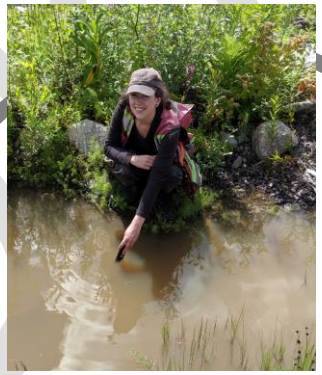
College of New Caledonia

CNC

Research Forest

Growing New Knowledge

CNC Research Forest Management Plan #4 2023 to 2028



Acknowledgements

The creation of the College of New Caledonia (CNC) Research Forest was the result of the hard work and contribution of a forestry coalition led by the British Columbia Ministry of Forests and the forest industry represented by the Council of Forest Industries. Members of the working group included the Association of British Columbia Forest Professionals, Canadian Forest Products Ltd., the Canadian Institute of Forestry, Central Interior Logging Association, Council on Northern Interior Forest Employment Relations, the Consulting Foresters of British Columbia, the Prince George Truckers Association, Spectrum Resources Group and the University of Northern British Columbia. Without the foresight of these groups, there would not be a Research Forest committed to applied forestry research in central/northern British Columbia, nor would there be any form of technical natural resources and forestry education offered by CNC. Thanks to these efforts it will not only be possible to continue to provide technical education programming but to add another dimension to forest management research and education in the region.

CNC is also very appreciative of the collaboration and support of Dunkley Lumber Ltd., who is a critically important partner in the operational implementation of the Research Forest. For over 10 years, the employees of Dunkley Lumber Ltd. have provided regular professional and technical expertise necessary to implement harvesting and silviculture activities consistent with the approved Management Plan. The collaborative harvesting operations provide the necessary revenue to support a vibrant NRFT program and ongoing research activities undertaken by the CNC Research Forest office and CNC Applied Research and Innovation office.

The land and forest resources of the CNC Research Forest Units located north of Prince George are within the southwestern portion of the Treaty 8 area, which includes the rights and interests of the McLeod Lake Indian Band (McLeod Lake – Tse'Khene peoples), West Moberly First Nations, Halfway River First Nation and Doig River First Nation. The CNC Research Forest Units located south and southeast of Prince George are within the traditional territory of the Lheidli T'enneh First Nation and the Nazko First Nation. CNC is grateful for the opportunity to be involved in the stewardship of natural resources within these territories.

This Page is Intentionally Left Blank

Table of Contents

BACKGROUND INFORMATION

Brief Geographical Information

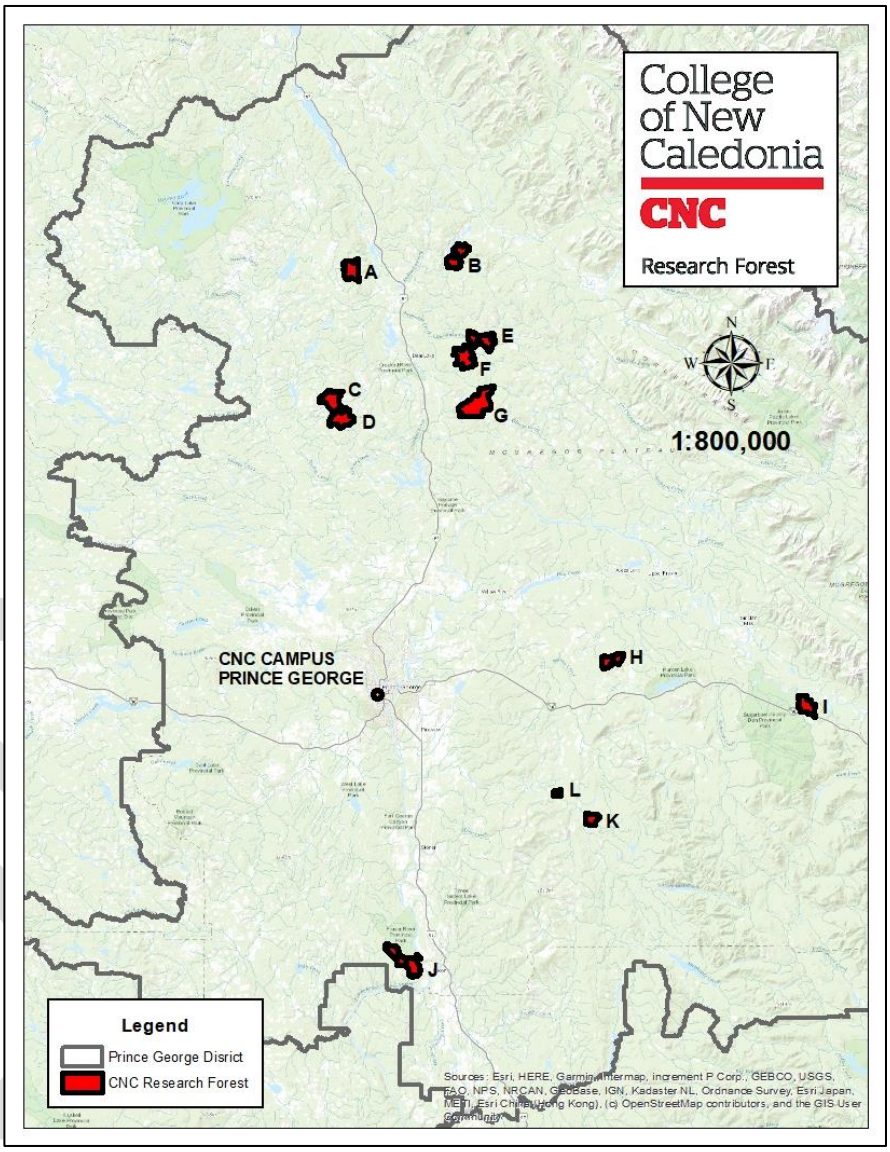
Purpose of Research Forest

Administration of Research Forest

Introduction to Research Forest

The College of New Caledonia Research Forest (CNC Research Forest) is comprised of 12 units of Provincial forest land totaling approximately 12,500 hectares, all of which are located within 100 km of Prince George as shown in Figure 2.

Figure 2. Location of CNC Research Forest



CNC is provincially authorized to use and develop the forest resources within the CNC Research Forest area to fulfil the mandate of supporting and enhancing the delivery of education and research related to natural resources and forestry. The CNC Research Forest complements other provincial research forests including the Aleza Lake Research Forest, the John Prince Research Forest, and the Alex Fraser Research Forest.

Geography of Research Forest

Research Forest Units A to G, J, K and L span climates ranging from dry/warm to very wet/cool, within the Sub-Boreal Spruce biogeoclimatic zone, while Units H and I are located within the Interior Cedar Hemlock biogeoclimatic subzone. The seven research units located north of Prince George are situated within the rolling landscapes of the Nechako and McGregor Plateau. Unit J, located south of Prince George, is also located within the Nechako plateau, but in an area that is drier and warmer than the units found north of Prince George. Unit K and L, located southeast of Prince George, are also located on rolling plateau landforms, but are part of the Fraser Plateau. Units H and I, located east of Prince George, are situated within the alternating mountain and trench landscape associated with the northern extent of the Cariboo Mountains.

The vast majority of the Research Forest is dominated by conifer forests comprised mostly of white spruce, subalpine fir and lodgepole pine in the north and southeast areas; white spruce, Douglas-fir and lodgepole pine in the south (Unit J); and western hemlock, white spruce, subalpine fir and western red cedar in the east. Aspen, paper birch, balsam poplar, cottonwood, black spruce and englemann spruce round-out the other tree species that may be regularly encountered. Table 1 provides a listing of the individual Research Forest units along with the general location, associated biogeoclimatic zones, and gross land area (includes water features).

Table 1. Summary of Individual CNC Research Forest Units

Unit ID	**General Location** (Direction from Prince George)	**BEC Subzone**	**Exhibit A Gross Area (ha)**
A	North – McGregor Plateau	SBSwk1	941.4
B	North – McGregor Plateau	SBSwk1	1,056.2
C	North – Nechako Plateau	SBSwk1	1,061.3
D	North – Nechako Plateau	SBSwk1	1,103.7
E	North – McGregor Plateau	SBSwk1	1,082.0
F	North – McGregor Plateau	SBSwk1	1,210.0
G	North – McGregor Plateau	SBSwk1 (SBSvk/ESSFwk2)	2,278.5
H	East – Cariboo Mountains	ICHwk4	735.5
I	East – Cariboo Mountains	ICHvk2	886.3
J	South – Nechako Plateau	SBSdw3 (SBSmh)	1,585.7
K	Southeast – Fraser Plateau	SBSwk1	468.0
L	Southeast = Fraser Plateau	SBSmk1	158.5
Total Area (ha)			**12,566.9**

Purpose of the Research Forest

The CNC Research Forest was initiated at a time when enrollment in the CNC Natural Resources and Forestry (NRFT) program was very low, and cancellation of the program was contemplated. The establishment of the Research Forest offered revenue for program funding and educational opportunities allowing for the continuation and enhancement of CNC's NRFT program.

The special use permit authorizing the CNC Research Forest states the following outcomes towards education and research:

- "The Research Forest will be managed to facilitate applied research and teaching on a wide range of topics from environmental to natural resource management."
- "CNC will continue to offer a vibrant and dynamic Natural Resources and Environmental Technology program (now the Natural Resources and Forest Technology program) in Prince George and to ensure program graduates are eligible to become Registered Forest Technologists with the Association of British Columbia Forest Professionals."

Provincial Authorization of CNC Research Forest

The CNC Research Forest is authorized under two long-term provincial tenures:

Special Use Permit (SUP) S24940 was issued by the Prince George District Manager of the Ministry of Forests under the Forest Act. The term of the original SUP was five years and was re-issued for 25 years commencing November 28, 2012. The SUP designates specific parcels of land to be used for the Research Forest and requires the Research Forest be managed under an approved management plan prepared in accordance with the SUP. The *Forest and Range Practices Act* (FRPA) requirements for operational planning (Forest Stewardship Plans) do not apply to the SUP, however, most of the forest practices standards required under the Forest Planning and Practices Regulation are applicable.

Occupant Licence to Cut (OLTC) L49404 was awarded over the entire SUP area and provides CNC the authority to harvest and remove timber. The OLTC was awarded with an expiry date of November 27, 2037 to coincide with the SUP term.

Role of the CNC Research Forest Society

The SUP authorizing the CNC Research Forest requires CNC to appoint an independent governing board to oversee the management of the Research Forest. To fulfill this oversight role, CNC established the College of New Caledonia Research Forest Society (CNCRFS), which is a fully recognized society governed under the *Society Act.*

In particular, the CNCRFS was established to:

1) provide stewardship of the Research Forest under the terms of the licence;
2) provide core funding support to CNC's Natural Resources and Forest Technology (NRFT) program; and
3) to conduct and support applied research in response to the needs of regional stakeholders in the forest sector.

The CNCRFS governing board continues to operate with a broad and balanced membership, and fulfills its purpose by providing direction for the Management Plan, approving annual budgets, and directing the financial proceeds of the Research Forest.

A funding allocation model based on yearly student enrollment is in place to provide reliable, ongoing funding to the CNC Natural Resources and Forest Technology program. In addition, the CNCRFS board has full discretionary authority for the use of surplus Research Forest revenues to fund forest resource related research activities, and enhancements to the NRFT program as per documented protocols.

Role of College of New Caledonia

Although the CNCRFS provides management direction and oversight, it is CNC that holds the rights and authorities under SUP S24940 and OLTC L49404. CNC provides for the direct management and administrative support for all Research Forest operations including forest harvesting, silviculture activities, research, education, community outreach and extension services. CNC is responsible for ensuring that all requirements under the forest tenures and associated provincial Acts and Regulations are met. CNC is also entrusted with managing revenue and expenses associated with Research Forest operations and holding net revenues in trust for the CNCRFS.

Through CNC's existing industry partnerships, CNC has successfully managed and operated the Research Forest, establishing a reliable revenue flow and regular operations to fund and enhance the NRFT program, along with regular natural resources education and research opportunities, implemented via CNC's Research Forest office and CNC's Applied Research and Innovation office.

ABOUT THIS MANAGEMENT PLAN

Term

Purpose and Scope of Management Plan

Term of Management Plan

This Management Plan commences on the effective date specified by the District Manager. Should the District Manager not specify an effective date in the notice of approval, the default effective date shall be assumed to be the date of the District Manager's notice.

Management Plan #4 is proposed for a five-year term. This term will provide an appropriate timeframe to implement the strategic focus and goals developed by the CNC Research Forest Society.

The Plan commences on the effective date and remains in force until the earlier of:

1) five years from the effective date;
2) approval of a replacement management plan;
3) termination of the Management Plan by the District Manager;
4) termination of the Management Plan by the CNC Research Forest Society Board; or
5) termination of the Special Use Permit.

Purpose and Scope of Management Plan

CNC Research Forest Society Strategic Plan

This Management Plan acknowledges the current vision and goal of the CNC Research Forest Society Strategic Plan and includes the necessary management direction and forest resource stewardship guidelines to support the fulfillment of the Strategic Plan.

Forest Resource Studies, Research and Education

Without limiting future possibilities, this Management Plan provides general direction to forest resource studies and research consistent with the strategic direction provided by the CNC Research Forest Society to:

1) support continuous improvement of forest ecosystem stewardship practices and ecosystem resiliency;
2) provide for ongoing opportunities for NRFT and student and faculty involvement in research;
3) support regionally important research related to forest ecosystem resources;
4) provide new learning opportunities for the NRFT program and others served by CNC.

Forest Stewardship Objectives, Practice Requirements and Standards

This Management Plan describes a multitude of forest stewardship objectives and associated forest practices and standards, applicable to all or portions of the Research Forest. These practices and standards are designed to exceed legislative requirements and minimize the impacts to multiple forest ecosystem values so that forest ecosystem health and function may be maintained or improved over the current condition. These forest practices and standards will be met when engaging in forest harvesting, reforestation, road building and road maintenance activities, as well as when planning and implementing novel forest resource uses or extractions.

Timber Supply Review -- 5-Year Harvest Level

The Management Plan provides an analysis of the projected availability of economically viable timber and resulting short term and long-term impact to forest resources based on current forest stewardship assumptions. The mapping and forest resource data used to support the analysis was enhanced through LiDAR data and systematic forest sampling. Upon professional consideration of the timber supply analysis, this Plan recommends a level of forest harvest consistent with the strategic direction on forest ecosystem stewardship and this Plan's practice requirements and standards.

Obligations and Commitments to First Nations and Public

The Management Plan includes a commitment to undertake information sharing and consultation with First Nations along with an opportunity for public review. In addition, the Plan includes a commitment, by CNC (the provincial forest tenure holder), to report activities and results to government, and to meet the Management Plan requirements and any other District Manager direction specified in the Management Plan approval.


CNC RESEARCH FOREST SOCIETY STRATEGIC PLAN
Strategic Vision
Strategic Goals

CNC Research Forest Society Strategic Plan

The CNC Research Forest Society Strategic Plan is the culmination of significant input and discussion with internal and external persons connected to or affected by the CNC Research Forest. From late 2021 to April 2022, advice and input was received from representatives of the following focus groups: McLeod Lake-Tse'Khene First Nation, Lheidli T'enneh First Nation, Nazko First Nation, CNC Research Forest Society Board members, CNC Research Forest employees, CNC Natural Resources and Forest Technology faculty, CNC Executive and Management, and industry partners and supporters. CNC and the CNCRFS is grateful for the time and contributions of those involved in the strategic planning process.

Vision for CNC Research Forest

The current CNC Research Forest vision statement and primary outcomes being pursued during the term of this Management Plan are provided below.

The CNC Research Forest will become a regional leader in forest ecosystem research and education, in collaboration with First Nations and other partners.

In pursuit of the vision, the CNC Research Forest enterprise, in collaboration with other CNC departments, will focus on achieving the following outcomes:

- **High impact applied research:**
  Designing, conducting, integrating, and sharing meaningful research that answers key information gaps in forestry knowledge
- **Education and knowledge sharing:**
  Integrating knowledge generated by Research Forest activities into programming at CNC, spreading learning widely, and sharing expertise
- **Meaningful and mutually beneficial partnerships with First Nations**:
  Incorporating Indigenous voices, values, cultural knowledge and goals into how we steward the forest ecosystem
- **Forest ecosystem health and resilience:**
  Monitoring and stewarding the CNC Research Forest to improve ecosystem health, resulting in a resilient forest ecosystem

For further clarity, regional refers to the general geographic area served by CNC, which includes the areas and numerous communities near Prince George, McBride, Valemount, Bear Lake, Mackenzie, Fort St. James, Vanderhoof, Fort Fraser, Fraser Lake, Burns Lake, Hixon, and Quesnel.

Strategic Goals

During the term of this Management Plan, the operation and outcomes of the CNC Research Forest will contribute toward multiple goals under four primary areas of strategic focus, which include:

- research;
- education;
- Indigenous partnerships; and
- forest ecosystem stewardship.

These strategic goals are documented in the CNC Research Forest Society's Strategic Plan.

Strategic Research Goals

With respect to research outcomes, the Strategic Plan identifies the following goals which will guide the various activities and outcomes of CNC employees and students affected by the CNC Research Forest.

1) Develop a research focus based on CNC Research Forest Society strengths and the region's needs as they evolve.
2) Showcase research activities and knowledge generation.
3) Re-establish a robust structure to support the administration of research activities.
4) Pursue collaborative research with First Nations, industry and other partners.

The efforts and activities directed towards the research goals are intended to fulfill and not limit the foundational research purposes of the CNC Research Forest and CNC Research Forest Society, which include:

- to conduct short-term, financially self-sufficient research activities, funded primarily from research grants obtained from public research agencies or companies;
- to link with provincial, federal and international research institutions that have extensive experience in research;
- to conduct and support applied research in response to the needs of regional stakeholders and according to the Society's research priorities;
- to provide opportunities for First Nations to utilize the research forest land base for pertinent research projects or other initiatives that contribute to a better understanding of social, economic or environmental factors important to First Nations and undertake or participate in such activities;
- to provide opportunities for Natural Resources and Forest Technology students to undertake or participate in applied research projects.

Strategic Education Goals

With respect to educational outcomes, the Strategic Plan identifies the following goals which will guide the various activities and outcomes of CNC employees and students affected by the CNC Research Forest.

1. Provide continued financial and research support for the Natural Resources and Forest Technology program, with added focus on practical forest-based learning and the integration of knowledge generated by the Research Forest into Natural Resources and Forest Technology programming at CNC.

2. Support the integration of Indigenous knowledge and values into Natural Resources and Forest Technology programming.

3. Fund initiatives that maximize faculty and student exposure to, or active participation in, cutting-edge, future-oriented forestry practices.

4. Raise the profile of cutting-edge operational research and knowledge generation occurring on the CNC Research Forest.

5. Support the development of non-credit courses and collaborative education projects related to forest ecosystem stewardship.

The efforts and activities directed towards educational goals are intended to fulfill and not limit the foundational educational purposes of the CNC Research Forest and CNC Research Forest Society, which include:

- to provide ongoing fiscal support for the Natural Resources and Forest Technology program at the College of New Caledonia; and
- to provide opportunities for Natural Resources and Forest Technology students to undertake or participate in applied research projects.

Strategic Indigenous Partnerships Goals

With respect to Indigenous Partnership outcomes, the Strategic Plan identifies the following goals, which will guide the various activities and outcomes of the CNC employees and students affected by the CNC Research Forest.

1. Incorporate Indigenous values and ways of knowing into the CNC Research Forest Society's approach to its activities.

2. Make genuine, sustained, and welcomed efforts to improve relationships and demonstrate trustworthiness.

3. In parallel, identify what benefits the CNC Research Forest Society can offer, what First Nations want, and how to develop a sustainable new governance model.

4. Develop a clear communications plan with a focus on articulating and demonstrating the benefits of the CNC Research Forest to First Nations communities.

Indigenous Stewardship and Direction

This Management Plan was developed at a time when the CNC Research Forest Society and CNC employees were refocusing their efforts towards establishing new relationships with Indigenous communities and Nations. The aim of new relationships is to explore Indigenous collaborations and partnerships in forest resource stewardship and forest resource research and education that will better serve Indigenous and non-Indigenous peoples of the CNC region. At this time, there is a lack of clarity about the incorporation of Indigenous knowledge, culture and leadership in the stewardship of the Research Forest and in the delivery of research and educational benefits. The CNC Research Forest Society and CNC employees remain open to wide-ranging possibilities with First Nations whose territories support the Research Forest.

With regard to ongoing planning, it is important to recognize that the future integration of Indigenous culture and knowledge into the Research Forest may necessitate amendments to this Management Plan, or perhaps result in a significantly different replacement Management Plan or a transition to a different administration and planning approach.

Forest Ecosystem Stewardship Goals

With respect to forest ecosystem stewardship, the Strategic Plan identifies the following goals, which will shape the nature of forest resource stewardship, resource monitoring and research and education activities undertaken within the Research Forest:

1. Establish CNC Research Forest Society ecological stewardship principles.
2. Develop a stewardship framework that is anchored in a clear purpose, takes a balanced approach to social, environmental, and economic values, and fulfills the Research Forest's commitments.
3. Involve Natural Resources and Forest Technology students in making sound stewardship decisions by seeking their input.

Planning and Implementation of Strategic Goals

The ongoing planning and implementation of the CNC Research Forest Society's strategic goals not only relies on achievement of innovative research and forest resource practices, it depends on innovation in the way the Society and CNC interact and the way both entities interact and respond to regional Indigenous and non-Indigenous needs. This mandate for change and innovation presents a significant challenge for the Society and CNC, but also presents substantial new opportunities for collaboration in the advancement of forest resource education and research.

