alnus rubra*) component is often present, indicating a disturbance history—either natural (windthrow, colluvial disturbance) or human-caused (hand logging, First Nations use). Pacific crabapple (*Malus fusca*) occurs on sites close to tidewater.

Hemlock regeneration, blueberries, huckleberries, and false azalea dominate the moderately developed shrub layers, sometimes with scattered salal. The closed canopy results in a very sparse herbaceous layer. Deer fern, spiny wood fern (*Dryopteris expansa*), and twayblades (*Listera* sp.) are typical, sometimes with scattered oak fern and skunk cabbage (wetter pockets only). Lanky moss and step moss dominate the well-developed bryophyte layer but many other species are common as

well, such as leafy mosses, flat-moss (*Plagiothecium undulatum*), Oregon beaked-moss (*Eurhynchium oregonum*), yellow-ladle liverwort (*Scapania bolanderi*), *Sphagnum rubiginosum*, and stiff-leaved haircap moss (*Polytrichastrum alpinum*) (on disturbed soil).

Soils are moderately well drained, generally with relatively shallow forest humus horizons and deeper mineral soils (over rock) in comparison to CWHvh2/01 sites. Steeper slopes and/or coarse textured mineral horizons maintain drainage and forest productivity. Richer bedrock and some natural disturbance history are also linked to higher nutrient status and productivity on these sites. Scattered moss-covered stumps are common, resulting from mid-1900s hand logging.

In contrast to CWHvh2/04 sites throughout much of the CWHvh2, Lelu Island examples lack amabilis fir.

CWHvh2/05: western red cedar- Sitka spruce – sword fern

TEM Code: RF

LAA Area Mapped: 2.0 ha (0.8% of mapped area)

RAA Area Mapped: 203.4 ha (0.4% of mapped area)

Site Series Description: This site series occurs within the LAA but outside of Lelu Island. This is a rich forested site that develops on bedrock. This site series is similar to the CWHvh2/01 site series, with a major difference being the lack of salal and presence of Sitka spruce and sword fern instead (Banner et al. 1993). Abundant sword fern in the understory differentiates this site series from the CWHvh2/04 and CWHvh2/06 units. Tree species frequently found in this site series include western red cedar, western hemlock and Sitka spruce. Shrubs are sparse in this site series, and include false azalea and red huckleberry. The most predominant herbs are sword fern, with some deer fern and false lily-of-the-valley. Lanky moss and Oregon beaked moss are the most common mosses found in this site series (Banner et al. 1993).

This site series is provincially blue-listed (BC CDC 2013).

CWHvh2/06: western red cedar–Sitka spruce–foamflower (Banner et al. 1993)

TEM Code: SF

LAA Area Mapped: 1.2 ha (0.5% of mapped area)

RAA Area Mapped: 2,319 ha (4.6% of mapped area)

Site Series Description: This site series has only one small occurrence on the island: Polygon 179, a riparian unit near the mouth of the largest stream on the central west coast. Forest productivity is high on this riparian seepage site. Forest composition is similar to the CWHvh2/04 unit, a mix of western red cedar and western hemlock with a minor Sitka spruce and red alder component. Shrub layers are well developed with blueberries, huckleberries, false azalea and western hemlock regeneration dominating. Scattered salmonberry (*Rubus spectabilis*) also occurs. The herb layer is diverse with nutrient-rich indicators such as oak fern, rosy (*Streptopus lanceolatus*) and clasping twistedstalks (*Streptopus amplexifolius*), foamflower, and spiny wood fern being characteristic. Wetter pockets have skunk cabbage.

Patches of shiny liverwort, leafy mosses, *Sphagnum rubiginosum*, and Oregon beaked-moss in addition to the usual lanky moss and step moss characterize the bryophyte layer.

Soils are moist but freely drained, with aerated, nutrient-rich seepage water, resulting in high forest productivity. While fairly similar other sites in this unit occurring elsewhere in the CWHvh2, amabilis fir is lacking and the diversity of ferns is lower (no lady fern or beech fern). Devil's club is often found on CWHvh2/06 but this species was not encountered anywhere on the island.

No photo was taken for this site series.

CWHvh2/07: western red cedar- Sitka spruce – devil's club (Banner et al. 1993)

TEM Code: SD

LAA Area Mapped: 2.3 ha (0.9% of mapped area)

RAA Area Mapped: 1,430.0 ha (2% of mapped area)

Site series description: This site series is very productive and typically found in seepage sites on lower slopes and toe slopes (Banner et al. 1993). This site series exists where seepage flows are continuous, rather than stagnant. The obvious understory of devil's club distinguishes this site series from others in the area. Typical tree species in this site series include western hemlock, amabilis fir, Sitka spruce and western red cedar. Shrubs include an abundance of devil's club and salmonberry with red huckleberry. The herbaceous layer is composed of many species, including deer fern, spiny wood fern, lady fern, oak fern, three-leaved foamflower and five-leaved bramble. Lanky moss and large leafy moss are the most predominant moss species (Banner et al. 1993).

This site series is provincially blue-listed (BC CDC 2013).

3.1.2 Bog Units

CWHvh2/32: slope/blanket bogs (Banner et al. 1993)

Wb32: common juniper–tufted club rush–hoary rock-moss (MacKenzie and Moran 2004)

TEM Code: Wb52

LAA Area Mapped: 19.3 ha (7.6% of mapped area)

RAA Area Mapped: not captured by North Coast TEM

Site Series Description: Extensive blanket bogs are a characteristic feature of the flat to gently sloping central plateau of Lelu Island. The development of these bog ecosystems is controlled largely by the hyperoceanic (cool, wet, foggy) climate of the exposed outer coast in combination with gentle topography. Blanket bogs in the CWHvh2 tend to occur in a complex with bog woodlands and bog forests and this is case on Lelu Island.

Trees species are present mostly as low shrubs (less than 2 m tall) with very scattered taller individuals. "Bonsai" shore pine is always present and yellow-cedar is very common. Western red cedar, western hemlock, and mountain hemlock are less common. Other typical shrubs are sweet gale (often dominant), Labrador tea, bog blueberry, and common juniper.



Photo 2: CWHvh2/32: common juniper–tufted club-rush–hoary rock-moss Slope/blanket bog (TEM Code Wb52); Lelu Island

A diverse dwarf shrub/herb community includes tufted club-rush, black crowberry, western bog laurel, white beak-rush (*Rhynchospora alba*), cloudberry, great burnet, sundews, three-leaved goldthread (*Coptis trifolia*), bog rosemary, pale sedge (*Carex livida* var *radicaulis*), many-flowered sedge, deer cabbage, swamp gentian (*Gentiana douglasiana*), common butterwort (*Pinguicula vulgaris*), and many more.

The moss layer includes drier hummock species such as hoary rock mosses, and reindeer lichens (*Cladina rangiferina*, *C. portentosa* subsp. *pacifica*) and wetter bog species including numerous species of peat moss (“drier” hummock formers such as *Sphagnum rubellum* and *S. fuscum* with other species in the wet hollows such as *S. lindbergii* and *S. papillosum*). Purple worm liverwort is common in many bogs.

These slope/blanket bogs represent a complex of many different micro-communities that reflect differences in soil and water regimes (including chemistry), and exposure. Soils consist of saturated peat derived from peat mosses and sedges (mostly mesisols). Peat depth is commonly greater than 2 m on the island.

Lelu Island blanket bogs are similar in many ways to those occurring elsewhere in CWHvh2 with some distinctions in species composition/dominance. Sweet gale is a dominant species throughout most of the Lelu Island bogs but elsewhere in the CWHvh2, this species tends to be more restricted. The nutrient-rich bedrock geology on Lelu Island may be responsible for the dominance of sweet gale. As mentioned in the shallow open water description, the common hypermaritime bog lichen, *Siphula ceratites*, is curiously absent from Lelu Island bogs.

CWHvh2/12: shore pine–yellow-cedar–sphagnum “bog woodlands” (Banner et al. 1993)

TEM Code: Wb53

LAA Area Mapped: 55.9 ha (22% of mapped area)

RAA Area Mapped: 4,434 ha (9% of mapped area)

Site Series Description: Bog woodlands are also a common site unit on the island, especially on the gently sloping to level plateau where a very extensive complex of bog woodlands and open blanket bogs occurs. Shore pine is the dominant tree species but canopies are very open and seldom greater than 10 m in height—thus the term “woodland” to describe this unit. Yellow-cedar and western red cedar are common associates and western and mountain hemlock also occur.

Because of the open woodland canopy, shrub layers are well developed and often characterized by dense stunted yellow-cedar and western red cedar. Salal, Labrador tea, western bog-laurel, bog blueberry, and sweet gale (*Myrica gale*) are common associates. The herb/dwarf shrub layer is a diverse mix of mostly bog species. Goldthread, lingonberry, black crowberry, cloudberry (*Rubus chamaemorus*), deer cabbage, Indian hellebore, great burnet (*Sanguisorba officinalis*), skunk cabbage, and several sedges are typical.

Several species of peat moss (*Sphagnum capillifolium*, *S. fuscum*, *S. papillosum*, *S. rubiginosum*) dominate with lanky moss, step moss, red-stemmed feathermoss, and many lichen species. The liverworts *Mylia taylori*, *Pleurozia purpurea*, and *Herbertus aduncus* (often epiphytic) are common in bog woodlands.

Soils consist of saturated sphagnum peat, frequently greater than a meter deep, with many over 2 m deep. The Lelu Island bog woodlands are typical of the CWHvh2/12 unit, though many are of relatively low stature, between 3 and 6 m tall.

CWHvh2/31: topogenous (basin) bog (Banner et al. 1993)
Wb51: Shore pine–Black crowberry–Tough peat moss (MacKenzie and Moran 2004)

TEM Code: Wb51

LAA Area Mapped: 0.5 ha (0.2% of mapped area)

RAA Area Mapped: not captured by North Coast TEM

Site Series Description: In contrast to the blanket bogs that cover extensive areas, topogenous (or basin) bogs occur mainly where water and peat has accumulated in basins or depressions in the landscape. Their formation is more a reflection of landform and topography than climate. Three small polygons of Wb51 were mapped on Lelu Island.



Photo 3: CWHvh2/31: shore pine–black crowberry–tough peat moss topogenous (basin) bog (TEM Code: Wb51); Lelu Island

The topogenous bogs in CWHvh2 tend to be much smaller in area, have wetter surfaces, sometimes with floating Sphagnum mats at their centre, and lack tall shrub/tree layers, compared with the slope/blanket bogs (Cwhvh3/52). On Lelu Island, the vegetation communities in Wb51 are similar to Wb52 except that they lack the bonsai shore pine and other shrubby tree species as well as sweet gale. Because they often coalesce with blanket bogs in larger bog complexes, the distinction between the two types may be difficult: the polygons mapped occur in small isolated basins surrounded by forest, away from the main blanket bog complex on the plateau of the island. Topogenous bogs, because they form in small basins/ponds, tend to be deepest (greater than 2 m) at their centre.

