



Ecological Assessment

Parcel A of DL88 and DL89, Plan 27287 & Lot 9, Plan 31200
DL90, Galiano Island, BC

March, 2021

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- Summary of changes and updates to ecological condition since the 2009 baseline documentation included with the Crystal Mountain Ecosystem-based Land-use Plan (Erickson, 2010)
 - Summary of the distribution of Sensitive Ecosystems and Habitat Types according to proposed Crystal Mountain and Islands Trust Conservancy lot configuration
 - Ecological Considerations for the proposed Crystal Mountain Site Plan and location of structures.
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Prepared for Crystal Mountain Society
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Introduction

This report provides a summary of the observed changes in ecological character and describes new disturbances that have taken place since the detailed ecological assessment was completed in 2009 as part of the '*Crystal Mountain Ecosystem-based Land-use Plan for Parcel A of DL89 except part in plan 27287 and Lot 9 Plan 31200 D190, Galiano Island, BC*'. The report also updates and improves the accuracy of ecological classifications and map unit boundaries.

Updates are based on field observations that took place during three site visits on November 3rd, November 20th and December 10th, 2020. GPS was used to aid mapping updates along with detailed review of current aerial photography. All ecological communities documented in the 2009 assessment were visited. The review assessed the general character of the ecosystems and dominant species, noting only the most significant and obvious changes. This review did not include a detailed species inventory and did not verify species by species coverage estimates.

Observations and updates are listed for each ecological community (EC). If a community is not listed, there were no significant changes observed.

Map 1 shows the revised ecological community boundaries.

This report is a companion document to the original 2009 ecological assessment. The 2009 report is included as Appendix 1.

In addition to updating the baseline documentation, this report addresses requested information (items 2 and 3 below) from Islands Trust Planner, Brad Smith, communicated verbally in a meeting with Crystal Mountain representatives and Keith Erickson and outlined in his October 5th, 2020 Staff Report to the Galiano Island Local Trust Committee (File No: GL-RZ-2014.1).

1. *Conduct a site visit to confirm if site conditions remain the same or have changed (e.g. increased beaver activity may have shifted hydrology in low lying areas).*
2. *Compare proposed location of CMS structures on site plan with ecological data to identify any areas of significant concern or potential impact.*
3. *Provide a summary of habitat features/types on the 25% portion retained by CMS versus the 75% proposed for transfer to ITC (% wetland habitat).*

The report identifies ecological communities considered as 'sensitive ecosystems' and locates them in relation to the proposed subdivision lot configuration (Shown on Map 2 – Sensitive Ecosystem Distribution). The report also summarizes the distribution of ecological communities, or, habitat types according to the proposed subdivision lot configuration, in Figure 1. In addition, the report discusses the criteria used to determine the proposed lot configuration and siting plan and provides further recommendations for final siting of structures.

General Trends and Observations of Forest Succession on the Properties

Mature Forest Communities

Areas characterized by mature forest appeared substantively unchanged in structural, compositional, and functional aspects.

Pole Sapling or Immature Forest Communities

These stands were logged in 1993 or 1994 and do not appear to have been planted. Natural regeneration would have taken a year or two to respond making the age of the dominant tree canopy roughly 15 years old in 2009 and 26 years old in 2020. The stand is now cusp on becoming a young forest where a dense conifer dominated canopy is forming and the natural stem exclusion process is beginning to ramp up. General shifts between 2009 and 2020 include:

- Increased canopy closure.
- Increased dominance of conifer species, particularly Douglas-fir.
- Marginal decrease in broadleaf tree cover.
- Marginal decrease in shrub (salal) cover.
- Marginal decrease in cover of moss and herbaceous species.
- Evidence of the initiation of stem exclusion in very dense Douglas-fir patches.
- Slightly older trees that were already established as saplings or poles in the sub-canopy prior to logging are emerging as dominant structures in the stands.

Ecological Communities

Crystal Mountain Properties
December 2020 Update

Scale: 1 : 3,500

Projection: UTM Zone 10 NAD83

Map Rotation: 46 degrees West of North

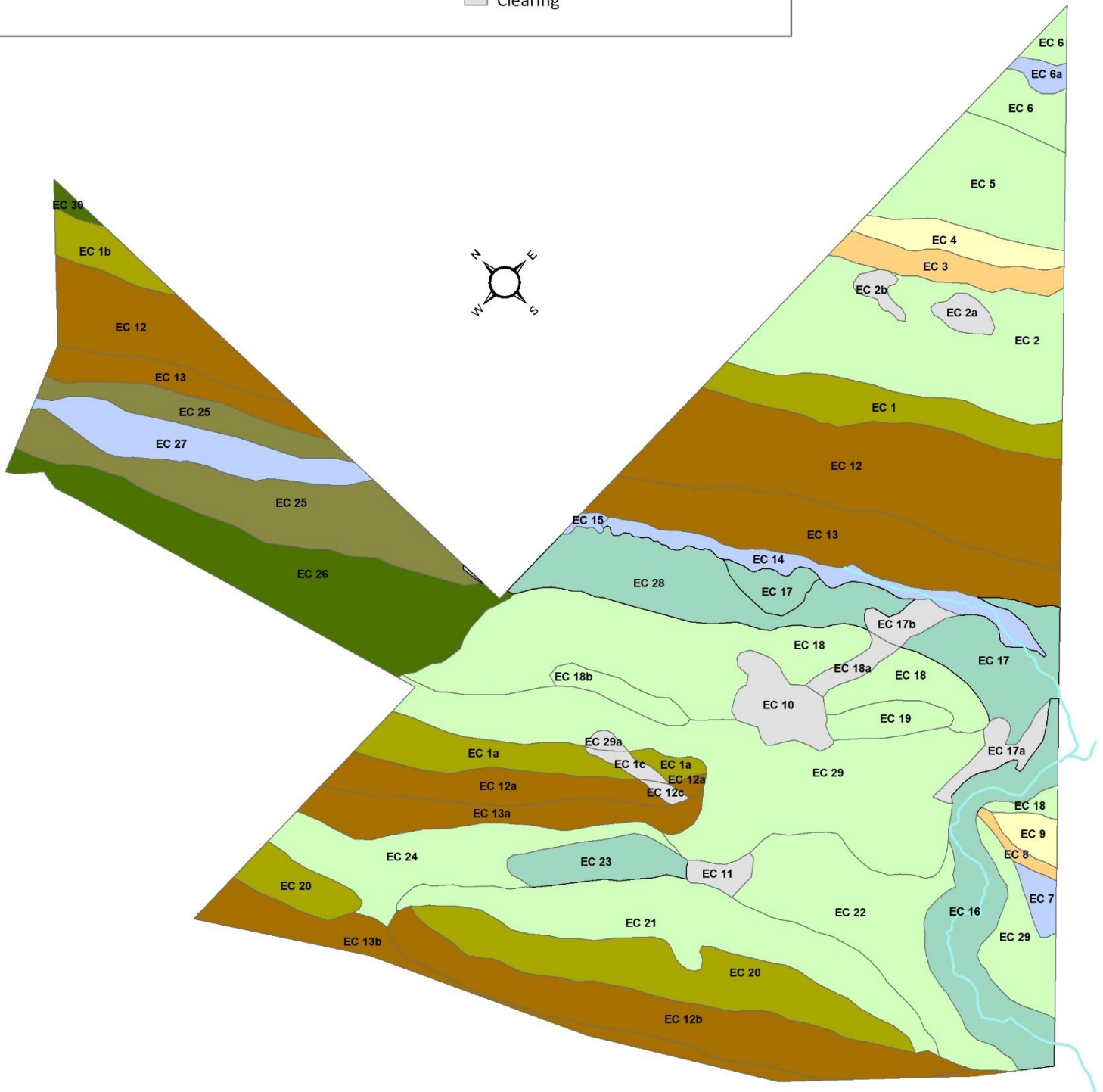
Map Date - Feb 3, 2021

Produced by: Keith Erickson



- Creek
- Mature Forest - Moist Soil
- Mature Forest
- Mature Forest - Steep SW Slope
- Mature Forest - Ridge
- Immature Forest - Moist Soil
- Immature Forest
- Immature Forest - Steep SW Slope
- Immature Forest - Ridge
- Wetland
- Clearing

MAP 1



Ecological Communities (EC): Changes and Updates

EC 01

A meditation platform was removed from southwest edge of ridge in Polygon 1 in 2016. This site is now designated for day use meditation which does not require infrastructure.

2013 – Platform in active use.



December 2020 – site recovering.



In Polygon 01a, a patch of forest extending south from the meditation platform has been logged to create an unobstructed view to the Trincomali Channel. The cutting extends down through Polygon 12a and into Polygon 29. The platform and clearing are shown on the accompanying map and labeled as Polygons 01c, 12c and 29a.



EC 02

A sleeping hut and related clearing have been established in this polygon. The clearing is shown on the revised Ecological Communities Map and is shown as Polygon 2b. Access to the hut is from the established easement road through EC02.



EC 03

Includes small patches of Provincially red listed CDFmm/01 Douglas-fir – dull Oregon grape in deeper soiled pocket sites on the steep slope between rock outcrops.

EC 05

Taking on young forest character with Douglas-fir and Western redcedar seed trees taking on more of a dominant forest canopy structure and salal dominated patchy gaps beginning to fill in with Douglas-fir poles.

EC 06

This community is characterized by CDFmm/01 – 70%, CDFmm/05 – 30%.

Polygon 06a is an old landing or log sorting area with compacted, seasonally flooded soils. The ecosystem on this disturbed, moisture receiving site is difficult to classify though the amount of standing water in the winter would suggest that it would have wetland characteristics of a Western redcedar - salmonberry – skunk cabbage (CDFmm/11) community in its natural state.

EC 07

This community more closely resembles a seasonally flooded, Sitka willow-Pacific willow-skunk cabbage swamp (Ws51) ecosystem. It is not a CDFmm/09 low bank floodplain ecosystem as previously identified.

EC 12

A portion of polygon 12a was logged to provide a view from the meditation platform. This area has been delineated on the ecosystem map and is now labeled as EC12c. While the trees have been removed, the area retains its shrub and herbaceous cover, though these layers were temporarily disturbed from the tree falling.

EC 14

Boundaries have been adjusted to include the seasonally flooded wetland area that runs along the base of the primary ridge/cliff ecosystem according to 2020 field reconnaissance.

EC 15

This ecological community, as described in the original report has been absorbed into adjacent, but similar communities and the map has been adjusted accordingly.

The wetland depression portions have been merged with EC14 and the lower slope CDFmm/06 portions have been merged with EC28 and EC17 according to their dominant tree and understory cover.

The map label EC15 now refers to a small, previously unmapped wetland that was discovered at the toe of the major cliff line along the norther boundary of Lot A. The wetland is dominated by slough sedge (*Carex obnupta*) mixed with patches of hardhack (*Spirea douglasii*) along with scattered willow (*Salix sitchensis?*), Pacific ninebark (*Physocarpus capitatus*) and black hawthorn (*Crataegus douglasii*) in the shrub layer. The margins of the wetland are lined with red alder, Western redcedar, and grand fir along with a dense sword fern and salal patches characteristic of a CDFmm/06 ecosystem as it transitions into EC28 to the west and EC13 to the east.



EC 16

This community has been incorporated into EC17 in areas where they shared a boundary to more accurately reflect the ecological continuity observed during the 2020 site visit. Polygon 16a is now part of 17a. As a result of this change, the new description is as follows:

EC16 is a riparian forest (CDFmm/06) characterized by scattered Douglas-fir, bigleaf maple and Western redcedar dominant trees in a matrix of young red alder in the sub-canopy and a sword fern dominated understory with scattered salmonberry throughout. There are moister areas in small depressions along the creek where red alder is mixed with black cottonwood and a higher concentration of salmonberry occurs.

The ecosystem begins to transition to a young Douglas-fir / Western redcedar dominated forest with scattered red alder, grand fir and salmonberry towards the southern corner of the property.

Additional species were observed in December 2020 include cascara, pacific willow, and snowberry.

EC 17

Boundaries have been adjusted according to 2020 field reconnaissance (see EC15 and EC16).

17a and 17b have started to regenerate to red alder except where the road is still used. These areas would benefit from a 'rough and loose' decompaction treatment.

Sleeping huts have been established in both Polygon 17a and 17b. The sleeping huts were established on the edges of the polygons and included some tree and vegetation clearing. Crystal Mountain has indicated that the sleeping huts will be moved from these locations.

After the huts are removed from these areas, the compacted, grass dominated clearings and old roadbeds are slated for 'rough and loose' decompaction treatment to restore a natural ecosystem.

EC 18

Average diameter main canopy Douglas-fir tree was cored and is estimated to be 24 years old.

A new polygon labeled 18b was delineated within EC18. It is a long, narrow band running parallel to a portion of the main driveway access from Devina. Excess soil and rock produced during the construction of Devina Dr. was piled in this area and left for decades. A young bigleaf maple stand has now grown up on the fill. The understory includes scattered, suppressed grand fir and Douglas-fir saplings growing and a thick layer of moss connecting a few scattered patches of sword fern.

EC 19

EC19 is mostly comprised of a Douglas-fir dominated CDFmm/01 ecosystem on a moderately sloped 'knoll' with small pockets of steeper southwest facing slope. The understory is mostly salal with pockets of dull Oregon grape. Arbutus will likely be surpassed by Douglas-fir and be shaded out of this stand.

EC 20

Pole/sapling areas are mainly located along the northeastern boundary of the polygon. There are a few old Douglas-fir trees that should be considered dominant (A1) accounting for roughly 8% cover.

EC 21

There are young, dominant Douglas-fir (20% cover) and arbutus (5% cover) trees throughout the matrix of smaller pole-sapling Douglas-fir canopy. There are also a couple of larger Western redcedar trees scattered throughout.

This community is roughly 80% pole-sapling and 20% young forest. The density of older, larger trees increases towards the upper slope position along the border with EC20.

EC 22

Scattered Douglas-fir trees beginning to emerge as co-dominant with red alder. A small, slough sedge dominated pocket wetland (too small to map) was discovered at the end of the old logging road in the southern 'panhandle' of this polygon. The seepage drains down to Porlier Pass Road. Spurge Laurel was also observed here.

EC 23

Red alder dominated CDFmm/06 (70%) transitions to a Pacific willow (*Salix lucida*) - slough sedge (*Carex obnupta*) dominated wetland, possibly a CDFmm/14 (30%) site with a fluctuating water table. Compaction related to machine use during logging was observed in the wet depression portion of the polygon making it difficult to determine the ecosystem classification. Black cottonwood (*Populus trichocarpa*), and Cascara (*Rhamnus purshiana*) were also observed along the margins of the wet depression, in the dominant tree layer and tall shrub layer respectively.

EC 24

This stand is transitioning from a pole/sapling to a young forest with Douglas-fir beginning to form a main canopy (A2) layer. The ecosystem is a CDFmm/01-04 (90%) with a slightly moister, depression area running roughly north/south along the old road and where this 'valley' opens up to the west with moisture running down towards the ocean through a gap in the ridge line (EC20).

EC 25/26

Meditation huts have been carefully deconstructed and removed. There is 1 outhouse and 1 storage shed remaining in this area. These structures are slated to be removed prior to transfer of the land.

Dec. 2020: Site of former meditation hut.



Shed to be removed.



EC 28

Observation in December 2020 clearly identifies a stream and wetland complex similar to that described in Ecosystem 15 (see description in original report and updates in this document) along the narrow depression at the base of the slope (with southwest facing EC13 on the other side). This area has been removed from EC28 and the map has been adjusted accordingly.

A small area was cleared of shrubs and a couple of trees were cut to accommodate a tent platform in this polygon. The platform will be removed, and the site will be restored prior to transfer. This area is shown on the updated map.



Disassembled platform shown in background. Stump of cut tree just to right of platform.