To further solidify the implication of pursing the strategic goals, the following list summarizes the primary roles and necessary undertakings to ensure fulfillment of the strategic direction defined by the CNC Research Forest Society:

- the CNC Research Forest Society, CNC administration, CNC research staff, and Natural Resources and Forest Technology (NRFT) faculty receive and understand the insight and input from Indigenous and non-Indigenous experts from across the region;
- with Society oversight and support, CNC increases regular communication and engagement efforts with Indigenous communities to improve relationships and seek common collaborations in forest resource education, research and forest ecosystem stewardship;
- with Society oversight, CNC develops and implements clear communications with First Nations concerning future outcomes and benefits of the CNC Research Forest, particularly those involving novel collaborations;
- the Society and CNC openly explore barriers to Indigenous involvement in Research Forest activities and the NRFT program, and propose and implement solutions to remove or overcome the barriers;
- in collaboration with First Nations, the Society and CNC openly consider a variety of options for First Nation involvement in directing and implementing educational, research and forest stewardship activities associated with the Research Forest;
- with support and guidance from the Society, CNC establishes the human resources and supporting business structures to seek and implement new research collaborations within the CNC region;
- the Society and CNC recognize and prioritize competing research interests;
- CNC develops and maintains research expertise consistent with regional needs and priorities as opportunities arise and evolve;
- CNC attracts talented external and internal researchers, who are able to implement novel, cutting-edge research;
- CNC, in collaboration with their research partnerships, use various social media and communication avenues to successfully showcase the activities and results of forest resource research activities;
- the Society, with CNC support, develops overarching principles, objectives and guidelines concerning forest ecosystem stewardship that will allow future forest operations to sustainably support the educational and research purposes of the Society;
- with Society support, CNC is able to incorporate novel forest resource practices into annual Research Forest operations, which benefit both forest ecosystem health and education opportunities;

- with Society support, CNC increases the amount of highly accessible demonstration sites and educational/research installations available to students;
- CNC promotes a culture of research and innovation amongst employees and students;
- CNC ensures there is continual two-way input and information exchange between the NRFT program, the Society and CNC researchers for the benefit of NRFT education and forest ecosystem stewardship.
- CNC seeks greater NRFT curriculum flexibility to integrate new Indigenous knowledge and practical learning opportunities while also maintaining NRFT program quality assurance and external accreditation;
- with Society support, CNC identifies, prioritizes and implements new educational offerings in forest ecosystem stewardship, which are not part of the NRFT program.

Forest Resource Research and Education

Research Forest Operations Plan

Objectives and Practice Requirements for the Stewardship of Multiple Forest Resource Values

Revenue for Forest Resource Education and Research

The Research Forest is expected to generate or maintain revenues from forest operations, which in turn provide the necessary funding to reliably deliver the CNC NRFT education program each year. The revenues must also be sufficient to fund all remaining legal stewardship obligations associated with the Research Forest tenure. The revenue that accumulates in excess of the two costs, specified above, is to be directed towards educational enhancements to the NRFT program and the implementation of regionally important research; in particular, research that provides opportunities for NRFT student and faculty participation.

During each of the previous Management Plan terms, the CNC Research Forest successfully generated enough revenue from the sale of harvested timber to fund the implementation of research and educational enhancements. In particular, the spruce beetle salvage harvesting that occurred between 2016 and 2019 provided a wealth of revenue that may be directed towards forest resource research and educational enhancement during this Management Plan period and beyond.

Increased Focus on Forest Resource Research and Education

In consideration of the funding available during this Management Plan period, a significant number of forest resource studies and research projects are possible, which are expected to fulfill the CNC Research Forest Society's strategic focus and goals towards improving forest resource research and education. In addition, continual expansion and enhancement of forest resource research and educational outcomes are expected to be driven by the pursuit of multiple strategic goals, which partially includes the following:

- a focus on indigenous relationships;
- a commitment for an improved CNC structure to support the administration and implementation of research;
- increased research collaboration;
- incorporation of Indigenous knowledge;
- a commitment to forest ecosystem stewardship, improved research communications; and
- a commitment to student involvement in practical, cutting-edge activities.

Achieving the desired research and educational improvements lies in wider collaboration, support and involvement of Indigenous peoples, industry, and provincial government agencies in the planning and implementation of research projects within the Research Forest and the CNC region. With improved collaborations and partnerships, a wider spectrum of novel research and innovation is expected. This will allow CNC to capture new educational opportunities involving students and faculty, including valuable practical and experiential learning that is new to the CNC NRFT program and other CNC students.

Continuing and Upcoming Research and Education

The CNC Research Forest Society seeks to remain open to any research deemed important by the peoples and stakeholders of the CNC region. Although the forest resource research possibilities are seemingly endless, a number of forest resource research themes continue to be pursued or are currently being considered. The following sections are intended to provide an indication of the current research focus, recognizing that the research efforts may shift notably in response to evolving Indigenous relationships, new research collaborations, the application of new knowledge, and evolving social and environmental circumstances.

It is important to recognize that forest resource research implemented as a result of CNC Research Forest funding is not limited to the CNC Research Forest. Where the CNC Research Forest lacks suitable sites to support field research deemed regionally important, research projects are often implemented within other areas of provincial forest within the CNC Region, in coordination with First Nations, provincial agencies, and potentially affected stakeholders.

Woodland Caribou Forest Habitat

The application of forestry practices within Research Forest Unit I, if consistent with caribou recovery direction, may provide an important opportunity to implement experimental treatments and subsequent studies that may inform the ongoing provincial recovery efforts for Southern Mountain caribou. Any consultation regarding forest development in Unit I will also include discussion on potential research partnerships to support caribou recovery efforts.

Ungulate Winter Range for Moose

The application of forestry practices within Research Forest Unit H that are consistent with the conservation or enhancement of moose winter range may provide an important opportunity to implement experimental treatments and subsequent studies that may assist in informing ongoing provincial efforts towards the management of moose habitat. Any consultation regarding forest development in Unit H will also include discussion on potential research partnerships to support moose conservation and enhancement efforts.

Bull Moose. Research Forest 2019.

Regionally Important Wildlife and Species at Risk

Studies of individual wildlife species, which are recognized as regionally important or sensitive, will continue to contribute to the understanding of wildlife habitat function as determined by a variety of indicator species.

Stewardship of Wildlife Habitat Services within Forest Ecosystems

The monitoring and assessment of wildlife use and wildlife habitat within harvested and non-harvested areas are to continue throughout the Research Forest to improve ongoing knowledge and understanding of wildlife impacts, and to determine where and when recovery treatments may be necessary in post-harvest areas. This includes multi-year research to test and evaluate differing harvest treatments and silviculture treatments for maintaining and enhancing wildlife habitat function.

Northern Goshawk. Shutterstock ©

Post-Harvest Ecosystem Services

The regular monitoring, assessment and study of post-harvest forest ecosystems are to continue to determine the effect of differing tree retention and cutblock designs which will inform future tree retention practices aimed at increasing the conservation of plant biodiversity, wildlife habitat, and multiple ecosystem functions.

Wildlife Use of Post-Harvest Coarse Woody Debris Piling

The monitoring and assessment of wildlife use of coarse woody debris piles within harvested areas will continue across multiple cutblocks to improve knowledge about the effectiveness of CWD piling and the attributes of successful CWD piling.

Post-Harvest Riparian and Stream Function

The regular monitoring, assessment and study of both pre-harvest and post-harvest stream channels and associated riparian areas will continue to determine the effect of harvesting and road building. In some cases, this may involve multiple post-harvest assessments within a riparian area to determine trends in functioning condition and the rate of recovery from impactful conditions. The regular monitoring and study are expected to inform future tree retention as well as harvesting and road building practices aimed at conserving the function of riparian areas, wetlands, lakes and stream channels.

Riparian retention between Cutblocks A-2 and A-5. Uschenko 2019.

Effectiveness of Road Rehabilitation

The effectiveness of road rehabilitation is proposed as a focus of future studies, in particular, to better understand the effectiveness of past treatments in re-establishing soil structure and water drainage that is similar surrounding cutblock conditions. It is also important to study and

understand the productivity of rehabilitated roads, in terms of their forest growth and yield, compared to surrounding cutblock conditions.

Epidemic Bark Beetles

The monitoring and study of epidemic bark beetles and their effects on forest ecosystems, within the Prince George area, will continue as an area of applied research and will rely on information from regular consultation and input from First Nations, provincial agencies, and the forest industry. This includes, but is not limited to, experiments examining beetle life cycle, beetle populations, beetle baiting and trapping, remote sensing of beetle attack, ground assessment of beetle attacked trees, wood shelf-life post-beetle attack, wood products from dead and dying conifer trees, and beetle attack modelling.

Trial installed to examine the efficacy of various artificial pheromones to enhance spruce beetle capture. Uschenko 2022.

Climate Trends and Effects on Forest Ecosystems

To improve the understanding of trends in climate and the influence on forest ecosystems, continued monitoring and study of weather and soil moisture is a priority through the maintenance of existing climate/soil stations and the installation of additional stations within or near the Research Forest.

Reforestation with Novel Trees to Address Changing Forest Ecosystem Health Hazards

Experimental reforestation with alternative tree species or alternative genetics (based on geographic location) is expected to continue. These trial areas are intended to inform future planting and reforestation aimed at reducing the changing hazards to the survival, health, and growth of conifer trees as a result of current and projected climate change. The implications to

forest ecosystem function and services will also be examined when reforesting with non-standard species or genetics.

Novel Stocking Standards and Assessments

There is an ongoing need for experimentation and study examining novel stocking standards and novel ways to assess and verify the performance of managed stands. This need for new standards and approaches are necessary to address the changing hazards to the survival, health, and growth of managed trees as a result of current and projected climate change. The future reforestation standards and assessments of managed stands also need to address the resilience and function of forest ecosystems, particularly in regard to riparian function and wildlife habitat function. For these reasons, it is expected that all future cutblocks will contain some area that is prescribed inconsistently with the provincial Reference Guide for Forest Development Stocking Standards, in order to fulfill research priorities. The implementation of experimental areas is subject to both the avoidance of significant future timber supply losses (based on current knowledge) and no significant negative impacts to forest ecosystems, riparian function, and wildlife habitat function.

Research Assistant with western red cedar, ponderosa pine and wester larch from 2012 Assisted Tree Migration Trial. Mjolsness 2021.

Alternative Reforestation Standards and Stand Tending

Experimentation and research into young stand silviculture treatments, and post-free growing stand tending treatments is expected. This includes experimentation with new silviculture treatment regimes, new brushing techniques, or new vegetation suppression techniques to support silviculture innovation is expected. In particular, it is a priority that monitoring and research is designed to inform future stewardship practices, which may improve the balance between maintaining conifer health and performance and maintaining ecosystem diversity and wildlife habitat function.

Intermediate Harvesting in Mid-Aged Stands

Given the significant amount of regional land base occupied by post-free growing, regenerated forests, operational harvesting trials in mid-aged managed stands is expected to continue. These projects are intended to maintain or improve forest ecosystem health, forest biodiversity, wildlife habitat function, and available merchantable timber yield and/or timber quality, while avoiding significant impacts to any one objective. Studies of these trials will include short-term and long-term monitoring and assessments to improve the understanding of the impacts and benefits of these treatments on multiple forest values.

35-year-old spruce stand proposed for commercial thinning treatment. Mjolsness 2021.

Partial Harvest in Mature Forests

Given that mature, natural forests within the region, within many landscapes, are reduced from the expected natural range of variation, the remaining mature forests are increasingly important to overall forest biodiversity, health and function. This means that experimentation with differing harvest methods and corresponding silviculture systems is of increasing importance in order to support continuing timber use, while conserving forest biodiversity, multiple forest ecosystem services, forest ecosystem resiliency, and reducing contributions to climate change.

Examining Wood Waste resulting from Harvesting

There is a recognized need to better understand the feasibility of extracting and utilizing the majority of wood waste resulting from processing sawlog timber during harvest. There is a coinciding need to reduce and eliminate the carbon dioxide and smoke emissions from traditional wood waste burning within harvested areas. Experimentation and studies examining alternative wood fibre uses and alternative waste disposal treatments are a new area of research and education that may be pursued.

Stewardship of Forest Ecosystem Vegetation

In collaboration with First Nations, there is a growing opportunity and need for experimentation and research examining the stewardship of forest plants important to First Nations and/or regional communities. These studies may involve and examine all stages of forest stewardship in terms of sustaining and enhancing multiple forest plants during forest harvesting and reforestation. These studies may also involve the propagation and growing of multiple plant species, under natural conditions and within cultivated gardens and greenhouses. These studies must also be mindful of

the health and resilience of individual species and forest ecosystems, particularly under projected climate change conditions.

Novel Wood and Forest Products
Considering the declining timber supply in many areas, current social expectations for forest use, and increasing forest ecosystem health risks due to climate change, there is a growing need to derive more value from harvested timber and other forest products, waste less harvested wood fibre, and improve the overall efficiency of extracting resources and manufacturing products. It is expected that research supporting innovations in wood products and other forest products that also reduce contributions to climate change will be pursued with the support of regional collaborators and partners.

Research and Educational Facilities

CNC and its research partners have established numerous sites and areas that have, and are, currently 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 locations over time is important as there may be value in revisiting inactive sites to support or complement future study and research. Previously established research site locations that are within or immediately adjacent to the Research Forest Units are shown on the maps in Appendix F. More information regarding each site may be obtained by contacting the Research Forest Manager.

In addition to sites established by CNC, one pre-existing provincial government research site has been identified within the CNC Research Forest. It is located in Research Forest Unit D and is identified on provincial government maps as active fertilization trial EP 0886.13.09 and requires protection. In addition, a new provincial government research site was established during 2020 within Research Forest Unit F. This research site contains a trial testing the growth performance of planted mid-elevation hybrid white spruce derived from second generation orchard seed. The approximate location of both provincial research sites are provided in Appendix F. The management of both sites will require forest practices and research activities to be designed in a manner that will not influence the forest growing conditions within the trial areas.

Managing Research and Educational Sites:
The installation of minor facilities to support ongoing research and educational activities is expected to occur on each Research Forest Unit. These minor facilities include, but are not limited to, the following:

- climate stations
- soil monitoring stations
- surface and ground water monitoring stations
- stream water monitoring stations

- temporary fish traps
- trial planting of conifer and deciduous trees
- trial planting of upland forest species
- conifer seed progeny plantation trials (provincial)
- nesting boxes for birds and other wildlife
- semi-permanent and permanent sample plots
- motion activated cameras
- fertilization trials
- wildlife habitat restoration/enhancement and monitoring equipment
- stream restorations/enhancement and monitoring equipment
- picnic tables for workers and students
- information signage
- walking access trails
- roads and large trails for motorized vehicles

Research Forest Information Sign, Unit B. Uschenko 2022.

Upon completion of research and educational activities, all minor facilities, other than plantations, are to be removed if they are not expected to be used within the next 5 years. This includes the deactivation/rehabilitation of the site and access roads/trails if there is any measurable footprint that reduces forest ecosystem productivity.

A proposed research or education facility, with a large footprint, or those that are expected to have a measurable impact on a natural resource value will be referred to the appropriate provincial government agency, affected First Nation(s) and affected natural resource stakeholders prior to implementation. Approval from a provincial statutory decision-maker(s) is required for any new, significant research facility.

The Operations Plan is to be updated annually or biennially for the addition or revision of research and education facilities and sites.

FOREST STEWARDSHIP OBJECTIVES AND PRACTICE REQUIREMENTS

Research Forest Operations Plan

Objectives and Practice Requirement Detail for the Stewardship of Multiple Forest Resource Values

Forest Stewardship Objectives, Practice Requirements and Standards

A multitude of forest resource values are identified in the following subsections. For each forest resource value, the Plan may include a stewardship objective towards the value, and in all cases, includes the practice requirement or standard to be met or exceeded in order to provide for the sustainable stewardship management of the specific value. These practice standards/requirements are provided in ***italicized*** text for increased visibility. For some values, the practice standards/requirements may be stated as specific actions that are clearly measurable, while for other values the requirements may be less defined and the potential for measuring results may be limited.

Research Forest Operations Plan

CNC also maintains a Research Forest Operations Plan, which may contain more specific information or direction that significantly enhances the required practices and outcomes specified within this Management Plan. Once created, the Operations Plan becomes an integral component of the current Management Plan. Every two years, the Operations Plan is to be updated and submitted to the Prince George Natural Resource District Manager. Voluntary updates may occur more often as demanded by changing circumstances. Each Operations Plan update must include updated mapping for completed operations, as well as mapping and descriptions of all proposed forest harvesting, road building or research implementation which may affect First Nations, stakeholders or the public. Where outcomes within the Research Forest vary from the Management Plan requirements, the Operations Plan is required to contain additional information to explain and rationalize these differences.

Varying from the Management Plan

Upon approval, CNC has committed to implementing this Management Plan as written and any other direction provided by the District Manager. It is expected that any variances from the Plan will be examined and prescribed in advance with appropriate professional rationale. A variance will be documented through:

- individual Site Plans;
- Operations Plan; and/or
- other documented information and rationale.

It is expected that variances from this Management Plan will most often occur as a result of various forms of research and education. Examples of research include conducting experimental forestry practices, establishing operational treatment trials, and undertaking demonstrations for student education.

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.

Archaeological and Cultural Heritage Resources

After completing multiple field assessments to identify potential archaeological and cultural heritage resources within or adjacent to the Research Forest, the following sites were found:

- Subsurface Lithic Site near Willow River
- Trail near Willow River (full extent not determined)

Archaeological assessment conducted in Unit L. Mjolsness 2020.

There is 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, and/or treaty and Indigenous 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 provide input to CNC to ensure cultural heritage resources are managed and protected during Research Forest operations to the satisfaction of affected the First Nation(s).

The objective with respect to Archaeological and Cultural Heritage Resources is to provide opportunities for potentially affected First Nations to be involved in the assessment and management of archaeological and cultural heritage resources. To achieve this objective, the following practice requirements 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 affected First Nation(s) for a period of 60 days in advance of operations (or another length of time as agreed with the affected First Nations), so that 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 the potential for a cultural heritage feature is identified by a First Nation, a person with interests in the area, or a previous Archaeological Overview Assessment, an Archaeologist will undertake an Archaeological Overview Assessment and/or Preliminary Field Assessment to identify cultural heritage features and potential archaeological features; and*

b) *where there is potential for an archaeological resource as identified by a First Nation, a person with interests in the area, or a provincially recognized Archaeological Predictive Model/Mapping/Assessment, an Archaeologist will undertake or oversee an Archaeological Overview Assessment and/or Preliminary Field Assessment and/or an Archaeological Impact Assessment, as necessary.;*

4) *archaeological or cultural heritage resource findings from any field assessments completed by an Archaeologist will be shared with the affected First Nation(s) for a period of 60 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 management direction regarding any identified sites;*

5) *unless extraordinary circumstances apply and the affected First Nations agree with modifying or removing an identified archaeological or cultural heritage resource, then all identified resources will remain in place with protective measures applied to the adjacent land as necessary to protect or conserve the resource;*

6) *the management direction provided by an affected First Nation regarding the protection or conservation of an archaeological or cultural heritage site is to be implemented as directed; and*

7) *where a previously unidentified site, which may have the potential 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 6 above.*

Prince George Land and Resource Management Plan (LRMP)

All of the Research Forest Units lie within Prince George Natural Resource District to which the Prince George Land and Resource Management Plan (LRMP) applies. This provincial plan was established in 1999, and provides overarching public and government guidance about numerous natural resource values for each Resource Management Zone identified within the LRMP. Although the objectives and strategies within the LRMP are not legalized, in many cases they have guided the implementation of existing legal provincial orders and objectives with the intent to improve the sustainable management of key resource values within the Prince George District. For a summary of the sections of the LRMP that apply to the Research Forest, refer to Table 2 below:

Table 2. Resource Management Zones Identification and Management Category.

Research Forest Unit	RMZ Identification	Category of Management
Units A, C and D	#9 Weedon Lake	Enhanced Resource Management
Unit B	#6 Crooked River	General Resource Management
Units E, F and G	#5 Chuchinka Creek	Enhanced Resource Management
Unit H, K and L	#27 Willow River Valley	Enhanced Resource Management
Unit I	#46 Bowron River Valley	General Resource Management
Unit J	#20 Baldy Hughes/Tagai Lake	Enhanced Resource Management

The Research Forest is covered by two different Resource Management Zones. The direction of each zone is summarized immediately below:

Enhanced Resource Management Zone (Research Units A, C, D, E, F, G, H, J, K and L)

- land identified, on the basis of suitability, for intensive development of resources, such as timber, minerals, petroleum and destination resorts
- resource development activities are a priority in this zone; incremental silviculture activities are encouraged
- resource development activities are subject to all relevant provincial laws and regulations
- resource management guidelines will be applied in a way that recognizes the resource development priority of the zone, while minimizing the impact on other resource values

General Resource Management Zone (Research Unit B and I)[2]

- land to be managed for a wide array of resource values and permissible uses
- guidelines for non-extractive resource values may modify resource development activities while recognizing this zone's role in supporting economic resource development activities are subject to all relevant provincial laws and regulations (e.g., the Forest Practices Code of British Columbia Act.)
- Within each Resource Management Zone, specific wildlife, tree species, and resource values are identified, which are to be maintained or enhanced. The specific species and resource values are summarized immediately below:

[2] Ministry of Forests, Lands, Natural Resource Operations, and Rural Development. Prince George Land & Resource Management website as sourced January 2021. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/omineca-region/princegeorge-lrmp/prince_george_lrmp.pdf

Research Forest Units A, C & D - #9 Weedon Lake – Enhanced Resource Management

- Wildlife Species: fishers, grizzly bear, marten, moose, deer (black-tailed)
- Resources values: Agriculture and Range

Research Forest Units E, F, and G - #5 Chuchinka Creek – Enhanced Resource Management

- Wildlife Species: grizzly bear, marten, moose
- Resources values: Recreation/Tourism

Research Forest Unit B - #6 Crooked River – General Resource Management

- Wildlife Species: fishers, grizzly bear, marten, moose, deer (black-tailed), trumpeter swan (Crooked River) and Douglas-fir
- Resources values: Agriculture and Range and Recreation/Tourism

Grizzly Bear. Research Forest 2022.

