College of New Caledonia

CNC

Research Forest

Growing New Knowlege

CNC Research Forest Development Plan 2020 to 2022

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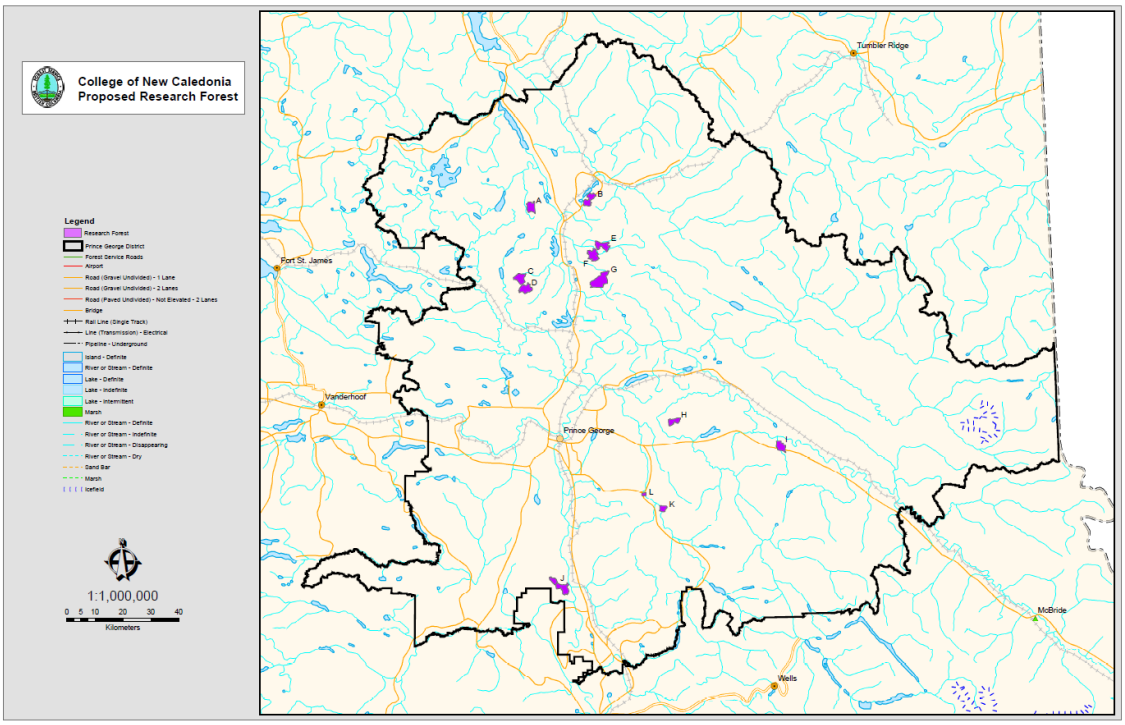
Research Forest Tenure and Management Plan Requirement

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 details as specified in the SUP document. This Development Plan was initiated after submission of Amendment #1 to Management Plan #3, which is proposed to be effective until June 30, 2022. Amendment #1 was submitted to incorporate the new timber supply review completed in September 2017. The new TSR involved new vegetation, stream, and road inventory information, revised modelling assumptions, revised spruce beetle mortality assumptions and new timber supply modelling software. Wherever possible, the content and requirements of this Development Plan are consistent with direction under Amendment # 1, 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, 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 the 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

The intent is to regularly replace the Development Plan, at least once during each Management Plan period. This approach ensures that operational results are verified for consistency with the Management Plan direction, at least once during the approved Management Plan period. This

Development Plan replacement falls within the fifth year of the current Management Plan which is applicable to the 6-year period between July 2016 and June 2022. This Plan includes the current status up to October 31, 2020, along with the forest development planning to June 2022 and beyond. The intent is to replace this Development Plan on or about July 1st, 2022, unless an earlier update or revision is necessary.

The Development Plan may be revised and updated at any time during the 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, including new forest development planning,
- Incorporate new natural resource information,
- Reflect innovation and findings from research, and
- 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 period.

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, and 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 proposed Research Sites are provided under Appendix B.

Table 1 summarizes the currently proposed cutblocks to be harvested along with the estimated net harvest area, currently planned harvest year/season and timber volume. If there are any specific comments that apply to a proposed cutblock (example: referral date, important forest health factors or research linkages), then those are provided as well. Where sufficient planning has occurred, Table 1 includes cutblocks well beyond the 2-year period applicable to this Development Plan document. The actual harvest area of any cutblock and the resulting timber volume, along with yearly and seasonal scheduling is expected to change regularly, depending on multiple variables which include, but are not limited to: forest health factors, specific natural resource values, specific terrain and timber attributes, log prices and the operational goals of the parties purchasing logs.

Where a cutblock is listed in Table 1, a corresponding cutblock area is shown on the Development Plan Maps included in Appendix A.

Table 1: Summary of Proposed Cutblocks

Proposed Cutblock	Proposed Harvest Area	Proposed Harvest Year	Proposed Harvest Season	Tree Species	Clearcut or Partial Cut	Harvest Method	Estimated Harvest Volume	Comments
K-1	28	2021	Winter	Spruce, Balsam	Clear	Ground	11,000	
K-2	40	2021	Winter	Spruce, Balsam	Clear	Ground	14,000	
J-3	58	2021	Summer	D. Fir, Spruce, Balsam	Clear	Ground	19,400	
D-101	50	2022	Summer	Spruce	Partial	Ground	5,000	Commercial Thinning; Research
D-102	40	2022	Summer	Spruce	Partial	Ground	4,000	Commercial Thinning; Research
A-101	45	2022	Summer	Pine	Partial	Ground	4,500	Commercial Thinning; Research

L-2	21	2025	Winter	Spruce, Balsam, D. Fir	Clear	Ground	6,500	
K-3	12	2025	Winter	Spruce, Balsam	Clear	Ground	3,900	
K-4	16	2025	Winter	Spruce, Balsam	Clear	Ground	5,200	
K-5	18	2025	Winter	Spruce, Balsam	Clear	Ground	5,800	
J-1	27	2026	Summer	D. Fir, Spruce, Balsam	Clear	Ground	9,000	
J-5	50	2026	Summer	Spruce, D. Fir, Balsam	Clear	Ground	16,700	
J-7	58	2026	Summer	Spruce, Balsam, D. Fir	Clear	Ground	19,400	
J-8	65	2027	Summer	Spruce, Balsam, D. Fir	Partial	Ground	7,800	Partial Cut, Com. Thin; Research
J-9	49	2028	Summer	Spruce, Balsam, D. Fir	Clear	Ground & Cable	16,400	
J-10	21	2028	Summer	Spruce, Balsam, D. Fir	Clear	Cable	7,000	
J-11	51	2028	Summer	Spruce, Balsam, D. Fir	Clear	Ground & Cable	17,000	
J-12	44	2030	Summer	Spruce, Balsam, D. Fir	Clear	Ground	14,700	
J-14	52	2030	Summer	Spruce, Balsam, D. Fir	Clear	Ground	17,400	
J-2	30	2040	Summer	Spruce, D. Fir, Balsam	Clear	Ground	10,000	

J-4	54	2040	Summer	Spruce, Balsam, D. Fir	Clear	Ground	18,000	
J-15	28	2042	Summer	Spruce, Balsam, D. Fir	Clear	Ground	9,300	Formerly part of J-10
J-6	19	2042	Summer	Spruce, D. Fir, Balsam	Clear	Ground	6,300	
J-13	35	2042	Summer	Spruce, Balsam, D. Fir	Clear	Ground	11,700	

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 amount of old forest currently remaining (with the completion of harvesting up to summer 2020), as well as the projected amount of old forest after 2030 and 2040 (based on current harvest planning) is summarized in Table 2. The maps used to derive the current and projected amount of old forest are included in Appendix C. To prevent over-estimation of the current and projected amount of old forest that properly contributes to old forested habitat, this analysis excludes low density forest types (<100 stems/ha), which may have limited old forest attributes. As well, very small fragments of old forest were deleted from the mapping and old forest summary. Table 2 summarizes the amount of old forest within each unit, expressed in hectares and as a percentage of the productive, forested landbase within each unit.

Consistent with the Management Plan requirements, this information satisfies the annual requirement to report on old forest retention areas. The area reported in Table 2 and mapped in Appendix C only includes areas that were pine-leading, (prior to mountain pine beetle attack), if the remaining live trees are 120 years old or greater (age is based on leading live species). The forest typing and ages used in this analysis are from the 2017 CNC forest inventory, which recorded age as of the end of 2016 growing season. Stand ages were appropriately increased for the 2020, 2030, and 2040 analysis of old forest area.

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

Table 2: Current (2020), Old Forest Amount and Projected Old Forest Amount Post-2030 and Post-2040

Research Forest Unit	Crown Forest Land Base (CFLB) (ha)	Current Old Forest Area (2020) (ha)	Current Old Forest Percentage (2020) (%)	Projected Old Forest Area (2030) (ha)	Projected Old Forest Percentage (Post-2030) (%)	Projected Old Forest Area (2040) (ha)	Projected Old Forest Percentage (Post-2040) (%)
A – Kerry Lk	933.8	180.5	19% (10% Min.)	182.2	20% (10% Min.)	192.1	21% (10% Min.)
B – Tacheeda	1,053.4	329.3	31% (14% Min.)	365.3	35% (14% Min.)	370.9	35% (14% Min.)
C – Caine	1,043.5	140.4	13% (10% Min.)	144.7	14% (10% Min.)	150.9	14% (10% Min.)
D – Caine	1,081.9	129.7	12% (10% Min.)	152.5	14% (10% Min.)	155.8	14% (10% Min.)
E – Chuchinka	1,078.0	374.6	35% (10% Min.)	393.2	36% (10% Min.)	418.2	39% (10% Min.)
F – Chuchinka	1,198.7	206.2	17% (10% Min.)	214.2	18% (10% Min.)	214.1	18% (10% Min.)
G – Angusmac	2,185.2	498.5	23% (10% Min.)	517.8	24% (10% Min.)	542.0	25% (10% Min.)
H – Purden	727.3	553.1	76% (25% Min.)	553.1	76% (25% Min.)	553.1	76% (25% Min.)
I – Hungary	844.0	445.6	53% (25% Min.)	553.2	66% (25% Min.)	635.5	75% (25% Min.)
J – Blackwater	1,581.2	746.4	47% (10% Min.)	480.8	30% (10% Min.)	357.3	23% (10% Min.)
K – Willow	460.3	225.4	49% (25% Min.)	135.5	29% (25% Min.)	140.6	31% (25% Min.)
L – Willow*	158.5	12.0	8% (10% Min.)	12.1	8% (10% Min.)	12.1	8% (10% Min.)
Total	**12,345.8**	**3,841.8**	**31%** (19% Min.)	**3,704.6**	**30%** (19% Min.)	**3,742.7**	**30%** (19% Min.)

*The small old forest retention within Unit L 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 currently well

above the 10% minimum. The actual future harvesting in Unit L will be prescribed to ensure 10% of the Unit L area is maintained as mature forest.

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 PGTSA 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 are a number of forested areas, adjacent to the Research Forest, which are proposed for retention in order to recruit future old growth areas. There is also proposed Old Growth Management Areas near the Research Forest. The maps provided in Appendix D show the location of these recruitment areas and proposed Old Growth Management Areas, and how they align with wildlife tree retention areas and biodiversity corridors planned within the Research Forest.

Regardless of the adjacency of old forest recruitment areas being implemented by forest licensees, all Units with proposed or harvested cutblocks contain areas identified as biodiversity corridors. These are spatially identified areas beyond prescribed wildlife tree retention areas that serve to continuously conserve areas of mature and old growth forests. In most cases the identified corridors are intended to provide continuous forest cover connectivity between WTRAs and forest stands adjacent to the Research Forest. The corridors may also serve to protect old growth forest that has attributes of interior old forest conditions (not significantly influenced by forest edge). Where possible, the corridors are composed of mature and old growth forests, but may include areas with young stands (natural or reforested) in which dominant tree cover is 3m or greater. In some instances, primarily within Units C, D and parts of Unit E and F, the biodiversity corridors were implemented after the full planning or harvest of cutblocks was completed, and the resulting biodiversity corridors do not include sufficient mature and old forest areas. As the forests regenerate throughout these Research Forest Units, further biodiversity areas will be added as additional forest cover 3m and greater is achieved.

