Husby Group

Forest Stewardship Plan
Supporting Information

2018

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Supporting Information

1.0 Preamble

This FSP Supporting Information document is meant to assist reviewers in the FSP approval process. Where necessary, rationales have been provided for results and strategies within the FSP that may require added clarification and background info, in order for FSP reviewers to more fully understand the intent and direction proposed by the Plan Holder.

2.0 Application

Protected Area Impacts

In general, it is understood that the Plan Holder's operations must factor in adjacent landholders and that operations within the Plan Holder's tenures should not adversely affect areas outside of the Plan Area, including Parks or Protected Areas. As such, the Plan Holder will plan their operations to factor in adjacent landholders and the values that may potentially be affected. Any management strategies or actions implemented to protect adjacent landholders will be confined to the Plan Area (i.e., treatments will not occur outside of the FSP Area).

Where the Plan Holder operates near other stakeholders or landholders, the standard approach taken will be to contact the stakeholder/landholder early in the development process and work proactively to ensure that stakeholder/landholder concerns are considered.

Legal Surveys

Where the Plan Holder proposes development areas near a Protected Area or other property/ tenure boundary, it is incumbent on the Plan Holder to ensure they are not operating outside of the Plan Area and that they do not encroach on Protected Areas or other tenures. This is a requirement established under the Forest Act, and is not an objective to be addressed under the FSP. It is expected that when the Plan Holder commences development adjacent to a Protected Area or other property/tenure boundary, the first issue that will be addressed is the location of the tenure boundary utilizing original boundary descriptions and locating blazes and pins in the field. Newer boundaries such as those along Protected Areas and cedar stewardship areas will use commercial grade GPS equipment. In addition to spatially locating boundaries, the Plan Holder will typically contact potentially affected stakeholders and work collaboratively to ensure that their management concerns are addressed (e.g., offer to meet with adjacent tenure holders to field-check boundary locations).

3.0 Clarifications

Operational Feasibility is clarified in the Forest Stewardship Plan to mean "that a Qualified Professional rationalizes that a goal can be completed without unreasonable difficulty, without employing unnecessary means, and without incurring extreme costs to achieve the same outcome by removing the factor that will require said difficulty, unnecessary means and incurring extreme costs."

Operational feasibility is referred to in the FSP regarding alterations, removals, and/or reduction in the size of the reserves associated with Cultural Cedar Stands, CMTs and/or Monumental Cedars. The Plan Holder is committed to maintaining the integrity of these features and their reserves but there are

examples when alterations, removals or reductions in the size of reserve zones would allow for the best management of these features when considering cultural, social, environmental and economic factors. These objectives are considered in no particular order but rather considered together to determine the best management option. Some examples to illustrate when Operational Feasibility may be considered while determining a management strategy are:

Example 1: Several CMTs are located along a proposed road location. The original road location is considered the optimal route. The Plan Holder moves the road location to the second- best route and 1 CMT is located along this route. If the road route is moved again to avoid the one CMT then the only other road routes would result in extreme cost. The Plan Holder would remove the CMT because of Operational Feasibility reasons resulting in the best management of the other resources.

Example 2: A monumental cedar >120cm dbh is located within a development area near the top of a ridge. The area is known to have a high risk for windthrow. If the entire area of the reserve associated with the monumental cedar is retained a portion of the reserve (.2 of a tree length) would be located at the top of the ridge completely exposed to wind and at an extreme risk for windthrow. The reserve would be reduced to an appropriate size so that the reserve is not exposed to the wind because of Operational Feasibility.

4.0 Results & Strategies

Cultural and Social Objectives

The Council of the Haida Nation has developed a competency-based program (open to Haida and non-Haida) that caters to the LUO requirements. Certified surveyors need to pass a written and practical examination (65% minimum on both to pass). Examinations are 1.5 days in length and include testing for CMT identification, Monumental Cedar identification, cultural plant identification, survey methodology, and standards and ecosystem classification.

The Cultural Features Identification Survey (CFIS) program also includes a quality assurance/audit aspect to ensure that the quality of surveys remains consistently high. Approximately 10% of surveys will receive full audits annually.

The Plan Holder will adhere to the FSP and their Standard Operating Procedures (SOPs) which are in accordance to the objectives of the Cedar Stewardship Area Management Plan found at http://www.haidanation.ca/wp-content/uploads/2018/02/Cedar-Man-Plan.FINAL-downsized.pdf.

Tracking Ledger – The Plan Holder utilizes a tracking ledger to track harvesting area, hydrological recovery area, total area of upland stream area, % hydrological recovery, % hydrological recovery balance, and sensitive watershed available area to harvest.

The current “Inventory of Cedar Stewardship Areas” is established under the LUO. Where the Plan Holder proposes to harvest within a Cedar Stewardship Area (CS Area) they will track the depletions, as outlined in the FSP. To ensure all commitments are met, the Plan Holder will maintain a ledger to track the additions/removals to the baseline inventory noted above. The Ledger is an electronic database that tracks both the hectares of CS Area harvested by LU, as well as a spatial representation to identify areas.

Haida Traditional Heritage Features

Applicable HTHFs

The Council of the Haida Nation's Cultural Features Identification Survey manual indicates that where potential HTHFs are identified during a survey an independent Archaeological Impact Assessment (AIA) will be required/conducted.

Karst

"Karst Features" are identified in the LUO as Class 2 HTHFs, and have results specific to the LUO Objectives for HTHFs. Under the LUO, Karst Features are not well defined and would therefore include all potential karst occurrences.

However, "Karst Resource Features" have also been established under GAR, which includes a more specific definition. Additional results have been specified for the FRPA requirements.

For clarity, if a karst occurrence meets the definition of Karst Resource Feature as designated under the GAR Order, it will also be managed to the higher standard, which will ensure that it is not damaged or rendered ineffective, regardless of any intergovernmental processes that may be completed under the LUO Objective for HTHFs.

Haida Traditional Forest Features

Class 2 HTFFs

To be consistent with the LUO, the establishment of stand level retention will be one of the strategies employed to maintain the integrity of the HTFF. The use of stand level retention will be at the discretion of the signing Forester and will be detailed in the Site Plan.

Cedar Retention

15% Cedar Retention Requirements

The Plan Holder has implemented strategies in the FSP to meet the objective. The prescribing Forester will illustrate in the site plan how the objective was met. If required, the weighted cedar retention requirements will be calculated using the inventory mapping information available. An example to illustrate the calculations is provided in Figure 1 below.

Figure 1: 15% Cedar Retention Calculation Example

Sample Development Area

Development Area = 35.0ha, consisting of 3 inventory polygons

Polygon A= 15.0ha - Inventory= C_{10}

Polygon B = 10.0ha - Inventory= H_5B_5

Polygon C = 10.0ha - Inventory = H_5C_5

No-harvest zones established for Type I Fish Habitat= 3.5ha (Inventory = C_{10}) Monumental Cedar No-harvest zone= 2.5ha (Inventory = H_5C_5)

Weighted Cedar Content Calculation

The weighted pre-harvest cedar composition for the Development Area is calculated as follows:

Cedar % = (sum areas of inventory polygons * associated % cedar content)/area of Development Area

= [(Polygon A* Cw inv. for A) + (Polygon B * Cw inv. for B) + (Polygon C * Cw inv. for C)]/ area of Development Area

= [(15.0ha*100%) + (10.0ha*0%) + (10.0ha*50%)]/35.0ha

= [(15.0 + 0 + 5.0ha)]/35.0ha

= 20.0ha/35.0ha

= 57% = pre-harvest combined cedar content for the Development Area (or 20.0ha, measured in area)

Therefore, as the Development Area is > 10.0ha and the combined pre-harvest cedar content is> 30%, the 15% cedar retention requirement applies.

Calculation of Cedar Area Required

In order to meet the cedar retention requirement, Plan Holder must retain a minimum of 15% cedar, measured in hectares, consistent with the FSP Strategies. For the example above, the minimum cedar retention area required would be calculated as follows:

The minimum Cedar Retention Area required = 15% * the weighted cedar content for the Development Area. As calculated above, the weighted cedar content was 57%, or 20.0ha

= 15%*20.0ha

= 3.0ha

Therefore, for the Development Area, 3.0ha of cedar area must be reserved (i.e., 3.0ha of C_{10} inventory; or 6.0ha of H_5C_5).

Establishing Cedar Reserves

In this example, there are two retention areas already established. The sum of the weighted cedar retention areas associated with the established retention areas is calculated as follows:

Cedar content for Type I Fish Habitat no-harvest zone = (area* cedar inventory for polygon)

= 3.5ha*100%

= 3.5ha

Cedar content for Monumental Cedar no-harvest zone = (area* cedar inventory for polygon)

= 2.5ha*50%

=1.25ha

Therefore, the total weighted area of existing cedar retention areas = 3.5 + 1.25ha = 4.75ha

Summary

Given that there are > 3.0ha of cedar retention areas established for the Development Area and that both of the designated cedar retention areas are greater than 1.0ha in size, for this example, provided that the prescribing Forester confirms that the cedar retention stands contain a range of diameters of cedar that are representative of the pre-harvest stand, all of the strategies for the 15% cedar retention requirement are deemed to be met.

With regards to the strategy committing to retaining a range of cedar which is representative of the pre-harvest area, the Plan Holder will do this by selecting areas of similar species and stand characteristics as the harvest area. Where the prescribing Forester cannot easily determine that 15% weighted cedar is retained the weighted cedar area retained will be calculated as above to ensure the objective is met. It will be left to the prescribing Forester to ensure that the cedar retention stands that are selected to meet the 15% cedar retention requirement are representative of the pre-harvest stands and this should be documented within the Site Plan.

20% Cedar Regeneration Requirements

The Plan Holder will calculate this strategy by defining “composition” based on live stems per hectare of western red and yellow cedar (as indicated in the cruise compilation), rather than a volumetric approach (use of sph is consistent with previous MSSc procedures). A cedar requirement survey will be completed within 20 years and made available to the Province.

Specific rationales for Cedar Retention objective are provided (in FSP section) as follows:

Where development areas have pre-harvest cedar (western red cedar and yellow cedar) composition greater than 20% in the harvested area, as indicated in the cruise compilation (measured in percent of cedar sph, not including dead potential or dead useless), then the Plan Holder will regenerate the area according to the minimum post-harvest cedar composition and strategies listed below.