CWHvh2/11: western red cedar–yellow-cedar–goldthread “bog forests” (Banner et al. 1993)

TEM Code: YG

LAA Area Mapped: 53.4 ha (21% of mapped area)

RAA Area Mapped: 5,900 ha (12% of mapped area)

Site Series Description: Bog forests are common on gently sloping terrain throughout the island. At the upper end of these slopes, the terrain becomes gentler and imperfectly to poorly drained. This gives rise to many CWHvh2/11 bog forest sites at the transition to the bog-dominated plateau of the island.

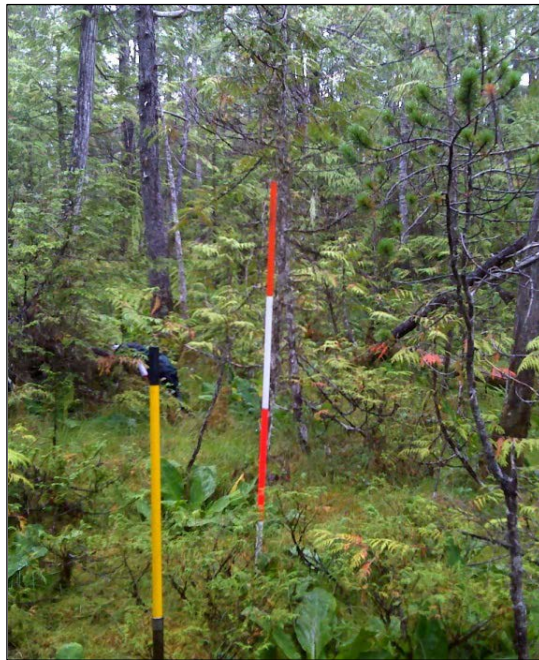


Photo 4: CWHvh2/11: western red cedar–yellow-cedar–goldthread “bog forest” (TEM Code YG); Lelu Island

Forest canopies, 15 to 18 m in height, are scrubby and very open mixtures of western red cedar, yellow-cedar, and shore pine. Western and mountain hemlock also occur. Shrub layers are well developed and dominated by salal. A mix of upland shrub species (blueberries, huckleberries, false azalea) in addition to bog species (Labrador tea, western bog laurel (*Kalmia microphylla*)) is typical. This is also the case with the herb/dwarf shrub layers, which have high diversity resulting from both upland and bog species. Typical species are goldthread (*Coptis* sp), deer fern, deer cabbage (*Fauria crista-galli*), lingonberry (*Vaccinium vitis-idaea*), yellow-flowered sedge (*Carex anthoxantha*), many-flowered sedge (*Carex pluriflora*), Indian hellebore (*Veratrum viride*), Pacific reedgrass (*Calamagrostis nutkaensis*), and skunk cabbage. A diversity of peat-mosses (*Sphagnum papillosum*, *S. capillifolium*, *S. rubiginosum*) species in addition to lanky moss and step moss characterize the bryophyte layer. Poorly drained organic soils derived from peat moss are typical (mostly mesisols). Organic soils are generally deeper than 50 cm and commonly over 1 m deep. CWHvh2/11 occurring on the island is quite typical of sites found elsewhere in the CWHvh2.

3.1.3 Estuarine Units

Ed01: tufted hairgrass–meadow barley (MacKenzie and Moran 2004)

TEM Code: Ed01

LAA Area Mapped: 0.1 ha (0.03% of mapped area)

RAA Area Mapped: not captured by North Coast TEM

Site Description: One small estuarine meadow community occurs along a small tidal stream at the north end of the island.. Tufted hairgrass (*Deschapsia cespitosa*), meadow barley (*Hordeum brachyantherum* ssp *brachyantherum*), and Lyngbye's sedge (*Carex lyngbyei* spp. *cryptocarpa*) form the dominant vegetation cover in the meadow. Other species include yarrow (*Achillea millefolium*), silverweed (*Potentilla* sp), sea-milkwort (*Glaux maritime*), scarlet paintbrush (*Castilleja miniata*), seacoast angelica (*Angelica lucida*), Alaska plantain (*Plantago macrocarpa*), and beach lovage (*Ligusticum scoticum* ssp *hultenii*).

Soils are imperfectly to poorly drained, silty loam Gleyed Regosols and Gleysols, derived from fluvial/marine sediments.

This site series is provincially red-listed (BC CDC 2013).

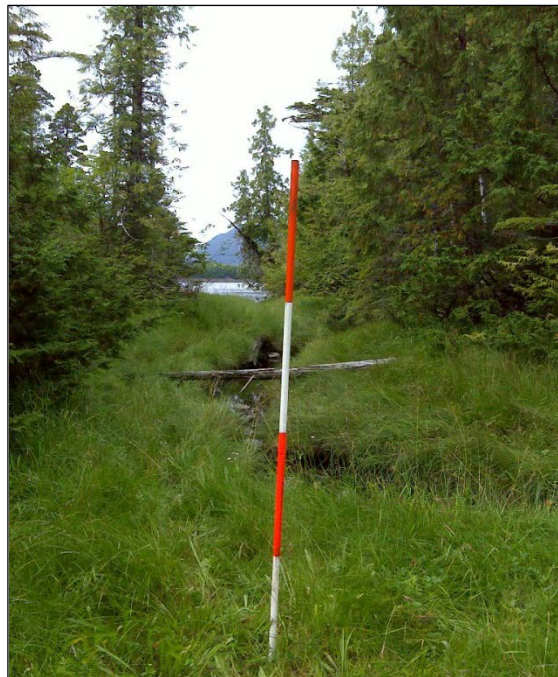


Photo 5: CWHvh2/Ed01: tufted hairgrass–meadow barley (TEM Code: Ed01); Lelu Island

3.1.4 Swamp Units

CWHvh2/13: western red cedar–Sitka spruce–skunk cabbage “swamp forests”
(Banner et al. 1993; Lewis 2007)

Ws54: western red cedar–western hemlock–skunk cabbage (MacKenzie and Moran 2004)

TEM Code: Ws54

LAA Area Mapped: 13.4 ha (5 % of mapped area)

RAA Area Mapped: not captured by North Coast TEM

Site Series Description: Several small skunk cabbage swamp forests occur on the island. In contrast to the scrubby bog forests (CWHvh2/11), which are widespread and form large polygons on the island, these swamp forests are small and localized in wet depressions that have significant mineral seepage influence. Polygon size ranges from 0.03 to 0.3 ha for CWHvh2/13 while CWHvh2/11 polygons are generally over one ha in area.

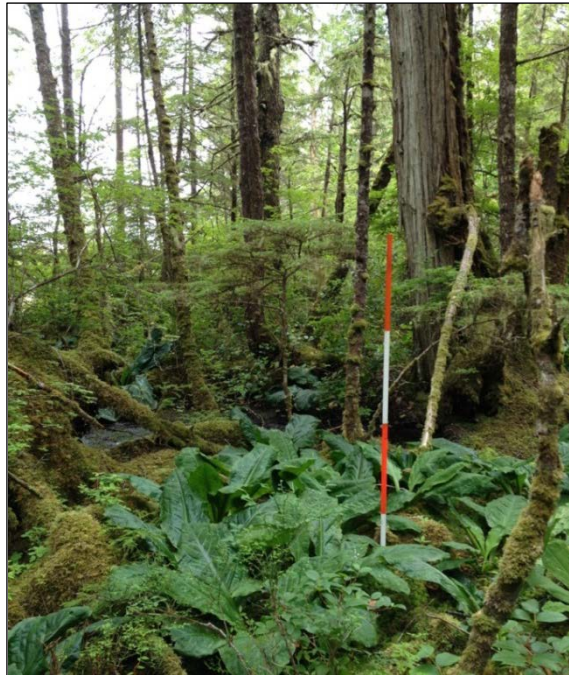


Photo 6: CWHvh2/13: western red cedar–Sitka spruce–skunk cabbage “swamp forest” (TEM Code: Ws54); Lelu Island

Swamp forests are moderately productive mixes of western red cedar and western hemlock with main canopies reaching 25 to 28 m. The most nutrient rich examples have a Sitka spruce component while the poorer examples tend to have yellow-cedar and scattered shore pine (transitional to bog forests). Trees are generally growing on drier hummocks away from the wet hollows/areas of standing water that are typically scattered throughout. Shrub layers are well developed and dominated by hemlock regeneration, salal, blueberries and huckleberries, and false azalea. Salmonberry sometimes occurs.

The overwhelming vegetative characteristic of the swamp forests is the dominance, and especially the high vigour, of skunk cabbage. In CWHvh2, this species occurs on most forested sites as scattered individuals of poor to moderate vigour, but only in the swamp forests does it become dominant and extremely vigorous, especially in the wet hollows. There are often signs of deer browsing on the skunk cabbage. In addition to skunk cabbage, a high diversity of herbs characterizes the swamp forests: lady fern, foamflower, oak fern, deer fern, bunchberry, Indian hellebore, false lily-of-the-valley, clasping and tall twistedstalks, soft-leaved sedge, Merten's sedge and numerous others. Lanky moss and step moss are dominant on the drier hummocks, while the wetter depressions are colonized by *Sphagnum rubiginosum*, shiny liverwort, and leafy mosses.

Swamp forest soils are poorly to very poorly drained, either with organic humisols/mesisols or gleysolic mineral soils with very high organic matter content ("black muck soils").

The CWHvh2/13 examples occurring on Lelu Island are fairly typical of swamp forests occurring throughout the CWHvh2.

This site series is provincially blue-listed (BC CDC 2012).

3.1.5 Shallow Open Water Units

Wa: shallow open water

TEM Code: OW

LAA Area Mapped: 1.4 ha (0.5% of mapped area)

RAA Area Mapped: 1.7 ha (< 1% of mapped area)

Site Series Description: Small, shallow ponds are a characteristic feature of the blanket bog complex on the gentle plateau of the island. Most ponds are less than 500 m² in area but a few larger ponds up to 1,100–1,300 m² also occur. Standing water is generally less than 50 cm deep over saturated, amorphous sedimentary peat. Peat deposits underlying the ponds may be greater than 2 m deep but many are much shallower. Several *Sphagnum* hummock islands occur throughout most ponds with vegetation communities essentially the same as the blanket bogs (Wb32).

Shallow open water plant communities are dominated by buckbean and Rocky Mountain pond lily is abundant in some ponds. Other commonly occurring vascular plant species include spreading rush (*Juncus supiniformis*), Sitka sedge (*Carex sitchensis*), flat-leaved bladderwort (*Utricularia intermedia*), and, especially near pond edges, great and round-leaved sundews (*Drosera rotundifolia* var *rotundifolia*), white beak-rush (*Rhynchospora alba*), sticky false asphodel (*Triantha glutinosa*), and narrow-leaved cotton-grass (*Eriophorum angustifolium*). The two peat mosses that best tolerate the aquatic or semi-aquatic habitats around pond edges are *Sphagnum lindbergii*, and *S. tenellum*.

