



Forest Development Plan 2017/18 Operating Year

**Applicable to Approved CNC Research Forest
Management Plan #3 and Amendments**

Development Plan Updated: February 2017

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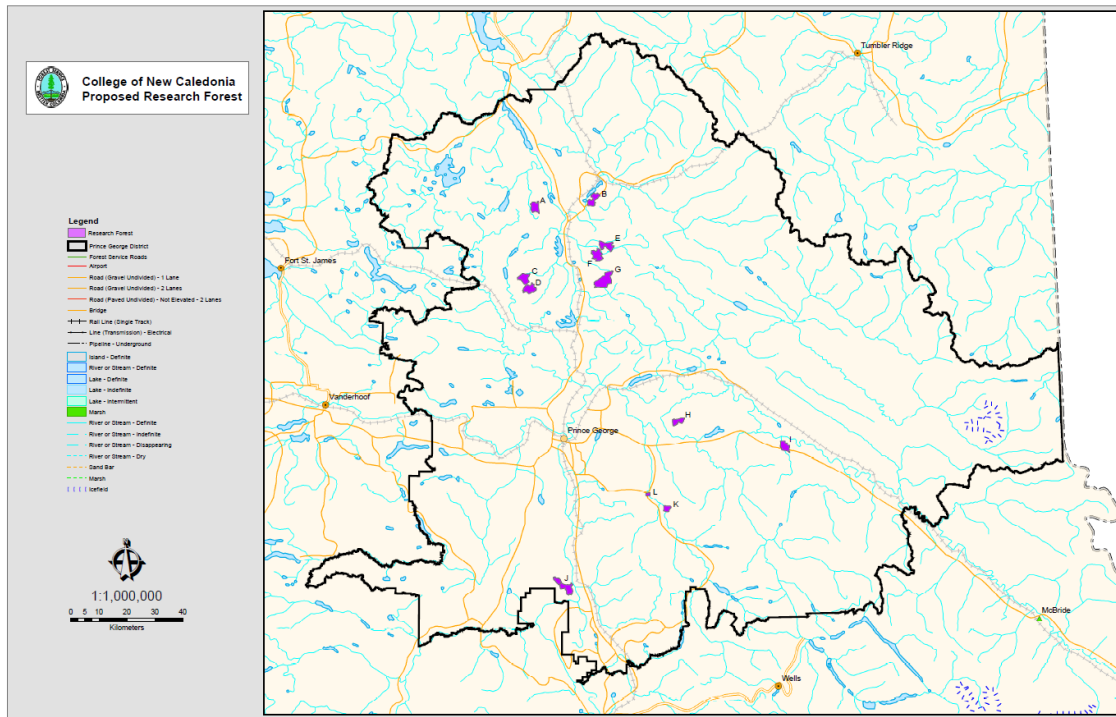
Research Forest Tenure and Management Plan Requirement

The use and occupation of the CNC Research Forest areas is authorized under Special Use Permit (SUP) S24940 issued by the BC Ministry of Forests Lands and Natural Resource Operations. Authority to cut and remove timber is provided under Occupant License to Cut (OLTC) L49404. Both tenure documents are effective until November 2037.

The SUP designates the land area of the Research Forest and requires that the Research Forest be managed under an approved Management Plan containing detail as specified in the SUP document. This Development Plan was initiated during a period of transition from Management Plan #2 and Management Plan #3, which is effective from July 1, 2016 until June 30, 2021 as per the District Manager letter dated January 20, 2017. Wherever possible, the content and requirements of this Development Plan are consistent with direction under Management Plan #3.

Figure 1 provides a map of the CNC Research Forest locations within the Prince George Natural Resource District.

Figure 1: Research Forest General Location Map



Purpose and Content of the Development Plan

Because the OLTC, which authorizes the cutting and removing of timber, is a minor tenure and, since there is no requirement to prepare a forest stewardship plan, many of the requirements

under the *Forest and Range Practices Act* and the *Forest Planning and Practices Regulation* do not apply to forest and research operations within the Research Forest. Furthermore, the SUP does not require the preparation of a Development Plan for the Research Forest. This leaves the Management Plan as the sole provincial planning requirement for the CNC Research Forest.

This Development Plan is prepared as an important professional planning link between the Management Plan and the various forestry and research operations implemented within the Research Forest. The purpose of the Development Plan is multi-fold:

- 1) To provide further direction and practice standards applicable to site plans and prescriptions;
- 2) To provide further information which was considered and analyzed in support of the Management Plan objectives, strategies, and commitments;
- 3) To demonstrate that planned and completed operations are consistent with the Management Plan;
- 4) To provide information and rationale where operations may not be fully consistent with the Management Plan;
- 5) To provide evidence that the commitments in the Management Plan have been achieved;
- 6) To summarize the annual forest development operations planned and completed within the Research Forest; and
- 7) To record and track important information that may be used to continuously improve the Management Plan and future Development Plans and the operations implemented to achieve both plans.

Since the Development Plan is, in many ways, a furthering of the Management Plan content and commitments, both content and structure in this Development Plan are similar to the Management Plan. In some cases, the Management Plan provides sufficient specificity that further detail in the Development Plan is not required. Where this applies, the Development Plan will simply include the Management Plan content as necessary. This duplication is necessary for the Development Plan to be the primary source of information regarding annual operations.

The Development Plan is not intended to provide mapping of all future harvesting, road building and research locations for the entire term of the Management Plan, although future versions may include this. The primary expectation is that the Development Plan will be regularly revised to reflect current mapping for harvested cutblocks and roads, all known proposed/planned cutblocks and roads, along with mapping of all current research sites.

Regular Development Plan Replacement and Revision

Annual replacement of the Development Plan is planned for each operating year of the approved Management Plan. This document provides the current status and future development underway or planned as of the second operating year of Management Plan #3.

For future annual consistency, new replacement Development Plans are scheduled for completion by June 30th each year. This coincides with the July 1st effective date of the currently approved Management Plan.

Along with the annual replacement, the Development Plan may be revised and updated at any time during a year to reflect current operating information and conditions. This includes Development Plan revisions and updates to:

- Ensure consistency with each new approved Management Plan or amendment, include new forest development planning,
- Incorporate new natural resource information,
- Reflect innovation and findings from research,
- Incorporate revised practice standards, and to incorporate new input from the public, First Nations and natural resource stakeholders.
- Professional signing of each material revision or update to the Development Plan is required.

Important changes to each Development Plan version will be highlighted. Depending on the scope and nature of operations, it may be possible that there are no revisions within a Development Plan year.

Regular First Nations, Stakeholder and Public Input

Since regular information exchange with natural resource stakeholders and First Nations is an expected outcome of the Management Plan, each Development Plan version that includes revised or new forest development will require a new operational referral or notification to potentially affected First Nations and natural resource stakeholders. This ensures that concerned parties may regularly provide input or otherwise become involved in the Research Forest planning and operations. It may also be necessary to refer proposed cutblocks, roads and research sites to Provincial Ministries and Agencies, and other affected persons to ensure input into planning and operations is achieved as per the Management Plan strategies and commitments.

Results, Strategies, Procedures, and Standards for Achieving Management Plan Direction

The major section headings that follow reflect the sections of the Management Plan that contain objectives, results, strategies. Substantial wording from the Management Plan was copied into this document as *italicized* text.

Each of the subsequent major section headings provide all necessary results, strategies, procedures and standards for achieving the direction specified within the Management Plan. Where applicable, this document may also provide past or current operational results in order to demonstrate achievement of the Management Plan requirements or that operational outcomes are consistent with the Management Plan. To ensure no confusion between Management Plan and Development Plan content, the Development Plan procedures, standards, critical information, and operational results, are displayed in [non-italicized blue font](#).

Development Plan Schedule and Overview Maps

Appendix A includes one or more maps for each Research Forest Unit (A to L), showing all of the currently proposed and harvested cutblocks and roads. Like the Management Plan maps, the Development Plan maps include all other features or areas within or adjacent to the Research Forest (e.g. Recreation features, trapline boundaries or visual quality objectives). Maps of the active and previous Research Sites are provided under Appendix D.

Table 1 summarizes the area (hectares) of the proposed and existing cutblocks within each Research Forest unit. Proposed cutblocks, or cutblocks where harvesting is not complete, are highlighted in light grey.

Table 1: Summary of Proposed and Existing Cutblocks by Research Forest Unit

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
A	A-1		134.3					
	A18171-141-6			121.7				
	A27990-B20-1			91.5				
	A-2		81.7					
	A-8		41.6					
	A-3	54.4						
	A-4	44.7						
	A-5	112.4						
	A-6	48.8						
	A-7	17.5						
Totals		277.8	257.6	213.2	748.6	182.7	931.3	Approx. 19.6% Mature Forest Retention

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
B	A18171-875-3			53.3				
	A18171-876-6			62.5				
	A18171-875-2			63.2				
	A18171-876-5		50.9					
	A48792-E-1			40.6				
	A48792-E-2		16.6					
	B-1		109.9					
	B-2	121.5						
	B-1505	56.6						
	B-1506	54.4						
	B-1511	35.0						
	B-1512	81.6						
Totals		349.1	177.4	219.6	746.1	296.4	1,042.5	Approx. 28.4% Mature Forest Retention

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
C	Partial-1							284.9 ha of Partial Cut (1966)
	A18167-710-2			64.6				
	A28479-1			98.0				
	A18167-707-2			47.5				
	C-1		173.9					
	C-2		319.0					
	C-3		31.5					
Totals		-	524.4	210.1	734.5	315.1	1,049.6	Approx. 30.0% Mature Forest Retention
D	A18167-701-2			98.9				
	A18167-701-1			101.6				
	A18167-746-2			83.3				
	A18167-746-1			98.1				
	D-1		314.0					
	D-2		104.9					
	D-3		87.8					
	D-4		22.2					
Totals		-	528.9	381.9	910.8	168.8	1,079.6	Approx. 15.6% Mature Forest Retention

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
E	A40873-360-16			102.8				
	A40873-672-21		40.9					
	A40873-680-14		35.7					
	E-1		100.9					
	E-2		97.5					
	E-3		60.0					
	E-4		11.5					
	E-5	36.7						
	E-6	41.9						
	E-7	17.2						
	E-8	34.8						
Totals		130.6	346.5	102.8	579.9	463.4	1,043.3	Approx. 44.4% Mature Forest Retention

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
F	A02955-1			103.3				Harvested in 1974
	A18166-416-2			41.9				
	A40873-680-7		54.0					Overlaps with F-2
	A40873-680-5		47.4					
	A40873-U05-34		59.1					
	F-1		68.0					
	F-2		95.6					
	F-3		126.0					
	F-4		106.8					
	F-5	16.0						
	F-6	68.5						
	F-7	50.4						
	F-8	85.5						
	F-9	98.8						
	F-10	25.7						
Totals		344.9	556.9	145.2	1,047.0	163.0	1,210.0	Approx. 13.5% Mature Forest Retention

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
G	A40873-675-119		43.2					
	A02955-10-4			50.6				Harvested in 1978
	A40873-635-120		55.6					
	A40873-636-81		47.0					
	A40873-636-100		62.9					
	A40873-616-109		41.0					
	A40873-616-116		51.6					
	A40873-636-93		48.5					
	A40873-365-2			50.1				
	A40873-364-73			58.2				
	A40873-365-1		49.9					
	G-1		142.6					
	G-2		95.4					
	G-3		188.5					
	G-4		117.0					
	G-5	165.8						
	G-6	157.4						
	G-7	82.0						
	G-8	96.9						
	G-9	90.3						
	G-10	74.5						
Totals		666.9	943.2	158.9	1,769.0	351.3	2,120.3	Approx. 16.6% Mature Forest

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
H	A18165-821-2		57.1					
	A18165-832-1		25.9					
	A49818-A-2		33.0					
	A49818-A-1		63.4					
	A18165-824-8			4.4				
Totals		0	179.4	4.4	183.8	535.7	719.5	Approx. 74.5% Mature Forest Retention
I	A02993-1			154.1				Two blocks, harvested in 1975
	A09673-1			6.9				Harvested in 1978
Totals		0	0	161.0	161.0	684.0	845.0	Approx. 80.9% Mature Forest Retention

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Forest Area Within Unit	Comments
J	A18158-617-1		19.7					Two blocks, harvested in 1975
	A07772-1							158.4ha of Partial Cutting, harvested in 1982
	A18158-606-2		49.9					
	A18158-606-3		11.4					
	A18158-604-679		28.2					
	Carrier		174.4					
Totals		0	283.6	0	283.6	1285.4	1569.0	Approx. 81.9% Mature Forest Retention

CNC Research Forest Unit	Cutblock ID	Proposed Area	Harvested Area with Forest <20 Years Old	Harvested Area with Forest 20 to 59 Years Old	Total of Proposed and Harvested Area	Remaining Mature Forest Area	Total Unit Area	Comments
K	W0210			36.7				Harvested in 1970
	W0210			93.6				Harvested in 1970
	A18166-14			5.3				Harvested in 1986
	W0210-A-1			22.4				Harvested in 1989
	A24957-1			1.2				Harvested in 1987
	A02958			38.8				Harvested in 1979
	W0210-B-1			11.3				Harvested in 1995
Totals		0	0	209.3	209.3	248.8	458.1	Approx. 54.3% Mature Forest Retention
L	W0210-S		94.4					
Totals		0	94.4	0	94.4	63.4	157.8	Approx. 40.2% Mature Forest Retention
Overall Totals						4,756.6	2,226.0	Approx. 38.9% Mature Forest Retention

Varying from the Management Plan

Upon approval, CNC has committed to implementing this Management Plan as written and as per any direction by the District Manager. It is expected that any variances from the following natural resource management objectives, results, and strategies will be planned and prescribed in advance with appropriate professional rationale. A variance will most often be documented through individual signed site plans but may also include documentation within the Development Plan or other documented information and rationale. It is expected that variances from this plan will most often be a result of various forms of research. Examples of research include conducting experimental forestry practices, establishing operational treatment trials, and undertaking educational activities.

It is also possible that a variance may be necessary due to unforeseen or changed environmental conditions or unidentified circumstances. However, in the case of a persistent unexpected environmental condition, (such as extreme, prolonged drought) or other circumstance that requires regular variance, the Management Plan will be revised or amended accordingly.

Some of the Management Plan requirements are those specified under the Forest Planning and Practices Regulation that apply to minor forest tenures and forest tenures without Forest Stewardship Plans. Where planned operations may not comply with a regulated requirement, then it will be necessary for CNC to submit a request for exemption to the Minister, as per subsection 91 (1) (b) of the Forest Planning and Practices Regulation, specifying the type of the exemption and the rationale for the request.

Landscape Biodiversity and Old Forest Maintenance

Old Forest Objective

The importance of maintaining biodiversity and old forest within the Research Forest is acknowledged and, therefore, the management objective is to meet the provincial old forest implementation guidance that specifically applies to the CNC Research Forest.¹ In particular, the Provincial guidance provides an option to retain 19% of the Research Forest Crown Forest Landbase as old forest, which is defined as stands greater than 120 years old.

Old Forest Results

The expected area of old forest remaining after the harvesting of all proposed cutblocks under this Development Plan is mapped and included under Appendix L. This is the potential result if minimal wildlife tree and riparian retention is implemented for all the proposed cutblocks for

¹ Ministry of Forests, Lands, and Natural Resource Operations, 2009. Regional Executive Director Implementation Guidance for the PG TSA Landscape Biodiversity Objectives. https://www.for.gov.bc.ca/tasb/slrp/srmp/north/prince_george_tsa/pg_tsa_guidance_document_20091008.pdf

which site plans are not yet completed. Table 2 summarizes the amount of the expected old forest area within each unit, expressed in hectares and as a percentage of each unit.

Consistent with the Management Plan requirements for reporting, this information satisfies the annual requirement to report on old forest retention areas. The area reported in Table 2 and mapped in Appendix L includes only areas of non-pine-leading forest that are 120 years old or greater. The age of each contributing stand is from the 2017 forest inventory. The previous Development Plan reported using ages from the provincial vegetation resource inventory. In some cases, the areas that were formerly pine-leading old forest are now non-pine leading old forest. This analysis does contain some old forest fragments that are not within riparian areas. These fragments are shown on the Appendix L maps.

Table 2: Remaining Old Forest Projection if All Proposed Cutblocks Were Harvested with Minimal Retention

Research Forest Unit	Crown Forest Land Base (CFLB) (includes existing Road area) (ha)	Projected Old Forest Area (ha)	Projected Old Forest Percentage	Comments
A – Kerry Lake	933.8	146.2	16% (10% Minimum)	
B – Tacheeda Lakes	1,053.4	402.2	38% (14% Minimum)	Currently large amount of retention anticipated for visual quality
C – Caine Creek	1,043.5	142.2	14% (10% Minimum)	
D – Caine Creek	1,081.9	133.3	12% (10% Minimum)	
E – Chuchinka Creek	1,078.0	432.4	40% (10% Minimum)	
F – Chuchinka Creek	1,198.6	168.7	14% (10% Minimum)	
G – Angusmac Creek	2,185.2	557.5	26%	

			(10% Minimum)	
H – Purden Mountain	727.3	553.5	76% (25% Minimum)	
I – Hungary Creek	844.0	445.9	53% (25% Minimum)	Another 23% is occupied by stands 100 to 119 years old
J – Fraser River	1,581.2	752.0	48% (10% Minimum)	Another 10% is occupied by stands 100 to 119 years old
K – Willow River	460.3	210.7	46% (25% Minimum)	
L – Willow River	158.5	12.0	8%* (10% Minimum)	Another 9% is occupied by stands 110 and 119 years old
Total for All Units	12,345.7	3,956.6	32%	
Crown forest landbase as calculated from the 2017 timber supply review				
*The small old forest retention is a result of the harvesting being conducted under another license and management plan (Woodlot License W0210). Although current old forest retention is below target, retention of mature forest 100 years old and greater is above target at 17%.				

Interior Old Forest Objective

Because of the multiple small units that compose the Research Forest and the amount of existing young forest within and adjacent to the Research Forest units, maintaining Interior Old Forest as per the PG TSA Landscape Biodiversity Order is not a reasonable expectation. However, the importance of the intent of the interior old forest objectives is recognized. Consistent with that intent, the management goal is to develop strategies to retain old forest areas that are valued for their biodiversity and which will sustain multiple old forest attributes. Strategies consistent with the management goal may include but are not limited to the following, where practicable:

- 1) *Retention areas that are not within or not adjacent to riparian management areas may only contribute to the old forest percentage, if they meet a specified minimum width and size as specified within the Development Plan;*

The specified width and size is 150m and 2.25ha.

- 2) *Maintain old forest retention continuity with spatially identified old forest retention areas planned by other forest tenure holders;*

There is a recruitment strategy for old forest retention being implemented within Natural Disturbance Unit A4 with the McGregor Plateau, as per the PGTSA Biodiversity Order. Figures 2, 3 and 4 show the areas currently being managed for biodiversity and old forest conservation within Research Forest Units B, E, and G respectively, and how they align with the recruitment areas identified under the A4 strategy.

Figure 2: Old Forest Planning Adjacent to Unit B

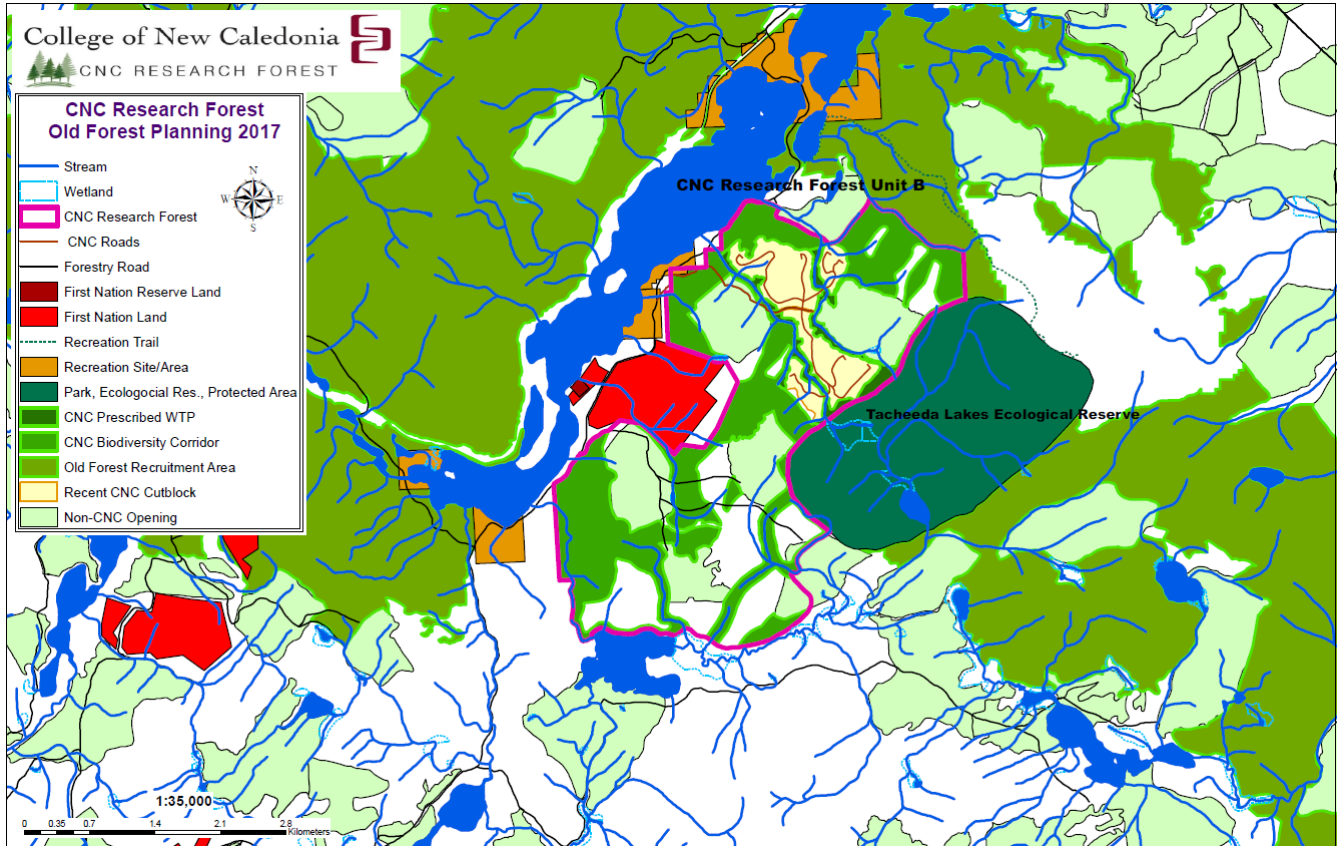


Figure 3: Old Forest Planning Adjacent to Unit E

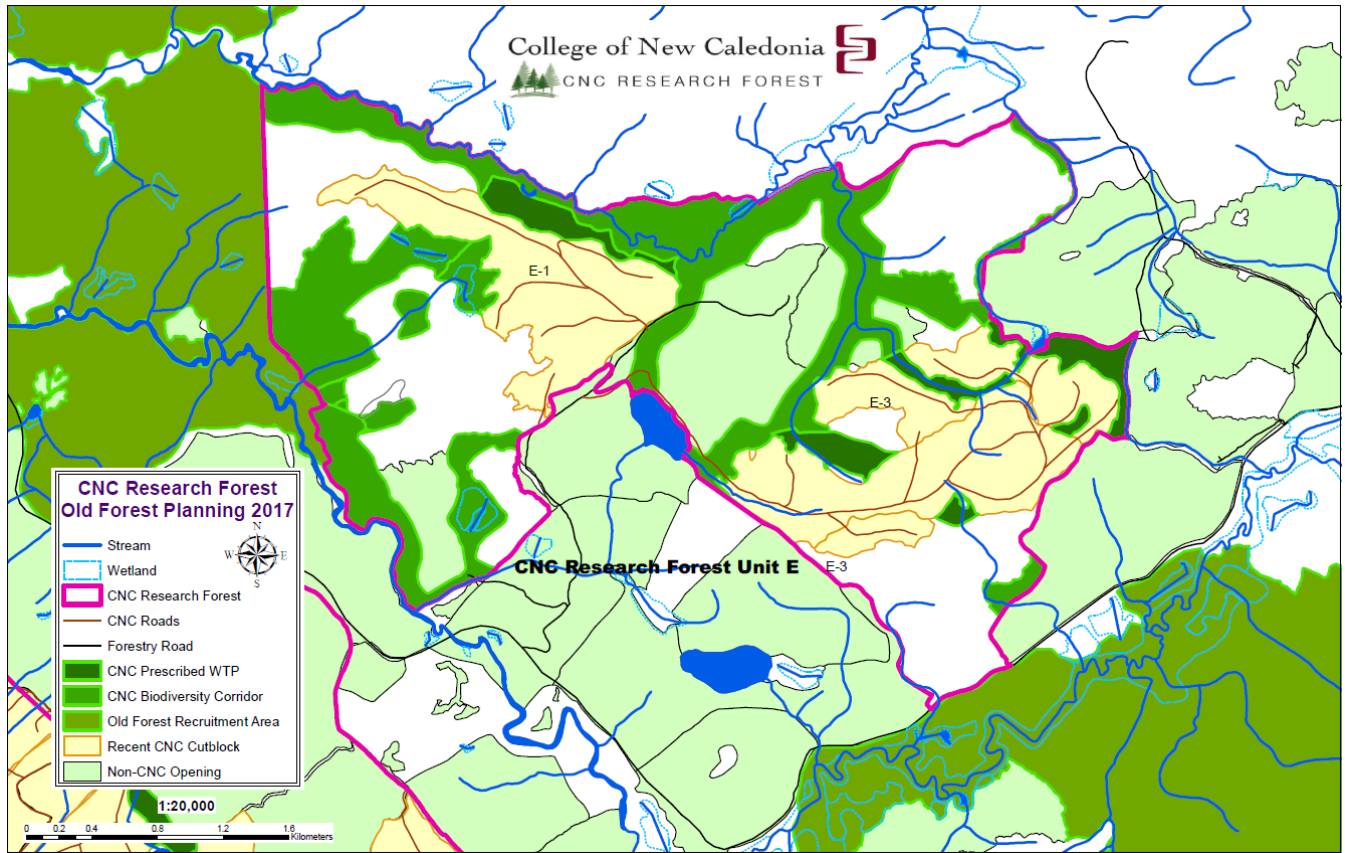
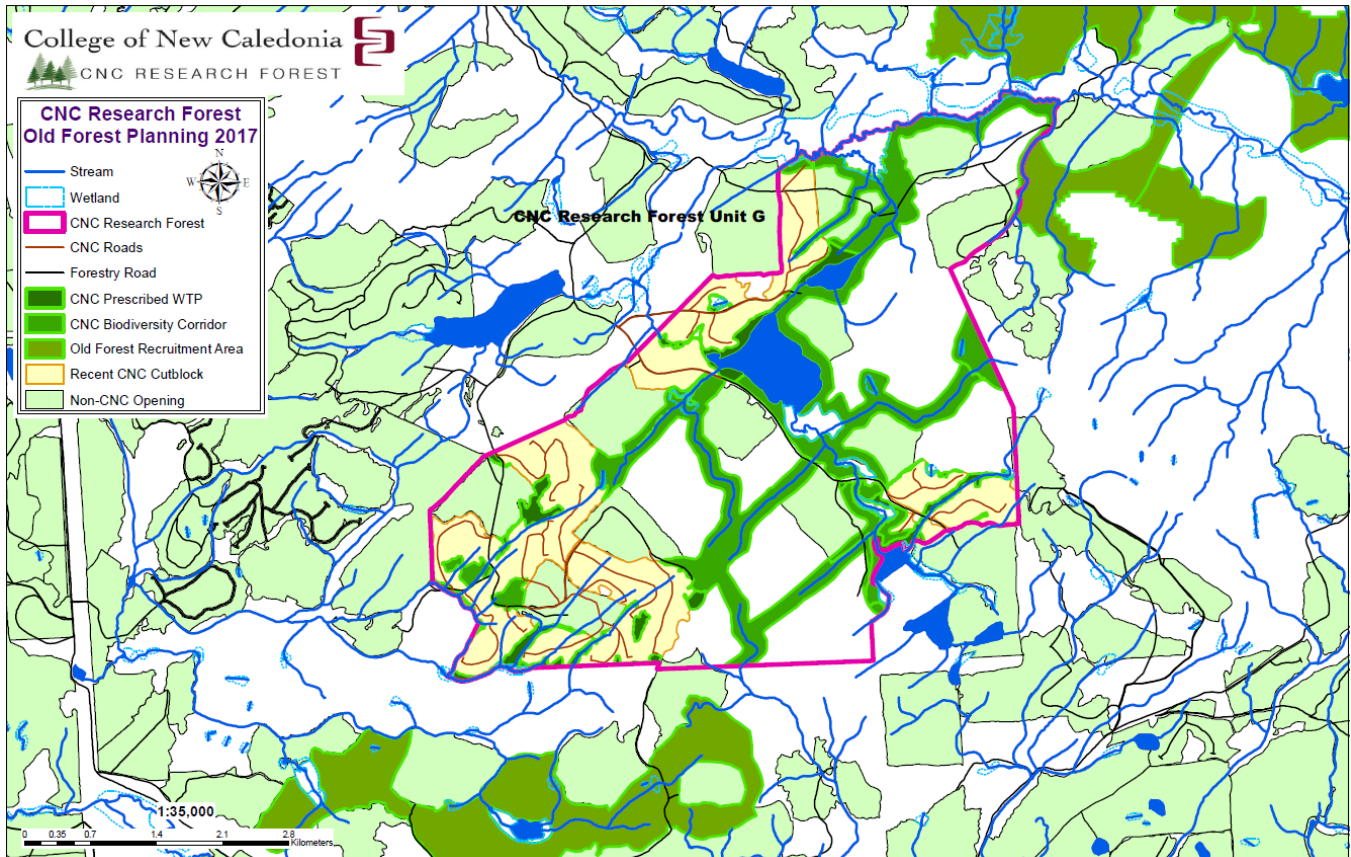


Figure 4: Old Forest Planning Adjacent to Unit G



- 3) Anchor old forest retention on significant wildlife habitat features (e.g., nests, dens, and mineral licks) or areas supporting blue or red-listed ecosystems or species;
- 4) Maintain a minimum buffer of forests >3m in height around all identified wildlife habitat features, as specified within the Development Plan;

The intent is to conserve and protect significant wildlife features or areas that have unique or rare qualities. The beneficial amount of retention and type of retention may vary depending on the size and type of feature and the species affected. Available professional expertise is necessary to determine the potential treatment options in each case. Where professional expertise may not be available and conservation or protection is deemed necessary, then 200m shall be the minimum buffer applied for a habitat feature within old forest (>120 years old). This buffer width is expected to conserve old forest attributes (avoid edge effects) near the habitat feature where old forest conservation is determined to be important.