EC 29

Dense Douglas-fir dominated stand transitioning to a young forest. This ecosystem has a significantly higher percent cover of Douglas-fir than observed in the original report – approaching 50% now. Arbutus, red alder, and bitter cherry remain in the stand (though will be shaded out over the next few decades). The ecosystem includes the occasional larger diameter,

dominant bigleaf maple and remnant Douglas-fir. There is a higher concentration of larger diameter trees in the upper slope portions along the boundary with EC01a. Soils are also drier and slightly poorer in nutrients in this upper slope area.

A small chunk of this ecosystem has been cleared around the meditation platform and has been labeled EC29a on the map. The area has been cleared of trees but retains a partial shrub – salal – layer.

Summary of Sensitive Ecosystems and Habitat Types

Crystal Mountain is proposing a rezoning that requires the subdivision of Lot A to create two parcels, one retained by Crystal Mountain and one transferred to the Islands Trust Conservancy along with the entirety of Lot 9, for conservation purposes. Crystal Mountain will retain 25% of the total area (Lot 9 and Lot A) or 6.14 hectares and the Islands Trust Conservancy (ITC) will receive 75% of the total area or 18.41 hectares.

Ecological communities designated as sensitive include:

- Wetlands
- Riparian forest including all areas within 30m of the stream channel
- Forests with moist to wet soils (CDFmm/06, CDFmm/11, CDFmm/14)
- Mature Forest
- Rare and endangered ecological communities
- Steep slopes and cliffs with shallow soils in all forest structural stages

Based on the updated ecological community classification and mapping completed in December 2020 and the proposed subdivision lot configuration dated March, 2021, sensitive ecological communities are distributed as follows (see Map 2):

- Total area of sensitive ecological communities on the properties: 15.53 hectares
- Total area of sensitive ecosystem in proposed CM Portion: 1.04 hectares (6.7%)
- Total area of sensitive ecosystem in proposed ITC Portion: 14.49 hectares (93.3%)

The following table provides a summary of how the full range of mapped and described ecological communities (in this report) are distributed across the proposed properties.

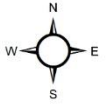
FIGURE 1: Ecosystem Types by Proposed Lot

Ecological Community Type	Sensitive	Total Area (ha)	Crystal Mountain		Islands Trust Conservancy	
			Area (ha)	% of Ecosystem	Area (ha)	% of Ecosystem
Clearing		0.84	0.60	71%	0.24	29%
Immature Forest		9.08	4.61	51%	4.46	49%
Immature Forest - Moist Soil	yes	1.36	0.12	9%	1.24	91%
Immature Forest - Ridge	yes	0.33		0%	0.33	100%
Immature Forest - Steep SW Slope	yes	0.30		0%	0.30	100%
Mature Forest	yes	1.34		0%	1.34	100%
Mature Forest - Moist Soil	yes	2.30		0%	2.30	100%
Mature Forest - Ridge	yes	2.20	0.49	22%	1.71	78%
Mature Forest - Steep SW Slope	yes	5.87	0.31	5%	5.55	95%
Wetland	yes	0.94		0%	0.94	100%
Total		24.55	6.14	25%	18.41	75%

MAP 2

Sensitive Ecosystem Distribution

Crystal Mountain Society Proposed
Subdivision Lot Configuration, March 2021

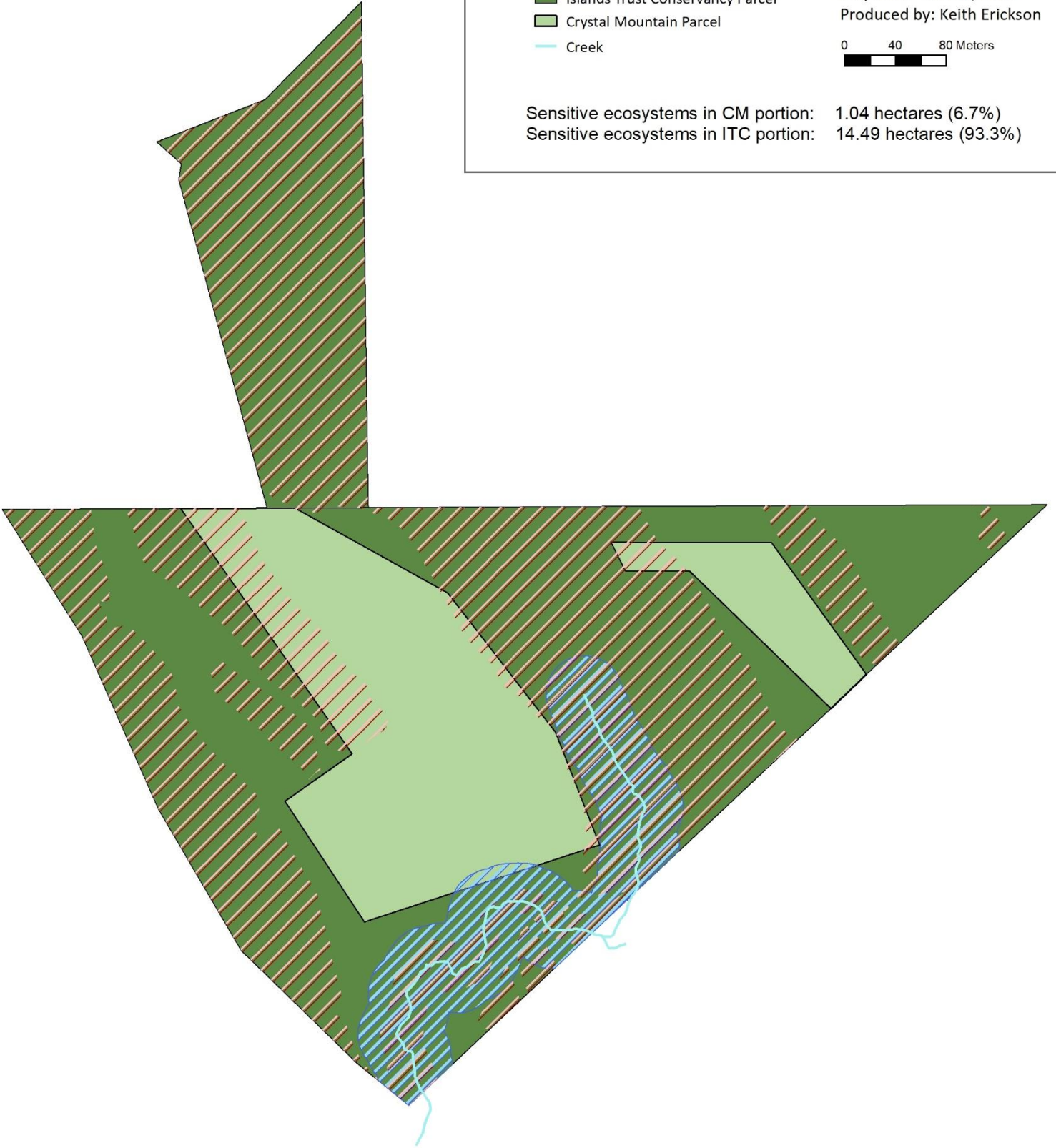


- Sensitive Ecosystem
- Riparian Buffer (30m)
- Islands Trust Conservancy Parcel
- Crystal Mountain Parcel
- Creek

Scale: 1 : 4,000
UTM Zone 10 NAD83
Map Date - March, 2021
Produced by: Keith Erickson



Sensitive ecosystems in CM portion: 1.04 hectares (6.7%)
Sensitive ecosystems in ITC portion: 14.49 hectares (93.3%)



Ecological Considerations of Crystal Mountain Site Plan and Proposed Location of Structures

Crystal Mountain has prepared a site plan that considers maximum protection and minimum impact to ecological values on the land given the following critical development criteria to achieve the Society's spiritual education goals:

1. Ensure limited, long-term spiritual education use in the upper ridge location where the elements of privacy required for this use can be adequately achieved.
2. Ensure facilities to accommodate multi-day, overnight, spiritual education use for up to 28 participants. Accommodations, as much as possible, should be arranged in manner that provides visual and auditory solitude / privacy for participants.
3. Ensure access to viewpoints and view corridors for spiritual education participants.
4. Provide facilities to accommodate a caretaker of the land and administrative management of Crystal Mountain Society programs.
5. Ensure access to spiritual education use areas from public roads.
6. Ensure Emergency Access across Lot A that serves to connect Devina Drive with Porlier Pass Road.
7. Utilize 'buildable' areas specified by the Geotechnical survey completed for Lot A.

Given these development parameters, Crystal Mountain Society has developed a subdivision lot configuration using the following ecological criteria:

- Protect a minimum 30m riparian buffer either side of the seasonal stream channel except for where the requested Emergency Access necessarily crosses the stream.
- Protect all wetlands.
- Protect moist forest areas including all CDFmm/06 ecological communities.
- Protect shallow soiled, ridge, cliff and steep southwest facing slope that include Provincially red listed CDFmm/02 Douglas-fir / Arbutus and CDFmm/01 Douglas-fir – dull Oregon grape ecological communities.
- Protect areas characterized by mature forest (80+ years of age)
- Focus development in areas where ecological values have been compromised due to historical land-use and of higher resilience to disturbance:
 - Areas that were clear-cut in in the mid-1990's
 - Logging roads and compacted landings
 - Areas impacted from the construction of Devina Drive (spoil areas).
 - Ecosystems that are common and well represented locally and Provincially.
 - Areas characterized by soils that are well drained and are less susceptible to compaction from disturbance (drier, deeper, sands and gravels)

Further, Crystal Mountain has developed a site plan for the layout of buildings and structures within the proposed subdivision lot created for Spiritual Education use (see Map 3: Crystal Mountain Society (CMS) Site Plan Proposal -- 75% Land Transfer). The site plan shows the broad areas, within which, various proposed structures and facilities will be located along with

the approximate locations of structures. The certainty of building site locations varies and is reflected through the ‘broadness’ of the areas. Locations for the kitchen and washroom facilities, meditation hall, caretaker cottage, service buildings and water related infrastructure are narrowly defined. Locations for future meditation huts and camping sites are more broadly defined. “Infrastructure Areas” and their related structures and services are shown in the table below. Their locations are shown on Map 3.

FIGURE 2: Development Footprint Table

Infrastructure Area	Size (ha.)	Infrastructure Included	Actual Lot Coverage (m ²)
Kitchen / Washroom Area (Area A – lower)	0.2	Kitchen (125m ²) Bath/Laundry (70m ²) Septic Tank	195 m ²
Kitchen / Washroom Area (Area B– Upper Ridge)	0.1	Kitchen/Bath/Laundry (36m ²) Storage Bldg. (10m ²) Water Storage Tank	46 m ²
Service Building Area	0.1	Office (70m ²) Storage/Workshop (80m ²) Water Storage Tanks	144 m ²
Caretaker Building Area	0.1	Caretaker Bldg (80m ²) Septic Tank	80 m ²
Meditation Hall Area	0.05	Meditation hall (125m ²)	125 m ²
Septic Field Area	0.1	Primary field (80m ²) Upper ridge field (32m ²)	112 m ²
Parking Area	0.1	9 spaces (Devina) (284m ²) 1 space (caretaker) (44m ²) 1 space (upper ridge) (44m ²)	372 m ²
Meditation Hut Area 1	1.15	14 x med hut (15m ²) 2 x long-term med hut (21m ²)	252 m ²
Meditation Hut Area 2	0.25	3 x med hut (15m ²)	45 m ²
Meditation Hut Area 3	0.20	2 x long-term med hut (21m ²)	42 m ²
Meditation Hut Area 4	0.7	1 x long-term med hut (21m ²)	21 m ²
Camping Area	1.0	6 x seasonal tent sites (14m ²)	84 m ²
TOTAL	3.05	30 x buildings 6 x tent sites 2 x septic fields 11 x parking spaces TOTAL LOT COVERAGE	911 m ² 84 m ² 112 m ² 372 m ² 1,479 m ²
		LOT COVERAGE % (includes septic and parking)	2.4%

Final siting of all buildings, structures, utilities, and services will be guided by the following criteria:

1. No structures are permitted in sensitive ecosystems (as defined and shown in this report).
 - a. The existing meditation platform is located on the boundary of an area characterized by a mature forest ridge ecosystem (sensitive). When this existing structure is replaced by the proposed Meditation Hall, siting of the hall will utilize existing footings or be moved away from the ridge (to the northeast).
 - b. Two existing meditation huts on the property are in areas characterized by moist soils and are outside of the proposed Crystal Mountain parcel boundaries. These huts will be removed, and their current sites will be remediated (rough and loose decompaction and planting) prior to rezoning.
2. Minimize hydrological impacts by utilizing existing roads, created by historical logging activities that pre-date Crystal Mountains ownership, for access.
3. Locate utility corridors (power and water lines) along existing roads that are also used as access routes, whenever possible.
4. Protect remnant old forest structures that were not degraded or removed during the most recent clear-cut. At a minimum, establish critical root protection zones (RPZ) around trees where no buildings may be located, or soil disturbance may occur. The RPZ radius can be calculated using the 'tree diameter method' employing a 12 to 1 ratio – 12 units in radius for every 1 unit in tree diameter at breast height, or, as otherwise advised by an arborist. Significant structures to be protected include:
 - Mature or old-growth trees and any remnant young trees (taller and larger than main forest canopy) that survived the clearcut.
 - Large diameter snags or "wildlife trees" (greater than 50cm in diameter).
5. Generally, cluster structures together as much as possible and minimize the 'spread' of development into the forest. It is recognized that this criterion will be weighed against development criteria #2 above.
6. Utilize existing compacted soil areas for siting structures whenever possible.



Existing Easement across Lot 9 in favour of neighbouring Lots 10 to 14.

LOT 10

LOT 9
DL90, Plan 31200

DeVina Drive

DL 87

Proposed Lot Boundaries

- Islands Trust Conservancy
- Crystal Mountain
- Property Line Setbacks

Water System

- Observation Well
- Primary Well
- Proposed Ridge Well
- Potable Storage Tank
- Septic Tank

Access Routes

- Primary Access Road
- Access Road
- Trail
- Easement To Lands Beyond
- Emergency Access SROw

Buildings

- Caretaker Building
- Bath / Laundry
- Kitchen / Dining
- Meditation Hall
- Office
- Kitchen / Bath / Laundry
- Service Building
- Med Hut
- Long-term Med Hut
- Tent Pad
- Parking Spaces/Aisle
- Septic Field

Infrastructure Areas

- Parking Area
- Meditation Hut Area
- Camping Area
- Kitchen / Washroom Area
- Meditation Hall Area
- Service Building Area
- Caretaker Building Area
- Septic Field Area

Sensitive Ecosystems

- Old Forest, Moist Forest, Wetlands, Ridges, Cliffs
- 30m Stream Buffer
- stream