Lelu Island shallow open water communities are quite typical of the CWHvh2 but of notable absence is the white waterworm lichen, *Siphula ceratites*, usually characteristic of hypermaritime pond edges and portions of the bogs subject to temporary inundation. The rush-like aquatic plant, *Scheuchzeria palustris*, is also often present in hypermaritime bog ponds but was not found in the Lelu Island ponds.



Photo 7: CWHvh2/Wa: shallow open water (TEM Code: OW); Lelu Island

3.2 Ecological Communities at Risk

One red-listed and four blue-listed ecological communities were found in the LAA (see Table 7; see Figure 4). These communities comprise approximately 11% of the LAA (see Table 7). In contrast, blue-listed ecological communities comprise approximately 15% of the Kaien Landscape Unit (see Table 8).

Table 7: Ecological Communities at Risk within the LAA

Ecosystem Code	TEM Map Code	Ecosystem Name	BC CDC Ecological Community Name	Area (ha)	Global/State Rank ^A	Provincial Status ^B
CWHvh2/04	HM	Western hemlock–Sitka spruce/lanky moss forest	<i>Tsuga heterophylla</i> – <i>Picea sitchensis</i> / <i>Rhytidiadelphus loreus</i>	10.5	GNR/S3	Blue
CWHvh2/05 ^C	RF	Western red cedar – Sitka spruce/sword fern	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Polystichum munitum</i>	1.6	G3?/S2S3	Blue
CWHvh2/07 ^C	SD	Western red cedar – Sitka spruce/devil's club	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Oplopanax horridus</i> Very Wet Hypermaritime 2	1.6	GNR/S3	Blue
CWHvh2/13 (Ws54)	RC	Western red cedar–Sitka spruce/skunk cabbage swamp	<i>Thuja plicata</i> – <i>Picea sitchensis</i> / <i>Lysichiton americanus</i>	13.3	G3?/S3?	Blue

Ecosystem Code	TEM Map Code	Ecosystem Name	BC CDC Ecological Community Name	Area (ha)	Global/State Rank ^A	Provincial Status ^B
CWHvh2/Ed01	Ed	Tufted hairgrass–meadow barley estuarine meadow	<i>Deschampsia cespitosa</i> ssp. <i>beringensis</i> – <i>Hordeum brachyantherum</i>	0.1	G3/S2	Red

NOTES:

^A Global and State rankings are as follows: 1-critically imperiled, 2-imperiled, 3-vulnerable, 4-apparently secure, 5-secure, GNR–Unranked.

^B Blue listed refers to ecological communities which are of special concern; Red listed refers to ecological communities that are endangered, threatened or extirpated (BC CDC 2013).

^C Indicates plant community with a structural stage greater than or equal to six (mature forest > 80 years old).

CWHvh2/04: HwSs–lanky moss. This unit is part of the *Tsuga heterophylla*–*Picea sitchensis*/*Rhytidadelphus loreus* ecological community. Mature to climax vegetation from the following site series are included in this community: CWHvh1/04, CWHvh2/04, CWHwh1/01, and CWHwh2/01. Its distribution is in the hypermaritime subzones of the CWH zone on the mainland, the outer coast of Vancouver Island, and on Haida Gwaii. The forest stands of this community are relatively productive. They are often harvested, which is likely the main reason for the blue listing, as the site conditions of this ecological community are not rare (see Table 8).

CWHvh2/05: CwSs–sword fern. This unit is part of the *Thuja plicata*–*Picea sitchensis*/*Polystichum munitum* ecological community. Mature to climax vegetation from the CWHvh1/05, CWHvh2/05 and CWHwh1/03 site series are included this community. This community exists in coastal BC, within the hypermaritime subzones of the CWH zones on Haida Gwaii, the mainland and Vancouver Island.

CWHvh2/07: CwSs–devil’s club. This unit is part of the *Thuja plicata*–*Picea sitchensis*/*Oplopanax horridus* ecological community. The CWHvh2 is the only subzone that this mature to climax ecological community is found in. This ecological community is only found north of Vancouver Island, Haida Gwaii and the hypermaritime north coast.

CWHvh2/13 (Ws54): CwSs–skunk cabbage. This unit is part of the *Thuja plicata*–*Picea sitchensis*/*Lysichiton americanus* ecological community. Mature to climax vegetation from the following site series are included in this community: CWHdm/12, CWHds1/12, CWHds2/12, CWHmm1/12, CWHms1/11, CWHms2/11, CWHvh1/13, CWHvh2/13, CWHvm1/14, CWHwh1/12, CWHwh2/06, CWHws1/11, CWHxm1/12, and CWHxm2/12. This is wide-ranging ecological community of coastal BC, which is more at risk in the south than in the northern part of its range. As noted above, occurrences of this community tend to be small in size. Although not generally targeted for harvesting, they can be influenced by harvesting due to disruption of hydrology or removal of some productive trees growing on higher microsites.

CWHvh2/Ed01: tufted hairgrass–meadow barley. This unit is part of the *Deschampsia cespitosa* ssp. *beringensis*–*Hordeum brachyantherum* ecological community. This is an upper estuarine meadow community of coastal BC. Because this inventory focused on the terrestrial ecosystems, there was only one occurrence of this community within the LAA study area boundary. Although not

obviously part of a larger estuary, these upper estuarine ecosystems are influenced by tidal brackish water.

Table 8: Ecosystems at Risk within the RAA

Ecosystem Name	TEM Map Code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Western hemlock–amabilis fir/deer fern	HD	CWHvm1/06	6-7	4.1	< 1
		CWHvm2/06	7	0.3	< 1
Western hemlock–Sitka spruce/lanky moss	HM	CWHvh2/04	3-7	5,428.0	11
Western hemlock–western red cedar/salal	HS	CWHvm1/03	7	4.6	< 1
Western red cedar–Sitka Spruce/sword fern	RF	CWHvh2/05	6-7	203.0	< 1
Western red cedar–Sitka spruce/devil's club	SD	CWHvh2/07	3-7	1,430.0	3
Sitka spruce/salal	SS	CWHvh2/14	7	0.7	< 1
Yellow-cedar–mountain Hemlock/twisted stalk	YT	MHwh1/05	6-7	395.0	1
Total				7,465.7	15

NOTE:

All communities in this table are blue-listed.

3.2.1 Plant Species at Risk

No federally SARA listed species or provincially red- or blue-listed vascular plants, mosses or lichens were found within the LAA.

3.2.2 Old Forest

The TEM indicates that 60% of the LAA is old forest (see Table 9; see Figure 5), including western hemlock, western red cedar, and mountain hemlock community types (see Table 9). Of particular note are CWHvh2/04 (western hemlock-Sitka spruce/lanky moss), CWHvh2/05 (western red cedar – Sitka spruce/sword fern), CWHvh2/07 (western red cedar-Sitka spruce/devil's club) and CWHvh2/13 (western red cedar-western hemlock/salal), all of which are also blue-listed community types (see Table 9).

Table 9: Old Forest within the LAA

Ecosystem Code	TEM Map Code	Ecosystem Name	Structural Stage	Area (ha)	Area (%)
CWHvh2/04	HM	Western hemlock–Sitka spruce/lanky moss	7b	5.5	2
CWHvh2/01	HS	Western red cedar–western hemlock/salal	7a-7b	81.3	32
CWHvh2/13 (Ws54)	RC	Western red cedar–Sitka spruce/skunk cabbage swamp	7a-7b	13.2	5
CWHvh2/06	SF	Western red cedar–Sitka spruce/foamflower	7b	0.1	< 1
CWHvh2/11	YG	Western redcedar–yellow-cedar/goldthread bog	7b	52.7	21
Total				152.8	60

Approximately 55% of the RAA is considered old forest, distributed among 27 distinct community types (see Table 10). This relative abundance of old forest is similar to that found within the LAA (see Table 9; see Figure 5).

Table 10: Old Forest within the RAA

Ecosystem Name	TEM Map Code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Western hemlock–amabilis fir/blueberry	AB	CWHvm1/01	7	16.3	< 1
		CWHvm2/01	7	1.1	< 1
Amabilis fir–western red cedar/foamflower	AF	CWHvm1/05	7	0.8	< 1
Amabilis fir–western red cedar/salmonberry	AS	CWHvm1/07	7	1.2	< 1
Western hemlock–amabilis fir/deer fern	HD	CWHvm1/06	7	3.1	< 1
		CWHvm2/06	7	0.3	< 1
Western hemlock–Sitka spruce/lanky moss	HM	CWHvh2/04	7	4,465.4	9
Western red cedar–western hemlock/salal	HS	CWHvh2/01	7	10,225.3	20
Western hemlock–western red cedar/salal	HS	CWHvm1/03	7	4.6	< 1
Lichen–mountain hemlock parkland	LM	MHwhp/00	7	31.0	< 1
Mountain hemlock–Sitka spruce/blueberry	MB	MHwh1/01	7	2,158.8	4
Mountain hemlock–amabilis fir–blueberry	MB	MHwhp/00	7	372.7	< 1
Mountain hemlock–yellow-cedar/deer cabbage	MD	MHwh1/06	7	170.8	< 1
		MHwh1p/06	7	3.8	< 1
Mountain hemlock–mountain heather parkland	MH	MHwhp/00	7	23.2	< 1
Mountain hemlock–yellow-cedar/mountain-heather	MM	MHwh1/02	7	10.2	< 1
Mountain-heather–racomitrium scrub	MR	MHwh1/	7	2.6	< 1
Rock group cliff class	Rc	CWHvh2/00	7	900.0	2
Western red cedar–Sitka spruce/sword fern	RF	CWHvh2/05	7	152.2	< 1
Western red cedar–yellow-cedar/salal	RS	CWHvh2/03	7	475.0	1
Western red cedar–Sitka spruce/devil's club	SD	CWHvh2/07	7	936.1	2
Western red cedar–Sitka spruce/foamflower	SF	CWHvh2/06	7	1,426.4	3
Sitka spruce/salal	SS	CWHvh2/14	7	0.7	< 1
Bog wetland class	Wb	CWHvh2/00	7	82.5	< 1
Yellow-cedar–mountain hemlock/skunk cabbage	YC	MHwh1/09	7	28.0	< 1
Western red cedar–yellow-cedar/goldthread	YG	CWHvh2/11 (Wb)	7	4,773.6	10
		CWHvm1/12	7	3.2	< 1

Ecosystem Name	TEM Map Code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Mountain hemlock–yellow-cedar/goldthread	YG	MHwh1/04	7	654.6	1
		MHwh1p/	7	8.8	< 1
Yellow-cedar–mountain hemlock/hellebore	YH	MHwh1/07	7	66.1	< 1
Mountain hemlock–yellow-cedar/sphagnum	YS	MHwh1/08	7	3.4	< 1
Yellow-cedar–mountain hemlock/twistedstalk	YT	MHwh1/05	7	393.4	1
Total				27,395.2	55

3.2.3 Wetlands

The TEM indicates that 61% of the LAA consists of wetland ecosystems (see Table 11; see Figure 6). These wetland ecosystems include bogs, swamps, estuarine meadow, and shallow open water. The blanket bog/upland forest complex of the LAA is reasonably typical of the CWHvh2 that characterizes the outer portions of the north and central coast. While the extent of wetlands, specifically peatlands, on Lelu Island and the adjacent northern shore is not unusual for the outer coast of BC, this biogeoclimatic subzone variant is a globally less common ecosystem complex. These bog ecosystems represent a high volume of saturated organic soil material, primarily sphagnum peat, which has accumulated over time.