Research Forest Units H, K and L - #27 Willow River – Enhanced Resource Management

- Wildlife Species: grizzly bar, marten, moose, elk, deer (black-tailed), Douglas-fir
- Resources values: Agriculture and Range, Recreation/Tourism, access

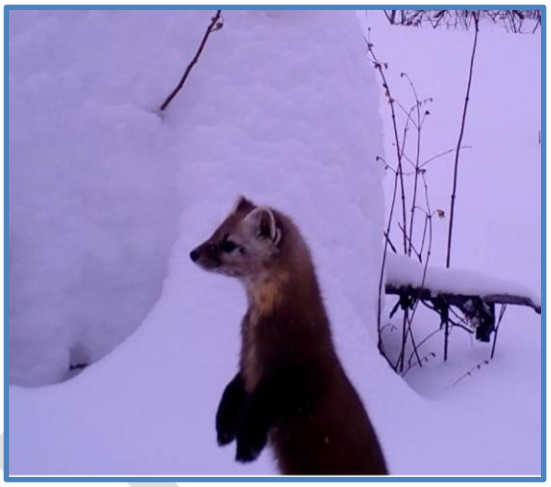
Research Forest Unit I - #46 Bowron River Valley – General Resource Management

- Wildlife Species: caribou, grizzly bear, marten, moose, deer (black-tailed)
- Resources values: Backcountry Recreation/Tourism and Recreation/Tourism

Southern Mountain caribou. Uschenko 2022.

Research Forest Unit J - #20 Baldy Hughes/Tagai Lake – Enhanced Resource Management[3]

- Wildlife Species: marten, moose, deer (black-tailed), and Douglas-fir
- Resources values: Agriculture and Range, and Recreation/Tourism



Pine marten. Research Forest 2022.

In summary, the LRMP generally identifies a priority on resource development within the zones containing the Research Forest, and identifies the following as key species for maintenance and enhancement: caribou, grizzly bear, marten, moose, elk, deer (black-tailed), and Douglas-fir (trumpeter swan is not included as this is a species specific to the winter habitat offered by the Crooked River, well beyond the Research Forest). The LRMP also identifies the following resource values as a potential priority in and around the Research Forest: Backcountry Recreation/Tourism and Recreation/Tourism.

There are multiple practice requirements designed to mitigate the impacts to forest ecosystems and the functioning of post-harvest habitat. The primary migrating requirements are the limitations on the percentage of young managed stands and limitations on the amount of permanent road being maintained. These requirements, along with the requirements concerning the conservation of biodiversity, cutblock size, distance to cover, wildlife trees, coarse woody debris and riparian areas are aligned with reducing initial mature forest impacts from new harvesting and quickening the post-harvest recovery of habitat necessary to support the wildlife species identified under the LRMP.

Landscape Biodiversity and Old Forest Maintenance

Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area (PGTSA)

The provincial Order Establishing Landscape Biodiversity Objectives for the PGTSA was legally established in 2004, and specifies objectives for "old forest retention", "old interior forest" and "young forest patch size distribution" for each Natural Disturbance Unit (NDU) defined under the order (NDUs are defined by grouping similar ecosystem subzones).

[3] Ministry of Forests, Lands, Natural Resource Operations, and Rural Development. Prince George Land & Resource Management website as sourced Jan. 2021. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/omineca-region/princegeorge-lrmp/princegeorgelandandresourcemanagementplan_rmz_1-54.pdf

Old Forest Retention Objective

The importance of maintaining biodiversity and old forest within the Research Forest is acknowledged, therefore the stewardship objective is to meet provincial old forest targets within the boundaries of the Research Forest.[4] In particular, the provincial guidance identifies that within the CNC Research Forest, 19% of Crown Forest Land Base[5] is to be old forest defined as stands greater than 120 years old.

In recognition that the Research Forest is an amalgamation of geographically separated units occupying differing biogeoclimatic subzones and landscapes, specific old growth retention requirements are identified for each Research Unit as summarized in Table 3. These specific old forest retention requirements are consistent with the amount of old forest retention identified for the natural disturbance units (identified under the Prince George Biodiversity Order) which apply to each Research Forest Unit. Old forest within the Research Forest is defined as any stand with a current age of greater than 120 years old.

The old forest retention requirements specified for each Research Forest Unit (summarized in Table 3) actually results in an overall old forest retention average of 24%, which far surpasses the 19% requirement of the provincial order.

[4] 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

[5] Crown forest land base (CFLB) is the area of productive forested Crown land excluding alpine areas, lakes, wetlands, roads, or other non-productive forest types.

Table 3. Minimum Old Forest Percentage of CFLB to Retain in Each Research Forest Unit[6]

Research Forest Unit	Minimum Old Forest Percentage of CFLB	Natural Disturbance Unit (From PG Biodiversity Order)
A – Kerry Lake	*17%*	*McGregor Plateau (A3) – Moist Interior Plateau*
B – Tacheeda Lakes	*26%*	*McGregor Plateau (A4)*
C – Caine Creek	*12%*	*McGregor Plateau (A3) – Moist Interior Plateau*
D – Caine Creek	*12%*	*McGregor Plateau (A3) – Moist Interior Plateau*
E – Chuchinka Creek	*26%*	*McGregor Plateau (A4)*
*F – Chuchinka Creek**	*26%*	*McGregor Plateau (A4)*
*G – Angusmac Creek**	*26%*	*McGregor Plateau (A4)*
H – Purden Mountain	*53%*	*Wet Trench Valley SBS*
I – Hungary Creek	*53%*	*Wet Trench Valley SBS*
J – Fraser River	*17%*	*Moist Interior Plateau (A12 & A7)*
K – Willow River	*30%*	*Wet Trench Valley ICH*
*L – Willow River**	*12%*	*McGregor Plateau (A3)*
Total for All Units	*24%*	

*The current amount of old forest (>120 years old) within Units F, G, and L is currently below the minimum old forest percentage threshold. Units G and L exceed the old forest target, if stands aged ≥100 years are included.

Interior Old Forest Objective

This Plan recognizes the importance of the interior old forest objectives stated under the Prince George Biodiversity Order. Consistent with the intent of the Order, the stewardship objective is to implement practices that retain old forest areas that are valued for their biodiversity and/or wildlife habitat, and which will sustain multiple old forest attributes. Further to this objective, retained old forest areas are not to be limited to small, isolated patches or areas that are largely influenced by the edges of openings or very young forests. The required practices consistent with the stewardship objective include, but are not limited to the following:

1) *Areas retained for the conservation and protection of old forest stands are to be 2.25 ha and 150 m wide in any direction. Retention areas less than 2.25 ha and 150 m wide may be considered if they have other attributes which increase their value for biodiversity and wildlife habitat and/or conserve uncommon or rare ecosystems, habitat or species.*

2) *Old forest retention areas planned within the Research Forest are to be spatially continuous with mature and old forest areas that are located adjacent to the Research Forest, particularly areas that are identified as protected or conserved. These protected or conservation areas may include retention areas planned by other forest tenure holders, as well as provincially or federally designated parks, protected areas, reserve areas, and other conservation areas identified under First Nations' land and resource plans. In particular, this applies to the following provincial parks and protected areas: Tacheeda Lakes Ecological Reserve adjacent to Research Forest Unit B, Sugarbowl – Grizzly Den Park adjacent to*

[6] Ministry of Forests. 2005. As sourced from the Province of British Columbia's website for Omineca Region Land Use Plans on February 7, 2022. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/omineca-region/princegeorge-biodiversity-order/biodiversity_order.pdf

Research Forest Unit I, and Fraser River Park adjacent to Research Forest Unit J. In addition, old forest recruitment areas are identified throughout the Prince George area and are found adjacent to Research Forest Units: B, E, and G.

3) *Anchor old forest retention on significant wildlife habitat features (e.g., nests, dens, and mineral licks) or areas supporting blue or red-listed ecosystems or species.*

4) *Maintain old and mature forest, or where old and mature forest is absent, maintain forests >3m in height around all identified wildlife habitat features. The width of the forest buffer is to be determined from available professional expertise. Where professional expertise is not available, a minimum buffer width of 200 m is to be applied. A 200 m width is expected to significantly reduce the potential impacts associated with windthrow and other edge effects.*

5) *Within Research Forest Unit I, retain all mature cedar and hemlock leading stands within the approximate areas shown on the maps within Appendix B, which display ecosystems at risk and uncommon forest types. 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.*

6) *Within all Research Forest Units, retain the majority of old and mature forests with a high component of deciduous species and black spruce. The approximate location of these forest types are shown on maps within Appendix B.*

7) *Within all Research Forest Units A to G, and K, retain the majority of the old and mature forests within the SBSwk1 02, 03, 04, and 06 ecosystems. Within Research Forest Units H and I, retain the majority of old and mature forests that are ICHwk4 03 ecosystem. Within Research Forest Unit J, retain the majority of old and mature forests within the SBSmh 01, 05, and 07 ecosystems. The approximate locations of these ecosystems are shown on the maps within Appendix B.*

Young Forest Patch Size Distribution Objective

There are three practice requirements to manage the cumulative amount of young forest area within any Research Forest Unit. The primary concern is limiting the distribution of stands 40 years of age or less, within all units, at all times.

1) *For Research Units with Epidemic Forest Health Factors:*
   Meet or exceed the Chief Forester Guidance Regarding Spruce Beetle Sanitation and Salvage with regard to stand-level retention. Where an individual cutblock exceeds 100 ha or the cumulative area of a cutblock and adjacent stands less than 40 years old exceed 100 ha, then the retention of adjacent mature stands (>60 years old) is to be 25% or greater of the combined area consisting of the harvest area, adjacent area less than 40 years of age and the retained mature area. (e.g. Retention Area (ha) / [Retention Area (ha) + Cutblock/Young Area (ha)] $\geq$ 25%).

   Cutblocks and stands less than 40 years old are considered adjacent to one another if the separating stand averages less than 100 m wide. To qualify as a separating stand, an area must have an average of 400 tree/ha that are greater than 3.0 m tall.

2) *For Research Units without Epidemic Forest Health Factors:*
Individual cutblocks are limited to 60 ha, and the sum of a cutblock area and any adjacent stand less than an average of 3.0 m in height is limited to 60 ha. Cutblocks and stands less than 3.0 m in height are considered adjacent to one another, if the stand separating them, averages less than 200 m wide.
To qualify as a separating stand, an area must have an average of 400 trees/ha that are greater than 3.0 m tall.

3) *Biodiversity Corridors, which are formed primarily of mature stands and old forest stands (greater than 120 years old), are to be maintained at all times. Biodiversity Corridors are intended to maintain areas of relatively continuous protective forest cover (3.0 m or taller) at all times.*

   Only stands that are determined to be free growing may be included in Biodiversity Corridors. The location and design of Biodiversity Corridors may change over time, and are to be identified and updated as part of the Operations Plan. Harvesting may occur within a Biodiversity Corridor providing that the average stand age is >60 years, and within each harvested hectare, a minimum of 300 codominant or dominant trees are retained. The approximate location of Biodiversity Corridors may be observed on the Management Plan Maps within Appendix A.

Provincial Old Growth Initiative

As of the writing of this Management Plan, the Province announced its intention to defer the harvest of approximately 2.6 million hectares of ancient forest, priority old growth and rare old growth forest within British Columbia. The Province is currently engaging with First Nations to determine the future management approach for these identified ancient and old forests.

Along with this announcement, the Province made available digital mapping of the identified deferral areas through their Old Growth Forests' webpage, which includes old growth deferral areas located within the Research Forest. It is not known what proportion of the identified ancient and old forest located within the Research Forest will become legally protected from harvesting. For further information on the location of the identified ancient and old forests, refer to the Management Plan Maps provided in Appendix A. Table 4, below, summarizes the amount of identified old growth forest located within each Research Forest Unit (there is no ancient forest currently identified). The vast majority of the identified old growth forest is located within Research Forest reserves and Biodiversity Corridors, and therefore was already planned for conservation or protection. The identified old growth forest within and outside of reserves and Biodiversity Corridors is also summarized within Table 4, below.[7]

[7] Ministry of Forests, Lands, Natural Resource Operations, and Rural Development. Old Growth Forests – Old Growth Maps website as sourced Jan.2021.
https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/old-growth-forests/old-growth-maps

Table 4: Summary of Provincial Old Growth Deferral Areas within Each Research Forest Unit

Research Forest Unit	Total Old Growth Deferral Area (ha)	Old Growth Deferral within Reserve Area (ha)	Old Growth Deferral outside of Reserve Area (ha)	Old Growth Deferral outside Reserve and Harvested Blocks (ha)	Total Productive Forest Area (ha)
A					908
B	66.2	48.9	17.3	10.6	999
C					1034
D					1054
E					1005
F	0.7	0.5	0.2		1177
G	22.3	16.2	6.1	5.6	2127
H	2.0	2.0	0.0		721
I	57.2	27.8	29.5	29.5	798
J	17.9	14.9	2.9	2.9	1571
K	62.7	36.3	26.4	3.8	456
L					156
Total	229.0	146.5	82.5	52.4	12006

The requirement under this Management Plan is to leave all provincially identified ancient or old growth forests unharvested and protected, until otherwise informed by the Province and the affected First Nation(s). Under some circumstances, this may require modification or stoppage of adjacent road building, forest harvesting, forest health management, and research activities to ensure the identified forests are not materially affected by adjacent Research Forest operations.

Where ancient or old growth forests outside of the provincially identified areas are identified through field confirmation, then these additional forests may be left unharvested and protected, and in some cases, may be substituted for the ancient or old growth forests identified by the Province that do not meet ancient or old forest criterion following field verification. In the event that any identified ancient or old growth forest cannot be found within or near the identified location, then the Ministry of Forests and the affected First Nation(s) will be contacted to determine the management approach for the area in question. Any substitution of provincially identified ancient or old forest will only occur after confirming with the Ministry of Forests and the affected First Nation(s).

Regionally Important Species and Species at Risk

Woodland Caribou (Southern Mountain Caribou)

Research Forest 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 mountains and valleys southwest of the Fraser River, which encompasses Research Forest Unit I, are identified as the habitat of the North Cariboo herd, which is one of fifteen herds in

the Southern Mountain population.[8] The establishment of Sugarbowl-Grizzly Den Park, adjacent to Research Forest Unit I, on the west side of Hungary Creek, provides for the protection of the caribou movement corridor that was previously identified under provincial ungulate winter range objectives established in 2003 (Order U-7-003)[9]. Due to the immediate proximity to the park, it is reasonable to assume that forest cover within Unit I is also used by caribou as movement corridor or as seasonable low elevation habitat. It is therefore recognized that the previous objectives established for caribou corridors under the Ungulate Winter Range designation may be applicable to the management of forests within Unit I.

The governments of Canada and British Columbia established an agreement in 2020 to undertake a collaborative approach to development and implement conservation and recovery measures for Southern Mountain caribou. As more specific direction is developed as a result of the Provincial and Federal government actions on caribou recovery, the Research Forest Operations Plan will be updated as necessary to address management objectives and practice requirements that uphold the established conservation and recovery measures.

Until further recovery measures are established for the Southern Mountain caribou (southern group), the implementation requirement regarding caribou habitat stewardship is to consult with the Ministry of Forests and affected First Nations to determine the acceptable scope of forest development, and the specific management and forestry practices necessary to uphold current direction on caribou recovery. This applies to Research Forest Units I, K and L.

Ungulate Winter Range for Moose

The Province recently designated ungulate winter range ID u-7-022, #29 (moose) which surrounds Research Forest Unit H in the Bowron Mountain-Purden Lake area. The UWR area may be viewed on the Management Plan maps included in Appendix A. Although the UWR excludes the Research Forest boundary, *the expectation is to manage Unit H to meet the requirements and intent of the objectives and general wildlife measures. The approved general wildlife measures and objectives include the following:*[10]

1) *The net area to be reforested for the cutblock must not exceed 60 ha, or the cutblock must not exceed 100 ha and must retain 40% or more of the basal area of the stand that was on the cutblock before timber harvesting.*

---

[8] Province of British Columbia. 2022. Mapping Application available via Caribou Recovery Webpage as sourced February 2022. https://governmentofbc.maps.arcgis.com/apps/MapSeries/index.html?appid=60eef687ed3a44a1881b1b79e47c7f41

[9] Ministry of Environment. 2022. Available via Ungulate Winter Ranges Webpage as sourced February 2022. https://www.env.gov.bc.ca/wld/frpa/uwr/approved_uwr.html

[10] Ministry of Forests, Lands, Natural Resource Operations and Rural Development. 2022. Ministerial Order under the Government Actions Regulation--Ungulate Winter Range u-7-022 in the Prince George Forest District.

2) *The distance from any point within the net area to be reforested, to either a Reserve or Security Cover, must not exceed 125 metres.*

   Security Cover means an area with stem density that obscures 90% of the moose at a distance of 60 m, measured using a 2 m by 2 m dark surface area and having only 0.4 m^2 visible between the period of November 21 to April 25, stem height averages greater than 3 m, and minimum size of 3 ha.

3) *To be measured at free growing date, outside of road and roadside processing and decking areas, and within the net area to be reforested, retain, if present, one dominant deciduous stem per 100 m^2 achieved either through selection and retention of mature deciduous during harvest or natural regeneration.*

4) *Within one year of the commencement date, rehabilitate the end of all temporary access structures that extend within 300 m of the outer boundary of the net are to be reforested; and deactivate all remaining temporary access structures in accordance with the Forest Planning and Practices Regulation, Sec. 82(1). The effect of this requirement is that no long-term roads are established within 300 m of the edge of any cutblock.*

   Rehabilitate means de-compacting compacted soils, returning displaced surface soils, side-cast, and berm materials, and managing for erosion and sedimentation.

6) *Within four years of the commencement date, rehabilitate the first 100 m of the temporary access structure from the junction with permanent access structures.*

7) *To be measured at free growing date, outside of road and roadside processing and decking areas, retain if present, contiguous areas of preferred moose browse or mature deciduous less than one hectare in size.*

   Preferred moose browse means any or all of the following: trembling aspen, black cottonwood, less than or equal to 3 m in height, paper birch less than or equal to 3 m in height, Douglas-fir, subalpine fir, red-osier dogwood, high-bush cranberry, willow, black twinberry, Saskatoon, beaked hazelnut, elderberry, mountain ash, raspberry, currant, rose, and Douglas maple.

8) *The use of herbicide is permitted only for the control of invasive plants or noxious weeds.*

9) *No brushing within 20 m of the outer boundary of the net area to be reforested.*

10) *Outside of the areas specified in item 8 above, retain all preferred moose browse in direct competition with a crop tree.*

11) *Promote stand heterogeneity by using a diversity of tree species identified in an approved stocking standard.*

Management of Moose Habitat across the Landscape

Bull Moose near Bowron River UWR. Research Forest 2021.

In addition to the general wildlife measures and objective applicable to Unit H, conservation of moose habitat within the Research Forest is being considered through the implementation of Biodiversity Corridors, which are intended to maintain interconnected areas of mature conifer forest cover through all periods of future harvesting. Partial harvesting may occur in the Biodiversity Corridors, but the protective functions of the corridors must be maintained at all times, so they provide thermal cover, snow interception cover, security cover, and potential calving and rutting areas. The vast majority (90%) of existing Research Forest Biodiversity Corridors include mature forests greater than 120 years old, but also include reforested areas where the dominant tree cover is 3 m or greater. The Biodiversity Corridors are not intended to be permanent and static throughout time. Rather, as forests continue to grow and develop, and as forest conditions change, the composition and location of the corridors may change. The current design and distribution of Biodiversity Corridors may be viewed on maps provided in Appendix A or B.

Provincially Listed Terrestrial Ecosystems within SBSmh Biogeoclimatic Subzone

The SBSmh portion of Unit J is located within the area that is approximately 700 to 1100 m from the edge of the Fraser River. For the conservation and protection of listed ecosystems within the SBSmh (moist hot) biogeoclimatic subzone, the practice requirement is that 80% of the area is to be conserved and protected by no harvesting and/or harvesting that is consistent with the maintenance of a Biodiversity Corridor. This approach is intended to minimize the rate of alteration to the existing ecosystems due to timber harvesting.

Provincially Listed Terrestrial Ecosystem within SBSdw3, SBSmk1, SBSwk1, SBSvk, ICHwk4, ICHvk2, and ESSFwk2

The potential locations of provincially listed ecosystems, within the Research Forest, were identified using the Research Forest's terrestrial ecosystem mapping. For convenient reference, the maps provided in *Appendix B* show the potential boundaries of the listed ecosystems.

The practice requirement is to field verify the location of listed ecosystems and conserve the majority or all field confirmed ecosystem area through forest reserves. In some circumstances, additional forest reserve areas beyond the listed ecosystem area may be required for adequate protection of the ecosystem. It is also possible that listed ecosystems may exist within the Research Forest, but are not identified within the current terrestrial ecosystem mapping. The same conservation and protection measures apply to those listed ecosystems discovered via other field work and assessments. The longevity and long-term objectives of any forest reserves established to

conserve or protect listed ecosystems will be determined via research and consultation with available experts in forest ecology, and will consider the ecosystem sensitivity to disturbance and the forest's value towards supporting other provincially listed plants and animals.

Provincially Listed Plants and Animals

To address the management of listed species that are largely dependent on terrestrial habitat, the practice requirement is to implement the conservation and protection measures described in this Plan for forest biodiversity, mature forest, old forest, protective forest cover (3 m and greater), cutblock size, distance to cover, cutblock structure, coarse woody debris, rare/limited forest cover, listed ecosystems, riparian areas, and permanent road disturbance.

Prior to final cutblock design and harvesting/road building, all cutblocks are to be assessed for wildlife habitat features. Conservation and protective measures are to be prescribed for any uncommon or locally important features identified. Where expertise relating the conservation of any uncommon or important wildlife feature cannot be sourced, then a forest reserve that is 200 m or wider in all directions beyond the feature is to be established.

Provincially Listed Ecosystems, Plants and Animals within Aquatic or Wetland Areas

Pygmy Water-lily. Shutterstock ©

As it is often difficult to determine which aquatic and wetland areas host listed plants and animals, all classified streams, lakes, and wetlands, and their upland interface, within or adjacent to the Research Forest, are to be conserved and protected by implementing the required reserve and tree retention listed under the sections titled, "Riparian Area and Water Quality Stewardship" and "Wildlife Tree Retention". Where a provincially listed species is observed or assessed within a waterbody, wetland or riparian interface, additional forest retention and stewardship measures, beyond those identified under the Riparian Area and Water Quality section, may be implemented in order to conserve or protect the listed species. As well, listed aquatic and wetland species are to be conserved and protected by conserving watershed functioning (particularly the functioning of small streams) and water quality by implementing the practice requirements specified under the sections titled, "Additional Restrictions and Requirements within Riparian Areas", "Water Quality Management", and "Watershed Stewardship".