In regards to the use of stem per hectare (sph) versus volume (m^3) or basal area (m^2), it was thought that sph would provide the most accurate picture of what was located (found) on site. Using volume or basal area may have resulted in varying percentages for similar blocks. With regards to the removal of dead potential and dead useless from the cruise information (i.e., net-merch volume), it was determined that they should not be included in the calculation, as they are no longer contributing to the Mean Annual Increment of the site. This portion of the LUO objective is focused on cedar regeneration, in essence, replacing live trees with live trees.

The cedar commitment will be determined on a cutblock by cutblock basis. The cedar regeneration requirement for a cutblock will be calculated by multiplying the NAR times the appropriate Minimum Post-Harvest Cedar Composition, as indicated in Table 7 below. Location of planted cedar within the cutblock will be at the discretion of the prescribing Forester, and consistent with approved stocking standards.

Table 1: Minimum Post Harvest Cedar Composition, Based on Pre-Harvest Cedar Composition

Pre-harvest Cedar Composition %	Minimum Post-Harvest Cedar Composition (sph)
20–29	100
30–39	150
40–49	175
50–59	200
60–69	250
70–79	300
80–89	350
90–100	400

The Net Area to be Reforested (NAR) is used as this is the only area that will be restocked. All reserves and NPUNN will not be restocked. Table 1 was established based on the former Cedar Policy for the Haida Gwaii Forest District, with the top two pre-harvest composition categories being increased from those stated in the Policy.

The location for planting the required cedar has been left up to the prescribing Forester so that they can maximize site productivity, and plant the cedar in the most desirable locations.

The use of naturals will be encouraged, and will count towards the final survey of cedar.

The Plan Holder is committed to protecting planted trees as well as monitoring plantations for survival. The 80% survival target was established as a reasonable benchmark to initiate fill planting. By allowing up to 20% mortality of planted cedar, the Plan Holder is afforded a reasonable amount of operational flexibility. The 20% lee-way in survival will also temper any variation or anomalies that come about during surveys.

a) Cedar acceptability criteria will be as follows:

i) *Regenerated cedar will only be accepted if they are of good form and vigour;*

ii) *Regenerated cedar will only be accepted if they are ≥ 1.2m tall.*

Acceptability criteria are provided to support the fact that the Plan Holder are working to establishing the cedar regeneration such that they will be reasonably expected to form part of the future stand. While the cedar obligation is not part of a Free Growing Survey, the acceptability criteria are much the same. Acceptability criteria are based on the Free Growing tree damage criteria as defined in the Ministry of Forests Guide to Establishment to Free Growing Guidebook for the Vancouver Forest Region-V2.3.

The 1.2m minimum height is provided to ensure that the cedar regen is above deer browse height and beyond the need for protection.

While the cedar obligation resembles a free growing survey in some aspects, the cedar obligation is a different and as a stand-alone obligation it will be managed accordingly. The obligation due date has been established such that the Plan Holder is encouraged to meet the cedar regen obligation as early as possible, but is still provided enough time to allow for fill planting and stand tending activities, if required.

It should be noted that while there will be a minimum post-harvest cedar composition calculated for the block, the final amount of cedar established may not always meet the requirement. Provided that the Plan Holder has shown due diligence in attempting to re-establish a cedar composition (i.e., planted, protected, surveyed, fill planted once) then the obligation will be deemed fulfilled based on the amount of cedar that have been established.

The cedar regeneration requirement for a given cutblock may be lower than those set in the FSP, provided that the new requirement is consistent with the outcome of a completed intergovernmental process.

An intergovernmental process option was added to the Cedar Regeneration Section, to allow the Plan Holder the option of addressing exceptional circumstances, for example other objectives established under the LUO.

Western Yew

The Plan Holder's objective is to protect as many western yew trees as possible. The Licensee wishes to target protection of 100% of individual western yew on a development area level. This target can be tracked by comparing the pre-harvest and post-harvest mapping and recording of western yew occurrences. The Plan Holder will use the following strategies to retain individual Western Yew:

- Western Yew will be retained in reserves outside of the block boundary,
- During harvesting operators will fall and yard away from Western Yew,

Monumental Cedars

The Licensee will do the following to track the harvesting and provide Monumental Cedars to the Haida Nation:

1. Monumental Cedars will be identified during the block planning stage by certified CFI surveyors.
2. Prior to harvesting, Monumental Cedars will be marked in the field using unique ribbon and/or paint.

3. Prior to harvesting, Monumental Cedars will be provided to Haida Gwaii Cultural Wood Program and an estimated availability date will be proposed.
4. Once harvested, Monumental Cedars butts will be marked, with a unique identifier, and will be placed in a landing on along the road.
5. Once harvested, the Haida Nation will be provided the Monumental Cedar for an amount equal to the associated logging costs.

Aquatic Habitats (LUO) & Riparian Areas (FRPA)

Stream Riparian Classifications and Management – LUO vs. FRPA

There is significant "overlap" between the requirements under the LUO and FRPA (including the FPPR). For most objectives, reconciling the differences between the LUO and FRPA is straightforward. However, there is significant conflict between the LUO and FRPA regarding stream classification, and to a lesser extent, stream management requirements.

The LUO and FRPA both establish stream classification systems, which do not correlate 100% of the time. Both the LUO and FRPA also establish reserve and management zones, which again, do not correlate (FRPA zones are measured in metres and LUO zones are measured in tree-lengths, which are linked to site series and seral stage). Lastly, the LUO and FRPA both establish restrictions and management requirements within riparian areas, but again, these do not necessarily correlate.

Table 2, below provides a brief comparison of the riparian requirements between the LUO and FRPA. For analysis purposes, the tree-length height for LUO streams was assumed to be 40m, based on an average tree-height for zonal sites across all BEC units and seral stages. If anything, this assumption is conservative, as most riparian areas are likely richer than zonal sites, resulting in taller tree-heights.

Table 2 shows that in most cases, the riparian reserve requirements meet or exceed those established under FRPA, especially for Type I and II Fish Habitat streams.

Table 2: LUO vs. FRPA Stream Management Comparison

	Stream Class	RRZ / No-Harvest Zone	RMZ	RMA	RMZ BA Retention
Comparable large fish stream classes and management zones (LUO vs. FRPA)	FRPA - S1	50m	20m	70m	0–100
	FRPA - S2	30m	20m	50m	0–100
	FRPA - S3	20m	20m	40m	0–100
	LUO - Type I Fish Habitat	2.0 Tree-lengths (80m)	-	2.0 Tree-length (80m)	N/A
Comparable small fish stream classes and management zones (LUO vs. FRPA)	FRPA - S4	-	30m	30m	0–100
	LUO - Type II Fish Habitat	1.0 Tree-length (40m)	0.5 Tree-length (20m)	1.5 Tree-lengths (60m)	~100%
Comparable "non-fish" stream classes and management zones (LUO vs. FRPA)	FRPA - S5	-	30m	30m	0–100
	FRPA - S6	-	20m	20m	0–100
	LUO - Upland Stream	-	-	30m	N/A

Two realistic options exist when trying to develop results/ strategies to address both the LUO and the

FRPA objectives: follow the LUO only, or try to develop a process to simultaneously meet the conflicting objectives of both the LUO and FRPA.

The FSP has been developed to address all the stream riparian requirements using the LUO approach except for where a LUO approach does not address a stream, as is the case for S5 and S6 streams. These examples will be managed as per FRPA (and FPPR) requirements.

The Plan Holder ensures that aquatic habitat features are identified in the engineering and Site Planning phases by employing experienced and educated forest professionals. This includes registered forest technicians, professional foresters and foresters in training. These people are trained by accredited schools in species and habitat recognition. The Site Plan forester ensures that features are properly identified, described and management is properly prescribed to meet the legal requirements.

Wetlands & Lakes

The FSP was developed to where wetlands and lakes meet the definition of Type I or II Fish Habitat, they will be managed as such. However, in all other cases, wetlands and lakes will be managed as per FRPA (and FPPR) requirements.

Upland Stream Areas

Hydrological Recovery

In the Upland Stream section of the Plan, the term "hydrologically recovered" is used when referring to Upland Stream Areas. Hydrological recovery will be determined by applying a consistent methodology utilizing:

- Most current inventory – includes plan holder's updates from field verifications and inventory investments;
- The total area of the sub-unit less Type I and II fish habitat area;
- Hydrological recovery curves appropriate for the area.

Inventory & Tracking Ledger

Prior to initiating developments within one of the designated watershed-sub-units, the Plan Holder will complete an analysis to determine the "baseline inventory" of Upland Stream Area and the proportion that is not hydrologically recovered. The analysis is meant to be a GIS exercise that produces a tabular summary of areas that are hydrologically recovered or not, as well as a spatial element to illustrate the results. These two outputs will form the basis for the Tracking Ledger.

To ensure all commitments are met, the Plan Holder will continue to maintain the Ledger to track the hydrological status of the watershed sub-unit.

Watershed Assessments

Where the Plan Holder proposes to harvest such that <70% of a watershed sub-unit is hydrologically recovered, they have committed to ensuring that watershed assessment is completed by a qualified professional. Given that the Plan Holder is exceeding the "default" threshold of 70%, a more stringent assessment of the watershed sub-unit is required. Therefore, the "watershed assessment" is meant to be detailed in nature and will be completed by a Qualified Professional (e.g., like a Coastal Watershed Assessment Procedure).

High-Humidity Microclimates

The Plan includes a result regarding stream channels in Upland Stream Areas that are incised, have

steep gradients and support riparian plant communities that are dependent on high-humidity microclimates.

The key pieces in determining whether a stream supports a riparian plant community that is dependent on a high-humidity microclimate is two-fold. First, the stream must possess characteristics sufficient to produce the high-humidity microclimate. Second, the diagnostic high-humidity-dependent plant community must be present. These two factors are interdependent, and therefore the Plan Holder must consider both when identifying these unique Upland Stream channels.

As a general guideline for identifying these key pieces, the following is provided:

Riparian Plant Community

- on creek sidewalls and adjacent trees plant communities will consist of ferns, herbs, and shrubs that are dependent on moist/ wet soils (e.g., maidenhair fern, lady fern, and salmonberry); as well as an abundance of bryophytes that are dependent on high moisture levels.

Stream Channel Characteristics

- Streams are typically 1–3m wide, with bedrock-rock substrates and are generally steep (>20% slope) and broken/ irregular with step-pool structure.
- Channels are typically deeply incised (similar to a gully, sidewalls >3m, side-slope >50%) and rock controlled, with minimal soils, thus leaving minimal potential for erosion or debris flows.
- Channels typically contain waterfalls and a spray/ mist is produced or will be during high water flow, creating a cooler microclimate (noticeable on a warm day).
- Usually shaded by trees or oriented such that shade is produced within the reach, regardless of canopy closure.