Table 11: Wetland Ecosystems within the LAA

Ecosystem Code	TEM Map Code	Ecosystem Name	Structural Stage	Total area (ha)	Area (%)
Bog Units					
CWHvh2/32 (Wb52)	JR	Common juniper/tufted club-rush/hoary rock moss bog	3a	19.3	10
CWHvh2/12 (Wb53)	LS	Shore pine–yellow cedar/sphagnum bog	3b	55.9	28
CWHvh2/31 (Wb51)	TS	Shore pine/black crowberry/tough peat moss bog	2b-3a	0.5	< 1
CWHvh2/11	YG	Western red cedar–yellow cedar/goldthread bog	5-7b	53.4	24
Estuarine Units					
CWHvh2/Ed01	Ed	Tufted hairgrass–meadow barley estuarine meadow	2b	0.1	< 1
CWHvh2/00	Em	Estuarine marsh class	2b	1.0	< 1
CWHvh2/00	Et	Estuarine tidal flat class	1a	9.4	4
Shallow Open Water Units					
CWHvh2/Wa	OW	Shallow open water	2c	1.4	1
Swamp Units					
CWHvh2/13 (Ws54)	RC	Western red cedar–Sitka spruce/skunk cabbage swamp	7a-7b	13.3	2
Total				154.3	61

In contrast, wetlands within the Kaien Landscape Unit comprise only 34% of the total area (see Table 12). Wetlands within the RAA are most commonly bog forests composed of western red cedar, yellow cedar or shore pine with either sphagnum or goldthread (see Table 12).

Table 12: Wetland Ecosystems within the RAA

Ecosystem Name	TEM Map code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Bog Units					
Shore pine–yellow-cedar/sphagnum	LS	CWHvh2/12 (Wb53)	3b	4,434.1	9
Shore pine/sphagnum	LS	CWHvm1/13	3b	0.8	< 1
Bog wetland class	Wb	CWHvh2/00	2a-7	1,604.9	2
		MHwh1/00	2b-3a	721.1	1
Western red cedar–yellow-cedar/goldthread	YG	CWHvm1/12	6-7	9.9	< 1
		CWHvh2/11 (Wb)	3b-7	5,900.2	12
Mountain hemlock–yellow-	YG	MHwh1/04	3b-7	855.1	2

Ecosystem Name	TEM Map code	Ecosystem Code	Structural Stage	Area (ha)	Area (%)
Cedar/goldthread		MHwh1p/	7	8.8	< 1
Mountain hemlock–yellow-cedar/sphagnum	YS	MHwh1/08	3b-7	1,635.4	3
Fen Units					
Fen wetland class	Wf	CWHvh2/00	2b	53.9	< 1
Floodplain Units					
Low bench flood class	FI	CWHvh2/00	2a-3a	45.9	< 1
Marsh Units					
Marsh wetland class	Wm	CWHvh2/00	2b	58.3	< 1
		CWHvm1/00	2b	13.8	< 1
Shallow Water Units					
Shallow open water wetland class	Ww	CWHvh2/00	2c	1.7	< 1
Swamp Units					
Western red cedar-Sitka spruce/skunk cabbage	RC	CWHvh2/13 (Ws54)	3-7	1,493.5	3
Swamp wetland class	Ws	CWHvh2/00	3b	3.8	< 1
Unclassified Wetland Units					
Alpine wetland class	Wa	MHwhp/00	2b	2.0	< 1
Total				16,843.2	34

Wetland Function

The Federal Policy on Wetland Conservation (the Policy) is for no net loss of wetland functions: (i) on federal lands and waters; (ii) in areas affected by the implementation of federal programs where the continuing loss or degradation of wetlands has reached critical levels; and, (iii) where federal activities affect wetlands designated as ecologically or socio-economically important to a region (Government of Canada 1991). The Policy applies to the wetlands within the LAA because it is federal crown land managed by a federal agent (PRPA). The wetland ecosystems in the LAA provide several wetland functions. Of particular note are wetland types CWHvh2/Ed01, which is a red-listed community type (see Table 7), and CWHvh2/13, which is both a blue-listed community type (see Table 7) and contains old forest (see Table 9).

Within the context of the Policy, wetland functions include the natural ecological processes associated with wetlands as well as the derivation of benefits that any of these processes may provide to humans (Lynch-Stewart et al. 1996). The latter are sometimes referred to as wetland *values* (to humans) to distinguish them from wetland *functions* (ecological processes).

Wetland functions can be grouped among three broad types:

- Hydrological
- Biogeochemical
- Habitat.

Hydrological Function

Hydrological function is the capacity of a wetland to store, moderate, and release water in a watershed (i.e., for groundwater recharge/discharge, flood flow alteration, or base flow augmentation). This function is important to maintain human and ecological life support systems, protect infrastructure, and enhance social values. This function of a wetland is driven by its hydrogeomorphic setting, basin form, its water balance, and the quantity and velocity of water moving through the system (Bond et al. 1992).

Lelu Island wetlands are characterized by high densities of absorbent peat-forming moss species (i.e., sphagnum mosses) and decomposed sedges associated with bog ecological communities, interspersed with extensive areas of shallow open water and surrounded by old forest.

- Lelu Island does not supply water for regional drinking water or usable surface water for residents or industry, nor does it provide water storage for agriculture purposes.
- Lelu Island wetlands have the potential to moderate the magnitude of runoff events; however, the receiving water body downstream of the LAA is the ocean and so there is no particular opportunity for the wetlands in the LAA to provide flood control to developed areas. High volumes of precipitation are absorbed by the bogs after summer months when the water balance is low, but saturated soils in the fall, winter and spring would have limited capacity to absorb additional moisture from precipitation.

Biogeochemical Function

Biogeochemical function of wetlands refers to the capacity of the wetland to improve water quality or store carbon.

The wetland ecological communities on Lelu Island have the following characteristics:

- They store large amounts of carbon. The ability of the Lelu Island wetland complex to sequester and store carbon contributes to maintenance of the global carbon cycle and its role in global climate regulation.
- They have low pH with low redox potential, and little interaction with groundwater. As a result, these wetlands have a low potential, chemically, for oxidizing or precipitating nutrients, hydrocarbons and other contaminants.
- They may provide a source of soluble organic carbon as food chain support to down-gradient watercourses.
- They do not play a substantial role in stabilizing sediment flow: the gradient is low and substrates have low quantities of mineral soil particles.
- They are generally nutrient-poor and are, therefore, not expected to be a source of nutrients for transfer to wildlife.

Habitat Function

Habitat function refers to the manner in which a wetland contributes to biological productivity and diversity. Habitat functions provided by wetlands on Lelu Island include the following:

- Foraging, nesting, and stopover habitat for migratory birds, including songbirds and shorebirds
- Providing habitat for amphibians, including observations of northwestern salamander
- Contributing to habitat diversity, as indicated by supporting one red-listed estuarine wetland and one blue-listed swamp
- Potentially supporting federally and provincially listed wildlife species at risk
- Providing roosting and foraging habitat for the SARA-listed great blue heron *fannini* subspecies.

3.2.4 Traditional Use Plants

Six of the eight tree species documented as used by First Nations were found within the LAA (Compton 1993; MacDonald 2005). These species include hemlocks, amabilis fir, Pacific crabapple, Sitka spruce, western red cedar and yellow-cedar. Twenty-four shrub species were identified as useful and ten were found during surveys (Compton 1993; MacDonald 2005). These include: Alaska blueberry, black crowberry, blueberries, bog cranberry, devil's club, juniper, Labrador tea, red huckleberry, salal and salmonberry. Three of ten species of herbs and the fern were found, including bunchberry, hellebore, skunk cabbage and licorice fern (Compton 1993; MacDonald 2005).

Some of the species identified as those used by First Nations were unable to be identified from the name, including black mountain berry, mountain huckleberry, lily root and Pacific clover root (see Table 13).

Table 13: Traditional Use Plants Observed in the LAA

Species	Latin Name	First Nation Use	Occurs in the LAA
Trees			
Hemlock	<i>Tsuga species</i>	Food (cambium)	Yes
Pacific silver fir	<i>Abies amabilis</i>	Food (cambium)	Yes
Pacific crabapple	<i>Malus fusca</i>	Food	Yes
Sitka spruce	<i>Picea sitchensis</i>	Food (cambium)	Yes
Western red cedar	<i>Thuja plicata</i>	Material	Yes
Yellow cedar	<i>Chamaecyparis nootkatensis</i>	Material	Yes
Shrubs			
Alaska blueberry	<i>Vaccinium alaskaense</i>	Food	Yes
Black crowberry	<i>Empetrum nigrum</i>	Food	Yes
Black mountain berry		Food	unconfirmed

Species	Latin Name	First Nation Use	Occurs in the LAA
Blueberry	<i>Vaccinium sp</i>	Food	Yes
Bog cranberry	<i>Oxycoccus oxycoccus</i>	Food	Yes
Devil's club	<i>Oplopanax horridus</i>	Medicine (bark)	Yes
Juniper	<i>Juniperus sp</i>	Medicine	Yes
Labrador tea	<i>Rhododendron groenlandicum</i>	Medicine, food	Yes
Red huckleberry	<i>Vaccinium parvifolium</i>	Food	Yes
Salal	<i>Gaultheria shallon</i>	Food	Yes
Salmonberry	<i>Rubus spectabilis</i>	Food	Yes
Herbs			
Bunchberry (western cordillera)	<i>Cornus unalaschensis</i>	Food	Yes
Hellebore	<i>Veratrum viride</i>	Medicine	Yes
Lily root		Food	unconfirmed
Pacific Clover root		Food	unconfirmed
Skunk cabbage	<i>Lysichiton americanus</i>	Food	Yes
Ferns			
Licorice fern	<i>Polypodium glycyrrhiza</i>	Medicine	Yes

3.2.5 Weeds

No weeds on the noxious weed list or the Northwest Invasive Plant Council's list of target invasive plant species were found within the LAA (see Table 4).