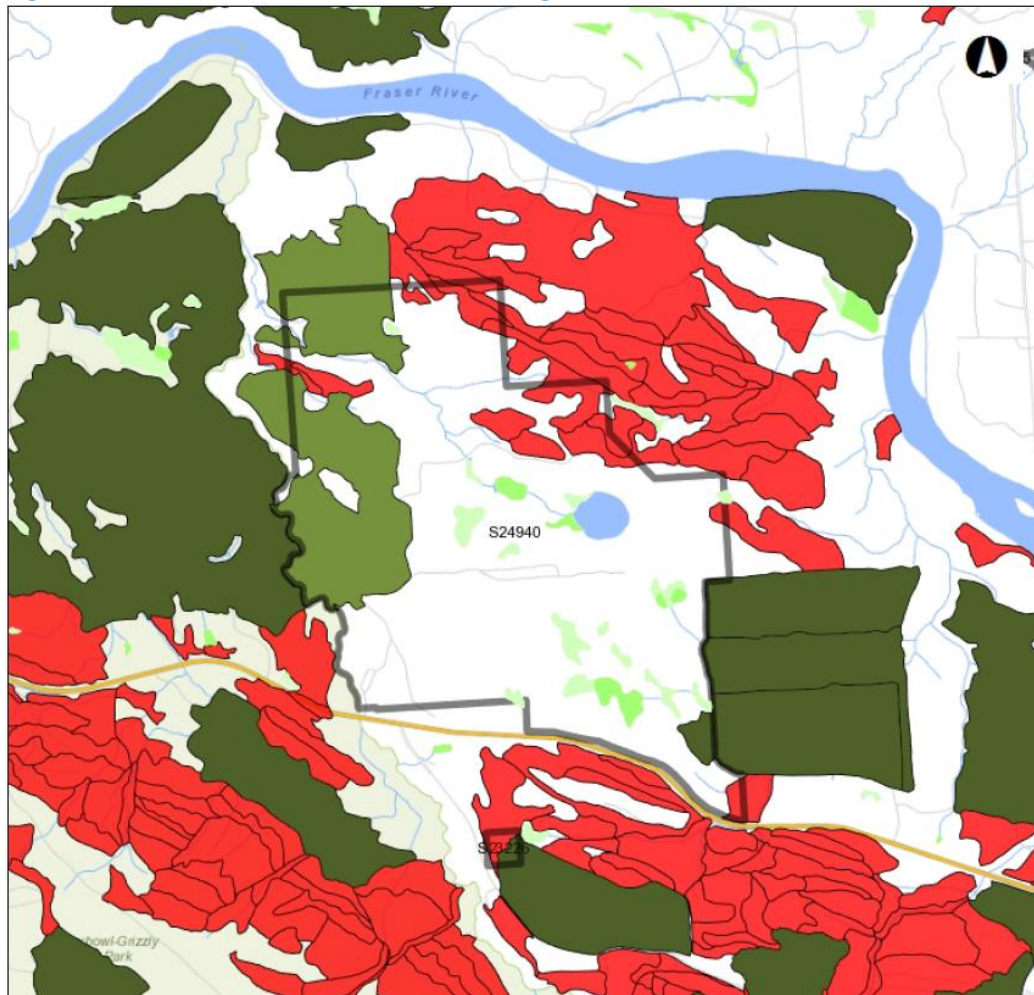
- 5) Within each unit, maintain a minimum percentage of old (>120 years), non-pine-leading forest stands based on area, as specified within the Development Plan; and

For each Research Forest unit, non-pine forests greater than 120 years old will occupy, at a minimum, the percentage of the crown forest land base listed in the column titled, “Projected Old Forest Percentage”, within Table 2.

The projected remaining amount (hectares) of non-pine old forest after harvesting all of the proposed cutblocks under this Development Plan is also included in Table 2. This is the potential worst case result, where minimal wildlife tree and riparian retention is implemented for all the proposed cutblocks for which site plans are not yet completed.

- 6) *Within Unit I, retain all mature cedar and hemlock leading stands within the approximate areas shown in red within Figure 5. This is consistent with maintaining the forested areas rated as having a moderate to high potential biodiversity value as identified on the 2008 map produced by the Provincial Integrated Land Management Bureau.²*

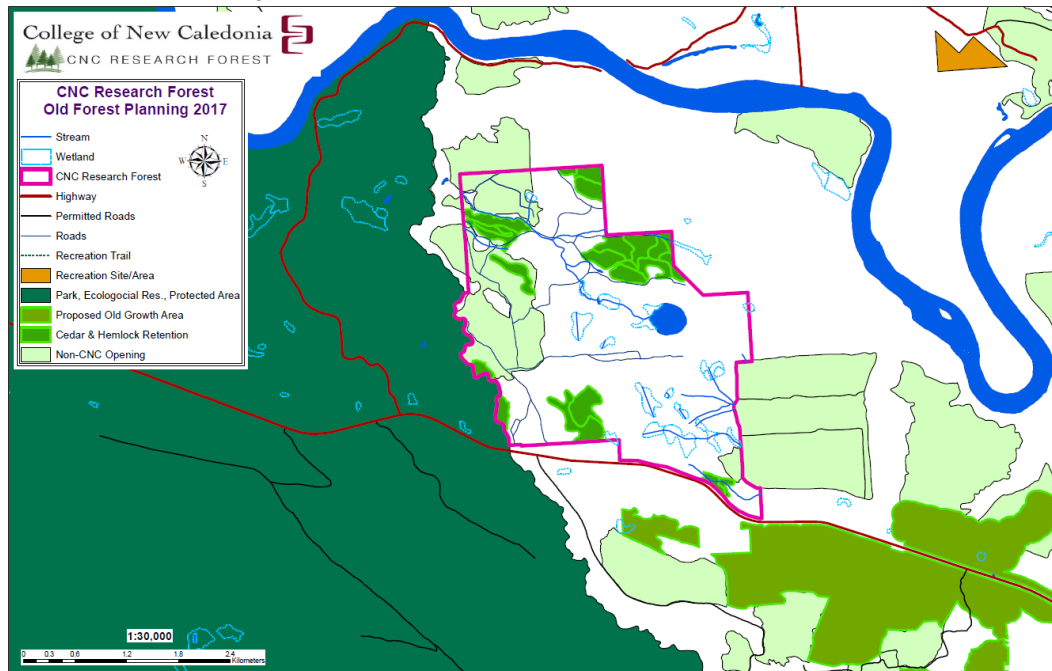
Figure 5: Mature Cedar and Hemlock Leading Stands in Unit I



² Integrated Land Management Bureau, Province of British Columbia, 2008. Guidance Biodiversity Management of ICH in the Prince George LRMP Area.

Applying the new forest inventory completed in 2017, the cedar or hemlock-leading stands that are to be retained from harvesting within Unit I are shown in Figure 6, below.

Figure 6: Mature Cedar and Hemlock Leading Stands for Retention within Unit I (as per 2017 forest inventory)



Species at Risk Conservation and Protection

Caribou Corridor

Unit I, adjacent to Sugarbowl Park and Protected Area, is within an area identified as habitat for the southern Mountain Caribou population, which is a red-listed species. In particular, the area in and around Unit I is recognized as a movement corridor for southern Mountain Caribou between the Torpy River area and the Sugarbowl Mountain area. Managing the overall integrity of the caribou movement corridor requires due consideration when planning for forest harvesting and roads. To ensure that Research Forest operations are consistent with the intent of the movement corridor, consultation will occur with available, qualified natural resource professionals to determine any necessary measures to be implemented. This may include, but is not limited to, specified timing for all forestry practices and research undertakings, alteration of road and cutblock design, modification of forest cover and vegetation retention, implementation of monitoring before and post-treatment, and postponement of operations. These strategies will also be undertaken where a significant wildlife habitat feature is identified prior to or during Research Forest operations.

Ecosystems or Species at Risk

Any identified ecosystems or species at risk habitat may be partially conserved or fully protected after consulting with available natural resource professionals. In addition, other forest practice modifications or research modifications may be undertaken to minimize current and future hazards to areas supporting listed ecosystems and species. As an example, hazards may include, but are not limited to, windthrow, disease, insects, or invasive plants.

For 2017-18, the potential and planned operations are all within units that occupy the Moist Interior Plateau and McGregor Plateau Ecosections of the Prince George District. Units A, B, E and F are fully within the SBS wk1 biogeoclimatic subzone, and the majority of Unit G is within the SBS wk1 subzone with limited harvesting within the SBS vk and ESSF wk2 subzones.

Using the terrestrial ecosystem mapping, completed in 2017, potential ecosystems listed in Table 3 will be both identified and verified by map and field prior to completion of harvesting. Only the upland ecosystems and plants within the SBS wk1, SBS vk and ESSF wk2 subzones are provided in Table 3. Forestry harvesting operations are not planned for the ecosystems and plants within non-forest types (eg. wetlands, bogs, marshes, ponds, and lakeshores). All plants found in Table 3 are dependent on moist to wet growing sites typical of the riparian areas along small streams, wetlands and lakes. Since the majority of these areas are planned for conservation throughout Units A, B, E, F and G, with the establishment of riparian reserves and biodiversity corridors, no further actions to identify and manage these plants is being planned at this time.

Table 3. Listed Upland/Terrestrial Ecosystems and Plants Potentially Impacted by Forest Development within the Development Plan Year

English Name for Ecosystem	BC List	Identified Wildlife	Biogeoclimatic Units	Ecosystem Group
Hybrid White Spruce / Hardhack / Oak Fern	Red		SBSwk1/06	Terrestrial - Forest: Coniferous - moist/wet
Lodgepole Pine / Black Huckleberry / Reindeer lichens	Blue		SBSvk/09;SBSwk1/02	Terrestrial - Forest: Coniferous - dry
Lodgepole Pine / Black Huckleberry - Velvet-leaved Blueberry	Blue		SBSvk/02;SBSwk1/03	Terrestrial - Forest: Coniferous - dry
Douglas-fir - Hybrid White Spruce / Knight's Plume	Blue		SBSmk1/04;SBSwk1/04	Terrestrial - Forest: Coniferous - dry
Douglas-Fir - Hybrid White Spruce / Thimbleberry	Blue		SBSmh/01;SBSmh/05;SBSmh/06;SBSvk/03	Terrestrial - Forest: Coniferous - dry;Terrestrial - Forest: Coniferous - mesic

Scientific Species Name	English Name	BC List	Identified Wildlife	Name Category	Biogeoclimatic Units
<i>Rhodobryum roseum</i>	Rose moss	Blue		ICHwk;SBSwk	
<i>Malaxis paludosa</i>	Bog Adder's-mouth Orchid	Blue		SBSdw;SBSwk	Bog;Swamp;Conifer Forest - Moist/wet
<i>Malaxis brachypoda</i>	White Adder's-mouth Orchid	Blue		SBSvk	Fen;Riparian Forest;Rock/Sparsely Vegetated Rock;Conifer Forest - Moist/wet;Mudflats - Intertidal
<i>Epilobium halleianum</i>	Hall's Willowherb	Blue		ICHwk;SBSwk	Vernal Pools/Seasonal Seeps;Stream/River; Meadow;Conifer Forest - Moist/wet;Alpine/Subalpine Meadow
<i>Nymphaea tetragona</i>	Pygmy Waterlily	Red		SBSmk;SBSwk	Bog;Riparian Forest;Riparian Shrub;Meadow;Deciduous/Broadleaf Forest;Conifer Forest - Mesic (average);Conifer Forest - Dry;Conifer Forest - Moist/wet;Mixed Forest (deciduous/coniferous mix);Riparian Herbaceous;Gravel Bar

Species at Risk Results

Figures 7 to 11 show the ecosystems at risk as identified from the 2017 Terrestrial Ecosystem Mapping or from field assessments completed during or after 2016. Based on current inventory and assessments, this includes areas that are dominated by SBS wk1 02, 03, 04, or 06 ecosystems. The maps also show the areas that are Douglas-fir leading or deciduous leading.

A significant portion of the ecosystems at risk, along with Douglas-fir and deciduous leading areas are being planned for retention as part of prescribed wildlife tree retention areas/patches or the biodiversity/wildlife corridors. The overlap between currently planned retention areas and ecosystems at risk may easily be observed within Figures 7 to 11.

Approximately 4 ha of area within the mid portion of Cutblock D-1 is typed as SBS wk 1 02 within the Terrestrial Ecosystem Mapping, but subsequent field work assessed the area as SBS wk1 01/05. Either way, approximately 0.7 ha of the area was prescribed for wildlife tree retention.

Figure 7. Retention Planning Overlap with Ecosystems at Risk within Unit A

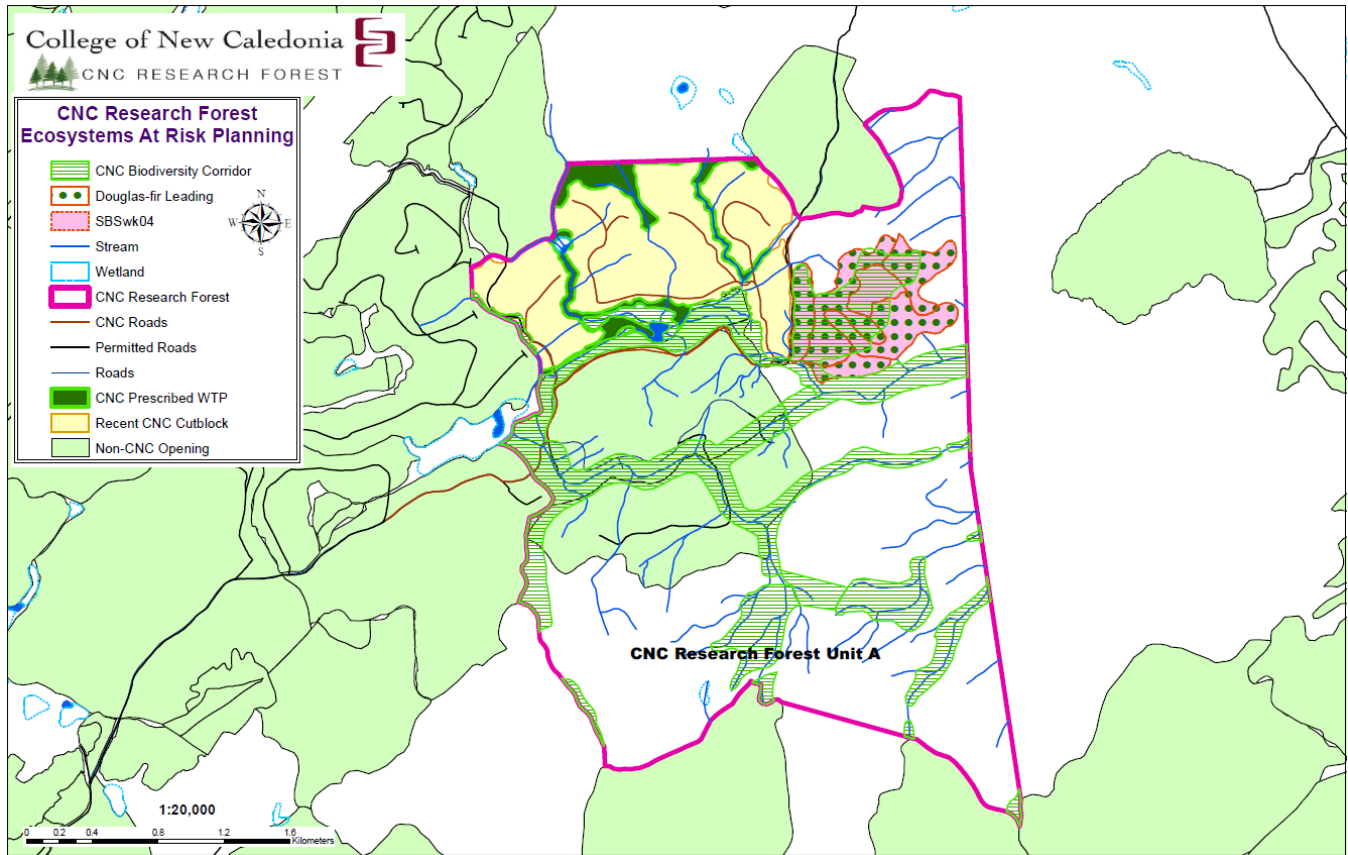


Figure 8. Ecosystem at Risk Field Assessed within Cutblock C-1

The area shown in yellow was field assessed as being 70% SBS wk1 04 and 30% SBS wk1 02. The area shown is 1.8 ha. This area was harvested along with the rest of Cutblock C-1 during the winter of 2017.

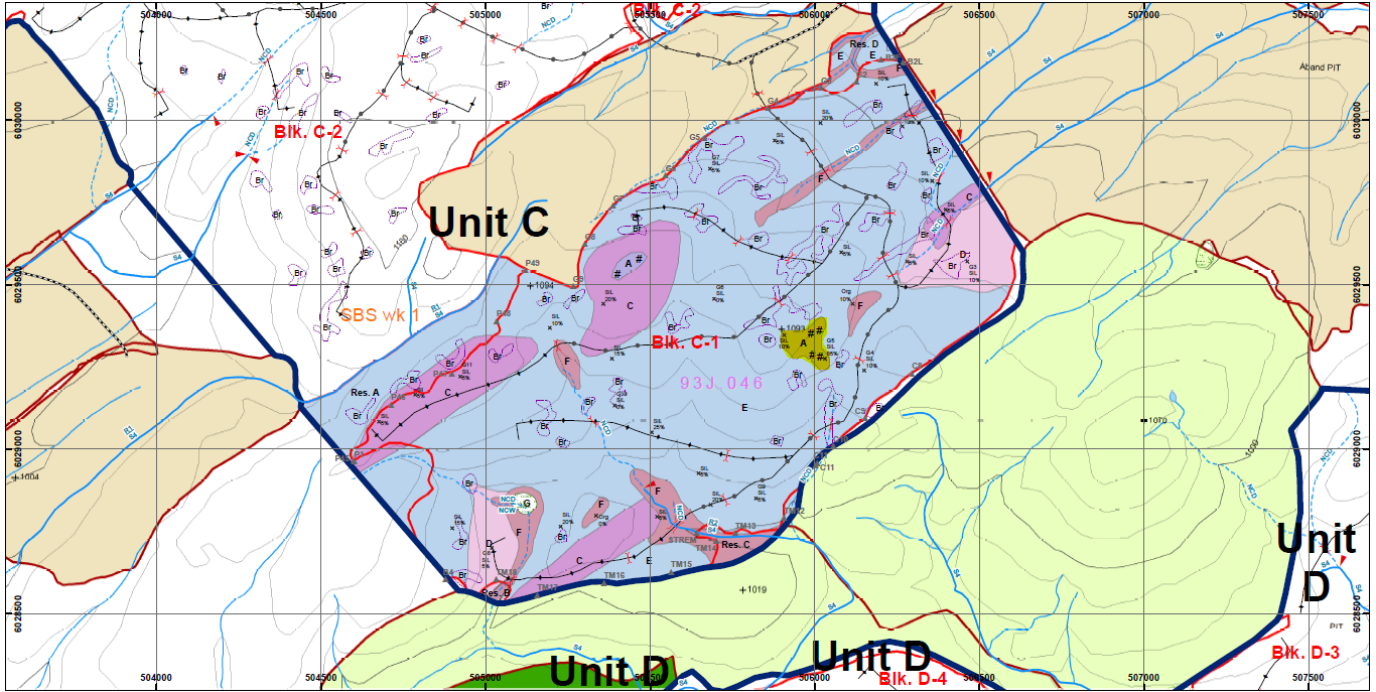


Figure 9. Ecosystem at Risk Field Assessed within Cutblock C-2

The area shown in orange was field assessed as being 70% SBS wk1 04 and 30% SBS wk1 02. The area shown is 2.5 ha. A very small portion of this SBS wk1 04 type was reserved (note overlapping red line) within a prescribed wildlife tree retention area. The remainder of the SBS wk1 04/02 type was harvested along with the rest of Cutblock C-2 during the winter of 2017.