Sensitive Watersheds

Inventory & Tracking Ledger

Prior to initiating developments within one of the designated sensitive watersheds, the Plan Holder will complete an analysis to determine the "baseline inventory" for the watershed, including determining the current ECA. The analysis is meant to be a GIS exercise that produces a tabular breakdown of the ECA, as well as a spatial element to illustrate the results.

ECA will be calculated based on:

- Most current inventory – includes plan holder's updates from field verifications and inventory investments;
- The total area of the sensitive watershed;
- Hydrological recovery curves appropriate for the area.

To ensure all commitments are met, the Plan Holder will maintain the Ledger to track the ECA for the watershed.

Watershed Assessments

Where the Plan Holder proposes to harvest such that exceed the prescribed ECAs for a sensitive watershed, they commit to ensuring that a watershed assessment is completed by a qualified

professional. Given that the Plan Holder is exceeding the "default" ECA, a more stringent assessment of the watershed is required. Therefore, the "watershed assessment" is meant to be detailed in nature and will be completed by a Qualified Professional (e.g., similar to a Coastal Watershed Assessment Procedure).

Temperature Sensitive Streams

There are no temperature sensitive streams designated in the Plan Area. Should a temperature sensitive stream be designated, the Plan Holder will follow the practice requirements under FPPR s. 53.

Community Watersheds

Watershed Assessment & Tracking Ledger

Prior to initiating developments within one of the designated Community Watersheds, the Plan Holder will ensure that a watershed assessment is completed. This assessment is meant to be detailed in nature and will be completed by a Qualified Professional (e.g., like a Coastal Watershed Assessment Procedure). The outputs from the watershed assessment will form the basis for the Tracking Ledger.

To ensure all commitments are met, the Plan Holder will continue to maintain the Ledger to track the developments within the watershed.

Active Fluvial Units

Refer to the *Glynnis Horel* Alluvial Fluvial Units for Haida Gwaii paper in the Appendix.

Biodiversity

Ecological Representation

Representation Analysis

The representation analysis proposed by the Plan Holder is a GIS oriented exercise to determine the inventory of ecosystems, based on the best information available and updates to the information including but not limited to field verifications and TEM updates.

Tracking Ledger

To meet the LUO Objectives, the Plan Holder maintains a ledger to track the additions/removals to the baseline ecosystem inventory, including areas that have been designated for recruitment.

Adjacency

The Plan Holder recognizes the importance of biodiversity on the landscape. They refer to the Biodiversity Guidebook developed in 1995 along with FRPA and FPPR requirements to determine adjacency and connectivity.

Bird Nest Identification

The Plan Holder recognizes that importance of correctly identifying bird nest. The Plan Holder will provide their forestry development staff with training in correctly identifying nests. Indications of active bird nests include:

- Seeing a nest with eggs
- Birds flying up or out just in front of you

- Birds swooping at you or attacking you
- Birds dropping down in front of you without flapping their wings
- Cheeping coming from tree cavities or trees or shrubs
- Birds flying into tree cavities.

Northern Goshawk, Great Blue Heron and Northern Saw-Whet Owl

An objective of the Plan Holder is to identify and manage for the habitats of Northern Goshawk, Great Blue Heron, and Northern Saw-Whet owls' habitats. Experience, education and further training of the Plan Holder' forestry development team in nest identification should result in potential nests being identified during the planning phase. If/when the forestry development team identifies a potential nest site the plan holder shall have the potential nest and surrounding area assessed by a Qualified Registered Professional working within their scope of practice to determine/confirm if the nest is present and a Northern Goshawk, Great Blue Heron, or Northern Saw-Whet Owl. The prescribing Forester will consider Northern Goshawk, Great Blue Heron, and Northern Saw-Whet owl habitat creation when prescribing stand level retention strategies. Retaining snags and larger trees with old growth characteristics will be prescribed and documented in the Site Plan when the prescribing Forester determines that the cutblock is suitable for such methods.

Marbled Murrelet Nesting Habitat

Inventory

The "inventory" is meant to be an GIS exercise to clarify the Marbled Murrelet nesting habitat that has been identified, and what nesting habitat has been reserved. The "inventory" in not meant to be a field analysis to identify or refine nesting habitat. The inventory analysis will be based on the best information available (i.e., the "Ecological Representation analysis conducted during Detailed Strategic Planning by the Joint Technical Working Group 2010").

Tracking Ledger

In order to meet the LUO Objectives, the Plan Holder will maintain a ledger to track the additions/removals to the baseline Marbled Murrelet nesting habitat inventory.

Northern Goshawk Habitat

Restricted Activities

As the restricted activity zones have the potential to significantly impact forest operations, especially where nests are close to major roads. The Plan Holder will complete an assessment to determine if the nest is active and where the assessment determines that the nest site is inactive, the restricted activity zone will not be required. The assessment completed by the qualified professional:

1) will be completed within the Goshawk Breeding Season; and
2) will be re-assessed each breeding season, unless the Plan Holder elect to maintain the restricted activity zone, regardless of nest use; and
3) will consider the various Northern Goshawk nest uses, nest fidelity and the best information available with regards to Northern Goshawk recovery strategies.

Great Blue Heron Nesting Habitat

As the restricted activity zones have the potential to significantly impact forest operations, especially where nests are close to major roads. The Plan Holder will complete an assessment to determine if the nest is active and where the assessment determines that the nest site is inactive, the restricted activity zone will not be required. The assessment will be completed by the Qualified Professional within the Great Blue Heron Breeding season, and:

1) will be re-assessed each breeding season, unless the Plan Holder elect to maintain the restricted activity zone, regardless of nest use; and
2) will consider the various Great Blue Heron nest uses and the best information available with regards to Great Blue Heron habitat management.

Black Bear Dens

An objective of the plan holder is to protect active Black Bear dens used for over winter hibernation. A qualified person, that is defined as a Forestry Professional, or someone working under the direct supervision of a forestry professional, who has completed wildlife and bear identification training or has equivalent experience, will complete a Black Bear den reconnaissance of each block during the planning stage. If an active Black Bear den used for over winter hibernation is identified, then the plan holder will adhere to the results and strategies of this plan. Where possible the plan holder will include management zones, areas adjacent to management zones, and Black Bear day dens in stand level retention. Stand level retention will be prescribed and documented in the Site Plan and when the prescribing Forester determines the cutblock suitable for such methods retention patches will be linked together. A windthrow assessment will determine the likelihood of wind damage and the prescribing Forester will use this information to prescribe the appropriate stand level retention strategy.

Annual Reporting and Data Submission

Throughout the FSP, the Plan Holder committed to submitting documentation and digital spatial data to the Council of the Haida Nation, and to the Province of BC, on an annual basis. For clarity, a December 31st deadline was chosen, as this is typically an effective time operationally, as well as administratively. Generally, all development area information is submitted at the RP and CP stages, meeting the annual reporting and data submission objective. The December 31 deadline will still be utilized for any updates to the data or features outside development areas that did not get captured in the RP or CP submission process.

Windthrow Management & Management Prescriptions

It is recognized that windthrow is a significant management issue within the Plan Area. Although objectives are not clearly established in legislation for windthrow management, the Plan Holder completes a windthrow assessment that is included in the Site Plan for all cutblocks. The assessments will be completed to standards as outlined in windthrow assessment training on Haida Gwaii and will include a consideration of both windthrow hazard and consequence criteria, resulting in an overall windthrow risk rating. Additionally, the windthrow assessment:

a) will be signed-off by a Qualified Professional; and
b) will be used to develop management prescriptions for appropriate areas, particularly management zones or no-harvest zones, based on knowledge of prevailing winds and resource features in the area.

The objective for windthrow management is to minimize the impacts of wind on standing timber commensurate with the stand and landscape level values located within the Development Area. This includes the protection of timber supply and stand level features (e.g. features protected by management and/ or reserve zones). The Plan Holder will assess potential windthrow impacts at the Site Planning phase. A Qualified Professional will determine the windthrow risk throughout the development area using tools such as the BCTS Windthrow Manual. The Qualified Professional will consider hazard and consequence of windthrow on the cut block boundary timber and other retained timber. Where practicable, windthrow management treatments will be prescribed. These treatments could include: engineering cutblock boundary locations to minimize windthrow; feathering (partial cutting) timber edges.

Tracking Ledgers - General

The concept of maintaining a Ledger was developed during the implementation of the 2011 Haida Gwaii FSP to track the requirements associated with Cedar Stewardship Areas, Upland Streams, Sensitive Watersheds, Ecological Representation, Marbled Murrelet nesting habitat, and Community Watersheds.

The intent for the Ledgers is to provide a clear picture of the baseline/ existing status of the element in question and allow the Plan Holder and Ministry of Forests staff to understand and track the progress of forest operations and planning. The Ledger forms part of the due diligence system, as well as being a planning tool for meeting FSP obligations. The Ledger will continue to be maintained by the plan holder for their tenure areas.

Ledgers will also be used to track depletions and deletions from said features above until spatial updates are completed at which time the ledgers will “re-start” with new numbers, except for the case of tracking CSA harvest areas and/ or 5-year harvest levels in sensitive watersheds. Spatial updates and ledger updates occur at minimum annually.

5.0 Climate Change

The Plan Holder recognizes the significance of climate change and how it may alter their management strategies in the future. The Plan Holder is taking steps to prepare and plan for the changing climate. The Plan Holder will adhere to the *Chief Forester's Standards for Seed Use* and will revise their procedures if or when the standards are amended. The Plan Holder will plant ecologically suited tree species.

There is increasing interest regarding the impacts of climate change on Haida Gwaii forest resources. The BC government continues to monitor the environmental impacts of a changing climate on Haida Gwaii forest resources. Models are now available that predict the shift of Biogeoclimatic Zones across Haida Gwaii and coastal BC. Fortunately, due to the moderating influences of the ocean, the climatic changes on Haida Gwaii are predicted to be less dramatic as compared to the interior of BC.

Forest geneticists and tree breeders have begun to provide foresters with information and tools that will provide assistance in the establishment of tree species given changing environmental conditions. For example, the Chief Forester has provided guidance to assist foresters in the selection of tree species given the elevational influences of climate change. This FSP incorporates management strategies and stocking standards (e.g, ecological/ commercial species, SEDRSS) that will provide stand retention and establishment flexibility. This will help to promote adaptive management with respect

to climate change.