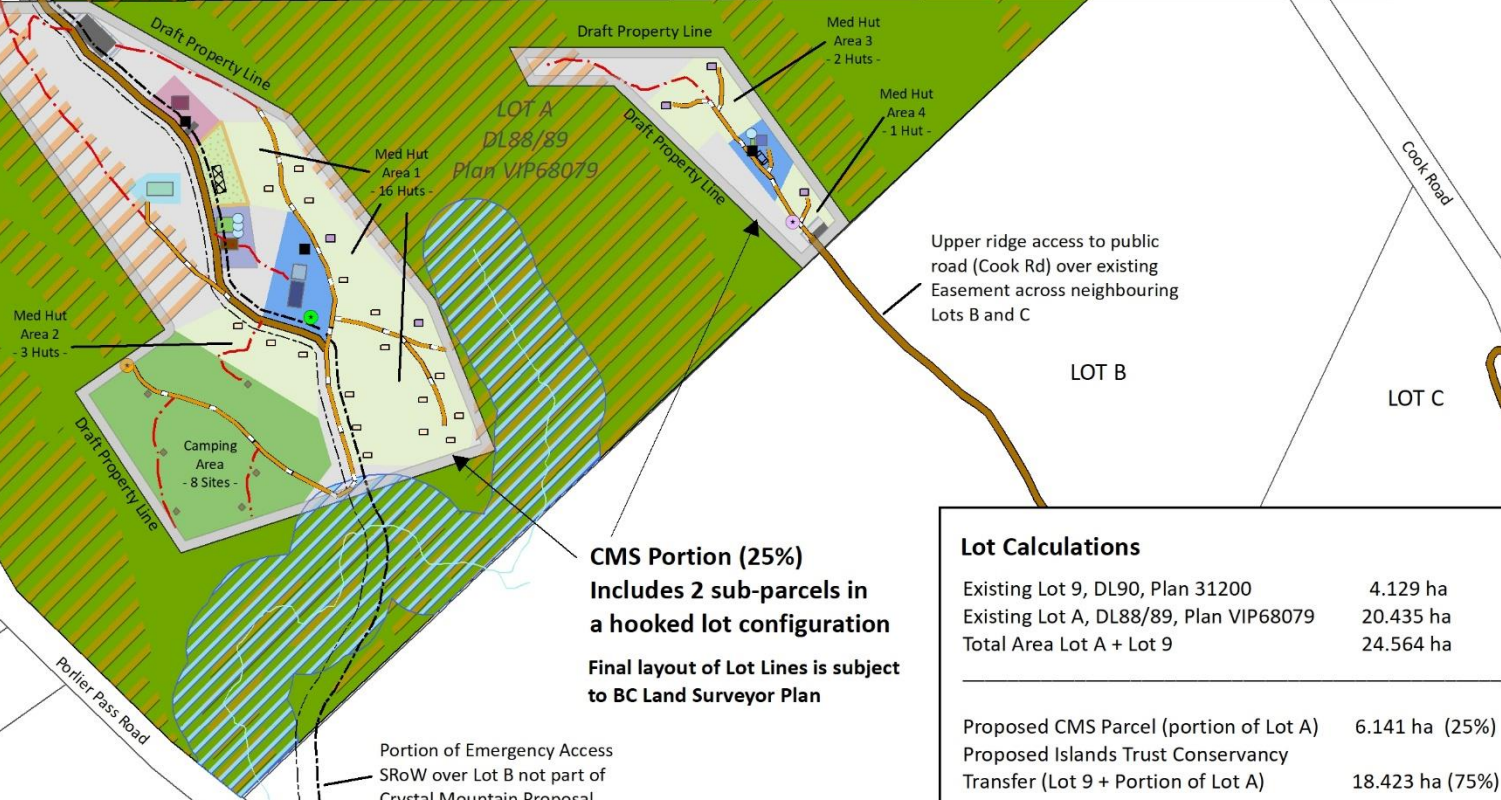
0 25 50 100 Meters



Map Date: March 13, 2021

Scale: 1 : 4,200

Projection: UTM Zone 10 NAD83



CMS Portion (25%)
Includes 2 sub-parcels in a hooked lot configuration
Final layout of Lot Lines is subject to BC Land Surveyor Plan

Portion of Emergency Access SROw over Lot B not part of Crystal Mountain Proposal

Lot Calculations

Existing Lot 9, DL90, Plan 31200	4.129 ha
Existing Lot A, DL88/89, Plan VIP68079	20.435 ha
Total Area Lot A + Lot 9	24.564 ha

Proposed CMS Parcel (portion of Lot A)	6.141 ha (25%)
Proposed Islands Trust Conservancy Transfer (Lot 9 + Portion of Lot A)	18.423 ha (75%)

APPENDIX 1 – 2009 Ecological Assessment

Excerpt from:

Crystal Mountain Ecosystem-based Land-use Plan

Parcel A of D189 except part in plan 27287 & Lot 9 Plan 31200 D190, Galiano Island, BC

Keith Erickson, January 2010, Revised April 2014

3.1 Biological and Geographical Inventory

3.1.1 Climate¹

The rainshadow effect of the Olympic and Vancouver Island mountains and the moderating effects of the ocean are the dominant influences on the climate of Galiano Island. Kerr (1951) describes the Island as having a “Transitional, Cool Mediterranean Climate”. Galiano exhibits a pattern of warm, dry summers and mild, wet winters with an average of approximately 1,900 to 2,000 hours of sunshine (Renneseth and Barr, 1982) and 254 frost free days (Agriculture Canada, 1989) per annum. The average annual rainfall recorded at the North Galiano Atmospheric Environment Service station is 920 mm (from 1977 to 1988). Annual rainfall ranges from 597.3 mm to 1152.6 mm (Harrison, 1994). Over 75% of the total annual precipitation falls during the winter months (Nov. to Feb.), with less than 10% falling as snow.

The months of January and February produce the coldest mean temperatures of 4° to 5° Celsius, while July and August are the warmest months with mean temperatures of 17° to 19° Celsius. The combined effects of low precipitation, warm temperatures, and high number of sunshine hours often result in an annual moisture deficit on Galiano Island from mid-June to early October (Harrison, 1994). This deficit can often reach drought conditions in areas of recent clearcuts, such as those found on Lot A, and can result in an extreme forest fire hazard.

3.1.2 Topography

The properties exhibit a complex topography through a series of 4 major southeast to northwest running ridges with their associated steep southwest facing slopes and cliffs, gentle northeast facing slopes and wet depressions or flat benches. The elevation ranges from approximately 10 meters at the lowest point along Porlier Pass road to 125 meters at the highest point near the northeastern corner of Lot A. All areas of the property are below 140 meters in elevation and are not part of “Development Permit Area 4: Elevated Groundwater Catchment Areas” described in the Galiano Island Official Community Plan (Consolidated October 30, 2013).

3.1.3 Hydrology

The properties fall within the North Trincomali Groundwater Region, with a surface flow that empties into the Trincomali Channel. Approximately 10 hectares or just over 40% of the properties are designated as Groundwater Recharge Areas. Recharge areas generally incorporate the higher elevation portions of the properties including the teaching platform ridge and its associated steep southwest facing slope and gentle northeast facing slope and the area including

¹ Excerpt from: *Erickson, Keith. 2008. Heritage Forest Management Plan. Galiano Conservancy Association. Galiano Island.*

and above the major cliff/ridge that bisects the properties. The moist forest, wetland and creek areas in the depressions are considered to be part of the groundwater discharge zone. Elevated water recharge areas such as those found on the property are considered of great value to the maintenance of water quality in aquifers, of special significance for wells drilled at lower elevations along the shoreline with regard to salt water intrusion.

Spotlight Creek is the major drainage system associated with the properties running roughly from northwest to southeast through the lower portion of the properties. The creek originates from the large wetland complex adjacent to Devina Drive flowing under the main driveway access to Lot 10. The Spotlight Creek watershed is relatively small, even by Galiano standards, totaling approximately 60 hectares in size. The creek is intermittent and runs only during peak rainfall months from November through to the spring. In accordance with the BC Riparian Areas Regulation assessment methodology, Spotlight Creek is considered a non-fish bearing system and does not support salmonids, game fish or regionally significant fish. Fish absence was determined based on stream gradient and the presence of a human made permanent impassible barrier as the creek enters Spotlight Cove. The impassible barrier is a 20 meter long culvert at a 10% slope with a measured 2cm maximum stream depth at high flow (December 30, 2009). The creek gradient increases to 30% for a 15 meter stretch just upstream from the culvert and then flattens back down to 10% for close to 300 meters. The stream is completely dry over the summer months, eliminating the possibility for presence of any resident fish species.

The upper portion of the properties located roughly above 100 meters in elevation are a part of the Jack Creek Watershed, however, stream channels or any above ground flow associated with the Jack Creek were not observed on the properties.

3.1.4 Soil

According to the Agriculture Canada report, *Soils of the Gulf Islands of British Columbia Volume 3*, the Properties are characterized by three different soil types:

1. Saturna: Saturna is the dominant soil type on the properties covering the majority of the gently to moderately sloping areas over roughly 55% of the property. Saturna soils are well-drained and droughty during the summer. They have developed on shallow deposits of channery, sandy loam to channery, loamy sand textured, colluvial and glacial drift materials over sandstone bedrock within 100cm of the surface. Areas of the property are characterized by very shallow lithic Saturna soils often associated with bedrock exposures or very thin mineral soil layers less than 50 cm deep. Coarse fragment content varies between 20 and 50%.
2. Rock-Saturna: Rock-Saturna soils are found along the ridges and associated steep southwest facing slopes on the properties and account for roughly 30% of the area. They are characterized by patches of exposed sandstone bedrock often covered with moss, mixed with

areas covered with a shallow well drained Saturna mineral soil layer. Mineral soils are either colluvial or glacial drift derived, generally between 10 and 50cm thick and have a coarse fragment content that varies between 20 and 50%.

3. Parksville: Parksville soils are a minor component of the properties accounting for roughly 15% of the area. They occur on nearly level to very gently sloping (0.5 – 5%) topography in depressional areas, swales and drainageways between bedrock ridges. Parksville soils are poorly drained with a layer of sandy or silty loam of fluvial origin overlying deep silty clay loam to silty clay textured marine deposits that are virtually stone free. Distinct mottles are often present within 50 centimeters of the surface. They are saturated with water to within 30cm of the surface from late fall to spring. During summer, the water table drops to below 60cm, allowing the surface horizons to become dry. Soil receives seepage and runoff water from surrounding slopes, which tends to keep the soil moist during dry periods.

3.1.5 Wildlife

The diversity of ecosystems on the properties supports many species of animals. Fauna observed while surveying the lot are listed below. Surveys took place between September 2009 and December 2009.

List of bird species observed:

Turkey Vulture	Northern Flicker	Winter Wren
Red-tailed Hawk	Pileated Woodpecker	Varied Thrush
Bald Eagle	Common Raven	American Robin
Barred Owl	Northwestern Crow	Dark-eyed Junco
Rufous Hummingbird	Chestnut-backed Chickadee	Pine Siskin
Downy Woodpecker	Common Bushtit	
Hairy Woodpecker	Brown Creeper	

Other fauna observed include:

<u>Mammals</u>	<u>Amphibians</u>	<u>Reptiles</u>
Red Squirrel	Red-legged Frog (blue-listed)	Northwestern Garter Snake
Raccoon	Pacific Tree Frog	
Black-tailed Deer	Rough-skinned Newt	
Deer Mouse		

3.1.6 Ecosystem Types

The Crystal Mountain Lands are characterized by a wide range of ecological conditions due to their topographic complexity and past logging activities. Ecosystem types are determined by two primary factors – the site characteristics (such as soil, slope and aspect) and the disturbance

history (the type of disturbance and time since it occurred). The soils and the topography determine the various species and assemblages of plants that will grow on a site and the disturbance history determines the present condition of the plant communities and their successional status (eg. plant communities that form immediately after a disturbance such as a regenerating clearcut vs. plant communities that form 300 years after disturbance - an old-growth forest).

Soil conditions generally follow topographic trends with deeper, moister, nutrient rich soils occurring in the depressions and shallow, dry, nutrient poor soils occurring on the ridge tops. The general pattern of vegetation from a wet depression to a dry ridge top is as follows:

- Depressions are often dominated by broadleaf trees with scattered large diameter conifers growing on rich raised mounds. The understory is diverse and lush in appearance, often characterized by a mix of shrubs, ferns, sedges, rushes, grasses and mosses.
- Moist depression areas generally transition to conifer dominated lower to mid-slopes with patchy but robust shrub and fern dominated understories that generally coincide with canopy gaps. The composition of the trees and understory varies depending on the aspect (the direction that the slope faces) and how steep or gentle the slope is.
- Upper slope and ridge-top areas are generally comprised of a mix of conifer and broadleaf (primarily *Arbutus* (*Arbutus menziesii*)) with a more consistent cover of understory shrubs and mosses with fewer ferns. The shallow and poor soils on the ridge-tops generally produce smaller diameter trees that are gnarly or weathered in appearance.

Succession ranges from undisturbed mature climax forest on some of the very steep southwest facing slopes to highly disturbed, non-vegetated sites where the soil disturbance from logging related activities was so severe that pioneering vegetation has not yet been able to establish. The general pattern of vegetation development after a clearcut is as follows – a flush of herbaceous and shrubby vegetation emerges as tree seedlings begin to establish about 3 years after the disturbance leading to a diverse mixed pole/sapling forest with a robust, diverse understory for about 20 years. The pole/sapling forest then moves into the young forest phase characterized by a very dense conifer dominated tree canopy with a sparse understory and general loss of diversity. The young phase lasts for roughly 40 to 50 years as the forest slowly thins itself out through natural competition and the onset of various root diseases and other pathogens. These natural processes lead to the young forest's transition into a more complex, multi-layered, mixed species mature and eventually old-growth forest diverse in composition (the parts), structure (the arrangement of the parts) and function (how the parts work).

The majority of Lot A is recovering from an intense clearcut which took place in 1993. The land is currently in the pioneering seral stage characterized by patchy and diverse pole / sapling forest of varied vegetative composition depending on slope position, aspect, slope and soil depth. The moist depression sites are generally dominated by red alder (*Alnus rubra*) with sword fern

(*Polystichum munitum*) and patches of salmonberry (*Rubus spectabilis*) in the understory. The drier, gently sloping logged areas are characterized by dense patches of Douglas-fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*) poles with very little understory vegetation scattered within a more open mix of Douglas-fir, red alder, bitter cherry (*Prunus emarginata*), big-leaf maple (*Acer macrophyllum*), grand fir and arbutus with salal (*Gaultheria shallon*), Oregon-grape (*Mahonia nervosa*) and sword fern dominant in the understory.

Remnant patches of healthy mature forest are located in thin strips along the ridge tops and down the associated southwest facing steep slopes where logging was not practical. The majority of Lot 9 is also characterized by mature forest growing under a variety of ecological conditions. Ecosystem types range from western redcedar (*Thuja plicata*), Douglas-fir, big-leaf maple dominated northeast facing, moderate slopes to red alder, salmonberry dominated seasonally flooded wetland depression to Douglas-fir, arbutus dry rocky ridge top.

Each of the 30 ecosystem types identified on the Crystal Mountain Lands has been listed and described according to its site characteristics, vegetation, and soils as well as its related disturbance history, successional trajectory and restoration issues. Ecosystem types have been identified through field work conducted between September 2009 and December 2009. The detailed ecosystem type descriptions have been included as Appendix 1 of this document. MAP 2 shows the locations of the various ecosystem types.

3.2 Disturbance History

The primary disturbance on the properties over the past century has been logging. Lot A has been logged at least twice and Lot 9 once. MacMillan Bloedel records suggest that the upper portion of Lot A was cut in the late 1870's while the lower portion was cut in the early 1920's. Timbermarks suggest that Lot A was clearcut by the owner previous to Crystal Mountain between 1993 and 1996. It appears that the property was not planted and is regenerating naturally. The clearcut was intensive and appears to have been completed with excavators and skidders resulting in significant impacts to the soils, especially in moist and seasonally flooded areas.