The biodiversity corridors are not required to maintain static throughout time. As forests continue to grow and develop, and as forest conditions change, the composition and location of the corridors may change. The objective is for the biodiversity corridors to

provide reasonable forest cover connectivity, primarily composed of mature forest (includes old growth) within all Research Forest Units and to areas adjacent to the Research Forest. Although harvesting may occur within the biodiversity corridors, it is to be limited so that the primary objective of continuous, mature forest cover is not significantly altered. The preference is for biodiversity corridor harvesting to be limited to individual tree selection methods (thinning and partial cutting) where the valuable attributes of a mature or old growth forest are maintained continuously.

Interior Old Forest Results

Although the actual amount of interior old forest (old forest not influenced by edge) is not tracked, the development planning process does continuously adjust the configuration of areas identified for the conservation and recruitment of old and matured forested areas. The location of the currently planned biodiversity corridors, designed to recruit and conserve old and mature forested areas, are shown in the maps provided in Appendix D. The maps also include a summary of the amount of biodiversity corridor areas that are currently identified as old forest (>120 years), mature forest (60 to 119 years), immature forest (30 to 59 years) and young forest (1 to 29 years).

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 a minimum buffer of 200m will be 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*

With regard to the "non-pine-leading" wording, the intent of this Management Plan objective is to ensure that no areas of primarily dead pine forest are contributing to the old forest amount. With the 2017 CNC forest inventory, the live portion of the mountain pine beetle attacked forest types is now fully described. This allows the remaining live forest in mountain pine beetle areas to be properly assessed as old forest. The result is that, in some areas formerly described as dead, mature pine stands are now included as old forest providing that they have sufficient live, old trees. The areas that have dominant pine trees

and contribute to old forest due to sufficient old, live stems are shown in medium green on the maps within Appendix C.

For each Research Forest Unit, the specified minimum percentage of old forest (120 years and greater) that may occupy the forested land base (area not included within wetlands and water) is listed under the column titled, "Projected Old Forest Percentage", within Table 2. The minimum old forest amount per unit ranges from 10% to 25%.

The projected remaining amount (hectares) of old forest after harvesting all of the proposed cutblocks under this Development Plan is also included in Table 2.

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]

The mature cedar and hemlock leading stands, identified via the most recent forest inventory and proposed for conservation are shown on maps provided in Appendix E, which display rare ecosystems and less common forest types. The proposed biodiversity corridors planned over and adjacent to these hemlock and cedar stands are also identified in the same maps.

Partial cutting of cedar and hemlock leading stands within Unit I may occur for research and education purposes, but the tree removal is to be limited to individual trees or small groups of trees, so that the original old forest characteristics and primary wildlife habitat attributes are not compromised.

Ungulate Winter Range

The Province recently identified areas that are planned for designation as ungulate winter range for moose. One of these identified UWR polygon, specifically u-7-022, #29, surrounds Unit H in the Bowron Mountain-Purden Lake area. Although the UWR does not include the Research Forest Area, the intent is to manage Unit H to meet the requirements and intent of the proposed objectives and general wildlife measures. As currently proposed, the general wildlife measures include the following:

- No Pesticide use.
- Loop roads must not be constructed in any one Gross Block Area.
- In stands where more than one species is identified as preferred in an approved stocking standard, plant all preferred species
- All access structures in a Gross Block Area must be rehabilitated within three years of completion of Timber Harvesting within that Gross Block Area.

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

- Maximum Gross Block Area created as a result of primary forest activities must not exceed 27 hectares.
- Within a Gross Block Area, the edge-to-edge horizontal distance between any reserves and/or harvested Opening outer edge must not exceed 250 metres.
- To achieve a mixed species stand, blocks shall be replanted in equal proportions within the net area to be reforested.

In addition, strategies are to be developed to meet the following objectives:

- Primary forest activities must implement strategies which conserve and enhance moose habitat and includes, but is not limited to, the following moose life requisites:
    a) Thermal cover,
    b) Snow interception cover,
    c) Security cover,
    d) Calving areas,
    e) Rutting areas,
    f) Significant Mineral Licks, and
    g) Significant Wallows.

Ungulate Winter Range Results

Addressing Moose General Wildlife Measures and Objectives

Preliminary planning for interconnected mature forest cover has occurred with the identification of biodiversity corridors throughout Unit H. These corridors are largely intended to be left unharvested so that they may provide for the continuous conservation of thermal cover, snow interception cover, security cover, and potential calving and rutting areas. The vast majority (90%) of the currently identified biodiversity corridors include mature forests greater than 120 years old, but also include plantations where the dominant tree cover is 3 m or greater. The biodiversity corridors are not required to maintain static throughout time. As forests continue to grow and develop and as forest conditions change, the composition and location of the corridors may change.

Understanding Moose Use throughout the Year

During January 2021, field reconnaissance was completed within and adjacent to Unit H to verify moose winter use and observe snow levels across the elevation range. There was moose evidence (recent tracks and moose pellets) demonstrating notable winter use both within and adjacent to the Research Forest. During reconnaissance, cameras were installed to continuously observe and record wildlife activity within and near the Research Forest. Additional field reconnaissance and a camera monitoring is likely to be implemented during both summer and winter conditions during the next few years. The intent is to better inform the Research Forest staff about the level of moose use and how it changes with seasonal and differing winter conditions.

Further interfacing with Regional Specialists and other professionals studying moose populations and habitat is planned. Where possible, the Research Forest staff will collaborate with others in the study of identified moose habitat areas within the Research Forest and/or general Prince George area.

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.

As more specific direction is developed as a result of the Provincial and Federal government planning on caribou recovery, this section of the Plan will be updated as necessary. At this time, the recovery planning process has recognized the long-term increase in moose, deer and elk populations within and adjacent to caribou as an important factor, which has significantly altered the predator levels (primarily wolves) near caribou populations. Alteration and disturbance of caribou habitat, leading to loss and fragmentation of caribou habitat, increased habitat for moose, and increased favourable pathways for wolves were recognized as significant contributing factors increasing pressure on caribou populations. As a result of these findings, caribou recovery planning is likely to focus on practices that may reduce moose and wolf density, which may necessitate different harvesting, road management, and silviculture practices within recovery planning areas.

Given the importance and difficulty in achieving caribou recovery, future forest development within CNC Research Forest Unit I is proposed to support education and research that may improve forest and natural resource management practices that conserve or enhance caribou habitat and minimize or prevent conditions that support high predation levels.

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.

During the term of this Plan, proposed and planned operations may occur within both the SBS wk1, mk1 and dw3 subzone variants. Although harvesting and road building is planned within CNC Research Forest Unit J, no development is planned within the SBS mh biogeoclimatic subzone, located adjacent to the Fraser River, as this subzone has a very limited geographical range within the Prince George Natural Resource District. 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 are provided in Table 3. Forestry harvesting operations are not planned for the ecosystems and plants within the non-forest and marginal forest types (eg. wetlands, bogs, marshes, ponds, and lakeshores), as these areas and their associated upland riparian areas are planned for conservation. This includes the wetlands and peatlands that may contain Tamarack trees within the dw3 subzone variant, which are red-listed. No further actions to identify and manage plants dependent on these vegetation types are being implemented at this time.

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

English Name for Ecosystem	BC List	Ident-ified Wildlife	Biogeoclimatic Units	Ecosystem Group
Hybrid White Spruce / Hardhack / Oak Fern	Red		SBSwk1/06	Terrestrial - Forest: Coniferous - moist/wet
Hybrid White Spruce / Hardhack – Prickly Rose	Blue		SBS dw3/06	Terrestrial - Forest: Coniferous - mesic
Black spruce / skunk cabbage / peat mosses	Blue		ICHvk2/Ws09; SBSvk/Ws09; SBSwk1Ws09	Terrestrial - Forest: Coniferous – moist/wet; Wetland – Mineral: Wetland Swamp (Ws)
Lodgepole Pine – Black Spruce / Red-Stemmed Feathermoss	Blue		SBSdw3/05	Terrestrial - Forest: Coniferous – mesic and moist/wet
Lodgepole Pine / Black Huckleberry / Reindeer lichens	Blue		SBSvk/09;SBS wk1/02	Terrestrial - Forest: Coniferous - dry

Lodgepole Pine / Black Huckleberry - Velvet-leaved Blueberry		Blue		SBSvk/02;SBSwk1/03	Terrestrial - Forest: Coniferous - dry
Sandberg's bluegrass – slender wheatgrass		Red		SBSdw3	Terrestrial – Grassland: Grassland (Gg)
(Balsam Poplar, Black Cottonwood) – spruces / red-osier dogwood		Red		ICHwk4/Fm02;SBSwk1/Fm02	Terrestrial – Flood: Flood Midbench (Fm); Terrestrial – Forest: Broadleaf – moist/wet
Douglas-fir – Lodgepole Pine / Clad Lichens		Blue		SBSdw2/02;SBSdw3/02/SBSmh/02&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
Douglas-fir / Douglas maple / step moss		Red		SBSmh/04	Terrestrial - Forest: Coniferous - dry
Scientific Species Name	**English Name**	**BC List**	**Ident-ified Wildlife**	**Name Category**	**Biogeoclimatic Units**
Rhodobryum roseum	Rose moss	Blue		ICHwk;SBSwk	
Malaxis paludosa	Bog Adder's-mouth Orchid	Blue		SBSdw;SBSwk	Bog;Swamp;Conifer Forest - Moist/wet
Malaxis brachypoda	White Adder's-mouth Orchid	Blue		SBSvk	Fen;Riparian Forest;Rock/Sparsely Vegetated Rock;Conifer Forest - Moist/wet;Mudflats - Intertidal
Epilobium halleanum	Hall's Willowherb	Blue		ICHwk;SBSwk	Vernal Pools/Seasonal

					Seeps;Stream/River;Meadow;Conifer Forest - Moist/wet;Alpine/Subalpine Meadow
Nymphaea tetragona	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
Pedicularis parviflora ssp. parviflora	Small-Flowered Lousewort	Red		ICHwk;SBSmh;SBSmk;SBSwk	
Pyrola elliptica	Shinleaf Wintergreen	Blue		SBSdw;SBSmh	

Ecosystems or Species at Risk Results

Appendix E includes maps of the rare and at risk ecosystems that are within the Research Forest. These ecosystems were identified from the 2017 Terrestrial Ecosystem Mapping or from field assessments completed post-2015. The rare and at risk ecosystems are those that are provincially blue or red-listed and include the following ecosystem associations.

- SBS vk - 02, 03, 09
- SBS wk1 – 02, 03, 04, 06
- SBS mk1 - 04
- SBS dw3 - 02, 05, 06,
- SBS mh – 01, 02, 03, 04, 05, 06, 07, 08
- ICH wk4 – 02, 03

In addition, maps in Appendix E show forested areas with significant cover of Douglas-fir, cedar/hemlock, deciduous, mature live lodgepole pine, and black spruce (within SBS dw3). These forests species are less common in the Prince George area, and therefore provide for less common biodiversity and habitat attributes, making them a focus of conservation.

A significant portion of the ecosystems at risk, along with less common stand types previously described are planned for retention as part of prescribed wildlife tree retention areas or as planned biodiversity corridors. The overlap between currently planned retention areas and ecosystems at risk may easily be observed on maps located within Appendix E.

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;

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

Retain Douglas-fir trees ≥ 50cm DBH

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

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.

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

Retain cottonwood, birch, and aspen trees ≥ 45cm

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

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

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 2.0-5.0m tall.

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

As mentioned in the previous Development Plan, computer analysis of LiDAR data was undertaken to identify potential areas with high understory density. The computer analysis of the LiDAR data was not reliable in identifying understory trees, and therefore the LiDAR findings have not been applied to the development of site plans or logging plans. Although there is no current testing of LiDAR data occurring, LiDAR may be examined, again, to determine other stand attributes which may be used to determine retention opportunities during harvest.

Wildlife Tree Retention Results

Wildlife Tree Retention Anchored on Wildlife Habitat Features or Species/Ecosystems at Risk

The prescribed retention that aligns with ecosystems at risk is described under the section titled, “Species at Risk Results”.

Wildlife Tree Retention Connectivity with Other Forest Tenure Holders

Mature and old forest retention has been planned and prescribed to connect to old forest recruitment areas adjacent to the Research Forest. This planning is further described under the sections titled, “Interior Old Forest Objectives” and “Interior Old Forest Results”.

Conserving Large Diameter Douglas-fir

Retention of Douglas-fir >50 cm is prescribed for every cutblock containing Douglas-fir.

Conserving a Representative Proportion of Any Larger Douglas-fir Leading Stands

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 Appendix E, which displays both the Douglas-fir leading areas and the ecosystems at risk.