To aid in further understanding aquatic and wetland species stewardship, further monitoring may be implemented to examine whether the intended result was achieved and if additional actions are required.

Special Trees

Special trees are unusually large, standing trees of a certain species, which are specified and protected by the Special Tree Protection Regulation. *Any special tree that is identified within or adjacent (within 56 m) of the Research Forest is to be reported to provincial Minister in order to provide for its future protection. This includes special trees that are accidently cut or damaged, upon discovery. Any specified or reported tree is to be is to be protected by retaining all the supporting trees within a 56 m radius of the tree. Special trees that occur within or adjacent to the Research Forest are of the following species and diameter at breast height:*

- *Douglas-fir (160 cm),*
- *western red cedar (290 cm),*
- *cottonwood (176 cm).*

The identification of special trees is to be undertaken as part of field assessments to identify wildlife habitat features prior to any forest development.

It is likely that a standing large tree of any species is an important wildlife tree or wildlife habitat feature, whether living or dead. In recognition of the unique biodiversity and ecosystem function of large trees, areas with a high potential for large trees were identified by examining the results of LiDAR scanning completed in 2016. Maps identifying these potential large tree locations are provided in Appendix C. *Prior to any forest development, these high potential areas, and the forested area within 100 m, are to be field assessed for the presence of large trees. Trees of any species that are equal to or greater than 130 cm DBH, or of uncommon height, will be considered for protection. Depending on multiple site factors, it may be necessary to retain supporting trees at distances significantly beyond 56 m of any large tree in order to conserve and protect the unique habitat and ecosystem function of the forest.*

Wildlife Tree Retention

Bird nest with young. Uschenko 2018.

In addition to the legal requirements under the Forest Planning and Practices Regulation to establish a wildlife tree retention area as part of each cutblock, the practice requirements for conserving wildlife trees include the items immediately below. The Forest Planning and Practice Regulation requirements for wildlife tree retention are available in Appendix E.

1) *Other than riparian areas, avoid the establishment of isolated (not contiguous with other forest that is 3.0 m or greater in height) wildlife tree retention areas that are less than 2 ha or less than 50 m wide.*

2) *Maximize the amount of wildlife tree retention area that is within 250 m of forest cover and 3.0 m or greater in height. The maximum distance between an isolated wildlife tree retention area and forest cover, that is 3.0 m or greater in height, is 400 m.*

3) *Maximize the amount of mature forest, and old forest contained within all wildlife tree retention areas.*

A secondary management goal is to retain areas of wildlife trees that are valued for their ecology and wildlife habitat. Practice requirements to achieve this goal includes the following:

1) *Assess cutblocks for listed ecosystems at risk, listed species at risk, wildlife habitat features, and large trees prior to harvest.*

2) *Anchor wildlife tree retention on wildlife habitat features (e.g. nests, dens, and mineral licks) or areas containing blue- or red-listed ecosystems and plant species.*

3) *Maintain wildlife tree retention connectivity with spatially identified wildlife tree retention areas and old forest retention areas planned by adjacent forest tenure holders.*

4) *Conserve individual Douglas-fir trees by retaining a portion of Douglas-fir trees >50 cm DBH within all harvest areas, where present.*

5) *Conserve a representative proportion of any Douglas-fir leading stand by retaining at least 1 ha of any contiguous Douglas-fir leading area that is greater than 2 ha, within all Research Forest Units, except Units H and J. Within Research Forest Units H and J, retain at least 2 ha of any contiguous Douglas-fir leading area that is greater than 4 ha.*

6) *Conserve deciduous trees by retaining the majority of all cottonwood, birch and aspen trees within all harvest areas and avoid cutting any deciduous trees ≥ 40 cm DBH. When individual deciduous trees ≥ 40 cm DBH are being reserved with the intent of conserving potential fisher denning habitat, then additional forest retention to protect the large deciduous trees must be considered.*

Retention of immature subalpine fir and paper birch in Cutblock J-3. Pollard 2022.

7) *Conserve a representative proportion of any larger deciduous leading stand by retaining at least 2 ha of any contiguous deciduous leading area that is greater than 4 ha, within all Research Forest Units.*

8) *Conserve or enhance the amount of snag trees available as wildlife trees or future coarse woody debris, by stubbing five or more dead or live trees per hectare of various species. Stubs are to be 20 cm DBH or greater and 2.0 m to 5.0 m in height.*

9) *Conserve stand structure within clearcut areas by retaining non-commercial-sized understory tree species, in particular spruce, subalpine fir, lodgepole pine and Douglas-fir.*

Coarse Woody Debris Retention

In addition to the legal requirements of the Forest Planning and Practices Regulation, the practice requirements for conserving coarse woody debris include the items immediately below. The Forest Planning and Practice Regulation requirements for coarse woody debris retention are available in Appendix E.

Marten observed on CWD corridor in cutblock B-1. Research Forest 2021.

For cutblocks outside of the SBSmh, SBSdw3 and SBSmk1 subzones, conserve coarse woody debris and avoid the burning of downed trees valued for ecosystem function and habitat, by retaining an average of 16 logs per hectare, each being a minimum of 5 m in length and 15 cm in diameter, distributed across each cutblock.

Ermine recorded on CWD corridor in cutblock D-3. Research Forest 2020.

For cutblocks within the SBSmh, SBSdw3, and SBSmk1 subzone, conserve coarse woody debris and avoid the burning of trees valued for ecosystem function and habitat, by retaining an average of 8 logs per hectare, each being a minimum of 2 m in length and 7.5 cm in diameter, distributed across each cutblock.

The 16 log minimum was chosen based on analysis of the coarse woody debris retention data that was collected under the Province's Stand-Level Biodiversity Effectiveness Evaluation Protocol.[11]

[11] 60 cutblocks within the Prince George Natural Resource District were randomly selected and assessed for coarse woody debris retention post-harvest. The 16 logs per hectare represents the 25th percentile of the number of retained logs (10m long or greater) per hectare per cutblock for all 60 cutblocks. The data for the 60 cutblocks was sourced from the following: Ministry of Forests, Lands and Natural Resource Operations –

More recent measurement of post-harvest coarse woody debris within the Research Forest confirms that the coarse woody debris target is reasonably achievable within the wetter subzones of the Research Forest.

In addition to the target for dispersed coarse woody debris retention, each cutblock is to be assessed for the potential to establish individual piles and corridors of coarse woody debris to provide for wildlife habitat, particularly hunting and denning habitat for marten. The decision to implement individual piles or corridors is dependent on a number of site factors assessed both before and after harvest. These include, but are not limited to, the availability of large coarse woody debris, machine access post-harvest, proximity to permanent roads, post-harvest fire hazard, overall landscape condition, suitability of adjacent forest cover, and distance to suitable forest cover.

Where suitable, individual coarse woody debris piles approximately 3 m in diameter and 2 m tall (or larger) are to be constructed approximately 20 m from protective forest cover edge, preferably adjacent to riparian areas. Long corridors (approximately 2 m wide, 1.5 m tall, and up to 200 m long) are to be constructed across harvested areas to connect stands with protective forest cover. These corridors are intended to provide a protective travel and hunting corridor for marten within harvested areas that otherwise may be avoided by marten without treatment. In addition, other wildlife species are expected to regularly use and occupy these coarse woody debris piles and corridors.

Riparian Area and Water Quality Stewardship

Riparian Area Stewardship

After considering the extensive evaluation of small stream functioning in post- harvest areas, the observation of wildlife features within riparian areas, and the rate and impact of post-harvest windthrow, the following minimum riparian reserve requirements are to be implemented within the Research Forest. These requirements are based on implementation of the riparian classifications established under the Forest Planning and Practices Regulation. For all classes of streams, lakes and wetlands, this Plan's requirements meet or significantly exceed the conservation and reserve requirements established under the Forest Planning and Practices Regulation.

Riparian retention around a small lake in Cutblock A-1. Uschenko 2021.

Forest and Range Evaluation Program (FREP), 2015. Stand-Level Biodiversity Data Verified and Collected for the North from 2006 to 2014.

Riparian Reserves and Riparian Management Zones

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

Table 5. Provincial standard for Riparian Management Zones

Riparian Class	*Qualities that Define Stream Class*	*Riparian Management Area (metres)*	*Riparian Reserve Zone (metres)*	*Riparian Management Zone (metres)*
S1-B	*Fish Bearing & >20m Wide*	*70*	*50*	*20*
S2	*Fish Bearing & 5m to 20m Wide*	*50*	*30*	*20*
S3	*Fish Bearing & 1.5m to 5m Wide*	*40*	*20*	*20*
S4	*Fish Bearing & <1.5m Wide*	*30*	*12*	*18*
S5	*Non-Fish Bearing & >3m Wide*	*40*	*20*	*20*
*S6 **	*Non-Fish Bearing & <3m Wide*	*30*	*12*	*18*
*W1 or W5***	*>5ha*	*50*	*50*	*0*
W3	*1 to 5ha*	*50*	*50*	*20*
L1-B	*>5ha to 1000ha OR If designated L1B by Minister*	*50*	*50*	*20*
L3	*1ha to 5ha*	*50*	*50*	*20*

**A stream may be classified as S6, instead of S4, after completing an in-field assessment that considers stream channel attributes, stream gradient, connectivity to known fish-bearing streams, channel blockages, and water quality. Some of these assessment factors may be determined from high quality aerial imagery and LiDAR derived digital modelling.*

*** 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*

Retention within a Riparian Management Zone

To conserve riparian habitat and to provide protection to the riparian reserve, 20% or greater of the total basal area within the riparian management zone is to be retained and composed of standing trees that are reasonably representative of the physical structure of the riparian management zone as it was before harvesting. The distribution of the retained standing trees within each management zone is dependent on the assessment of multiple site characteristics including, but not limited to tree species composition, stand density, windthrow hazard, and wildlife habitat features.

Restrictions in a Riparian Management Area[12]

A person must not construct a road in a riparian management area, unless one of the following applies:

(a) locating the road outside the riparian management area would create a higher risk of sediment delivery to the stream, wetland or lake to which the riparian management area applies;

(b) there is no other practicable option for locating the road;

(c) the road is required as part of a stream crossing.

If a road is constructed within a riparian management area, a person must not carry out road maintenance activities beyond the clearing width of the road, except as necessary to maintain a stream crossing.

A person who is authorized in respect of a road must not remove gravel or other fill from within a riparian management area in the process of constructing, maintaining or deactivating a road, unless

(a) the gravel or fill is within a road prism,

(b) the gravel or fill is at a stream crossing, or

(c) there is no other practicable option.

Restrictions in a Riparian Reserve Zone[13]

An agreement holder must not cut, modify or remove trees in a riparian reserve zone, 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;

---

[12] Province of British Columbia. 2022. As sourced from the BC Laws Website on February 16, 2022. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14_2004#division_d2e9829

[13] Province of British Columbia. 2022. As sourced from the BC Laws Website on February 16, 2022. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14_2004#division_d2e9829

(f) carrying out a sanitation treatment;

(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;

(i) felling or modifying a tree for the purpose of establishing or maintaining an interpretive forest site, recreation site, recreation facility or recreation trail.

An agreement holder who fells, tops, prunes or modifies a tree may remove the tree only if the removal will not have a material adverse effect on the riparian reserve zone.

An agreement holder must not carry out the following silviculture treatments in a riparian reserve zone:

(a) grazing or broadcast herbicide applications for the purpose of brushing;

(b) mechanized site preparation or broadcast burning for the purpose of site preparation;

(c) spacing or thinning.

Restrictions in a riparian management zone[14]

An authorized person who cuts, modifies or removes trees in a riparian management zone for an S4, S5 or S6 stream that has trees that contribute significantly to the maintenance of stream bank or channel stability must retain enough trees adjacent to the stream to maintain the stream bank or channel stability, if the stream

(a) is a direct tributary to an S1, S2 or S3 stream.

Fish Sampling and Riparian Evaluations

Regular testing for fish presence in streams and lakes will continue throughout the Research Forest. The knowledge of fish inventory, combined with the current and predicted condition of individual stream channels and riparian areas, will be used to determine the nature and scope of any necessary recovery treatments. Riparian areas and stream channels are to be assessed post-treatment to determine the need for further treatments and to improve the implementation of future recovery and improvement works.

Water Quality Management

The Forest Planning and Practices Regulation (FPPR) requirements and the additional practice requirements specified under the "Riparian Management" section are designed to conserve water quality in streams, wetlands, and lakes. It is also recognized that minimizing sediment delivery into streams from roads and stream crossings is critical to maintaining water quality. Therefore, it is necessary to implement additional practices that are known to prevent or reduce road sediment

[14] Province of British Columbia. 2022. As sourced from the BC Laws Website on February 16, 2022. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14_2004#division_d2e9829

delivery to streams, including practices applicable to road location, design, maintenance and deactivation. These practices are consistent with the 2013 report by Carson and Maloney[15] which considered 4,033 sites assessed under the provincial Water Quality Effectiveness Evaluation.

When locating and designing roads:

1) *Minimize the amount of permanent road.*
2) *Minimize road length that parallels streams and minimize road length within riparian management areas;*
3) *Minimize roads across steep slopes;*
4) *Minimize roads within unstable areas;*
5) *Minimize sensitive stream crossings;*
6) *Minimize stream crossings with steep approaches; and*
7) *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:

1) *Minimize the amount of disturbed soil within road right-of-ways;*
2) *Minimize the time roadside areas with disturbed soil remain non-vegetated or non-armoured, particularly where silty or fine-textured soils exist;*
3) *For all season roads, minimize amount of road surface composed of fine-textured material;*
4) *Maximize amount of subgrade and road surface that is crowned to promote immediate removal of surface water;*
5) *Minimize distance of interrupted ditch flow towards streams; and*
6) *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:

1) *Minimize the creation of berms that may hold run-off water on road surface for long-distances;*
2) *Maintain or enhance road crowning;*
3) *Minimize prolonged existence of wheel ruts in road surface;*
4) *Minimize use of fine-textured material for re-surfacing; and*
5) *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 and rehabilitating roads:

1) *Minimize the amount of permanent roads without surface stabilizing (gravel) material.*
2) *Deactivate and rehabilitate roads in the first available season following harvest to minimize the annual amount of sediment from road features, and to minimize the alteration of natural drainage patterns. In many circumstances, this means immediately upon completion of log hauling, particularly for winter road construction.*

[15] 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

3) *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;*
4) *Minimize the time that any roadside areas with disturbed soil remain non-vegetated or non-armoured, particularly where silty or fine-textured soils exist;*
5) *Where improved soil stability and reduction of sediment delivery may be achieved, re-contour stream crossings to natural angle of approach or less; and*
6) *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 Stewardship

The Research Forest is located within the boundaries of 28 small, separate watersheds (primarily 3rd and 4th order watersheds). For the vast majority, the total Research Forest area represents <1% to 16% of each watershed area. There are only 3 small order watersheds in which the Research Forest occupies greater than 20% of the watershed, which applies to Units E and F (23%), Unit G (21%) and Unit J (27%). Given the Research Forest's limited influence over small watersheds and its negligible influence on larger watersheds (5th order and larger), the general approach to watershed stewardship is to apply individual site practices that are expected to mitigate the cumulative effect of harvesting and road building on the function of streams and site practices that conserve and protect upland areas adjacent to wetlands and lakes.

The practices to address watershed conservation are all described within other sections of this Management Plan, which include the following:

1) *The practices to conserve and protect mature and old forest specified under the following sections: Old Forest Retention Objective, Interior Old Forest Objective, and Provincial Old Growth Initiative.*
2) *The practices to limit the continuous amount of area occupied by young forests (≥40 years old) specified under the Young Forest Patch Size Distribution Objective.*
3) *The practices to conserve wildlife trees and coarse woody debris specified under the following sections: Special Trees, Wildlife Tree Retention, and Coarse Woody Debris Retention.*
4) *The practices to conserve and protection riparian areas specified under the Riparian Area and Water Quality Management section.*
5) *The practices to limit permanent roads and to rehabilitate roads under the section titled, "Soil Disturbance from Permanent Roads."*

Watershed assessments may be undertaken for watersheds influenced by the Research Forest to inform the planning of future forest development and/or to assist in determining the need for restorative practices to improve overall watershed, or function of individual riparian areas and streams.

A further practice requirement is to fully support external communication and information exchange to assist the Province or other forest tenure holders in assessing the current and predicted condition of watersheds which overlap the Research Forest. Where an external watershed assessment finds that a watershed is significantly impacted by current cutblocks and/or roads, or predicts that a watershed will be significantly impacted by future forest development, then restorative and/or mitigating actions will be discussed, coordinated and implemented with the Province, affected First Nations, and other forest tenure holders.

Road Rehabilitation in Cutblock K-2. Uschenko 2021.

Under Appendix D, there is a description of each watershed, in which the various Research Forest Units are located. These are 3rd order and greater watersheds as defined by the provincial Fresh Water Atlas Assessment Watershed boundaries.

Soil Management

Soil Disturbance from Permanent Roads

The Forest Planning and Practices Regulation limits the amount of soil disturbance from permanent roads to 7.0% of each cutblock area, unless prescribed conditions apply. *In the event that Research Forest operations result in roads exceeding 7.0% of any cutblock area (under prescribed conditions), then the practice requirement is to implement road rehabilitation to reduce the permanent road area to 7.0% or less of the cutblock area. Road rehabilitation will occur in the first available season after the completion of harvesting.*

Road Rehabilitation in Cutblock F-5. Mjolsness 2020.

The Research Forest management objective is to establish and maintain permanent roads and trails within Research Units A to G, J, K and L to provide for reliable, safe and efficient long-term access while minimizing permanent road impacts on soil/forest productivity and multiple forest values. The consevation and protection of multiple forest values within Units H and I currently supersedes the significant expansion of permanent roads. The permanent roads and trails are necessary to support continuing silviculture treatments, research/education access, and the ability to effectively respond to various forest health factors

Consistent with the objective for permanent roads, the practice requirement is to limit future permanent roads to an average of less than 2.0% of new cutblock areas. It is recognized that for efficient havesting roads may have to temporarily exceed 2.0% of any cutblock area, so regular road rehabilitation will be necessary within most future cutblocks, as it has been for the last 10 years. For each Research Forest Unit, other than Unit L, the practice requirement is to limit all permanent roads to less than 3.0% of the original forested area. For Research Forest Unit L, the requirement is to limit all permanent roads to less than 4.0% of the original forested area.

The practice requirements for road rehabiliation include all of the following:

1) *Minimize the amount of permanent road within 400 m of cutblock boundaries.*
2) *Minimize the amount of permanent road within isolated tree reserves.*
3) *Minimize the amount of permanent road with culverts or bridges.*
4) *Maximize the amount of rehabilitated road area that is able to support the common target tree densities identified under Reseach Forest stocking standards. Consider revegetationwith deciduous species and/or moose browse species.*
5) *Rehabilitate roads in the first available season following harvest. In many circumstances, this means immediately upon completion of log hauling, particularly for winter road construction.*
6) *Distribute coarse woody debris evenly across the rehabilitation area, where available.*
7) *Minimize areas within the rehabilitation that may cause water to collect and form new, shallow ponds.*

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. *To achieve the desired soil conservation within all Research Forest Units, the practice requirements are to limit soil disturbance within each prescribed standard unit to the following:*

1) *5% of the prescribed net area to be reforested within standard units that are predominantly comprised of sensitive soils*.*
2) *10% of the prescribed net area to be reforested within standard units that are not predominantly comprised of sensitive soils.*
3) *25% of roadside work areas, which may extend up to 40 m from the edge of a road.*

**Standard units must be field assessed for texture, coarse fragment composition, soil moisture regime, slope, terrain, subsurface soil conditions, and precipitation to determine if the soil is sensitive to compaction, displacement, or soil erosion.*

Road and Trail Access

The objective is to maintain a reliable, safe road and trail network to and within each Research Forest Unit that minimizes impacts to forest ecosystem health. The road and trail network is necessary to support continuing access for forest operations, educational and research activities, First Nation use, stakeholder use, and general recreational use by the public.

Long-term Roads and Trails: To support this objective, additional new, long-term roads (spanning more than one Management Plan period) and trails may be established within Research Forest Units H, I, J and K during the term of this Management Plan. Additional long-term roads and trails, within Units H and I, are to be avoided unless they are required for research related to moose and caribou habitat.

Long-term roads required for continuing access will be maintained and/or deactivated to varying degrees to ensure road use safety and environmental protection. It is possible that other natural resources stakeholders may require long-term access through the Research Forest that is currently not recognized. Where possible, the amount of long-term road will be minimized in collaboration with other stakeholders, and future deactivation or rehabilitation of the long-term roads will be identified and implemented as soon as possible.

For roads that are required for temporary operational or research access, the requirement is to reduce or completely remove their footprint to conserve forest productivity and to reduce impacts to other forest resource values over the long-term. This will be accomplished by rehabilitating or deactivating non-necessary road sections. Rehabilitation will occur as described under section 36 of the Forest Planning and Practices Regulation as follows:

1) *Removing or redistributing woody materials that are exposed on the surface of the area, as necessary to limit the concentration of subsurface moisture on the area. If the erosion of exposed soil from such an area would cause sediment to enter a stream wetland or lake, then place woody debris on the exposed soil or revegetate the exposed mineral soil.*
2) *Decompacting compacted soils.*
3) *Returning displaced surface soils, retrievable side-cast and berm materials.*

Road Construction, Maintenance, Deactivation and Use

The ability to construct a new road within the Research Forest is authorized under Special Use Permit 24940. *Any construction, industrial use, maintenance and deactivation of a road within the Research Forest must comply with multiple practice requirements and standards specified under the relevant sections of the Forest and Range Practices Act and the Forest Planning and Practices Regulation. These include laws and regulations pertaining to, but not limited to, the following:*

- *Road, culvert, bridge, and other road structure safety;*
- *Bridge and culvert designs, including peak flow requirements;*
- *Bridge defects;*
- *Culvert fabrication;*
- *Bridge and culvert records;*

- *Clearing/Right-of-way widths;*
- *Road maintenance;*
- *Road deactivation;*
- *Notification of road construction;*
- *Notification of use of a forest resource road; and*
- *Payment by user of a forest resource road.*

For easy reference, the practice requirements and standards applicable to road construction, use, maintenance and deactivation are included in Appendix E.