3.3 Conservation Significance

The Crystal Mountain lands are located within the Coastal Douglas-fir Biogeoclimatic Zone (CDF), an ecological classification that has recently been identified as imperiled (a high risk of extinction) both Provincially and globally in Biodiversity BC's "Taking Nature's Pulse: The Status of Biodiversity in British Columbia". The fact that the Crystal Mountain lands have not

Crystal Mountain Ecosystem-based Plan

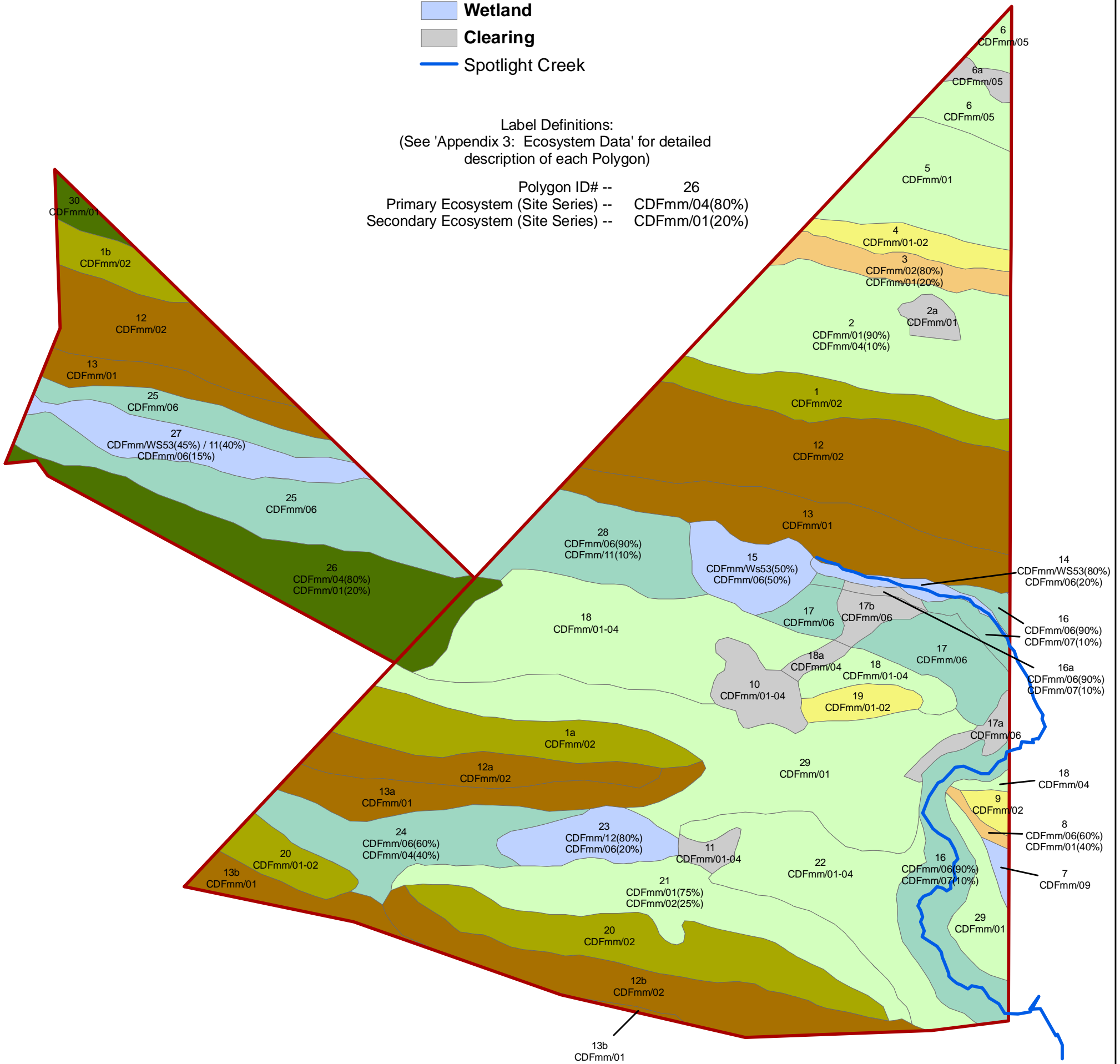
-- Ecosystem Types --

2

- Property Boundary
- Mature Forest
- Mature Forest Ridge
- Mature Forest Steep Slope / Cliff
- Pole Forest
- Pole Forest Ridge
- Pole Forest Steep Slope / Cliff
- Moist Soil / Riparian Forest
- Wetland
- Clearing
- Spotlight Creek

Label Definitions:
 (See 'Appendix 3: Ecosystem Data' for detailed description of each Polygon)

Polygon ID# --	26
Primary Ecosystem (Site Series) --	CDFmm/04(80%)
Secondary Ecosystem (Site Series) --	CDFmm/01(20%)



Produced by: Keith Erickson (R.P.Bio.)
 Map Date: December 2009
 Scale: 1 : 2,850
 Projection: UTM Zone 10 NAD83
 Rotation: 46.5 degrees W of N



been developed or permanently altered is a significant conservation achievement within the most densely populated region of the Province. Despite the industrial scale logging that has occurred on the lands in the past, there are a number of remnant patches of healthy mature and old-growth forest that have been identified along the steep slopes and ridge-tops of Lot A and over most of Lot 9. These areas are of significant conservation importance. In addition, a seasonal stream, a variety of small wetlands and the associated riparian ecosystems provide important habitat for wildlife. The diversity of ecological conditions and associated vegetation communities and wildlife resulting from the remarkable topographic complexity of the properties is also of high conservation significance – and is of particular importance when considering adaptation to climate change and migration routes of flora and fauna from drier to wetter sites or vice versa.

3.3.1 Ecosystems and Species at Risk

The properties include intact mature examples of two provincially red-listed ecological communities recognized by the British Columbia Conservation Data Centre:

- Community: Douglas-fir - arbutus (*Pseudotsuga menziesii* - *Arbutus menziesii*)
Global Rank: Not Ranked
Provincial Rank: Red (S2) – Imperiled
Site Series: CDFmm/02
Location (MAP2): Polygons 1, 12 and 20
- Community: Douglas-fir / dull Oregon-grape (*Pseudotsuga menziesii* / *Mahonia nervosa*)
Global Rank: G2 – Imperiled
Provincial Rank: Red (S2) – Imperiled
Site Series: CDFmm/01
Location (MAP2): Polygons 1, 12 and 20

The properties also include a young early successional example of the following listed ecological community:

- Community: red alder / skunk cabbage (*Alnus rubra* / *Lysichiton americanus*)
Global Rank: Not Ranked
Provincial Rank: Blue (S2S3) – special concern, vulnerable to extirpation or extinction
Site Series: CDFmm/11
Location (MAP2): Polygon 14

The properties are also home to a robust population of the provincially blue-listed (species of special concern, vulnerable to extirpation or extinction) red-legged frog (*Rana Aurora*). Red-legged frogs were observed in, but are not limited to, the following locations on MAP 2: Polygons 2, 6, 7, 8, 14, 15, 16, 17, 25, 27 and 28.

3.3.2 Landscape Connections

Ecosystems located on the Crystal Mountain properties are part of a larger generally southeast to northwest running ridge and valley system that includes several significant wetland complexes and mature forest stands. Large portions of the system have been protected within Dionisio Provincial Park to the northwest, the Provincial Ecological Reserve #128 to the southeast and most recently within District Lot 87, immediately adjacent and wedged between the Crystal Mountain properties (See MAP3: Landscape Connections). District Lot 87 was acquired by the Provincial Government and is intended to become a BC Park’s managed protected area, but has not been officially transferred or designated at this time. Its transfer to BC Parks management may be contingent on additional rezoning and development of privately held lands linking District Lot 87 with Dionisio Park.

Protection of ecosystems on the Crystal Mountain lands will directly contribute to overarching goals for landscape connectivity on the northern portion of Galiano Island. It will specifically conserve portions of the Spotlight Creek watershed and will preserve ecosystem integrity along north/south and cross-island landscape level corridors.

3.4 Identified Threats to Ecosystem Values

Threats to ecosystem values are determined by identifying and assessing all current and potential uses or activities associated with the Crystal Mountain properties and surrounding areas. Threats have been identified and classified using criteria developed by the International Union for Conservation of Nature (IUCN) – a now generally accepted standard methodology. Threats and associated impacts will be addressed through the development of management zones and through the strategies and recommendations outlined in the remainder of this document.

IUCN Threat Category	Specific Threat	Associated Impacts
Residential and Commercial Development – Tourism and Recreation Areas	Development of retreat huts, service buildings, managers cottage, septic system	Habitat loss Habitat fragmentation Encroachment on sensitive ecosystems
Human Intrusions and Disturbance – Recreational Activities	Meditation sites - clearing for light or view sites on ridges	Habitat loss Soil erosion and compaction
	Walking / Hiking - trail network	Minor habitat fragmentation Soil erosion and compaction
Transportation and Service Corridors	Access roads and parking lot(s)	Habitat loss Habitat fragmentation Soil erosion and compaction
	Utility and Service Lines – hydro lines, water lines	Habitat loss Habitat fragmentation

Natural System Modifications – Fire Suppression	Fire suppression – general fire suppression and fuel load buildup	Habitat loss from catastrophic fire Alteration of natural disturbance regimes
Natural System Modifications – Water Management / Use	Damming of creek and use of water (for neighbouring water license)	Downstream habitat loss
	Excessive use of groundwater (wells) by Crystal Mountain and on surrounding properties within the groundwater region	Degraded groundwater quality
Invasive Species – Non-native Species	Scotch broom, Himalayan / Evergreen blackberry	Habitat loss
Pollution – Household Sewage	Leaking septic systems	Degraded stream water quality Degraded groundwater quality
	Seepage from Outhouses	Degraded stream water quality Degraded groundwater quality
Biological Resource Use – Gathering Terrestrial Plants	Uncontrolled harvest of native plants / fungi	Species loss Habitat loss
Biological Resource Use – Logging / Wood Harvesting	Unsustainable harvest of timber	Habitat loss Habitat fragmentation Degraded stream water quality Degraded groundwater quality Soil erosion and compaction
Climate Change	Droughts	Species loss Decrease in groundwater recharge
	Storms and Flooding	Species loss
	Habitat shifting	Species loss

Ecosystem 1

Description: Mature Douglas-fir (*Pseudotsuga menziesii*), Arbutus (*Arbutus menziesii*) – salal (*Gaultheria shallon*) (CDFmm/02) vegetation community along major ridgeline. The ecosystem is characterized by very shallow, rapidly drained, dry soils with a high coarse fragment content and poor to medium soil nutrient regime. The dominant Douglas-fir trees are generally between 80 and 150 years old with older veterans scattered throughout.

Polygon ID:	1	Slope:	convex	Aspect:	230°
Structural Stage:	MFm	Mesoslope Position:	crest	Site Series:	CDFmm/02
Soil Nutri. Regime:	VP - P	Soil Moisture Regime:	1	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	20	30	10	2	2			B1 is higher (20%) in poly 1a
<i>Arbutus menziesii</i>		10	10					Southwest side of crest
<i>Thuja plicata</i>		2	2					
<i>Acer macrophyllum</i>			T					
<i>Gaultheria shallon</i>					70			
<i>Mahonia nervosa</i>					3			
<i>Rosa gymnocarpa</i>					T			
<i>Lonicera ciliosa</i>				T				
<i>Lonicera hispidula</i>					T			
<i>Symphoricarpos alba</i>					T			
<i>Pachistima myrsinites</i>					T			
<i>Cornus nuttalli</i>				T				
<i>Goodyera oblongifolia</i>						T		
<i>Kindbergia oregana</i>							T	
<i>Dicranum scoparium</i>							T	
<i>Rhytidiadelphus triquetrus</i>							T	
<i>Timmia austriaca</i>							T	
<i>Racomitrium</i>							T	
Cover by Layer (%)	Tree:	70	Shrub:	75	Herb:	2	Moss:	2

Soils:

Soils range in depth from exposed bedrock to 50cm. Well defined L and F layers with a thin H and thin Ae and occasionally Ah in patches. High in coarse fragments (50-60%), rapidly drained, and light in colour. Abundant mycelia and fauna found in soil where decay class 5 cwd is present.

Wildlife and Wildlife Habitat:

Observed during data collection: bald eagle (heard in tree top) and seen flying,

Habitat: snags are rare but extensively used by woodpeckers, cwd is scattered throughout and includes a variety of diameters and decay classes.

Disturbance History:

Evidence of selective logging with single stem selection occurring during clearcutting of adjacent forest on northeast facing slope. In Polygon 1a logging has been more extensive resulting in ‘dog-hair’ like Douglas-fir regeneration on the northeast side of the crest. Polygon 1b has also been selectively logged but is adjacent to intact mature forest on the northeast and southwest facing slopes.

Both polygon 1, 1a and 1b have structures and clearing associated with meditation retreat activities – a recently cleared site with a pieced together platform (approx. 100 sqft) at the southwest edge of the ridge in Polygon 1; an established well constructed teaching platform (approx. 1200 sqft) in the transition area between the crest/ridge and northeast facing upper slope in Polygon 1a, and; a frequently visited pagoda (monument) in Polygon 1b.

Succession:

These mature forest sites will continue to move towards climax without too much variation in tree composition and cover. As ecosystems on the northeast facing slopes adjacent to Polygons 1 and 1a develop into young and mature forests, light in these ridge polygons will decrease slightly possibly resulting in a reduction of shrubby salal cover and an increase in moss ground cover.

Restoration Recommendations:

Restoration is not required.

Ecosystem 2

Description: Douglas-fir, western redcedar (*Thuja plicata*) naturally regenerating pole forest (CDFmm/01 – 90%, CDFmm/04 – 10%) approximately 15 years in age with scattered young 50 to 60 year old seed trees. The polygon includes a number of microsites of varying slope, aspect and mesoslope character ranging from moister micro depressions to dryer rock outcrops. Soils are generally well drained silty loams with moderate coarse fragment content and moder humus forms and vary in depth between 30 centimeters to greater than 80 cm.

Polygon ID:	2	Slope:	Variable, generally 5%		Aspect:	Concave - southwest to northeast
Structural Stage:	PSc	Mesoslope Position:	Flat		Site Series:	CDFmm/01 (90%) CDFmm/04 (10%)
Soil Nutrient Reg.:	M-R	Soil Moisture Regime:	2-4		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	5		20	10	T		T	
<i>Thuja plicata</i>	2		10	5	2		T	
<i>Alnus rubra</i>				3				On moister micro-sites
<i>Salix scouleriana</i>				5				On moister micro-sites
<i>Arbutus menziesii</i>			2					On drier micro-sites

<i>Gaultheria shallon</i>					60				
<i>Polystichum munitum</i>						5			
<i>Pteridium aquilinum</i>						1			
<i>Abies grandis</i>				1					On richer micro-sites
<i>Acer macrophyllum</i>				T					
<i>Kindbergia oregana</i>							10		On richer micro-sites
<i>Achlys triphylla</i>						T			On richer micro-sites
<i>Cornus nuttallii</i>				T					On moister micro-sites
Cover by Layer (%)	Tree:	35	Shrub:	85	Herb:	10	Moss:	10	

Soils:

Silty loam with 25-50% coarse fragment content, well drained to moderately well drained. Moder humus form. Soil depth varies from 30 to greater than 80cm.

Wildlife and Wildlife Habitat:

Observed during data collection: red legged frog, hairy or downy woodpecker, piliated woodpecker heard.

Habitat: mixed species, mixed aged forest with gaps and scattered snags is excellent habitat for birds, small mammals etc. Moist areas support amphibians.

Disturbance History:

The area was logged 15 to 20 years ago leaving a variety of scattered young seed trees that were not worth removing at the time of logging. Area is regenerating naturally. Char marks on cwd and stumps indicates low intensity slash burn after logging.

Landing area (Polygon 2a) has been cleared to support meditation retreat activities and currently includes an outhouse. Two trails leading from the road to the ridge have been established.

Succession:

Stand will develop into uneven aged, multi-storied young forest over the next 15 to 20 years with canopy closure increasing and stem exclusion occurring for several decades there after.

Restoration Recommendations:

Minor thinning over the next 20 years could maintain or increase diversity in the stand while providing small diameter poles for use. None of the older seed trees should be removed.

Ecosystem 3

Description: Small cliff and talus slope characterized by bedrock outcrops, exposed boulders, and pockets of shallow soil. The ecosystem is characterized by open, patchy Douglas-fir – oceanspray (*Holodiscus discolor*) (CDFmm/02 – 80%) plant community with a minor component of Douglas-fir – salal (CDFmm/01 - 20%) and approximately 30% exposed rock. A number of young Douglas-fir seed trees are scattered amongst regenerating Douglas-fir poles.

Polygon ID:	3	Slope:	80%	Aspect:	225°
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Structural Stage:	PSc	Mesoslope Position:	Upper Slope	Site Series:	CDFmm/01 (20%) CDFmm/02 (80%)
Soil Nutri. Regime:	VP – P	Soil Moisture Regime:	0-1	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	15			40	T			
<i>Thuja plicata</i>				T				
<i>Acer macrophyllum</i>		2		T				
<i>Mahonia nervosa</i>					10			
<i>Holodiscus discolor</i>				10				
<i>Lonicera hispidula</i>				T	T			
<i>Lonicera ciliosa</i>				T	T			
<i>Rhamnus purshiana</i>				T				
<i>Rosa gymnocarpa</i>					T			
<i>Gaultheria shallon</i>					50			
<i>Linnaea borealis</i>					2			
<i>Taxus brevifolia</i>				T				
Cover by Layer (%)	Tree:	15	Shrub:	90	Herb:	5	Moss:	2

Soils:

Pockets of soil are rapidly drained, generally shallow and light in colour with a sandy loam texture and between 35 and 70% coarse fragment content. They are characterized by a mor humus form and have a high content of semi decomposed wood and a deep litter layer.