Unit B

An epidemic level of Douglas-fir beetle attack combined with spruce beetle attacked was detected along the northeastern portion of Unit B. A portion of the Douglas-fir stands were removed as part of the salvage harvesting of cutblock B-5. The remaining Douglas-fir leading stands that are included within the planned Biodiversity Corridors (to conserve visual quality and to provide for biodiversity/wildlife), may be observed in Appendix E.

Units C, D, F, G, I, K and L

There were no Douglas-fir leading stands identified within the CNC 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 Appendix E, shown previously, which displays both the Douglas-fir leading areas and the ecosystems at risk.

Unit H

A small portion (approximately 10%) of the identified Douglas-fir stands are currently included within the biodiversity corridors, however no harvesting is currently proposed for the Douglas-fir areas. The amount of long-term retention of Douglas-fir will be re-evaluated when harvesting is planned. The location of Douglas-fir stands within Unit H may be observed in Appendix E.

Unit J

There are significant areas with Douglas-fir leading forests within Unit J. Many of these stands are included in proposed cutblocks, but notable continuous Douglas-fir stands will be designated as wildlife tree retention areas or included within the planned Biodiversity Corridor areas. Those Douglas-fir stands that are currently planned for retention are shown in Appendix E.

Conserving Large Diameter Cottonwood, Birch and Aspen Trees and Conserving Deciduous Stands

For all Research Forest units, the maps within Appendix E show the identified cottonwood, birch and aspen areas, and how they align with currently prescribed wildlife tree retention areas or proposed biodiversity corridors.

For all cutblocks containing deciduous trees, stubbing and full retention of deciduous trees is prescribed.

Units A, C, D and G

No mappable deciduous-leading stands were identified within Units A, C, D, and G.

Unit B

Small areas of birch-leading stands existed within the Cutblock B-2 area. Scattered birch trees were retained with the harvest of B-2.

Units E and F

The majority of the deciduous leading stands within Unit E and F, based on the CNC forest inventory, are planned for retention.

Unit H

The identified cottonwood and birch leading areas identified within Unit H are planned for retention.

Unit J

The majority of the identified deciduous areas (includes aspen, birch and cottonwood) within Unit J are planned for retention.

Unit L

The majority of the identified deciduous areas (includes aspen and birch) within Unit L are planned for retention.

Retaining Stubbed Live Trees

For all cutblocks, a minimum of 5 (or greater) stub trees per hectare, of any species, is prescribed. Stubs are prescribed to be 2 to 5 m tall.

Retaining Non-commercial Sized Understory Trees

Currently, all prescriptions include a requirement to retain understory patches and individual understory trees. Variable results were achieved between fall 2018 and summer 2020 depending on original stand conditions, winter logging conditions and individual machine operators.

Wildlife Tree Retention Areas within Every Cutblock

During the winter of 2019, cutblocks B-3 and B-6 were harvested with moderate levels of various sized trees retained across multiple areas in both cutblocks. Cutblock B-3 was included in the ongoing study of biodiversity and wildlife habitat within harvested areas. It is expected that this research and monitoring will provide useful information about the

differences in biodiversity value, wildlife habitat value, and wildlife use associated with differing retention levels and differing distributions of retained trees.

Figure 2 and Figure 3 below shows additional tree retention (beyond prescribed Wildlife Tree Retention Areas) within Cutblock B-3 and B-6, respectively. These retention areas are designed to contribute to post-harvest biodiversity and vertical structure for wildlife habitat.

The wildlife tree retention achieved for all cutblocks harvested during the 2018-19 and 2019-20 fiscal years (April 2018 to March 2019, and April 2019 to March 2020) are shown in Table 4. It may be observed that the management requirement for a minimum of 3.5% of each cutblock area to be retained as wildlife tree retention areas was well surpassed with prescribed cutblock retention ranging from 6.2% to 64.1% from 2018 to 2020. In addition, the annual requirement for an average of 10% of all cutblock areas to be wildlife tree retention was well surpassed with an average of 28.5% for 2018-19 and an average of 37.3% for 2019-20.

Figure 2: Photo of Post-Harvest Tree Retention (beyond Prescribed Wildlife Tree Retention Area) within Cutblocks B-3

Figure 3: Photo of Post-Harvest Tree Retention (beyond Prescribed Wildlife Retention Areas) within Cutblocks B-6

Table 4: Summary of Annually Prescribed Wildlife Tree Retention Areas (April 1, 2018 to March 31, 2020)

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
A-3	69.7	18.5	26.5%	Harvest Complete
A-4	48.4	12.2	25.2%	Harvest Complete
A-5	133.3	22.7	17.0%	Harvest Complete. Final retention area exceeded 22.7 ha
A-6	50.7	8.1	16.0%	Harvest Complete
B-3	101.1	25.4	25.1%	Harvest Complete
B-4	32.5	8.9	27.4%	Harvest Complete
B-5	37.8	16.3	43.1%	Harvest Complete
B-6	14.7	3.8	25.9%	Harvest Complete
E-6	66.4	27.3	41.1%	Harvest Complete
E-9	27.2	14.6	53.7%	Harvest Complete
E-10	27.6	17.7	64.1%	Harvest Complete
F-5	23.0	6.3	27.4%	Harvest Complete
F-6	135.2	42.1	31.1%	Harvest Complete
F-8	32.5	2.0	6.2%	Harvest Complete
F-11	16.6	6.5	39.2%	Harvest Complete
Total for 2018-19	**816.7**	**232.4**	**28.5%**	
F-7	78.3	28.7	36.7%	Harvest Complete
F-9	96.9	36.7	37.9%	Harvest Complete
Total for 2019-20	**175.2**	**65.4**	**37.3%**	

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]

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

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

As part of the biodiversity and wildlife habitat studies, some sampling of post-harvest coarse woody debris (CWD) was completed within Research Forest Units B and D. The most recent sampling completed within Unit B found an average of 78 m^3/ha and 99 m^3/ha of CWD within Cutblocks B-1 and B-3, respectively. Examining just large pieces of CWD (defined as a minimum of 20 cm in diameter and 10 m long), the sampling found an average of 35 pieces/ha in cutblock B-1 and 33 pieces/ha in cutblock B-3. This far exceeds the management plan requirement for an average of 16 CWD pieces greater than 5 m long per hectare. Within Research Forest Unit D, the CWD sampling found that cutblocks D-1, D-2 and D-3 ranged from 66 m^3/ha to 187 m^3/ha. Examining just large pieces of CWD, the sampling found that all three cutblocks averaged more than 26 pieces/ha, which also far exceeds the management plan requirement. Further sampling of CWD is likely to be completed as part of future research projects. Any future results will be reported in subsequent Development Plan updates or replacements.

The assessments within Unit B and Unit D also found that the amount of big CWD within cutblocks was substantially lower than the amount of big CWD found within the mature forests adjacent to the cutblocks, where the vast majority of CWD (74% to 92%) of composed of big pieces. This suggests that harvesting is resulting is a significant loss of big CWD, and that more effort should be applied in conserving large CWD during harvest. These findings are based on sampling mature forests that have experienced significant spruce beetle attack, mortality, breakage and blowdown. It is expected that the long-term level of big, non-decayed CWD in these mature spruce/balsam forests is actually much less, and therefore the average post-harvest big CWD content within the cutblocks may be adequate compared to non-beetle affected spruce/balsam forests. This assumption about the amount of big CWD post-harvest, in comparison to the long-term big CWD amount in non-damaged spruce/balsam stands has not been verified through sampling.

The recruitment 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 (2 to 5 m tall) and understory trees.

CWD Piling for Marten and Meso-carnivore Habitat:

Since the summer of 2017, CWD piling within harvested cutblocks has been occurring on a regular basis. The CWD piling consists of small individual piles near tree edges (preferably along riparian edges) as well as long, continuous CWD piles to connect areas of mature forest habitat.

A map and pictures of Cutblock G-8 and E-8 are shown in Figures 4 and 5 as an example of the type and location of CWD piling implemented within the 2017-18 cutblocks.

Some form of CWD piling for habitat improvement was implemented for all cutblocks that were harvested during April 2017 to March 2018. The long, continuous CWD piles are intended to provide suitable travel and feeding corridors between separated areas of mature tree habitat. The CWD piles are expected to attract large quantities of rodents, a food 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 piling, some of the piles are being continuously monitored with game cameras. This is currently occurring within Cutblocks A-2, B-1, D-3, E-7 and G-8. Cutblocks previously monitored throughout the summer of 2018 include C-2 and G-10. The results of the monitoring and other observations will be shared with the John Prince Research Forest to further aid their continuing study of CWD treatments post-harvest.

Figure 4. Picture of completed CWD corridor that provides connectivity across rehabilitated road located within the road right-of-way between Cutblocks A-3 and A-4.

Figure 5. Picture of a single CWD pile completed near the edge of Cutblock A-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	*Fish Bearing & >20m Wide with Large Flood Plain*	*100*	*0*	*100*
S1-B	*Fish Bearing & >20m Wide*	*70*	*50*	*20*
S2	*Fish Bearing & 5m to 20m Wide*	*50*	*30*	*20*

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

S3	*Fish Bearing & 1.5m to 5m Wide*	*40*	*20*	*20*
S4	*Fish Bearing & <1.5m Wide*	*30*	*0*	*30*
S5	*Non-Fish Bearing & >3m Wide*	*30*	*0*	*30*
S6	*Non-Fish Bearing & <3m Wide*	*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*

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 ≥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 ≥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 ≥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

Where previous Development Plans provided a description of the harvesting completed within every riparian management area of each cutblock, this Development Plan only describes the riparian areas that were harvested inconsistent with the requirements of the Management Plan during the Fall of 2018 to the Summer of 2020. The results for cutblocks harvested between 2016 and the summer 2018, inclusive, were previously summarized in the 2018-2020 Development Plan.

It is notable that the number of riparian areas within or adjacent to cutblocks harvested from Fall 2018 to Summer 2020 was far less than those retained in cutblocks harvested prior to Fall 2018. This may have been partially contributed to all cutblock riparian areas being harvested consistent with forest retention required in the Management Plan, whereas two riparian areas did not achieve Management Plan requirements during the previous Development Plan reporting period.

Over the last four years, riparian evaluations, consistent with the provincial Forest and Range Evaluation Program have been completed on numerous streams. In some cases, riparian evaluations have occurred on streams prior to harvest, so the changes that may result from harvest impacts may be more clearly assessed. The intent is to reassess all of the streams and riparian areas that were evaluated post-harvest as at a high risk of non-functioning or assessed as currently non-functioning. The reassessment of these streams will indicate whether the stream channels and adjacent riparian areas are adequately recovering. In the event that these streams are not improving, subsequent restoration and enhancement treatments may be considered.

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 Maloney[6], 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.

[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

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;
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) When 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 5. *Where future operations within a Research Forest unit may have the potential to negatively impact conditions within one or more watersheds, this is 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 F.