4 KEY RESULTS AND FINDINGS

Baseline data on vegetation resources were collected to support the assessment of potential effects on vegetation associated with the proposed Project. Key results and findings of the baseline studies are presented below. Emphasis is placed on the vegetation resources in the LAA where potential effects on vegetation resources are most likely to occur. Key results and findings include:

- The majority of the LAA (61%) is covered by wetlands (154 ha) while 39% of the LAA consists of uplands (98 ha). This pattern of abundance of ecosystems contrasts with the surrounding RAA where 34% of the area is covered by wetlands and 51% consists of uplands.
- Bogs are the dominant wetland class in the LAA; 124 ha out of 154 ha of wetlands present are bogs.
- The LAA contains 0.1 ha of one red-listed plant community (CWHvh2/Ed01: tufted hairgrass–meadow barley estuarine meadow), and 27 ha of blue-listed plant communities (CWHvh2/04: western hemlock–Sitka spruce/lanky moss forest, CWHvh2/05: western red

cedar-Sitka spruce/sword fern forest, CWHvh2/07: western red cedar-Sitka spruce/devil's club forest and CWHvh2/13 (Ws54): western red cedar-Sitka spruce/skunk cabbage swamp).

- Wetlands in the LAA provide multiple habitat functions including: foraging, nesting and staging habitat for migratory birds (including songbirds and shorebirds); nesting and foraging habitat for federally-listed species at risk; and supporting two wetland communities that are provincially-listed ecological communities at risk.
- Approximately 60% of the LAA is old forest. Old forest structural stages occur within both uplands and wetlands
 - Six tree species, ten shrub species and three herb species used by First Nations in the region were detected in the LAA.
 - No plant species at risk or non-native invasive plant species were detected through surveys.

5 CLOSURE

This TDR for vegetation has been prepared for the sole benefit of Pacific NorthWest LNG Limited Partnership to describe baseline conditions of vegetation resources within the proposed project assessment areas. This report is based on field studies and review of existing data completed between August 2012 and July 2013. If there are any questions regarding the content of the report, please contact Andrea Pomeroy by e-mail at andrea.pomeroy@stantec.com.

Respectfully submitted,

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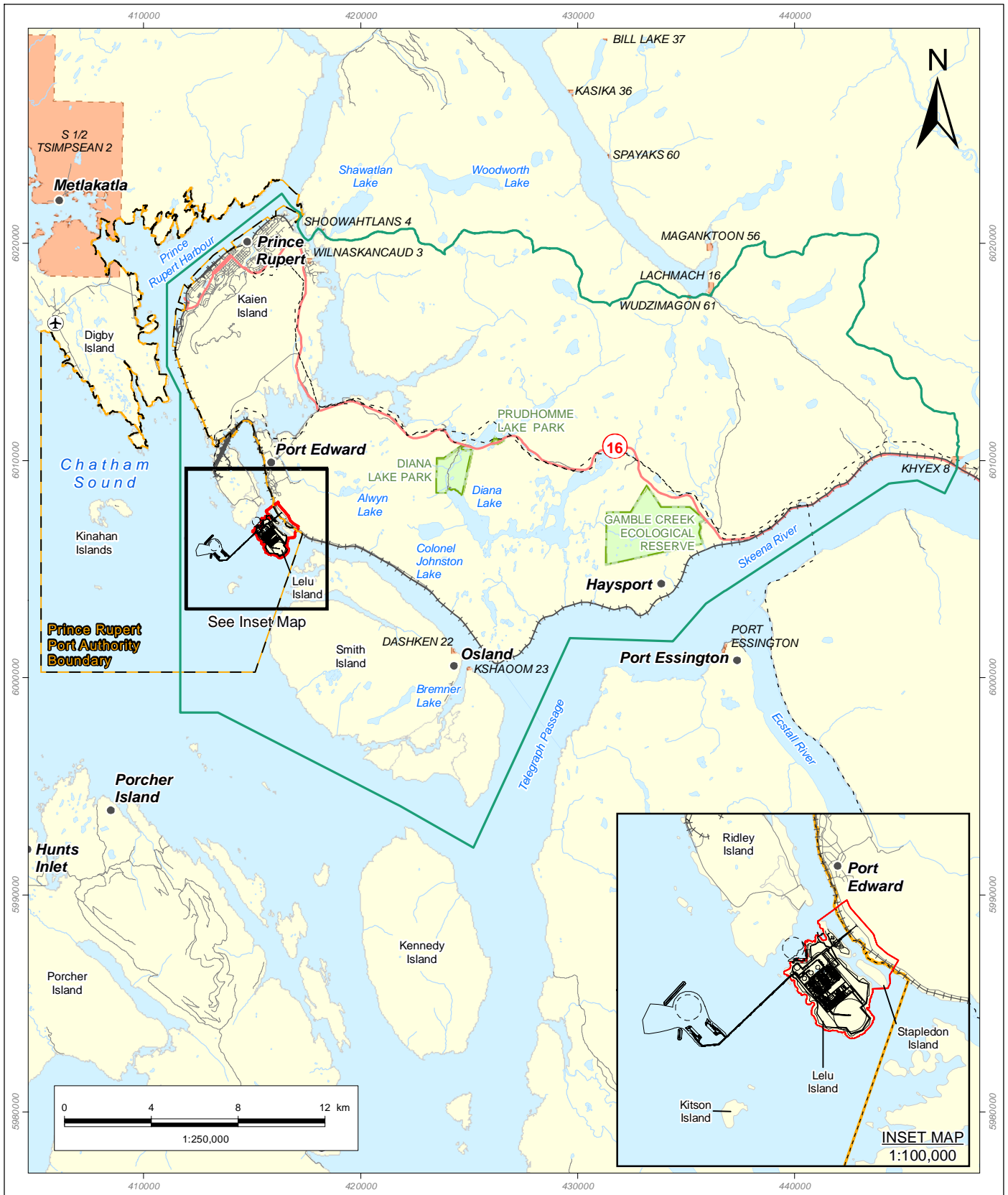
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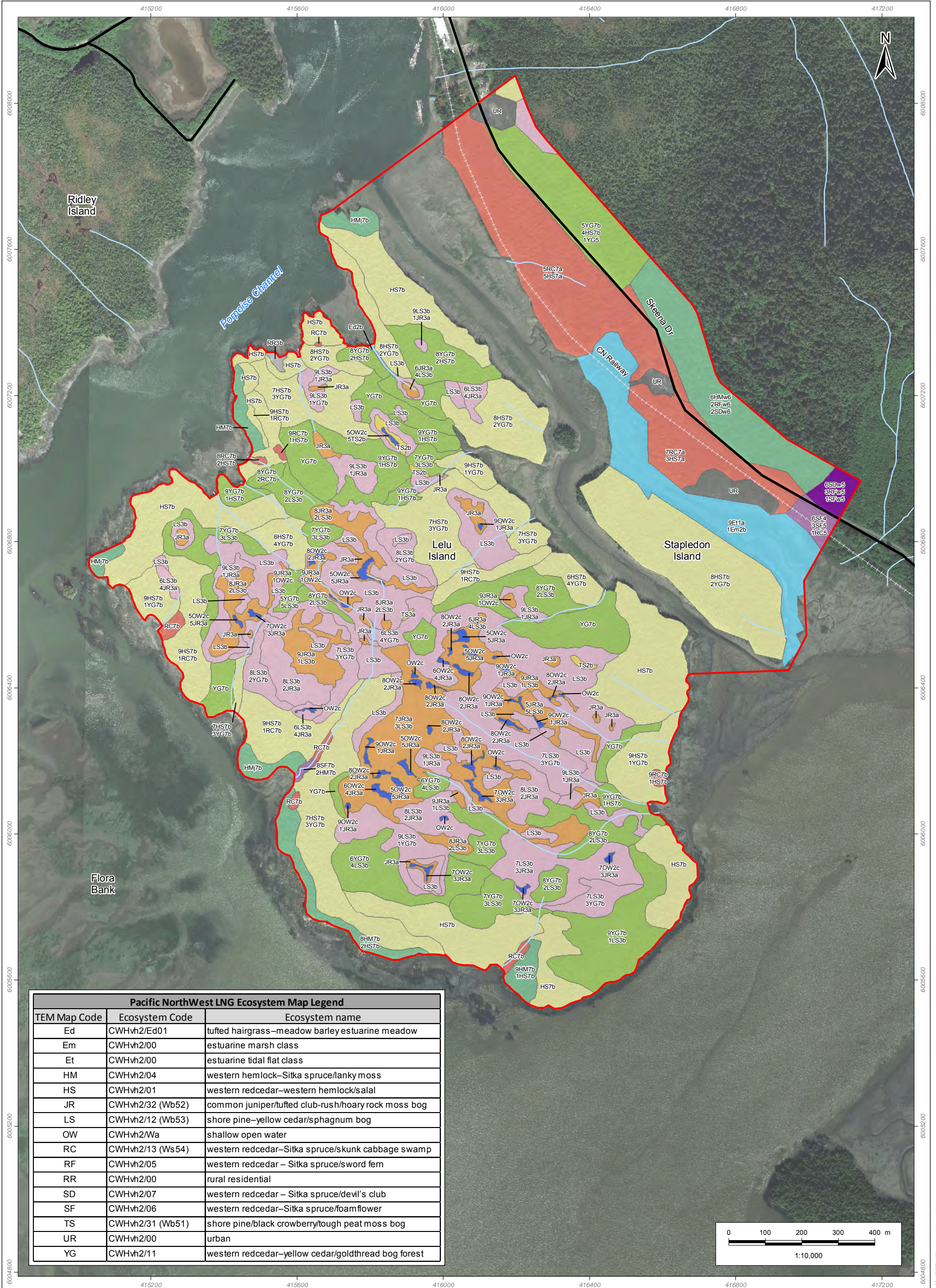
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7 FIGURES



<ul style="list-style-type: none"> Local Assessment Area Regional Assessment Area Project Component Turning Basin 	<ul style="list-style-type: none"> Airport City or Town Electrical Power Transmission Line Highway Railway Secondary Road Watercourse 	<ul style="list-style-type: none"> Indian Reserve Prince Rupert Port Authority Boundary Protected Area Waterbody
<p>Pacific North West LNG</p> <p>Local and Regional Assessment Areas for Vegetation</p>		
<p>Sources: Government of British Columbia; Prince Rupert Port Authority; Government of Canada, Natural Resources Canada, Centre for Topographic Information; Progress Energy Canada Ltd.</p> <p><i>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</i></p>		
<p>DATE: 11-FEB-14</p> <p>FIGURE ID: 123110537-217</p> <p>DRAWN BY: K. POLL</p>	<p>PROJECTION: UTM - ZONE 9</p> <p>DATUM: NAD 83</p> <p>CHECKED BY: D. HUEBERT</p>	<p>PREPARED BY:</p> <p> Stantec</p> <p>PREPARED FOR:</p> <p> Pacific North West LNG</p> <p>FIGURE NO:</p> <p style="font-size: 24px; text-align: center;">1</p>