Wildlife and Wildlife Habitat:

Habitat: exposed rock and cliff is good habitat for northern alligator lizard

Disturbance History:

Any trees of merchantable size were harvested 15 to 20 years ago at the time of the clearcut in Polygon 2. Young seed trees were left.

Succession:

A main canopy of Douglas-fir will slowly develop on this naturally regenerating site over the next several decades eventually leading to a closed canopy with very little exposed cliff face and sparse understorey cover.

Restoration Recommendations:

None recommended.

Ecosystem 4

Description: Douglas-fir – salal (CDFmm/01- 02) dominated regenerating pole forest with scattered young Douglas-fir and western redcedar seed trees on a convex ridgeline. Soils are very well drained, shallow with silty-loam texture and high (50-70%) coarse fragment content.

Polygon ID:	4	Slope:	Variable - convex	Aspect:	Southwest to northeast
Structural Stage:	PSc	Mesoslope Position:	Crest	Site Series:	CDFmm/01 - 02
Soil Nutrient Reg.:	VP-P	Soil Moisture Regime:	1-2	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	3		5	35				
<i>Thuja plicata</i>	5		5	5				
<i>Arbutus menziesii</i>			5					
<i>Gaultheria shallon</i>					60			
<i>Mahonia nervosa</i>					15			
<i>Kindbergia oregana</i>							10	
Cover by Layer (%)	Tree:	25	Shrub:	90	Herb:	T	Moss:	10

Soils:

Silty loam with 50-70% coarse fragment content, very well drained. Mor humus form. Soils are shallow.

Wildlife and Wildlife Habitat:

Observed during data collection: pacific tree frog, raven

Habitat: several snags along the ridge with evidence of woodpecker use.

Disturbance History:

Logging 15 to 20 years ago left a high concentration of western redcedar and Douglas-fir seed trees along the ridgeline.

Succession:

Stand will develop into uneven aged, multi-storied young Douglas-fir dominated forest over the next 20 to 30 years with a reduction in shrub / understorey cover due to canopy closure increasing and stem exclusion occurring for several decades there after.

Restoration Recommendations:

No restoration required – allow natural processes to continue.

Ecosystem 5

Description: Northeast facing, mid to upper slope, zonal Douglas-fir – salal (CDFmm/01) regenerating pole forest with scattered young Douglas-fir and western redcedar seed trees. Soils

are well drained and shallow with sandy loam texture and high (50%) coarse fragment content.

Polygon ID:	5	Slope:	35%	Aspect:	60°
Structural Stage:	PSc	Mesoslope Position:	Mid to upper slope	Site Series:	CDFmm/01
Soil Nutrient Reg.:	M	Soil Moisture Regime:	2	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	2		1	30	1			
<i>Thuja plicata</i>	5		2	5	1			
<i>Arbutus menziesii</i>	1		1					
<i>Gaultheria shallon</i>					75			
<i>Mahonia nervosa</i>					1			
<i>Rosa gymnocarpa</i>					1			
<i>Polystichum munitum</i>						3		
<i>Pteridium aquilinum</i>						10		
<i>Kindbergia oregana</i>							20	
<i>Holodiscus discolor</i>				T				
<i>Vaccinium ovatum</i>				T				
<i>Cytisus scoparius</i>				T	T			Along old road
Cover by Layer (%)	Tree:	12	Shrub:	95	Herb:	15	Moss:	20

Soils:

Silty loam with 50% coarse fragment content, well drained. Moder humus form.

Wildlife and Wildlife Habitat:

Habitat: abundant coarse woody debris scattered throughout.

Disturbance History:

The area was logged 15 to 20 years ago leaving a variety of scattered young seed trees that were not worth removing at the time of logging. Area is regenerating naturally. No evidence of burn after logging – slash remains on site.

Landing area (Polygon 2a) has been cleared to support meditation retreat activities and currently includes an outhouse.

Succession:

Stand will develop into uneven aged, multi-storied young Douglas-fir dominated forest over the next 20 to 30 years with a reduction in shrub / understory cover due to canopy closure increasing and stem exclusion occurring for several decades there after.

Restoration Recommendations:

There is an opportunity for restoration thinning treatments over the next 20 years with a goal of maintaining and enhancing structural and compositional diversity while removing a small portion

of the stems for use.

Ecosystem 6

Description: Northeast facing, mid to lower slope, Douglas-fir, western redcedar – salal (CDFmm/05) regenerating pole forest with scattered young Douglas-fir and western redcedar seed trees. Soils are moderately well drained and with silty loam texture and moderate (25-35%) coarse fragment content.

Polygon ID:	6	Slope:	5-15% (concave)	Aspect:	60°
Structural Stage:	PSc	Mesoslope Position:	Mid to lower slope	Site Series:	CDFmm/05
Soil Nutrient Reg.:	M	Soil Moisture Regime:	5	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	5		T	30				
<i>Thuja plicata</i>	30		5					
<i>Alnus rubra</i>				1				On edge of landing
<i>Gaultheria shallon</i>					65			
<i>Holodiscus discolor</i>				T				
<i>Pteridium aquilinum</i>						5		
<i>Hylocomnium splendens</i>							8	
<i>Kindvergia oregano</i>							10	
<i>Rhytidiadelphus loreus</i>							1	
<i>Lonicera hispidula</i>					2			
<i>Polystichum munitum</i>						1		
<i>Trientalis latifolia</i>						1		
<i>Vaccinium ovatum</i>					1			
<i>Linnaea borealis</i>					1			
<i>Achlys triphylla</i>						T		
<i>Lonicera ciliosa</i>				1				
<i>Cytisus scoparius</i>				T	T			On landing – poly 6a
<i>Cirsium spp.</i>						T		On landing – poly 6a
<i>Senecio jacobaeae</i>						T		On landing – poly 6a
<i>Grass spp.</i>						2		On landing – poly 6a
<i>Juncus effusus</i>						T		On landing – poly 6a
<i>Carex spp.</i>						T		On landing – poly 6a
Cover by Layer (%)	Tree:	40	Shrub:	90	Herb:	10	Moss:	20

Soils:

Silty loam with 25-35% coarse fragment content, moderately well drained. Moder humus form.

Wildlife and Wildlife Habitat:

Observed during data collection: tree frog, squirrel nut cache, deer scat, red legged frog, dragonfly.

Habitat: Snags and large diameter coarse woody debris observed.

Disturbance History:

The area was logged 15 to 20 years ago leaving a variety of scattered young seed trees that were not worth removing at the time of logging. Area is regenerating naturally. No evidence of burn after logging – slash remains on site.

Landing area (Polygon 6a) was cleared and served as a staging area during past logging. Soils have been heavily disturbed and compacted and are now dominated by invasive grasses, thistles, scotch broom and tansy ragwort. Due to moist soils and timing of logging, deep ruts were left from machinery and are now compacted micro-depression sites where sedges and rushes are growing.

Succession:

Stand will develop into uneven aged, multi-storied young forest over the next 15 to 20 years with canopy closure increasing and stem exclusion occurring for several decades there after.

Restoration Recommendations:

There is an opportunity for restoration thinning treatments over the next 20 years with a goal of maintaining and enhancing structural and compositional diversity while removing a small portion of the stems for use.

Landing site: removal of scotch broom (*Cytisus scoparius*), tansy ragwort (*Senecio jacobaeae*) and thistles (*Cirsium spp.*) followed by planting of native species including but not limited to Douglas-fir, western redcedar, grand fir (*Abies grandis*), red alder (*Alnus rubra*), evergreen huckleberry (*Vaccinium ovatum*), and red elderberry (*Sambucus racemosa*). De-compact soil around planting sites and protect species susceptible to deer browse.

Ecosystem 7

Description: Seasonally flooded wet bench dominated by Pacific willow (*Salix lucida ssp. laciandra*) nootka rose (*Rosa nootkensis*), and slough sedge (*Carex obnupta*) (CDFmm/09). This polygon is a moisture receiving site with soils that are very rich but poorly drained due to a clay mineral soil layer and is flooded during winter storm events.

Polygon ID:	7	Slope:	<1%	Aspect:	250°
Structural Stage:	PSb	Mesoslope Position:	Flat	Site Series:	CDFmm/09
Soil Nutrient Reg.:	VR	Soil Moisture Regime:	05-07	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Salix lucida ssp laciandra</i>				15				
<i>Salix scouleriana</i>				10				

<i>Equisitum arvense</i>						10			
<i>Carex obnupta</i>						40			
<i>Rubus ursinus</i>						3			
<i>Elymus hirsutus</i>						5			
<i>Rosa nootkensis</i>				25	5				
<i>Alnus rubra</i>				20					
<i>Rubus discolor</i>				2	2				
<i>Kinbergia praelonga</i>							15		
<i>Menthe arvensis</i>						T			
<i>Rosa gymnocarpa</i>						T			
<i>Rubus spectabilis</i>						2			
<i>Gaultheria shalon</i>						T			On raised micro-sites
<i>Polystichum munitum</i>						T			On raised micro-sites
Cover by Layer (%)	Tree:	35	Shrub:	85	Herb:	10	Moss:	10	

Soils:

Silty loam over top of heavy clay approximately 50 cm deep. Thick H and Ah horizons, dark coloured. Low coarse fragment content (10 – 15%) characterized by a few platy sandstone cobbles. Poorly drained.

Wildlife and Wildlife Habitat:

Observed during data collection: heard lots of unidentified frog calls.

Habitat: Moist area supports amphibians and shrubby thicket like riparian provides high quality bird habitat.

Disturbance History:

The area appears to have been logged and is located next to the Crystal Mountain driveway – the ditch along the driveway provides significant water additions during storm events.

Succession:

Seasonal flooding will maintain willow and red alder in this ecosystem with possible infill of western redcedar as raised micro-sites develop over time. No cedar seedlings were observed.

Restoration Recommendations:

More in-depth investigation into hydrological alterations caused by the ditch and driveway should occur to determine whether restoration is required.

Ecosystem 8

Description: Red alder / bitter cherry (*Prunus emargenata*) – oceanspray (*Holodiscus discolor*) (CDFmm/01 – 40%) (CDFmm/06 – 60%) disturbed pole-sapling, lower/tow slope. The polygon is a transition zone from flat seasonally flooded Polygon 7 to a drier southwest facing upper slope characterized by Polygon 9.

Polygon ID:	8	Slope:	Concave, 25-60%		Aspect:	250°
Structural Stage:	PSm	Mesoslope Position:	Flat		Site Series:	CDFmm/01 (40%) CDFmm/06 (60%)
Soil Nutrient Reg.:	M-R	Soil Moisture Regime:	4-5		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Prunus emarginata</i>			15					
<i>Alnus rubra</i>		60	10					
<i>Salix scouleriana</i>			2					
<i>Pteridium aquilinum</i>						15		
<i>Gaultheria shallon</i>				10				
<i>Holodiscus discolor</i>				20				
<i>Rubus discolor</i>				40				
<i>Rubus parviflorus</i>				T				
<i>Acer macrophyllum</i>				T				
<i>Elymus glaucus</i>						1		
<i>Urtica dioica</i>						1		
<i>Rubus ursinus</i>					1			
<i>Lactuca muralis</i>						T		
<i>Polystichum munitum</i>						1		
<i>Kinderbergia oregana</i>							5	
<i>Pseudotsuga menziesii</i>				2				
<i>Abies grandis</i>				1	1			
<i>Lonicera ciliosa</i>				1				
Cover by Layer (%)	Tree:	75	S`hrub:	70	Herb:	15	Moss:	5

Soils:

Silty loam with moderate coarse fragment content between 35 and 50%. Patchy deeper soil pockets interspersed with exposed boulder talus from ridge crest above. Moderately well drained.

Wildlife and Wildlife Habitat:

Observed during data collection: heard lots of unidentified frog calls.

Habitat: Moist area supports amphibians and shrubby thicket like riparian provides high quality bird habitat.

Disturbance History:

Logged in mid 1990's. Logging likely contributed to slope instability leading to movement of boulders and soil from the cliff/ridge above.

Succession:

Red alder canopy will eventually be overtaken by Douglas-fir and grand fir that have established on drier, deeper soil micro-sites eventually leading to a conifer dominated mature forest.

Restoration Recommendations:

None recommended.

Ecosystem 9

Description: Douglas-fir / Arbutus (*Arbutus menziesii*) naturally regenerating pole forest (CDFmm/02) with scattered young seed trees. The polygon includes the upper slope and crest areas with an aspect that shifts from southwest to northeast. Soils are very shallow and very well drained with a high coarse fragment content and loamy textured mineral soil.

Polygon ID:	9	Slope:	Convex 0 - 90%		Aspect:	southwest to northeast
Structural Stage:	PSm	Mesoslope Position:	Crest – upper slope		Site Series:	CDFmm/02
Soil Nutrient Reg.:	P-M	Soil Moisture Regime:	1		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>			5	50				
<i>Arbutus menziesii</i>			10	2				
<i>Salix scouleriana</i>				1				
<i>Abies grandis</i>				1	2			
<i>Thuja plicata</i>				2				8% on northeast side of ridge
<i>Holodiscus discolor</i>				10				
<i>Mahonia nervosa</i>					5			
<i>Gaultheria shallon</i>					10			
<i>Lonicera hispidula</i>					10			
<i>Polystichum munitum</i>						T		
<i>Amelanchier alnifolia</i>						T		
<i>Vaccinium parvaflorum</i>				T	T			
<i>Cytisus scoparius</i>					T	5		
<i>Racomitrium spp.</i>							30	
<i>Prunus emarginata</i>				15				
<i>Kindbergia oregana</i>							20	
<i>Rhytidiadelphus triquetrus</i>							5	On northeast side of ridge
Cover by Layer (%)	Tree:	15	Shrub:	65	Herb:	25	Moss:	50

Soils:

Very shallow, characterized by cracks and crevices with deeper soils between exposed boulders and bedrock. Loam with high coarse fragment (50-60%) and very well drained. Some of the deeper soil pockets have a small Ah and darker soils indicating scattered richer micro-sites.

Wildlife and Wildlife Habitat:

Observed during data collection: evidence of intense deer browse on Saskatoon (*Amelanchier alnifolia*), red huckleberry (*Vaccinium parvaflorum*) and scotch broom.

Disturbance History:

Polygon was logged resulting in increased exposure to winds. Loose rock and soil also suggests susceptibility to mass wasting – also increased from logging. Intense deer browse was also noted to the extent where the establishment of preferred species such as Saskatoon is severely impeded.

Succession:

Stand will develop into a Douglas-fir dominated site with scattered Arbutus – species like bitter cherry (*Prunus emarginata*) will die off over the next 20 years.

Restoration Recommendations:

Remove scotch broom by cutting during flowering season. Pulling will damage shallow, loose soils.

Ecosystem 12

Description: Mature to Old-growth Douglas-fir – Arbutus (CDFmm/02) southwest facing steep slope with exposed bedrock and boulder cliff micro-sites scattered throughout. Soils are generally less than 30cm in depth except on flatter “shelf” micro-sites also scattered throughout the polygon where deeper soil have been able to accumulate. In the smaller Polygon 12b along Porlier Pass road, there is a 25% component of Douglas-fir – salal (CDFmm/01) on a slightly shallower slope (50 – 60%).