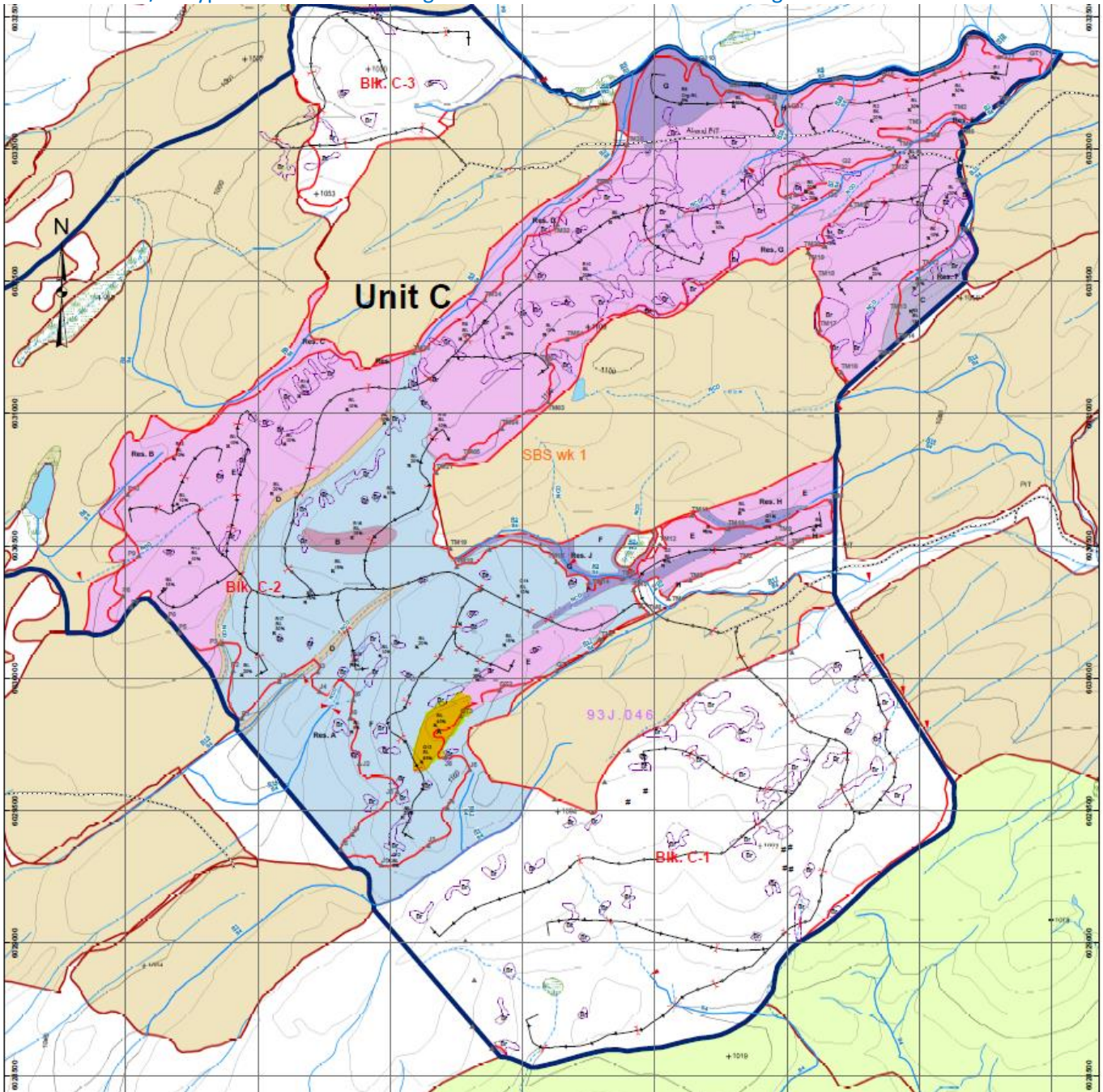


Figure 10. Retention Planning Overlap with Ecosystems at Risk within Unit E

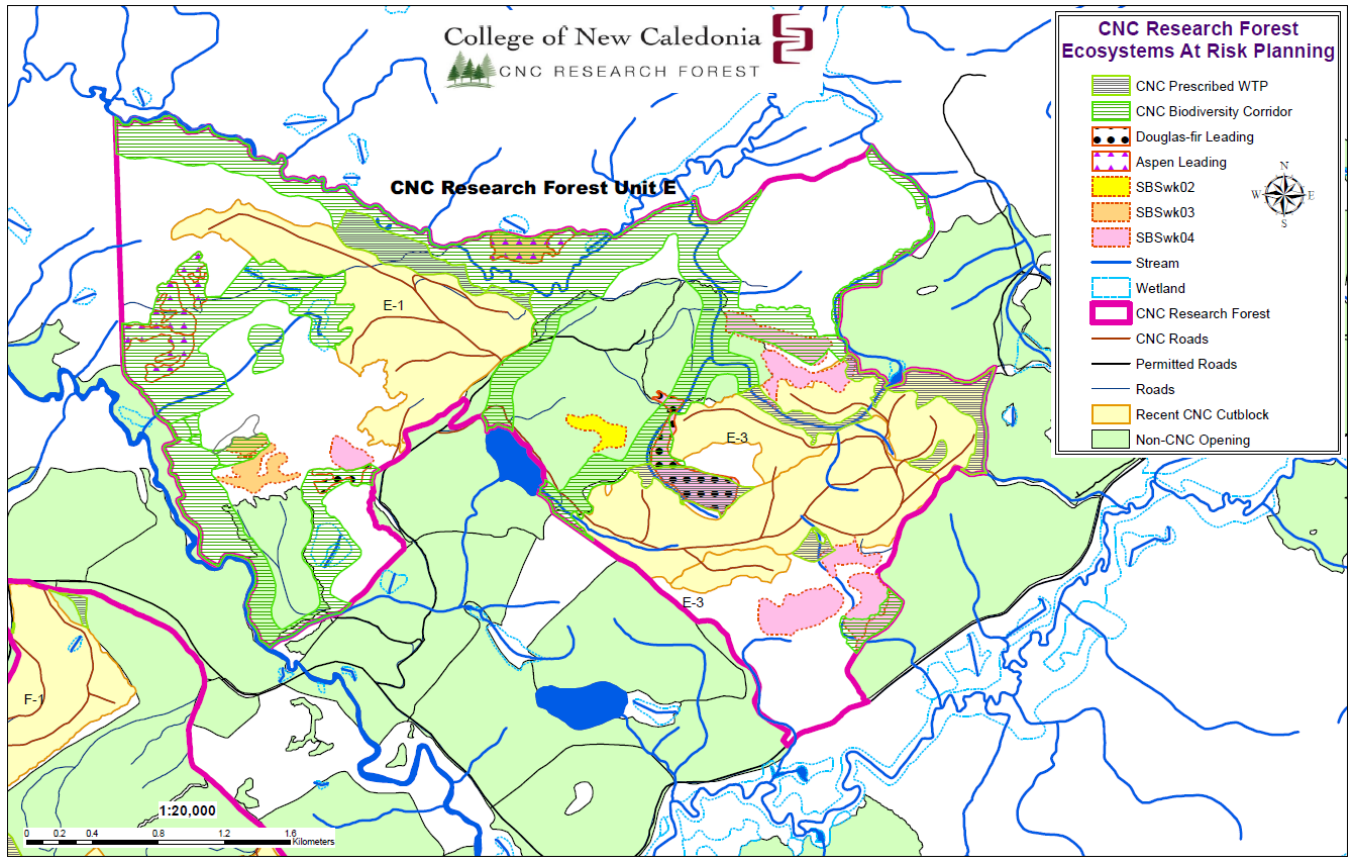
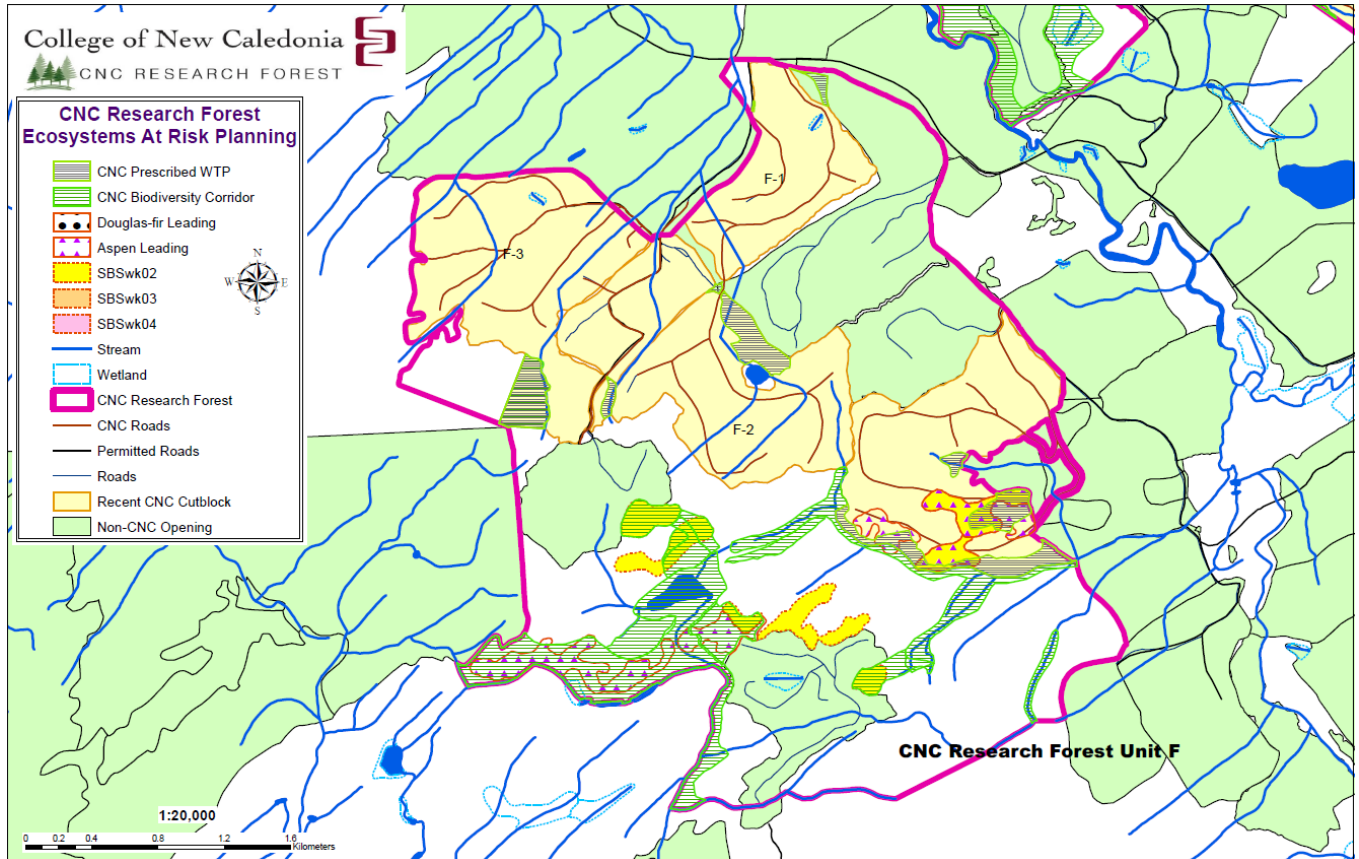


Figure 11. Retention Planning Overlap with Ecosystems at Risk within Unit F



Wildlife Tree and Coarse Woody Debris Retention

Wildlife Tree Retention

The Forest Planning and Practices Regulation requires the following to be met (shown in italics). The objective is to meet or exceed the regulated practice requirements. For item 1, below, the minimum wildlife retention for any 12 month period is 10%. The regulatory requirements under items 2 to 4 remain unchanged.

- 1) If an agreement holder completes harvesting in one or more cutblocks during any 12 month period beginning on April 1 of any calendar year, the holder must ensure that, at the end of that 12 month period, the total area covered by wildlife tree retention areas that relate to the cutblocks is a minimum of 7% of the total area of the cutblocks.*
- 2) An agreement holder who harvests timber in a cutblock must ensure that, at the completion of harvesting, the total amount of wildlife tree retention areas that relates to the cutblock is a minimum of 3.5% of the cutblock.*
- 3) For the purposes of subsection (1) and (2), a wildlife tree retention area may relate to more than one cutblock if all of the cutblocks that relate to the wildlife tree retention area collectively meet the applicable requirements of this section.*
- 4) An agreement holder must not harvest timber from a wildlife tree retention area unless the trees on the net area to be reforested of the cutblock to which the wildlife tree retention area relates have developed attributes that are consistent with a mature seral condition.³*

In addition, a management goal is to retain areas of wildlife trees that are valued for their ecology and wildlife habitat. Strategies consistent with the management goal may include but are not limited to the following, where practicable:

- 1) Anchor wildlife tree retention on wildlife habitat features (e.g., nests, dens, and mineral licks) or areas containing blue- or red-listed ecosystems or species; and*
- 2) Maintain wildlife tree retention connectivity with spatially identified wildlife tree retention areas and old forest retention areas planned by other forest tenure holders.*

Refer to Figures 2, 3, and 4 for existing old forest retention planning by other forest tenure holders

In addition, specific strategies will be identified in the Development Plan for:

- 3) Conserving large diameter standing Douglas-fir trees;*

Retain Douglas-fir trees \geq 50cm DBH

- 4) Conserving a representative proportion of any larger Douglas-fir leading stands;*

³ Ministry of Forests, Lands and Natural Resource Operations, 2016. Statutes and Regulations Webpages. http://www.bclaws.ca/Recon/document/ID/freeside/14_2004

Within Units A, B, C, D, E, F, G, I, K and L, retain at least 1ha of any Douglas-fir leading stand. Within Units H and J, retain at least 2.25ha of any Douglas-fir leading stand.

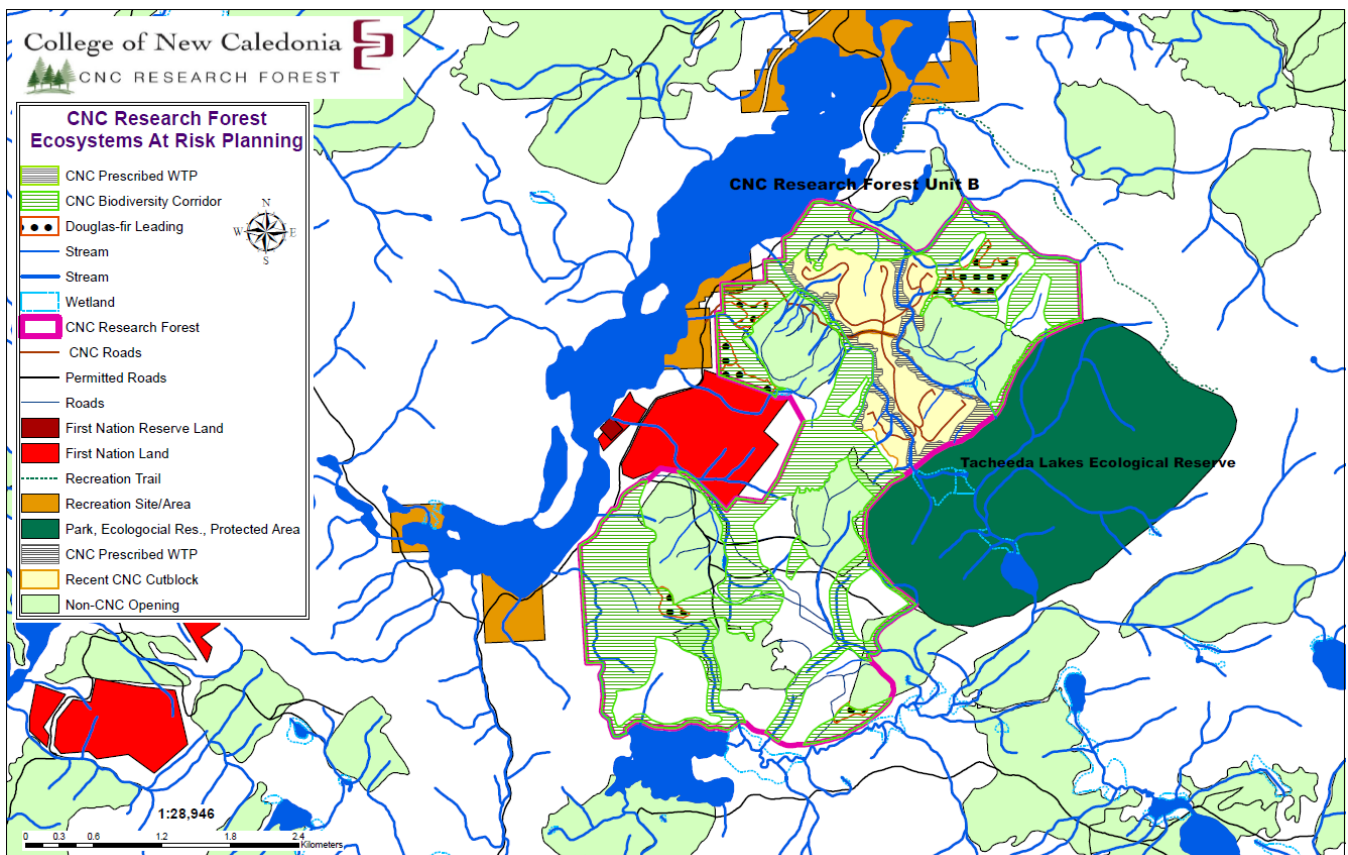
Unit A

The majority of Douglas-fir leading stands within Unit A, based on the 2017 forest inventory, are planned for retention. This may be observed in Figure 7, which shows both the Douglas-fir leading areas and the ecosystems at risk.

Unit B

The Douglas-fir leading stands within Unit B, based on the 2017 forest inventory, are all included within areas planned for visual retention or biodiversity/wildlife retention as may be observed in Figure 12, below.

Figure 12. Retention Planning Overlap with Douglas-fir Stands within Unit B



Units C, D, F and G

There were no Douglas-fir leading stands identified within the 2017 forest inventory or during field work.

Unit E

All of the Douglas-fir leading stands within Unit E, based on the 2017 forest inventory, are planned for retention. This may be observed in Figure 10, which shows both the Douglas-fir leading areas and the ecosystems at risk.

5) *Conserving large diameter cottonwood, birch and aspen trees;*

Retain cottonwood, birch, and aspen trees $\geq 45\text{cm}$

6) *Conserving a representative proportion of larger deciduous leading stands;*

Within all units, retain at least 2.25ha of any deciduous leading stand

Units A, B, C, D and G

There are no identified mature deciduous leading stand within Units A, B, C, D, and G.

Units E and F

The majority of the deciduous leading stands within Unit E and F, based on the 2017 forest inventory, are planned for retention. This may be observed in Figures 10 and 11, which shows both the deciduous leading areas and the ecosystems at risk.

7) *Retaining a minimum amount of stubbed live trees in otherwise clearcut areas; and*

Within all units, retain a minimum of 5 stub trees per hectare, of any species. Stubs are to be $\leq 5.0\text{m}$ tall.

The above was achieved on all cutblocks harvested between April 2016 and March 2017, and is planned for all cutblocks to be harvested during 2017-18.

8) *Retaining non-commercial sized understory tree species, in particular spruce, balsam and Douglas-fir in otherwise clearcut areas.*

Within Cutblock B-1, individual understory trees and patches of understory were retained to achieve visual screening and to maintain structural diversity and biodiversity post-harvest. Some of the results may be viewed in Figures 13 and 14, below.

Figure 13. Understory Retention Post-harvest within Cutblock B-1



Figure 14. Understory Retention Post-harvest within Cutblock B-1



For the fall and winter of 2017-18, experimental analysis of LiDAR data will be undertaken to identify areas with high understory density prior to harvest. If this method of assessment is successful, then a representative portion of the identified understory areas will be added to the logging plans for harvest retention.

Wildlife Tree Retention Results

The wildlife tree retention achieved for all cutblocks harvested during 2016-17 is shown in Table 4, along with the planned wildlife tree retention for cutblocks to be harvested during 2017-18, that were fully laid-out prior to February 2018.

Table 4: Summary of Wildlife Tree Retention Areas (April 1 2016 to March 31, 2017)

Cutblock	Total Forest Area within Cutblock (Includes NCC, but does not include natural NP area) (ha)	Wildlife Tree Retention Area (ha)	Wildlife Tree Retention % (Proportion of forest area in cutblock)	Comments
D-1	407.2	93.2	22.9%	
D-2	118.0	13.1	11.1%	
D-3	121.6	33.8	27.8%	
D-4	34.4	12.2	35.5%	
C-1	193.4	19.5	10.1%	0.4ha of Natural NP
C-2	417.7	98.7	23.6%	
C-3	39.6	8.1	20.5%	
G-3	211.9	23.4	11.0%	0.2ha of Natural NP
G-4	133.0	16.0	12.0%	
B-1	146.8	36.9	25.1%	
Total for 2016-17 Year	1,823.5	354.9	19.5%	
A-2	102.3	26.0	25.4%	
A-8	56.9	20.9	36.7%	
A-3	69.7	18.5	26.5%	
A-4	48.4	12.2	25.2%	
A-5	133.3	22.7	17.0%	
B-2	152.3	30.8	20.2%	
E-5	54.2	17.6	32.5%	
E-6	66.4	27.3	41.1%	
E-7	21.2	5.5	25.9%	
E-8	39.1	5.8	14.8%	
G-2	95.4	25.3	26.5%	
G-5	202.7	81.8	40.4%	
G-6	222.1	62.9	28.3%	
G-7	84.0	17.6	21.0%	
G-8	100.1	35.4	35.4%	
G-9	99.6	37.4	37.6%	

G-10	79.2	11.3	14.3%	
Total for 2017-18 Year	1,626.9	459	28.2%	

Coarse Woody Debris Retention

The Forest Planning and Practices Regulation requires the following to be met for coarse woody debris retention (shown in italics). The objective is to meet or exceed the regulated practice requirements, so for the requirement below, the minimum logs on a cutblock is an average 16 logs per hectare, each being a minimum of 5 m in length and 7.5 cm in diameter.

An agreement holder who carries out timber harvesting must retain at least the following logs on a cutblock: If the area is in the Interior, a minimum of 4 logs per hectare, each being a minimum of 2 m in length and 7.5 cm in diameter at one end.⁴

During the term of this plan, a goal is to monitor and study trends in the natural amount and distribution of coarse woody debris within forested areas within and surrounding the Research Forest. In addition, a goal is to determine which combinations of coarse woody debris attributes can be used to optimize the beneficial effects to small mammals within recent clearcut areas and young forests. Retention related practices that significantly increase beneficial effects to small mammals will be incorporated into the Development Plan on an annual basis and into future Management Plans upon scheduled revisions.

Coarse Woody Debris Treatment and Study Results

During this Development Plan period, a systematic sampling of the amount, size and distribution of coarse woody debris (CWD) remaining post-harvest is not planned. Because all harvesting is focused in old-aged spruce and balsam stands that are highly damaged from spruce beetle and blowdown, there is relatively high amounts of coarse woody debris existing pre-harvest.

Based on casual observations of the completed 2016-17 harvesting within Units B, C, D and G, the remaining CWD levels are adequate. The few exceptions may be within the harvested areas that were occupied by large alder patches where the original forest density was low. The provision of future coarse woody debris across all cutblocks is also expected to be adequate due to the post-harvest retention of mature Douglas-fir, mature deciduous trees, tree stubs (≤ 5 m tall) and understory trees.

During the spring and summer of 2017, long, continuous (up to 200m) CWD piles were created within Cutblocks C-2, D-1, D-3, and G-3. Further CWD piling is currently planned for Cutblock B-1 and G-4. The approximate locations of the completed piling are shown in Figures 15 to 18. The CWD piles are intended to provide suitable travel and feeding corridors between separate areas of mature tree habitat. The CWD piles are expected to attract large quantities of rodents, a food

⁴ Ministry of Forests, Lands and Natural Resource Operations, 2016. Statutes and Regulations Webpages. http://www.bclaws.ca/Recon/document/ID/freeside/14_2004

source for marten and other meso-carnivores, and to provide protective cover for travel across otherwise clearcut areas. To provide for continuous improvement of the CWD corridors, some of the piles will be monitored by trail cameras, starting in the summer of 2017, with regular onsite observations undertaken to determine if there is appropriate uptake by animals as planned. The results of the monitoring and observations will be shared with the John Prince Research Forest to further aid their continuing study of CWD treatments post-harvest.

Figure 15. Locations of CWD Piling Treatments

The yellow areas depict the completed CWD piling for wildlife habitat with Cutblock C-2.

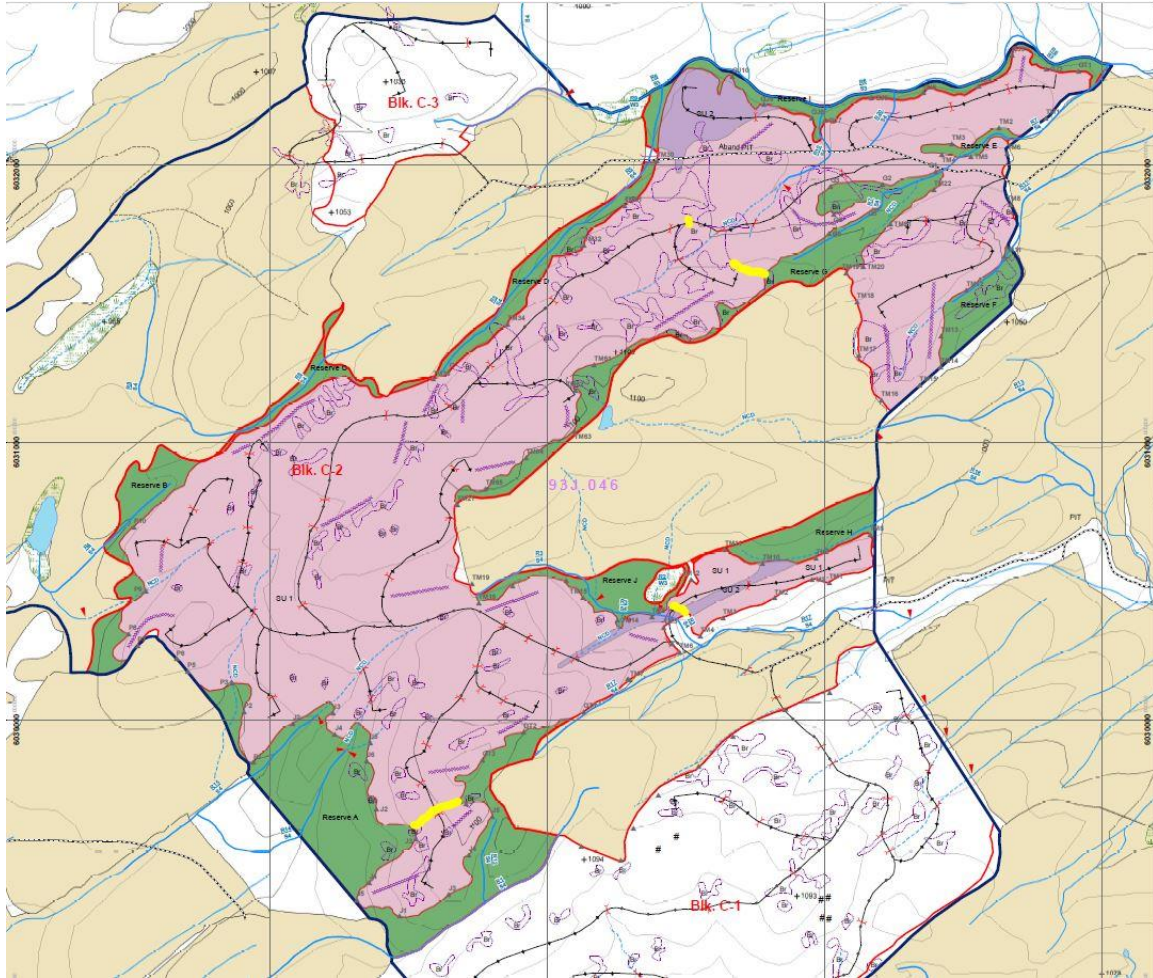


Figure 16. Locations of CWD Piling Treatments

The yellow areas depict the completed CWD piling for wildlife habitat in Cutblock D-1.

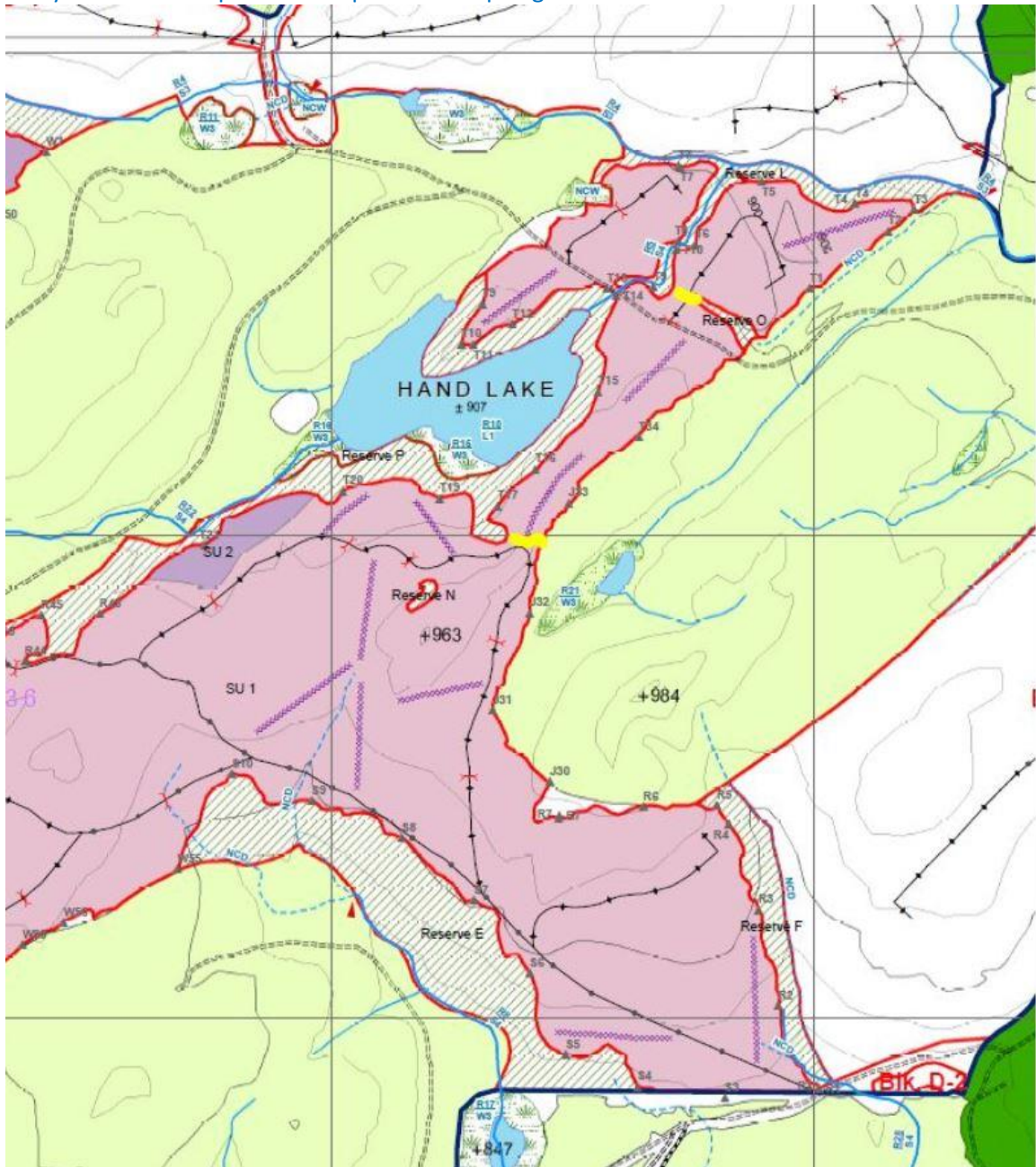


Figure 17. Locations of CWD Piling Treatments

The yellow areas depict the completed CWD piling for wildlife habitat in Cutblock D-3.