Table 5. 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*
	5th 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	*4th 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*
Research Forest Unit	***Watershed Description***	***Interim Hazard Rating***	***Potential Watershed Concerns***	***Watershed Assessment Recommended***
	Basin that drains directly into Merton Lake and Merton Creek via small streams	*Stream Flow – M* *Sediment – M* *Riparian - M*	*None*	*N*
	Negligible portion 3rd 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 4th order basin that drains into lower section of Caine Creek	*n/a*	*See Unit C comments for this watershed*	*Y*
	Basin that drains directly into Caine Creek via small order streams. Same basin as described for Unit C.	*Stream Flow – M* *Sediment – L* *Riparian – M*	*There is a small order stream basin (see Appendix C) that may be largely modified by planned harvesting in Units D and C*	*N*
E	*Basin that drains directly into the northern branch of Chuchinka Creek*	*Stream Flow – VL* *Sediment – VL* *Riparian – VL*	*None*	*N*
	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.	*Stream Flow – VL* *Sediment – VL* *Riparian – VM*	*None*	*N*
F	*Same basin as described immediately above that drains directly into the southern branch of Chuchinka Creek*	*Stream Flow – L* *Sediment – L* *Riparian – M*	*None*	*N*
	Basin that drains directly into mid-lower section of Angusmac Creek	*Stream Flow – L* *Sediment – L* *Riparian – M*	*None*	*N*

Research Forest Unit	*Watershed Description*	*Interim Hazard Rating*	*Potential Watershed Concerns*	*Watershed Assessment Recommended*
G	*Basin that drains directly into the mid-section of Angusmac Creek*	*Stream Flow – L* *Sediment – VL* *Riparian – L*	*None*	*N*
	Negligible portion of basin that drains into mid and lower section of Angusmac Creek. Same basin as described for Unit F.	*n/a*	*None*	*N*
	4th order basin that flows northward into the Crooked River	*Stream Flow – L* *Sediment – L* *Riparian – M*	*None*	*N*
	Negligible portion of 4th order basin located, mostly south of Unit G, that ultimately drains towards the Crooked River	*n/a*	*None*	*N*
H	*Basin that drains directly into the Bowron river via small order streams*	*Stream Flow – VL* *Sediment – VL* *Riparian – M*	*None*	*N*
	3rd order basin, mostly to east of Unit H, that drains into the Bowron River	*Stream Flow – VL* *Sediment – VL* *Riparian – M*	*None*	*N*
I	*Basin that drains directly into the south side of the Fraser River via small order streams*	*Stream Flow – L* *Sediment – H* *Riparian – L*	*None*	*N*
	Basin that drains directly into Hungary Creek via small order streams	*Stream Flow – L* *Sediment – M* *Riparian – L*	*There is a small order stream basin (see Appendix C) that may be largely modified by planned harvesting in Unit I*	*N*
J	*4th order basin that occupies north western majority of Unit J and drains into Fraser River*	*Stream Flow – L* *Sediment – M* *Riparian – M*	*None*	*N*
	Basin that drains directly into the west side of the Fraser River via small order streams	*Stream Flow – L* *Sediment – VH* *Riparian – L*	*There is a small order stream basin (see Appendix C) may be largely modified by planned harvesting in Unit J*	*N*

Research Forest Unit	*Watershed Description*	*Interim Hazard Rating*	*Potential Watershed Concerns*	*Watershed Assessment Recommended*
K	*Basin that drains directly into the east side of the Willow River from small order streams*	*Stream Flow – H* *Sediment – M* *Riparian – M*	*None*	*N*
	Basin that drains into Pitoney Creek	*Stream Flow – L* *Sediment – VL* *Riparian – M*	*None*	*N*
L	*Basin that drains directly into the east side of the Willow River from small order streams. Same basin as described for Unit K.*	*Stream Flow – H* *Sediment – M* *Riparian – M*	*None*	*N*

*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. While the preliminary assessment shows a high stream flow hazard, it is not expected that Research Forest operations would significantly affect the overall hazard rating, as limited mature forest areas within the watershed 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, both stream flow and sediment hazard is identified as 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 Research Forest harvesting 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. There is a sizeable old growth recruitment area identified west and east of Unit E, which precludes harvesting for multiple years. As well, the western part of the watershed is occupied by a large area of non-mature forest stands which offer limited harvesting opportunities. Considering these areas, limited harvesting beyond the Research Forest boundary is expected within the watershed. Even with full salvage harvest of the remaining mature spruce and balsam stands within the Research Forest, the hazard for this watershed is not expected to reach a high rating. Currently, the preliminary provincial assessment indicates both a low stream flow and low sediment hazard. Any watershed 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 salvage harvesting completed in Unit G, a notable change in watershed conditions may have occurred. In addition, Canfor is also harvesting spruce beetle affected stands adjacent to Unit G, and has additional harvesting planned. Based on the preliminary watershed assessments provided by the province, the Angusmac watershed is currently assessed with a low stream flow hazard and very low sediment and riparian area hazards.

During 2017-18, CNC contacted BCTS and Canfor by email to communicate about the total salvage harvest plans within the Angusmac watershed. Canfor identified that they are tracking watershed modifications and the resulting hazards. In July 2017, I provided Canfor with estimates of our future harvesting to salvage across CNC Unit G. At one point in time, Canfor communicated that the Angusmac watershed has the capacity for approximately 1,700ha of harvest while CNC was proposing up to 750ha of harvesting (final harvesting amount was approximately 636 ha). In the last communication, Canfor replied stating that the Angusmac watershed should not be of concern due the current equivalent clearcut area. Canfor also communicated in November 2017 to confirm that they have correct mapping for the harvested areas within CNC Research Forest Unit G.

Unit K:
For the drainage basin that flows directly into the Willow River from small order streams, the stream flow hazard is rated as high while the sediment hazard is rated as medium. Unit K only occupies approximately 2% of that watershed area, and currently a maximum of about 45 ha of harvesting is proposed within this watershed. This amount of harvesting is not expected to measurably affect the future watershed hazard ratings for this basin.

The other drainage basin affected by Unit K is the Pitoney Creek watershed. A maximum of about 105 ha of CNC harvesting is proposed within this watershed area. With little watershed change expected from the proposed harvesting and the current low stream flow and low sediment, the future watershed conditions are not of concern.

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.

No watershed assessments were undertaken since the last Development Plan, and none are currently planned. Since about 2017, the approach on watershed management has focused on implementing site specific riparian management and road treatments that are expected to lower the overall effect of accumulated harvesting within watersheds. This includes increased riparian retention on all classified streams, and the rehabilitation of all roads and stream crossings not required for long-term access. For many cutblock areas, the result is 100% rehabilitation of in-block roads, including reforestation with an ecologically suited tree species. In addition, overall harvest planning, since 2017, was modified to conserve larger areas of mature forest cover retention that are interconnected, where possible. The ongoing retention areas to mitigate watershed hazards may be further understood by reviewing the Wildlife Tree Retention Results section (Table 4), along with Appendix D, which shows the prescribed Wildlife Tree Retention Areas and the planned biodiversity corridors. The scope of completed road rehabilitation treatments, which also serves to mitigate watershed hazards may be observed by reviewing Table 7, under the Permanent Road Disturbance Results section, which summarizes the amount of cutblock area occupied by new permanent roads in 2017.

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 continuing silviculture obligations, research access, and the ability to quickly respond to various forest health factors.

Each cutblock site plan is designed to recognize and estimate the amount of permanent roads, 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 uses while conserving the soil and other forest resources.

Permanent Road Disturbance Results

To ensure ongoing timber supply analysis properly accounts for the reduction in productive forest landbase from permanent road construction, it is necessary to accurately track road rehabilitation and the remaining permanent road area within the Research Forest. This is done via maintenance of a digital road layer composed of all Research Forest road sections, which includes multiple attributes about the type of road and whether it is built, deactivated, or rehabilitated.

To accurately quantify the expected, average amount of permanent road required to access future harvest opportunities, the area of the remaining non-rehabilitated roads, constructed since the last timber supply review, was totaled and compared to the total productive area of all

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

the harvested cutblocks. The total remaining road area equates to 1.12% of the total prescribed cutblock area, which is significantly less than the previous timber supply forecast of 1.37%. The calculation does not include the road area and prescribed area of Cutblock G-6, as the road rehabilitation within that area is not complete. The table summarizing the road and cutblock areas involved in the calculation of the average is provided in Appendix G.

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.

Dispersed Soil Disturbance Results

Since summer 2018, continued large-scale salvage harvesting occurred in Research Forest Units B, E and F, as planned in the previous Development Plan. The majority of this harvesting occurred during winter conditions. Based on regular harvesting supervision and post-harvest insepctions, no soil disturbance surveys were conducted, as all prescribed standard unit areas were deemed to be meeting soil disturbance limits.

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

Cutblocks K-3, K-4 and K-5 are proposed near the Willow River, north of Ispah Lake, and fall within an area with a retention visual quality objective. To date, no visual assessment have been conducted on these cutblocks.

Portions of cutblocks J-11 and J-14 fall within an area with a partial retention visual quality objective associated with the Fraser River. To date, no visual assessment has been conducted on these cutblocks.

Visual Quality Management Results

During the winter of 2019, Cutblocks B-3, B-4, B-5, and B-6 were harvested. The viewpoints discussed, below, were not revisited post-harvest to confirm if any portions of these cutblocks are visible. The much larger Cutblock B-1 (near B-4, B-5 and B-6) was observed, post-harvest, from the Tacheeda Lake Recreation Site-harvest, and was found to be barely visible with no evident bare ground.

Cutblock B-3

This cutblock is proposed for sanitation and salvage harvesting during the winter of 2019 and is located along the southern end of Unit B. The cutblock design has been finalized and a visual assessment has been completed, as there is potential that the western portion of the planned cutblock may be visible from the southern end of Tacheeda Lakes. The proposed harvest area falls under a partial retention visual quality objective. The assessment selected two viewpoints within the southern end of Tacheeda Lakes and predicted that the proposed harvesting will not be visible from viewpoint #2, the northern-most viewpoint. The assessment also predicted that a change in the visible tree canopy line may occur, but no bare ground will be viewable. Based on this assessment, the proposed harvesting is not expected to increase the the level of alteration from the viewpoints.

Cutblock B-4

This cutblock, proposed for sanitation and salvage harvesting, is located upslope of the First Nation lands within the mid portion of Unit B. A visual assessment was completed on the prescribed cutblock design as it is likely portions of the harvest area will be visible from the main body of Tacheeda Lakes, with limited harvesting visbility from the Tacheeda Lakes Recreation Site. The proposed harvest area falls under the partial retention visual quality objective. The assessment selected considered two viewpoints on Tacheeda Lakes, only one of which was fully assessed, as the other was determined to be fully terrain blocked. The remaining viewpoint was located near the central portion of the main Tacheeda Lake. The assessment predicted that a small amount of bare ground may be visible, along with a change in tree line. Overall, it is predicted that the amount of visble bare ground disturbance may increase by 1.5%, but the affected landform will still meet the definition of a partial retention visual quality objective.

Cutblocks B-5 and B-6

These cutblocks are proposed for salvage harvesting and are located at relatively elevated positions within the northern end of Unit B. A visual assessment was undertaken as portions of

this area are likley visible from the main body of Tacheeda Lakes and at the Tacheeda Lakes Recreation Site. The proposed harvest area falls under the partial retention visual quality objective. The assessment considered three different viewpoints from the main Tacheeda Lake, including the view from the Tacheeda Lakes Recreation Site. The assessment predicted that the harvesting for Cutblock B-5 will result in visbile bare ground from viewpoints #2 and #3, which are located on nothern half of the main Tacheeda Lake. From viewpoint #1, which is at the Recreation Site, the predicted visible bare ground is expected to be very minimal. From all viewpoints, the landform is expected to maintain its partial retention characteristic with the harvesting of Cutblock B-5. The same viewpoints were also examined for the combined effect of Cutblock B-5 and B-6 harvesting, with a slightly different viewing angle focused more upslope towards Cutblock B-6. The assessment predicted that there will be no addition of visable bare ground with the harvesting of Cutblock B-6, although the upper treeline of the viewable landform is expected to change from viewpoint #2 and #3. As such, the partial retention characteristic of the landform is expected to be maintained.

Existing and New Recreation Use of Research Forest

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.*

Proposed Strategies Recreation Opportunities within Research Forest

The previous Development Plan included specific strategies regarding recreation opportunities within the Research Forest. These have been generalized as follows:

1) A similar level of road access, as existed prior to the establishment of the Research Forest, will be maintained to each Research Forest unit unless its continued existence or 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) As agreed to by the CNC NRFT program, road and trail improvements to various Research Forest Units may be created or improved for student and instructor access to outdoor teaching and research sites.
3) Directional roadside signage will be installed and maintained for the majority of CNC Research Forest Units.
4) Large sign kiosks, displaying map information and Research Forest activities, will be installed and maintained at the majority of Research Forest Units, to inform the public and local recreationlists.
5) Picnic tables will be installed for use by CNC Research Forest staff, CNC students, CNC Instructors and for general public use.

Recreational Access Management Results

1) Permanent road access to all Research Forest Units is currently available. Access to Research Forest Unit J is expected to be significantly improved during the term of this Development Plan.
2) The typical road developments necessary to support regular Research Forest operations are expected to provide adequate student and instructor access over the next 5 years. Roadside brushing in Unit L as well as the sign kiosk installations and the short trails in Units A, D and G are expected to improve student and instructor experience over the next 5 years.
3) Directional roadside signage is installed for all Research Forest areas except Unit J. Signs were installed for Unit J, but were subsequently removed by someone. Limited directional roadside is expected to be re-installed along the access to Unit J during the term of this Development Plan.
4) Eight of the Eleven planned Research Forest sign kiosks are installed. The remainder will be completed during the term of this Development Plan. Figure 6 shows the sign kiosks installed within Research Forest Units I and G.
5) Picnic tables for a portion of the Research Forest areas will be installed during the term of this Development Plan.