Polygon ID:	12	Slope:	80%		Aspect:	250°	
Structural Stage:	MF m	Mesoslope Position:	Mid to upper slope		Site Series:	CDFmm/02	
Soil Nutrient Reg.:	M	Soil Moisture Regime:	0-1		Photo Points:		

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	5	40	5	1	T		T	
<i>Arbutus menziesii</i>		15	15					
<i>Acer macrophyllum</i>		10	5					Mainly on mid slope
<i>Thuja plicata</i>				T	T			In CDFmm/01 Poly 12b
<i>Holodiscus discolor</i>				1				
<i>Gaultheria shallon</i>					10			Mainly on mid slope
<i>Mahonia nervosa</i>					20			Mainly on mid slope
<i>Linnaea borealis</i>					T			
<i>Vaccinium ovatum</i>					1			
<i>Lonicera hispidula</i>					25			Mainly on upper slope
<i>Polystichum munitum</i>						1		

<i>Lactuca muralis</i>						T		
<i>Kinbergia praelonga</i>							5	On rocks
<i>Kinbergia oregana</i>							5	On rocks
<i>Lonicera ciliosa</i>				T				In CDFmm/01 Poly 12b
<i>Grass spp.</i>							15	
Cover by Layer (%)	Tree:	75	Shrub:	55	Herb:	15	Moss:	5

Soils:

Silty loam with medium coarse fragment content (30-50%), a medium to dark color, a mor humus form and very shallow. Exposed soil (no veg) and rock accounts for approximately 35% of the polygon.

Wildlife and Wildlife Habitat:

Observed during data collection: Bald eagles and Turkey vultures observed flying over steep slope / cliff.

Habitat: Large diameter snags and coarse woody debris and living veteran Douglas-firs are scattered throughout the polygon and all show signs of woodpecker use. A few scattered old-growth Douglas-fir trees provide rare canopy and below ground habitat associations.

Disturbance History:

Lower portion of the polygon has been selectively logged for Douglas-fir. Old-growth Douglas-fir trees show fire scars while mature trees do not indicating that the area was burned during or after the original logging entry in the early 1900's.

Succession:

Stand will continue to mature with a relatively stable species composition.

Restoration Recommendations:

None recommended.

Ecosystem 13

Description: Young Douglas-fir / western redcedar / big-leaf maple (*Acer macrophyllum*) (CDFmm/01) mixed forest characterized by large exposed boulders and soil deposited from the steep slope/cliff area above in Polygon 12. Exposed rock and boulder account for between 60% of surface cover at the bottom of the slope to 30% in the upper portion of the polygon.

Polygon ID:	13	Slope:	Concave 15 - 55%		Aspect:	250°
Structural Stage:	YFm	Mesoslope Position:	Mid to lower slope		Site Series:	CDFmm/01
Soil Nutrient Reg.:	M	Soil Moisture Regime:	3		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>		15	5	10	T		T	

<i>Thuja plicata</i>		25	10	5	T		T	
<i>Arbutus menziesii</i>			T					
<i>Acer macrophyllum</i>		15	10	1	T		T	
<i>Gaultheria shallon</i>					15			
<i>Mahonia nervosa</i>					3			
<i>Holodiscus discolor</i>				1				
<i>Polystichum munitum</i>						10		
<i>Kinbergia oregana</i>						15		
<i>Alnus rubra</i>				5				
<i>Lonicera hispidula</i>					5			
<i>Lactuca muralis</i>						T		
<i>Gallium aparine</i>						T		
<i>Racomitrium spp.</i>							15	Lower slope on talus
Cover by Layer (%)	Tree:	35	Shrub:	85	Herb:	10	Moss:	10

Soils:

Very well drained silty loam with medium coarse fragment content (30-50%), a medium to dark color, a mor humus form and generally shallow.

Wildlife and Wildlife Habitat:

Observed during data collection: Raven

Habitat: Lots of potential hiding and den sites in cracks and fissures created by boulders.

Abundant coarse woody debris.

Disturbance History:

The polygon was logged in the early 1900's and was high-graded again in the 1990's when the major clearcut on the property occurred. The major natural disturbance is from mass wastage with large gaps within the polygon formed due to high boulder content and very few soil pockets suitable for tree growth.

The major disturbance to Polygon 13b is from Porlier Pass road with permanently altered light conditions along with consistent disturbance from traffic. Also, polygon 13b was not high-graded.

Succession:

Lower boulder dominated area will slowly develop canopy cover as existing trees grow and more regen is recruited. The upper "less bouldery" area will continue to develop mature forest characteristics. The soil communities on in the talus dominated area where high-grade logging occurred will take many decades or even centuries to re-establish and support tree growth.

Restoration Recommendations:

None recommended.

Ecosystem 14

Description: Western redcedar – sword fern (*Polystichum munitum*) – skunk cabbage (*Lysichiton americanum*) swamp (Ws53 – 80%). The seasonally flooded wetland depression is recovering from logging related disturbance and is currently characterized by regenerating red alder pole forest mixed with graminoid dominated open patches. Raised micro-sites are scattered throughout the swamp area and transition into a CDFmm/06 (20%) moist forest along the edges of the polygon. A seasonal stream channel is braided through the wetland area and varies in width to from concentrated (1m width) to dispersed (no defined channel).

Polygon ID:	14	Slope:	Less than 1%		Aspect:	Depression (160°)
Structural Stage:	PSb	Mesoslope Position:	Depression		Site Series:	CDFmm/11 (80%) CDFmm/06 (20%)
Soil Nutrient Reg.:	R-VR	Soil Moisture Regime:	6-7		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes	
<i>Alnus rubra</i>				65					
<i>Abies grandis</i>				T	T			On raised micro-sites	
<i>Thuja plicata</i>	2			T	T			On raised micro-sites	
<i>Acer macrophyllum</i>	T							On raised micro-sites	
<i>Rubus spectabilis</i>				1	1				
<i>Gaultheria shallon</i>					1			On raised micro-sites	
<i>Polystichum munitum</i>						55		On raised micro-sites	
<i>Urtica dioica</i>						3			
<i>Juncos effusus</i>						T			
<i>Lysichiton americanum</i>						5			
<i>Scirpus microcarpus</i>						5			
<i>Equisetum arvense</i>						25			
<i>Achlys triphylla</i>						2			
<i>Elymus glaucus</i>						5			
<i>Kindbergia praelonga</i>							2		
Cover by Layer (%)	Tree:	2	Shrub:	70	Herb:	95	Moss:	2	

Soils:

Soils range from wet year round in the centre to seasonally wet on the fringes. Characterized by deep organic horizon with underlying heavy clay.

Wildlife and Wildlife Habitat:

Observed during data collection: red legged frog and active beaver damming (freshly cut small diameter red alder stumps and downed stems with beaver tooth patterns)

Habitat: mixed species, mixed aged forest with gaps and open water for the majority of the year is excellent habitat for birds, amphibians and mammals.

Disturbance History:

The polygon was clearcut logged around 16 years ago with varying degrees of disturbance to soils – indicated by variation in regenerating vegetation communities.

Freshly felled red alder is being used by beaver to create a new dam which is increasing the size of the flooded wetland area.

Succession:

Swamp area will continue to develop forest canopy transitioning from a red alder dominated community into a western redcedar dominated community. Red alder will remain as a long-term component of the stand. Succession will depend on degree of soil disturbance with high impact areas taking longer to develop forest canopy. If beaver persist with the development of new dams the water table may be raised in affected areas creating pockets of year round marsh habitat – trees and shrubby vegetation in the flooded area will likely die and marsh vegetation adapted to year round flooding will increase.

Restoration Recommendations:

Recommend planting red alder and western redcedar in appropriate raised (dryer) micro-sites within the more heavily disturbed (no red alder canopy) areas.

Ecosystem 15

Description: Young red alder (*Alnus rubra*) / western redcedar – sword fern (*Polystichum munitum*) / salmonberry (*Rubus spectabilis*) swamp (Ws53 - 50%) in depression areas transitioning into sword fern dominated lower slope with scattered young big-leaf maple and western redcedar (CDFmm/06 - 50%) left after logging. The polygon also includes a seasonal stream channel that varies in width to from concentrated (1m width) to dispersed (no defined channel) to subsurface flow.

Polygon ID:	15	Slope:	1 - 5%		Aspect:	45°	
Structural Stage:	PSb	Mesoslope Position:	Depression – lower slope		Site Series:	Ws53 (50%) CDFmm/06 (50%)	
Soil Nutrient Reg.:	R	Soil Moisture Regime:	5-7		Photo Points:		

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Alnus rubra</i>			65					
<i>Abies grandis</i>				1	1			Raised micro-sites
<i>Thuja plicata</i>	5		5	T	T			
<i>Acer macrophyllum</i>			15					
<i>Rubus spectabilis</i>				15	1			
<i>Polystichum munitum</i>						60		
<i>Climacium dendroides</i>							T	
<i>Plagiomnium insigne</i>							5	

<i>Kindbergia oregana</i>							10		
<i>Kindbergia praelonga</i>							5		
<i>Rhytididiadelphus triquetrus</i>							T		
<i>Achlys triphylla</i>						5			
<i>Elymus glaucus</i>						5			
<i>Carex sp.</i>						10			
<i>Gaultheria shallon</i>					1				Raised micro-sites
<i>Salix scouleriana</i>				T					
<i>Rubus ursinus</i>					1				
Cover by Layer (%)	Tree:	80	Shrub:	20	Herb:	80	Moss:	20	

Soils:

Dark silty loam with high organic content, thick Ah and low coarse fragment content (10%).
Seasonally saturated with standing water during winter months.

Wildlife and Wildlife Habitat:

Observed during data collection: red legged frog, piliated woodpecker heard.
Habitat: multi-layered vegetation with broadleaf canopy, salmonberry and water source
extremely valuable for wildlife.

Disturbance History:

Soils have been heavily impacted from machinery during logging 15 to 20 years ago. Old stumps indicate a mature forest community dominated by large western redcedar with the odd Douglas-fir and grand fir scattered on micro-sites. Red alder is very spindly and dense due to soil disturbance and fluctuating water table.

Succession:

Western redcedar will gradually grow up and replace the red alder as the dominant cover with grand fir and Douglas-fir taking hold on appropriate microsites over the next 50 or 60 years. Micro-sites will continue to develop creating a more patchy swamp/dry site mosaic.

Restoration Recommendations:

Recommend targeted thinning of red alder to encourage the growth of western redcedar and grand fir saplings. Thinning should be completed in dry summer months without the use of any machinery.

Ecosystem 16

Description: Riparian forest characterized by young red alder - sword fern community (CDFmm/06 – 90%) on a lower slope mixed with red alder / black cottonwood (*Populus balsamifera spp. trichocarpa*) – salmonberry community (CDFmm/07) in small depression areas along the edge of the seasonal creek where flooding occurs. In polygon 16a, patches of young forest are mixed with open shrub and pole/sapling dominated areas where soils were more heavily impacted during logging and regeneration is hindered.

Polygon ID:	16	Slope:	2-30% - concave		Aspect:	variable
Structural Stage:	PSb	Mesoslope Position:	Lower slope		Site Series:	CDFmm/06 (90%) CDFmm/07 (10%)
Soil Nutrient Reg.:	R	Soil Moisture Regime:	6		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>		2	T	T	T			No A2/A3 in disturbed areas
<i>Thuja plicata</i>		1	2	5	T			No A2/A3 in disturbed areas
<i>Alnus rubra</i>		25	20	5				No A2/A3 in disturbed areas
<i>Abies grandis</i>		T	T	1	T			No A2/A3 in disturbed areas
<i>Arbutus menziesii</i>				T				On raised micro-site
<i>Gaultheria shallon</i>					5			
<i>Polystichum munitum</i>						50		Less in flooded areas
<i>Pteridium aquilinum</i>						T		
<i>Acer macrophyllum</i>		3	T	T				
<i>Kindbergia oregana</i>							1	
<i>Achlys triphylla</i>						3		
<i>Equisetum arvense</i>						3		
<i>Rubus discolor</i>				1	1			In flooded area by road
<i>Vaccinium parvaflorum</i>				T				
<i>Populus balsamifera trichocarpa</i>				T				In flooded areas
<i>Sambucus racemosa</i>				T				In flooded areas
<i>Rubus spectabilis</i>				3	2			In flooded areas
<i>Carex spp.</i>						2		In flooded areas
<i>Grass spp.</i>						2		More in disturbed areas
<i>Urtica dioica</i>						1		
<i>Rubus ursinus</i>					T			
<i>Kindbergia praelonga</i>							2	more in flooded areas
<i>Climacium dendroides</i>							T	
<i>Plagiothecium undulatum</i>							T	
<i>Plagiomnium insigne</i>							T	
<i>Holodiscus discolor</i>				T				In disturbed areas
<i>Gallium aparine</i>						T		In disturbed areas
<i>Crataegus monogyna</i>					T			In disturbed areas
<i>Mahonia nervosa</i>					T			In disturbed areas
<i>Cirsium spp.</i>						T		In disturbed areas
<i>Symphoricarpos albus</i>					T			In disturbed areas
<i>Salix scouleriana</i>			1					In disturbed areas

<i>Tellima grandiflora</i>					T		In disturbed areas		
Cover by Layer (%)	Tree:	60	Shrub:	30	Herb:	65	Moss:	5	

Soils:

Imperfectly drained silty clay loam with low coarse fragment content (10%) and thick H and Ah horizons. Moder humus form. Mottles are present in clay layer approximately 50 cm deep indicating a slightly fluctuating water table and /or saturation during winter months.

Wildlife and Wildlife Habitat:

Observed during data collection: red legged frog, tree frog, red squirrel

Habitat: multi species, riparian forest with gaps, floodplains and scattered snags is excellent habitat for birds, small mammals, amphibians etc. Freshwater available in winter, fall and spring.

Disturbance History:

The area was clearcut 15 to 20 years ago. Machine use has damaged and compacted soils and is more pronounced in areas used for repeated access (polygon 16a). Regeneration has been compromised in these areas and they remain in the shrub/herb successional phase.

Succession:

Red alder will continue to dominate the polygon for several decades with western redcedar and grand fir slowly emerging as the red alder dies off. Areas of heavier soil disturbance will continue to develop very slowly with a mixed tree canopy forming over the next 20 – 30 years.

Restoration Recommendations:

Recommend planting western redcedar and red alder in polygon 16a where soils have been disturbed.

Recommend the removal of the black ABS pipe and the weir from the lower portion of the creek.

Ecosystem 17

Description: Moist, red alder dominated pole forest with a sword fern and grass dominated understory (CDFmm/06). The ecosystem is recovering from heavy soil disturbance and compaction that occurred during logging approximately 15 years ago. Polygons 17a and 17b were likely old road and staging areas during logging and have been significantly impacted by extensive soil compaction and disturbance. As a result, these areas have not been able to develop a tree canopy and have a dominant vegetation cover of grasses and sword fern.

Polygon ID:	17	Slope:	5-10% - concave	Aspect:	variable
Structural Stage:	PSb	Mesoslope Position:	Lower slope	Site Series:	CDFmm/06
Soil Nutrient Reg.:	R	Soil Moisture Regime:	6	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes	
<i>Pseudotsuga menziesii</i>				5	1			1% in 17a/b	
<i>Thuja plicata</i>				T				1% in 17a/b	
<i>Alnus rubra</i>				60				5% in 17a/b	
<i>Abies grandis</i>				1	3			1% in 17a/b	
<i>Prunus emarginata</i>				10					
<i>Gaultheria shallon</i>					2				
<i>Polystichum munitum</i>						50		20% in polygons 17a/b	
<i>Pteridium aquilinum</i>						T		5% in 17a/b	
<i>Acer macrophyllum</i>				2					
<i>Kindbergia oregana</i>							2		
<i>Achlys triphylla</i>						T			
<i>Equisetum arvense</i>						3			
<i>Rubus discolor</i>				2					
<i>Scirpus microcarpus</i>						T		In 17b	
<i>Sambucus racemosa</i>				1					
<i>Rubus spectabilis</i>				2	2				
<i>Carex spp.</i>						T			
<i>Grass spp.</i>						25		60% in Polygons 17a/b	
<i>Urtica dioica</i>						5			
<i>Rubus ursinus</i>						T			
<i>Kindbergia praelonga</i>							2		
<i>Elymus hirsutus</i>						10			
<i>Rhytidiadelphus triquetrus</i>							T		
<i>Plagiomnium insigne</i>							4		
<i>Polytrichum juniperinum</i>							T		
<i>Gallium aparine</i>						T			
<i>Cirsium spp.</i>							T	5% in 17a/b	
<i>Dactylis glomerata</i>						3			
<i>Agropyron repens</i>							T		
<i>Tellima grandiflora</i>						T			
Cover by Layer (%)	Tree:		Shrub:	80	Herb:	95	Moss:	10	

Soils:

Modor humus form with 15 – 25% coarse fragments, a deep Ah layer and a silty clay loam mineral horizon texture. There are signs of compaction between 10 and 30 cm and a clay layer at approximately 40 cm.