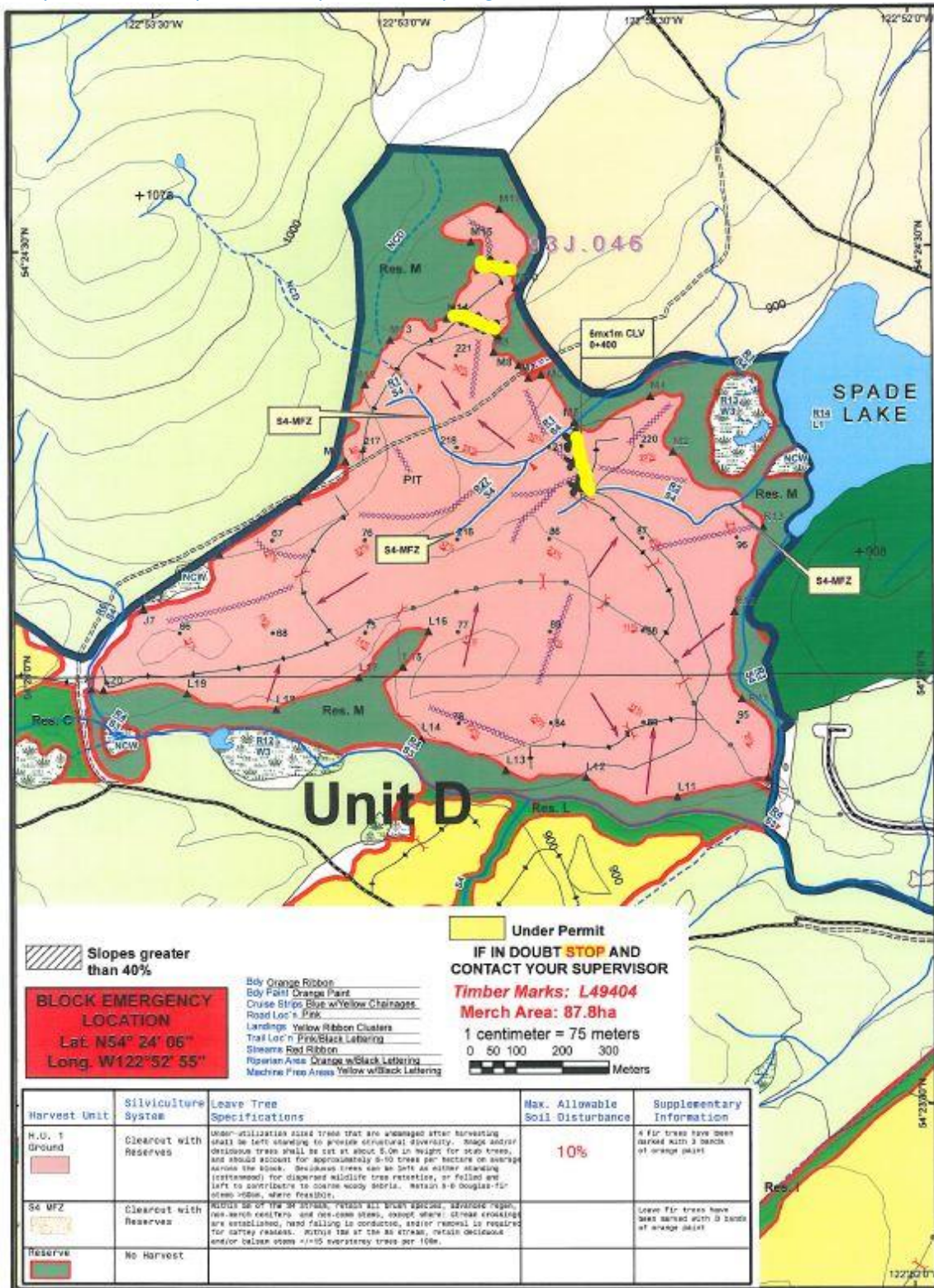
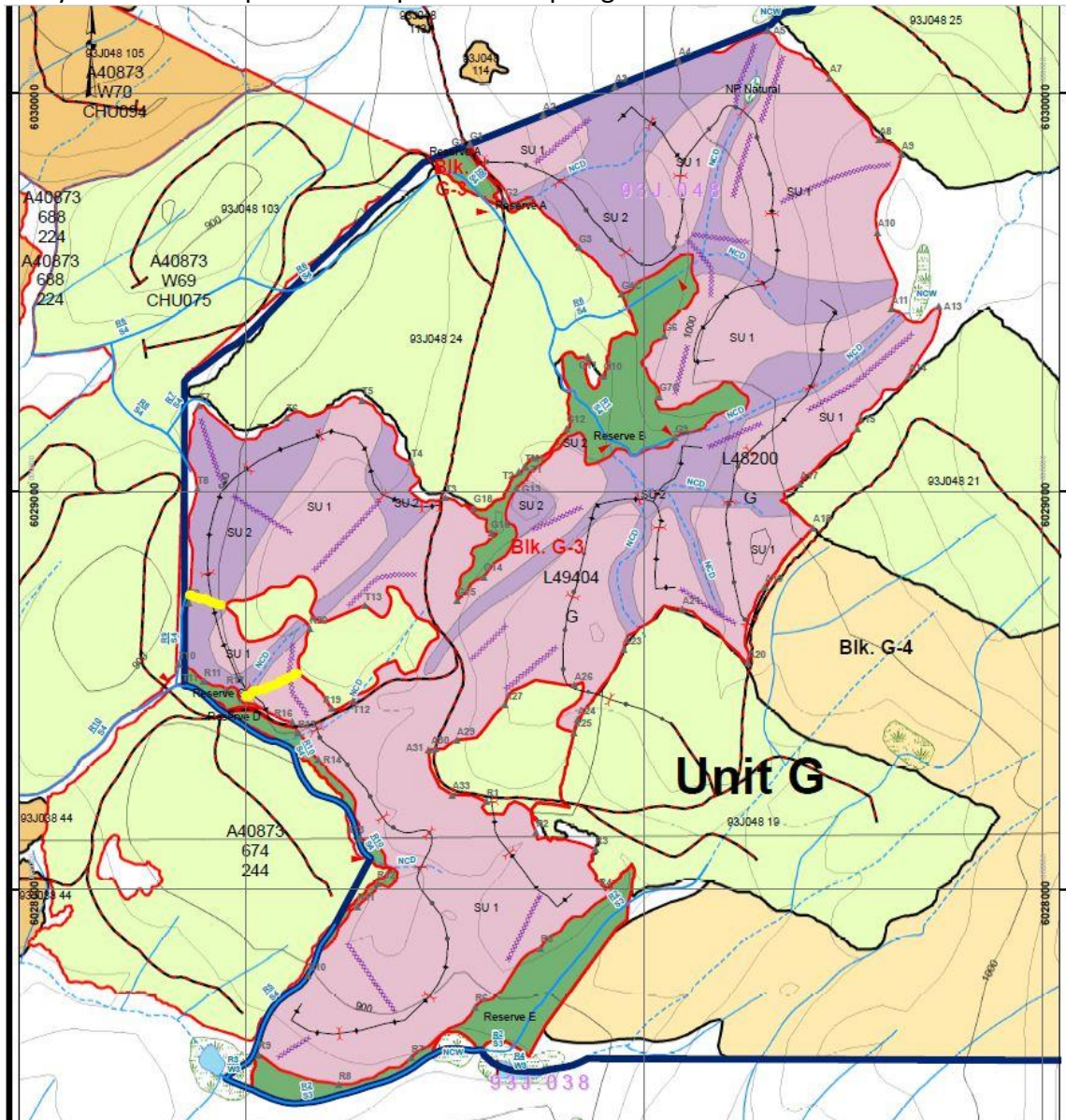


Figure 18. Locations of CWD Piling Treatments

The yellow areas depict the completed CWD piling for wildlife habitat with Cutblock G-3.



Riparian Management

The Forest Planning and Practices Regulation (FPPR) requires the following to be met regarding the establishment of riparian management areas and forest retention within riparian management areas (shown in italics):

Designated Riparian Management Areas ⁵

The following types of streams, wetlands, and lakes are required to have the following riparian reserve zones and management zones established:

Riparian Class	Qualities that Define Stream Class	Riparian Management Area (meters)	Riparian Reserve Zone (meters)	Riparian Management Zone (meters)*
S1-A	<i>Fish Bearing & >20m Wide with Large Flood Plain</i>	100	0	100
S1-B	<i>Fish Bearing & >20m Wide</i>	70	50	20
S2	<i>Fish Bearing & 5m to 20m Wide</i>	50	30	20
S3	<i>Fish Bearing & 1.5m to 5m Wide</i>	40	20	20
S4	<i>Fish Bearing & <1.5m Wide</i>	30	0	30
S5	<i>Non-Fish Bearing & >3m Wide</i>	30	0	30
S6	<i>Non-Fish Bearing & <3m Wide</i>	20	0	20

*Minimum width unless active floodplain extends beyond management zone, then the width of the riparian management zone extends to the outer edge of the active flood plain.

Riparian Class	Qualities that Define Wetland Class	Riparian Management Area (meters)	Riparian Reserve Zone (meters)	Riparian Management Zone (meters)
W1 or W5*	>5ha	50	10	40
W3	1 to 5ha	30	0	30

* Two or more W1 wetlands within 100m of each other OR One W1 within 80m of one or more W3 wetlands OR Two or more W3 wetlands within 60m of each other, if total area >5ha

⁵ Ministry of Forests, Lands and Natural Resource Operations, 2016. Statutes and Regulations Webpages. http://www.bclaws.ca/Recon/document/ID/freeside/14_2004

Riparian Class	Qualities that Define Wetland Class	Riparian Management Area (meters)	Riparian Reserve Zone (meters)	Riparian Management Zone (meters)
L1-B	>5ha to 1000ha OR If designated L1B by Minister	10	10	0
L3	1ha to 5ha	30	0	30

Restrictions within Riparian Management Zones

Must ensure that the percentage of the total basal area within the riparian management zone specified in Column 2 is left as standing trees, and

- The standing trees are reasonably representative of the physical structure of the riparian management zone, as it was before harvesting and
- Retain enough trees adjacent to the stream to maintain the stream bank or channel stability if the stream is S4, S5, or S6, and has trees that contribute significantly to the maintenance of stream bank or channel stability, and is a direct tributary to an S1, S2 or S3 stream.

Column 1 Riparian Class	Column 2 Basal Area to be Retained Within Riparian Management Zone (%)
S1-A or S1-B stream	≥20
S2 stream	≥20
S3 stream	≥20
S4 stream	≥15 (see item #1 below)
S5 stream	≥20 (see item #2 below)
S6 stream	Not applicable or ≥ 15 (where drains into S1, S2, S3 or S4 stream)
All classes of wetlands or lakes	≥10 or ≥40 (where wildlife feature)

The objective is to meet or exceed the regulated practice requirements described previously, in order to conserve valuable riparian wildlife habitat, maintain stream channel stability, long-term large woody debris, shading of the stream channel and to minimize new fine organic debris and new sediment input into the stream channels. As such, the target for:

- 1) S4 streams is to retain ≥15% of the original basal area within the RMZ;
- 2) S5 streams is to retain a 20m RRZ, and retain a 20m RMZ with ≥20% of the original basal area;

- 3) S6 streams is to retain $\geq 15\%$ of the original basal area within the RMZ of S6 streams that drain directly into a S1, S2, S3, or S4 stream;
- 4) W1, W3, and W5 wetlands is to retain $\geq 40\%$ of the original basal area within the RMZ where there is an obvious wildlife feature identified at the time of assessment (e.g., a well-used animal trail, an animal den, raptor nest, mineral lick, heavy ungulate rutting evidence, or heavy ungulate browse) within the RMA; and
- 5) L1B and L3 lakes is to retain $\geq 40\%$ of the original basal area within the RMZ (30m for L3 and 40m for L1B lakes) where, identified at the time of assessment, there is an obvious wildlife feature within the RRZ or RMZ, or where at the time of assessment, regulated game fish are observed or known to be present within a lake.

In the absence of an obvious wildlife feature, the retention for wetlands and lakes will be a riparian reserve zone as identified under "Designated Riparian Management Areas" and the basal area retention as stated under "Restrictions within Riparian Management Zones".

In addition to the previous, the following practices are intended to conserve riparian habitat, water quality, and minimize disturbance to the stream channel.

- 6) *There is to be no machine wheels or tracks operated within 5m of any stream.*
- 7) *Where practicable considering original forest structure, all resource features and windthrow hazard:*
 - a) *Retention within a RMZ is to be concentrated within 10m of the stream channel or riparian reserve edge, and*
 - b) *Within all RMZs, achieve or exceed the wildlife tree and coarse woody debris retention strategies listed under the "Wildlife Tree Retention" and "Coarse Woody Debris Retention" sections of this Development Plan.*

There are a number of other legal practice requirements, specified under the FPPR related to the management of riparian features and areas. These are listed below:

None of the following may be carried out in a riparian reserve zone:

- 1) Grazing or broadcast herbicide applications for the purpose of brushing;
- 2) Mechanized site preparation or broadcast burning for the purpose of site preparation;
- 3) Spacing or thinning;
- 4) Cut, modify or remove trees, except for the following purposes:
 - a) Felling or modifying a tree that is a safety hazard, if there is no other practicable option for addressing the safety hazard;
 - b) Topping or pruning a tree that is not wind firm;
 - c) Constructing a stream crossing;
 - d) Creating a corridor for full suspension yarding;
 - e) Creating guyline tiebacks;
 - f) Carrying out a sanitation treatment. This does not include clearcut harvesting for bark beetles;
 - g) Felling or modifying a tree that has been windthrown or has been damaged by fire, insects, disease or other causes, if the felling or modifying will not have a material adverse impact on the riparian reserve zone. This does not include clearcut harvesting for bark beetles;
 - h) Felling or modifying a tree for the purpose of establishing or maintaining an interpretive forest site, recreation site, and recreation facility or recreation trail.

Riparian Management Results

A summary of all the resulting riparian treatments for all cutblocks harvested during 2016-17 is Table 5: The riparian results for the cutblocks planned for harvest during late 2017 and winter 2018 will provided in the next Development Plan.

Table 5: Summary of Riparian Treatments (April 1 2016 to March 31, 2017)

Cutblock	Riparian Features	Riparian Reserve Zone - No harvest Area	Retention in Riparian Management Zone	Comments
D-1	6 – S4 Streams	10 - 50m	33 to100% of area fully retained	
	1 – S3 Stream	20m+	>50% of area fully retained	
	1 – L1 Lake	44m+	n/a	Exceeds Man. Plan #3 requirements. N/a because site plan applied to previous man. plan where no RMZ required
	1 – L3 Lake	30m+	100% of area fully retained	
	5 – W3 Wetland	30m+	100% of area fully retained	
D-2	1 – S4 Stream	10m+	>33% of area fully retained	
	1 - W3 Wetland	30m+	100% of area fully retained	
D-3	3 – S4 Streams	10m+	>50% of area fully retained	
	2 – S4 Streams	None	>50% of trees retained within 5 to 7m	May not fully meet Man. Plan #3, but very close. Site Plan prepared under Man. Plan #2
	1 – S3 Stream	40m+	100% of area fully retained	
	3 – W3 Wetlands	25m+	>83% of area fully retained	
	1 – L1 Lake	100m+	100% of area fully retained	
D-4	3 – S4 Stream	50m+	100% of area fully retained	

	1 – S3	50m+	100% of area fully retained	
	1 – W3 Wetland	50m+	100% of area fully retained	
C-1	1 – S4 Stream	50m+	100% of area fully retained	
	1 – Stream	None	>50% of trees retained within 5 to 7m	May not fully meet Man. Plan #3, but very close. Site Plan prepared under Man. Plan #2
C-2	11 – S4 Streams	5 to 25m+	16 to 100% of area fully retained	
	4 – S4 Streams	None	>50% of trees retained within 5 to 7m	May not fully meet Man. Plan #3, but very close. Site Plan prepared under Man. Plan #2
C-3	2 – W3 Wetlands	20 to 50m+	66 to 100% of area fully retained	
	1 – S3 Stream	25m+	>25% of area fully retained	
G-3	7- S4 Streams	5 to 25m	16 to 83% of area fully retained	
	2 – W3 Wetlands	15m+	>50% of area fully retained	
	1 – S3 Stream	25m+	>25% of area fully retained	
G-4	4 – S4 Streams	None	>50% of trees retained within 5 to 7m	May not fully meet Man. Plan #3, but very close. Site Plan prepared under Man. Plan #2
	1 – W3 Wetland	30m+	100% of area fully retained	
	1 – S3 Stream	24m to 50m	20 to 100% of area fully retained	
B-1	1 – S3 Stream	24m+	100% of area fully retained	
	2 – S4 Stream	10-50m	50-75% of area fully retained	

	1 – S4 Stream	0m	>50% of trees retained within 5 to 7m	May not fully meet Man. Plan #3, but very close. Site Plan prepared under Man. Plan #2
	1 – W1 Wetland	20m – 50m	70% of area fully retained	

Water Quality Management

The Forest Planning and Practices Regulation (FPPR) requirements and the additional Management Plan targets specified under the “Riparian Management” section are designed, in part, to conserve water quality in streams, wetlands, and lakes. It is also recognized that minimizing the sediment delivery to streams from roads and stream crossings is critical to the overall management of water quality. Therefore, it is necessary to implement additional strategies that are known to prevent or reduce road sediment delivery to streams. This includes strategies for road location, design, maintenance and deactivation. These strategies are stated in the Development Plan and are consistent with the practices identified in the 2013 report by Carson and Maloney⁶, which considered 4,033 sites assessed under the Provincial Water Quality Effectiveness Evaluation.

The following strategies are consistent with practices identified in the 2013 Carson and Maloney report. These strategies are applicable to the design, construction, maintenance, and deactivation of roads for forest development, research, and education.

When locating and designing roads:

- 1) Minimize road length that parallels streams and minimize road length within riparian management areas;
- 2) Minimize roads across steep slopes;
- 3) Minimize roads within unstable areas;
- 4) Minimize sensitive stream crossings;
- 5) Minimize stream crossings with steep approaches; and
- 6) Maximize control of ditch water and run-off from road surface through proper identification of cross-drain culvert placement.

When constructing roads or harvesting cutblocks:

- 7) Minimize the amount of disturbed soil within road right-of-ways;
- 8) Minimize the time that any roadside areas with disturbed soil remain non-vegetated or non-armoured, particularly where silty or fine-texted soils exist;
- 9) For all season roads, minimize amount of road surface composed of fine-textured material;

⁶ B. Carson and D. Maloney. 2013. Provincial Water Quality Effectiveness Evaluation Results (2008-2012). Ministry of Forests, Lands and Natural Resource Operations, Resource Practices Br., Victoria BC FREP Report 35. <http://www.for.gov.bc.ca/hfp/frep/publications/index.htm>

- 10) Maximize amount of subgrade and road surface that is crowned to promote immediate removal of surface water;
- 11) Minimize distance of interrupted ditch flow towards streams; and
- 12) Minimize amount of sediment that may be delivered directly to streams from non-vegetated soil cuts, ditches and road surfaces through careful implementation of the following near streams: ditch depth, stream crossing armour, ditch armour, ditch blocks, cross-drain culverts, and ditch run-outs.

When maintaining roads:

- 13) Minimize the creation of berms that may hold run-off water on road surface for long-distances;
- 14) Maintain or enhance road crowning;
- 15) Minimize prolonged existence of wheel ruts in road surface;
- 16) Minimize use of fine-textured material for re-surfacing; and
- 17) Regularly monitor and maintain road sections that are partially deactivated (Ex: where there was removal of stream crossings or installation of water bars and cross ditches).

When deactivating roads:

- 18) Maximize the control of ditch water and run-off from road surface through careful placement of stream crossing armour, ditch armour, ditch blocks, water bars, cross-drains and ditch run-outs;
- 19) Minimize the time that any roadside areas with disturbed soil remain non-vegetated or non-armoured, particularly where silty or fine-texted soils exist;
- 20) Where improved soil stability and reduction of sediment delivery may be achieved, re-contour stream crossings to natural angle of approach or less; and
- 21) Where re-planting roads, maximize water absorbing capability of the former road surface and subgrade by de-compacting soil and placing woody debris on the ground surface.

Watershed Management

A preliminary watershed assessment of 3rd order and greater watersheds occupied by the Research Forest was completed by the Ministry of Forests, Lands and Natural Resource Operations during 2015 and 2016.

The results of this preliminary study of watersheds are summarized in Table 6. Where future operations within a Research Forest unit may have the potential to negatively impact conditions within one or more watersheds, also identified in Table 6. For these streams and watersheds, the strategy is to have a qualified professional undertake a watershed assessment to further understand the predicted watershed hazards and risks. Future forest planning, forest practices and research projects will consider the professional recommendations for reducing downstream impacts to the watersheds identified in this plan. As watershed conditions and planned harvest levels change, the Development Plan will be annually updated to identify the current watersheds to which this strategy applies. It is acknowledged that the ability to reduce downstream impacts outside of the Research Forest may be limited by how effectively operations may be coordinated with other forest and land tenure holders.

For additional information, a more complete description of each watershed and the preliminary assessment is provided in Appendix B.

Table 6. Summary of Watershed Conditions within Research Forest

Research Forest Unit	Watershed Description	Interim Hazard Rating	Potential Watershed Concerns	Watershed Assessment Recommended
A	Basin that drains directly into Kerry Lake	Stream Flow – VL Sediment – VL Riparian - VL	None	N
	Basin that drains directly into Crooked River	Stream Flow – L Sediment – M Riparian - M	None	N
	5 th order basin that drains into Weedon Creek	Stream Flow – H Sediment – H Riparian - M	None	N
B	Basin that drains directly into Tacheeda Lakes	Stream Flow – VL Sediment – VL Riparian - M	None	N
	Basin that drains into Horseshoe Lake	Stream Flow – L Sediment – VL Riparian - M	None	N
C	4 th order basin that drains into lower section of Caine Creek	Stream Flow – H Sediment – H Riparian – M	High interim hazard ratings, along with severe spruce beetle and significant planned harvesting	Y
	Basin that drains directly into Caine Creek via small streams	Stream Flow – M Sediment – L Riparian - M	See Unit D comments for this watershed	Y
	Basin that drains directly into Merton Creek headwaters	Stream Flow – M Sediment – M Riparian - M	None	N
	Basin that drains directly into Merton Lake and Merton Creek via small streams	Stream Flow – M Sediment – M Riparian - M	None	N
	Negligible portion 3 rd order basin that drains into Merton Creek	n/a	None	N
D	Basin that forms part of headwaters for Caine Creek	Stream Flow –H Sediment – M Riparian - M	High interim stream flow hazard, along with severe spruce beetle and significant planned harvesting	Y
	Negligible portion 4 th order basin that drains	n/a	See Unit C comments for this watershed	Y

	<i>into lower section of Caine Creek</i>			
	<i>Basin that drains directly into Caine Creek via small order streams. Same basin as described for Unit C.</i>	<i>Stream Flow – M Sediment – L Riparian – M</i>	<i>There is a small order stream basin (see Appendix D) that may be largely modified by planned harvesting in Units D and C</i>	<i>N</i>
<i>E</i>	<i>Basin that drains directly into the northern branch of Chuchinka Creek</i>	<i>Stream Flow – VL Sediment – VL Riparian – VL</i>	<i>None</i>	<i>N</i>
	<i>Basin that drains directly into the southern branch of Chuchinka Creek. Together Unit E and F, may have a large potential influence on this watershed.</i>	<i>Stream Flow – VL Sediment – VL Riparian – VM</i>	<i>None</i>	<i>N</i>
<i>F</i>	<i>Same basin as described immediately above that drains directly into the southern branch of Chuchinka Creek</i>	<i>Stream Flow – L Sediment – L Riparian – M</i>	<i>None</i>	<i>N</i>
	<i>Basin that drains directly into the mid and lower section of Angusmac Creek</i>	<i>Stream Flow – L Sediment – L Riparian – M</i>	<i>None</i>	<i>N</i>
<i>G</i>	<i>Basin that drains directly into the mid-section of Angusmac Creek</i>	<i>Stream Flow – L Sediment – VL Riparian – L</i>	<i>None</i>	<i>N</i>
	<i>Negligible portion of basin that drains into mid and lower section of Angusmac Creek. Same basin as described for Unit F.</i>	<i>n/a</i>	<i>None</i>	<i>N</i>
	<i>4th order basin that flows northward into the Crooked River</i>	<i>Stream Flow – L Sediment – L Riparian – M</i>	<i>None</i>	<i>N</i>
	<i>Negligible portion of 4th order basin located, mostly south of Unit G, that ultimately drains towards the Crooked River</i>	<i>n/a</i>	<i>None</i>	<i>N</i>
<i>H</i>	<i>Basin that drains directly into the Bowron river via small order streams</i>	<i>Stream Flow – VL Sediment – VL Riparian – M</i>	<i>None</i>	<i>N</i>
	<i>3rd order basin, mostly to east of Unit H, that</i>	<i>Stream Flow – VL</i>	<i>None</i>	<i>N</i>

	<i>drains into the Bowron River</i>	<i>Sediment – VL Riparian – M</i>		
<i>I</i>	<i>Basin that drains directly into the south side of the Fraser River via small order streams</i>	<i>Stream Flow – L Sediment – H Riparian – L</i>	<i>None</i>	<i>N</i>
	<i>Basin that drains directly into Hungary Creek via small order streams</i>	<i>Stream Flow – L Sediment – M Riparian – L</i>	<i>There is a small order stream basin (see Appendix D) that may be largely modified by planned harvesting in Unit I</i>	<i>N</i>
<i>J</i>	<i>4th order basin that occupies north western majority of Unit J and drains into Fraser River</i>	<i>Stream Flow – L Sediment – M Riparian – M</i>	<i>None</i>	<i>N</i>
	<i>Basin that drains directly into the west side of the Fraser River via small order streams</i>	<i>Stream Flow – L Sediment – VH Riparian – L</i>	<i>There is a small order stream basin (see Appendix D) may be largely modified by planned harvesting in Unit J</i>	<i>N</i>
<i>K</i>	<i>Basin that drains directly into the east side of the Willow River from small order streams</i>	<i>Stream Flow – H Sediment – M Riparian – M</i>	<i>None</i>	<i>N</i>
	<i>Basin that drains into Pitoney Creek</i>	<i>Stream Flow – L Sediment – VL Riparian – M</i>	<i>None</i>	<i>N</i>
<i>L</i>	<i>Basin that drains directly into the east side of the Willow River from small order streams. Same basin as described for Unit K.</i>	<i>Stream Flow – H Sediment – M Riparian – M</i>	<i>None</i>	<i>N</i>

*The percentage of area that Unit E and F occupy within the watershed draining into the southern branch of Chuchinka Creek is notable. Where areas adjacent to Units E and F may experience significant loss of mature forest cover, then the influence of future forest development in Units E and F may significantly add to the watershed impact and require assessment.