Figure 6. Sign Kiosk and Picnic Table at Research Forest Unit I - Hungary Creek (top) and Sign Kiosk at Unit G – Angusmac Creek (bottom)

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.

[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

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.

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

During the term of this Forest Development Plan, the proposed harvesting and hauling is not expected to have a significant impact on the Recreational sites and trails listed previously. The Willow-Coalmine Road will be active during the winter of 2021 for log hauling from Unit K. Also, the proposed Unit K log hauling will occur along the access road to the Grizzly Lake recreation site, however this will occur during the winter months, when recreational use at Grizzly Lake is low.

Recreation Referral Results

No recent recreation site/trail referrals have occurred.

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.

Proposed Road and Trail Access Management

Consistent with the the road and trail objective and strategies, rehabilitation of short-term roads is planned within all new cutblocks scheduled during the term of this Development Plan. It is expected to result in rehabilitation of the vast majority of in-cutblock roads.

There is currently no deactivation or rehabilitation treatment planned for existing roads and trails (ones present prior to CNC development) that are regularly used by motorized vehicles.

Road and Trail Access Management Results

The Development Plan Maps provided in Appendix A show the current road network for all Research Forest Units. The existing Research Forest roads are displayed as either permanent or temporary, with temporary roads shown as rehabilitated, as applicable. Rehabilitated road sections are not expected to function as roads or trails, as they are intended to be part of the productive forest area.

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 the Appendix, 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 the Appendix. 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.

During the term of Development Plan, commercial thinning is proposed adjacent to the existing Provincial trial with Unit D. The boundary of this trial, along with any required buffer, will need to be verified prior to conducting the commercial thinning operation.

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. Mapping of the research project site locations is provided in Appendix B, but is only updated once per year, unless significant new project additions warrant map updating. The maps currently provided are updated to Summer/Fall 2020.

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*

[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_ps.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_ps.html

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 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]

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[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

[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.

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.

Proposed Development Adjacent to Provincial Parks

Consistent with the previous referral to BC Parks, a sizeable no harvest buffer is planned within the Research Forest adjacent to the Fraser River Provincial Park. In addition, continual road access will be limited through continual road rehabilitation and road deactivation. These measures are expected to minimize the potential impacts to the Fraser River Park.

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.

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http://www.env.gov.bc.ca/bcparks/planning/mgmtplns/fraser_river/fraser_river_ps.pdf?v=1459895694354

[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 under this Development Plan include:

1) Carrier Lumber and Canfor – Unit K. This is primarily related to road-use
2) Carrier Lumber – Unit J and Unit L. This is primarily related to road use

During 2020, Carrier Lumber was contacted multiple times about road and gravel use along the Willow-Coalmine, as well as notifications of the CNC Research Forest's intention to begin forestry operations within Unit J. No issues or concerns resulted from these communications.

Canfor and Lakeland Mills have been in contact with CNC numerous times concerning planning and operations adjacent to Units A, C, D, F and G. Information concerning Research Forest planning and adjacent licensee planning has been shared and discussed freely. To date, there are no unresolved issues concerning adjacent licensee harvesting and road construction.

Road Construction and Shared Road Use in Research Forest Unit C and D

Canfor and CNC, on multiple occasions, have communicated about Canfor using the roads within Units C, D and G for access new spruce beetle cutblocks adjacent to the Research Forest. This includes both road construction work within the Research Forest and applying for road permit authority through Research Forest Units C and D, as conducted by Canfor. This additional road construction and road use, within Unit C, D and G is expected to occur during the term of this Forest Development Plan. These works and road use are not expected to negatively impact the Research Forest Management Plan objectives and strategies.

Road Construction and Shared Road Use Specific in Research Forest Unit A

Lakeland Mills is proposing new cutblocks adjacent to the south side of Unit A, which, due to terrain, will require some log hauling to travel north through the Research Forest, which will require the construction of short sections of road within Research Forest Unit A. This additional road construction and road use within Unit A is expected to occur during the term of this Forest Development Plan. These additional constructions are not expected to negatively impact the Research Forest Management Plan objectives and strategies.

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

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 6 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 6. Trapping and Guiding Licenses Overlapping with the Research Forest[18]

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]

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.

[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

[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

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 beyond summer 2020, referrals identifying newly designed cutblock development within Units J and K, along with the proposed commercial thinning within Units A and D, were sent to affected trappers and guides. This includes:

1) Guiding License 710G003 Alfred Schneider (Unit J)
2) Guiding License 709G001 Ken Watson (Unit K)
3) Guiding Licnese 724G002 Steve Saunders (Unit A & D)
4) Trapping License 710T003 Robert Denis (Unit J)
5) Trapping License 707T001 & 709T004 Wayne Sharpe (Unit K)
6) Trapping License 724T004 Daniel and Matthew Morris (Unit A & D)
7) Trapping License 716T008 Eugene & Albert Isadore (Unit A)

The proposed harvesting in Unit L has not yet been referred to affected trappers and guides.

The 2016 Management Plan was also referred to all trapline holders as part of the public review process, along with the Management Plan Amendment #1 (concerning new timber supply review), which was referred during fall 2017.

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

Trappers and Guides Referral Results

The referrals and notifications sent to the Trappers and Guides for Units A, D, K and J are provided in Appendix H.

With the Unit J referral, follow-up phone conversations with Robert Denis and Alfred Schneider revealed the following management issues:

- Robert Denis' cabin located south of Unit J
- Limiting the road accessible by motor vehicle, at any point in time
- Do not allow for access to lake in southwest portion of Fraser River Park
- Wildlife Mineral Lick near proposed Cutblocks J-7, J-8, J-9
- Robert Denis prefers to be notified about all operations, including road brushing/road improvement works.

CNC will continue to work with Robert Denis to minimize impacts to his trapline operations. This depends on readily sharing plans regarding road development, road deactivation, road rehabilitation, timing of operations and forest and wildlife habitat retention areas. By sharing information, the intent is to collaboratively plan for forestry operations that may reduce the

effects of harvesting on trapping resources and trapping activities. Regarding the Mineral Lick, identification and assessment of the area is required, along with collaborative communication with Robert Denis, prior to proceeding with any operations adjacent to the feature. These efforts towards the trapline are also expected to limit the effects on the guiding territory, unless informed differently by Alfred Schneider.

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.

During October 2018, the mineral license holder for the area along the Willow River adjacent to Unit L was contacted about the existing trail that originates in the southwestern end of Unit L and travels towards the Willow River. The license holder stated that he is not actively using the trail nor is he expecting to use the trail in the near future, but he does not want to see the trail deacivated or blocked as he has continuing interests in the mineral license.

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

[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

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

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. No further forestry operations adjacent to the communication site within Unit G are proposed at this time.

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 includes harvesting near the private lands described above. The McLeod Lake (First Nation) Forestry office committed to providing any applicable McLeod Lake Band referral information to the land holder. To date, the referral process has not garndered any concerns from the landowner regarding the CNC proposed or onoging operations. No further forestry operations, adjacent or near, this private land are proposed at this time.

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

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[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

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 ranking protocol developed by an archaeologist. This potential ranking 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 an archaeological overview assessment where there is no provincially recognized Archaeological Predictive Model.

Archaeological Assessment Results for Units B, E, and F

Since the last Development Plan, archaeological assessments have been completed for cutblocks K-1, K-2, A-101, D-101, D-102, and within the Unit L partial-cut pine salvage area. A summary of the assessments completed and the associated findings is provided in Table 7, immediately below.

Table 7: Summary of Completed Archaeological Assessments for Cutblocks and Roads (2018-2020)

CNC Cutblock	Assessment Date	Type of Assessment(s) Required	Findings
K-1	August 2018	Archaeological Impact Assessment	No archaeological or cultural heritage resources identified
K-2	August 2018	Archaeological Impact Assessment	No archaeological or cultural heritage resources identified
Near L-EX1 Salvage Area	August 2020	Archaeological Impact Assessment	One lithic site identified near Willow River. Area to be protected with a 30m or greater no harvest zone
A-101	October 2020	Archaeological Overview Assessment	Areas of Archaeological potential identified within proposed commercial thinning boundary, which requires an AIA or elimination of proposed treatment area
D-101	October 2020	Archaeological Overview Assessment	Areas of Archaeological potential identified within proposed commercial thinning boundary, which requires an AIA or elimination of proposed treatment area

D-102	October 2020	Archaeological Overview Assessment	Areas of Archaeological potential identified within proposed commercial thinning boundary, which requires an AIA or elimination of proposed treatment area

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 140m^3/ha of net live conifer timber;*

A cutblock is deemed a salvage operation when the current amount of live timber (or predicted amount of live timber within 2 years) equates to 140 m^3/ha of net timber volume or 130 m^3/ha of sawlog volume. Considering the high variability in wood product value derived from subalpine fir (balsam) timber, stands that are subalpine fir dominated (>75% subalpine fir-leading) may be considered salvage stands even where the net live volume is estimated to exceed 140m^3/ha.

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, particularly Canfor-Prince George, concerning harvesting operations, log hauling and road-use.

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 160m^3/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, no young stands, within cutblocks reforested under a Research Forest Management Plan have been identified for treatment.

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 160m^3/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 500m^3/year during the 10 to 60-year period.); and*

To date, no intermediate-aged plantations or natural stands have been identified for treatment.

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

All Research Forest Units continue to be viewed via helicopter flight, on an annual basis, particularly where the provincial aerial overview survey identifies forest health factors near or within the Research Forest.

There continues to be some level of notable spruce beetle, Douglas-fir beetle, and western balsam bark beetle within or adjacent to every Research Forest Unit.

Units A to G
Although spruce beetle and western balsam bark beetle remain active within and surrounding Units A to G, regular monitoring and oversight is not being undertaken, as the majority of the remaining mature stands are identified for the conservation of biodiversity and mature forest cover connectivity.

Unit H
Within 2 Km of Unit H, there is one spot with individual Douglas-fir trees affected by Douglas-fir beetle and one spot with individual subalpine fir affected by western balsam bark beetle. Within Unit H, there is one spot with individual spruce trees affected by spruce beetle. Severe budworm attack was noted across the majority of Unit H, along with a small area of cedar flagging.

Unit I
Within 2 km of Unit I, there is one spot with individual spruce trees affected by spruce beetle. As well, cedar flagging is present within and near Unit I.

Unit J
Within 2 km of Unit J, there are 3 spots identified with a few individual spruce trees affected by spruce beetle, along with 1 spot with a few individual Douglas-fir trees affected by Douglas-fir beetle. Within Unit J, there is 1 spot identified with a few individual spruce trees affected by spruce beetle, along with one area with trace spruce beetle attack located in the gully/drainage that separates the Fraser River Park from Unit J. During the summer of 2020, an additional helicopter flight and ground reconnaissance identified a few spots with individual spruce beetle attacked trees within the northwestern portion of Unit J.

Unit K
Within 2 km of Unit K, there are 3 spots identified with a few individual spruce trees affected by spruce beetle. The previously identified spots with individual trees attacked by balsam bark beetle are scheduled for removal by harvesting as part of larger planned cutblocks.

Unit L
Within 2 km of Unit L, there are 3 spots identified with a few individual spruce trees affected by spruce beetle.

Forest Health Treatment Results

Units A to G
Removal of the spruce beetle, western balsam bark beetle and blowdown within the remaining mature forests within Units A to G is not being considered as the vast majority of these remaining stands are identified for the conservation of biodiversity and mature, forest cover connectivity.

Units H to L
No treatments are currently planned, but further monitoring is planned to assess the prevalence of spruce beetle, Douglas-fir beetle, and western balsam bark beetle, along with the budworm attack in Unit H.

Spruce Beetle Collection and Monitoring

During the spring and summer of 2019 and 2020, CNC installed funnel traps with spruce beetle lures at multiple sites with the Bear Lake area west of Highway 97. Air temperature monitors were also deployed at all the collection sites. The intent is to trap beetles throughout the entire spruce beetle flight period to better correlate air temperature with the emergence and flight activity of spruce beetles. The results from 2019 and 2020, along with previous years' results support the temperature thresholds stated in the provincial hauling and milling guidance released within the Omineca region.

Forest Health Experimental Results

2020 Funnel Trapping Trials

To further study ways to improve spruce beetle funnel trapping success, two trials were conducted during the spring and summer of 2020. One tested the effectiveness of replacing the artificial pheromone lure with a small piece of spruce tree stem-wood. The second trial, studied the difference in spruce beetle capture among funnel traps, equipped with standard artificial pheromone lures that were subjected to differing light intensity. Neither trial identified means of improving the rate of spruce beetle capture beyond the standard installation of funnel with artificial pheromone lures.