Wildlife and Wildlife Habitat:

Observed during data collection: red legged frog, tree frog, raven

Disturbance History:

The area was very heavily impacted by machinery during logging. There is evidence slash pile burning after logging with large deposits of charred wood/ash in soils. Soil compaction is

evident as well as soil mixing from bulldozers. Stumps remaining on the site are dominated by western redcedar (75%) and Douglas-fir (25%)

Succession:

Red alder will continue to dominate the polygon for several decades with western redcedar and grand fir slowly emerging as the red alder dies off. Areas of heavier soil disturbance will continue to develop very slowly with a mixed tree canopy forming over the next 20 – 30 years.

Restoration Recommendations:

Recommend pulling apart and spreading remaining slash piles to create a more natural distribution of coarse woody debris and to reduce the risk of high intensity fire getting into adjacent conifer dominated stands.

Recommend spot planting of red alder, western redcedar and grand fir in polygons 17a and 17b to hasten the formation of a tree canopy – de-compact soil around planting sites to provide a more favorable growing condition for the planted tree.

Ecosystem 18

Description: Dense Douglas-fir / grand fir (*Abies grandis*) dominated pole forest with sparse Oregon grape (*Mahonia nervosa*) / sword fern understory (CDFmm/04). The Polygon is characterized by dense conifer areas mixed with patches of red alder. Polygon 18a was likely an old road and staging area during logging and has been significantly impacted by extensive soil compaction and disturbance. As a result, this area has not been able to develop a tree canopy and has a dominant vegetation cover of grasses and sword fern.

Polygon ID:	18	Slope:	5-15% - concave	Aspect:	NE to E
Structural Stage:	PSb	Mesoslope Position:	Mid Slope	Site Series:	CDFmm/04
Soil Nutrient Reg.:	R	Soil Moisture Regime:	2-3	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>				40	1			
<i>Thuja plicata</i>				T	T			
<i>Alnus rubra</i>				10				
<i>Abies grandis</i>				40	1			
<i>Prunus emarginata</i>				T				
<i>Gaultheria shallon</i>					5			
<i>Polystichum munitum</i>						2		
<i>Mahonia nervosa</i>					10			
<i>Kindbergia oregana</i>							2	
<i>Rubus discolor</i>				2				
<i>Dicranum spp.</i>							2	
<i>Lonicera ciliosa</i>				T				

Cover by Layer (%)	Tree:		Shrub:	95	Herb:	2	Moss:	4
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Soils:

Moderately well drained silty clay loam with 25% coarse fragments and moder humus form. Observed a distinct mushroom smell and an abundance of fungal mycelia.

Wildlife and Wildlife Habitat:

Observed during data collection: none observed

Disturbance History:

Logged approximately 15 years ago, with very dense natural regeneration taking place resulting in a barren forest floor and relatively low diversity.

Succession:

The stand will continue as a very dense Douglas-fir, grand fir dominated young forest with very barren understory and poor species diversity for the next 80 to 100 years while natural stem exclusion takes place.

Restoration Recommendations:

Recommend well planned thinning treatments with a goal to increase species diversity and general tree growth - possibly making multiple entries over the next 30 to 40 years. Limited removal of Douglas-fir and grand fir stems from the site is possible while still achieving restoration goals.

Recommend spot planting of Douglas-fir, western redcedar and grand fir in polygon 18a to hasten the formation of a tree canopy – de-compact soil around planting sites to provide a more favorable growing condition for the planted tree.

Ecosystem 19

Description: Douglas-fir – Arbutus (CDFmm/01-02) pole forest on a small ridge and associated southwest facing steep slope. Dominated by pole trees with scattered young and mature trees throughout, characterized by exposed bedrock and very shallow soils on the crest with slightly deeper soil pockets on the southwest facing steep slope.

Polygon ID:	19	Slope:	Variable, 5-30%	Aspect:	S – SW, convex
Structural Stage:	PSc	Mesoslope Position:	Crest / upper slope	Site Series:	CDFmm/01-02
Soil Nutrient Reg.:	P - M	Soil Moisture Regime:	1-2	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	1			40				
<i>Thuja plicata</i>	1			5				
<i>Alnus rubra</i>				1				

<i>Abies grandis</i>				T				
<i>Arbutus menziesii</i>				10				
<i>Gaultheria shallon</i>					30			
<i>Holodiscus discolor</i>				5	T			
<i>Mahonia nervosa</i>					5			
<i>Rosa gymnocarpa</i>					T			
<i>Kindberia oregana</i>							1	
<i>Pteridium aquilinum</i>						2		
<i>Polytrichum juniperinum</i>							T	
<i>Lonicera hispidula</i>					2			
<i>Lonicera ciliosa</i>					1			
<i>Rubus discolor</i>				2				
<i>Cytisus scoparius</i>					1			
Cover by Layer (%)	Tree:	2	Shrub:	80	Herb:	5	Moss:	2

Soils:

Silty loam with 50% coarse fragment content, well drained. Mor humus form with an Ae horizon.

Wildlife and Wildlife Habitat:

Observed during data collection: none observed

Habitat: Scattered medium diameter snags well used by woodpeckers.

Disturbance History:

Logged approximately 15 years ago with evidence of soil disturbance from heavy machinery scattered throughout in patches – often coinciding with Scotch broom (*Cytisus scoparius*) and Himilayan blackberry (*Rubus discolor*) cover. Scattered charred areas suggest spot slash burns after logging or a patchy broadcast burn.

Succession:

Stand will continue to develop into a Douglas-fir / Arbutus dominated young forest with a diverse canopy and understory.

Restoration Recommendations:

Recommend removal of Scotch broom and Himilayan blackberry.

Ecosystem 20

Description: Douglas-fir – Arbutus (CDFmm/02) / Oregon beaked moss mature forest ridge mixed with patches of regenerating pole forest clearcut 15 years ago. Polygon is characterized by very shallow soils with significant patches of moss covered exposed boulders and bedrock.

Polygon ID:	20	Slope:	Variable, 5-20%	Aspect:	SW - NE, convex
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Structural Stage:	MFm / PSm	Mesoslope Position:	Crest	Site Series:	CDFmm/02
Soil Nutrient Reg.:	P	Soil Moisture Regime:	0-1	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>		10	5	5	2		T	
<i>Thuja plicata</i>				5	2		T	Mainly on NE aspect
<i>Acer macrophyllum</i>		5						
<i>Abies grandis</i>		T	T	T				
<i>Arbutus menziesii</i>		20	5				T	
<i>Gaultheria shallon</i>					35			Increases on NE aspect
<i>Polystichum munitum</i>						T		
<i>Mahonia nervosa</i>					15			
<i>Rosa gymnocarpa</i>					T			
<i>Kindberia oregana</i>							30	
<i>Rhytidadelphus lorus</i>							T	
<i>Hylocomnium splendens</i>							1	
<i>Lonicera hispidula</i>					3			
<i>Lonicera ciliosa</i>				T				
<i>Trientalis latifolia</i>						T		
<i>Gallium aparine</i>						T		
<i>Vaccinium parvaflorum</i>				T	T			
<i>Dicranum spp.</i>							T	
Cover by Layer (%)	Tree:	45	Shrub:	60	Herb:	2	Moss:	35

Soils:

Mor humus form with a thin Ae horizon. Soil has a silty loam texture with a very high coarse fragment content (50-70%) mostly consisting of flat platy sandstone cobbles. Well to rapidly drained.

Wildlife and Wildlife Habitat:

Observed during data collection: Raven, bald eagle, seagull

Habitat: Scattered snags well used by woodpeckers and coarse woody debris of varying decay class scattered around the polygon.

Disturbance History:

Logging encroached up into slightly deeper soiled portions of the ridge creating a wavy border along the northeast side of the ridge between the mature forest and regenerating clearcut.

Succession:

Developing into a mixed species, multi-layered canopy young/mature forest with a diverse moss dominated understory. Regen in clearcut areas is thick and healthy and will begin to self thin over the next several decades.

Restoration Recommendations:

None recommended.

Ecosystem 21

Description: Patches of Douglas-fir dominated pole forest (CDFmm/01 – 75%) mixed with very shallow soiled, open areas dominated by exposed boulders and bedrock (CDFmm/02 – 25%). The northeast facing area spans from an upper slope to a lower slope and is characterized by appropriate variation in moisture and nutrient regimes with soils that are slightly drier and poorer at the top and slightly moister and richer at the bottom.

Polygon ID:	21	Slope:	20-30%	Aspect:	50°
Structural Stage:	PSc	Mesoslope Position:	Mid slope	Site Series:	CDFmm/01 – 75% CDFmm/02 – 25%
Soil Nutrient Reg.:	P - R	Soil Moisture Regime:	1-3	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>				60	2		T	
<i>Thuja plicata</i>				4	1		T	
<i>Alnus rubra</i>				5				
<i>Abies grandis</i>				T	T			
<i>Arbutus menziesii</i>				8				
<i>Acer macrophyllum</i>				5				
<i>Gaultheria shallon</i>					30			
<i>Holodiscus discolor</i>				5				
<i>Mahonia nervosa</i>					30			
<i>Rosa gymnocarpa</i>					T			
<i>Kindberia oregana</i>							5	
<i>Pteridium aquilinum</i>						T		
<i>Polytrichum juniperinum</i>							T	
<i>Rhytidiadelphus triquetrus</i>							T	
<i>Dicranum spp.</i>							T	
<i>Rubus discolor</i>				2	2			
<i>Hylocomnium splendens</i>							T	
<i>Gallium aparine</i>						T		
<i>Lactuca muralis</i>						T		
<i>Polystichum munitum</i>						5		Lower slope
<i>Symphoricarpus albus</i>					1			
<i>Vaccinium parviflorum</i>					T			
<i>Grass spp.</i>						5		
<i>Cytisus scoparius</i>				T				

<i>Lychnis coronaria</i>						T		
<i>Rubus ursinus</i>						T		
Cover by Layer (%)	Tree:		Shrub:	95	Herb:	15	Moss:	10

Soils:

Silty loam with 30 – 50% coarse fragments increasing to over 50% similar to polygon 20 in upper areas. Moder humus form with a thin Ah, very well drained.

Wildlife and Wildlife Habitat:

Observed during data collection: Raven, bald eagle

Disturbance History:

Logged approximately 15 years ago - thin soils are sensitive to compaction.

Succession:

The patchy appearance with dense stands of regenerating Douglas-fir and open rocky outcrops will continue for several decades until the canopies of large maturing trees begin to close in over rocky outcrop gaps. Dense regen areas will begin to lose diversity over the next 10 to 15 years and the dominant Douglas-fir canopies shade everything else out.

Restoration Recommendations:

Recommend removal of Scotch broom and Himalayan blackberry.

Recommend thinning of Douglas-fir in dense areas to increase tree growth and improve or maintain species diversity.

Ecosystem 22

Description: Young Red alder – salal dominated gently sloping south facing moisture receiving area. The polygon includes old logging access routes on its eastern and western edges and is characterized by relatively heavy disturbance and soil compaction with a central core of less disturbed young mixed red alder, Douglas-fir and western redcedar forest.

Polygon ID:	22	Slope:	5 - 10%	Aspect:	180°
Structural Stage:	SH	Mesoslope Position:	Mid slope	Site Series:	CDFmm/01-04
Soil Nutrient Reg.:	M-R	Soil Moisture Regime:	4	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Alnus rubra</i>	5	50						
<i>Abies grandis</i>				5				
<i>Thuja plicata</i>	5	5		2				
<i>Acer macrophyllum</i>		2						
<i>Psuedotsuga menziesii</i>		2		10				

<i>Gaultheria shallon</i>					45			
<i>Rubus spectabilis</i>					2			
<i>Polystichum munitum</i>						15		
<i>Mahonia nervosa</i>					5			
<i>Rubus parvaflorus</i>					T			
<i>Kindbergia oregana</i>							2	
<i>Kindbergia praelonga</i>							T	
<i>Achlys triphylla</i>						T		
<i>Urtica dioica</i>						3		
<i>Salix scouleriana</i>				T				
<i>Lonicera ciliosa</i>				T				
Cover by Layer (%)	Tree:	70	Shrub:	65	Herb:	20	Moss:	5

Soils:

Moder humus form with an Ah layer of variable thickness (0-5cm). Mineral soil has 20 to 35% coarse fragments, a sandy loam texture and a dark reddish brown hue. Soil is moderately to well drained and is moisture receiving from adjacent cliff/ridge areas.

Wildlife and Wildlife Habitat:

Observed during data collection: none observed.

Disturbance History:

A wide strip (10 – 15m) area running down the northeastern side of the polygon was used as a skid road to access the creek area – deep ruts were observed. There is also an old logging road located on the southwestern edge of the polygon. Disturbance from logging and log hauling has likely resulted in the red alder dominance.

Succession:

Heavily disturbed road areas will remain dominated by red alder for 40 to 50 years – as the alder start to die and fall over, the Douglas-fir, grand fir and western redcedar waiting in the sub canopy will be released and gradually take over. The less disturbed central portion of the polygon will continue to grow into a multi-stories, mixed species young forest.

Restoration Recommendations:

None recommended.

Ecosystem 23

Description: Red alder – sword fern / salmonberry (CDFmm/12 – 80%) dominated pole forest with scattered young western redcedar and bigleaf maple. The site has a strongly fluctuating water table due to flat topography, dense relatively fine soils, and receiving moisture from adjacent cliff / ridge sites. The polygon is characterized by raised micro-sites scattered within and around its edges where there is less water table fluctuation in the rooting zone and the ecosystem more closely resembles a CDFmm/06 site series (20%) with no salmonberry and more salal.

Polygon ID:	23	Slope:	2 - 5%		Aspect:	320°	
Structural Stage:	PSb	Mesoslope Position:	Flat		Site Series:	CDFmm/12 (80%) CDFmm/06 (20%)	
Soil Nutrient Reg.:	VR	Soil Moisture Regime:	5f		Photo Points:		

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Alnus rubra</i>				40				
<i>Abies grandis</i>				T	T			
<i>Thuja plicata</i>	5		5	5				
<i>Acer macrophyllum</i>	5		5					
<i>Psuedotsuga menziesii</i>				1	T			
<i>Salix scouleriana</i>				20				
<i>Gaultheria shallon</i>					5			
<i>Rubus spectabilis</i>				20				
<i>Polystichum munitum</i>						50		
<i>Cornus stolonifera</i>				T				
<i>Plagiomnium insigne</i>							T	
<i>Kindbergia oregana</i>							3	
<i>Kindbergia praelonga</i>							3	
<i>Achlys triphylla</i>						3		
<i>Urtica dioica</i>						T		
<i>Carex opnupta</i>						1		
<i>Equisetum arvense</i>								
<i>Pteridium aquilinum</i>						2		
<i>Vaccinium parvaflorum</i>					T			
<i>Rubus ursinus</i>					T			
<i>Rubus discolor</i>				8	2			
<i>Sambucus racemosa</i>				2				
<i>Grass spp.</i>						6		
<i>Rubus parvaflorum</i>				T				
<i>Dicranum spp.</i>							T	
<i>Rhytidiadelphus loreus</i>							T	
<i>Gallium aparine</i>						T		
<i>Gallium trifidum</i>						T		
<i>Rubus laciniatus</i>				T	T			
Cover by Layer (%)	Tree:	20	Shrub:	90	Herb:	60	Moss:	10

Soils:

An underlying layer of moderately well drained sandy loam with a layer of sandy clay loam above with 10 to 15% coarse fragments. Very thick H and Ah layers combining to a depth of approximately 15cm. Moder humus form.