Unit A:

About 3% of the 5th order watershed draining into the Weedon system is occupied by mature forest within Unit A. The preliminary assessment shows a high stream flow hazard, but it is not expected that Research Forest operations would significantly affect the overall hazard rating due to the limited mature forest area that will be harvested. Operations within Unit A will apply measures to reduce negative watershed effects including road rehabilitation for more than 50% of the roads, and increased riparian area retention as part of the biodiversity corridor planning.

Unit B:

About 14% of the lands that drain directly into Tacheeda Lakes are contained within the Research Forest. Currently, the stream flow hazard is very low. Considering that the level of harvest in Unit B will be reduced for visual management and biodiversity maintenance, and that road rehabilitation will also be prescribed for the majority of new roads, it is expected that CNC operations will have a limited measurable effect on the Tacheeda Lakes watershed.

Unit C and D:

Prior to 2016/17 winter harvesting, it was recognized that Unit C and Unit D occupy a significant area within two Caine Creek watersheds that have a high peak flow hazard* based on a preliminary, level 1 assessment. A further higher-level assessment prior to harvest was anticipated, but was dependent on securing the appropriate professional expertise to undertake the assessment. For further information regarding the completed operations within the Caine Creek watersheds, along with currently completed assessments and findings, refer to the section titled, "Watershed Assessment and Management Results."

Unit E and F:

Combined, Units E and F occupy approximately 23% of the area within the watershed that drains directly into the mid-lower section of the southern branch of Chuchinka Creek. Because of the large old growth recruitment planning by other licenses and the lack of fully mature timber types in the western part of the watershed, limited harvesting is expected in this watershed, excluding that planned for the Research Forest. Even with full salvage harvest of the remaining mature spruce and balsam stands within the Research Forest, the hazard for this watershed are not expected to reach a high rating, and any effects will be partially mitigated by the planned road rehabilitation and the enhanced riparian retention.

Unit G:

About 21% of land that contributes to the watershed draining directly into the mid-upper section of Angusmac Creek is located within Unit G. With the recent large amount of spruce beetle affecting Unit G, an increase in mature forest harvest is anticipated within this watershed over the next 3 years. The watershed is currently assessed with a low stream flow hazard and very low sediment and riparian area hazards. With only CNC harvesting, this watershed may never experience impactful watershed conditions, but the potential level of harvest in the remaining watershed is uncertain at the time of this Development Plan. The potential need to collaborate with other licensees on watershed management will be further investigated.

Watershed Assessment and Management Results

Where the services of a qualified person may not be available to assess a potentially affected watershed to the appropriate level, as an alternative, collaboration with the Ministry of FLNRO or other forest licensees in monitoring or studying the future watershed conditions will be pursued.

Addressing Watershed Conditions Pre-harvest

During May 2016, CNC contacted Pierre Beaudry, a local, practicing consultant in forest hydrology with extensive experience in assessing watersheds in the Prince George area, about completing a further assessment of the Caine Creek watersheds to improve the understanding

of the existing and future watershed hazards. The assessment of the Caine Creek watersheds was also to include evaluating the sensitivity of the downstream channels, the values at risk, and the overall management risk. Due to other project commitments, Pierre was unable to proceed with an assessment prior to September, nor was he able to recommend a suitable person as an alternative.

Given the spruce beetle salvage priority and need to start operations during the summer or early fall, CNC decided to contact John Rex, the Ministry of Forests and Natural Resource Operations' Regional Hydrologist for the Omineca Region (including the Prince George Natural Resource District), as a possible source of further assessments. CNC met with John Rex in June to discuss collaborating on evaluations and monitoring within the Caine Creek watersheds. Although there was no firm commitment, John Rex believed it was reasonable that his temporary staff may be able to evaluate streams within the Caine Creek watersheds as part of their summer program. To date, the Ministry of Forests, Lands and Natural Resource Operations (Ministry) is unable to complete assessments in the Caine Creek watersheds.

Without the further assessment and guidance of a qualified person, the following measures have been or are expected to be implemented to potentially limit the hydrological impacts of the sanitation and salvage harvest planned within Research Forest Units C & D:

- Limit the amount of area that contributes to the hydrologically disturbed area. In this case, the target was limiting the contributing hydrologically disturbed area within each of the three watersheds identified under Table 6 to 60% of the total watershed land area within the Research Forest.
- Maintain significant amounts of variable sized coarse woody debris across harvested areas. This is expected to be a natural outcome due to winter harvesting, an abundance of large balsam, recent blowdown, and frequent older dead trees, both standing and fallen.
- Prescribed wildlife tree retention is concentrated along riparian areas and drainage gullies and tree retention is planned near stream edges on every small classified stream (all S4) to aid long-term stability of stream channels.
- The number of new stream crossings was minimized. Only two new stream crossings were required for all planned harvesting in Unit D, one of which will be removed post-harvest. Within Unit C, only one new stream crossing is proposed, which will be removed post-harvest.
- Ensuring that road construction and maintenance provides for the control of natural surface and near-surface water drainage during harvest and post-harvest.
- Substantial rehabilitation of harvesting roads across Unit C and Unit D post-harvest, leaving, on average, 1.25% of prescribed cutblock areas with permanent roads. Virtually all of the roads planned for the sensitive soils within Standard Unit 2 of Cutblock C-2 are to be rehabilitated, with the exception of a 0.1ha main access road crossing a narrow portion of the Standard Unit. It is noted that the only sensitive soils identified from assessments within Unit C and D were within Standard Unit 2 of Cutblock C-2, however high erosion hazard was noted throughout the Unit C and D area.
- Improved the size and stream flow capacity of the existing crossings within Unit C and Unit D, where the new installations were expected to improve conditions and not cause further impacts.

- Installed beaver screen protection on susceptible culverts to prevent potential blockage during high flow.

2017 Watershed Assessment

Due of the current uncertainty surrounding what may be accomplished in partnership with the Ministry, CNC pursued a post-harvest assessment using the latest inventory, imagery and LiDAR data. This assessment included an adjustment of watershed boundaries based on the new digital elevation modelling derived from the 2016 LiDAR data. The full 2017 assessment report is provided in Appendix B.

Peak Flow (Stream Flow) Hazard Results from 2017 Assessment

The 2017 assessment rated the peak flow hazard as 0.92, 0.85 and 0.73 for each of the three respective watersheds within the Caine Creek drainage basin. This is based on a potential hazard index score ranging from 0 to 1.0, where 1.0 is the highest level 1 hazard rating that may be calculated, and a value of 0.5 is considered potentially impactful. As part of the assessment, the effect of the 2016-17 CNC harvesting in Units C and D on the peak flow index was examined. The assessment found an 11%, 11% and 9% increase in the peak flow index for each of the three watersheds. In no case however, was the peak flow index increased to its maximum index rating of 60%, although watershed #1 was increased to 55% and watershed #2 was raised to 51%.

Surface Erosion (Sediment) Hazard Results from 2017 Assessment

A surface erosion hazard rating of 0.95, 0.825 and 0.825 was calculated for each of the watersheds within the Caine Creek drainage basin. With values over 0.5, these are considered potentially impactful.

Riparian Buffers Hazard Results from 2017 Assessment

A maximum riparian buffers hazard of 1.0 was calculated for all three watersheds within the Caine Creek drainage basin.

Mass Wasting Hazard Results from 2017 Assessment

A mass wasting hazard assessment, conducted in 2017, determined there was no appreciable hazard score for any of the three watersheds.

Interpretation of Watershed Hazard Results

Assuming the two assessments are comparable, the 2017 CNC assessment indicates the hazard rating changes listed in Table 7, below:

Table 7. Hazard Ratings Differences between 2016 and 2017 Assessment

Watershed Hazard	Watershed 1	Watershed 2	Watershed 3
Peak Flow (Stream Flow) Hazard:	High (Unchanged)	High (Unchanged)	Medium to High
Surface Erosion (Sediment) Hazard:	Medium to High	High (Unchanged)	Low to High
Riparian Buffer Hazard:	Medium to Very High	Medium to Very High	Medium to Very High

When critically evaluating the hazard rating changes stated in Table 7, the differences in riparian buffer hazards above do not align with changes attributable to the CNC harvesting and road building. The 2017 assessment calculated a "portion of stream logged score" of 40%, 45%, 35% for each watershed, where the values from the Ministry assessment could not have been larger than 20% for each watershed to have medium hazard rating. According to these results, the CNC harvesting, which occupied less than 10% of the area in watersheds 2 and 3 (and assumedly less than 10% of the total watershed stream length) would be responsible for a 15% to 25% increase in the portion of watershed streams logged. For this reason, the change in the riparian buffer hazard scoring/rating is not being considered.

As part of the 2017 assessment, the peak flow index was calculated based on the conditions prior to the CNC harvesting and after CNC harvesting was completed. Based solely on the peak flow index, the 2017 assessment found the same peak flow hazard ratings as the 2016 assessment. The consistency between results provides further confidence in the peak flow hazard scoring/rating for both assessments.

The surface erosion hazard scoring/rating is largely driven by road density and roads within 100m of streams. It is not easy to readily recognize whether the changes between the 2016 and 2017 assessment are realistic based on the addition of CNC roads.

Without further analysis, it is reasonable to conclude that the majority of changes between the 2016 and 2017 assessments for peak flow and surface erosion scores may be representative of the changes resulting from both the CNC harvesting and road building during 2016/17. If the previous is assumed, the factors contributing to the significant increases in overall scoring for both peak flow and surface erosion are due to differences in road density, stream crossing density and roads within 100m of a stream. (For example: Within watershed 3, the increase in harvest area was not responsible for change from a medium peak flow hazard scoring/rating to a high scoring/rating, instead it was due to the current road density across the watershed).

Management Direction Based on 2017 Assessment

Based on the 2017 level 1 assessment, both the current road density and current amount of stream crossings potentially have the greatest influence on watershed impacts within the Caine drainage basin. At this point in time, reduction of road density and stream crossings is one of the few mitigating factors that may be implemented within a short time period; otherwise watershed recovery is largely dependent on the re-establishment and growth of conifer forests over the next twenty years.

As communicated earlier in this section, a number of measures were planned for implementation that may potentially lessen the impact of roads constructed in 2016/17. These measures included:

- 1) Minimizing the number of new stream crossings. Only two new stream crossings were required for the harvesting in Unit D. Both stream crossings were fully removed in the spring of 2017. Within Unit C, only one new stream crossing was necessary and was fully removed in the spring of 2017.
- 2) Rehabilitating roads across Unit C and Unit D post-harvest, including roads within sensitive soils. 14.7 ha (60.1%) of the total 24.1 ha road area within Unit C was rehabilitated in the spring of 2017, and only 0.1 ha of access road remains with sensitive

soils. Within Unit D, 14.7ha (67.1%) of the total 21.9ha road area is planned for rehabilitation in the spring/summer of 2018. The new stream crossings installed during 2016/17 are removed.

- 3) Improving the size and stream flow capacity of the existing crossings within Unit C and Unit D. This occurred at the crossing downstream of Hand Lake and along southern access road to Cutblock C-2, where two bridges were used to improve the stream crossings.
- 4) Installation of beaver screens to protect susceptible culverts and prevent potential blockage during high flow. This occurred on the crossing downstream of Hand Lake and at the first crossing towards town from the Hand Lake crossing.

With no further harvesting planned within Units C and D, substantial road rehabilitation underway, and all the new temporary stream crossings removed, the necessary watershed mitigation measures are complete or properly planned for completion in 2018. As designed, only a minimum amount of new road is being left in place to support future silviculture practices and research activities. Unless further information regarding the Caine Creek watersheds is made available, no additional measures or strategies will be implemented.

Roads

The Forest Planning and Practices Regulation requires the following to be met for permanent roads (shown in italics). The objective is to meet or exceed the regulated practice requirements in order to conserve the long-term productivity of the Research Forest landbase. This will be achieved through rehabilitating sections of road that are not required for long-term access.

- (1) An agreement holder must ensure that the area in a cutblock that is occupied by permanent access structures built by the holder or used by the holder does not exceed 7% of the cutblock, unless
 - (a) There is no other practicable option on that cutblock, having regard to
 - (i) The size, topography and engineering constraints of the cutblock,*
 - (ii) In the case of a road, the safety of road users, or*
 - (iii) The requirement in selection harvesting systems for excavated or bladed trails or other logging trails, or**
 - (b) Additional permanent access structures are necessary to provide access beyond the cutblock.**
- (2) If an agreement holder exceeds the limit for permanent access structures described in subsection (1) for either of the reasons set out in that subsection, the holder must ensure that the limit is exceeded as little as practicable.*
- (3) An agreement holder may rehabilitate an area occupied by permanent access structures by
 - (a) Removing or redistributing woody materials that are exposed on the surface of the area and are concentrating subsurface moisture, as necessary to limit the concentration of subsurface moisture on the area,*
 - (b) De-compacting compacted soils, and*
 - (c) Returning displaced surface soils, retrievable side-cast and berm materials.**

- (4) If an agreement holder rehabilitates an area under subsection (3) (a) and erosion of exposed soil from the area would cause sediment to enter a stream, wetland or lake, or a material adverse effect in relation to one or more of the subjects listed in section 149 (1) of the Act, the agreement holder, unless placing debris or revegetation would not materially reduce the likelihood of erosion, must*
- (a) Place woody debris on the exposed soils, or*
 - (b) Revegetate the exposed mineral soils.⁷*

Managing the Amount of Permanent Roads

It is expected that road rehabilitation will be a regular undertaking within most cutblocks to reduce long-term road disturbance levels, consistent with the timber supply review (TSR) assumption of an 1.37% average reduction in productive area for future roads within new harvesting areas.

At the same time, reliable long-term access to cutblock boundaries and between cutblocks is desired for the ease of managing the continuing silviculture obligations, research access, and the ability to quickly respond to various forest health factors.

Each cutblock site plan is to recognize and estimate the amount of permanent road and be revised for actual outcomes in rehabilitation and permanent roads. When identifying both the permanent and temporary roads with each site plan, it is important that communication occur with all concerned parties so that planned road access will properly support all expected use while conserving the soil and other forest resources. As more planning is undertaken within each Research Forest unit, it is expected that the predicted amount and location of permanent roads versus temporary roads within each site plan will become more accurate.

Permanent Road Disturbance Results

In order to ensure ongoing timber supply analysis properly accounts for the reduction in productive forest landbase from permanent road construction, accurate recording of final road rehabilitation is necessary for each cutblock. Maps showing the results of road rehabilitation completed in 2016 are provided in Appendix C, which includes Cutblocks C-1, C-2, C-3, D-3, E-2, E-3, E-4, and G-4. Table 8 summarizes the prescribed amount of permanent roads within the cutblocks harvested during 2016/17 and the cutblocks planned for 2017/18. Some differences between the amount of prescribed and actual permanent roads is expected, therefore future Development Plans will be updated for final road results as road rehabilitation is completed.

Road rehabilitation for Cutblocks D-1, D-2, D-4, B-1 and F-4 (harvested in 2016/17) will be provided in future Development Plan documents.

⁷ Ministry of Forests, Lands and Natural Resource Operations, 2016. Statutes and Regulations Webpages. http://www.bclaws.ca/Recon/document/ID/freeside/14_2004

Table 8: Summary of Permanent Road Disturbance within each Cutblock

Cutblock	Harvest Year	Total Forest Area within Cutblock (Includes NCC, but does not include natural NP area)	Prescribed Permanent Road Area	Final Permanent Road Area Post-Rehabilitation	Permanent Road % (Proportion of forest area in cutblock)	Comments
		(ha)	(ha)	(ha)		
D-1	2016-17	407.1	4.6	n/a	1.13%	
D-2	2016-17	118.0	1.0	n/a	0.85%	
D-3	2016-17	121.6	1.6	n/a	1.32%	
D-4	2016-17	34.4	0.0	n/a	0.00%	
C-1	2016-17	193.4	2.9	2.9	1.50%	0.4ha of Natural NP
C-2	2016-17	417.7	5.4	5.4	1.29%	
C-3	2016-17	39.6	1.1	1.1	2.78%	
G-3	2016-17	211.9	4.2	3.8	2.0%	0.2ha of Natural NP
G-4	2016-17	133.0	1.9	n/a	1.43%	
B-1	2016-17	146.8	2.1	n/a	1.43%	
A-2	Planned	104.5	2.7	n/a	2.58%	
A-8	Planned	57.5	1.3	n/a	2.26%	
A-3	Planned	69.7	1.2	n/a	1.72%	
A-4	Planned	48.4	0.2	n/a	0.41%	
A-5	Planned	133.3	2.8	n/a	2.10%	0.5ha of Natural NP
B-2	Planned	152.3	3.0	n/a	1.96%	
E-5	Planned	54.2	0.5	n/a	0.92%	
E-6	Planned	66.4	0.6	n/a	0.90%	
E-7	Planned	21.2	0.6	n/a	2.83%	
E-8	Planned	39.1	0.3	n/a	0.76%	
G-2	Planned	95.4	2.3	n/a	2.41%	0.4ha of Natural NP
G-5	Planned	202.7	1.0	n/a	0.49%	
G-6	Planned	222.1	4.0	n/a	1.80%	0.9ha of Natural NP
G-7	Planned	84.0	1.3	n/a	1.54%	
G-8	Planned	100.1	2.1	n/a	2.09%	
G-9	Planned	99.6	1.8	n/a	1.80%	
G-10	Planned	79.2	2.3	n/a	2.90%	0.1ha of Natural NP
Total for Year 2016 to 2018		3,453.2	52.8	n/a	1.52%	

As may be observed within Table 8, the average percentage of permanent roads for of all the 2016-2018 cutblocks slightly exceeds the 1.37% assumption set within the 2016 timber supply modelling, which applies to harvesting beyond winter 2016. It is also noteworthy that none of the cutblocks is prescribed for road disturbance greater than 2.9%.

Dispersed Soil Disturbance

The value of conserving natural soil properties within the non-roaded areas of cutblocks is recognized as important for ensuring properly functioning ecosystems and watersheds and for maximizing the long-term productivity of the forests. To achieve soil conservation across cutblocks, a management goal for each Research Forest unit, as a whole, is to limit the average dispersed soil disturbance from new harvesting to the following:

- 1) 5%, which is applicable to the average soil disturbance within all prescribed standard units that are predominantly comprised of sensitive soils in a Research Forest unit,*
- 2) 10%, which is applicable to the average soil disturbance within all prescribed standard units that are not predominantly comprised of sensitive soils in a Research Forest unit, and*
- 3) 25%, which is applicable to the average soil disturbance within all the roadside work areas within a Research Forest unit.*

Preventative and Remedial Actions for Dispersed Soil Disturbance

The targets stated previously are to be achieved by having every prescribed Standard Unit meet these targets. Regular harvesting supervision is to observe on-going soil disturbance and undertake the necessary corrective actions to prevent excessive soil disturbance within each Standard Unit.

In the event that excessive soil disturbance is observed within any prescribed Standard Unit, it will then be documented and any necessary revisions or amendments to the site plan will be undertaken, along with any field actions to minimize impacts to natural resource values (e.g., water quality) and any measures to reduce the soil disturbance, where practicable.

Visual Quality Management

The following Research Forest units are located where visual quality objectives (VQO) have been established.⁸

Unit A: Modification VQO

Two map polygons with a modification VQO are established within the eastern portion of Unit A due to visibility from the Crooked River, Kerry Lake, and/or Highway 97.

Unit B: Retention and Partial Retention VQO

One narrow visual polygon with a retention VQO is established along the western edge of Unit B along Tacheeda Lakes. Two polygons representing a partial retention VQO are established across the majority of the remaining area within Unit B due to visibility from Tacheeda Lakes.

Unit G: Modification VQO

A small visual polygon with a modification VQO is established along one of the western facing slopes in the southern part of Unit G due to visibility from Highway 97.

Unit H: Modification and Partial Retention VQO

One visual polygon with a partial retention VQO and one polygon with a modification VQO occupy the southern portion of Unit H due to visibility from Highway 16 East. The slopes of Mount Bowron, within Unit H, are covered by a polygon with a partial retention VQO due to visibility from Highway 16 East.

Unit I: Partial Retention VQO

One narrow visual polygon, with a partial retention VQO, occupies the southern edge of Unit I adjacent to Highway 16 East.

Unit J: Partial Retention VQO

One visual polygon with a partial retention VQO is established over the eastern edge of Unit J due to visibility from the Fraser River.

Unit K: Retention VQO

One visual polygon with a retention VQO objective is established over the western side of Unit K due to visibility from Tsitniz Lake. Another polygon is established over the southern portion of Unit K due to visibility from Ispah Lake.

The objective for all VQO polygons is to undertake forest development so that the visible landscapes within the VQO polygons meet the definition of altered forest landscape within Sections 1 and 1.1 of the Forest Planning and Practices Regulation.

⁸ DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Visual Landscape Inventory.

https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

Proposed Development within Visually Sensitive Areas

For the 2017-18 period, planned operations potentially affect the areas with established visual quality objectives within Units A and B.

Unit A

Substantial harvesting is planned to start in 2017 as a result of a large amount of new spruce beetle attack. The eastern portion of Unit A is potentially viewable from Kerry Lake and Highway 97. It is expected that digital modelling will be implemented prior to harvest to assess the potential affect of the proposed harvesting on the viewable landforms with Unit A. In this case, view points from Kerry Lake, Crooked River/Highway 97, and the Kerry Lake Recreation Site are expected to be assessed for visual impact prior to finalizing cutblock designs.

Unit B

Beyond Cutblock B-1, new spruce beetle attack continues to affect large areas within Unit B and therefore substantial salvage harvesting is planned. With the Tacheeda Lakes being a high-use recreation area, and with the large amount of Unit B covered by partial retention visual quality objectives, it is expected that digital assessments of the predicted landscape/landform conditions will occur prior to finalizing cutblock designs.

Recent harvesting has occurred on the private lands adjacent to Unit B. It is likely that the private land harvesting occupies sizeable portions of the viewable landscapes/landforms within the Research Forest. This may pose an additional challenge if the private land harvesting is already occupying all or the majority of the allowable landscape alteration. In this situation further guidance should be sought from the Ministry of Forests, Lands and Natural Resource Operations concerning the future management of the visual quality objectives within the affected landscapes.

Visual Quality Management Results

Cutblock G-4 – Harvested Winter 2017

A portion of cutblock G-4 included harvesting within the modification visual quality objective polygon. In consideration of a number of factors, it was concluded that, regardless of the landscape condition, the landscape will meet the definition of “modification”, simply due to the its viewable size and the difficulty of discerning any colours or features on the landscape from any of the viewpoints.

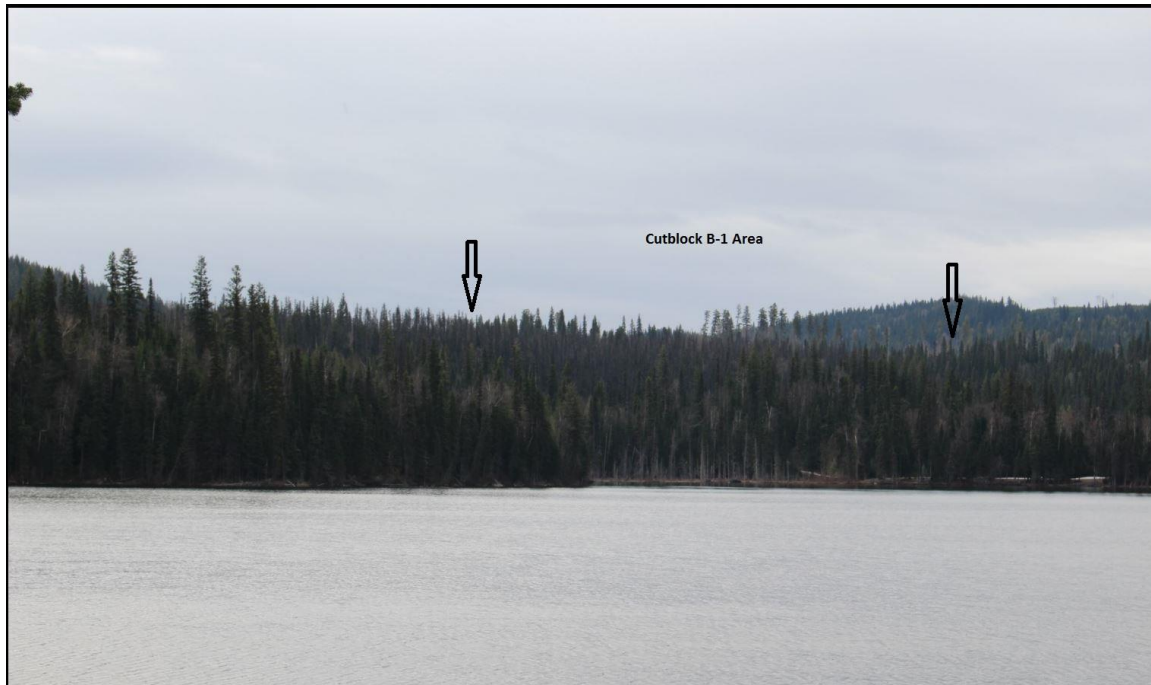
Photographs to confirm the predicted post-harvest condition as viewed from the Crystal Lake area and from Highway 97 (south of Hart Lake) are still planned.

Cutblock B-1 – Harvested Winter 2017

Based on the digital modelling completed in the summer of 2017, the harvesting in B-1 is not expected to alter the landform view beyond the provincially regulated definition. Foreground screening is expected to largely block the view of the landforms on which B-1 is situated.

In spring of 2017, the landform containing Cutblock B-1 was photographed from the Tacheeda Lakes Recreation Site, while still being viewed from other vantage points surrounding the recreation sites. The picture of the Recreation Site view is provided below in Figure 19. From these areas, the harvested area was not seen, so Cutblock B-1 easily achieves the visual quality objective from the most important viewpoint.

Figure 19. View of Landform containing Cutblock B-1 as Observed from the Tacheeda Lakes Recreation Site



Cutblocks A-2 and A-8 – Harvested Summer/Fall 2017

A visual impact assessment was completed for the eastward facing landform containing Cutblocks A-2 and A-8, which may affect the visible landforms as viewed from Kerry Lake (including Kerry Lake Recreation Site) and Crooked River/Highway 97. Digital modelling supporting the assessment shows that a portion of the harvesting may be visible from Kerry Lake and the Kerry Lake Recreation Site, however pictures from the Recreation Site indicate that the harvesting will not be visible due to foreground screening. If the harvesting is visible, the amount of visibly altered landform(s) (as estimated measured from the digital modelling) is expected to meet the provincially regulated definition for the visual quality objectives. The digital model representations of the proposed harvesting are provided within Appendix K.

The results of the harvesting will be photographed from the Kerry Lake Recreation Site and Highway 97 (Crooked River) to confirm the predictions of the visual impact assessment.

Cutblock B-2 – Harvested Summer/Fall 2017 and Winter 2018

A visual impact assessment was completed for the landform(s) containing Cutblock B-2, which may be visible from multiple points within the southern half of Tacheeda Lakes. A single representative viewpoint on Tacheeda Lakes was selected for visual impact assessment. The digital modelling supporting the assessment predicts that no ground disturbance will be seen,

but there may be a change in the visible tree canopy. The current visibly altered ground represents 7% of the landform area. Based on numerical assessment alone, the visible landform is expected to continue to meet the limits of a partial retention visual quality objective. The digital model representations of the proposed harvesting are provided within Appendix K.