The Plan Holder will continue to monitor climate change impacts on the ground through Site Plan surveys (e.g., monitoring stand and understory conditions) and silviculture surveys (e.g., survival, forest health). Significant findings will be communicated back to researchers and the governments

6.0 Measures to Prevent Impact on Natural Range Barriers

For the purposes of this FSP, forage refers to forage for Range purposes only. As of the submission date of this FSP, there are no Range activities on the FSP area. As there are no objectives for forage, there are no results or strategies that relate to forage.

Measures to prevent impact on natural range barriers are not submitted in the FSP as there currently are no agreements under FRPA within the Plan Area.

7.0 Stocking Standards

Stocking Standards - General

The Stocking Standards proposed within the FSP are based on the Reference Guide for FDP Stocking Standards[7] (MOF, November 2010), as well as stocking standards from the currently approved FSPs for the Plan Area, and the experience and local knowledge of Foresters who work in the Plan Area.

Ecologically Acceptable and Commercially Valuable Species

Ecologically and commercially suitable species are provided in the stocking standards in the Appendix. The suitability/ acceptability of regeneration will be determined in the field by a Qualified Professional based on site-specific soil moisture, nutrient, aspect, and elevation characteristics and tree performance in response to the site. Tree species that are ecologically suitable and commercially valuable are listed in the standards provided in the Appendix.

It should be noted that while the concept of preferred and acceptable species was commonly used in previous FSPs, recently tenure holders have moved away from this prescriptive approach and moved towards allowing the prescribing Forester determine the appropriate species selections for a site (as detailed within the Site Plan), based on the ecologically suitable species for the ecotype, as detailed within the FSP stocking standards. It should also be noted that the Establishment to Free Growing Guidebook: Vancouver Forest Region[10] (MOF. V2.3, October 2007) states that both “Preferred” and “Acceptable” species “are ecologically suited to the site” (pg. 6–7). The difference between “Preferred” and “Acceptable” has to do with management activities, not ecological suitability. For the stocking standards for this FSP, the ecologically suitable species for a given BEC unit are simply a combination of the “Preferred” and “Acceptable” species.

The Plan Holder does not intend to change the way that they manage their silviculture obligations under the proposed stocking standards. Prompt reforestations efforts will be maintained, with planting being the primary mode of reforestation. Prescribing Foresters will focus on matching the most appropriate tree species to the reforestation sites, without compromising the economic value of future stands (i.e., match the best tree species to the given site; avoid conversion of cedar stands to hemlock).

Given that the Plan Holder must ensure that crop trees (at Free Growing) must be of good form and vigour, free from competition, and expected to remain so, it can reasonably be expected that the Plan Holder will manage reforested areas such that tree species are well suited/adapted to

their sites.

Minimum Stocking Standard Cedar Content (MSSc)

One of the changes in the proposed stocking standards, from previous FSPs, is the elimination of the Minimum Stocking Standard for cedar (MSSc). As discussed under the Cedar Retention strategy (LUOs. 7) above, while the MSSc will be eliminated, the concept of maintaining cedar in the regenerating stands has been carried forward and it is estimated that the amount of cedar planted will increase under the new FSP, compared with previously approved FSPs.

Free-Growing Heights

Free-Growing heights have been established based on previously approved FSPs, as well as local knowledge and experience. While some Free-Growing heights may deviate from FDP stocking standard guides, at the time of Free-Growing the trees must still be of good form and vigour, ensuring that they are well adapted to their sites. Additionally, the trees that are accepted at Free-Growing must be reasonably expected to continue growing well and be part of the stand at rotation age (i.e., be above brush competition and no longer under deer browse pressure).

As Free-Growing declarations must be signed-off by Registered Professional Foresters or Registered Forest Technologists, there is a professional reliance safeguard in place to ensure that crop trees are well suited to their growing sites and expected to remain so into the future.

Sitka Spruce (Ss)

Free-Growing heights for Sitka Spruce are reduced as indicated given the reduction in brush competition (as a result of deer browse). While the height requirement is reduced, the performance expectations are still such that acceptable trees must be of good form and vigour and reasonably expected to continue growing well.

Red and Yellow Cedar (Cw and Yc)

Free-Growing Heights for cedar are provided, consistent with the cedar regeneration objective, above. While cedar Free-Growing heights are reduced from FDP stocking standard guides, the performance expectations are still such that acceptable trees must be of good form and vigour and reasonably expected to continue growing well. Furthermore, the 1.2m minimum height will ensure that the cedar are above deer browse height.

Minimum Inter-Tree Distance Exceptions

Exceptions to the standard 2.0m inter-tree distance have been included for situations where plantable spots may be limited in availability. By reducing the minimum inter-tree distance Plan Holder will be able to utilize the best available growing sites, ensuring effective reforestation is achieved.

Mixed Conifer–Hardwood Management

Red alder has been included as an ecologically suitable species for some BEC units. For these situations, the intent is for Plan Holder to identify the hardwood management strategies and stocking standards within the Site Plan, prior to harvesting. For the development area, separate stocking standards for conifers and red alder are to be assigned (based on a 0.25ha minimum stratum size). Where red alder is the leading species, the hardwood stocking standard will be applied. Where red alder is not the leading species, it will not be accepted as a crop tree.

As mixed hardwood management is relatively new on Haida Gwaii, the application of the hardwood

stocking standards has been limited to a maximum of 200ha per year, for all of the Plan Holders combined. It is acknowledged that the hardwood stocking standards will need to be reviewed in the next 5 years (i.e., at the end of the term of the FSP), including a review of any Timber Supply impacts.

Free Growing Survey System

Development areas will be pre-stratified into appropriate polygons assigning alder or conifer stocking standards and surveyed as separate strata, consistent with standard survey procedures and the Site Plan.

All alder and conifer plots will be tallied separately, according to the respective stocking standards, to determine the overall achievement of stocking and reporting of inventory labels for each stratum within the development area.

The mixed-wood stocking standards have been prepared, based on the work done by the Coast Region FRPA Implementation Team – Silviculture Working Group, as presented in the paper, "Hardwood Management in the Coast Forest Region[11]" (July 2011). The stocking standards are intended to be consistent with the direction provided in the Hardwood Management paper.

FSP implementation

The Plan Holder is committed to adhering to the 2018 Haida Gwaii FSP Implementation Agreement found in Appendix F.

Appendix

Appendix A: *Husby Watershed Tables*

Table 3: 2016 Husby Area Available in Sensitive Watersheds Feb.15, 2017

Watershed Name	Sensitive Watershed	Taan Area	Area(ha) Harvested 2012	% Logged 2012	Area(ha) Harvested 2013	% Logged 2013	Area(ha) Harvested 2014	% Logged 2014	Area(ha) Harvested 2015	% Logged 2015	Area(ha) Harvested 2016	% Logged 2016	2012-2016 Tally %	2017 Area Available within 5 year 5% Cap	Under CP Area (ha)	Area Available After CP	Planned Blocks Area (ha)	Area Available After CP & Planned Blocks
Ain River	Yes	1,950.8		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	97.5		97.5		97.5
Awun River1	Yes	2,191.9	52.1	2.4%		0.0%		0.0%		0.0%		0.0%	2.4%	57.5		57.5		57.5
Awun River2	Yes	1,082.1		0.0%		0.0%	31.5	2.9%		0.0%	21.4	2.0%	4.9%	1.2		1.2		1.2
Awun River3	Yes	2,257.0		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	112.9		112.9		112.9
Baxter Creek	Yes	320.2		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	16.0		16.0		16.0
Beattie Anchorage Residual1	Yes	1,806.1		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	90.3		90.3	12.7	77.6
Blackwater Creek	Yes	3,425.5		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	171.3		171.3	12.4	158.8
Brent Creek	Yes	34.6		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	1.7		1.7		1.7
Canyon Creek	Yes	2,789.5		0.0%		0.0%		0.0%		0.0%	28.8	1.0%	1.0%	110.7		110.7		110.7
Chinukundl Creek	Yes	2,147.4		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	107.4		107.4		107.4
Deena Creek1	Yes	14.1		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	0.7		0.7		0.7
Deena Creek2	Yes	179.7		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	9.0		9.0	0.0	9.0
Deena Creek3	Yes	119.3		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	6.0		6.0		6.0
Demon Creek	Yes	1,478.0	19.8	1.3%		0.0%		0.0%		0.0%		0.0%	1.3%	54.1		54.1		54.1
Ghost Creek	Yes	3,296.3	21.1	0.6%		0.0%		0.0%	18.3	0.6%		0.0%	1.2%	125.4		125.4	50.6	74.8
Gold Creek	Yes	3,214.7	55.8	1.7%		0.0%	27.2	0.8%		0.0%	2.7	0.1%	2.7%	75.1		75.1	21.7	53.4
Haans Creek	Yes	2,688.6		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	134.4	44.6	89.8	63.4	26.4
Honna River1	Yes	1,649.3		0.0%		0.0%		0.0%		0.0%	0.4	0.0%	0.0%	82.1	23.6	58.5		58.5
Keats Creek	Yes	260.1		0.0%		0.0%		0.0%	0.1	0.0%		0.0%	0.0%	12.9		12.9		12.9
King Creek	Yes	2,286.7		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	114.3		114.3	40.3	74.0
Lower Yakoun River2	Yes	1,580.1		0.0%	1.2	0.1%		0.0%		0.0%		0.0%	0.1%	77.8		77.8		77.8
Lower Yakoun River3	Yes	1,585.4		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	79.3		79.3		79.3
Mamin River1	Yes	3,487.7		0.0%	47.3	1.4%		0.0%		0.0%		0.0%	1.4%	127.1		127.1	9.6	117.5
Mamin River2	Yes	2,156.3		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	107.8		107.8	34.1	73.7
Mamin River3	Yes	2,173.9		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	108.7		108.7	30.8	77.9
Mamin River4	Yes	1,302.6		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	65.1		65.1		65.1
Mamin River5	Yes	1,987.1		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	99.4		99.4	63.4	36.0
Martin Creek	Yes	1,885.0		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	94.3		94.3		94.3
Mathers Creek1	Yes	3,211.2		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	160.6		160.6	38.3	122.3
Mathers Creek2	Yes	1,270.7		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	63.5		63.5	7.9	55.6
Mathers Creek3	Yes	1,649.4		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	82.5		82.5		82.5
Mathers Creek4	Yes	1,873.2		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	93.7		93.7	36.9	56.7
Mosquito Lake1	Yes	1,181.9		0.0%	21.6	1.8%		0.0%		0.0%		0.0%	1.8%	37.5		37.5		37.5
Mosquito Lake2	Yes	1,422.3		0.0%	3.9	0.3%		0.0%		0.0%		0.0%	0.3%	67.2		67.2		67.2
Mosquito Lake4	Yes	152.2		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	7.6		7.6		7.6
Nina Creek	Yes	1,879.6		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	94.0		94.0	103.1	-9.2
Parsons Creek	Yes	352.8		0.0%	38.8	11.0%		0.0%		0.0%		0.0%	11.0%	-21.1		-21.1		-21.1
Phantom Creek	Yes	1,840.2	5.7	0.3%		0.0%	34.0	1.8%	17.9	1.0%		0.0%	3.1%	34.4	18.7	15.7	13.0	2.7
Queen Charlotte Skidegate Residual1	Yes	313.0		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	15.6		15.6		15.6
Queen Charlotte Skidegate Residual2	Yes	256.0		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	12.8		12.8		12.8
Queen Charlotte Skidegate Residual3	Yes	11.0		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	0.5		0.5		0.5
Shale Creek	Yes	1,558.7		0.0%	37.2	2.4%		0.0%		0.0%		0.0%	2.4%	40.7		40.7		40.7
Skedans Creek3	Yes	1,596.5		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	79.8		79.8		79.8
Skidegate Lake Residual1	Yes	1,482.6		0.0%		0.0%		0.0%	62.4	4.2%		0.0%	4.2%	11.8		11.8	18.7	-6.9
Skidegate Lake Residual2	Yes	2,493.2		0.0%		0.0%	114.5	4.6%		0.0%		0.0%	4.6%	10.2		10.2		10.2
Talking Bear Creek	Yes	1,675.7		0.0%		0.0%		0.0%		0.0%	21.6	1.3%	1.3%	62.2		62.2	36.1	26.1
Upper Yakoun River	Yes	1,826.1		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	91.3		91.3		91.3
Yakoun River1	Yes	2,127.0		0.0%		0.0%	0.2	0.0%	21.4	1.0%		0.0%	1.0%	84.7		84.7		84.7
Yakoun River2	Yes	2,936.0		0.0%		0.0%		0.0%	70.5	2.4%	37.9	1.3%	3.7%	38.4		38.4	12.0	26.4
Yakoun River3	Yes	1,098.2		0.0%		0.0%		0.0%		0.0%		0.0%	0.0%	54.9		54.9	35.6	19.3