Visual Quality Stewardship

The following Research Forest Units are located where visual quality objectives (VQO) have been established.[16] Visual Quality Objective polygons can be viewed on the maps in Appendix A.

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.

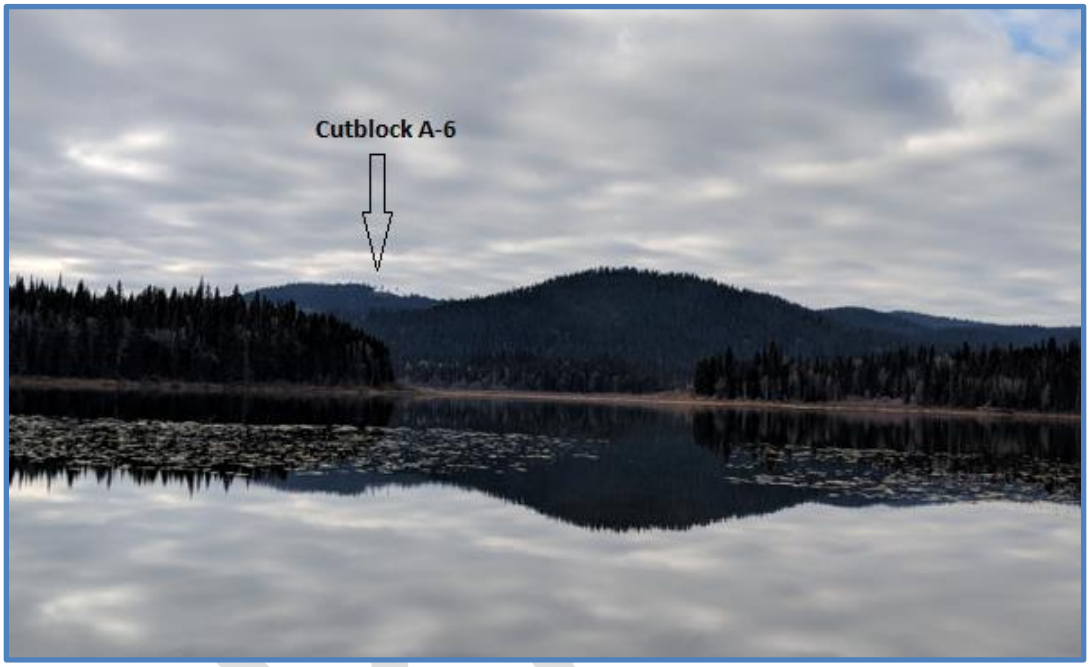
[16] DataBC, Province of British Columbia. 2016. Natural Resources Dataset – Visual Landscape Inventory. https://catalogue.data.gov.bc.ca/dataset?sector=Natural+Resources&download_audience=Public

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.



Visual Quality Assessment of Unit A, Cutblock A-6, as taken from the Kerry Lake Recreation Site. Uschenko 2018.

The practice requirement for all VQO polygons is to undertake forest operations (harvesting and road building) 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. Practices to limit or block the visibility of harvesting and roads include, but are not limited to, the following:

1) *Consulting with the applicable provincial Agency and affected First Nation regarding management options;*
2) *Applying visual models to estimate the visibility of cutblocks and roads as part of planning and design processes;*
3) *Prior to harvest or road building, assessing the viewable landforms, and taking photos, from significant viewpoints;*
4) *Altering the design and location of a cutblock and road;*
5) *Limiting the size or width of clearcut areas;*
6) *Limiting the amount of road accessing and within a cutblock;*
7) *Rehabilitating and planting roads to limit the longevity of visibility;*
8) *Leaving patches or scattered tree retention within a cutblock;*

9) *Partial harvesting within a cutblock;*
10) *Increasing the size of foreground or down-slope forest retention areas; and*
11) *Undertake post-harvest inspections, including photos from significant viewpoints, to verify visibility, and to inform future planning and design processes.*

For further reference, the definitions of altered forest landscape specified under the Forest Planning and Practices Regulation are provided in Appendix E.

Provincial Parks, Protected Areas, Ecological Reserves and Recreation Sites and Trails

The Prince George LRMP includes the objective to encourage a variety of recreation and tourism opportunities for most of the resource management zones applicable to the Research Forest. *Where the Research Forest is near or adjacent to a designated Provincial Park, Protected Area, Ecological Reserve or recreation feature, the management requirement is to ensure harvesting, road building, and various forestry, research and education activities do not diminish the value of the provincial site or experience of recreationalists. Activities within the Research Forest, which may enhance recreation opportunities associated with provincial sites, are only to be pursued in coordination with the appropriate provincial agency.*

Practices to manage the Research Forest resources consistent with the maintenance or enhancement of provincial sites, include, but are not limited to, the following:

1) *Consulting with the applicable provincial agency and affected First Nation regarding management options;*
2) *Altering the design and location of a cutblock and/or road;*
3) *Altering the harvest method and tree retention within a cutblock;*
4) *Limiting the amount of permanent road accessing remote provincial sites;*
5) *Deactivating or rehabilitating and planting roads to limit future use;*
6) *Establishing forest reserves adjacent to provincial sites;*
7) *In coordination with the applicable provincial agency, establishing interpretive sites within the Research Forest that may complement existing recreation in the area;*
8) *Applying visual models to estimate the visibility of cutblocks and roads as part of planning and design processes; and*
9) *Undertake post-harvest inspections, including photos from significant viewpoints, to verify visibility, and to inform future planning and design processes.*

The following recreational features are located adjacent to or near Research Forest Units.[17]

ATV & Snowmobile Road Routes – Unit K and L

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

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

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 Recreation Sites are established on Tacheeda Lakes just north of Unit B.

Tacheeda Lookout Trail – Unit B

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.

[17] 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 following Provincial Parks, Protected Areas, and Ecological Reserves were identified using the geographic data provided by DataBC, Province of British Columbia.[18]

Tacheeda Lakes Ecological Reserve

Unit B is situated immediately adjacent to the west side of the Tacheeda Lakes Ecological Reserve. The 526 ha reserve is composed mostly of mature spruce-leading forests within the McGregor Plateau ecosection, of which only 0.64% is designated as Park/Protected Area/Reserve. Although small, the ecological reserve contributes 11.85% of the overall protected areas system of the McGregor Plateau.[19]

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) and its transition with the wet, cool Engelmann Spruce-Subalpine Fir subzone (ESSFwk2).[20] This type of Provincial Reserve is not created for outdoor recreation. Most ecological reserves, however, are open to the public for non-destructive pursuits like hiking, nature observation and photography. As well, research and educational activities may be carried out but only under permit.[21]

Sugarbowl-Grizzly Den Provincial Park and Protected Area

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

The primary roles of the park and protected area are to protect critical habitat for the southern 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

[18] 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

[19] 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

[20] 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

[21] 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

representation of the Upper Fraser Trench ecosection and the Interior very wet, cool Cedar-Hemlock (ICHvk2) biogeoclimatic subzone.[22]

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 Park is to provide representation of the Quesnel Lowlands ecosection, and the moist hot and dry warm Sub-Boreal Spruce forests. Fraser River Park currently provides the greatest extent of representation in the protected areas system of the Quesnel Lowlands ecosection, which includes the moist, hot Sub-Boreal Spruce subzone (SBSmh) and the dry, warm Sub-Boreal Spruce subzone (SBSdw3). 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.[23]

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.[24]

Recreation Use within Research Forest

Any recreational development within the Research Forest may only be considered if the applicable provincial agency, and the affected First Nation agrees with the development and the future maintenance responsibility for the site lies with the government or a First Nation jurisdiction. The maintenance responsibility for a recreational site does not preclude the Research Forest offering services to establish and maintain any site. Prior to the development or alteration of any recreational features, the proposal will be referred to affected natural resource stakeholders to ensure that any recreational development, alteration, use and future maintenance will not unduly affect their permissions and rights under their provincial tenure.

---

[22] 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

[23] 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

[24] 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

Where repeated recreation use resulting in observable impacts is detected within the Research Forest, consultation will occur with the appropriate provincial agency and affected First Nation(s) regarding the management of the recreational activity.

Adjacent Forest Tenure Holders

Tree Farm Licence 30, held by Canadian Forest Products Ltd, is located immediately adjacent to the eastern boundary of Research Forest Unit G. It is also recognized that there is a multitude of active forest licences operating adjacent to and near the Research Forest, and in the future there may be additional volume-based forest tenures or area-based forest tenures awarded adjacent or near the Research Forest. *When planning for harvesting within the Research Forest and/or road construction and/or road maintenance, the affected tenure holders will be contacted to determine whether any modifications to operations or timing may be necessary to accommodate coinciding activities of the adjacent tenure holders. Where possible, this will be done 60 days in advance of operations when planning new road access outside of the Research Forest, and 30 days in advance of operations when other activities are involved.*

Trapping, Guiding, and Range Tenures

The Research Forest is widely spread over a number of trapping and guiding tenures. These tenure holders are identified by Research Forest Unit in Table 6. It is noted that trapping cabin locations near the boundary of Unit J (trapping licence 710T003) are identified within the provincial natural resources dataset, as well as a hunting camp near the northern boundary of Unit E (guiding licence 716G001).

Table 6. Trapping and Guiding Licences Overlapping with the Research Forest[25]

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	

[25] 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

K	707T001, 709T004		709G001	
L	709T004		709G001	

In some cases, activities associated with a trapping licence 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.[26]

Overlapping and adjacent trapping, guiding and range tenure holders will be consulted when proposing operations that may influence a trapline, guiding area, or range resources. This may include, but is not limited to, consultation regarding timing of operations, road access planning, shared road use, old forest retention planning, and wildlife tree retention planning. The affected stakeholders will be consulted 60 days or more in advance of planned operations. The specific timing of operations may be very important to trapping, guiding, and range tenure holders, and therefore, prior to initiating operations that may impact their operations, the holder will be notified of the commencement date and the approximate duration. This notification is to occur 14 days in advance of commencing operations.

As trapping and guiding licence holders change over time and new range tenures may be issued in the future, the Operations Plan will be annually updated to identify current trapping, guiding, and range tenure holders.

Provincial Land, Resource Tenures and Landowners

Mining Tenures and Notices of Works

There are multiple active mineral tenures overlapping various units of the Research Forest. Currently there are no Notices of Work issued for mining activity within or immediately adjacent to the Research Forest based on information available via the provincial iMap application as of March 17, 2022. Due to the notable amount of active mineral tenures, it is expected there will be future Notices of Work for mining activities within or adjacent to the Research Forest during the span of this Management Plan. As part of the Operations Plan process, annual searches for new Notices of Work will be undertaken to ensure there is coordination between mining operations and future Research Forest operations as necessary.

Communication Site and Access Right-of-Way

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

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

Private Land

The western boundary of Research Forest Unit B is immediately adjacent to privately held land as shown on the Management Plan Content Maps within Appendix A.[27]

When planning harvesting activities within the Research Forest and/or road construction and/or road maintenance, the practice requirement is to contact the affected tenure holders and landowners to determine whether any modifications to operations or timing may be necessary to accommodate the interests of the affected tenure and land holders. Where necessary, the applicable provincial Ministry governing the potentially affected resources or land may also be contacted for advice and guidance regarding planned operations. Where possible, this will be done 60 days in advance of operations when planning new road access outside of the Research Forest, and 30 days in advance of operations when other activities are involved.

Forest Health Stewardship

There are a multitude of primary threats to the maintenance or enhancement of forest ecosystem health within and adjacent to the Research Forest. These threats include:

- epidemic levels of pests and pathogens,
- increasing extreme weather events,
- persistent stress from shifting climatic averages,
- wildfire,
- clearcut harvesting,
- conifer reforestation post-harvest,
- post-harvest management of non-conifer species,
- road construction,
- human activities associated with vehicular access,
- the geographic shifting of native species due to climate change and/or due to ecosystem modifications,
- loss of fish and wildlife diversity, and
- the introduction of invasive species.

Given the long history of forest ecosystem modifications from forest management, and the outbreak of multiple epidemic-level forest health factors, along with the difficulty of modelling and adapting practices to future climate change, it is not conceivable that ecosystem health will be maintained consistently across all the forest ecosystem types within the Research Forest. Along with the current and future uncertainties associated with the condition of forest resources within the Research Forest area, it is important to recognize the potential for shifting stewardship direction and priorities that may arise from efforts to learn about Indigenous values and

[27] 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

knowledge, and the possibility of co-developing different stewardship and management approaches.

In recognition of future uncertainties, the general forest health management objective is to prioritize the maintenance of forest ecosystem health function across all types of upland and wetland ecosystems within the Research Forests in lieu of forest health practices that are largely focused on any single tree species. Practices that maintain or improve forest ecosystem health are to be implemented to address current forest health incidents, and where possible, mitigate the likelihood of forest health factors that may unfavourably affect future forest ecosystem health and/or individual plant species. This demands consideration of forest ecosystem health at all stages of forest stewardship, and the recognition of future shifts in ecosystem conditions resulting from the combined effects of widespread ecosystem modification due to past activities, and the current experience of accelerated climate change.

Commandra Blister Rust on lodgepole pine. Uschenko 2017.

Much like the conservation of watershed function is obtained through a multitude of individual decisions and practices, many of the objectives and practice requirements contained in other parts of this Management Plan, are in fact, measures to improve, maintain, conserve, or protect ecosystem health and function. *The practice requirements to maintain current and future forest ecosystem health within the Research Forest are far-reaching, and include, but are not limited to the following:*

1) *implement annual aerial detection and assessment of forest health factors, or utilize existing Provincial Annual Overview Assessment findings;*
2) *implement ground reconnaissance, inspections, or assessments for any areas identified with a non-endemic level of forest health factors from aerial detection or other fieldwork;*
3) *consult with the applicable provincial agency and affected First Nation regarding forest health treatment options;*
4) *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;*
5) *undertake 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;*
6) *subject to other Management Plan objectives and practices, prioritize the 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 140 cubic metres per hectare of net live conifer timber;*
7) *subject to other Management Plan objectives and practices, prioritize the sanitation, salvage and re-stocking of managed stands less than 50 years old, where there is moderate*

to high likelihood of not achieving 160 cubic metres per hectare of conifer yield by age 65 without treatment, and the effect of the treatments reduces the allowable annual cut less than 500 m^3/year over the next 30 years. The volume threshold is to be evaluated on the average yield of the existing cutblock containing the effected stand;

8) when considering isolated occurrences of forest health factors, other than bark beetle, affected areas less than 15 ha are considered a lower treatment priority;

9) without increasing the likelihood of epidemic pathogens or insects, apply partial cutting where ecologically appropriate, and retain non-commercial-sized conifer trees, deciduous trees, and wildlife trees across all harvest areas to conserve post-harvest plant and wildlife habitat function;

10) utilize partial cutting to maintain the overall plant health, structural diversity, plant diversity, and wildlife habitat function in stands >60 years old that are primarily managed for old forest retention, protection of resource features, and/or mature forest connectivity;

11) when reforesting harvested areas, achieve and balance the following:

a) plant or recruit a diversity of tree species consistent with the pre-harvest forest cover;

b) plant or recruit different tree species or different genetic stock than the pre-harvest forest, when it is expected these species will be better adapted to future climatic and forest health factors;

c) the planting or recruitment of different tree species or different genetic stock than the pre-harvest forest is not to significantly alter the near-term ecosystem and wildlife habitat functioning of the future forest;

d) regenerated tree density and distribution shall not significantly reduce wildlife habitat function of the future forest; and

e) for managed forest >20 years old, consider wildlife habitat improvement treatments or commercial-thinning operations to improve the balance between timber yield, and plant diversity and wildlife habitat.

The implementation of the forest health practices, provided above does not preclude the achievement of the other practices requirements identified in this Management Plan, unless the forest health condition is the primary reason for not being able to achieve the Management Plan direction.

<u>Lodgepole Pine-Leading Stands Affected by Epidemic Mountain Pine Beetle</u>

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

The vast majority of the pine-leading stands that were mass-attacked by mountain pine beetle are now reclassified spruce-leading or subalpine fir-leading, which arose from the persistence of the live non-pine trees present in the codominant, intermediate, and understory layers. The thriving live spruce and subalpine fir forest cover within these stands, along with dead standing and coarse woody debris from lodgepole pine breakage and blowdown is recognized for its significant contribution to current and future biodiversity and ecosystem/wildlife habitat function. These stands are also projected to produce operationally and economically feasible timber value. The

overall value of these stands precludes undertaking the salvage of any remaining dead lodgepole pine that may have remaining sawlog and pulp log value. Dead lodgepole pine will only be harvested if associated with harvest of other tree species that meet current stewardship objectives. In these circumstances, the lodgepole pine is likely a secondary or tertiary species in the stand.

Spruce-Leading Stands Affected by Epidemic Spruce Beetle

The spruce beetle epidemic, which was first detected in 2014 within the northeast portion of the Prince George District, has continued to affect additional forests each year since 2014 resulting in a substantial area of spruce mortality across the Omineca region, particularly within the Prince George and Mackenzie Natural Resource Districts. Research Forest Units A to G all experienced epidemic spruce beetle attack and extensive spruce mortality. Extensive salvage harvesting was implemented in Research Forest Units A to G between 2016 and 2019. The current proportion of young stands (40 years and less) verses mature and old forest cover, in many units, precludes further salvage of spruce mortality, unless the stands are selected for harvest for other forest stewardship purposes.

As of the writing of this Management Plan, no further epidemic spruce beetle attack has been observed within Research Forest Units H to L, however there is notable spruce beetle attack along the northern boundary of Unit J.

Vegetation Management

Invasive Plants

The objective is to minimize the introduction and spread of invasive plant species, particularly within newly soil disturbed areas. Where significant occurrences of invasive plants are found within the Research Forest, the objective is to report the occurrences and support necessary treatments to reduce or remove the invasive plants. *The specific practice requirements include, but are not limited to the following:*

1) *revegetate portions of disturbed soil to reduce the conditions favorable to establishment of invasive plants. Where available, grass and plant seed native to northern British Columbia be will be used for revegetation, along with other ecologically suitable tree and brush species;*
2) *rehabilitate unnecessary short-term roads so they are not a vector for the establishment of invasive plants;*
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 Northwest Invasive Plants Council in undertaking invasive plant treatments.*

Marsh Plume Thistle, a noxious plant species identified within the Research Forest. Central Kootenay Invasive Species Council ©, Invasive Species Council of BC ©

Sustainable Conifer Log Products from Managed Stands

Managed Stands - Sawlogs

The objectives towards sustaining forest and ecosystem health and function take precedent over timber management, except where a specific research and education pursuit may be rationalized.

Subject to sustaining forest ecosystem health and function, and consistent with the current and foreseeable demand for timber products, the primary timber objective is to produce sawlog quality conifer trees from managed stands, ideally with an average sawlog yield exceeding 300 m^3/ha, after approximately 75 years.

For Research Forest Units A-G and K the reforestation is targeted at maintaining forests dominated by hybrid spruce (approximately 70%) with significant lodgepole pine and subalpine fir throughout. Douglas-fir will also be maintained within managed stands in all units.

For Units H and I, variable mixtures of western red cedar, western hemlock, subalpine fir, Douglas-fir and lodgepole pine are targeted along with hybrid spruce. These tree species are representative of the natural conifer diversity within the northern ICH biogeoclimatic zone.

Research Units J and L are targeted towards forests mixed with hybrid spruce, Douglas-fir, lodgepole pine. These tree species are representative of the natural conifers within the mesic ecosystems of the SBSmk1 biogeoclimatic subzone-variant.

Sawlog Timber Enhancement Treatments:

Where stand treatments are expected to maintain or improve forest ecosystem health and wildlife habitat functioning, then commercial thinning treatments or other spacing treatments may be implemented to improve sawlog size and quality within managed stands.

Managed Stands – Non-Sawlog

It is recognized that a significant portion of the standing and fallen non-sawlog trees present in many mature forest stands help sustain forest ecosystems and wildlife habitat function. *The non-sawlog fibre within forest stands which is in excess of properly function forest ecosystems and wildlife habitat, may be removed and utilized for forest products.*

Sustainable Forest Resources from Managed Stands

To support the potential utilization of other forest resources, that is not currently occurring, the general stewardship objective is to sustain forest ecosystem health and function and to lessen the rate of unfavourable change to upland and aquatic areas associated with climate change. It is recognized that, within some areas of the Research Forest, ecosystem improvement treatments may be required to maintain or enhance forest resources to ensure current and future sustainability of flora and fauna that may be valued for uses other than traditional timber-based products.