2020 Spruce Log Milling Study

The CNC Research Forest and CNC Applied Research Forest staff completed dendrochronology analysis of a large sample of spruce logs to determine the time of mortality. The sampled logs were selected from a population of logs selected for a milling study comparing the lumber out-turn of dead spruce logs to green spruce logs. The study was a cooperative undertaking between major forest licensees and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

Continuing Spruce Shelf-Life Study

CNC is providing the primary analysis supporting federally funded research project that is examining the change in physical wood properties post-spruce beetle attack. The project partners include local major forest licensees and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development as the primary collaborator. The study currently involves spruce wood samples that have existed for up to 5 years post-beetle attack.

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 0.18m^3/tree and average tree height is greater than 22m and where the remaining live trees are not expected to achieve 160m^3/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 180m^3/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 160m^3/ha of conifer yield by age 65 (rehabilitation treatments are dependent on the availability of Provincial funding).*

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

There are currently no plans to harvest or rehabilitate the areas occupied by standing dead lodgepole pine within Units A, B, E, F, I, J, K and L. In most cases, these formerly pine-leading areas are now re-classified as non-pine leading with the existing intermediate-sized trees now forming the dominate tree canopy. These remaining stands will be left unmanaged to avoid further impacts from salvage harvesting (in addition to those impacts from spruce beetle salvage harvesting). The residual non-pine leading stands are expected to produce economical timber products when the stands reach maturity. It is also important to recognize that a significant portion of the stands with dead, mature lodgepole pine are within rare/at risk ecosystems that are currently identified for conservation. Athough, there is no strategy or proposal to harvest dead lodgepole pine, it is possible that small portions of stands with dead pine may be included within proposed harvesting, where stands are not being retained for biodiversity or wildlife habitat.

There is no harvest priority associated with the dead pine stands under the current timber supply review and under current operational plans. All dead pine volume is considered non-operable, and therefore do not contribute any timber volume to the forecasted allowable annual cut.

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 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. This area is not planned for harvest due to the steep slopes and relatively low volumes 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, 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 maintian 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. While it is not fully contiguous area, 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 approximately 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 choosen for harvest during previous salvage harvesting 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 20,000m^3 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

With the completion of planned salvage harvesting within Research Forest Units A to G, the remnant stands with intermediate to old (>40 years old) spruce trees was examined to determine how much operationally available spruce volume is at risk of being lost to further spruce beetle attack. The analysis did not consider spruce that is located within prescribed wildlife tree retention areas or in currently planned biodiversity corridors. These areas are generally not available for harvest as conservation of forest biodiversity, ecosystems at risk, and mature forest habitat are the primary objective.

The analysis shows that the notable area with spruce content remains within the northeastern portion of Unit A (where Cutblock A-7 was once proposed), within the northwestern portion of Unit C, and within various locations within Unit E.

The area identified within Unit A was considered a moderate to high priority for salvage harvesting, but was left unharvested to improve the balance between large connected young forest (0-40 years old) and mature forest. Even with the former Cutblock A-7 not harvested, the area in Unit A is occupied by less than 25% mature forest (60 years and greater).

The identified area in Unit C was not considered for salvage harvest as the vast majority is balsam-leading with an age of approximately 65 years. Considering the stand age equates to both a lower hazard of spruce beetle attack and a greater ability of the stand to rebound from beetle attack, the area was considered a low priority for salvage harvesting.

A significant portion of the remaining, non-salvaged forests within Unit E were considered to be a low salvage priority for the same reason as explained for Unit C.

Overall, it is estimated that less than 15,000 m^3 of formerly live spruce timber may be lost to ongoing beetle attack with Units A, C and E, but will not result in any significant forested area becoming uneconomical to harvest in the future.

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

Dunkley Lumber was responsible for establishing and submitting the hauling and milling plans for spruce beetle logs harvested and hauled from the Research Forest during fall 2018 to summer 2020.

The harvesting that occurred during the fall of 2018 and winter of 2018/19 required log storage within the Winton Global (Hart Highway) Log Yard. A significant portion of the log storage included logs infested with spruce beetles, but, consistent with provincial guidance, this inventory was moved to the Dunkley Lumber mill yard for milling prior to mid-June 2019.

Harvesting Consistency with Chief Forester Guidance Regarding Spruce Beetle Sanitation and Salvage

Stand and Landscape-Level Retention for Harvesting in Response to Spruce Beetle Outbreaks

The Chief Forester guidance regarding stand and landscape-level retention was released in September 2017, and aimed at those involved in designing harvesting in response to spruce beetle outbreaks within the Omineca Region (includes Prince George and Mackenzie Timber Supply Areas). There are 25 items listed in the guidance. The following summarizes the key categories of guidance relevant to the management of the CNC Research Forest. For each category of guidance, the Research Forest harvesting since September 2017 is examined to test consistency with the Chief Forester guidance. This includes examination of the following cutblocks: A-2, A-3, A-4, A-5, A-6, A-8, B-3, B-4, B-5, B-6, E-5, E-6, E-7, E-8, E-9, E-10, F-5, F-6, F-7, F-8, F-9, F-11, G-2, G-5, G-6, G-7, G-8, G-9, and G-10. The design and layout of many of these cutblocks was finalized prior to the implementation of the Chief Forester guidance.

Coordinated Harvest and Landscape-Level Retention Planning

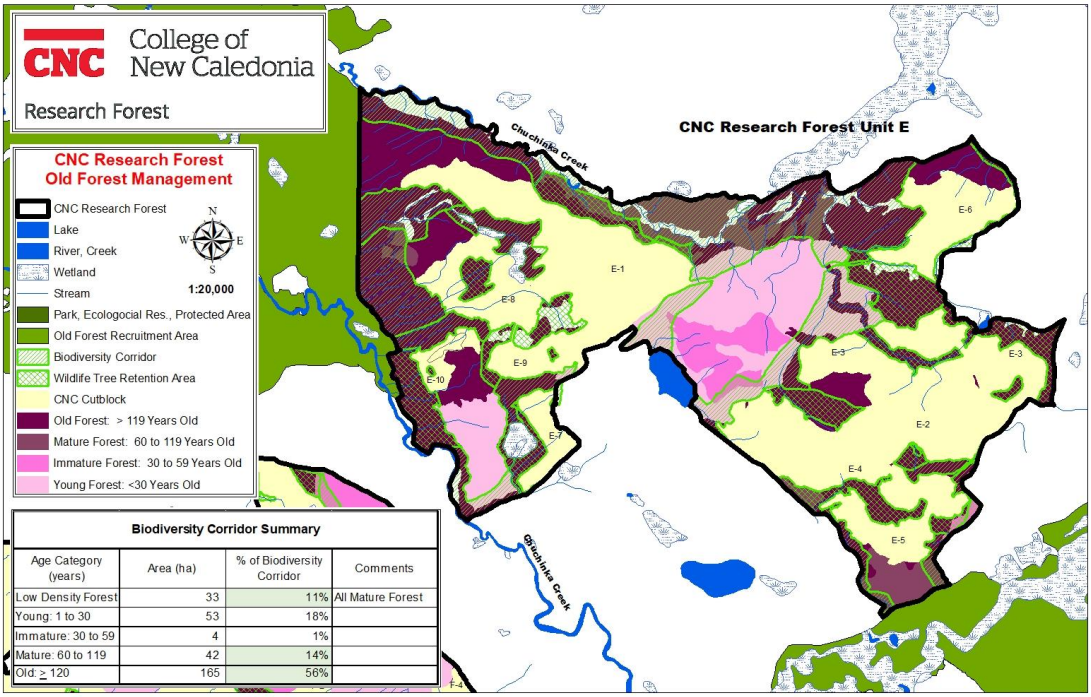
There should be an effort between licensees, in partnership with government and First Nations, to coordinate harvest planning and develop a spatialized retention plan that identifies areas retained from harvesting for a minimum of 40 years. The plan should be long-ranging and minimize large amalgamated openings. Retention areas should be located to benefit multiple values. Landscape biodiversity thresholds established in orders are legal requirements to be met. There should be collaboration on the tracking of harvesting, partial harvesting and retention in response to the beetle outbreak.

Results:

During 2017, spatial planning of potential retention areas (referred to as biodiversity corridors) was completed for all remaining non-harvested areas within Units A, B, E, F and G. These retention areas were aimed at maintaining mature forest connectivity, where possible, largely include old forest (>120 year old) spruce and balsam stands, and include the retention of rare ecosystems (primarily SBS wk1 02, 03, and 04 sites), riparian areas, and both Douglas-fir leading and deciduous-leading stands.

In terms of future forest development, these biodiversity corridors were intended for the establishment of wildlife tree retention areas, which are assumed to remain unharvested for 60 years, or remain as biodiversity corridors in instances where only 33% of the area may be less than 60 years old at any time. This supersedes the requirement to leave the areas unharvested for a minimum of 40 years. As an example, Figure 7 shows the current configuration of wildlife tree areas and biodiversity corridors within Research Forest Unit E. It should be noted that some of the biodiversity corridor area include non-mature forests, in which harvesting is to be delayed to ensure recruitment of connecting mature forests. Maps showing the current wildlife tree retention areas and planned biodiversity corridors, within all Research Forest Units, may be found in Appendix D.

Figure 7: Wildlife Tree Retention Areas and Biodiversity Corridors within Research Forest Unit E



Mid-Term Timber Supply Considerations in Retention Planning

Marginal or non-impacted stands should be retained in order to contribute to the mid-term timber supply. Ensure the impacts on all forest values including mid- and long-term stand yields are considered.

Results

For the vast majority of spruce beetle cutblocks harvested or planned, the bark beetle attack percentages were very high, so there was limited opportunities for retaining significant sized areas suitable for mid-term timber supply. In almost every case, the only areas predicted to provide sufficient mid-term timber volume were balsam-leading or those with high balsam volume in codominant and intermediate sized trees. This means that any mid-term timber available in spruce beetle affected areas was forecasted to be composed of 75% or more balsam volume. The future economic viability of these stands was deemed highly speculative as similar mature balsam stands are considered problem stands under current timber supply assumptions. In consideration of this, the location of retention areas was primarily based on the potential to contribute to various forest values rather than mid-term timber supply (ex. Riparian areas, uncommon habitat, and ecosystems at risk).

Stand-Level Retention Relative to Early Seral Patch Size

New harvesting is expected to take into account existing harvest openings. Early seral stands are considered 0 to 40 years old. Minimize the creation of large early seral patches (>1,000ha) and provide rationalization when doing so. Stand-level retention of mature / old forest structure should increase as the size of the harvest patches increases:

Patch Size	Percent of Patch Unharvested/Retained
<50 ha	10%
50-100 ha	>10%
101-1,000 ha	>15%
>1,000 ha	>25%

Results:

Due the existing pattern of previous harvesting and current, wide distribution of large, early seral patches (<40 years old) within and adjacent to the Research Forest, it is not possible to undertake any sizeable spruce beetle harvesting without contributing to relatively continuous early seral patches greater than 1,000 ha. This is the case for many extensive areas within the Prince George Timber Supply Area. The alternative is to ensure that all management objectives are met within each Research Forest Unit (ex.: old forest retention, riparian management, coarse woody debris retention, etc) and that the resulting area contains an appropriate percentage of remaining mature forest. The Chief Forester recommendation is >25% when the resulting continuous early seral patch >1,000 ha. Table 8 below, summarizes the total percentage of cutblock area prescribed as wildlife tree retention areas within each Research Forest Unit since the release of the Chief Forest guidance. Besides Research Forest Unit A, which is slightly below the recommended target (24.3% vs 25%), the post-guidance harvesting in all other Units has achieved the Chief Forester guidance of 25% for mature forest retention associated with cutblocks contributing to >1,000 ha early seral patches (less than 40 years old).

It is important to recognize that with the established planning for biodiversity corridors in combination with the prescribed wildlife retention areas, the Chief Forester's recommendations regarding stand-level retention associated with openings >1,000 ha was far exceeded for Units A, B, E, F and G, which were a focus of planning and salvage during 2017 and beyond.