Wildlife and Wildlife Habitat:

Observed during data collection: none observed.

Habitat: Moist area supports amphibians and shrubby thicket like salmonberry in fluctuating water table provides high quality bird habitat..

Disturbance History:

Logged approximately 15 years ago. Small areas where machinery was used extensively and possibly where logs were decked are scattered throughout this polygon – this has resulted in soil compaction and inhibited growth of native plants. These more heavily disturbed areas are often dominated by exotic grasses and blackberry thickets.

Succession:

Moving towards a young red alder dominated site with scattered individual large western redcedar and bigleaf maple trees. Western redcedar will gradually take over to form the dominant tree canopy with scattered Douglas-fir occurring on dryer micro-sites.

Restoration Recommendations:

None recommended.

Ecosystem 24

Description: Douglas-fir / grand fir / red alder - sword fern (CDFmm/06 – 60%) dominated gently sloped, moisture receiving pole forest site with a slightly drier soil area more characteristic of a CDFmm/04 site series (40%) mostly on the northwest side of the road that bisects the polygon. There are scattered young western redcedar and bigleaf maple trees scattered throughout the polygon.

Polygon ID:	24	Slope:	10%	Aspect:	320°
Structural Stage:	PSm	Mesoslope Position:	Mid slope	Site Series:	CDFmm/06 – 60% CDFmm/04 – 40%
Soil Nutrient Reg.:	R	Soil Moisture Regime:	4-5	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	2			30				
<i>Thuja plicata</i>	8			2				
<i>Alnus rubra</i>				15				
<i>Abies grandis</i>				25				
<i>Arbutus menziesii</i>				T				
<i>Acer macrophyllum</i>	5							
<i>Gaultheria shallon</i>					30			
<i>Holodiscus discolor</i>				10				
<i>Mahonia nervosa</i>					5			

<i>Rosa nootkensis</i>				T				
<i>Kindberia praelonga</i>							T	
<i>Pteridium aquilinum</i>						1		
<i>Rubus spectabilis</i>				5	1			
<i>Rhamnus purshiana</i>				T				
<i>Lonicera ciliosa</i>				T				
<i>Rubus discolor</i>				2	2			
<i>Salix scouleriana</i>				3				
<i>Achlys triphylla</i>							T	
<i>Lactuca muralis</i>							T	
<i>Polystichum munitum</i>							20	
<i>Symphoricarpos albus</i>						T		
<i>Rubus ursinus</i>						T		
Cover by Layer (%)	Tree:	15	Shrub:	85	Herb:	20	Moss:	1

Soils:

Silty clay loam overtop of a clay loam beginning at 30cm with 25 – 35% coarse fragments and a reddish hue. Mottling was observed below 30cm. The soils are characterized by a moder humus form and are moderately well drained.

Wildlife and Wildlife Habitat:

Observed during data collection: none observed.

Disturbance History:

Logged approximately 15 years ago. Small areas where machinery was used extensively and possibly where logs were decked are scattered throughout this polygon – this has resulted in soil compaction and inhibited growth of native plants. There is a noticeable lack of coarse woody debris in this polygon.

Succession:

The ecosystem is moving towards a Douglas-fir – grand fir dominated young forest with scattered western redcedar and bigleaf maples and a very sparse understory due to shading from a dense canopy. The naturally regenerating stand will self thin over the next 70 to 100 years.

Restoration Recommendations:

Recommend a light thinning of Douglas-fir and grand fir poles to increase growth in remaining trees and to maintain diversity in the stand. Leave stems as additions to coarse woody debris on the site.

Ecosystem 25

Description: Western redcedar / bigleaf maple – sword fern (CDFmm/06) dominated mature forest mixed with disturbed areas including old logging roads and selectively logged patches where western redcedar, grand fir and western hemlock saplings are the dominant tree regeneration with a sword fern dominated understory.

Polygon ID:	25	Slope:	20% (concave)		Aspect:	55°
Structural Stage:	MFm	Mesoslope Position:	Lower slope		Site Series:	CDFmm/06
Soil Nutrient Reg.:	R - VR	Soil Moisture Regime:	6		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>	5	10						
<i>Thuja plicata</i>		25		5	T			
<i>Alnus rubra</i>			5					
<i>Abies grandis</i>		2	2	5	T			
<i>Tsuga heterophylla</i>				T				
<i>Acer macrophyllum</i>		20	2				T	
<i>Gaultheria shallon</i>					1			
<i>Trientalis latifolia</i>						T		
<i>Mahonia nervosa</i>					10			
<i>Kindbergia oregana</i>							3	
<i>Kindbergia praelonga</i>							2	
<i>Pteridium aquilinum</i>						T		
<i>Rubus spectabilis</i>				1	T			
<i>Climacium dendroides</i>							T	
<i>Plagiothecium undulatum</i>							T	
<i>Plagiomnium insigne</i>							1	
<i>Neckera Douglasii</i>							T	
<i>Achlys triphylla</i>						2		
<i>Lactuca muralis</i>						T		
<i>Polystichum munitum</i>						60		
<i>Vaccinium parvaflorum</i>					T			
<i>Rubus ursinus</i>					T			
<i>Isothecium myosuroides</i>								
<i>Metaneckera menziesii</i>							T	
<i>Rhytidiadelphus triquetrus</i>							T	
<i>Equisetum arvense</i>						T		
<i>Carex spp.</i>						1		
<i>Grass spp.</i>						1		
<i>Galium trifidum</i>						T		
Cover by Layer (%)	Tree:	65	Shrub:	25	Herb:	70	Moss:	10

Soils:

Moder humus form with small patchy Ae and thick Ah layers. Moderately well to imperfectly drained silty clay loam with a silty clay layer appearing roughly at 60 cm in depth where mottling is evident. Coarse fragment content is approximately 15 to 20%.

Wildlife and Wildlife Habitat:

Observed during data collection: Red-legged frog, raven, bard owl.

Habitat: Variety of large diameter coarse woody debris of varying decay class – excellent for amphibians breeding in nearby flooded areas.

Disturbance History:

Selective logging over the past 60 to 80 years along with a number of small clearings associated with meditation huts and other associated infrastructure as well as old logging roads and trails.

Succession:

The mixed species canopy will continue to mature and maintain a similar composition. The currently broadleaf dominated areas on the fringe of the lower slope bordering with the wetland will slowly transition towards a greater percentage of grand fir and western redcedar in the canopy.

Restoration Recommendations:

Recommend removal of the deteriorating hut structures and old building materials.

Ecosystem 26

Description: Maturing western redcedar / Douglas-fir – sword fern / Oregon beaked moss (CDFmm/04 – 80%) dominated forest characterized by sword fern dominated canopy gaps (often associated with laminated root rot (*Phelinus wierii*) scattered throughout the polygon’s dense conifer canopy and relatively barren forest floor. The polygon transitions to a Douglas-fir dominated canopy as it moves into a slightly shallower and coarser soiled upper slope CDFmm/01 (20%) ecosystem. The area is just beginning to develop mature forest characteristics as it transitions from a young forest.

Polygon ID:	26	Slope:	30%		Aspect:	65°
Structural Stage:	MFc	Mesoslope Position:	Mid slope		Site Series:	CDFmm/04 - 80% CDFmm/01 – 20%
Soil Nutrient Reg.:	R - M	Soil Moisture Regime:	2-3		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Pseudotsuga menziesii</i>		20	T					
<i>Thuja plicata</i>		50	5	1	T			
<i>Alnus rubra</i>			1					
<i>Abies grandis</i>		2		T				
<i>Acer macrophyllum</i>		4	T					
<i>Gaultheria shallon</i>					3			
<i>Trientalis latifolia</i>					T			
<i>Mahonia nervosa</i>					5			

<i>Kindbergia oregana</i>							25		
<i>Kindbergia praelonga</i>							1		
<i>Rhizomnium glabrescens</i>							T		
<i>Pseudotaxiphyllum elegans</i>							T		
<i>Achlys triphylla</i>							1		
<i>Lactuca muralis</i>							T		
<i>Polystichum munitum</i>							20		
<i>Vaccinium parvaflorum</i>					1				
Cover by Layer (%)	Tree:	80	Shrub:	10	Herb:	25	Moss:	30	

Soils:

Moder humus form with Ah layers. Moderately to well drained silty loam with a silty clay layer appearing roughly at 50 cm in depth along the lower slope edge of Polygon 25. Coarse fragment content is approximately 25 to 35% increasing to 35 – 50% towards the upper slope edge.

Wildlife and Wildlife Habitat:

Observed during data collection: none observed.

Disturbance History:

The area was clearcut approximately 70 years ago – the stumps are low and almost all Douglas-fir. Prior to the clearcut, Douglas-fir would have occupied a much greater percentage of the canopy cover. The polygon appears to have naturally regenerated. Areas are scattered throughout where there appears to have been heavy soil disturbance from machinery.

Windthrow in areas affected by laminated root rot is the primary natural disturbance – the root rot gaps appear to be growing as die back in surrounding Douglas-fir canopies was observed.

Several meditation huts, sheds and trails are also located within the polygon.

Succession:

The stand is at the end of its young forest successional stage and is beginning to show mature forest characteristics resulting from root rot gap creation and the formation of a multi-storied canopy. The polygon will continue towards a mature forest as gaps and resulting understory diversity increase. The canopy will gradually move to a Douglas-fir dominated over the next century.

Restoration Recommendations:

Recommend removal of the deteriorating hut structures and unused shed structures.

Ecosystem 27

Description: Red alder – salmonberry dominated young forest characteristic of a seasonally flooded (WS53 – 45%) swamp interspersed with western redcedar / big-leaf maple areas occurring on very moist (CDFmm/11 – 40%) forest, and transitioning into a slightly drier (CDFmm/06 – 15%) lower slope ecosystem in a broad band along the gently sloping southern

edge and a narrow band along the toe of the adjacent cliff to the north.

Polygon ID:	27	Slope:	0-1%		Aspect:	160°
Structural Stage:	YFb	Mesoslope Position:	Depressio n		Site Series:	WS53 – (45%) CDFmm/11 (40%) CDFmm/06 (15%)
Soil Nutrient Reg.:	R-VR	Soil Moisture Regime:	7		Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes
<i>Alnus rubra</i>		10	20					
<i>Abies grandis</i>							T	Drier CDFmm06 sites
<i>Thuja plicata</i>		5	5	2	1			
<i>Acer macrophyllum</i>		10						
<i>Psuedotsuga menziesii</i>	2							On raised micro-sites
<i>Gaultheria shallon</i>					5			On raised micro-sites
<i>Rubus spectabilis</i>				35				
<i>Polystichum munitum</i>						20		
<i>Stachys spp.</i>						T		
<i>Plagiomnium insigne</i>							2	
<i>Kindbergia oregana</i>							2	
<i>Kindbergia praelonga</i>							5	
<i>Achlys triphylla</i>								
<i>Urtica dioica</i>						2		
<i>Carex opnupta</i>						2		
<i>Equisetum arvense</i>						8		
<i>Atherium felix-femina</i>						1		
<i>Vaccinium parvaflorum</i>				T	T			
<i>Rubus ursinus</i>					T			
<i>Carex spp.</i>						8		
<i>Sambucus racemosa</i>				T				
<i>Oenanthe sarmentosa</i>						1		Flooded area
<i>Lactuca muralis</i>						T		
<i>Tellima grandiflora</i>						T		
<i>Porella navicularis</i>							2	On salmonberry branches
<i>Rhyzomnium glabrescens</i>							T	
<i>Climacium dendroides</i>							T	
<i>Rhytidiadelphus loreus</i>							1	
<i>Rhytidiadelphus triquetrus</i>							T	
<i>Plagiothecium undulatum</i>							T	
<i>Isothecium myosuroides</i>							2	
<i>Hylocomnium splendens</i>							T	

Cover by Layer (%)	Tree:	10	Shrub:	10	Herb:	95	Moss:	2
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Soils:

Clay with high organic content in the flooded areas transitioning to slightly raised where red alder are growing which have an upper silty clay horizon. Moder humus form with very low coarse fragment content (0-5%), imperfectly to poorly drained.

Wildlife and Wildlife Habitat:

Observed during data collection: red legged frog, piliated woodpecker heard.

Habitat: Salmonberry and water source extremely valuable for wildlife. Active beaver damming occurring above culvert on Lot 10.

Disturbance History:

The area was logged in the early to mid 20th century. The soil has been severely compacted where road access has occurred resulting in water collection and channelization in the old ruts. There are patches scattered throughout with evidence of heavier disturbance including a staging area where an old Douglas-fir snag with a 50 to 60 foot high burn scar may be evidence of an intense slashpile burn.

Succession:

Red alder is commonly the dominant tree species that regenerates after logging in wet soils – the alder will slowly be taken over by a higher percentage of western redcedar and big-leaf maple as the soils continue to recover. Red alder will persist on the sites in gaps and openings. The percentage of the area characterized by raised micro-sites will also increase allowing for slight increases in Douglas-fir and grand fir cover over time. This area may also move towards a flooded marsh ecosystem if beaver continue to expand their territory and construct more damns in this area (this seems unlikely due to the the broad, gradual slope of in this polygon with no easily dammable ‘bottlenecks’ observed).

Restoration Recommendations:

None recommended.

Ecosystem 28

Description: Sword fern dominated and scattered young western redcedar, big-leaf maple and red alder (CDFmm/06 – 90%) open recently logged lower slope with small patches of seasonally open salmonberry – slough sedge (carex obnupta) flooded wet soils (CDFmm/11 – 10%). There is no defined seasonal stream channel in this polygon with flow likely occurring below the surface.

Polygon ID:	28	Slope:	2 - 10%	Aspect:	160°
Structural Stage:	SH	Mesoslope Position:	Lower slope	Site Series:	CDFmm/11 (10%) CDFmm/06 (90%)
Soil Nutrient Reg.:	R	Soil Moisture Regime:	6-7	Photo Points:	

Vegetation Species	A1	A2	A3	B1	B2	C	D	Distribution Notes		
<i>Alnus rubra</i>			2	1						
<i>Abies grandis</i>				T	T					
<i>Thuja plicata</i>	2		3	T	T					
<i>Acer macrophyllum</i>	5									
<i>Psuedotsuga menziesii</i>				T						
<i>Gaultheria shallon</i>					2					
<i>Rubus spectabilis</i>					5					
<i>Polystichum munitum</i>						80				
<i>Cornus stolonifera</i>				T						
<i>Plagiomnium insigne</i>							T			
<i>Kindbergia oregana</i>							T			
<i>Kindbergia praelonga</i>							T			
<i>Achlys triphylla</i>						T				
<i>Urtica dioica</i>						2				
<i>Carex opnupta</i>						5				
<i>Equisetum arvense</i>						5				
<i>Pteridium aquilinum</i>						T				
<i>Vaccinium parvaflorum</i>				T						
<i>Rubus ursinus</i>					T					
Cover by Layer (%)	Tree:	10	Shrub:	10	Herb:	95	Moss:	2		

Soils:

Dark silty loam with high organic content, thick Ah and low coarse fragment content (10%).
Seasonally moist.

Wildlife and Wildlife Habitat:

Observed during data collection: red legged frog, piliated woodpecker heard.
Habitat: Salmonberry and water source extremely valuable for wildlife.

Disturbance History:

Soils have been heavily impacted from machinery during logging 15 to 20 years ago. Old stumps indicate a mature forest community dominated by large western redcedar with the odd Douglas-fir and grand fir scattered on micro-sites.

Succession:

Western redcedar will gradually increase in density and become the dominant cover with grand fir and Douglas-fir taking hold on appropriate microsites and maple remaining a minor component over the next 50 or 60 years. Sword fern will remain a dominant understorey cover though species diversity should increase as the tree canopy develops

Restoration Recommendations:

None recommended.