Reforestation and Silviculture

Tree and Plant Species Stewardship

The intent is to maintain tree and plant species diversity within each Research Forest Unit, even after implementing multiple harvest areas and plantations. *This is to be achieved via a number of required practice requirements, as follows:*

1) *Maintain areas of existing mature forest cover that meets the distribution and size requirements as detailed in the section titled, "Wildlife Tree Retention".*
2) *Maintain existing deciduous-leading stands and individual/small groups of mature-sized deciduous trees, particularly those >40 cm DBH, as detailed in the section titled, "Wildlife Tree Retention".*
3) *Maintain existing Douglas-fir leading stands and individual/small groups of mature Douglas-fir trees, as detailed in the section titled, "Wildlife Tree Retention".*
4) *Maintain all mature cedar and hemlock leading stands within Unit I, as detailed in the section titled "Interior Old Forest Objective".*
5) *Maintain all mature and old forest, with a high component of deciduous species or black spruce, as detailed in the section titled, "Interior Old Forest Objective".*
6) *Maintain non-commercial-sized understory trees, as detailed in the section titled, "Wildlife Tree Retention".*
7) *Maintain existing forest cover between cutblocks and between cutblocks and young stands as detailed in the section titled, "Young Forest Patch Size Distribution Objective".*

8) *Retain Special Trees and protective surrounding forest cover, as detailed in the section titled, "Special Trees".*
9) *Maintain mature forest and old forest cover within Biodiversity Corridors, as detailed in the titled, "Young Forest Patch Size Distribution".*
10) *Where planting is the primary forest regeneration method post-harvest, plant with a species mix that is similar to existing forest stand conditions, with proper consideration for maintaining or improving forest ecosystem resiliency under projected climate change.*
11) *Avoid maintaining or planting only one tree species post-harvest, even if the pre-harvest stands are dominated by a single tree species. This applies to stands that are approximately 80% or greater of one species, by density or volume.*
12) *Where maintaining existing tree diversity within a forest stand is predicted to be difficult via clearcut harvesting and subsequent planting, avoid clearcutting in favour of partial harvesting that continually retains the existing tree species diversity, post-harvest.*
13) *Avoid planting tree species that accelerate the rate of change in forest ecosystem that is already occurring due to climate change. When experimenting with tree planting, favour trees of the same species as the pre-harvest stand, that have attributes or genotype that are better adapted to future climate hazards, as opposed to different species that also are better adapted to future conditions. This is particularly critical within forest ecosystems that are provincially recognized as at risk, and considered for harvesting.*
14) *Avoid the use of herbicide to kill, suppress, or alter deciduous and brush species competition as detailed in the section titled, "Treatments for Deciduous and Brush Competition".*
15) *Avoid brushing treatments within any non-mappable areas (areas less than 20 m wide or less than 1 hectare) with significant deciduous and brush competition. Avoid brushing treatments in riparian management zones. This is intended to maintain or enhance species biodiversity, along with forest ecosystem health and function.*
16) *Use grass seed that is Indigenous to the interior of British Columbia (and not considered noxious or invasive) where applying riparian area restoration or improvement treatments. This practice is to be applied on other exposed soil areas where native grasses and clovers are expected to be detrimental to ecosystem function or wildlife habitat function.*

Tree Planting

Tree planting is to occur where post-harvest conifer understorey (conifers less than 3.0 m tall) density is less than 500 stems/ha and where:

- *trees are harvested within stands 60 years or less, and the remaining density of live trees equal to or greater than 12.5 cm in diameter, at 1.3 m, is less than 500 stems/ha, or*
- *trees are harvested within stands 61 years or greater and the remaining density of live trees equal to or greater than 17.5 cm in diameter, at 1.3 m, is less than 300 stems/ha.*

Tree planting or silviculture treatments are not to occur where the area is occupied by mappable (approximately 0.2 ha and larger) areas of natural non-productive or natural non-commercial cover.

Natural non-productive areas and non-commercial cover are common throughout the Research Forest Units occupying the SBSwk1 biogeoclimatic subzone, and are valued for their unique ecosystem attributes and contribution to forest diversity and ground water function.

Sx seedling, planted in cutblock K-2, SBSwk1. Mjolsness 2021.

Site Plans for Areas to be Harvested and Reforested

A Site Plan describing the harvest area, the acceptable level of soil disturbance and reforestation standards, is to be prescribed and signed by a registered professional forester for all areas to be harvested. A Site Plan document is to include the following. (All prescribed numbers are to be specified to one decimal place.)

1) *Acknowledgement of a Professional Forester – The name, signature and seal or registration number of the Professional Forester that is prescribing the soil and reforestation standards.*
2) *Acknowledgement of Forest Tenure Holder – The name and signature of the person representing the provincial forest tenure holder.*
3) *Net Area to be Reforested – The area to which stocking standards apply.*
4) *Permanent Road Area – The area and percentage of road, to which stocking standards do not apply. The specified road percentage is determined by dividing the area of permanent roads by the total cutblock area and multiplying by 100.*
5) *Temporary Road – The area and percentage of road, to which stocking standards do apply (these are the roads included in the net area to be reforested). The specified road percentage is determined by dividing the area of temporary roads by the total cutblock area and multiplying by 100. Percentage is proportion of total cutblock area that is temporary road.*
6) *Natural Non-productive – The area, which is naturally non-productive, and to which stocking standards do not apply.*
7) *Natural Non-commercial Cover – The area, which is naturally occupied by non-commercial tree cover.*
8) *Wildlife Tree Retention Area – The area prescribed for the retention of wildlife trees, which may include riparian reserves and riparian management areas.*
9) *Total Cutblock Area – Area that includes Net Area to be Reforested, Permanent Roads (within cutblock), Natural Non-productive, Natural Non-commercial Cover, and Wildlife Tree Retention Area.*
10) *Standard Units – Identify each geographic unit, to which different stocking standards or different soil disturbance standards apply, and the net area to reforest within each Standard Unit.*
11) *Biogeoclimatic Classification – The biogeoclimatic site series or combination of site series that occupy each Standard Unit.*

12) *Maximum Allowable Dispersed Soil Disturbance – The maximum percentage of area to be occupied by soil disturbance within each Standard Unit based on soil sensitivity rating.*
13) *Stocking Standards – Includes all of the following:*
    a) *Regeneration Date/Delay - The latest date (or longest period) from the commencement of harvesting), by which regeneration stocking standards are to be met.*
    b) *Early Free Growing Date/Delay – The earliest date (or shortest period from the commencement of harvesting), by which free growing trees may be assessed.*
    c) *Free Growing Date/Delay – The latest date (or longest period from the commencement of harvesting), by which free growing stocking standards are to be met, if less than 20 years.*
    d) *Preferred and Acceptable Tree Species and Minimum Density – For each Standard Unit, the individual tree species that are preferred or acceptable and the minimum well-spaced density required for both preferred and acceptable species.*
    e) *Target Density – For each Standard Unit, the desired well-spaced density of preferred and acceptable tree species.*
    f) *Minimum Well-Spaced Inter-tree Distance – For each Standard Unit, the minimum inter-tree horizontal distance between countable well-spaced, preferred and acceptable trees within each Standard Unit. This is 1.6 m, unless another minimum distance may be rationalized.*
    g) *Minimum Free Growing Height – For each Standard Unit, the minimum height for a Preferred or Acceptable Tree to be considered free growing.*
14) *Extraordinary Circumstances - A description of any land, forest resource or ecosystem features, or other circumstances, which require soil or stocking standards modifications.*

A Site Plan is also to include one map or more that displays the following:

1) *Net Area to be Reforested – For each Standard Unit, the geographic area to which stocking standards apply*
2) *Permanent Road Area – The geographic area with road structures (ditches, berms, stream crossings, and roadway), to which Stocking Standards do not apply. This includes pre-existing Permanent Roads.*
3) *Temporary Road – The geographic area with road structures that will be removed or rehabilitated, and to which Stocking Standards apply.*
4) *Natural Non-productive – The geographic area occupied by natural non-productive features, to which Stocking Standards do not apply.*
5) *Natural Non-commercial Cover – The geographic area occupied by natural, non-commercial tree species, to which stocking standards do not apply.*
6) *Wildlife Tree Retention Area – The geographic area prescribed for the retention of mature wildlife trees, which may include riparian reserves and riparian management zones. Riparian reserves and riparian management zones are to be delineated from other Wildlife Tree Retention Areas.*
7) *Total Cutblock Area – The geographic extent of the outer boundary of the prescribed Cutblock that includes the Net Area to be Reforested, Permanent Roads (within cutblock), Natural Non-productive, Natural Non-commercial Cover, and Wildlife Tree Retention Areas, and Riparian Reserves.*

8) *Standard Units – Each geographic area to which different stocking standards or different soil disturbance standards apply.*
9) *Biogeoclimatic Classification – The geographic extent of each area occupied by a different biogeoclimatic site series or different combination of site series (for transitional areas and areas with a complex of site series).*

Stocking Standards

The provincial Reference Guide for Forest Development Stocking Standards will be used to prescribe the following stocking standards, which are applicable to each standards unit based on biogeoclimatic site series or a combination of site series:

- *Preferred and Acceptable Conifer Tree Species*
- *Preferred Broadleaf Tree Species*
- *Minimum density (stems/ha) of Preferred and Acceptable Well-spaced Trees*
- *Regeneration Date/Delay*
- *Minimum Free Growing Height*

Professional discretion is to be applied in prescribing the following stocking standards, consistent with the multitude of objectives and practice requirements contained in this Management Plan:

- *Target Density for All Preferred and Acceptable Tree Species (stems/ha)*
- *Earliest Free Growing Date/Delay*
- *Latest Free Growing Date/Delay, if not 20 years*
- *Minimum Well-Spaced Inter-tree Distance*

Stocking Standards for Areas to be Partially Harvested

For areas prescribed for commercial thinning or partial harvesting, a Site Plan is to include Residual Tree Stocking Standards. For each Standard Unit, these standards are to specify the minimum, average density or volume per hectare of acceptable and preferred tree species remaining after 12 months following harvest. The prescribed minimums are to be rationalized considering forest ecosystem health objectives and/or forest growth and yield objectives. These standards are to include a description of the post-harvest tree attributes required to be met in order to contribute to the density or volume of retained trees.

Stocking Standards Specified in Site Plans

The Stocking Standards applicable to each biogeoclimatic site series are to be professionally prescribed in a Site Plan prior to the harvest of any cutblock. The standards within any Site Plan are to include standards from the provincial Reference Guide for Forest Development Stocking Standards, as well as those derived from the professional evaluation of forest ecosystems and consideration of all the practice requirements within this Management Plan.

Tree Seed

Where tree planting is required, it is expected that the Chief Forester's Standards for Seed Use will be used in the selection and utilization of seed for conifer seedling production and conifer tree planting within the vast majority of harvested area within the Research Forest. To facilitate experimentation, the cutblocks harvested within the last two years and all future cutblocks may include areas up to 2 hectares that are reforested with seed that does not meet the Chief Forester's Standards. The implementation of these trial areas is subject to both the avoidance of significant future timber supply losses (based on current knowledge) and no significant, negative impacts to forest ecosystems, riparian function, and wildlife habitat function.

Pre-Free Growing Silviculture Treatments

The need for site preparation within harvested areas is to be assessed by an accredited forest professional prior to tree planting or prior to the prescribed Regeneration Date/Delay for areas where natural regeneration is sought. Treatments to managed stands, prior to free growing evaluation, also require assessment by an accredited forest professional, and in most circumstances is dependent on the completion and consideration of a silviculture survey that assesses and maps the inventory of: trees and plants within each stand, each stand's average forest health condition and average tree attributes, and recognizes the current hazards applicable to the managed commercial tree species.

<u>Treatments for Competing Deciduous and Brush Species</u>

Deciduous trees, brush 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. *The specific practice requirements, include, but are not limited to:*

1) *Consulting with the affected First Nation regarding brushing that may negatively impact areas or plants of importance to the First Nation;*
2) *Avoiding the removal of plants important to First Nations and stakeholders;*
3) *Maximizing the amount of deciduous trees and brush species that are not treated or altering the type of brushing treatment to conserve plant and ecosystem diversity and wildlife habitat function;*
4) *Implementing a variety of brushing treatments, including but not limited to, manual brushing, manual girdling, prescribed fire, and animal grazing;*
5) *Limiting herbicide applications to small experimental areas, and only if accepted by affected First Nations and resource stakeholders.*

Post-Free Growing Silviculture Treatments

Treatments to post-free growing managed forests may be implemented to maintain or improve any of the following:

1) *tree health and form (including sanitation treatments),*
2) *future timber quality and yield,*
3) *cost and efficiency of future harvesting,*
4) *forest ecosystem biodiversity,*
5) *riparian function,*
6) *wildlife habitat function,*
7) *availability of forest food, and*
8) *the availability of other forest resources.*

Reforested stand within CNC Research Forest Unit L, declared free growing in 2018. Research Forest 2017.

Forest stands considered for post-free growing treatments involving tree cutting are to be assessed by a Registered Professional Forester, and any treatments are to be prescribed via a Site Plan. The Site Plan is to include all of the document and map content listed under the section titled, "Site Plans for Areas to be Harvested", as well as the applicable stocking standard content listed under the section titled, "Stocking Standards". In addition, prescribed Site Plans for post-free growing stand treatments are to include:

1) *Clear treatment objectives and targets applicable to the forest resources being modified.*
2) *Standards and timelines for evaluating or verifying that the resource objectives and targets are met.*


Timber Supply Review
Timber Harvesting Land Base Defined
Stewardship/Management Assumptions
Alternative Harvesting Scenarios
Recommended 5-Year Harvest Level

Current Timber Supply Analysis and Modelling

A new timber supply review (TSR) was undertaken during early 2022, coinciding with the new Management Plan content. The 2022 TSR is based on timber inventory and forest resource information projected to the end of the 2021 growing season. This TSR is significantly different than the previous one, primarily due to the following revisions:

1) updated timber inventory for spruce beetle mortality, previous harvesting and previous reforestation;
2) redefined timber harvesting land base due to multiple new management objectives;
3) increased distribution of Biodiversity Corridor areas;
4) management assumptions for Biodiversity Corridors areas;
5) assumptions for future WTRA distribution;
6) assumptions for amount of future permanent roads;
7) definitions for each analysis unit (areas with similar growth expectations for managed stands);
8) new site index (growth productivity) data for spruce and lodgepole pine within Research Forest Units A to G, and J to L;
9) introduction of partial harvesting into modelling;
10) restricted harvesting in areas affected by spruce beetle epidemic;
11) increased requirements for old forest retention within all Research Forest Units; and
12) new sensitivity analysis for evaluating differing model scenarios.

NRFT group harvesting tour. Pollard 2018.

The TSR modelling was completed using Remsoft's Woodstock Optimization Studio (ver 2021.3), that maximizes harvest flow in consideration of management objectives/constraints, such as visual sensitive polygons, Biodiversity Corridors, and old-growth forests. The full details of the timber supply review are available within the Analysis Report and Data Package, which are contained in Appendix G.

The Timber Harvesting Land Base Netdown

A number of different assumptions and revised mapping was considered in defining the timber harvesting land base (THLB) used for the current TSR. In particular, the following changes from the previous TSR were applied.

1) re-mapping of non-forest and non-productive areas;
2) updated mapping of current area occupied by roads;
3) new definition for steep slope areas;
4) low productivity areas changed due to new site index information;
5) changed assumptions about amount of commercially feasible Hemlock-leading stands;
6) accurate mapping of all riparian reserve zones, based on the practice requirements specified under this Plan;

7) assumption that future areas for wildlife tree retention will occupy 4% of the THLB beyond riparian reserves and Biodiversity Corridor areas; and
8) assumption that future permanent roads will occupy 1.5% of THLB.

The cumulative result of the changes is that the THLB increased from 9,201 ha to 9,686 ha. This result is consistent with previous concerns that the 2017 TSR over-estimated low productivity areas and steep slopes. The full classification of the THLB may be observed in Table 7, immediately below.

Table 7. Timber Harvesting Land Base Net Down

Land Base Assignment Category	2021 Gross Area (ha)	2017 Effective Area (ha)
Total Area	*12,562.4*	*12,567*
Less:		
Non-Forest / Non-Productive	*439*	*221*
Existing Roads	*118*	*83*
Crown Forested Land Base (CFLB)	*12,006*	*12,266*
Less**:**		
Physically Inoperable / Steep Slopes	*536*	*664*
Low Productivity	*96*	*979*
Problem Forest Types:	*432*	*110*
[Deciduous *(Part of Bio. Corridors)]*		*5*
[Hemlock & Cedar-Leading]		*105*
Riparian Reserve Zones	*692*	*402*
Timber Harvesting Land Base (THLB)		
Less Aspatial Netdowns		
Future Wildlife Tree Retention*	*(4.0%) 410*	*(9.0%) 910*
Future Permanent Road Area	*(1.5%) 154*	*0*
Net Effective Harvestable Land Base	*9,686*	*9,201*

*In place of an actual mapped area reduction to account for future land prescribed for mature wildlife tree retention areas (WTRA), a non-spatial volume reduction was applied to all forest stands within the THLB. A 4% reduction was applied to estimate the various areas that may be occupied by prescribed WTRAs which are outside of forested steep slopes, riparian reserves, problem forest types, and Biodiversity Corridors.

Biodiversity Corridors

For this TSR, all Research Units have long-term Biodiversity Corridors identified and mapped. It is also assumed that currently prescribed Wildlife Tree Retention Areas will become part of the Biodiversity Corridor area in the future (approximately 50 to 60 years from now). The management assumption is to maintain continuous mature forest cover within all Biodiversity Corridors by implementing restrictive partial harvesting practices.

Modelling Stand Growth – Managed Stands

For natural stands (stands without harvesting history), timber growth and yield was projected using the provincial Variable Density Yield Prediction (VDYP) model version 7. For managed stands, growth and yield was projected using the provincial Batch Table Interpolation Program for Stand Yields version 4.4. Managed stands are defined as those disturbed through harvesting post-1987.

The entire Research Forest land base was classified into 17 separate analysis units in which the growth and yield is modelled the same regardless of geographic location. This simplifies the projection of forest growth necessary to support a full timber supply model. Significant THLB area (approximately 95%) is occupied by forest stands classified as the following, listed in descending order of THLB area:

- spruce-leading – moderate productivity
- subalpine fir-leading – moderate productivity
- spruce-leading – poor to moderate productivity
- spruce-leading – very good productivity
- spruce-leading – good productivity
- lodgepole pine-leading – good productivity
- subalpine fir-leading – good productivity
- Douglas-fir-leading-good productivity
- deciduous-leading – good productivity

The summary of managed stand types, above, demonstrates good overall productivity with the vast majority of current and future managed stand site indexes ranging between 18.8 to 24.2.

Managed stands were assumed to have a regeneration delay of 1 year and to be regenerated to an average density 1600 stems per hectare. The 1600 stems per hectare density was confirmed by the average stand density determined from multiple regeneration surveys completed in previous years.

Operational adjustment factors applied to the growth modelling assumes a 15% reduction in stand volume during each growth period to account for non-productive areas, gaps in forest stands, and various common forest health factors, and damaging events. As well, an additional 5% reduction in stand volume is applied linearly over 100 years to account for general losses resulting from decay, waste and breakage. The exception is for lodgepole pine leading stands, hemlock leading stands,

and stands within Unit H, which are reduced by 20% during each growing period to account for additional forest health pressures.

Key Management Assumptions Applied in Analysis

Timber Utilization

The timber utilization standards, which are applicable to tree harvesting and used in this timber supply analysis to calculate merchantable volumes for mature and immature stands, are shown in the Table 8 below.

Table 8. Utilization Standards (Unmanaged and Managed stands)

Species	Minimum Diameter at Breast Height (DBH)	Maximum Stump Height	Minimum Top Diameter
	centimeters (cm)		
Lodgepole Pine	12.5	30.0	10.0
Other Conifer	17.5	30.0	10.0
Deciduous	17.5	30.0	10.0

The bottom and top diameters, specified in Table 8, are applicable to most stands, but where it is feasible to utilize more of each tree for forest products, increased utilization will be implemented providing the additional utilization does not compromise coarse woody debris and other forest ecosystem health objectives.

Athough all conifer and deciduous species* within the Research Forest contribute to the allowable annual harvest, multiple forested areas were removed the THLB. The removed areas are not expected to be harvested and do not contribute timber voume to the projected allowable annual harvest. These removed areas included forest stands with greater than 50% hemlock, as well as multiple other cedar/hemlock leading polygons with a lack of commercial potential as a result of insufficient Douglas-fir and/or spruce volume.

*Tree species within the Research Forest include: white spruce, englemann spruce, black spruce, subalpine fir, lodgepole pine, western hemlock, western red cedar, Douglas-fir, aspen, birch, cottonwood and balsam poplar.

Minimum Harvestable Volume

Stands are not eligible to be harvested until 140 m^3/ha of volume is achieved. Stands that never achieve 140 m^3/ha, based on growth modelling, are removed from the THLB.

Spruce Mortality from Spruce Beetle

Due to the short shelf-life of spruce trees, which is assumed to be approximately 6 years, harvest modelling within Research Forest Units A to G does not consider dead spruce volume as available stand volume and dead spruce volume does not contribute volume to the allowable annual cut determined via the model. The short shelf-life of spruce is, in-part, based on the local milling study, conducted in 2019 that examined the sawmill out-turn from grey beetled attacked spruce harvested adjacent to the Research Forest.

Mature spruce forest heavily impacted by spruce beetle, resulting in significant blowdown events and loss of merchantability. Uschenko 2020.

Lodgepole Pine Mortality from Mountain Pine Beetle

Lodgepole pine timber volume previously killed by mountain pine beetle (between approximately 2001 to 2007) is not considered available harvest volume when the model selects for stands for harvesting, and dead lodgepole pine volume within stands does not contribute harvest volume to allowable annual cut determined via the model.

Other Timber Losses Due to Future Damaging Events

To account for the future loss of timber due to various forest health factors and damaging events, the harvest within each 5-year period is reduced by 2,125 cubic metres per year. This non-spatial volume reduction equates to approximately 1% of the Research Forest's long term sustained yield.

Stewardship of Old Forest

The amount of old forest (>120 years old) that is to be maintained within each Research Forest Unit was increased when modelling current and future forest harvest. The requirements for the maintenance of old forest now range between 12% to 53% of the crown forest land base[28] depending on Research Forest Unit; up from 10% to 25%. The old forest requirements are the same as those

[28] the area of productive forested Crown land and not include private land, non-forested areas like, lakes, roads, or non-productive forest.

stated within the Order Establishing Landscape Biodiversity Objectives for the Prince George Timber Supply Area, which identifies the individual targets for each biogeoclimatic subzone (or merged group of subzones) that applies to each Research Forest Unit.

Long-Term Biodiversity Corridors

Biodiversity corridors, intended to maintain continuous mature forest cover connectivity, were spatially identified within each Research Forest Unit. The previous TSR only identified Biodiversity Corridor areas within Research Forest Units A, B, E, F, and G. When modelling harvest, limited partial harvesting (<40% removal) is the only option available for stands within the corridors. A stand selected for partial harvesting within a corridor may only be selected for harvest after 60 years have elapsed since the previous harvest. This ensures that all future Biodiversity Corridors will maintain a continuous protective cover of mature trees.

Currently Prescribed Wildlife Tree Retention Areas (WTRA)

The locations of prescribed WTRA, as of 2021, were spatially identified for the timber supply modelling, and are not available for harvest selection for 60 years after their date of establishment. This is approximately the time when the cutblock that they are associated with is expected to achieve stand conditions that resemble mature forest conditions.