Table 8: Wildlife Tree Retention within Each Research Forest Unit

	Total Cutblock Area (ha)	Harvest Area (ha)	Reserve Area (ha)	Wildlife Tree Area %
UNIT A				
Unit A: Total Retention Post-guidance	**464.1**	**351.5**	**112.6**	**24.3%**
Unit A: Total Retention Pre-guidance	**158.7**	**134.3**	**24.4**	**15.4%**

Unit A: Overall Retention Total	**622.8**	**485.8**	**137.0**	**22.0%**
UNIT B				
Unit B: Total Retention Post-guidance	**338.4**	**253.2**	**85.2**	**25.2%**
Unit B: Total Retention Pre-guidance	**146.8**	**109.9**	**36.9**	**25.1%**
Unit B: Overall Retention Total	**485.2**	**363.1**	**122.1**	**25.2%**
UNIT C				
Unit C: Total Retention Post-guidance	**-**	**-**	**-**	**N/A**
Unit C: Total Retention Pre-guidance	**651.1**	**524.8**	**126.3**	**19.4%**
Unit C: Overall Retention Total	**651.1**	**524.8**	**126.3**	**19.4%**
UNIT D				
Unit D: Total Retention Post-guidance				**N/A**
Unit D: Total Retention Pre-guidance	**681.2**	**528.9**	**152.3**	**22.4%**
Unit D: Overall Retention Total	**681.2**	**528.9**	**152.3**	**22.4%**
UNIT E				
Unit E: Total Retention Post-guidance	**235.7**	**147.2**	**88.5**	**37.6%**
Unit E: Total Retention Pre-guidance	**344.1**	**302.2**	**41.9**	**12.2%**
Unit E: Overall Retention Total	**579.8**	**449.4**	**130.4**	**22.5%**
UNIT F				
Unit F: Total Retention Post-guidance	**382.5**	**260.2**	**122.3**	**32.0%**
Unit F: Total Retention Pre-guidance	**439.7**	**404.4**	**35.3**	**8.0%**
Unit F: Overall Retention Total	**822.8**	**664.6**	**157.6**	**19.2%**

UNIT G				
Unit G: Total Retention Post-guidance	**883.1**	**611.4**	**271.7**	**30.8%**
Unit G: Total Retention Pre-guidance	**517.8**	**448.6**	**69.2**	**13.4%**
Overall Retention Total	**1,400.9**	**1,060.0**	**340.9**	**24.3%**

Assuming that all Research Forest Units north of Prince George now have relatively continuous early seral patches in excess of 1,000 ha (considering continuous areas within and adjacent to the Research Forest), then it is important that the remaining mature forest area, or at least the intermediate to old (40 years and greater) forest area is 25% of the productive Unit area. Table 9 summarizes, by Research Forest Unit, the amount of area occupied by young (early seral) stands as well as the area occupied by mature forest. All Units except Unit D have 25% or more of the area currently occupied by stands 41 years old and greater. Unit D is reflective of layout, prescriptions, and large-scale harvesting that occurred during January to March 2017, prior to the Chief Forester guidance, released in September 2017. Within approximately 10 years a significant area of existing plantations within Unit D will exceed 41 years old, bringing the non-young percentage well past 25% of the total area.

Table 9: Summary of Resulting Young, Immature and Mature Forests within Research Forest Units A to G

Research Forest Unit	Young Forest Area: ≤41 Years (ha)	% of Unit with Young Forest	Immature Forest Area: 41 to 59 Years (ha)	% of Unit with Immature Forest	Mature Forest Area: ≥60 Years (ha)	% of Unit with Mature Forest	Non-Young Forest Area: ≥ 40 Years (ha)	% of Unit with Mature and Old Forest	Total Productive Forest Area (ha)
A	699	75%	19	2%	216	23%	235	25%	934
B	639	61%	0	0%	414	39%	414	39%	1,053
C	722	69%	0	0%	326	31%	326	31%	1,043
D	897	83%	0	0%	186	17%	186	17%	1,082
E	589	54%	0	0%	492	45%	492	46%	1,078
F	857	71%	108	9%	233	19%	341	28%	1,199
G	1574	72%	2	0%	553	28%	555	28%	2,185

Composition and Design of Landscape-Level and Stand-Level Retention

Retention areas should be representative of the forest that was present before harvesting (not limited to non-economic stands), including as many live and non-susceptible trees as possible. There should be an emphasis on connectivity and consideration of potential blowdown events. Retention should capture multiple values wherever possible. The distance to standing tree cover for animals should not exceed 250 m (also adds natural seed dispersal). Secondary stand structure should be retained along with large CWD in various patterns. Special consideration needs to be made in areas identified for Caribou management, which must follow government guidance for recovery.

As the spruce beetle attacked Research Forest Units were well-dominated by spruce and balsam-leading stands, the vast majority of retention areas are quite representative of the stands harvested. As a result, this recommendation was met. In addition, any significant areas of mature deciduous and Douglas-fir were retained, along with notable areas with ecosystems at risk.

As previously mentioned, live tree retention was often a secondary consideration due to both the high levels of spruce beetle attack and the few stands with predicted, economical mid-term timber volume. Despite the previous, the majority of retained stands have considerable live balsam content to provide ongoing biodiversity.

Connectivity of retention areas was a primary consideration for Research Forest Units A, B, E, F, and G, but was not part of design for Unit C and D. Particularly in the case of Unit D, this has resulted in a comparatively low retention of old forest and a dominance of early seral stage patches.

The distance to tree cover of 250 m for potential animal movement was not considered in the planning, and therefore is only achieved where smaller cutblocks were designed.

Secondary stand structure was prescribed for retention on all cutblocks, but variable results were achieved based on abundance of understory, original stand damage conditions, snow levels, operational considerations and individual operator experience and discretion. This continues to be an area of improvement. To further pursue improvement, enhanced secondary stand structure and individual mature tree retention will be attempted in a few targeted cutblocks over the next few seasons.

Significant amounts of coarse woody debris have been left scattered on the cutblocks in all Units as harvesting contractors were directed not to skid all potential pulp log pieces. In addition, roadside debris and other harvesting debris has been gathered and piled to produce potential habitat targeted for rodents and mesocarnivores. For multiple cutblocks, some of the CWD piling was done as long continuous corridors to provide favourable protective cover to allow mesocarnivores to travel between mature forest areas in otherwise clearcut areas. It is expected that the recommendations regarding CWD have been met.

The caribou management recommendations do not apply to the Research Units harvested to date.

Partial Harvesting

Partial harvesting should be utilized to optimize harvest of trees attacked by beetle while retaining healthy trees.

Results

No partial retention harvesting has been attempted to date. Partial retention harvesting, in spruce beetle areas, is most applicable in areas of leading-edge attack where small patch cuts and individual tree removal is expected to be effective at controlling or removing live beetle populations from a targeted area. Due to the extensive and severe attack within and surrounding the Research Forest, to date, there have been essentially no spruce beetle stands to support this approach to harvesting. Where feasible, scattered and patchy tree retention was achieved on sizeable portions of Cutblocks B-1, B-2, B-3, B-4, B-6, E-9, E-10, and F-5, which is providing for an increased level of post-harvest biodiversity and vertical structure.

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 to 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 the 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.

A grass mix, composed of species native to British Columbia, is being used and tested to revegetate disturbed areas within riparian zones and other areas. The intent is to determine whether the native seed mix may be more effective for revegetation in sensitive areas where there is a high expectation of negative impacts from invasive plants. The need for improved seed mixes for more sensitive areas is based on the observation that invasive species (particularly hawkweed) and alsike clover may be more prevalent within standard seeds than desired.

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 (often up to 100%) 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 notable 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;*

The application of herbicide is not being considered for the regular treatment of competing deciduous trees and other vegetation competition. Herbicide application may be considered to support the implementation of a valuable applied study of herbiciding, providing there is agreement with First Nations and any stakeholders affected by the potential herbicide use.

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

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

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.*

Deciduous and Brush Competition Results

Brushing Treatments and Herbicide Use

Pertaining to items 1 and 3, above, no applications of herbicide are planned within the Research Forest at this time. There are no brushing treatments, of any type, currently planned.

The most recent brushing treatment, which occurred during 2018 in Cutblock E-1, was accomplished through the manual cutting of aspen. Where aspen cover was dense and the conifer stocking was lower than desired within Cutblock E-1, small patches of aspen were left untreated to provide for future stand biodiversity.

Balancing Brushing with Other Objectives

When implementing the brushing in Cutblock E-1, only the aspen dominated areas were treated. No riparian management zones were treated. A few small areas with significant aspen cover were left untreated for biodiversity purposes as they are not expected to limit the achievement of free growing.

Experimenting with Brushing Techniques

Within Unit L, there a study was undertaken to examine differing brushing techniques to reduce aspen cover in young conifer stands. Another study in Unit L examined the effects of herbicide treatments on blueberry plants. No further brushing studies are proposed at this time.

Managing for Forest Products

Consistent with the current and foreseeable demand for timber products, the objective is to manage forests 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.

Managing for Forest Products Results

Reforestation for Forest Products

Harvesting since 2018 focused solely on salvaging stands affected by spruce beetle. As hybrid-white spruce is expected to be suitable to the predicted long-term climate change trends and the resulting shifts in biogeoclimatic zones and plant ecosystems within the Research Forest areas north of Prince George, spruce dominated the replanting of the salvage areas since 2018. Approximately 70% or more of each areas was reforested with hybrid-white spruce seedlings.

The performance of tree species, (western larch, western white pine, western red cedar, ponderosa pine, and Douglas-fir), potentially adapted to the predicted long-term climate within Research Forest Units A to G are being examined part of the trial plantation within Unit D, which will continue to be studied for at least another 5 years.

Commercial Thinning

Commercial thinning of intermediate-aged stands (30 to 50 years old) provides an opportunity to improve the future quality and volume of sawlogs produced from a given stand while also recovering wood fibre that may otherwise be lost prior to normal harvesting at rotation age. Although this is an important component of silviculture management in other parts of Canada, its application is very limited within the Prince George area. This provides an opportunity for the Research Forest to implement economically and operationally feasible commercial thinning operations and study the post-treatment results. In particular, it will be valuable to examine the post-harvest growth, wood quality and value of treated stands to verify that the intended objectives of commcercial thinning may be achieved without any unintended impacts to future timber quantity/quality or to other natural resource values.

Currently, three plantations within the Research Forest have been identified for potential commercial thinning, and are included as proposed harvest areas under this Development Plan. There are other intermediate-aged stands that will be examined for commercial thinning potential during the term of this Development Plan.

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 in 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. A portion of the non-utilized logs left after processing sawlogs and pulp logs will be left on site for CWD retention, while the remainder is to be burned.

Bioenergy producers, located in both Prince George and Mackenzie, were contacted multiple times during the spruce beetle salvage period, and offered the possibility of recovering fibre not used by primary forest operations. This fibre was offered at no cost to the bioenergy producers, (other than a very nominal administration fee). To date, there is no agreement on recovery of waste debris from CNC harvested cutblocks.

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.

Where areas of non-commercial cover are evident post-harvest, they are not to be planted along with the rest of the cutblock area. This avoids unnecessary effort in trying to reforest these areas while also ensuring continuation of these unique plant communities in the long-term.

Although there are no current plans, a better understanding of the post-harvest changes in non-commercial cover as a result of current harvesting practices is likely necessary to appropriately inform on future biodiversity and ecosystem management within the Research Forest.

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.

Tree Seed Results

A planting trial was established within Cutblock D-1 during May 2018, and expanded in 2019. The planting trial is intended to study site differences and tree survival and growth differences between a burned area and non-burned area. This study involves hybrid-white spruce, lodgepole pine, Douglas-fir, subalpine fir, western larch, western white pine, ponderosa pine, and western red cedar seedlings. The larch, white pine, ponderosa pine, and cedar seedlings are not compliant with the Chief Forester's standards, including the new climate based seed transfer standards applicable to larch in the Prince George area. There is a site plan with free growing standards applicable to the trial area, but considering the overall size of the two trial areas, the effect of the western larch, western white pine, ponderosa pine, Douglas-fir and western red cedar is not expected to compromise the achievement of free growing within the applicable standard unit of Cutblock D-1.

It is expected that any future use of non-compliant seed will be limited to experimental purposes within relatively small areas.

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 studies 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". Since 2018, sanitation and salvage harvesting in spruce and spruce/balsam stands has been the focus. The majoirty of conifer regeneration is to be achieved via the planting of spruce seedlings, consistent with the Chief Forester's Standards for Seed Use.

   Harvesting under this Development Plan is also planned in stands with a high component of spruce (>39%). Within Research Forest Unit J, harvesting under this Development Plan may include significant areas where Douglas-fir is a significant component (>39%) of the mature volume. Tree planting in these areas may not be dominated by hybrid spruce, particularly in consideration of the future hazards associated with predicted climate change. Alternatives to hybrid-white spruce include Douglas-fir, lodgepole pine, western larch, western white pine, and aspen.