Pacific NorthWest LNG Ecosystem Map Legend		
TEM Map Code	Ecosystem Code	Ecosystem name
Ed	CWHvh2/Ed01	tufted hairgrass–meadow barley estuarine meadow
Em	CWHvh2/00	estuarine marsh class
Et	CWHvh2/00	estuarine tidal flat class
HM	CWHvh2/04	western hemlock–Sitka spruce/lanky moss
HS	CWHvh2/01	western redcedar–western hemlock/salal
JR	CWHvh2/32 (Wb52)	common juniper/tufted club-rush/hoary rock moss bog
LS	CWHvh2/12 (Wb53)	shore pine–yellow cedar/sphagnum bog
OW	CWHvh2/Wa	shallow open water
RC	CWHvh2/13 (Ws54)	western redcedar–Sitka spruce/skunk cabbage swamp
RF	CWHvh2/05	western redcedar – Sitka spruce/sword fern
RR	CWHvh2/00	rural residential
SD	CWHvh2/07	western redcedar – Sitka spruce/devil's club
SF	CWHvh2/06	western redcedar–Sitka spruce/foam flower
TS	CWHvh2/31 (Wb51)	shore pine/black crowberry/tough peat moss bog
UR	CWHvh2/00	urban
YG	CWHvh2/11	western redcedar–yellow cedar/goldthread bog forest

<p>Dominant Map Code</p> <ul style="list-style-type: none"> Ed Em Et HM HS JR LS OW RC RR SD SF TS UR YG 	<p>Ecosystem Label</p> <p>e.g. 5SHx7</p> <p>5 = decile</p> <p>SH = map code</p> <p>x = map code modifier</p> <p>7 = structural stage</p>	<p>Local Assessment Area</p> <p>--- Railway</p> <p>— Road</p> <p>— Watercourse</p>
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Pacific NorthWest LNG

Terrestrial Ecosystem Mapping in the Local Assessment Area

Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; WorldView-2 Imagery, Imagery date: 2011.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

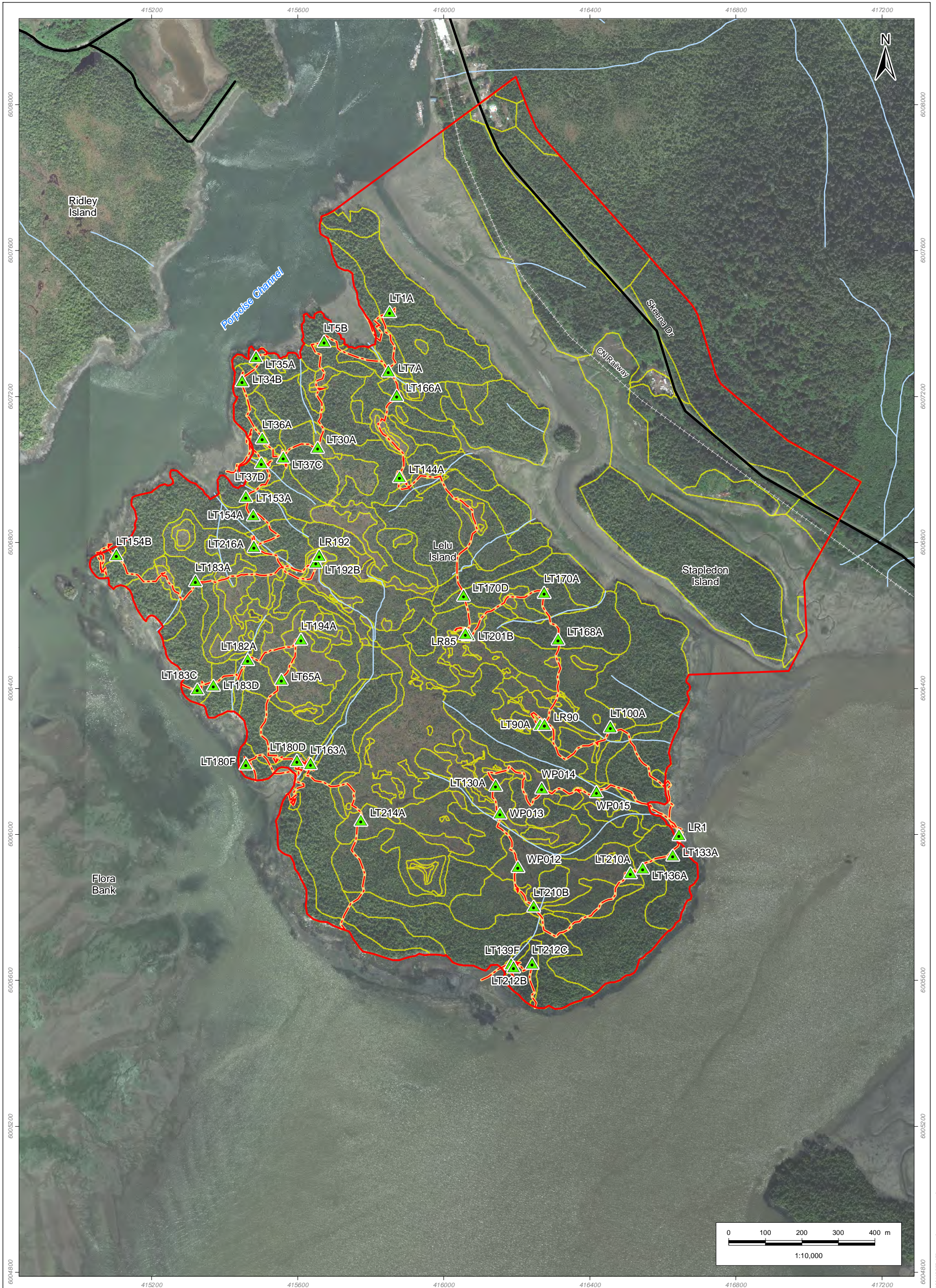
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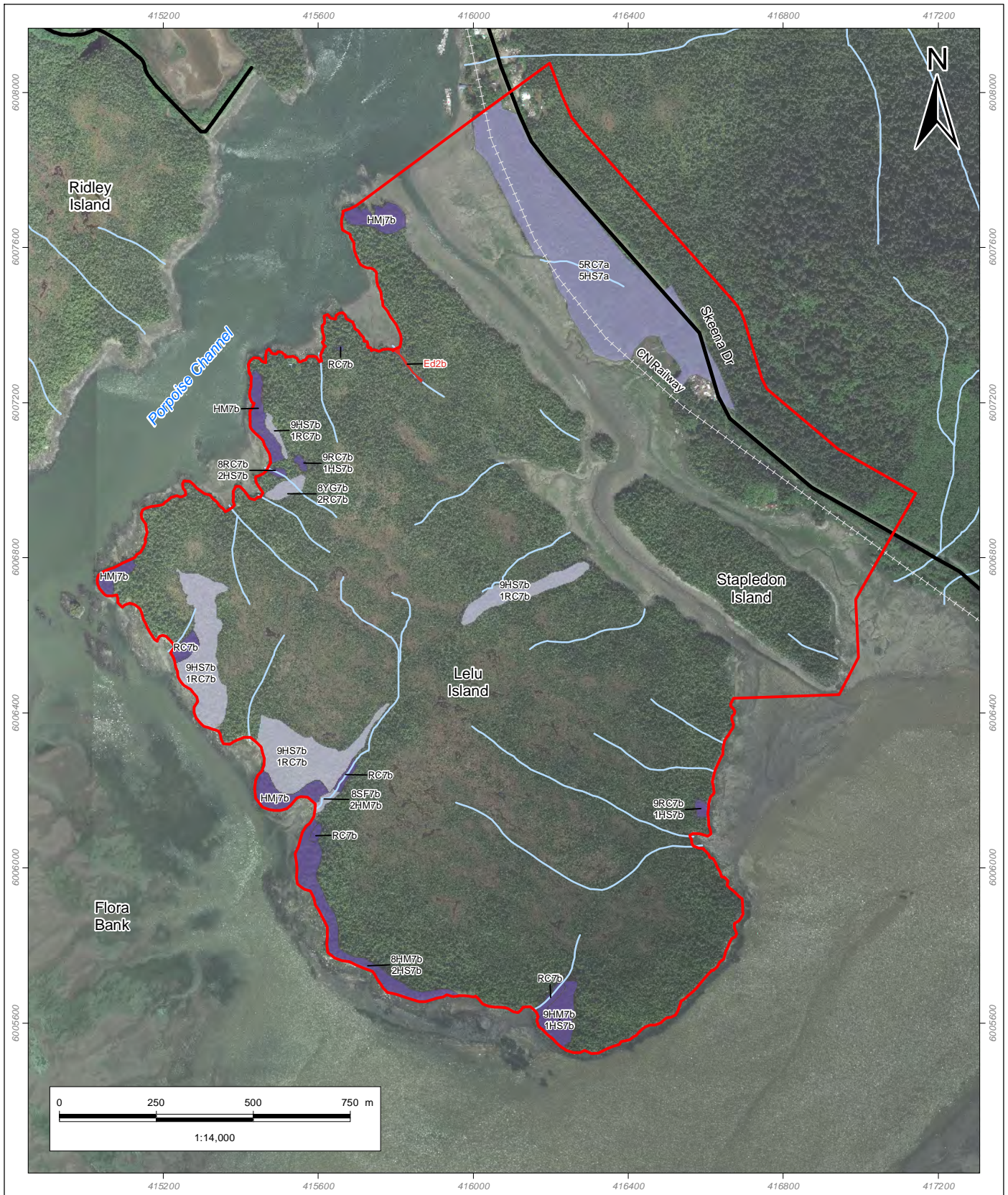
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2