Future Wildlife Tree Retention Areas

To account for stands that will be prescribed as WTRA in the future, the available timber volume of all THLB stands is reduced by 4%. This 4% reduction is in addition to riparian reserves, steep slopes, Biodiversity Corridors, cedar-hemlock stands, low-productivity stands, and visual quality areas that may also be prescribed as WTRA.

Future Riparian Reserves

A field assessment or assessment using imagery (aerial photos and terrain modelling from LiDAR data) was completed on all streams to determine stream class. A Research Forest riparian reserve coverage was created using this stream information, along with inventory mapping of wetlands and lakes, as available from 2021 consistent with the practice standards contained in this Management Plan. These areas are reserved from harvesting throughout all periods of the timber supply modelling.

Future Roads

Based on results since the last timber supply review (2017) to the end of winter 2019-2020, the area of all built permanent roads occupy approximately 1.1% of the area within harvested cutblocks. The median road percentage of all these cutblocks was 0.77%. To ensure the amount of future forested area converted to roads is not underestimated, a 1.5% volume reduction was applied to THLB stands.

Visual Quality Objectives

The Research Forest contains forested area with Visual Quality Objectives (VQO) ranging from retention to modification. Based on the VQO, each visual polygon within the Research Forest was assigned a maximum percentage of area that may be below a threshold height (e.g., 4.5 to 7 m). For

modelling purposes, harvesting may not occur within any visual quality polygon while the amount of area with stand heights less than the threshold values, exceeds the allowable denudation percentage, which is between 2.0% and 38.3%.

Base Case and Alternative Scenarios

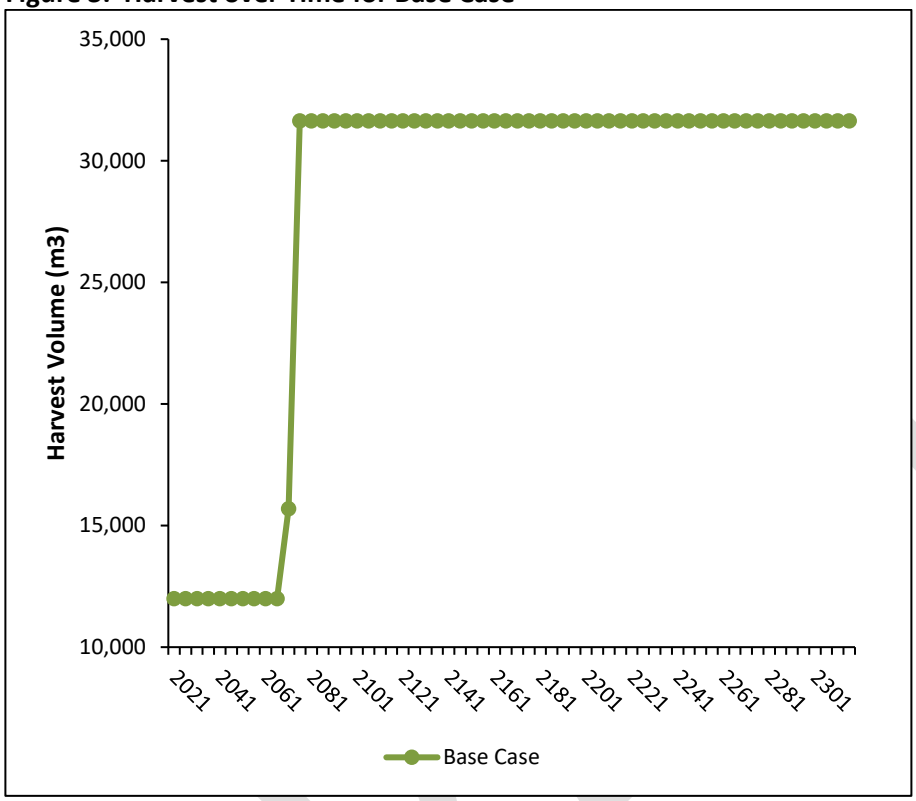
Timber supply modelling spanning a planning horizon of 300 years was undertaken based on harvest selections, forest growth and other model decisions applied in 5-year intervals. For the Base Case scenario, the following key assumptions and inputs, which are significantly different than those used in the previous TSR, were applied to the timber supply modelling.

1) Increased number of managed stand types to project stand growth and timber volume within managed stands.
2) Increased site indexes for modelling current and future growth within managed spruce and lodgepole leading stands within Units A, B, C, D, E, F, G, J, K and L, based on results from substantial field sampling.
3) No consideration of potentially available dead spruce timber volume (Units A to G), due to expected short shelf-life and limited opportunities for harvest due old growth retention objectives.
4) No harvest priority applied to the harvest of currently damaged stands within Research Forest Units A to G.
5) Significantly increased old growth retention targets for all Research Forest Units compared to previous timber supply review. This reflects implementation of old growth conservation that aligns with the non-Research Forest targets within the Order Establishing Landscape Biodiversity Objectives for the PGTSA.
6) All Research Forest Units contain spatially identified biodiversity corridors that occupy a significant portion of the timber harvesting land base. Biodiversity corridor harvesting restrictions were applied as follows:
    a) No harvest allowed for 20 years within biodiversity corridors located in Research Units A to G.
    b) No culmination age or minimum volume per hectare applies to harvesting within biodiversity corridors. Stands, outside of biodiversity corridors, cannot be harvested until culmination age is reached.
    c) Partial harvesting (40% removal) is applied within biodiversity corridors and a stand cannot be harvested again until 60 years has elapsed.
    d) Regeneration of future harvested stands within corridors is modelled as both natural stands (with no previous harvesting history) or as managed stands (if they are currently managed stands), and the future volume yield is reduced by 40 percent. The reduction accounts for the tree growth limitations imposed by continually maintaining a mature overstory.

Base Case

The Base Case resulted in an immediate AAC of 12,000 m^3 per year, which persists for approximately 45 years, then steeply increases to the long-term, stable AAC of 31,650 m^3 per year after approximately 50 years. The modelled harvest level under the Base Case is shown in Figure 3.

Figure 3. Harvest over Time for Base Case



Alternative Scenarios

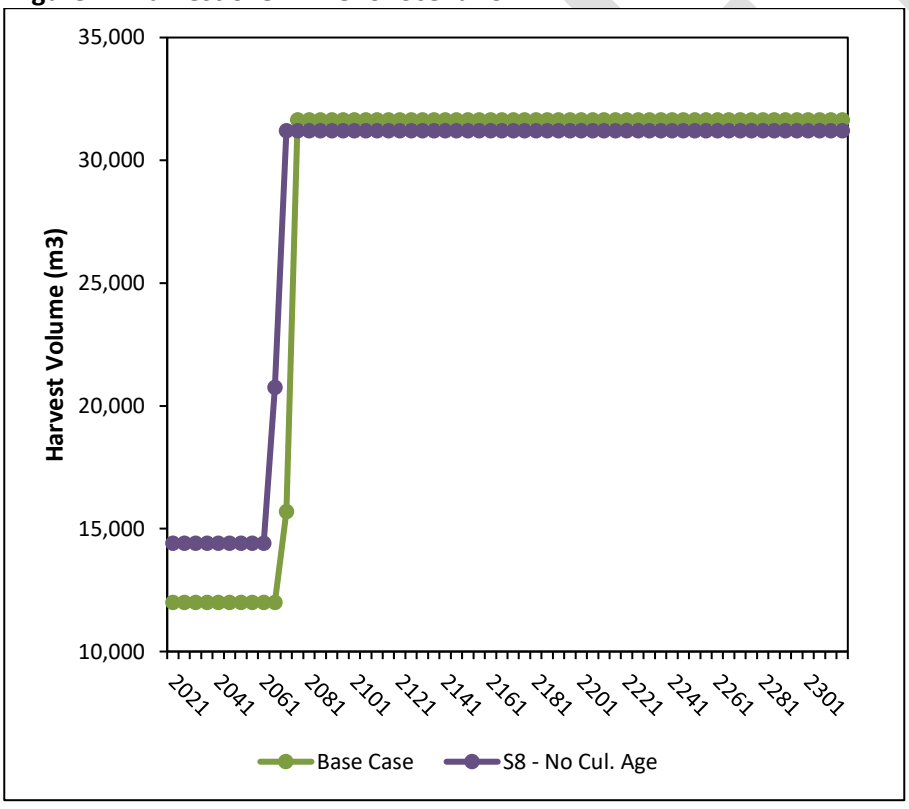
Three alternative harvest scenarios were modelled to better inform the final decision on AAC. These three scenarios are briefly described below, and the effect on the AAC is summarized in Table 9.

Alternative Scenario 1

This scenario is the same as the Base Case, but removes the requirement for stands, outside of Biodiversity Corridors, to reach culmination age prior to harvest. This is reflective of the flexible, future harvesting that is expected where older stands will not necessarily be the priority stands for harvest during the next twenty years.

This scenario resulted in more area being eligible for harvest, increasing the immediate AAC to 14,400 m^3 per year from 12,000 m^3 per year, but decreases the long-term AAC, after approximately 45 years, to 31,200 m^3 per year from 31,650 m^3 per year. It is also notable that a much-increased mid-term AAC is available 5 years earlier than in the Base Case. The modelled harvest level, under both Scenario 1 and the Base Case, is shown in Figure 4, immediately below.

Figure 4. Harvest over Time for Scenario 1

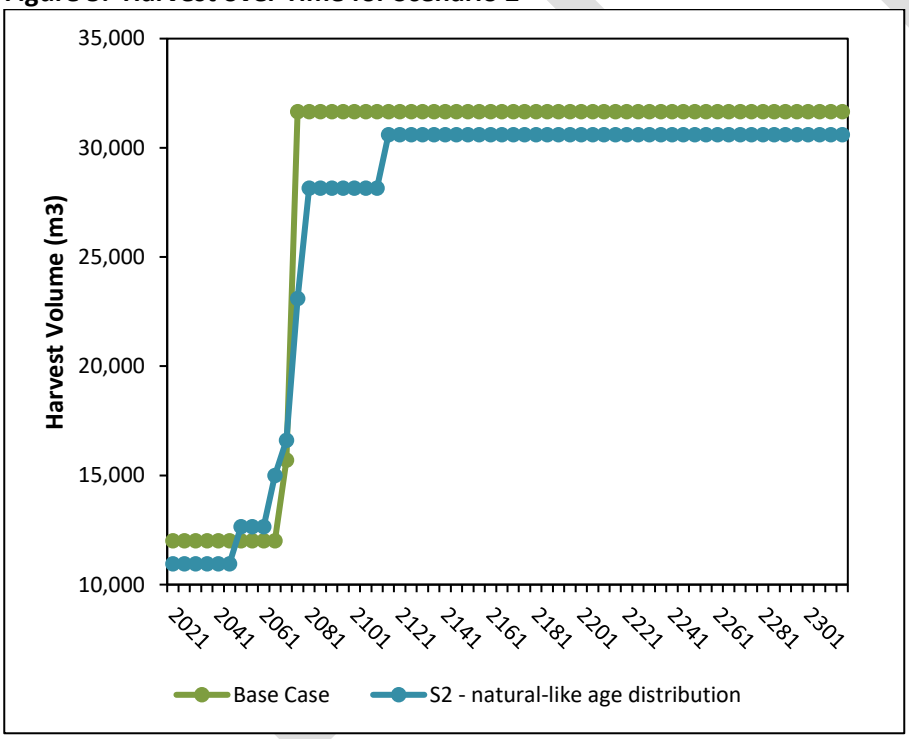


Alternative Scenario 2

This scenario differs from the Base Case, by applying restrictions to the amount of young forest (<41 years old) that may exist in each Research Forest Unit. Restrictions on the amount of young forests in combination with the maintenance of older forest cover contribute to improved conservation of watersheds and a balance of forest ages that is more similar to the natural range of variation (without harvesting on the landscape). The young stand restriction ranged from 11% to 36% of the forested land base depending on the Research Unit's biogeoclimatic classification.

This scenario resulted in less area being available for harvest compared to the Base Case, decreasing the immediate AAC to 10,950 m^3 per year from 12,000 m^3 per year, and decreases the long-term AAC, after approximately 95 years, to 30,600 m^3 per year from 31,650 m^3 per year. It is also notable that the AAC begins to increase substantially after approximately 45 years to approximately 15,000 m^3 per year, but ultimately increases more slowly towards the long-term AAC, compared to the base case. The modelled harvest level under both Scenario 2 and the Base Case is shown in Figure 5.

Figure 5. Harvest over Time for Scenario 2



Alternative Scenario 3

This scenario is the same as Scenario 2, but removes the requirement for stands outside of Biodiversity Corridors to reach culmination age prior to harvest. This is reflective of the flexible, future harvesting that is expected where the older stands will not necessarily be the priority stands for harvest during the next twenty years.

This scenario resulted in less area being available for harvest compared to the Base Case, decreasing the immediate AAC to 11,050 m^3 per year from 12,000 m^3 per year, and decreasing the long-term AAC, after approximately 95 years, to 29,800 m^3 per year from 31,600 m^3 per year. This Scenario produced more AAC than Scenario 2 in both the short-term and mid-term. Scenario 3 and the Base Case is shown in Figure 6, immediately below.

Figure 6. Harvest over Time for Scenario 3

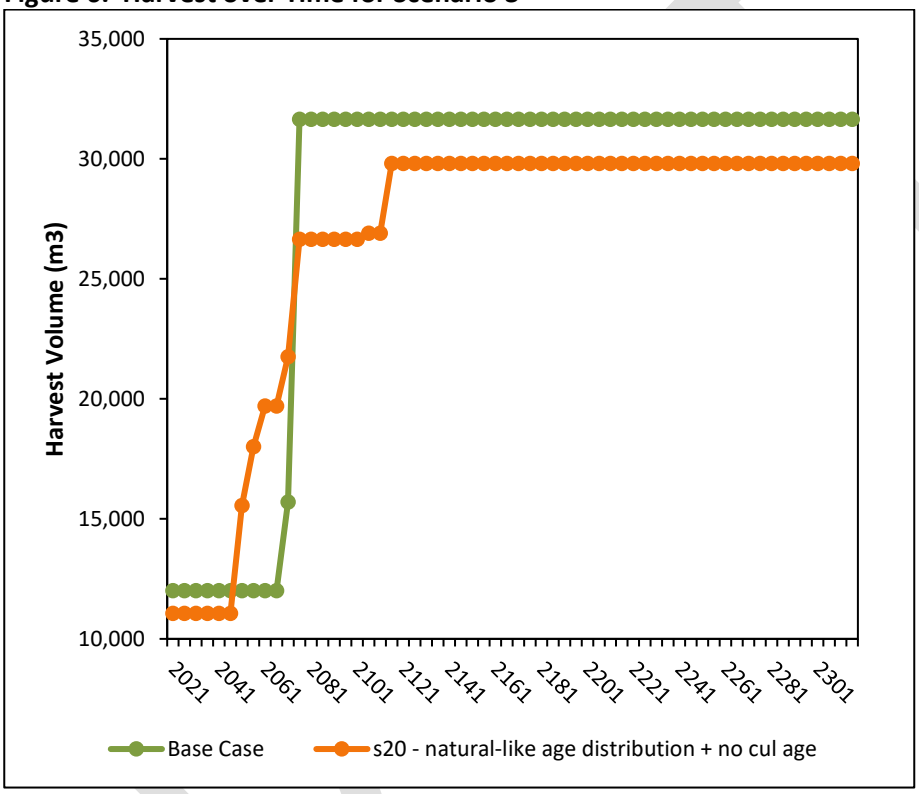


Table 9, immediately below, provides a tabular summary of the comparative harvest levels associated with the Base Case and alternative Scenarios considered.

Table 9. Comparison of Harvest Flow Summary for Modeled Scenarios

Scenario	Modeling Assumption	Feature Tested	Net Initial Harvest		Net Long-Term Harvest	
			Annual Harvest (m3/yr)	% change from Base Case	Long-Term Harvest (m3/yr)	% change from Base Case
0	Base Case	N/A	12,000	N/A	31,650	N/A
1	Remove Culmination Age	Base case assumptions, but remove culmination age requirement	14,400	20%	31,200	-1%
2	Restrict Amount of Young Stands	Limit the amount of immature (<41yrs) forests for wildlife habitat and watershed functioning	10,950	-9%	30,600	-3%
3	Restrict Amount of Young Stands and Remove Culmination Age	Limit the amount of immature (<41yrs) forests for wildlife habitat and watershed functioning, and remove culmination age requirement	11,050	-8%	29,800	-6%

Final Recommended Timber Supply Scenario

At this time, it has not been determined if the Research Forest will be managed with limits on the amount of young stands (<41 years old). It is possible that novel harvesting designs and methods with widespread retention of vertical forest structure may be able to alleviate the potential loss of wildlife habitat function and other ecosystem functions associated with higher proportions of young stands verses mid-aged stands (provided mature and old forest targets are always maintained). Given this current understanding, the short-term harvest levels under Scenarios 2 and 3 are not recommended. Likewise, there is uncertainty about the amount of harvest that may occur in stands less than culmination age, given this may allow increased short-term harvest where there are already substantial cumulative effects from previous harvesting and road building. It is also recognized that experimental, intermediate harvests within young and mid-aged stands are being planned, where impacts to forest ecosystem function may be minimized. This type of intermediate harvesting will contribute to additional short-term harvest volume over the Base Case harvest scenario. **For this reason, a short-term harvest level of 13,200 m^3/year, (1,200 m^3/year greater than the Base Case), is the recommended allowable annual harvest over the next 5 years.**

Determining Future Allowable Annual Cut

For the purposes of reducing uncertainty about sustainable harvest levels and reliable forecasting, the management plan timber and supply analysis is planned to be updated every five years, or more often, if new information becomes available or circumstances change significantly.

Tracking Harvested Volume Contributing to Allowable Annual Cut

It is important to recognize that the timber supply modelling and analysis was based on forest inventory attributes and projected volume growth using provincial standards. The forest inventory used for modelling in this analysis only includes live volume from upper canopy of trees, and does not include the contribution of merchantable-sized trees with crowns well-below the average canopy height, or volume contribution from dead standing and fallen trees. Previous harvest has demonstrated that, on average, the harvest volumes recovered are significantly greater than the projected inventory volume, particularly within older spruce and subalpine fir leading stands, and stands with distinguishable live and dead layers.

To reasonably estimate the harvested timber volume that is not recognized within the modelled AAC and forest inventory, the volume of non-sawlog grade logs that are delivered as pulp or fibre logs will not contribute to the AAC tracking. The timber volume contributing to the AAC will include the following:

- 100% of sawlog grade logs,
- 80% of non-sawlog grad logs delivered as sawlogs, and
- avoidable waste.


Obligations and Commitments to First Nations and Public
Information Sharing and Consultation with First Nations
Public Review
Reporting to Government
Professional Requirements
Tenure Holder Commitment

Information Sharing and Consultation with First Nations

In advance of developing this Management Plan, engagement with First Nations was undertaken during the winter of 2022 to support the future visioning, priorities and goals relevant to the period of this Management Plan. Representatives of the McLeod Lake-Tse'Khene First Nation, Lheidli T'enneh First Nation and Nazko First Nation participated in interviews and discussions regarding Indigenous perspectives applicable to the development of the strategic direction for the Research Forest. In particular, Indigenous input and advice was sought regarding how the Research Forest may better collaborate and serve the values and needs of First Nations. The result is the documentation of a thoughtful pathway to ensure CNC employees and the CNC Research Forest Society are able to respectfully explore with First Nations, the sharing and implementation of future Research Forest outcomes towards research, education, and forest stewardship. This two-way sharing is expected to lead to new collaborations and partnerships with First Nations and realignment of Research Forest management, delivery of education, research and forest stewardship.

Upon submitting this Management Plan, or any future amendment or replacement Management Plan to the Ministry of Forests, 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 to the District Manager, First Nations' input will be summarized and considered in preparation of the plan. Comments and input from First Nations will be submitted with the proposed plan, along with a summary of plan revisions to address the input received. All of this information will be considered in the District Manager's approval decision.*

Current information regarding efforts to fulfill Management Plan information sharing and consultation will be added to final version.

First Nation Involvement in Forest and Research Operations

CNC commits to providing First Nations with all proposals for forest harvesting and road building operations within the Research Forest, along with any important, impactful research proposals. When seeking input on operations, the proposed plans will be provided well in advance of implementation so that there is ample time to consider input. Information from this process will be provided to the Ministry of Forests for their ongoing consideration of Treaty Rights and Indigenous Rights related to the provincial administration of the CNC Research Forest.

In addition to 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 regarding a proposed management plan amendment or replacement. The goal is regular and meaningful First Nation involvement in CNC's planning processes and implementation of operations.

Public Input and Review

To ensure opportunity for public input, any proposed Management Plan or amendment that requires approval by the District Manager will be advertised for public review for a period of at least 60 days, prior to being submitted to the District Manager. At the same time, the proposed plan will also be distributed, either in digital or paper format, to the Ministry of Forests, adjacent forest tenure holders, guiding licence holders, and trapping licence holders so all may review and provide input regarding the proposed plan. Other stakeholders and 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 via the CNC Research Forest website, and 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 review and provide direct input to CNC. A representative of CNC will be available 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, public comments and input will be summarized and considered in the preparation of the plan. Comments and input from the public and other affected stakeholders will be submitted with the proposed plan along with a summary of plan revisions to address the input received. All of this information will be considered in the District Manager's approval decision.

Current information regarding advertising, distribution of Plan, and publicly available copies will be added to final version.

Notifying and Reporting to Government

Regular annual reporting to the Province, via their standard online forestry applications will occur with respect to harvested areas. *All harvested volume will be recorded thought procedures defined by the Provincial Scaling Manual and Logging Residue and Waste Measurement Procedures Manual.*

Each year, new cutblock openings will be digitally submitted into the provincial RESULTS database, and for existing cutblock openings in RESULTS, any changes or updated information will be submitted, including revisions to any of the following: prescribed tree stocking, prescribed soil disturbance, the net area to reforest, standard units, forest inventory, and regeneration status.