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.

Due to the overall small size of the trial plantation areas within Cutblock D-1, and the very small areas that contain only novel tree species, there is no significant risk to future timber supply within Cutblock D-1.

In addition, to the trial plantation established within Research Forest Unit D, a trial plantation examining the performance of alternate tree species may be implemented within Research Unit J during this Development Plan. This is necessary as Unit J is within a biogeoclimatic subzone (dw3) that is not found within the northern Research Forest Units, it is predicted, on average, that Unit J will have different future biogeoclimatic zone(s) and associated plant ecosystems than those in the northern Research Forest Units.

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.*

Since the introduction of this exception to the provincial stocking standards, all harvested cutblocks are being reforested and assessed 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.*

Under Management Plan #3, the planting within all harvested cutblocks was targeted at 1,600 stems/ha or greater. This is expected to continue with harvesting in Units J, K and L in the near future, unless strategies for the achievement of specific biodiversity, wildlife habitat, and plant ecosystem results precludes tree densities of 1,600 stems/ha or greater.

Tree Planting Density Results

Since 2018, the survey results for each planting unit in each cutblock found that, on average, post-planting tree density ranged from 1,600 to 2,185 stem/ha, which met, and in most cases, exceeded the 1,600 Development Plan target.

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.

In instances where different stocking standards or free growing criteria may be prescribed for individual cutblocks, all changes will be recorded under the "Stocking Standards" section of this Development Plan.

Since the introduction of this exception to the provincial stocking standards, no cutblocks have been prescribed alternate free growth criteria within riparian management areas.

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 Results

The regeneration delay objective was largely up held until the spring of 2018, after which approximately half of the harvested area from fall 2017 to fall 2019 may have a regeneration delay of 1 year. This small change in regeneration delay is not expected to measurably change the forecasted timber supply and available harvest level.

The harvesting scheduled beyond fall 2019 is expected to have a regeneration delay of less than 1 year.

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 I: SBSwk1, SBSvk, ESSFwk2, ICHwk4, ICHvk2, SBSmk1, SBSdw2, and SBSmh.

Prescribed Stocking Standards Results

Since the approval of Management Plan #3, all of the harvested cutblocks have varied from the Appendix I stocking standards in that planting was implemented to achieve 1,600 trees/ha or greater regardless of whether the prescribed standard unit target was 1,600 tree/ha or less.

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.

A need for fill-planting was identified within D-2 during surveys in 2018. The fill-planting was implemented during the spring of 2019. At this time, no further 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 new timber supply review (TSR) was completed in September 2017, which was fully included within the 2017/18 Development Plan. This current TSR includes multiple improvements to the forest inventory and natural resource information, as well as more accurate harvest modelling assumptions. With these improvements, a harvest level of 108,000 m^3 for five years was recommended for the period between July 1, 2017 and June 30, 2022. The following sections summarize some of the key improvements and changes incorporated into the current timber supply review.

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, which 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 140m^3/ha using the new forest inventory.

Subalpine Fir (Balsam) Inventories – reduced by 30% when assessed against the 140m^3/ha threshold. Recent operational information demonstrates that over 30% of the measured balsam volume within a stand 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 readily 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 are 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. In addition, wildlife and biodiversity corridors are spatially specified, in which the available harvest area is reduced within every 60 year period.

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 / PGTSA 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 140m^3/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, Amendment #1 (Applicable to July 2017 to July 2022):

With the completion of the new timber supply review in September 2017, the recommended harvest level was 108,000 m^3 for five years to continue the removal and salvage of spruce beetle affected timber. This equates to 540,000 m^3 of timber between the period of July 1, 2017 to June 30, 2022.

Because 540,000 m^3 is based on salvage and full recovery of damaged stands, the total volume includes standard inventory volume and the additional volume expected to be recovered from intermediate and suppressed trees, dead trees, and blowdown (net timber cruising volume). Given that the 540,000 m^3 is based on the recovery of all types of log volume, all scaled volume from all grades is included in the harvested total.

Consistent with the timber supply analysis and forecasting, harvesting has focused on spruce beetle affected stands within Research Forest Units A, B, E, F and G from July 1, 2017 till summer 2020 (only hauling in summer 2020). The resulting scaled harvest volume up between July 1, 2017 and October 2020 is 427,395 m^3. The individual cutblocks harvested from 2017 to 2020 is summarized in Table 10.

Although the 427,395 m^3 is significantly lower than the estimated 540,000 m^3, it is important to recognize that the combined volume associated with coarse woody debris (CWD) treatments and routine processing waste is significant and likely exceeds 50,000 m^3 during this period, although the amount was never measured. The combination of CWD, waste, and scaled volume brings the actual total harvesting volume to an estimated 490,000 m^3, which is approximately 90% of the 540,000 m^3 from the timber supply analysis. Given that the estimated 540,000 m^3 was the volume expected via standard timber cruising, and knowing that timber cruising often over estimates spruce/balsam log volume in the Prince George area, then the actual harvesting result is very similar to the 540,000 m^3 from the timber supply analysis.

Future Harvesting into 2021 and Beyond:

At this time, no further salvage harvesting is proposed, therefore the next harvesting in 2021 or later will be within undamaged stands and average 19,000 m^3/year.

Table 10: Harvested Volume under Management Plan #3, Amendment #1 from July 1, 2017 to October 31, 2018.

Cutblock	Year of Harvest	Spruce Volume (m^3)	Pine Volume (m^3)	Total Volume (m^3)	Comments
A-2	2017	19,823	-	30,842	Very high spruce damage from insect & blowdown
A-3	2018	7,894	-	15,265	Very high spruce damage from insect & blowdown
A-4	2018	3,912	-	10,118	Very high spruce damage from insect & blowdown
A-5	2018	25,739	-	42,803	Very high spruce damage from insect & blowdown
A-6	2018	4,801	507	13,225	High spruce damage from insect & blowdown
A-8	2017	6,252	-	11,129	Very high spruce damage from insect & blowdown
B-2	2017	9,181	-	13,415	High spruce damage from insect & blowdown
E-5	2018	1,465	-	2,534	Very high spruce damage from insect & blowdown
E-6	2018	7,425	-	10,756	High spruce damage from insect & blowdown
E-7	2017-18	3,192	-	4,645	Moderate spruce damage from insect & blowdown (spruce beetle removal priority)
E-8	2017-18	5,490	63	12,329	Moderate spruce damage from insect & blowdown (spruce beetle removal priority)
F-8	2018	2,736	-	4,641	Moderate to spruce damage from insect and blowdown
G-2	2017-18	9,390	-	19,746	High spruce damage from insect & blowdown
G-5	2018	4,762	-	11,578	High spruce damage from insect & blowdown

Cutblock	Year of Harvest	Spruce Volume* (m^3)	Pine Volume* (m^3)	Total Volume* (m^3)	Comments
G-6	2017-18	12,476	-	37,536	High spruce damage from insect & blowdown
G-7	2017-18	11,919	-	25,411	High spruce damage from insect & blowdown
G-8	2017-18	10,062	-	20,156	High spruce damage from insect & blowdown
G-9	2017-18	13,495	-	20,101	Moderate to High damage from insect & blowdown
G-10	2017-18	19,905	-	22,223	Moderate to High damage from insect & blowdown
Total Harvest Volume Summer 2017 to Fall 2018		**179,919**	**570**	**328,453**	
B-3	2018-19	11,000	-	18,259	High spruce damage from insect and blowdown
B-4	2018-19	3,525	172.8	5,553	Very high spruce damage from insect and blowdown
B-5	2018-19	2,796	191.7	7,319	High spruce damage from insect and blowdown. Also moderate Douglas-fir damage from insect and blowdown.
B-6	2018-19	2,421	-	2,951	Very high spruce damage from insect and blowdown
E-9	2018-19	1,193	67.1	2,350	Very high spruce damage from insect and blowdown
E-10	2018-19	2,102	-	2,921	Very high spruce damage from insect
F-5	2018-19	3,386	-	5,456	Moderate spruce damage from insect and blowdown
F-6	2018-19	14,117	254.0	24,925	Moderate spruce damage from insect and blowdown

F-7	2018-19	6,652	811.8	10,196	High spruce damage from insect and blowdown
F-9	2018-19	9,063	303.7	16,610	Moderate spruce damage from insect and blowdown
F-11	2018-19	1,185	-	2,400	Moderate spruce damage from insect and high blowdown damage to balsam and spruce
Total Harvest Volume Fall 2018 to Fall 2020		**57,439**	**1,801**	**98,942**	
Total Harvest Volume Post-2017 Timber Supply Review				**427,395**	

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. In 2019, the McLeod Lake representative's membership ended, and currently there are no other First Nations representatives within 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 operation related discussions regarding individual cutblock and road development.

In 2020, the CNC Research Forest Society established a First Nations Engagement committee to further the efforts of the Society and CNC in building relations and partnerships with Lheidli T'enneh, McLeod Lake and Nazko First Nations, whose territory includes the CNC Research Forest. The current goal of the committee is to offer various engagement and collaboration/partnership opportunities, and where agreeable to both a First Nation and the Society, provide support towards successful implementation.

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.

First Nations Operation Referral Results

The First Nation referral efforts and results, involving cutblocks that were harvested since 2018 or are currently planned for harvest post-2020, are summarized within Appendix J.

Recent engagement with First Nations has revealed the need for further discussion on opportunities to establish new collaboration agreements, whether those agreements are related to individual projects or wide-scoping protocols about shared use and benefits derived from the continuation of the Research Forest. The engagement towards new collaboration agreements will be focused on the indigenous rights associated with the territories of the Lheidli T'enneh, Nazko and McLeod Lake First Nations.

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.

During this Development Plan, the CNC Research Forest Society's First Nations Engagement committee will be offering and discussing further opportunities for collaboration in research projects important to the Lheidli T'enneh, McLeod Lake, and Nazko Nations.

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.

Provincial Reporting Results

RESULTS Reporting

Cutblocks harvested between Fall 2018 and Summer 2020 are now reported in the province's RESULTS database. This includes Cutblocks B-3, B-4, B-5, B-6, E-9, E-10, F-5, F-6, F-7, F-9 and F-11.

The proposed cutblocks to be harvested under this Development Plan will be reported to RESULTS during the spring of 2021 or later.

Annual Reports: 2018-19 and 2019-2020

Two annual reports summarizing Research Forest activities were completed and submitted to the Prince George Natural Resource District Manager in June 2019 and subsequently in June 2020. The recent annual report can be found in Appendix K.

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.

Site Plan Results

New Site Plans for Cutblocks and Associated Roads

All site plans (including silviculture prescriptions, logging plans, and road site plans) for cutblocks harvested between fall 2018 and summer 2020 were finalized and signed by Professional Foresters employed with Dunkley Lumber. The plans for temporary bridges necessary for access to cutblocks harvested between fall 2018 and summer 2020 were finalized and signed by Professional Foresters employed with SBS Forestry Ltd.

No Site Plans Required

A small salvage operation targeting dead and fallen lodgepole pine trees is proposed to occur within Unit L, during the winter of 2021. The intent is to minimize the removal or damage of all live trees and skid logs with a horse or small machine to avoid measurable soil disturbance. Because of the proposed, minimal effect on live trees, no reforestation is planned. For this reason, no site plan was deemed necessary. A Site Plan Exemption document and associated map was created and signed by the Research Forest Manager, which provided direction on the management of soil disturbance, riparian areas, and archaeological/cultural heritage resources.

Signatures of persons required to prepare plan.

Preparing Forester *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.*		
	Carl Pollard, R.P.F. Manager, Research Forest College of New Caledonia	***Date***

Appendix A: Development Plan Maps

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Appendix B: Active Research Site Maps

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Appendix C: Old Forest Distribution: Current, Post-2030 and Post-2040

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Appendix D: Distribution of Old and Mature Forest within Biodiversity Corridors (and within Wildlife Tree Retention Areas)

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Appendix E: Ecosystems at Risk and Uncommon Forest Types

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Appendix F: 2016 Watershed Description and Preliminary Assessment / 2017 Watershed Assessment for Caine Creek Basin

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Appendix G: Summary of Remaining Built Road Area Compared to Total Prescribed Cutblock Area from Summer 2017 to Summer 2020 (Since Last Timber Supply Review)

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Appendix H: Stakeholder Referrals

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Appendix I: Stocking Standards

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Appendix J: First Nations Referrals

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Appendix K: Annual Report

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