Post-harvest photography may not be captured from the assessed viewpoint as this requires water access, but post-harvest views adjacent from the shore of Tacheeda Lakes, if reasonably accessible, may be examined and photographed.

Existing and New Recreation Use

For all Research Forest areas, the objective is to support existing and new recreational use of the Provincial Forest. Strategies to support this objective may include, but are not limited to, the following:

- 1) Maintain road access to all Research Forest units;*
- 2) Install signage identifying each Research Forest unit at the main road entrance;*
- 3) Install additional signage within or near Research Forest units providing information about the area, points of interest, or ongoing Research Forest activities; and*
- 4) Develop new trails for both short-term and long-term research access, education, and recreation.*

As of summer 2017, the following strategies are expected to be undertaken:

- 1) Existing road access will be left in tact or improved unless its continued existence or current use is a risk to public safety or the environment. Existing road access may also be deactivated or rehabilitated where its continued existence and use may materially affect a First Nation or natural resource stakeholder.
- 2) Signage identifying the CNC Research Forest areas north of Prince George will be installed.

Road Access Management Results

The installation of directional road signage was initiated in the summer of 2017 for all Research Forest units and completion is expected by the end of summer 2017. A picture of an installed road sign is shown in Figure 20, below.

Figure 20. Directional Road Sign near Research Unit L



Provincial Recreation Sites and Trails

The following recreational features are located adjacent to or near Research Forest units.⁹

ATV & Snowmobile Road Routes – Unit K and L

The Willow-Coalmine Forest Service Road, which runs along the northern boundary of Unit L, is identified as an ATV and snowmobile route when the road is not being actively maintained for industrial purposes.

The Willow Forest Service Road (FSR), which runs past the southwest corner of Unit K, is identified as an ATV and snowmobile route when the road is not being actively maintained for industrial purposes.

⁹ DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Visual Landscape Inventory.
https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

Tsitniz Lake / Camp Friendship and Recreation Reserve – Unit K

Camp Friendship is located next to Tsitniz Lake. A Provincial Recreation Reserve encloses the area around Tsitniz Lake and the nearby area between the Willow Forest Service Road and the Willow River.

Ispah Lake – Unit K

A Provincial Recreation Site is established on Ispah Lake along the Willow FSR, just south of Unit K.

Tacheeda Lakes Recreation Sites – Unit B

The Tacheeda Lakes Middle and Tacheeda Lakes Point Provincial Recreation Sites are established on Tacheeda Lakes just north of Unit B.

Tacheeda Lookout Trail

A Provincial Recreation Trail has been established along the trail to the Tacheeda Fire Lookout site. This trail runs towards the east, just north of Unit B.

Fishhook Lake Recreation Site – Unit B

A Provincial Recreation Site is established on Fishhook Lake, just south of Unit B.

The strategy for all these recreation features is to consult and seek input from the Ministry of Forests, Lands and Natural Resource Operations when undertaking forest development and research project planning. The coinciding strategy is to achieve results from forest development, silviculture practices, and research projects that are consistent with the continued recreational use and enjoyment of the existing sites, trails, and camps.

Proposed Development Adjacent to Provincial Recreation Areas

Proposed operations within Unit B may affect the Tacheeda Lakes recreational features. The strategy described, immediately above, will be implemented. If there is any significant direction resulting from communication with the Ministry of Forests, Lands and Natural Resource Operations, then this Development Plan will be updated accordingly.

Recreation Referral Results

In December 2016, Cutblock B-1 was referred to the Ministry of Forests, Lands and Natural Resource Operations as part of the referral to BC Parks. At that time, no concerns were expressed in regard to the Tacheeda Lakes Recreation Site and Tacheeda Lookout Trail, except to ensure that the partial retention visual quality objective is achieved.

Road and Trail Access Management

The objective is to maintain a reliable road network, and trail network where applicable, to and within each Research Forest unit to support continuing access for forest operations, educational sites, research sites, First Nation use, stakeholder use, and general recreational use by the public.

For roads that are required for temporary operational or research access the objective is to reduce their footprint to conserve the available productive forest soils and to reduce water quality and watershed impacts over the long-term. This will be accomplished by rehabilitating or deactivating the non-necessary road sections. Rehabilitation will occur as described under section 36 of the Forest Planning and Practices Regulation and therefore will involve re-vegetating the former road area.

Consistent with the the road and trail objective and strategies, rehabilitation of roads is planned within all of the cutblocks scheduled for 2016 and 2017 as not all of the planned harvesting roads are required for long-term operations and research. The net permanent soil disturbance affect of the planned road building and subsequent rehabilitation is summarized with the section titled: "Tracking the Amount of Permanent Road Disturbance".

For previously existing roads and trails there are no treatments planned up to summer 2017 but further assessments of existing road conditions and disturbed road width will be undertaken to improve the existing road inventory information. This additional inventory information will be used for future road and trail planning and to enhance future timber supply analysis.

Research Site Locations

CNC and its research partners have established numerous sites and areas that have and are supporting natural resource monitoring, studies, and trials. Some of these sites and areas are used for multiple years of study while others may only be used for one season. Tracking these sites over time is important, as there may be value in revisiting inactive sites to support or complement future study and research. The previously established research site locations that are within or immediately adjacent to the Research Forest units are shown on the maps in Appendix F (Management Plan #3) along with a table summarizing specific information for each research site.

In addition to the sites established by CNC, one pre-existing provincial research site has been identified within the CNC Research Forest. It is located in Unit D and is shown on Provincial maps as EP 0886.13.09. It is identified as a fertilization trial. Its approximate location is shown on the Unit D map in Appendix F (Management Plan #3). Depending on its current condition and the applicability of the previous data collected, this site may be excluded from harvesting, road development, and silviculture practices for a significant period of time.

Knowing the location of existing and previous research projects is important information when planning the location of permanent and temporary road access and in finalizing the design of cutblocks. Within Appendix D of this Development Plan, a current list of the previous and on-going research projects is provided. Mapping of the research project site locations is also provided in Appendix D, but is only updated once per year, unless significant new project additions warrant map updating. The maps currently provided are updated to July 2017.

Provincial Designations and Forest/Land Tenures

The following Provincial Parks, Protected Areas, and Ecological Reserves were identified using the geographic data provided by DataBC, Province of British Columbia.¹⁰

Tacheeda Lakes Ecological Reserve

Unit B of the Research Forest is situated immediately adjacent to the west side of the Tacheeda Lakes Ecological Reserve. The reserve is composed of 526ha of mostly mature spruce-leading forests within the McGregor Plateau ecosection of which only 0.64% is under designated protection. Although small, the ecological reserve contributes 11.85% of the overall protected areas system of the McGregor Plateau.¹¹

The primary purpose of this Provincial Ecological Reserve is to protect the mature forest ecosystems representative of the wet cool Sub-Boreal Spruce subzone (SBSwk1 subzone) and its transition with the Engelmann Spruce-Subalpine Fir Zone (ESSFwk2 subzone).¹² This type of Provincial Reserve is not created for outdoor recreation. Most ecological reserves, however, are open to the public for non-destructive pursuits like hiking, nature observation and photography. As well, research and educational activities may be carried out but only under permit.¹³

Sugarbowl-Grizzly Den Provincial Park and Protected Area

Unit I is situated immediately east of the northern part of the Sugarbowl-Grizzly Den Provincial Park and Protected area.

The primary roles of the park and protected area are to protect critical habitat for the Mountain Caribou, protect the historically significant Grand Canyon of the Fraser, and to provide outstanding backcountry recreation opportunities within one hour of Prince George via the Sugarbowl and Viking Ridge Trails. The secondary role of the park and protected area is to

¹⁰ DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Visual Landscape Inventory.
https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

¹¹ British Columbia Ministry of Environment, Omineca Region. 2005. BC Parks Webpages, Tacheeda Lake Ecological Reserve: Purpose Statement and Zoning Plan.
http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/tacheeda_lake_er/tacheeda_lake_er_p_s.html

¹² British Columbia Ministry of Environment, Omineca Region. 2005. BC Parks Webpages, Tacheeda Lake Ecological Reserve: Purpose Statement and Zoning Plan.
http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/tacheeda_lake_er/tacheeda_lake_er_p_s.html

¹³ British Columbia Ministry of Environment. 2013. BC Parks Webpages, Tacheeda Lakes Ecological Reserve Webpage.
http://www.env.gov.bc.ca/bcparks/eco_reserve/tacheeda_er.html

provide representation of the Upper Fraser Trench ecosection and the Interior Cedar-Hemlock very wet, cool variant (ICHvk2) biogeoclimatic zone.¹⁴

Fraser River Provincial Park

Unit J is situated immediately adjacent to the southern boundary of Fraser River Park, which encompasses an area along the west side of Fraser River just north of the confluence of Naver Creek and the Fraser River.

The primary role of Fraser River Provincial Park is to provide representation of the Quesnel Lowlands ecosection, and moist hot and dry warm Sub-boreal Spruce forests. Fraser River Provincial Park currently provides the greatest extent of representation in the protected areas system of the Quesnel Lowlands ecosection and Sub-boreal Spruce moist hot (SBSmh) and Sub-Boreal Spruce dry warm, Blackwater variant biogeoclimatic zones. In the future, a secondary role will be to provide backcountry recreation access to the Fraser River, and opportunities for wildlife and nature-related recreation associated with a large river valley.¹⁵

The area provides excellent elk, deer and moose winter range. The high ungulate winter range values can be attributed to the south easterly facing slopes, the lower elevation and milder climate, which contributes to a lower snow depth.¹⁶

The strategy for all of the Parks and the Ecological Reserves is to consult with available expertise within the British Columbia Ministry of Environment and the British Columbia Ministry of Forests, Lands and Natural Resource Operations when proposing operations immediately adjacent to the Parks or Reserve Boundaries. The coinciding strategy is to achieve outcomes from forest and research operations that do not limit the achievement of the current, primary purposes, and secondary purposes where applicable, of the potentially affected Parks and Ecological Reserves.

¹⁴ British Columbia Ministry of Environment, Omineca Region. 2005. BC Parks Webpages, Sugarbowl-Grizzly Den Provincial Park and Protected Area: Purpose Statement and Zoning Plan.
http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/sugarbowl_grizzly/sugarbowl_grizzly_ps.pdf?v=1450743905560

¹⁵ British Columbia Ministry of Environment, Omineca Region. 2005. BC Parks Webpages, Fraser River Provincial Park: Purpose Statement and Zoning Plan.
http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/fraser_river/fraser_river_ps.pdf?v=1459895694354

¹⁶ British Columbia Ministry of Environment, Omineca Region. 2005. BC Parks Webpages, Fraser River Provincial Park: Purpose Statement and Zoning Plan.
http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/fraser_river/fraser_river_ps.pdf?v=1459895694354

Proposed Development Adjacent to Provincial Parks

Proposed operations within Unit B may affect the Tacheeda Lakes Ecological Reserve. The strategy described, immediately above, will be implemented. If there is any significant direction resulting from communication with the provincial government agencies, then this Development Plan will be updated accordingly.

Park Referral Results

In December 2016, Cutblock B-1 was referred to BC Parks, Ministry of Environment, in particular to see if there were any concerns regarding planned road development near the Tacheeda Lakes Ecological Reserve. BC Parks expressed a preference for a no harvest buffer between CNC Research Forest harvesting and the Ecological Reserve boundary, however they did not specify a minimum width or size when asked. Prior to harvesting, the Cutblock B-1 boundary was adjusted for increased conservation of the riparian management area along the W1 wetland situated near the western boundary of the Ecological Reserve. With the exception of a 100m span of the Cutblock B-1 boundary, which is 17m to 50m from the Ecological Reserve, the boundary is between 50m and 165m from the Ecological Reserve.

Forest Tenure Holders

Tree Farm License 30

Tree Farm License 30, held by Canadian Forest Products Ltd, is located immediately adjacent to the eastern boundary of Unit G of the Research Forest.¹⁷

Forestry License to Cut, Special Use Permit, Road Permit, and Road-use Permit Holders

It is recognized that over time, there may be forestry licenses to cut and special use permits issued and held by various persons who may be operating adjacent to Research Forest units. In most cases, it is expected that these users will be advised of the CNC Research Forest when issued their license or permit and that they will contact CNC as necessary to coordinate planning and operations.

Forest License Holders

There are numerous small and large forest licensees within the Prince George Timber Supply Area who operate immediately adjacent to the Research Forest and who may require new road access or the use of existing roads within the Research Forest.

The strategy for all Research Forest units, in respect of adjacent or overlapping forest tenure and permit holders, is to consult with available forest tenure and road permit holders when proposing operations that may influence a neighboring license area or may involve shared road use. This may include, but is not limited to, consultation regarding timing of operations, road access planning, shared road use, old forest retention planning, and wildlife tree retention planning.

¹⁷ DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Tree Farm License. https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

Because new forest tenures and permits are regularly issued and existing tenure and permit holders change over time, the Development Plan will be annually updated to identify current forest tenure and permit holders.

Forest Licensee and BCTS Referral Results

Nearby or adjacent forest licensees that may be affected by planned operations include:

- 1) Canfor – Tree Farm License 030 and various forest licenses (Units C, D, E, F, and G),
- 2) Sinclair Group (Lakeland Mills & Winton Global) – various forest licenses (Units A, B, C, D, E, and F), and
- 3) British Columbia Timber Sales – various timber sales licenses (Units A and G)

The Management Plan was referred to British Columbia Timber Sales and the identified licensees as part of the public review process. The Management Plan referral letter identified the areas that CNC will be operating within during 2016-17. No specific concerns were brought forward as a result of this process.

As mentioned under the section titled “Old Interior Forest Objective”, retention planning within Units B, E, F, and G is designed to be complementary to the old growth recruitment area that is being implemented by forest licensees and BCTS within the McGregor Plateau area.

More recently, BCTS and Canfor has been contacted about potential widespread salvage in Unit G and the potential combined impacts on the upper-Angusmac watershed. Currently assessed by Canfor, the watershed has the capacity for approximately 1,700ha of harvest while CNC is proposing up to 750ha of harvesting.

Regular sharing of harvesting operations with all forest tenure holders is also occurring through the Prince George Timber Supply Area Beetle Working Group.

Road Use Coordination Results

Where Canfor, the Sinclair Group, and other licensees hold road permits or road-use permits that may be affected by planned CNC road use, contact will be made prior to the start-up of operations to coordinate road use and maintenance.

Unit C and D Road Use:

During the summer of 2016, there were discussions with Canfor over continuing use of the main Caine Creek Road (Canfor Road Permit R02852) north of 14Km. Canfor was originally planning to remove and reuse the road bridges along this portion of the road, but agreed to leave them in place while harvesting operations were underway within CNC Units C and D. The long-term existence of these Canfor installed bridges on the Caine Road is not certain at this time.

Road Use Associated with Units A, B, E and G:

Regarding the log hauling for 2017-18 Cutblocks within Units A, B, E and G, CNC was not made aware of any notable issues regarding road use on the Davie-Muskeg FSR (and tributaries), the

6900 Road (Canfor road permit R01863), the 700 Chuchinka-Bear Lake FSR, the 700 Chuchinka FSR, and the Chuchinka-Colbourne FSR.

Trapping, Guiding, and Range Tenures

The Research Forest is widely spread over a number of trapping and guiding tenures. These tenure holders are identified in Table 9 along with each overlapping forest unit.

Trapping cabin locations near the boundary of Unit J (trapping license 710T003) are identified within the Provincial natural resources dataset.

A hunting camp near the northern boundary of Unit E (guiding license 716G001) is identified within the Provincial natural resources dataset.

Table 9. Trapping and Guiding Licenses Overlapping with the Research Forest¹⁸

Unit	Trapper	Provincially Mapped Cabins or Other Sites	Guide/Outfitter	Provincially Mapped Cabins or Other Sites
A	716T008, 724T004		724G002	
B	716T008		716G001	
C	724T004, 714T010		724G002	
D	724T004		724G002	
E	716T007, 716T008		716G001	Hunting Camp
F	716T007, 716T006		716G001	
G	716T006, 716T005		716G001	
H	707T004		707G001	
I	705T012		705G001	
J	710T003	Two Cabins	710G003	
K	707T001, 709T004		709G001	
L	709T004		709G001	

It is recognized that in some cases the activities associated with a trapping license may also be associated with a First Nation's treaty or aboriginal rights. Therefore, some trapline holders or users may be contacted more than once about proposed Research Forest operations as a result of information being provided directly to stakeholders as well as First Nations' offices.

Units K and L, near the Willow River, are located within a range tenure associated with the licensed hunting guide territory.¹⁹

¹⁸ DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Traplines and Guide Outfitter Areas.

https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

The strategy, in respect of the overlapping trapping, guiding and range tenures, is to consult with available trappers and guides (guides hold the range tenures) when proposing operations that may influence a trapline, guiding area, or range resources. This may include, but is not limited to, consultation regarding timing of operations, road access planning, shared road use, old forest retention planning, and wildlife tree retention planning.

The specific timing of operations may be very important to trapping, guiding, and range tenure holders. Therefore, prior to initiating operations, that may influence their territories, the holder will be notified of the commencement date and the approximate duration.

Because trapping and guiding license holders change over time and new range tenures may be issued, the Development Plan will be annually updated to identify current trapping, guiding, and range tenure holders.

Trappers and Guides Referrals

For operations proposed for 2017-18 and beyond, referrals identifying newly designed cutblock development within Units A, E, and F was sent to affected trappers and guides. This includes:

- 1) Guiding License 716G001 Vince Cocciolo (Units E, F, and G)
- 2) Guiding License 724G002 Steve Saunders (Unit A)
- 3) Trapping License 724T004 – Matthew and Daniel Morris (Unit A)
- 4) Trapping License 716T008 – Albert and Eugene Isadore (Unit A and B)
- 5) Trapping License 716T007 – See Guiding License 716G001 (Units E and F)
- 6) Trapping License 716T006 – Micheal and Earl Erickson (Unit F)

The Management Plan was also referred to all trapline holders as part of the public review process.

In addition to all of the above, stakeholders will be notified 2 weeks prior to the start-up of any harvesting and road building operations.

The referrals and notifications sent to the Trappers and Guides for Units A, E, and F are provided in Appendix E.

Trappers and Guides Referral Results

Applicable to Research Forest Units B, E, and F

After receiving operational referral information from CNC during 2016, Vince Cocciolo, who holds guiding license 716G001 and trapping license 716T007, met with the Manager of the CNC Research Forest to discuss potential conflicts between his guiding and trapping activities. Overall, he was supportive of all forestry activities and did not recognize any conflicts between CNC and his businesses. Vince did express concerns about the potential volume of log hauling traffic on the Chuchinka 700 and Chuchinka-Colbourne Roads during his peak guiding season (mid-September to mid-October). At this time, a notable amount of timber hauling along the

¹⁹ DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Range Tenure. https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

aforementioned roads is not planned for the late September and early October period. If there is a future need to increase the volume of timber hauling during this period, then further discussions with Vince regarding road-use will be undertaken.

Applicable to Research Forest Units A, E, and F

The applicable trappers and guides were providing a letter and mapping to show the proposed development with Units A, E, and F as a result of the recent advancement of beetle. The maps included the planned biodiversity corridors that are to be implemented to conserve old forest, biodiversity and wildlife habitat. The referral also advised that harvesting within Unit A may begin this summer while harvesting within Cutblocks E-5, E-6, F-5 and F-6 may start in September. To date, the trappers and guides have not raised any concerns or necessary actions to accommodate trapping and guiding use as a result of the current referral or past referrals.

Applicable to Research Forest Other than A to G:

Don Wilkins, representing trapping license 707T004 in which Unit H is located, has expressed repeated interest in reviewing and being involved in CNC forest development planning within Unit H. Don Wilkins received a copy of the previous Development Plan, but with no development planned for Unit H, he was not interested in further discussing CNC operations. There is a commitment to ensure Don Wilkins is involved in any future development planning that may occur for Unit H.

Range Tenure Referrals

There is no range tenure affected by proposed operations.

Mining Tenure and Notice of Work

There are mining tenures within all the units of the Research Forest, but there is only one active Notice of Work for current exploration or mining activities, which is located in the area of Unit L along the Willow River.²⁰

With respect to the ongoing mining operations affecting Unit L and in the event of a new Notice of Work, the strategy for all Research Forest units is to consult with available expertise within the British Columbia Ministry of Energy and Mines and the British Columbia Ministry of Natural Gas Development and consult with the exploration/mining proponent in coordinating forestry development and research activities with exploration and mining activities. This may include, but is not limited to coordination of road access management, old forest retention planning, and wildlife tree retention planning.

None of the proposed operations are expected to affect any existing mining tenure or active notice of work for mining.

²⁰ DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Mineral, Placer and Coal Tenure.
https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

Other Land Tenures

A communications site and an associated access right-of-way is located within the southern end of Unit G.

The objective, in respect of the overlapping land tenure right-of-way, is to appropriately involve the Ministry of Forests, Lands and Natural Resource Operations in planning regarding forest development and research projects, so that any existing and future use of the communication site and right-of-way may be appropriately accommodated.

Other Land Tenure Referral Results

Unit G – Communication Site

In September 2016, the Prince George Natural Resource District office informed CNC that the communication site is held by Telus and provided CNC with contact information. CNC contacted Telus by phone and email to explain the harvesting operations proposed within Cutblock G-4. This included information that CNC harvesting is proposed within the right-of-way tenure for the communication site. Telus did not have any objections or concerns. As a result of the communications with Telus, CNC committed to providing post-harvest information to Telus (pictures and information showing the communication site and the resulting adjacent harvesting). Pictures of the resulting harvesting adjacent to the communication site were sent to Telus on June 9, 2017. To date, there has been no response from Telus regarding the post-harvest update.

Adjacent Land Owners

The western boundary of Research Forest Unit B is immediately adjacent to privately held land as is displayed on the Management Plan Content Maps within Appendix G.²¹

The strategy, in respect of these lands, is to consult with the land owner when proposing operations that may influence the adjacent lands. This may include, but is not limited to, consultation regarding timing of operations, road access planning, shared road use, visual quality planning, old forest retention planning, and wildlife tree retention planning.

Land Owner Referral Results

The operations planned for Unit B may include area near or adjacent to the private lands described above. The Forestry Manager for the McLeod Band provided the owner of this land the same cutblock referral information that was sent to the McLeod Lake Band, the trappers and

²¹ DataBC, Province of British Columbia. 2016. Geographic Dataset – TANTALIS – Crown Tenures.

https://catalogue.data.gov.bc.ca/dataset?q=tantalis&download_audience=Public&type=Geographic&sort=score+desc%2C+record_publish_date+desc&page=1

guides (see maps provided within Appendix E of the 2016-17 Development Plan). This referral process did not bring forward any concerns from the landowner regarding the CNC proposed operations.

Archaeological and Cultural Heritage Resources

There are no previously identified archaeological sites within or immediately adjacent to the Research Forest units, but there is potential for new findings with the completion of future assessments.

There is also potential for future cultural heritage resource findings within or adjacent to Research Forest units. When discussing cultural heritage resources, this plan is referring to resources, sites or features important to the culture, traditional use, treaty rights and aboriginal rights of a First Nation. It is recognized that a cultural heritage resource may have various meanings that are unique to a First Nation and unique to a Nation's treaty and aboriginal rights. By regularly referring proposed operations to affected First Nations, there will be multiple opportunities for a First Nation to communicate about cultural heritage resources and provide the necessary knowledge, advice, and input to CNC.

The objective with respect to Archaeological and Cultural Heritage Resources is to provide reasonable opportunities for potentially affected First Nations to be involved in the assessment and the management of archaeological and cultural heritage resources. In order to achieve this objective, the following strategies will be undertaken:

- 1) Offer opportunities for First Nations members to be involved in identifying and assessing archaeological and cultural heritage resources;*
- 2) All proposed cutblocks and roads will be referred to the affected First Nation(s) for a period of 30 days in advance of operations (or another length of time as agreed with the affected First Nations), so that the First Nations have an opportunity to offer knowledge and input;*
- 3) Where operations are planned to remove forest cover, the following assessments will be undertaken to identify archaeological and cultural heritage resources and to provide recommendations regarding their conservation and protection:
 - a) Where an area is not covered by a provincially recognized Archaeological Predictive Model or a previous Archaeological Overview Assessment, an Archaeologist will undertake an Archeological Overview Assessment and/or Preliminary Field Assessment to identify potential archaeological sites and to identify cultural heritage resources;*
 - b) Where an area is covered by a provincially recognized Archaeological Predictive Model or Mapping or a previous Archaeological Overview Assessment, an Archaeologist will undertake an Archeological Overview Assessment and/or Preliminary Field Assessment to identify potential archaeological sites and to identify cultural heritage resources; and*
 - c) Where the potential for a cultural heritage feature is identified by a First Nation or a person with interests in the area, an Archaeologist will undertake an Archaeological Overview Assessment and/or Preliminary Field Assessment to identify cultural heritage features or potential archaeological features.*
 - d) Where there is potential for archaeological resources as identified by a First Nation, a person with interests in the area, an Archaeological Predictive Model, an Archaeological Overview Assessment or Preliminary Field Assessment, an Archaeologist will undertake or oversee an Archaeological Impact Assessment;**

- 4) *Archaeological or cultural heritage resource findings from any field assessments completed by an Archaeologist are to be shared with the affected First Nation(s) for a period of 30 days in advance of operations (or another length of time as agreed to with the affected First Nations), so that the First Nation(s) has a reasonable time to offer knowledge and input;*
- 5) *Reasonable efforts to incorporate a First Nation's input regarding conservation or protection of an archaeological or cultural heritage site will be undertaken, particularly as it relates to a treaty right or an aboriginal right; and*
- 6) *Where a previously unidentified site, which is expected to be an archaeological or cultural heritage site, is discovered while undertaking a forest practice or research, the forest practice or research will be modified or stopped to protect the remaining site until it may be assessed, referred, and incorporated into plans and final designs as described in items 1 to 5 above.*

Archaeological and Cultural Heritage Resources Assessment Results

Prior to forest development, the potential for archaeological resources (and coinciding cultural heritage resources) is determined using a standardized scoring protocol developed by an archaeologist. This potential rating is then reviewed by an archaeologist who takes into account other critical site information and historic information. These combined activities are expected to fulfill the requirement under item 3) a), above, to complete an archaeological overview assessment where there is no recognized Archaeological Predictive Model.

Archaeological Assessment Results for Units A, B, E, and G

Archaeological assessments were completed for Cutblocks A-2, A-8, A-3, A-4, A-5, A-6, B-2, E-5, E-6, E-7, E-8, G-5, G-6, G-7, G-8, G-9 and G-10 since the last Development Plan including archaeological impact assessments (AIA) for areas within Cutblocks E-8 and G-6. An AIA was completed for Cutblock G-2 in 2010 . There were no findings as result of the various assessments and no further assessment of the aforementioned cutblock areas is being considered at this time.

The archaeological assessments for the aforementioned cutblocks are available in Appendix F.

All Forest Health Factors

As per the "Current Management Challenges" section of this Management Plan, the Research Forest is expected to experience notable occurrences of forest pathogens, insects, and other forms of natural damage within all types of forest stands. This presents a regular challenge for on-going timber supply management and for implementing strategies to conserve and protect various forest resources. Given the significant ongoing and future forest health hazard for both mature and young timber, forest health management is expected to be an ongoing management focus.

The objective for forest health management is to minimize the risk to timber loss while conserving and protecting natural resources consistent with all the objectives within this plan.