Appendix B: *SFM & Environmental Policy*

Husby Forest Products Ltd.

Sustainable Forestry Management & Environmental Policy

We are committed to responsible stewardship of the forest and the environment throughout our operations. In conducting our business, we are committed to:

- practice Sustainable Forestry (SFI 2015-2019) which ensures forest productivity and health;
- protect the water resources, biological diversity, special sites, and aesthetic values of the forests under our management;
- maintain our infrastructure of roads as per our plans to allow for the public access to the forest resources and recreational opportunities;
- meet or exceed all applicable environmental and social laws, regulations, policies, and other pertinent requirements;
- minimize adverse environmental impacts and striving to prevent pollution;
- promote Sustainable Forest Management awareness throughout our operations;
- monitor our Sustainable Forest Management performance by regularly reviewing our activities, practices, performance measures, and indicators;
- provide training for our employees and contractors in environmentally responsible work practices;
- broaden the practice of sustainable forestry on public lands through community involvement, socially responsible practices, and through recognition and respect of Indigenous Peoples' rights and traditional forest-related knowledge;
- support advances in sustainable forest management through forestry research, science and technology; and
- continually improve the practice of forest management and monitor, measure, and report performance publically in achieving the commitment to sustainable forestry.

President: _____

Date: **December 15, 2016**

Appendix C: *Forest and Engineering SOP*

Standard Operating Procedures

Forestry &

- Engineering -

March 2002

Purpose

These Standard Operating Procedures (SOPs) provide documented guidance to Husby Forest Products Ltd. (Husby) personnel and associated contractors. By following these procedures, your activities should comply with all laws, regulations, and guidelines pertaining to forest practices and environmental protection.

Scope

The activities covered by this SOP include, but are not limited to:

- Planning (including on-the-ground layout of roads, cutblocks, etc.)
- Silviculture (including Chemical & Fertilizer Application)

Note: As planning requirements vary, these procedures do not specify the process for planning and silviculture, rather they are designed to ensure on-the-ground field layout is conducted in a way that minimizes impacts to the environment.

Under no circumstances are these procedures to replace or come before Husby's Safety or Environmental Policy.

SOPs apply to everyone working in our company and contract operations. These SOPs require that each employee perform their duties to the best of their abilities. We encourage personnel to take responsibility to clarify plans or activities if they are uncertain about how to achieve the desired results.

General Procedures

Summary

These procedures are written to help workers do their job in a safe and environmentally responsible manner.

Conduct activities to manage water drainage patterns, minimize site disturbance and to prevent sediment from entering watercourses.

Report any slides or significant slumps to the Supervisor immediately.

Do not store or transfer petroleum or hazardous materials in Riparian Management Areas.

Do not store or service trucks or equipment in Riparian Management Areas.

Return all petroleum and hazardous waste, as well as litter and other waste materials to camp for proper disposal.

Safety guidelines

At all times, activities must comply with Husby Safety Guidelines.

If hazards are identified and work cannot safely continue, notify the Supervisor immediately. Work elsewhere until instructions are received from the Supervisor.

Safety equipment

WCB first-aid regulations require safety equipment to be on-site at all times and checked regularly by operators / crew. Correct deficiencies promptly.

Fire equipment

During the fire season, all equipment required by the Forest Fire Prevention and Suppression regulation must be on-site, and checked on a regular basis, depending on weather patterns and fire danger risk.

All personnel required to fight fires must be trained.

General Procedures

Summary

These procedures are written to help workers do their job in a safe and environmentally responsible manner.

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Fire equipment

During the fire season, all equipment required by the Forest Fire Prevention and Suppression regulation must be on-site, and checked on a regular basis, depending on weather patterns and fire danger risk.

All personnel required to fight fires must be trained.

Spill kits

All equipment (including those of contractors) must contain a spill kit at all times. Crews must regularly inspect and restock the kits as needed. Consider documenting inspections in equipment logbooks.

Handle all petroleum and hazardous products spills according to the Husby Spill Plan.

All personnel required to fight fires must be trained.

Fuel transfer

Be familiar with the Fuel Transfer Procedures prior to dispensing petroleum products.

Handle products such that leaks and spills are minimized.

Visually inspect all components prior to transfer.

Eliminate all possible sources of ignition. NO SMOKING!

Ensure equipment is secure.

Remain in attendance during fuelling.

When finished fuelling:

- Clean up drips immediately
- report all spills immediately to the Supervisor.

Do not transfer petroleum products in or near riparian areas.

Written approvals and plans

Do not begin work without written plans and approvals.

Conduct activities according to the approved road layout and plans.

Minor modifications are permitted to address unforeseen circumstances. Do so only when activities will not significantly impact the environment.

Heavy rainfall

During periods of heavy rainfall, stop activities on or down slope of areas identified to have risks of landslides.

Seek immediate instructions from the Supervisor.

Emergencies, problems or issues

If an emergency occurs (like a fuel spill, fire, landslide or injury)

personnel must take appropriate measures to ensure their personal safety, then follow applicable Husby policies and procedures.

If personnel are uncertain about how to perform a task to achieve the desired results, immediate clarification from the supervisor must be received before continuing work. Work elsewhere until further instructions are received.

All personnel are responsible to ask questions when issues or problems arise.

When applying chemicals or fertilizer, all personnel must contact the Supervisor or work in an alternate area in the following situations:

- fish streams (S1—S4 streams) are incorrectly mapped or unidentified
- unstable terrain is found, but not identified in the plan
- unidentified resource features (such as, bear dens or CMT) are found
- missing or confusing ribbons, blazes or stations are encountered

Inspections & Investigations

Determine whether an inquiry by the government official(s), auditor, etc. is and Inspection or Investigation.

An inspection is a routine visit to monitor compliance with approvals and legal requirements.

An investigation is an alleged incident of non-compliance where charges may be laid.

Inspections

If the inquiry is an inspection, carry on work as usual and inform your supervisor in a timely manner.

Investigations

If the inquiry is an investigation, contact the Husby Supervisor immediately.

Inform the auditor or official you wish to have a Supervisor present, prior to answering questions.

Cooperate with the auditor or official but avoid making unnecessary statements.

Provide responses to question only when with first hand knowledge of the facts. Respond to direct questions, and avoid hearsay.

Sign documents or statements only if you choose.

Equipment maintenance & service

Maintain equipment so that they do not leak any more fluid than the normal operating loss of a well-maintained piece of equipment.

Inspect equipment for signs of excessive wear or leaks, as part of the daily maintenance routine.

Handle all spills according to the Spill Contingency Plan. Operators must reports all spills to the Supervisor immediately.

Dispose of soiled clean-up materials off-site, in the approved manner.

Do not refuel, service or wash trucks or equipment in Riparian Management Areas.

Return all servicing waste, used spill equipment and litter to the camp daily. Dispose of it in the approved manner.

Waste Management

Return all petroleum and hazardous waste materials to the shop or camp for proper disposal.

Collect aerosol cans in designated containers or drums.

Ensure your safety: do not attempt to puncture cans, unless proper training and safety equipment is provided.

Contain waste products, litter, and empty containers daily at the site. Dispose of them appropriately at the shop or camp.

Water Management Procedures

Manage and control water to maintain water quality and natural drainage patterns.

When conducting activities such as Stumping, use machines in streams as little as possible.

Use only one stream crossing location. Limit crossing to approved areas and during designated operating seasons.

Start up Guidelines – Planning

Summary

Review local information (including plans, maps, reconnaissance notes, correspondence, etc.) before on the ground field layout begins.

Review applicable legislation, guidebooks, etc. Special consideration should be given to requirements around streams, watercourses, Culturally Modified Trees, etc.

Review Field Marking Code.

Start up Guidelines – Silviculture

Summary

The Husby Supervisor must review area files (including maps, plans, correspondence, etc.) before activities begin.

Confirm that the Ministry of Forests (MoF) and/or Ministry of Water, Land and Air Protection (MoWLAP) has approved the activities.

Understand and comply with conditions that regulatory authorities may have prescribed.

Review Plans and Approvals

Before work starts up, Husby planning personnel must meet with the Supervisor to review the plan and field-check, where necessary. This includes, but is not limited to the review of:

- safety concerns
- planned locations for treatment areas
- identified areas of risk, concern, or sensitivity that may require adjusting the application technique
- sensitive areas such as: streams, landslide areas, etc.
- field marking codes

The amount of field review is dependent on the complexity of the activities. The review is complete when planning personnel and the Supervisor are confident that the plans will be correctly implemented.