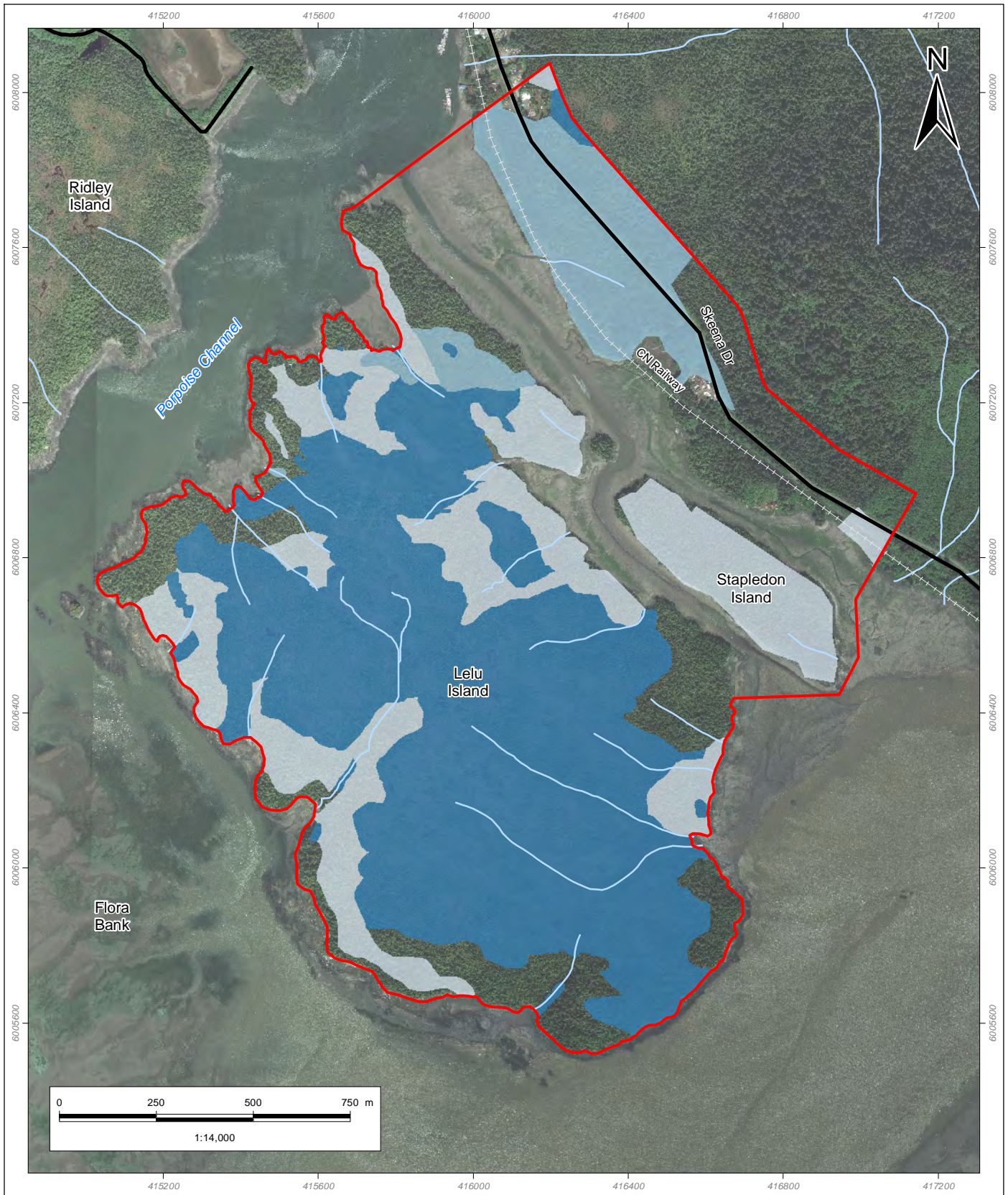
<ul style="list-style-type: none"> ▲ Rare Plant Sampling Location — Foot Traverse Terrestrial Ecosystem Polygon* Local Assessment Area --- Railway — Road — Watercourse <p><small>* Please refer to Terrestrial Ecosystem Study for detailed descriptions of vegetation communities.</small></p>	<p>Pacific NorthWest LNG</p> <p>Rare Plant Inventory Plots and Foot Traverse Survey Locations</p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; WorldView-2 Imagery, Imagery date: 2011.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">DATE: 11-FEB-14</td> <td style="width: 33%;">PROJECTION: UTM - ZONE 9</td> <td style="width: 33%;">DRAWN BY: K. POLL</td> </tr> <tr> <td>FIGURE ID: 123110537-170</td> <td>DATUM: NAD 83</td> <td>CHECKED BY: D. HUEBERT</td> </tr> </table>	DATE: 11-FEB-14	PROJECTION: UTM - ZONE 9	DRAWN BY: K. POLL	FIGURE ID: 123110537-170	DATUM: NAD 83	CHECKED BY: D. HUEBERT	<p>PREPARED BY:</p> <p> Stantec</p> <p>PREPARED FOR:</p> <p> Pacific NorthWest LNG</p> <p>FIGURE NO:</p> <p style="font-size: 24px; font-weight: bold; text-align: center;">3</p>
DATE: 11-FEB-14	PROJECTION: UTM - ZONE 9	DRAWN BY: K. POLL						
FIGURE ID: 123110537-170	DATUM: NAD 83	CHECKED BY: D. HUEBERT						



<p>Red Listed Ecological Community (100%)</p> <p>Percent Blue Listed Ecological Communities</p> <ul style="list-style-type: none"> > 60% 30% to 60% < 30% 	<p> Local Assessment Area</p> <p> Railway</p> <p> Road</p> <p> Watercourse</p>	<p>Pacific NorthWest LNG</p> <p>Ecological Communities at Risk in the Local Assessment Area</p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; WorldView-2 Imagery, Imagery date: 2011.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">DATE: 11-FEB-14</td> <td style="width: 50%;">PROJECTION: UTM - ZONE 9</td> </tr> <tr> <td>FIGURE ID: 123110537-150</td> <td>DATUM: NAD 83</td> </tr> <tr> <td>DRAWN BY: K. POLL</td> <td>CHECKED BY: D. HUEBERT</td> </tr> </table>	DATE: 11-FEB-14	PROJECTION: UTM - ZONE 9	FIGURE ID: 123110537-150	DATUM: NAD 83	DRAWN BY: K. POLL	CHECKED BY: D. HUEBERT	<p>PREPARED BY:</p> <p style="text-align: center;"></p> <p>PREPARED FOR:</p> <p style="text-align: center;"></p> <p>FIGURE NO:</p> <p style="text-align: center; font-size: 24px; font-weight: bold;">4</p>
DATE: 11-FEB-14	PROJECTION: UTM - ZONE 9								
FIGURE ID: 123110537-150	DATUM: NAD 83								
DRAWN BY: K. POLL	CHECKED BY: D. HUEBERT								



<p>Old Forest Coverage</p> <ul style="list-style-type: none"> > 60% 30% to 60% < 30% Local Assessment Area Railway Road Watercourse 	<p>Pacific NorthWest LNG</p> <p>Old Forest in the Local Assessment Area</p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; WorldView-2 Imagery, Imagery date: 2011.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p>		<p>PREPARED BY:</p> 
	<p>DATE: 11-FEB-14 FIGURE ID: 123110537-149 DRAWN BY: K. POLL</p>		<p>PROJECTION: UTM - ZONE 9 DATUM: NAD 83 CHECKED BY: D. HUEBERT</p>
	<p>FIGURE NO:</p> <p style="font-size: 24px; font-weight: bold; text-align: center;">5</p>		



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<p>Wetland Coverage</p> <ul style="list-style-type: none"> > 80% 50% to 80% < 50% Local Assessment Area Railway Road Watercourse 	<p>Pacific NorthWest LNG</p> <p>Wetlands in the Local Assessment Area</p> <p><small>Sources: Government of British Columbia; Government of Canada, Natural Resources Canada, Centre for Topographic Information; WorldView-2 Imagery, Imagery date: 2011.</small></p> <p><small>Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.</small></p> <table style="width: 100%; border: none;"> <tr> <td style="border: none;">DATE: 11-FEB-14</td> <td style="border: none;">PROJECTION: UTM - ZONE 9</td> </tr> <tr> <td style="border: none;">FIGURE ID: 123110537-148</td> <td style="border: none;">DATUM: NAD 83</td> </tr> <tr> <td style="border: none;">DRAWN BY: K. POLL</td> <td style="border: none;">CHECKED BY: D. HUEBERT</td> </tr> </table>	DATE: 11-FEB-14	PROJECTION: UTM - ZONE 9	FIGURE ID: 123110537-148	DATUM: NAD 83	DRAWN BY: K. POLL	CHECKED BY: D. HUEBERT	<p>PREPARED BY:</p> <p style="text-align: center;"></p> <p>PREPARED FOR:</p> <p style="text-align: center;"></p> <p>FIGURE NO:</p> <p style="text-align: center; font-size: 24px; font-weight: bold;">6</p>
DATE: 11-FEB-14	PROJECTION: UTM - ZONE 9							
FIGURE ID: 123110537-148	DATUM: NAD 83							
DRAWN BY: K. POLL	CHECKED BY: D. HUEBERT							

APPENDIX 1

Plant Species Observed within the LAA

PLANT SPECIES OBSERVED WITHIN THE LAA

Vegetation surveys within the LAA were conducted on two occasions: August 11 to 16, 2012 and May 2 to May 7, 2013. At survey locations, a full species list and basic habitat data were collected. If potential a rare plant species could not be identified in the field, it was collected and identified at a later time using microscope and an identification key. Plants collected were either identified at the end of the field day, or were dried and/or pressed for identification using microscopes and the identification keys and descriptions in the appropriate floras (Douglas et al. 1998a, 1998b, 1999a, 1999b, 2000, 2001a, 2001b, 2003; Flora North America 2012, Bryophyte Flora North America 2012, Goward et al. 1994; Goward 1999; Hultén 1968). Del Meidinger identified the vascular plant and lichen collections; Terry McIntosh identified the bryophyte collections.

Table 1-1 provides the complete species list of species recorded during field surveys.

Table 1-1: Plant Species Observed within the LAA

Species	Authority	English Name
Trees		
<i>Abies amabilis</i>	(Dougl. ex Loud.) Dougl. ex Forbes	Amabilis fir
<i>Chamaecyparis nootkatensis</i>	(D. Don) Spach	Yellow-cedar
<i>Pinus contorta</i> var. <i>contorta</i>	Dougl. ex Loud.	Shore pine
<i>Picea sitchensis</i>	(Bong.) Carr.	Sitka spruce
<i>Thuja plicata</i>	Donn ex D. Don	Western redcedar
<i>Tsuga heterophylla</i>	(Raf.) Sarg.	Western hemlock
<i>Tsuga mertensiana</i>	(Bong.) Carr.	Mountain hemlock
<i>Alnus rubra</i>	Bong.	Red alder
<i>Malus fusca</i>	(Raf.) Schneid.	Pacific crab apple
Shrubs		
<i>Gaultheria shallon</i>	Pursh	Salal
<i>Juniperus communis</i>	L.	Common juniper
<i>Rhododendron groenlandicum</i>	(Oeder) Kron & Judd	Labrador tea
<i>Menziesia ferruginea</i>	Sm.	False azalea
<i>Myrica gale</i>	L.	Sweet gale
<i>Rubus spectabilis</i>	Pursh	Salmonberry
<i>Vaccinium alaskaense</i>	Howell	Alaskan blueberry
<i>Vaccinium parvifolium</i>	Sm.	Red huckleberry
<i>Vaccinium ovalifolium</i>	Sm.	Oval-leaved blueberry
<i>Vaccinium uliginosum</i>	L.	Bog blueberry
Dwarf Shrubs		
<i>Andromeda polifolia</i>	L.	Bog-rosemary

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Appendix 1: Plant Species Observed within the LAA