This is to be achieved by (the following strategies do not apply to existing pine mortality from mountain pine beetle):

- 1) Implementing annual aerial detection and assessment of forest health factors;*
- 2) Implementing ground reconnaissance, inspections, or assessments for any areas identified having a non-endemic level of forest health factors from aerial detection or other fieldwork;*
- 3) Undertaking previously recognized insect trapping and baiting treatments to hold or suppress insect populations where there are non-endemic levels of insect attack and where adjacent stands are assessed with a high hazard for insect attack;*
- 4) Undertaking experiments within mature forests, young forests, and clearcut areas to evaluate new trapping and baiting treatments for conifer bark beetles.*
- 5) Undertaking sanitation and salvage harvesting treatments of various sizes and forms within stands greater than 50 years old, prior to sawlog shelf-life expiry, where there is a moderate to high likelihood of the stand being reduced to less than 140m³/ha of net live conifer timber;*

A cutblock is deemed a required salvage operation when the current amount of live timber (or predicted amount of live timber within 2 years) equates to 140 m³/ha of net timber volume or 130 m³/ha of sawlog volume. Due to speculative value of subalpine fir (balsam), stands that are dominated by live balsam volume (>75%) may also be considered salvage stands even where the live volume exceed 140 m³/ha of net volume or 130 m³/ha of sawlog volume.

- 6) Where possible, coordinate forest health treatments with adjacent forest tenure holders to improve effectiveness of treatments for areas within and outside of the Research Forest;*

CNC continues to participate in the Prince George Timber Supply Area Beetle Working Group, which has included updates on current and proposed operations and sharing of beetle information gained from forestry operations and experiments. CNC and Dunkley have also been in discussion with other forest licensees concerning harvesting operations, log hauling and road-use.

During the spring and summer of 2017, CNC collected spruce bark beetles from forested sites in the Chuchinka Creek area and provided the bark beetle catches and information to Natural Resources Canada so that they more accurately determine the temperature thresholds for spruce bark beetle. The results of this study have not been released.

- 7) Subject to considering biodiversity, riparian, water quality, and wildlife habitat values, undertaking sanitation treatments, and re-stocking if necessary, in young, managed stands (0 to 20 years old) where there is moderate to high likelihood of not achieving 160m³/ha of conifer yield by age 65 without treatment (the volume threshold will be evaluated on the average yield of the existing cutblock containing the effected stand);*

To date, there have been no areas identified for treatment within cutblocks reforested under a CNC Research Forest Management Plan.

8) *Subject to considering biodiversity, riparian, water quality, and wildlife habitat values and subject to Provincial funding, undertaking partial cut or clearcut sanitation and salvage harvesting treatments, and re-stocking, if necessary, in intermediate aged stands (21 to 50 years of age) where there is moderate to high likelihood of not achieving 160m³/ha of conifer yield by age 65 without treatment. (The volume threshold will be evaluated on the average yield of the existing cutblock or the expected future cutblock containing the affected stand. The maximum forecasted mid-term timber supply effect of forest health treatments in stands 21 to 50 years old is to be less than an average of 500m³/year during the 10 to 60-year period.); and*

A thorough assessment of the intermediate-aged stands within the Research Forest has not been undertaken. It is expected that any potential treatment areas may be initially identified using available provincial information, new inventory data, LiDAR data, and recent imagery. There should be reasonable provincial information for most of the intermediate-aged stands within the Research Forest as most are a result of previous harvesting. Any areas identified from the available information will require additional verification from ground reconnaissance.

9) *When considering isolated occurrences of forest health factors, other than bark beetle, the minimum treatment size is 15ha.*

10) *When undertaking harvesting treatments under objectives 3, 4 or 6, the objectives concerning retention of trees are to be achieved regardless of forest health factors.*

Forest Health Assessment Results

The total Research Forest area is assessed for forest health factors via a combination of self-implemented aerial and/or ground assessment along with provincial aerial assessments. A self-implemented aerial overview assessment of Research Forest Units was conducted on January 24th. Units A, B, C, D, E, F and part of G were viewed via a helicopter flight. In early June, Units J, K and L were viewed and assessed from a helicopter. Later in June, Units A, B, E, F and G were viewed again by helicopter. As of this time, no recent helicopter flight has been undertaken for Units H and I. The provincial low-level helicopter reconnaissance conducted in the fall of 2017 near Purden Lake indicated some small areas of Douglas-fir beetle attack within Unit H. This will be further self-assessed in 2018.

Research Forest Unit A

The helicopter flight during January 2017 observed scattered spruce beetle attack with yellowing and browning spruce trees throughout the majority of the mature stands. The small valley that drains eastward from Unit A currently has heavy spruce beetle attack as noted by an abundance of browning spruce trees from the top of the valley to the Research Forest boundary. A walk-through reconnaissance of this valley area and all of the remaining mature stands during spring 2017 is required to better assess the current levels of spruce beetle attack throughout Unit A.

The flight in late June 2017 detected a much higher amount of yellowing and browning of spruce trees throughout Unit A, representing a much greater level of spruce beetle attack than was observed earlier in 2017. Timber cruising was completed in the late spring/early summer for planned Cutblocks A-2 and A-8, which are located along the eastern boundary of Unit A, south of the small valley described in the January flight. The average level of combined beetle attack

and blowdown within spruce is 98%. A-2 and A-8 are salvage cutblocks based on the remaining live net volume.

Spruce beetle was found to be spread throughout the remaining mature stands in the southern portion of Unit A. Cutblocks A-3, A-4 and A-5 were laid-out during summer 2017 to address the widespread spruce beetle damage in Unit A. Timber cruising was completed this summer with the following combined beetle and blowdown damage results for A-3, A-4, and A-5.

Cutblock	Total Conifer Damage	Total Spruce Damage
A-3	55%	99% (salvage treatment)
A-4	43%	96% (salvage treatment)
A-5	57%	87% (salvage treatment)

Research Forest Unit B

A flight was conducted in January 2017 that recorded notable heavy spruce beetle attack in the northeastern portion of Unit B as well as large areas within the southern portion of Unit B. The flight in late June 2017, along with on-ground timber reconnaissance during spring/summer 2017 confirmed the wide distribution of bark beetle attack across Unit B.

Cutblock B-2, located in the southern portion of Unit B, was laid-out during the spring/summer of 2017 due to heavy spruce beetle attack. B-2 was timber cruised in the summer of 2017, the results of which measured that 62% of the total forest volume is damaged from beetle and blowdown and that 79% of the total spruce volume is damaged. B-2 is a salvage cutblock based on the remaining live net volume.

Research Forest Unit C

No further salvage or sanitation is planned for the remaining stands within Unit C. There is a sizeable area of mature balsam-leading forest in the northwestern portion of Unit C, but due to the limited spruce content and younger stand age, the stand is not expected to be altered significantly by spruce bark beetle.

Research Forest Unit D

The remaining mature timber within Unit D is composed primarily of prescribed riparian/lakeshore reserves and wildlife tree retention, and therefore no substantial salvage or sanitation operations are planned. As of the late June 2017 flight, a significant portion of the prescribed mature forest retention has bark beetle damage.

Research Forest Unit E

A flight, conducted in January 2017, recorded obvious heavy spruce beetle attack between Cutblock E-2/E-3 and Chuchinka Creek in the northeastern portion of Unit E, and heavy spruce beetle attack south of Cutblock E-2 and E-4. Cutblocks E-5 (south) and E-6 (north) were laid-out for sanitation/salvage harvesting. Timber cruising was completed this summer with the following combined beetle and blowdown damage results for E-5 and E-6.

Cutblock	Total Conifer Damage	Total Spruce Damage
E-5	66%	92% (salvage treatment)
E-6	64%	78% (salvage treatment)

There are also two notable patches of recent spruce beetle attack (approximately 20ha each) south and southwest of Cutblock E-1. The flight in late June confirmed bark beetle attack and spruce mortality in the areas described above. Ground reconnaissance further confirmed recent spruce beetle attack south and southwest of Cutblock E-1. Cutblocks E-7 and E-8 were laid-out for sanitation/salvage harvesting. Timber cruising was completed this summer with the following combined beetle and blowdown damage results for E-7 and E-8.

Cutblock	Total Conifer Damage	Total Spruce Damage
E-7	23%	31% (small sanitation/salvage treatment)
E-8	18%	30% (small sanitation treatment)

Research Forest Unit F

A flight conducted in January 2017 also detected patches of notable spruce beetle attack in the southern end of Unit F.

Another flight in late June confirmed the bark beetle attack and spruce mortality in the southern portion of Unit F. Ground reconnaissance has confirmed significant spruce beetle attack in the southeastern portion of Unit F, and further spruce beetle attack is expected in other areas within the southern half of Unit F. Cutblock planning is in progress, but is currently deemed a lower priority than other extensive spruce beetle attacks observed in other Research Forest units. Cutblock laid-out is expected occur during the winter and spring of 2018 as conditions allow.

Research Forest Unit G

The harvesting of Cutblock G-3 and G-4 areas within the southwestern portion of Unit G was completed in March 2017. Baiting and trap trees were deployed as part of the sanitation and salvage operations, but further bark beetle attack originating from neighbouring areas is expected within Unit G. The January 2017 flight was unable to confirm this as snow cover on the mature trees reduced detection ability. The subsequent flight in late June 2017 found significant yellowing and browning of spruce, particularly across the mid-slope position within northeastern portion of Unit G. Road building and sanitation/salvage cutblocks are currently being planned for the northeastern portion of Unit G.

On ground reconnaissance confirmed moderate to heavy spruce beetle attack within the mid to northeastern portion of Unit G. Six large cutblocks were laid-out during spring/summer 2017 to address the operable spruce and spruce/balsam stands with moderate to high damage. Cutblock G-2 was laid-out in previous years, but is now planned for harvest due to high spruce beetle damage. Timber cruising was completed this summer with the following combined beetle and blowdown damage results for the seven cutblocks (including Cutblock G-2).

Cutblock	Total Conifer Damage	Total Spruce Damage
G-2	49%	84% (salvage treatment)
G-5	46%	83% (salvage treatment)
G-6	39%	83% (salvage treatment)
G-7	37%	65% (salvage treatment)
G-8	47%	85% (salvage treatment)
G-9	39%	56% (salvage treatment)
G-10	44%	48% (large sanitation/salvage treatment)

Unit H

This area is rated with the lowest risk for bark beetle attack. Provincial aerial assessments have not identified any bark beetle activity or other significant forest health factors, so it has not been assessed further.

Unit I

Bark beetle attack is occurring in the Purden Lake area, so the risk associated with this Research Forest unit has increased during 2017. Provincial aerial assessments have identified small areas of Douglas-fir bark beetle attack. This will be further assessed in 2018.

Unit J

A flight in early June 2017, showed what appeared to be endemic spruce beetle attack, mostly within the riparian area along the park boundary. There was also a couple small patches of recent Douglas-fir mortality, which was assumed to be Douglas-fir beetle as increases in Douglas-fir beetle attack are also noted in other areas near Prince George and Quesnel. Due to the younger age of the spruce and Douglas-fir and mixed forest composition, widespread bark beetle outbreaks are not expected, but the area will be monitored for further beetle activity.

Unit K and L

These units were assessed during the flight in early June. No notable forest health factors were seen from the air within Unit L, but one small patch of mature spruce/balsam mortality was noted in the northwestern portion of Unit K. This is expected to be mostly balsam mortality, however this area will be ground assessed to confirm the affected tree species and the responsible forest health factor.

Forest Health Treatment Results

Research Forest Unit A

All of the cutblocks identified under Forest Health Assessment results are considered salvage harvesting operations due to the low remaining live volume. Harvesting is largely completed on cutblocks A-2 and A-8 and, due to scheduling of harvesting contractors, the remaining cutblocks are planned for harvest during the summer of 2018, as conditions allow.

Due to the widespread distribution of the spruce beetle attack and the high level of current attack, control measures (baiting and trap trees) are not expected to provide substantial control over bark beetle dispersal within the Research Forest or to neighbouring areas.

For the purposes of old forest conservation, forest biodiversity maintenance and wildlife habitat conservation, a number of interconnecting riparian reserves and wildlife tree retention area are planned where no sanitation or salvage treatment is planned.

Research Forest Unit B

The salvage harvesting for Cutblock B-2 was started in September 2017 and will be finished during the winter of 2018.

Further sanitation or salvage harvesting will be considered for the remaining steeper portions of Unit B for potential harvesting in 2018 and 2019, however this is subject to being able to continuously achieve the visual quality objectives.

For the purposes of old forest conservation, visual quality maintenance, forest biodiversity maintenance and wildlife habitat conservation, a number of interconnecting riparian reserves and wildlife tree retention area are planned where no sanitation or salvage treatment is planned.

Research Forest Unit E

The salvage harvesting planned as Cutblocks E-5 and E-6 will be started in the winter of 2018 and completed in the summer of 2018.

The sanitation harvesting planned as Cutblocks E-7 and E-8 is planned to be completed during the winter of 2018, prior to the spring 2018 spruce beetle flight.

No other sanitation and salvage volume is being planned at this time.

Research Forest Unit F

Further sanitation and salvage cutblocks are being planned for the southeastern portion of Unit F. Other areas in the southern half of Unit F will be considered for sanitation and salvage harvest based on the extent of bark beetle attack. This harvesting is expected to occur during both the winter and summer of 2019.

For the purposes of old forest conservation, forest biodiversity maintenance and wildlife habitat conservation, interconnecting riparian reserves and wildlife tree retention areas are planned within the southern half of Unit F.

Research Forest Unit G

All of the cutblocks currently laid-out, which includes (G-2, G-5, G-6, G-7, G-8, G-9, and G-10) are planned for harvest during the late fall of 2017 and winter of 2018. This totals over 600 ha of mostly salvage harvesting, with G-10, in the northeastern end, being a combination of salvage and sanitation harvesting. The expectation is that all of the volume will be removed prior to the spring 2018 spruce beetle flight.

For the purposes of old forest conservation, forest biodiversity maintenance and wildlife habitat conservation, interconnecting riparian reserves and wildlife tree retention areas are planned amongst the seven cutblocks.

Research Forest Units H and I

These units will be assessed for forest health factors by aerial flight in 2017.

Research Forest Unit J

There is a moderate hazard of further spruce or Douglas-fir beetle attack within Unit J. Further regular monitoring is necessary to watch for mortality in mature spruce and mature Douglas-fir stands.

Research Forest Unit K

The small patch of spruce/balsam mortality detected from the early June helicopter flight will be assessed by ground during the summer of 2017. The findings will be incorporated into future Development Plan amendments or replacements.

Research Forest Unit L

There is no notable forest health activity present. This area will be reassessed by helicopter in 2018. A free growing assessment of the previous CNC harvesting will be completed in the summer of 2017, which will provide further health information for the majority of the young stands within Unit L.

Spruce Beetle Collection during Spring and Summer 2017

During the early spring of 2017, CNC installed funnel traps with spruce beetle lures at three sites with the Chuchinka Creek area, along with temperature monitors. The intent was to set-up traps prior to the initiation of the spruce beetle flight, and to provide regular (weekly) beetle collections to Natural Resource Canada throughout the entire 2017 beetle flight. Natural Resource Canada will subsequently use the collections, along with other collections, to determine the temperature thresholds for the initiation and completion of spruce beetle flights for the Prince George area. CNC will use the information to aid in confirming or refining the strategies for the storage and transportation of spruce beetle infested logs within the Hart Log Yard.

Forest Health Experimental Results

2016 Spruce Beetle Funnel Trapping Trials

One funnel trapping trial was implemented to test the effectiveness of a new funnel trap design within mature spruce/balsam stands. The new funnel trap designs were not successful in capturing increased amounts of spruce beetle compared to the standard Lindgren funnel traps.

The other funnel trapping trial was implemented to test the effectiveness of adding an ethanol vapor component to individual funnel traps within a recent clearcut and within a mature spruce/balsam stand. There was no significant difference in spruce beetle catch between the traps with ethanol enhanced lures and the traps with traditional lures.

At this time, it is uncertain whether further studies into potential funnel trap and beetle lure improvements will be implemented with the Research Forest.

Mountain Pine Beetle Salvage

The remaining areas of mountain pine beetle damaged pine-leading stands within the Research Forest are now reaching the end of their economic shelf-life due to remaining volume per hectare and degradation of wood quality.

The objective for pine-leading stands killed by mountain pine beetle is to salvage remaining fibre value and return sites to productive conifer forests, subject to considering biodiversity, riparian, water quality, and wildlife habitat values. This will be achieved through the following strategies:

- 1) Salvage harvesting damaged pine-leading areas greater than 15ha, if there is remaining pine sawlog shelf-life as determined through an in-field assessment, where the average net tree size is greater than 0.18m³/tree and average tree height is greater than 22m*

and where the remaining live trees are not expected to achieve 160m³/ha of conifer yield by age 65 (this only applies when undertaking the harvest of adjacent stands where the average volume per hectare across all the areas – pine salvage area and adjacent stands -- is greater than 180m³/ha of net conifer timber); and

- 2) *Isolated damaged pine-leading stands less than 15ha or stands that have exceeded sawlog shelf life as determined from an in-field assessment, will be considered for rehabilitation treatments and full re-stocking where the remaining live trees are not expected to achieve 160m³/ha of conifer yield by age 65 (rehabilitation treatments are dependent on the availability of Provincial funding).*

Units A, B, E, F, J and L

There are currently no plans to harvest or rehabilitate the areas occupied by standing dead pine within Units A, B, E, F, I, J, K and L, which totals approximately 300ha. In most cases, these areas contain a low volume of dead pine for salvage that is of marginal quality. These areas also contain a moderate to good density of mature spruce-leading, balsam-leading or Douglas-fir-leading (Unit J) timber. Many of these remaining live tree layers are expected to produce merchantable volume in the foreseeable future. In addition, a notable amount of these dead pine occupy riparian areas, rare ecosystems (SBS wk1 02, 03, and 04), and uncommon mature forests (aspen and Douglas-fir leading in Units A to G) and therefore are planned for inclusion in prescribed tree reserves and biodiversity corridors. There is no harvest priority associated with the dead pine stands under the current timber supply review and under current operational plannings, and all dead pine volume is now considered non-operable. Dead pine stands do not contribute the volume to the forecasted allowable annual cut.

It is possible that portions of the remaining dead pine areas may be included with spruce beetle harvesting proposed for 2017/18, but the included area should be minimal.

Mountain Pine Beetle Salvage Results

The following summarizes the remaining dead pine stands as identified within the 2017 CNC forest inventory.

Unit A

There is 32 ha of dead, mature pine stands remaining in the northeast portion of Unit A. At this time, the vast majority of this area is planned for biodiversity retention. There is a high component of Douglas-fir throughout these stands and much of area is SBS wk04 (rare ecosystem) on steep terrain with rock outcrops.

Unit B

There is 13 ha of dead, mature pine stands remaining in the northwest portion of Unit B, but the area is not contiguous and is largely within a retention visual quality objective. The entire area of pine is planned for biodiversity and visual quality retention.

Unit C

There are no remaining mature pine stands within this unit.

Unit D

There are no remaining mature pine stands within this unit.

Unit E

In the most-southeastern portion of Unit E, there is a 19 ha stand of dead mature pine timber. This area is not planned for harvest due to the steep slopes and the relatively low volume of damaged pine. The area also supports a significant volume of live balsam-leading timber that is expected to provide future merchantable volume.

In the northeastern portion of Unit E, there is an 11 ha stand of beetle attacked mature pine-leading timber. This area is not planned for harvest as the damaged pine volume is relatively low and the area supports a significant volume of live spruce-leading timber that is expected to provide future merchantable volume.

There is 62 ha of beetle attacked mature pine stands that are somewhat contiguous throughout the southwestern portion of Unit E. Approximately half of the area is planned for biodiversity retention, particularly those stands that support live aspen-leading timber, Douglas-fir leading timber or that support rare SBS wk1 03 and 04 ecosystems. The majority of the other stands contain significant live volumes of spruce or balsam leading timber that are expected to provide future merchantable volume.

Unit F

There are no contiguous pine-leading areas > 15 ha. In total, there is 36 ha of beetle attacked mature pine timber remaining in the southern half of Unit F. Another 7 ha remains adjacent to the eastern boundary of Cutblock F-4 as a prescribed wildlife tree retention area. The majority of the 36 ha is not planned for harvest as it will be maintained for conservation of riparian area, rare SBS wk1 02 ecosystems, mature aspen, forest cover diversity, and wildlife habitat.

Unit G

There are no mature pine stands remaining within Unit G.

Unit H

There are no mature pine stands within Unit H.

Unit I

There are two dead, mature pine areas identified within the 2017 forest inventory. One is approximately 8 ha and is located west of the small lake within a wetland and bog complex. This area is currently planned to be reserved from harvesting to conserve the wetland complex. The other pine area is approximately 3 ha and is located near the highway, partly within the partial visual quality objective that runs parallel to the highway. This area will be left to grow as it also supports a good density of spruce-leading forest.

Unit J

There is approximately 59 ha with a dead, mature pine layer, but it is distributed in 11 separate patches within the western half of Unit J. These same patches support a moderate density of Douglas-fir or spruce-leading mature timber, while the average dead pine density is relatively low (approximately 200 stems/ha). Virtually all of this area is operable for future harvest, but the low dead pine density makes this area a low salvage priority.

Unit K

There is approximately 11 ha of dead mature pine in the southeastern portion of Unit K located on the steep slopes above Pitoney Creek. This area will be retained to maintain riparian values, slope stability, visual quality. This area also supports a good density of mature spruce.

There is approximately 42 ha of area that supports dead, mature pine along the western side of Unit K. It is not fully contiguous area, but there is one patch that is 26 ha. Nearly all of the 42 ha is located within a retention visual quality, and approximately 12 ha is located on the steep slopes above the Willow River. There is a moderate density of mature spruce growing throughout these areas while the dead pine density is relatively low (200 stems/ha). Harvesting across about 30 ha of the area may be operationally feasible in the future, but will be undertaken to capture the spruce timber. No operations are planned to salvage the low density dead pine through these areas.

Unit L

There is a 1 ha area located within the west, central area of Unit L that is identified as have a dead mature pine layer. It is part of the larger area that was not chosen for harvest when the area was salvage harvested for pine. This area has a low mature spruce density, but will be left to grow and develop along with the remaining mature forest areas within Unit L.

Spruce Beetle Sanitation and Salvage

A very large outbreak of spruce beetle attack on mature spruce trees is being experienced largely in the northeast portion of the Prince George Forest District (Parsnip River and Crooked River drainages). At the time of writing this Management Plan, this current outbreak has affected the majority of the mature spruce timber throughout Research Forest Units C and D. As well, a large amount of attack has been detected in Units E, F, and G. Greater than endemic levels of spruce beetle attack have also been observed in portions of Unit B.

The objective with respect to spruce beetle is to rapidly reduce beetle populations within all Research Forest units and rapidly recover the commercial value of attacked trees. This will be achieved through the following results and strategies:

- 1) Within areas that are not prescribed for the conservation of natural resources, the goal is to limit non-salvaged losses from spruce beetle to 20,000m³ over five years;*
- 2) Undertaking the regular detection, treatment, sanitation, and salvage of spruce beetle affected areas as per the strategies under the section "All Forest Health Factors"; and*
- 3) Collaborating with business partners to implement hauling and milling strategies consistent with current best management practices distributed by the Ministry of Forests, Lands, and Natural Resource Operations.*

Spruce Beetle Sanitation and Salvage Results

Non-salvaged Losses

Since the spruce beetle outbreak and salvage harvesting has only occurred for 2+ years, there is no estimate of predicted non-salvageable losses from spruce beetle within the Research Forest. Predictions of non-salvageable losses may be included in future Development Plans, as applicable.

Sanitation and Salvage Harvesting

The efforts to reduce spruce beetle populations and salvage infested volume are described under the “Forest Health Treatment Results”

Hauling and Milling Plans

A large portion of the logs harvested during the winter of 2017 were temporarily stored at the log yard located south of Bear Lake on the east side of the Hart Highway. This is an operational necessity as there is not enough trucking resources to move the logs from the Bear Lake area to the Dunkley Sawmill (primary destination of most logs) due to the long haul return time. In some cases, there are further hauling limitations due to safe logging truck numbers on certain sections of forest road.

Approximately half of the volume stored at the log yard was spruce logs, of which the majority was spruce beetle attacked. Hauling from the log yard to the final mill destinations has occurred continuously throughout the winter and was increased dramatically after March. Much of the log hauling occurred during the current spruce beetle flight, which began approximately about the middle of May. Funnel traps were installed in the log yard in early May to monitor beetle emergence and to schedule truck hauling accordingly. Hauling continues from the log yard at the time of this Development Plan.

Starting in April 2017, hauling from the log yard will prioritize the removal of full length spruce/balsam decks and large diameter cut-to-length decks. The hauling from the log yard will be restricted to night shift when temperatures are between 16°C and 25°C and spruce beetle is present in funnel traps. No hauling is to occur when temperatures exceed 25°C and spruce beetle is present in funnel traps. In addition to appropriately removing decked logs, the bark debris within the log yard will also be disposed of. The hauling and milling plan submitted for the spring 2017 period is included in Appendix G.

Storing logs at the Hart Highway log yard will be necessary for logs harvested during the fall and winter of 2017/18, and logs are expected to be on site until the mid-summer of 2018. A new hauling and milling plan is expected to be submitted to the Ministry of Forests, Lands and Natural Resource Operations prior to the spring 2018 spruce beetle flight.

Vegetation Management

Invasive Plants

The objective is to minimize the introduction and spread of invasive plant species where Research Forest operations causes soil disturbance. Where the invasive plants are found to occur within the Research Forest, the objective is report the occurrences and support necessary treatments to reduce or remove the invasive plants. Strategies to achieve these objectives may include, but are not limited to the following:

- 1) *Revegetate portions of disturbed soil to reduce the conditions favorable to establishment of invasive plants;*

Treatments involving revegetation of bare soil to prevent excess siltation into classified streams, wetlands and lakes are expected to limit the introduction and spread of invasive plants. For the most part, this includes using a grass seed mix to revegetate and stabilize exposed soil resulting from road building, and the installation and deactivation of stream crossings. Areas with road rehabilitation may also be vegetated using a grass seed mix for the same reasons.

- 2) *Rehabilitate unnecessary short-term roads so they are not a vector for the establishment of invasive plants;*

A substantial amount of new road construction (greater than 50%) will be regularly rehabilitated to limit the various impacts of road building. This regular road rehabilitation is also expected to limit the establishment of invasive plants. The amount of temporary road (road planned for rehabilitation) is provided within each cutblock site plan.

- 3) *Record the occurrence of the species identified as noxious within all regions of the Province and those identified as noxious within the Fraser-Fort George Region as per the Field Guide to Noxious Weeds and Other Selected Invasive Plants of British Columbia;*
- 4) *Report the occurrence of invasive species to the Northwest Invasive Plants Council so that they may determine any necessary treatments to reduce or remove invasive plants; and*
- 5) *Subject to available resources, provide assistance and support to the Council in undertaking invasive plants treatments.*

With regard to items # 4, 5 and 6, above, there has been no reported occurrences of noxious weeds within the Research Forest at this time.

Deciduous and Brush Competition for Conifer Trees

Deciduous trees, brush-type plants, and herbaceous plants are valued for their contribution to fish and wildlife habitat and overall ecosystem and species diversity. However, where they are suppressing conifer growth, deciduous and brush competition may require direct treatment to achieve the stocking and timber objectives in this plan.