Husby planning personnel must provide the Supervisor with up-to-date copies of all maps and plans.

Exchange amended plans and maps for outdated versions.

Pre-Work Meeting

Supervisor Responsibility

A Pre-Work Checklist must be completed prior to all new chemical and fertilizing activities. Once the checklist is complete, it must be filed as described on the document.

Give Operators / Crews information about the safety procedures before work begins.

Review rainfall shutdown procedures for areas identified to have risks of landslides.

Review plans with Operators / Crews before application begins.

Up-to-date plans and maps must be provided to the Operators / Crews before starting work in an area.

Where necessary, walk and review sensitive areas with Operators / Crews before work starts in these areas. (For example, locations where special care must be taken to protect fish streams or habitat).

During crew meetings, keep an accurate record of attendance and any comments and concerns raised.

Resolve any concerns identified during these meetings in a timely manner.

Operator / Crew Responsibility

Store a copy of the plan or map on site.

Know who and how to contact the Supervisor, should a problem or issue arise.

Always match the plan and map to what is found on the ground. (For example, the map must match the field layout.)

Know and understand your roles and responsibilities before beginning work in an area.

Monitoring Work

Supervisor Responsibility

Schedule regular monitoring of activities within each area to ensure crews are achieving planned objectives.

Camp management will decide on the frequency of on-site visits.

Adjust the frequency of on-site visits to reflect the following:

- experience of operators
- weather conditions (or seasonal constraints)
- rate of progress
- complexity of plans
- potential environmental impacts

Monitor activities to ensure seasonal constraints for worker safety and environmental protection are strictly followed. Stop all activities in areas affected by unstable terrain during periods of heavy rainfall.

After each on-site visit, document significant issues for follow-up as well as actions to correct any problems.

Work with Husby planning personnel to keep written records about all resource features, problems and issues.

Operator / Crew Responsibility

Report potential problems or resource features (CMTs, bear dens, etc.) not noted in the plan to the Supervisor.

Do not disturb resource features. Report these features to the Supervisor each day.

Stop activities that may disturb these features until the Supervisor reviews them in the field and gives instructions about how to continue.

Contact the Supervisor immediately if uncertain of the plan, or if you have a problem meeting the plan's objectives.

Work elsewhere until instructions are received from the Supervisor on how to continue.

Post-Work Inspections

Supervisor Responsibility

Co-ordinate final inspections of activities at the same time as they are being completed.

Generally assess whether the completed work is in conformance with approved plans and this SOP before the work is complete.

Document inspections.

Take action to ensure all outstanding issues are addressed.

Review assessment with the Operators / Crew.

Operator / Crew Responsibility

Ensure all work is completed to the best of your ability.

Notify the Supervisor of any problems or issues.

Return the plan or map to the Supervisor when activities are complete.

Ensure all waste materials are removed from site and disposed of in an approved manner.

Planning Procedures

Planning activities include, but are not limited to the following:

- road layout
- cutblock layout
- silviculture prescriptions
- surveys and plots

Supervisor Responsibility

Co-ordinate regular on-site visits to monitor progress and compliance with plans. Consider documenting visits using a checklist or diary.

Operator / Crew Responsibility

Clearly understand the plan. If uncertain, get clarification from the Supervisor before beginning work, or work in a different area until further instructions are received.

Review the Field Marking Code.

Modify the plan to address unforeseen problems only after consulting with the Supervisor.

Chemical & Fertilizer Application Procedures

Chemical & Fertilizer Application activities include, but are not limited to the following:

- Chemical brushing
- Chemical site preparation
- Fertilizer application at time of plant
- Broadcast Fertilizer application

Supervisor Responsibility

Complete a Pre-Work Checklist prior to the start-up of all new work. Once the checklist is complete, it must be filed as described on the document.

Co-ordinate regular on-site visits to monitor progress and compliance with plans. Consider documenting visits using a checklist or diary.

Operator / Crew Responsibility

Clearly understand the plan. If uncertain, get clarification from the Supervisor before beginning work, or work in a different area until further instructions are received.

Keep maps and plans on-site at all times.

Review the Field Marking Code.

Follow the plans as they are laid out in the field and be able to locate your work on the plan daily.

Modify the plan to address unforeseen problems only after consulting with the Supervisor.

Appendix D: *Husby SFI SOP*

Standard Operating Procedures

2012 May 1

Table of Contents

1. Soil Conservation – Standard Operating Procedures

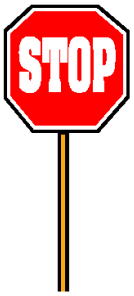
Field Operations

A) Before operations start, the operation must:

1) **Complete a pre-work meeting & checklist** with the Company supervisor to discuss:
   - strategies to stay within acceptable soil disturbance limits (e.g., low ground pressure equipment, avoid areas, skid pattern, etc.);
   - sediment control measures to be used, particularly around streams, wetlands, and lakes (e.g., silt fences, straw bails, etc.)
   - strategies to deal with any special requirements, potential problems or unforeseen conditions, e.g., fish stream crossings, culvert installations, in-stream work windows or variances
2) **Have a copy** of the appropriate plan such as Logging Plans, Fire Preparedness Plan (fire season only), the Spill Plan, geotechnical assessment report, SP's, and this standard operating procedure.

B) During operations, the operation must:

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations.
2) **Ensure** erosion control measures are readily accessible.
3) **Not** construct bladed skid trails unless approved in the logging plan or authorized in writing by the Company Supervisor.
4) **Ensure** that when constructing an excavated or bladed trail;
   - keep soil and slash out of any nearby streams wetlands or lakes;
   - place soil or slash where it cannot get into any of these watercourses;
   - construct cut and fill slopes that are stable and will not slump or rave;
   - maintain surface drainage patterns;
   - divert seepage water so it flows away from unstable slopes or streams; and
   - build it so that soil erosion is minimized and rehabilitation is facilitated.
5) **Do not operate machinery within 5 m of a stream bank,** unless specified in the SP, or for designated crossings, or during fire fighting. Minimize damage to stream bank and vegetation
6) **Install** all stream crossings and culverts during adequate lighting
7) **Keep fuel** and oil contained as required by the Company Spill Prevention and Response Plan. **Fuel and service** the machine a minimum of **50 m** from streams, wetlands, and lakes.
8) **Cross streams** at designated locations only and a minimum number of times & use sediment control measures as required. Ensure equipment is in good running order & that there are no fuel or oil leaks.
9) **Maintain** natural drainage patterns by employing drainage structures as required.
10) **Ensure** waste areas for road fill or logging debris are not located in Riparian Management areas.
11) **Check** your work in progress to ensure it meets the specifications.
12) **Employ** preventative measures in areas identified where siltation has a relatively high likelihood of entering a stream. These include, but are not limited to, tail ditches, settling ponds, hay bales, silt fences, curlex and geotextile fabric.
13) **Never** leave the job without fail-safing the drainage structures from an uncontrolled weather event
14) **Re**-vegetate (grass seed, whippets, etc.) exposed soil as required.
15) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: 1. **Weather (avalanche hazard, rain, wind, cold)** 2. **Excessive soil disturbance, compaction, rutting, siltation, slumping, or sliding of land is suspected.** 3. **Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** 4. **Soils (sedimentation to water, erosion, degradation, mass wasting)** 5. **Fire (hazard ratings – high or very high)** 6. **Non-compliance with the FRPA or plans (trespass, SP etc)** 7. **Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** 8. **Wildlife issues** 9. **Unidentified cultural or heritage values** 10. **Safety Issues** If you are uncertain about your task – stop work and ask your supervisor for clarification.

2. Water Management – Standard Operating Procedures

Field Operations

A) **Before operations start, the operation must:**

1) **Complete a Pre-work Meeting & complete the checklist** with the Company Supervisor to discuss:
   - the designated stream crossing locations.
   - the sediment control measures to be used, particularly around streams, wetlands and lakes i.e. silt fences, straw bails etc.
   - strategies to deal with any special requirements, potential problems or unforeseen conditions, eg. fish stream crossings, culvert installations, in-stream work windows or variances.
2) **Have a copy** of the appropriate plan such as bridge or major culvert site plan and map, Fire Preparedness Plan (fire season only), the spill plan, geotechnical assessment report, road permit & schedules and this standard operating procedure.

B) **During operations, the operation must:**

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations.
2) **Ensure** erosion control measures are readily accessible
3) **Install** all stream crossings and culverts during adequate lighting
4) **Keep fuel** and oil contained as required by the Husby Forest Products Spill Prevention and Response Plan. **Fuel and service** the machine a minimum of **50 m** from streams, wetlands and lakes.
5) **Cross streams** at designated locations only and a minimum number of times & use sediment control measures as required. Ensure equipment is in good running order & that there are no fuel or oil leaks.
6) **Maintain** natural drainage patterns by employing drainage structures as required.
7) **Install** culverts, cross drains and ditches as per the road construction design & road permit schedules concurrent with construction operations if possible. Install ditch blocks where required.
8) **Keep** equipment above the high water mark while installing the crossing unless the plans allow for in-stream work.
9) **Ensure** that culverts are armored on both the culvert outlet and inlet with suitable rock material as required.
10) **Ensure** waste areas for road fill or logging debris are not located in Riparian Management areas.
11) **Check** your work in progress to ensure it meets the specifications.
12) **Employ** preventative measures in areas identified where siltation has a relatively high likelihood of entering a stream. These include, but are not limited to, tail ditches, settling ponds, hay bales, silt fences, curlex and geotextile fabric.
13) **Never** leave the job without fail safing the drainage structures from an uncontrolled weather event.
14) **Re**-vegetate (grass seed, whippets, etc) exposed soil as required.
15) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials .

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: 1. **Weather (avalanche hazard, rain, wind, cold)** 2. **Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** 3. **Soils (sedimentation to water, erosion, degradation, mass wasting)** 4. **Fire (hazard ratings – high or very high)** 5. **Non-compliance with the FRPA or plans (trespass, SP etc)** 6. **Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** 7. **Wildlife issues** 8. **Unidentified cultural or heritage values** 9. **Safety Issues**
	If you are uncertain about your task – stop work and ask your supervisor for clarification.