Species	Authority	English Name
<i>Empetrum nigrum</i>	L.	Crowberry
<i>Kalmia microphylla</i>	(Hook.) Heller	Western bog-laurel
<i>Linnaea borealis</i>	L.	Twinflower
<i>Oxycoccus oxycoccus</i>	(L.) MacM.	Bog cranberry
<i>Rubus chamaemorus</i>	L.	Cloudberry
<i>Vaccinium caespitosum</i>	Michx.	Dwarf blueberry
<i>Vaccinium vitis-idaea</i>	L.	Lingonberry
Ferns and Fern-Allies		
<i>Athyrium filix-femina</i>	(L.) Roth	Lady fern
<i>Blechnum spicant</i>	(L.) Roth	Deer fern
<i>Dryopteris expansa</i>	(K.B. Presl) Fraser-Jenkins & Jermy	Spiny wood fern
<i>Gymnocarpium dryopteris</i>	(L.) Newman	Oak fern
<i>Huperzia selago</i>	(L.) Bernh. ex Schrank & Mart. sens. lat.	Northern fir-moss
<i>Lycopodium clavatum</i>	L.	Running club-moss
<i>Polypodium glycyrrhiza</i>	D.C. Eaton	Licorice fern
<i>Pteridium aquilinum</i>	(L.) Kuhn	Bracken fern
Graminoids		
<i>Agrostis aequivallis</i>	(Trin.) Trin.	Alaska bentgrass
<i>Calamagrostis nutkaensis</i>	(J. Presl) J. Presl ex Steud.	Pacific reedgrass
<i>Carex anthoxantha</i>	J. & K. Presl	Yellow-flowered sedge
<i>Carex disperma</i>	Dewey	Soft-leaved sedge
<i>Carex echinata</i>	Murr.	Star sedge
<i>Carex echinata ssp. phyllomanica</i>	(W. Boott) Reznicek	Coastal stellate sedge
<i>Carex livida</i>	(Wahlenb.) Willd.	Pale sedge
<i>Carex lyngbyei</i>	Hornem.	Lingbye's sedge
<i>Carex mertensii</i>	Prescott ex Bong.	Merten's sedge
<i>Carex pauciflora</i>	Lightf.	Few-flowered sedge
<i>Carex pluriflora</i>	Hult.	Many-flowered sedge
<i>Carex sitchensis</i>	Prescott ex Bong.	Sitka sedge
<i>Deschampsia cespitosa</i>	(L.) Beauv.	Tufted hairgrass
<i>Eriophorum angustifolium</i>	Honck.	Narrow-leaved cotton-grass
<i>Hordeum brachyantherum</i>	Nevski	Meadow barley
<i>Juncus arcticus</i>	Willd.	Arctic rush
<i>Juncus arcticus ssp. sitchensis</i>	Engelm.	Arctic rush
<i>Juncus supiniformis</i>	Engelm.	Spreading rush
<i>Leymus mollis</i>	(Trin.) Pilger	Dune wildrye
<i>Rhynchospora alba</i>	(L.) Vahl	White beak-rush

Species	Authority	English Name
<i>Trichophorum cespitosum</i>	(L.) Hartm.	Tufted clubrush
Forbs		
<i>Achillea millefolium</i>	L.	Yarrow
<i>Angelica lucida</i>	L.	Seacoast angelica
<i>Castilleja miniata</i>	Dougl. ex Hook.	Scarlet paintbrush
<i>Coptis aspleniifolia</i>	Salisb.	Spleenwort-leaved goldthread
<i>Coptis trifolia</i>	(L.) Salisb.	Three-leaved goldthread
<i>Cornus unalaschkensis</i>	Ledeb.	Alaskan bunchberry
<i>Drosera anglica</i>	Huds.	Great sundew
<i>Drosera rotundifolia</i>	L.	Round-leaved sundew
<i>Epilobium angustifolium</i>	L.	Fireweed
<i>Fauria crista-galli</i>	(Menzies ex Hook.) Makino	Deer-cabbage
<i>Gentiana douglasiana</i>	Bong.	Swamp gentian
<i>Glaux maritima</i>	L.	Sea-milkwort
<i>Ligusticum scoticum</i>	L.	Beach lovage
<i>Listera caurina</i>	Piper	Northwestern twayblade
<i>Listera cordata</i>	(L.) R. Br.	Heart-leaved twayblade
<i>Lysichiton americanus</i>	Hult. & St. John	Skunk cabbage
<i>Maianthemum dilatatum</i>	(A. Wood) Nels. & J.F. Macbr.	False lily-of-the-valley
<i>Menyanthes trifoliata</i>	L.	Buckbean
<i>Nuphar polysepala</i>	Engelm.	Rocky Mountain pond-lily
<i>Pinguicula vulgaris</i>	L.	Common butterwort
<i>Plantago macrocarpa</i>	Cham. & Schlecht.	Alaska plantain
<i>Plantago maritima</i>	L.	Sea plantain
<i>Platanthera aquilonis</i>	Sheviak	Northern green rein orchid
<i>Platanthera chorisiana</i>	(Cham.) Reichenb. f.	Chamisso's rein orchid
<i>Platanthera stricta</i>	Lindl.	Slender rein orchid
<i>Potentilla anserina</i>	L.	Common silverweed
<i>Potentilla villosa</i>	Pall. ex Pursh	Villous cinquefoil
<i>Rubus pedatus</i>	J.E. Sm.	Five-leaved bramble
<i>Sanguisorba officinalis</i>	L.	Great burnet
<i>Streptopus amplexifolius</i>	(L.) DC.	Clasping twistedstalk
<i>Streptopus lanceolatus</i>	(Ait.) Reveal	Rosy twistedstalk
<i>Triantha glutinosa</i>	(Michx) Baker	Sticky false asphodel
<i>Tiarella trifoliata</i>	L.	Three-leaved foamflower
<i>Tiarella trifoliata</i> var. <i>laciniata</i>	(Hook.) Wheelock	Cut-leaved foamflower
<i>Tiarella trifoliata</i> var. <i>trifoliata</i>		Three-leaved foamflower

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Species	Authority	English Name
<i>Trientalis europaea</i>	L.	Northern starflower
<i>Trientalis europaea</i> ssp. <i>arctica</i>	(Fisch. ex Hook.) Hult.	Northern starflower
<i>Veratrum viride</i>	W. Ait.	Indian hellebore
<i>Utricularia intermedia</i>	Hayne	Flat-leaved bladderwort
Mosses		
<i>Antitrichia curtipendula</i>	(Hedw.) Brid.	Hanging wing-moss
<i>Dicranum majus</i>	Sm.	Greater heron's-bill moss
<i>Dicranum fuscescens</i>	Turn.	Curly heron's-bill moss
<i>Dicranum groenlandicum</i>	Brid.	Greenland heron's-bill moss
<i>Dicranum pallidisetum</i>	(Bail.) Irel.	Pale-stalked broom-moss
<i>Dicranella</i> sp.	(Müller Hal.) Schimp.	Forklet-moss
<i>Dicranodontium denudatum</i>	(Brid.) Britt.	Beaked bow-moss
<i>Eurhynchium oregonum</i>	(Sull.) Jaeg.	Oregon beaked-moss
<i>Hookeria lucens</i>	(Hedw.) Sm.	Shining clear-moss
<i>Hylocomium splendens</i>	(Hedw.) Schimp.	Step moss
<i>Isoetecium myosuroides</i>	Brid.	Variable moss
<i>Plagiothecium undulatum</i>	(Hedw.) Schimp.	Flat-moss
<i>Pleurozium schreberi</i>	(Brid.) Mitt.	Red-stemmed feathermoss
<i>Polytrichastrum alpinum</i>	(Hedw.) G.L. Sm.	Stiff-leaved haircap moss
<i>Polytrichum strictum</i>	Brid.	Bog haircap moss
<i>Racomitrium lanuginosum</i>	(Hedw.) Brid.	Hoary rock-moss
<i>Rhizomnium glabrescens</i>	(Kindb.) T. Kop.	Large leafy moss
<i>Rhytidiadelphus loreus</i>	(Hedw.) Warnst.	Lanky moss
<i>Sphagnum austinii</i>	Sull.	Austin's peat-moss
<i>Sphagnum capillifolium</i>	(Ehrh.) Hedw.	Common red peat-moss
<i>Sphagnum fuscum</i>	(Schimp.) Klinggr.	Common brown peat-moss
<i>Sphagnum</i> cf. <i>inexpectatum</i>	Flatb.	
<i>Sphagnum lindbergii</i>	Schimp.	Brown-stemmed peat-moss
<i>Sphagnum magellanicum</i>	Brid.	Magellanic peat-moss
<i>Sphagnum pacificum</i>	Flatb.	Pacific peat-moss
<i>Sphagnum papillosum</i>	Lindb.	Fat peat-moss
<i>Sphagnum rubellum</i>	Wils.	Ruby peat-moss
<i>Sphagnum rubiginosum</i>	Flatberg	Rubiginose peat-moss
<i>Sphagnum squarrosum</i>	Crome	Shaggy peat
<i>Sphagnum subnitens</i>	Russ. & Warnst.	Lustrous peat-moss
<i>Sphagnum tenellum</i>	(Brid.) Bory	Soft peat-moss
<i>Splachnum ampullaceum</i>	Hedw.	Cruet collar-moss

Species	Authority	English Name
<i>Splachnum sphaericum</i>	Hedw.	Round-fruited collar-moss
<i>Ulota obtusiuscula</i>	C. Müll. & Kindb.	Twisted pincushion
Liverworts		
<i>Bazzania tricrenata</i>	(Wahlenb.) Lindb.	Three-toothed whip liverwort
<i>Diplophyllum albicans</i>	(L.) Dum.	Common fold-leaf liverwort
<i>Frullania tamarisci</i>	(L.) Dum.	
<i>Frullania tamarisci</i> ssp. <i>nisquallensis</i>	(Sull.) Hatt.	Hanging-millipede liverwort
<i>Herbertus aduncus</i>	(Dicks.) S. Gray	Common scissor-leaf liverwort
<i>Kurzia</i> sp.	G. Martens	
<i>Metzgeria conjugata</i>	Lindb.	
<i>Mylia taylorii</i>	(Hook.) S. Gray	Hard-scale liverwort
<i>Pellia neesiana</i>	(Gott.) Limpr.	Shiny liverwort
<i>Plagiochila porelloides</i>	(Torr. ex Nees) Lindenb.	Cedar-shake liverwort
<i>Pleurozia purpurea</i>	Lindb.	Purple-worm liverwort
<i>Scapania bolanderi</i>	Aust.	Yellow-ladle liverwort
Lichens		
<i>Calicium</i> sp.	Pers.	Stubble lichens
<i>Cladina mitis</i>	(Sandst.) Hustich	Lesser green reindeer
<i>Cladina portentosa</i>	(Dufour) Follmann	Maritime reindeer
<i>Cladina portentosa</i> ssp. <i>pacifica</i>	(Ahti) Ahti	Maritime reindeer
<i>Cladina rangiferina</i>	(L.) Nyl.	Grey reindeer
<i>Cladina</i> sp.	(Nyl.) Nyl.	Reindeer lichens
<i>Cladina stellaris</i>	(Opiz) Brodo	Star-tipped reindeer
<i>Lobaria oregana</i>	(Tuck.) Müll. Arg.	Lettuce lung
<i>Peltigera aphthosa</i>	(L.) Willd.	Freckle pelt
<i>Sphaerophorus globosus</i>	(Hudson) Vainio	Clustered coral
<i>Usnea</i> sp.	Dill. ex Adans.	Beard lichens