The objective is to reduce deciduous and brush competition where prescribed stocking standards are at risk of not being met or free growing achievement may be significantly delayed. This will be achieved by:

- 1) Implementing a variety of brushing treatments, including but not limited to, manual brushing treatments, prescribed fire, animal grazing, and herbiciding to remove or suppress the growth of deciduous trees, brush-type plants, and herbaceous plants where conifer-leading regeneration is prescribed;*

Cutblock E-1, which was harvested during winter 2011 has considerable area with young aspen cover. Low elevation digital photography was captured using an unmanned aerial vehicle. A high resolution orthophoto of Cutblock E-1 was created and subsequently the current forest cover was typed for all areas with significant aspen coverage. It is expected that the vast majority of these aspen areas will be brushed within two years. Herbiciding of the aspen will be limited to select ground treatments, if supported by affected First Nations.

- 2) Undertaking experiments within cutblocks to evaluate new brushing and vegetation suppression techniques targeted at deciduous trees, brush species, and herbaceous plant species;*

Within Unit L, there is currently a continuing study of differing brushing techniques on reducing aspen cover in young conifer stands and another study examining the effects of herbicide treatments on blueberry plants. See Appendix D for a brief description of the on-going research projects within the Research Forest.

- 3) Consulting with potentially affected stakeholders and First Nations when proposing any herbiciding operations; and*

Limited application (non-aerial) of herbicide within Cutblock E-1 may be initiated during this Development Plan period. Consultation with affected First Nations will be undertaken prior to any treatment. Details of any herbiciding treatment have not been considered at this time.

- 4) Limiting the type or amount of brushing treatments if they may materially affect the retention of trees and other plants that are important to achieving objectives within areas prescribed for the conservation and protection of natural resources.*

As for item 3, manual brushing of aspen within Cutblock E-1 may be initiated during this Development Plan period. Details of any manual brushing treatment have not been considered at this time.

Managing for Forest Products

Consistent with the current and foreseeable demand for timber products, the objective is to manage forest stands to maximize the yield of sawlog quality conifer trees. For all Research Forest units, this means a priority on the production of quality spruce trees. Despite the previous, it is recognized that the dominance of spruce regeneration may be reduced in respect of other tree species that are expected to be better adapted for yield under predicted climate and ecosystem conditions.

In order to help inform future tree regeneration and future timber yield decisions, applied research and innovation is expected to continue regarding tree species adaptation and survival outside of their current natural range of ecology and climate.

For the upcoming development year, sanitation and salvage harvesting in spruce and spruce/balsam stands is the focus. Conifer regeneration is expected to be dominated by the planting of spruce seedlings for all the cutblocks currently planned.

Non-Sawlog Wood Fibre

The objective for non-sawlog wood fibre is to explore, study, and implement options for recovering and utilizing all wood fibre that is remaining after fulfilling the conservation and protection objectives for all forest resource values.

Although the focus is the sanitation and salvage of sawlog-quality spruce logs, there is notable damaged pine and balsam volume in some areas. Harvesting in these areas will focus on the recovery of sawlog pieces and the remaining non-sawlog timber will be processed for recovery of pulp logs.

Bioenergy producers in both Prince George and Mackenzie were contacted in the spring and summer of 2017 to discuss the possibility of recovering log waste directly from harvested areas within Units B, C, D, and G. To date, there is no agreement on recovery of waste debris from CNC harvested cutblocks.

During the winter 2018, Pacific Bioenergy was provided information on the current fall and winter harvesting operations (2017/18) to support the potential recovery wood fibre from roadside harvesting debris.

Natural Non-Productive Forest and Natural Non-commercial Cover

Areas that were naturally non-productive forest or non-commercial cover (brush cover) are valued for their unique habitat qualities and contribution to overall ecosystem and species diversity.

The objective for any individual area that is naturally non-productive or non-commercial cover (equal to or greater than 0.2ha) is to avoid reforestation and avoid alteration of the soil and soil moisture attributes. The existing vegetation cover in these areas may be disturbed at the time of harvest to facilitate efficient operations.

The following Table 10 indicates the inclusion of natural non-productive area and non-commercial cover included within cutblocks boundaries that were harvested in 2016/17 and that are currently planned for harvest during this Development Plan period. Since the amount of non-commercial cover within cutblocks is sizable at >120ha (2016 to 2018 harvesting), a portion of this area with the highest potential for conifer reforestation, may be considered for

planting. At this time, it is expected that the majority of the non-commercial area within cutblocks will be left unplanted as per the management plan objective.

Table 10: Summary of Natural Non-Commercial Cover in cutblocks located in Research Units A, B, C,D,E, and G

Cutblock	Total Area Under Plan (ha)	Non-Productive Area (ha)	Non-commercial Area (ha)
G-3	212.0	2.0	0.0
G-4	133.0	0.0	6.0
D-1	407.2	0.0	0.0
D-2	118.0	0.0	0.0
D-3	121.6	0.0	0.0
D-4	34.4	0.0	0.0
C-1	193.8	0.4	10.3
C-2	417.7	0.0	22.9
C-3	39.6	0.0	0.8
B-1	146.8	0.0	1.5
Total	1,824.1	2.4	41.5
Cutblock	Total Area Under Plan (ha)	Non-Productive Area (ha)	Non-commercial Area (ha)
A-2	102.3	0.0	4.0
A-8	56.8	0.0	3.9
A-3	69.7	0.0	3.6
A-4	48.4	0.0	3.9
A-5	133.3	0.5	3.7
B-2	152.3	0.0	3.3
E-5	54.2	0.0	0.0
E-6	66.4	0.0	2.3
E-7	21.2	0.0	0.0
E-8	39.1	0.0	1.2
G-2	95.4	0.4	3.9
G-5	202.7	0.0	16.3
G-6	222.1	0.9	13.7
G-7	84.0	0.0	3.4
G-8	100.1	0.0	5.4
G-9	99.6	0.0	9.8
G-10	79.2	0.1	2.4
Total	1,626.8	1.9	80.8

Problem Forest Types

Areas that are naturally hemlock and cedar leading forests are valued for their unique habitat qualities and contribution to overall ecosystem and species diversity. As described under the section titled, “Interior Old Forest Objective”, natural hemlock and cedar leading stands within Unit I will be conserved for biodiversity. Within Unit H, the objective is to further explore the

economic recovery of timber and wood fiber value from hemlock and cedar stands. The conversion of mature hemlock and cedar leading stands to other conifer species may be undertaken; however, a representative portion of the natural hemlock and cedar stands will be retained consistent with the “Old Forest Retention” and “Wildlife Tree Retention” sections.

There is no development planned within hemlock or cedar leading stands during this development period.

Tree Seed

The objective is to realize the growth and yield benefits from Provincial tree seed improvement, while allowing experimentation with different seed sources to facilitate continuing study into assisted tree species migration and species adaptation to climate change.

The Chief Forester’s Standards for Seed Use will be used in the selection and utilization of seed for conifer regeneration in cutblocks within all Research Forest units. The application of the seed that does not meet the Chief Forester’s Standards is subject to not significantly increasing the risk to future timber supply and subject to achieving the conservation and protection objectives for all natural resource values.

For this development period, it is expected that all cutblocks will be planted with seedlings from seed that meets the Chief Forester’s Standards for Seed Use. Any seed not consistent with the Chief Forester standards, if any, will be limited to research projects.

Tree Species and Tree Density Selection

The objective is to realize the growth and yield benefits from implementing Provincial stocking standards while allowing experimentation to facilitate continuing study into assisted tree species migration and species adaptation to climate change.

The Provincial Reference Guide for FDP Stocking Standards will be used to prescribe preferred and acceptable conifer tree species and minimum stocking densities within each differing ecosystem association within each cutblock.

To facilitate further study, the following exceptions to the Provincial standards may be implemented.

- 1) There is strong preference for regenerating spruce on all Research Forest units, but this preference may be reduced in respect of other tree species that are expected to be better adapted for growth and yield under the predicted climate and ecosystem conditions.*

Same comment as under “Managing for Forest Products”. For the upcoming development year, sanitation and salvage harvesting in spruce and spruce/balsam stands is the focus. Conifer regeneration is expected to be dominated by the planting of spruce seedlings for all the cutblocks currently planned.

- 2) The experimentation and monitoring of planted conifer species expected to be better adapted for growth and yield under predicted climate and ecosystem conditions may be*

a focus of research in all Research Forest units. The planting of such tree species is subject to not significantly increasing the risk to future timber supply and subject to achieving the conservation and protection objectives for all natural resource values.

For this development period, no additional area is planned for planting with alternative tree species. The existing species trials within Units E, K, and L will continue to be monitored as part of the climate adaptation studies.

- 3) *Where it may be demonstrated that long-term yield is not expected to be reduced, then different free growing criteria may be applied than is recognized through the Provincial Reference Guide for FDP Stocking Standards. Different procedures for assessing free growing may also be applied than is recognized in the Provincial Silviculture Surveys Procedures Manual.*

For this development period, the planned cutblocks are being reforested using standard provincial free growing criteria and assessment methods.

- 4) *To increase conifer yield (volume per hectare) and conifer timber quality (reduced large branch production), increasing target planting densities will be considered for all ecosystem associations showing a target stocking of 1000 stems/ha or greater within the Provincial Reference Guide for Stocking Standards. The total density considered will be supported by growth modelling or best information that demonstrates the beneficial volume gains.*

The cutblocks harvested last winter, which included B-1, C-1, C-2, C-3, D-1, D-2 D-3, D-4, G-3, and G-4 were prescribed with a target density of 1,600 stems/ha. To date, planting has occurred within all the cutblocks, except B-1. Approximately half of G-4 was planted to date.

2017 Planting Density

The planting density results for Cutblocks D-1, D-2, D-3, D-4, G-3 and half of G-4 are provided below. These densities are based on the cutblock area excluding temporary roads and roadside processing areas. These areas will be planted in following years after debris pile burning and road rehabilitation. The densities provided are planted trees only and do not include natural trees. With the inclusion of natural trees, the target density of 1,600 stems/ha is expected to be met.

<u>Cutblock</u>	<u>Planted Density (stems/ha)</u>
D-1	1,556
D-2	1,550
D-3	1,559
D-4	1,636
G-3	1,537
G-4 (Part)	1,558

All of the area proposed for harvest in 2017/18 is expected to support an average target density of 1,600 stems/ha.

- 5) *Within prescribed riparian management areas, the achievement of free growing status is dependent on each assessed tree meeting a minimum height, along with minimum form and health criteria. Conifer free growing status is not dependent on conifer height relative to competing brush species or deciduous trees or conifer position relative to competing brush species or deciduous trees.*

Where different stocking standards or free growing criteria may be prescribed for individual cutblocks, then this will be recorded under the “Stocking Standards” section of this Development Plan.

None of the cutblocks harvested during 2016/17 were prescribed with alternative free growing criteria. The same applies to the cutblocks planned for harvest during 2017/18.

Tree Regeneration Delay

The objective is to minimize average conifer regeneration delay to minimize the time that any area is not yielding conifer volume. The expectation is that the majority of tree planting will be implemented the next spring or summer season following the completion of harvesting.

Regeneration Delay for 2016/17 Harvested Cutblocks

This regeneration objective was upheld despite the very large amount of salvage harvesting undertaken. The majority of Cutblocks C-1, C-2, C-3, D-1, D-2, D-3, D-4, G-3 and G-4 were planted in 2017. Only Cutblock B-1 was not planted in 2017; scheduled for 2018.

Tree Planting

The objective is to optimize the site selection for the majority of planted trees to ensure improved conifer seedling survival and initial growth.

As such, a minimum intertree spacing of 1.6m may prescribed for any ecosystem association. A minimum intertree spacing of less than 1.6m may be prescribed where site conditions, soil conditions or necessary site preparation severely limit optimum planting sites.

Across all standard units and cutblocks planned during this Development Plan, 1.6m is the prescribed minimum intertree spacing.

Stocking Standards

The stocking standards specified in this Development Plan are highly reflective of the provincial Reference Guide to FDP Stocking Standards. Standards for the following subzones within the Research Forest are included in Appendix H: SBSwk1, SBSvk, ESSFwk2, ICHwk4, ICHvk2, SBSmk1, SBSdw2, and SBSmh.

Prescribed Stocking Standards Results

Where variations from the Appendix H stocking standards were prescribed for individual cutblocks harvested during 2016/17 or for cutblocks proposed for harvesting in 2017/18, those variations will be explained below:

Stocking Standard Variations for 2016/17 Cutblocks G-3, G-4, D-1, D-2, D-3, D-4, C-1, C-2, C-3 and B-1:

As described under item 4, within the section titled “Tree Species and Tree Density Selection” a target planting/regeneration density of 1,600 stems/ha was prescribed. On average, all of these cutblocks are quite productive with few notable limitations, and therefore 1,6000 stem/ha density is expected to provide growth and yield advantages in the short and long-term.

Stocking Standard Variations for Proposed 2017/18 Cutblocks:

As above, a target planting/regeneration density of 1,600 stems/ha will be implemented for all cutblocks proposed for harvest during 2017/18.

Silviculture Treatments

The objective is to minimize silviculture treatment time to minimize the time that any area is not yielding acceptable conifer volume or quality.

Where a prescribed conifer area is determined to require silviculture treatments, such as, but not limited to, site preparation, brushing, fill-planting, or forest health sanitation, then the treatment(s) is to be undertaken within two growing seasons of detection.

At this time, no necessary silviculture treatments have been identified for CNC harvested cutblocks.

Managing Allowable Annual Cut (AAC)

For the purposes of reducing uncertainty about sustainable harvest levels and reliable forecasting, the Management plan timber supply analysis is planned to be updated every five years or more often, if new information or circumstances change significantly, as is currently the situation with increasing spruce beetle hazard and mortality.

Timber Supply Review Results

A timber supply review (TSR), as described in Management Plan #3, was completed in February 2016, which considered current spruce beetle attack, and mature timber deletions for previous harvesting and road building, and for cutblocks planned for harvest up to March 2016. This analysis was completed well in advance of 2018 (the required TSR replacement year) in consideration of the epidemic spruce beetle attack, the high hazard of further spruce beetle attack, the recently accelerated harvest within mature spruce stands.

A new timber supply review (TSR), as fully provided in Appendix M, was completed in September 2017. The current TSR includes significant new information and methodologies that more accurately reflect the most current forest inventory, ecological classification, road

inventory, stream inventory, spruce beetle mortality predictions, dead pine stand management, spatially defined management zones, and resource management assumptions. The new vegetation and forest inventory and ecological classification was delineated using current digital three dimensional viewing of recent (2015 imagery for all units, except Unit J, which relied upon 2013 imagery) high resolution photo pairs, LiDAR data, and ground sampling. For all units, the ecosystem classification and forest inventory was able to further define forest stand types into smaller polygons than was previously identified through the existing provincial vegetation resource inventory. With these inventory improvements and accurate modelling assumptions, more reliable harvesting forecasts and scenario analysis are available to guide future allowable annual cuts.

Land Base Assumptions

Non-Forest / Non-Productive – Area was reviewed again using a combination of CNC inventory and the provincial freshwater wetlands. Road Area – derived from current inventory of all existing roads identified via new digital photos and LiDAR, includes disturbed road width for all road sections. Low Productivity Area Determination – this includes all areas with a site index less than 8 or those that never reach 140m³/ha using the new forest inventory. Subalpine Fir (Balsam) Inventories – reduced by 30% when assessed against the 140m³/ha threshold. Recent operational information demonstrates that a balsam inventory greater than 30% cannot be recovered for sawlog products.

Steep Slopes – Operable cutoff is 45% slope, which matches current physical limits of ground-based skidding that is being implemented. This will be reviewed in the future, as cable yarding options are now available.

Riparian Reserves – Area was spatially defined from new stream classification identified via current digital photos and LiDAR. Reserve widths used are consistent with operational riparian retention for S4, S5, and S6 streams, wetlands, and lakes, which is well above regulatory minimums.

Stand Level Retention – 9% Stand Level retention applied to timber harvesting land base. This assumes that another 3% of stand level retention includes physically inoperable areas, problem forest types, and riparian reserves.

Non-Timber Management

Wildlife and Biodiversity Corridors - For the remaining salvage areas (currently Units A, B, E, F and G), biodiversity corridors spatially identified are to remain largely intact as mature forest throughout time. Harvest is restricted to areas that are >119 years old; only 34% of the area may be harvested within each 60 year period.

Landscape-Level Biodiversity / PG TSA Biodiversity Order – For each of the Research Forest units, a minimum percentage of the crown forest land base must be old forest (>120 years old) at all times. By Research Forest unit, the minimum percentage of old growth per Research Forest Unit ranges from 10% to 25%. This exceeds the requirement for an average of 19% old forest to be maintained across all units. To qualify as old growth, a stand must be non-pine-leading.

Visual Quality Objectives – As per the previous TSR, plan to perspective ratios applied to 5% slope classes were used to determine the minimum forest height that must be maintained within the non-altered areas of each visual polygon.

Minimum Harvest Criteria

Consistent with other provincial TSRs, the minimum threshold value of 140m³/ha is applied, however, to ensure volume recovery from each stand is optimized, harvest selection is limited to stands that have achieved 95% of their culmination mean annual increment.

Harvest Priority

Dead Pine – After considering the new inventory information and new operability thresholds, no dead pine stands were identified for salvage harvest. The existing dead pine volume has been fully discounted and does not contribute to the harvest volume. Some dead pine stands, however, may still be selected for harvest in the near future due to other live conifer volume.

Harvesting priority is applied to all stands with spruce beetle mortality for the first two periods.

Spruce Mortality

Based on recent assessments and timber cruising, up to 83% spruce mortality is assumed in all stands >99 years old within Research Forest units A, B, C, D, E, F, and G. For Units H, I, J, K, and L, 83% spruce mortality was applied to the oldest spruce stands until 33% of all the spruce-leading stand volume was selected for mortality.

Harvest Volume Results

Management Plan #3 (Effective from July 2016 to June 2021):

With the approval of Management Plan #3, the District Manager (DM) determined that an allowable annual cut (AAC) of 129,000 m³ per year for five years was appropriate in consideration of the new timber supply review information provided: updated forest inventory, the projected spruce mortality, predicted dead pine salvage, revised management assumptions, and the analysis of harvest forecasting. Consistent with this uplifted AAC, CNC planned large sanitation and salvage operations focusing on Research Forest Units B, C, D, and G. The harvest was completed as planned in March 2017. The resulting scaled harvest volume up to the end of June 2017 is recorded in Table 11, along with the remaining allowable harvest for the period from July 2017 to the end of June 2021.

Table 11: Harvested Volume from July 2017 to End of June 2017

Cutblock / Year of Harvest	Spruce Volume* (m ³)	Pine Volume* (m ³)	Total Volume* (m ³)	Comments
G-3	34,578	1,405	62,953	High Spruce Damage from Insect & Blowdown 100% Pine Damage from Insect & Blowdown
D-1,2,3,4	83,104	7,517	161,364	High Spruce Damage from Insect & Blowdown 100% Pine Damage from Insect & Blowdown
C-1,2,3	69,176	0	146,853	Very High Spruce Damage from Insect & Blowdown
G-4	15,935	850	32,902	Very High Spruce Damage from Insect & Blowdown 100% Pine Damage from Insect & Blowdown
B-1	26,692	916	35,902	Moderate to High Spruce Damage from Insect & Blowdown 100% Pine Damage from Insect & Blowdown
Total	229,485	10,688	**439,974	
Remaining 5-Year AAC Volume	n/a	n/a	205,026	AAC total between July 2016 and June 2021 is 645,000m ³ (129,000 m ³ /yr X 5 yrs)
<p>*The volume shown for each cutblock is the proportion of the total CNC scale volume (July 2016 to March 2017) that equates to the proportion of the net cruise volume of each cutblock to the total net cruise volume of all the listed cutblocks.</p> <p>**The total volume is exactly the provincially recorded scale volume for the CNC harvesting from July 2016 to the end of March 2017.</p>				

First Nations Involvement in the CNC Research Forest Society

First Nations' representation on the CNC Research Forest Society Board of Directors (Board) is a fundamental membership goal within the bylaws of the CNC Research Forest Society. In previous years, Board membership included First Nation's representatives, but the Board is currently operating without any First Nations members. The Board invites the McLeod Lake, Lheidli T'enneh, Nazko, West Moberly and Halfway River Nations to participate on the Board.

Upon request of the CNC Research Forest Manager, the McLeod Lake Indian Band nominated their current Youth Councilor to be a CNC Research Forest Society member. At the December 2017 annual general meeting, the existing CNC Research Forest Society directors unanimously voted to accept the McLeod Lake Youth Councilor as a director of the CNC Research Forest Society.

First Nations Strategic Planning Involvement

CNC welcomes the involvement of First Nations in strategic planning processes regarding future resource development and future research. Sharing and seeking input on specific operational plans is not the sole focus of First Nations involvement. Regular, proactive involvement in CNC's ongoing operational and research strategies is the desired goal to ensure that all stages of planning and operational implementation are respectful of the preferred management direction of each First Nation. CNC is striving to develop improved relationships and protocols with each First Nation to improve future planning and to improve the mutual benefits derived from the continued operation of the Research Forest.

To date, involvement of First Nations in Research Forest planning has been limited to annual referrals and related discussions regarding individual cutblock and road development.

First Nations Consultation Regarding Management Plan

Upon providing the proposed Management Plan to Ministry of Forests, Lands and Natural Resource Operations, it is expected that the Province will undertake consultation with affected First Nations, and directly involve CNC in the consultation process as appropriate. Prior to submission for approval to the District Manager, all First Nations' input will be summarized and considered in the proposed plan, along with any revisions to the plan to address the input. All of this information will be submitted as part of the proposed plan, which will be considered in the District Manager's approval decision.

Refer to document titled "Management Plan #3 - Public Review and First Nations Consultation". Any Management Plan direction resulting from the First Nations consultation regarding the Management Plan is recognized in the other sections of this Development Plan document.

Sharing and Involvement in Specific Resource Operations

CNC commits to providing First Nations all proposed plans for forest development operations within the Research Forest. When seeking input on significant operations, the proposed plans will be provided well in advance of implementation so that there is ample time to consider input. Where the proposed harvesting or resource extraction is small in area (less than 15ha) and proposed to control forest health factors (ex. spruce beetle), or otherwise time sensitive, CNC may respectfully notify the First Nation or request the First Nation's assistance in expeditiously resolving the Nation's input. The information from this process will be provided to the Ministry of Forests, Lands and Natural Resource Operations for their ongoing consideration of Treaty rights and aboriginal rights related to the Research Forest administration.

Aside from the above, CNC may also regularly contact First Nations for input and advice regarding an individual forest practice, a site plan, research implementation, research results, management of individual sites or areas within the territory, or early input on a proposed Management Plan amendment or replacement. The goal is regular and meaningful First Nation involvement in CNC's planning processes and the implementation of operations.

The following cutblocks were proposed and/or planned for development during late 2017 and early 2018. A summary of the information sharing and communication with First Nations is provided in Appendix I.

Cutblock G-2, G-5, G-6, G-7, G-8, G-9, G-10 (Angusmac Creek)

Cutblock E-5, E-6, E-7, E-8 (Chuchinka Creek)

Cutblock B-2 (Tacheeda Lakes)

Cutblock A-2, A-3, A-4, A-5, A-8 (Kerry Lake)

First Nations Related Research and Innovation

The Research Forest is intended to provide educational and applied research and innovation benefits to all the peoples of the region, and therefore CNC supports educational and research projects that may fulfill a need that is important to First Nations' and their territory. CNC is continuously willing to discuss ideas for new research projects or research activities that may supplement or support previously established innovative projects. CNC's interest in cooperative projects with First Nations is not limited to the CNC Research Forest units.

There are currently no active research projects involving First Nations. Since 2016, representatives from the McLeod Lake, Nazko and Nak'azdli Nations have expressed interest in three different projects, but collectively the First Nations representatives and CNC have not been available to advance these ideas.

Public Input and Review

To ensure a fair opportunity for public input, any proposed replacement or amended Management Plan that requires approval by the District Manager will be advertised for public review for a period of at least 60 days, prior to being delivered to the District Manager. At least 60 days before the plan is to be submitted to the District Manager for an approval decision, the proposed plan will also be distributed to the Ministry of Forests, Lands and Natural Resource Operations, adjacent major forest tenure holders, guiding license holders, and trapping license holders so all may review and provide input regarding the proposed plan. Other stakeholders and other concerned members of the public may also receive a proposed plan at least 60 days prior to submission to the District Manager.

A proposed plan will also be made available to the public at the CNC campus in Prince George, at least 60 days before being submitted to the District Manager. This allows for anyone, who may be interested in or affected by the plan, to easily review and provide direct input to CNC. A

representative of CNC will be available during this period to meet directly with the public and natural resource stakeholders to discuss and receive input on the proposed plan.

Prior to submission to the District Manager, all input will be summarized and considered in the proposed plan. Any revisions to the plan to address input will also be identified in the proposed plan. All of this information will be submitted as part of the proposed plan, which will be considered in the District Manager's approval decision.

Refer to document titled "Management Plan #3 - Public Review and First Nations Consultation". Any Management Plan direction as a result of the public consultation regarding the Management Plan is recognized in the other sections of this Development Plan document.

Notifying and Reporting to Government

CNC will be annually reporting new cutblock openings into the Provincial RESULTS database, and for existing cutblock openings in RESULTS, annually reporting changes to prescribed tree stocking, prescribed soil disturbance, the net area to reforest, forest inventory, and regeneration status.

RESULTS Reporting 2017-18

Cutblocks E-2, E-3, E-4, and F-4 (Harvested Winter 2015-16)

These openings were reported in RESULTS for the completion of planting that occurred during the spring/summer of 2016 and 2017. The reported information for these cutblocks is included in the 2016-17 Annual Report, which is included within Appendix J.

Cutblocks B-1, C-1, C-2, C-3, D-1, D-2, D-3, D-4, G-3, and G-4 (Harvested Winter 2016-17)

These new cutblocks were part of a large spruce beetle salvage harvest during the winter of 2016-17. These new openings are now reported in RESULTS, but were not included in the Annual Report as the RESULTS reporting was not complete at that time.

Annual Report 2016-17

An annual report summarizing Research Forest activities was completed and submitted in June 2017. It is included within Appendix J.

Site Plans

Site plans for individual cutblocks and roads will be completed in advance of any primary forest activity but are not submitted to the District Manager unless requested. Site plans will not be completed for minor road upgrading works necessary to improve road safety and reduce environmental impacts. Site plans for cutblocks will include the area prescribed for regeneration, the stocking standards and free growing standards that apply to each ecosystem association, the allowable amount of soil disturbance, the location of roads, and identify how the content and objectives of this Management Plan will be achieved. Site plans will be amended from time to time to adjust for changing conditions, previously unidentified resources, and to allow for the modification of forest practices consistent with this Management Plan.

A RPF must confirm that a site plan may not be required where very limited harvesting and road building operations are involved.

New Site Plans for Cutblocks and Associated Roads

Site Plans were completed signed for the following cutblocks which are planned for harvest during 2017-18:

A-2, A-3, A-4, A-5, A-8, B-2, E-5, E-6, E-7, E-8, G-2, G-5, G-6, G-7, G-8, G-9, G-10

No Site Plans Required

For the 2017-18 development period, all cutblocks planned for harvest require a site plan.

Signatures of persons required to prepare plan.

Preparing Forester <i>I certify that the work described herein fulfills the standards expected of a member of the Association of British Columbia Forest Professionals and that I did personally prepare the work.</i>		
	Carl Pollard, R.P.F. Manager, Research Forest College of New Caledonia	Date