3. Protection of Wildlife Habitat & Biological Diversity – Standard Operating Procedures

Field Operations

A) **Before operations start, the operation must:**

1) **Complete a Pre-work Meeting & complete the checklist** with the Company Supervisor to discuss:

- **Strategies** to deal with any special requirements, potential problems or unforeseen conditions;
- **Review** of SP and Logging Plan to ensure that any known Species at Risk requirements noted are discussed to ensure proper management techniques are employed;
- **Review** of SP and Logging Plan to ensure that Coarse Woody Debris requirements noted are discussed to ensure proper management techniques are employed;
- **Review** of SP and Logging Plan to ensure that Leave Tree and Stubbing requirements are discussed to ensure proper management techniques are employed;
- **Review** Invasive Plants that are known in the area of operation and strategies to ensure seed is not transferred to other operating areas
- **Have a copy** of appropriate plans such as Logging Plans, Fire Preparedness Plan (fire season only), the spill plan, geotechnical assessment report, SP's and this standard operating procedure;
- **Pre-work** to be completed by Contractor Supervisor with the crew and documented highlighting strategies for management of Wildlife Habitat, Invasive plants (noxious weeds) and Biological Diversity;
- **Training** of crew by Contractor Supervisor in how to ensure requirements are to be achieved.

B) **During operations, the operation must:**

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations; Check your work in progress to ensure it meets the specifications for the project.

2) **Employ** preventative measures in areas identified where potential damage to a raptors nest or leave tree may occur.

3) **Reserve** old wolf trees identified in the harvest area for wildlife purposes.

4) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials.

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: **1. Wildlife issues such as SARA sighting, bear dens, and raptor nests** **2. Unidentified Ecological, Geological , Cultural or Heritage values** **3. Weather (avalanche hazard, rain, wind, cold)** **4. Excessive soil disturbance, compaction, rutting, siltation, or slumping or sliding of land is suspected.** **5. Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** **6. Soils (sedimentation to water, erosion, degradation, mass wasting)** **7. Fire (hazard ratings – high or very high)** **8. Non-compliance with the FRPA or plans (trespass, SP etc)** **9. Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** **10. Safety Issues** **11. Invasive Plants identified in the plan are noted in the area** If you are uncertain about your task – stop work and ask your supervisor for clarification.

4. Protection of Ecological, Geological, Historical, & Culturally Special Sites – Standard Operating Procedures

Field Operations

A) **Before operations start, the operation must:**

1) **Complete a Pre-work Meeting & complete the checklist** with the Company Supervisor to discuss:
   - **Strategies** to deal with any special requirements, potential problems or unforeseen conditions;
   - **Review** of SP and Logging Plan to ensure that any special site noted is discussed to ensure proper management techniques are employed;
   - **Have a copy** of appropriate plans such as Logging Plans, Fire Preparedness Plan (fire season only), the spill plan, geotechnical assessment report, SP's and this standard operating procedure;
   - **Pre-work** to be completed by Contractor Supervisor with the crew and documented highlighting special site management techniques are understood;
   - **Training** of crew by Contractor Supervisor in how to identify Culturally Modified Trees.

B) **During operations, the operation must:**

1) **Follow** the Workers Compensation Act and regulations, TDG regulations and any other pertinent regulations; Check your work in progress to ensure it meets the specifications for the project;
2) **Employ** preventative measures in areas identified where the potential to damage a special site may occur;
3) **Ensure** the site is left in a clean and orderly manner by removing all garbage & waste materials.

STOP WORK IF:	
	Stop work and notify your supervisor if you are encounter any of the following conditions: **1. Unidentified Ecological, Geological , Cultural or Heritage values** **2. Weather (avalanche hazard, rain, wind, cold)** **3. Excessive soil disturbance, compaction, rutting, siltation, or slumping or sliding of land is suspected.** **4. Adverse conditions are encountered during construction activities (i.e. heavy rain, erosion, siltation, unstable soils, etc.).** **5. Soils (sedimentation to water, erosion, degradation, mass wasting)** **6. Fire (hazard ratings – high or very high)** **7. Non-compliance with the FRPA or plans (trespass, SP etc)** **8. Non-conformance with the EMS (major oil spill, chemical spill, fire etc)** **9. Wildlife issues** **10. Safety Issues**
	If you are uncertain about your task – stop work and ask your supervisor for clarification.

Appendix E: *Active Fluvial Units updated 2016*

Updated June 2016 for Haida Gwaii

Glynnis Horel, P. Eng.
G.M. Horel Engineering Services Ltd.

Active fluvial units include alluvial streams and their associated active floodplains, and active fans. They are of special significance because of the high ecological values often associated with them; and because the behaviour or character of these features might well be changed through harvesting. The critical deposits are those where erosion within the rooting depth is likely if the trees are removed; or in the case of active fans, where removal of trees can allow increased spread of sediment and debris deposition on the fan surface.

An initial identification of potential active fluvial units is typically done using office-based information (e.g., aerial photos, topography, hill shade, and stream patterns); but requires field verification to delineate the extent of the active portion of the unit. Features of these types occur across the landscape at all scales, from high-energy fans and large floodplains, to small, low-energy features on S6 upland streams.

STREAM CHANNEL TYPES

There are a number of stream classification systems in the scientific literature for denoting the physical attributes of channels and surrounding valley forms. For the purpose of forest management, and for identifying active fluvial units under the Haida Gwaii Land Use Objectives Order, coastal BC streams are categorized into three types based on characteristics relevant to forest management of coastal streams. The main distinction between the types is susceptibility to channel bank erosion and channel disturbance. This is consistent with the principles of the CIT Technical Report #3 (Church and Eaton 2004)[1]. For clarity, definitions for the stream types used in this document are provided in Table 4. "Alluvial" streams are those with alluvial channel bed and bank material, where one or both banks are in alluvial deposits – **these are active fluvial units**. "Semi-alluvial" streams are low-gradient streams (less than 8%) in confined channels with fluvially transported bed material and non-alluvial banks, or banks in glaciofluvial terraces that no longer inundate (e.g., were not formed by the contemporary stream). "Non-alluvial" streams are typically steeper gradient streams that are bedrock or boulder controlled but may have forced alluvial or semi-alluvial morphologies at choke points ("vertical jams"); or have log steps that store sediment. Low-gradient streams that have primarily bedrock or boulder-dominated channels are also non-alluvial streams.

[1]Coast Information Team reports prepared for ecosystem-based management, 2004.

ALLUVIAL STREAMS AND THEIR FLOODPLAINS

The importance of forests on floodplains

Because stream floodplains are composed of materials deposited by the contemporary stream, these materials can be moved by the stream. Thus they are susceptible to erosion during peak stream flows. In large alluvial streams, riparian forests provide critical erosion resistance in the rooting zone along channel banks. They also provide large wood debris (LWD), which has many functions depending on the size of the alluvial stream, and is crucial for channel morphology and habitat features. During overbank flows in flood events, both LWD and the standing riparian forest provide roughness to the surface of the floodplain and slow the velocity of stream flow, thus reducing its erosive power.

The portion of the floodplain area that floods frequently (typically within 5 years) is the most vulnerable to forest removal and to other disturbances. If this zone is logged, severe effects (significant channel widening, aggradation, loss of channel structure) often occur within a few years with normal peak flows. Large alluvial streams may take many decades to recover from these effects.

Identifying the active floodplain

The frequently flooded portion of a floodplain typically shows visible evidence of water flow or inundation (vegetative indicators, water-borne sediment, or wood debris); and includes medium bench terraces adjacent to the stream and flood channels where this evidence is apparent.

In an extensive floodplain with multiple stepped benches or terraces, an extreme event such as a 100-year flood may inundate a much larger area than the frequently flooded zone. During an extreme event, the stream may completely change its location within the floodplain.

The Haida Gwaii land use order defines an active floodplain to be “where water flows over land in a 1-in-100-year flood event, and includes low and medium benches…”

This provision conveys an intention to protect floodplains from these much rarer extreme events; and to ensure that, should such an event occur and the stream channel changes location within this larger floodplain, it would still be protected by riparian forest.

On these rarely inundated parts of the floodplain there may be little physical evidence to indicate the extent of the 100-year floodplain unless there has been an extreme event within the past few years. There may be no vegetative indicators or visible signs of water-borne sediment or wood debris. Determination of the 100-year floodplain in the field can be difficult unless there is a distinct topographic break. As well, medium benches are often not continuous or well defined; terraces may be discontinuous, or with varying stepped surface elevations.

Identification of the 100-year floodplain can be aided at locations where there is a designed bridge crossing on a floodplain. Bridge designs typically include flood frequency analysis and stage-discharge determination in order to set the design height of the bridge. The 100-year flood elevation is usually indicated on the design drawings; however, it is usually a relative elevation to a local benchmark established for the purpose of bridge design and construction. From this, one-metre lidar contours, if available, can be used to determine the absolute elevation and then extrapolate that to the limits of the

floodplain. However, one cannot extrapolate this flood elevation too far upstream or downstream of the bridge because the flood surface will be on a gradient similar to the stream gradient; and because the volume of water in the flood changes with distance along the stream channel. Note that not all bridges show a 100-year flood elevation; for example, if the bridge height is determined by the road grade well above a possible 100-year flood.

In the absence of design flood elevations, a best estimate of the 100-year floodplain can be made using the lidar hill shade image and 1 m contours, and then field checking to see if the floodplain delineated by this means appears reasonable.

Table 4: Stream Channel Types

Alluvial Channel	Alluvial channels are active fluvial units. They have at least one unconfined erodible bank in alluvial deposits. Alluvial deposits are material that was deposited by the stream under the contemporary flow regime. The stream has an identifiable floodplain (channel migration zone) and a riffle-pool or cascade-pool channel bed with a channel gradient up to 8% but typically ≤5%. Alluvial streams on fans can be steeper. The stream can erode its bank(s) and widen its channel. Riparian vegetation is critical to limit bank erosion. If there is a significant channel migration zone, stream position may change within this zone, triggered by disturbance or a large flood event. Abandoned channels or flood channels may be present. LWD is important for channel structure and habitat features. Alluvial channels are often reaches of highly productive fish habitat and are highly sensitive to disturbance such as increase in sediment, logging of riparian forest, removal of LWD from the channel, or loss of LWD supply.
Semi-alluvial Channel	Semi-alluvial channels are not active fluvial units. The channel has confining banks in non-alluvial material (e.g., till, colluvium, rock). The channel position is stable; the stream cannot move laterally beyond its active channel. The stream has a riffle-pool or cascade-pool channel bed and gradients less than 8% but typically ≤5%. LWD varies from important in small channels to absent or non-functional in large channels. Quality of habitat may be affected by aggradation or scour, removal of LWD, or loss of LWD supply.
Non-alluvial Channel	Non-alluvial channels are not active fluvial units. They are typically confined to entrenched channels with a stable position, although some non-alluvial channels flowing over rock or boulders may have limited lateral confinement. Banks are resistant to erosion (such as till, colluvium, rock). Non-alluvial channels are less sensitive to disturbance than semi-alluvial or alluvial channels. Banks in non-rock material may experience minor local widening or undercutting from erosion if vegetation is removed or in extreme storm events; and may experience bed or bank scour. Non-alluvial channels are typically transport zones. LWD function depends on stream energy and channel character. LWD is non-functional in high energy non-alluvial streams, but may function in small streams (especially those where gully processes occur) to trap sediment, limit scour, and control sediment transport. Channel bed is typically cascade-pool, step-pool, or rock-dominated.
Wetland	Low-energy stream through wetland, typically fine-textured deposits or organic material in bed and banks.

FANS

Background

- This landform is a cone- or fan-shaped deposition area where a confined tributary enters a larger valley and becomes unconfined. The fan limits may extend to a half circle, or may be limited by topography or cutting by the main valley stream to a narrow arc.

- Fans can have surface slopes up to 20^{O} (38%). Landforms steeper than this are considered cones.

- Alluvial processes dominate where the slope on the fan surface $<4^{0}$ (7%). Fans may be transitional – predominantly colluvial processes (debris flows) on the upper part of the fan, and alluvial processes on the lower fan. Between major colluvial events it is common for alluvial process to modify colluvial fans. For the purpose of defining "active fluvial units," no distinction is made between these processes.

- Fan sediments are typically coarsest at the apex, becoming finer downstream, although boulders can be scattered across the full length of debris flow fans, and entrenched streams can transport coarse material farther down the fan.

- The natural stability of a fan is related to the relative ratio of sediment and water being delivered from a watershed. Many of the fans in BC were essentially formed during deglaciation, and contemporary fan-building or fan-eroding activity is frequently limited to only a portion of the fan surface.

- Active deposition processes that originate from sources in the drainage area above the fan may be from:
    - Natural landslides – either chronic or infrequent, or
    - Land use effects such as slides from roads or cutblocks.

- A watershed that is producing more sediment relative to water usually has a shallow, poorly confined channel, with evidence of water flows and sediment accumulation on the fan surface laterally beyond the stream channel.

- A watershed that is producing more water relative to sediment usually has a channel that is entrenched. However, an entrenched channel does not always indicate a naturally stable fan. Periodic debris flows can fill a 4 m deep, entrenched channel in one event, leading to broadcasting of water and sediment.

- Debris flow levees, either recent or historic, can be features that "entrench" a channel.

- Multiple channels may be present on fan. It is common for these channels to be established historically, with water flow in any channel being the result of localized sediment accumulations (frequently associated with debris jams) that partially or totally block off flow in other channel(s).

- Consequences of logging a fan can be:
  - Nil on stable fan with stable watershed upslope and appropriate engineering and harvesting prescriptions; or
  - Destabilisation of channels because of loss of root reinforcement along channel banks, increased sediment broadcasting, or stream diversion from wood debris, inadequate drainage structures, and inappropriate road construction; and/or
  - Difficulty of reforestation due to ongoing sediment deposition.

  Destabilised fans can take decades to recover and restoration is rarely feasible.

Definition: Fans as active fluvial units

Determination of fan characteristics and assessment of fan activity follow the hydrogeomorphic criteria from Land Management Handbook 57 (Wilford et al. 2005)[2] and Land Management Handbook 61 (Wilford et al. 2009)[3].

Based on field evidence, individual fans can be stratified into two components: inactive and active units. The "active fluvial unit" is the active component of the fan (described below).

All or parts of fan surfaces with stands 200 years and older undisturbed by visible hydrogeomorphic processes, are considered stable within the timeframe of forest management and are not "active fluvial units."

If no hydrogeomorphic processes are evident, the stream channel position is stable, and the fan is forested with stands 50–200 years old because of disturbances other than hydrogeomorphic processes such as fire, disease, or insects, then the fan is not an active fluvial unit.

If no hydrogeomorphic processes are evident, the stream channel position is stable, and the fan has been previously harvested more than 50 years ago with no evidence of post-harvesting disturbance, then the fan is not an active fluvial unit.

The active fluvial unit (rarely the whole fan surface) is defined as the "hydrogeomorphic riparian zone". This is the zone where the forest stores sediment, maintains the stream location, and reinforces the soil mass.

Identification of hydrogeomorphic riparian zone

Indicators of hydrogeomorphic processes are:

<u>Airphoto evidence</u>

- Visible sediment sources such as landslides in the watershed upstream of the fan indicate potentially high sediment loads are being delivered to the fan.

[2] Wilford, D.J., M.E. Sakals, and J.L. Innes. 2005. Forest management on fans; hydrogeomorphic hazards and general prescriptions. B.C. Min. For., Res. Br., Victoria, B.C. Land Management Handbook No. 57.
[3]Wilford, D.M., M.E. Sakals, W.W. Grainger, T.H. Millard and T.R. Giles. 2009. Managing forested watersheds for hydrogeomorphic risks on fans. B.C. Min. For. Range, For. Sci. Prog., Victoria, B.C. Land Management Handbook 61.

- Variations in forest canopy on the fan surface linked to stream channels, such as deciduous bands or bands of younger stands than the surrounding forest (cohorts) indicate either multiple channels or land-clearing by debris flows or floods.

- Multiple channels which may appear as streams radiating out from the fan apex; may be inferred by the abrupt disappearance of the main channel from the airphoto view (smaller channels under the forest canopy); or may be visible as multiple points of discharge at the lower margin of the fan.

- Visible sediment accumulation in the channels or on the fan surface.

- Visible increase in gravel bars in the main stream immediately downstream of the confluence of the fan with a larger stream.

- Abrupt angles in the stream channel on the fan indicate a high potential for channel straightening.

Field evidence

- Unconfined stream channels with evidence of periodic flow on the fan surface outside the channels.

- Recent sediment distributed through the trees. “Recent” is defined as unvegetated or with limited accumulation of organic matter.

- Log steps storing sediment and debris.

- Visible channel diversions caused by jams of wood and sediment.

- Visible channel avulsions caused by sediment infilling or by erosion of the channel banks.

- Trees with partially buried boles (as evident from lack of butt flare).

- Scars on trees from impacts by transported sediment or wood.

- Levees of sediment and/or wood debris along the channel sides.

- Wood debris in jams, dikes along the channel sides, log walls piled against trees, or on the fan surface but recently water or debris flow transported.

- Root reinforcement along channel sides or across the fan surface which may appear as a network with minor erosion behind or below the roots.

(For more detailed descriptions of the hydrogeomorphic riparian zone, refer to Land Management Handbooks 57 and 61).

The limits of the hydrogeomorphic riparian zone are defined by delineating the zone from the apex

down where these processes occur. The top of the zone is the upstream point at which it is possible for the stream to be diverted from its present channel and re-occupy an older channel on the fan surface; or to flood the fan surface; or to establish a new channel in the event of a debris flow/debris flood/ flood event. This point may be at the fan apex, or if the stream is well entrenched in the upper part of the fan (such as in a complex fan where the contemporary stream has downcut through an earlier fan formed during deglaciation), at the lower limit of entrenchment.

If no clear margins are evident (such as topographic changes) the limit of the active fluvial unit is at the transition to undisturbed forest stands 200 years or older.

Roads on fans

The preferred location to cross a fan is at the apex. Crossing at the apex limits the length of road that can be affected by fan behaviour; however, if the channel above the fan is subject to debris flows or debris floods, the structure must still be able to accommodate this. The road location to the apex should be outside the limits of the fan and not cross up the fan surface.

Where this is not feasible, a road across the surface of an active fan must be able to accommodate debris deposition and channel switching. Because fans are permeable they may at times have significant subsurface flows that could be intercepted at road cuts and ditchlines. Ditchlines will also intercept broadcast surface flow occurring on the fan surface. If a road location crosses contours on a fan, the road ditch can encounter sufficient broadcast flow, seepage, or channelized flow to become a stream channel; or the road ditch can intercept a channel and divert the stream down the road. Channel avulsion above a road can wash out or bury a road. Active deposition can plug drainage structures or bury a road.

A road across the surface of an active fan should:

- Be located parallel to the contours to the extent possible, and avoid alignments up or down the fan surface. In particular, ensure drainage structures are either on flat grades or at dips in the road gradeline.

- Minimize cuts and fills to avoid intercepting seepage; and so that debris flows/debris floods reaching the road, or new stream channels cutting across the road, cause minimal impacts that are not significantly different than the natural behaviour of the fan.

- Have drainage structures preferably designed to be overrun if this is feasible. If this is not feasible, special designs may be needed for structures to accommodate debris flows or debris floods as well as anticipated stream floods. Armouring to train stream channels or construct ditch plugs must be durable rock coarser than the fan material, properly sized and founded to resist scour and entrainment. Avoid excavating sumps at the inlets of drainage structures in active channels as these will tend to aggravate bedload mobilization.

- Avoid excavating stream channels on fans if possible. If this can't be avoided, and it is necessary to do so to control stream flow to structures, the channels must be properly designed and constructed with suitable armouring to resist erosion, and other design features as appropriate such as sub-channel groins to limit bedload mobilization. Be aware that maintaining a channel to a structure could have consequences such as increased sediment deposition downstream on the fan surface. The downstream consequences should be carefully considered when reviewing options for drainage structures.

- Be deactivated when not in active use, with drainage structures removed or backed up with cross channels.

SMALL ACTIVE FLUVIAL UNITS ON LOW-ENERGY UPLAND STREAMS

Small fans and floodplains can be found on small streams as well as large streams, including on S6 upland streams, especially where topography is highly variable. They occur at topographic widenings and gradient breaks along stream channels. There are many of these small AFUs across the landscape in Haida Gwaii. Because they lack the energy of large streams, riparian vegetation such as shrubs or young trees can be sufficient to maintain channel erosion resistance; and smaller trees can provide functioning large wood debris. Recovery of channel disturbance therefore takes place over much shorter time intervals than for large streams, often in just a few years when shrubs and young regen take hold. However, disturbance of these features (such as by yarding) can cause accelerated transport of sediment downstream until vegetation takes hold. Individually these are small sources but the cumulative effects of many such small sources can be significant with respect to sediment loading in channels downstream.

Appendix F: *2017 Haida Gwaii FSP Implementation Agreement*