In addition, an annual report of operations will be submitted to the Prince George District Manager by June 1st of each year that summarizes the previous year's activities, including but not limited to harvesting, road building, planting, other silviculture practices, old forest retention areas, forest health management, research, and educational activities.

Requirement for Forest Professionals and Other Professionals

This Management Plan is to be prepared by or supervised by a Registered Professional Forester (RPF) and subsequently signed by that RPF. Any future updates or amendments to the plan will also require the appropriate involvement and certification of a RPF.

The Operations Plan and Site Plans, including updates and amendments to existing Operations and Site Plans, must also be prepared or supervised and subsequently signed by a RPF. Where tree harvesting occurs, but no Site Plan is prepared, a RPF must rationalize with documentation, why a Site Plan is not required.

Other Professionals must be involved or provide professional certification when undertaking certain types of planning, resource assessments, field preparation, recommendations, supervision of works and certification of completed works. This may include, but is not limited to Professional Archaeologists, Professional Biologists, Professional Engineers and Professional Geoscientists.

Periodic Management Plan Review and Replacement

Coinciding with each timber supply review, every five years or less, all management plan content and objectives will be reviewed to ensure consistency with new information, First Nations rights and interests, non-timber stakeholder use, public interest, and the current state of the natural resources. It is expected that a Management Plan amendment or replacement will occur every five years, and will involve an opportunity for public review and First Nations consultation. At any time, the District Manager may also direct CNC to replace the existing Management Plan and specify conditions which the new Management Plan must address.

Prior to undertaking a Management Plan amendment or replacement, upfront input may be requested from those who may be most affected by the Plan. It is also important to recognize that *prior to releasing any amended or new Plan to the public*, *the CNC Research Forest Society Board and CNC Board of Directors must acknowledge and support the Plan.* This independent oversight of any new Plan is critical to upholding the intended purpose of the Research Forest.

Licensee Commitments

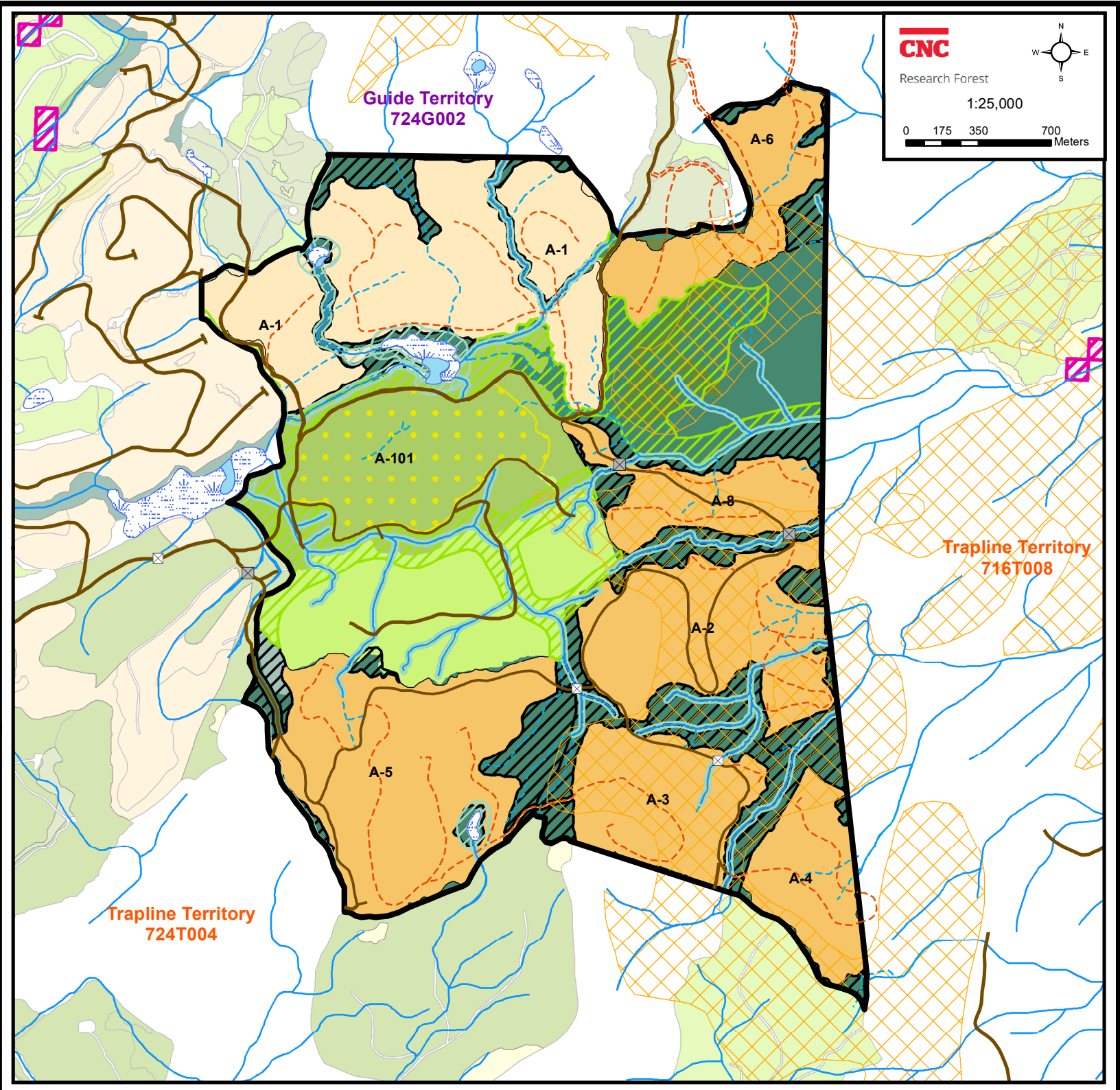
In carrying out this Management Plan, the intent is to meet the principles of sustainability and total resource management specified under Special Use Permit S24940.

It is the responsibility of CNC, as the holder of the Special Use Permit S24940, to implement the content of this Management Plan and any other direction provided by the District Manager, upon approving the plan.

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.*		Feb. 27, 2023
	Carl Pollard, R.P.F. Manager, Research Forest College of New Caledonia	***Date***
CNC Research Forest Society *I certify that this management plan is authorized on behalf of The College of New Caledonia Research Forest Society.*		
	Kalin Uhrich Chair, College of New Caledonia Research Forest Society	***Date***
College of New Caledonia Authorized Licensee Signature		
	Dennis Johnson President, College of New Caledonia	***Date***

Appendix A - Management Plan Maps



CNC Research Forest Unit A - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Area
- Wildlife Tree Retention Area
- Planned/Proposed Harvest
- Riparian Reserve Area

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

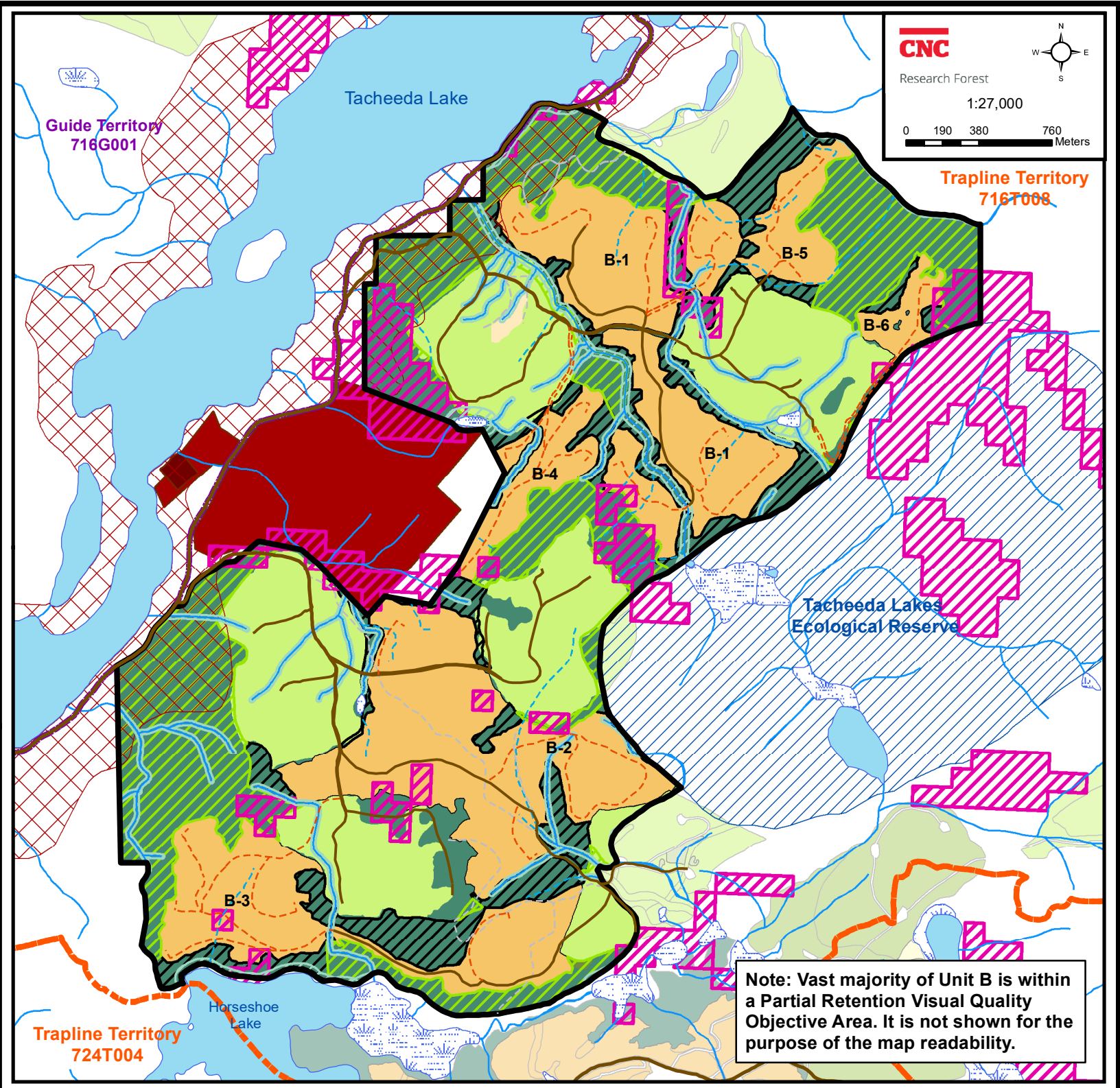
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit B - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Area
- Wildlife Tree Retention Area
- Riparian Reserve Areas

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

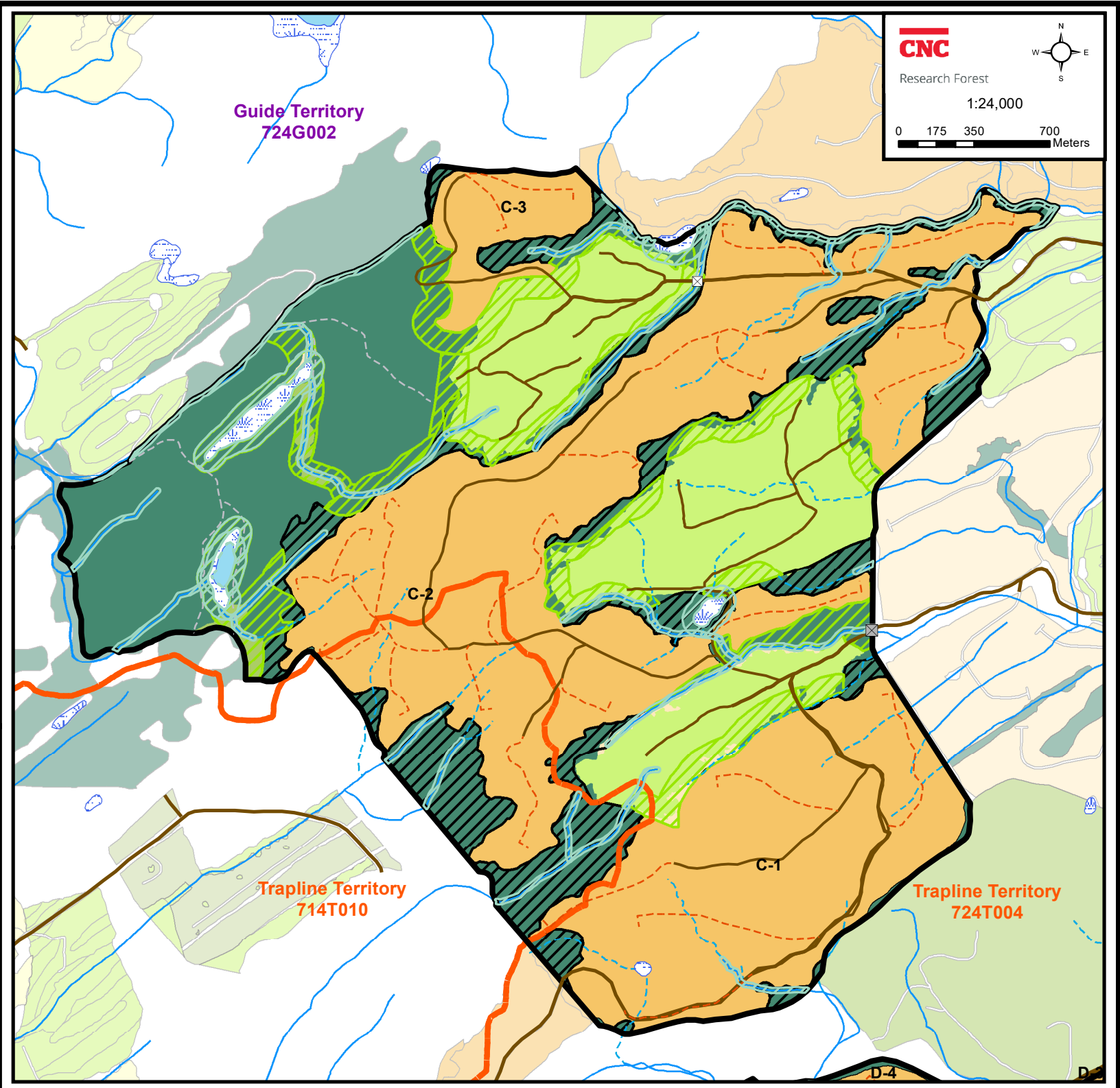
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit C - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area
- Riparian Reserve Areas

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

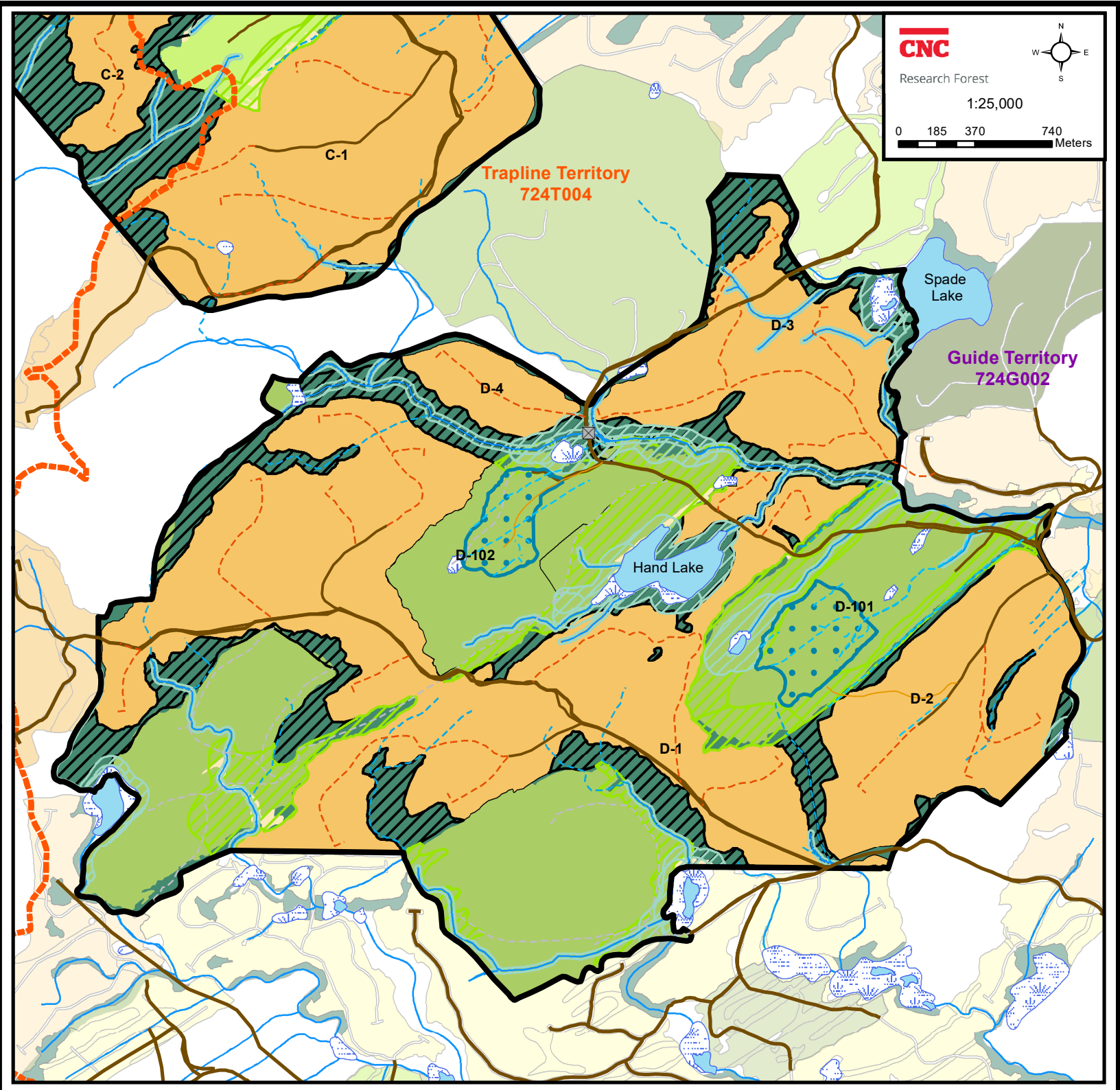
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit D - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Area
- Wildlife Tree Retention Area
- Riparian Reserve Area
- Partial Cut Treatment Area

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Existing Trails
- Planned Temporary Road
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

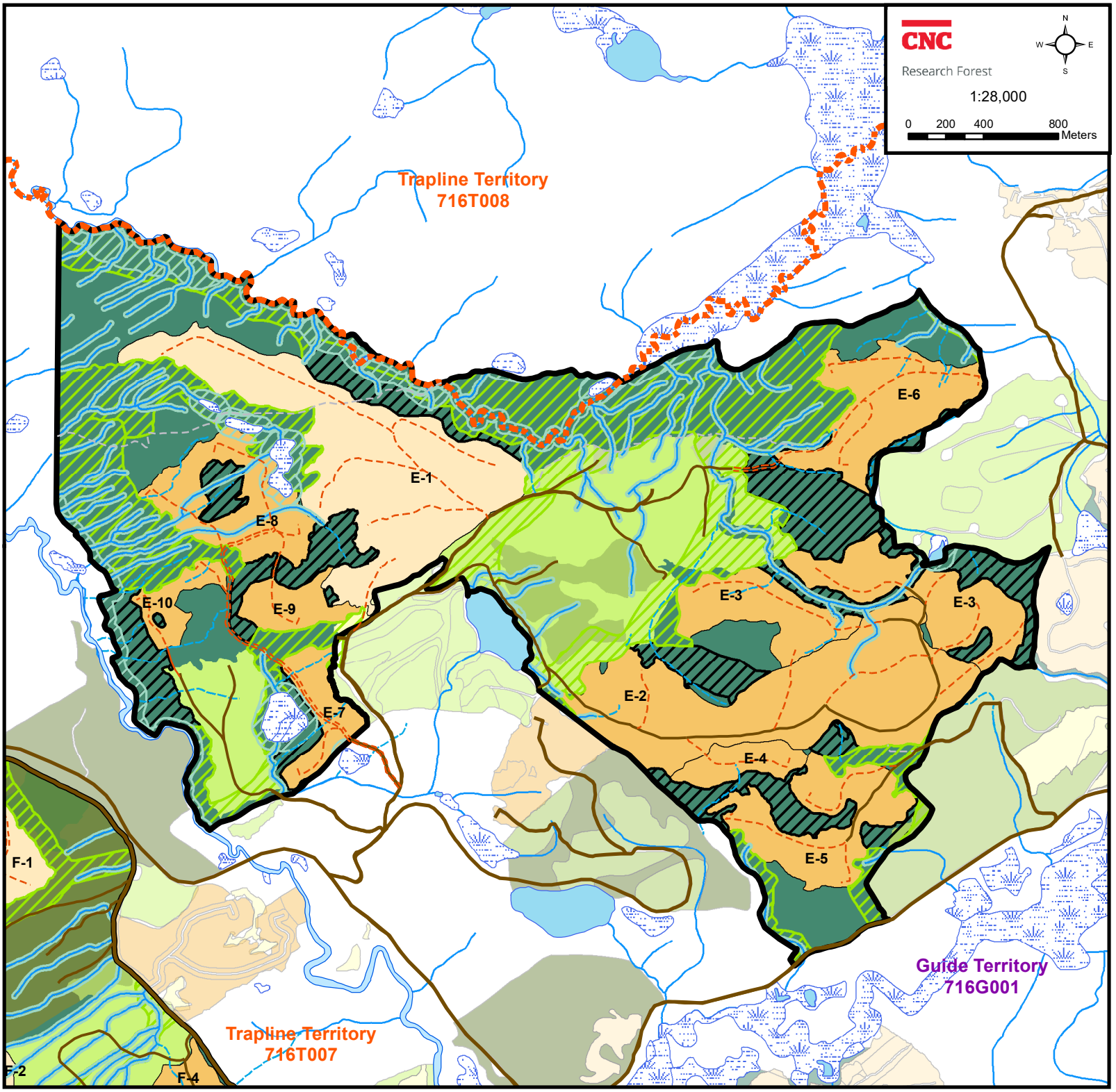
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit E - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Area
- Wildlife Tree Retention Area
- Riparian Reserve Area

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60
- 61+ Years

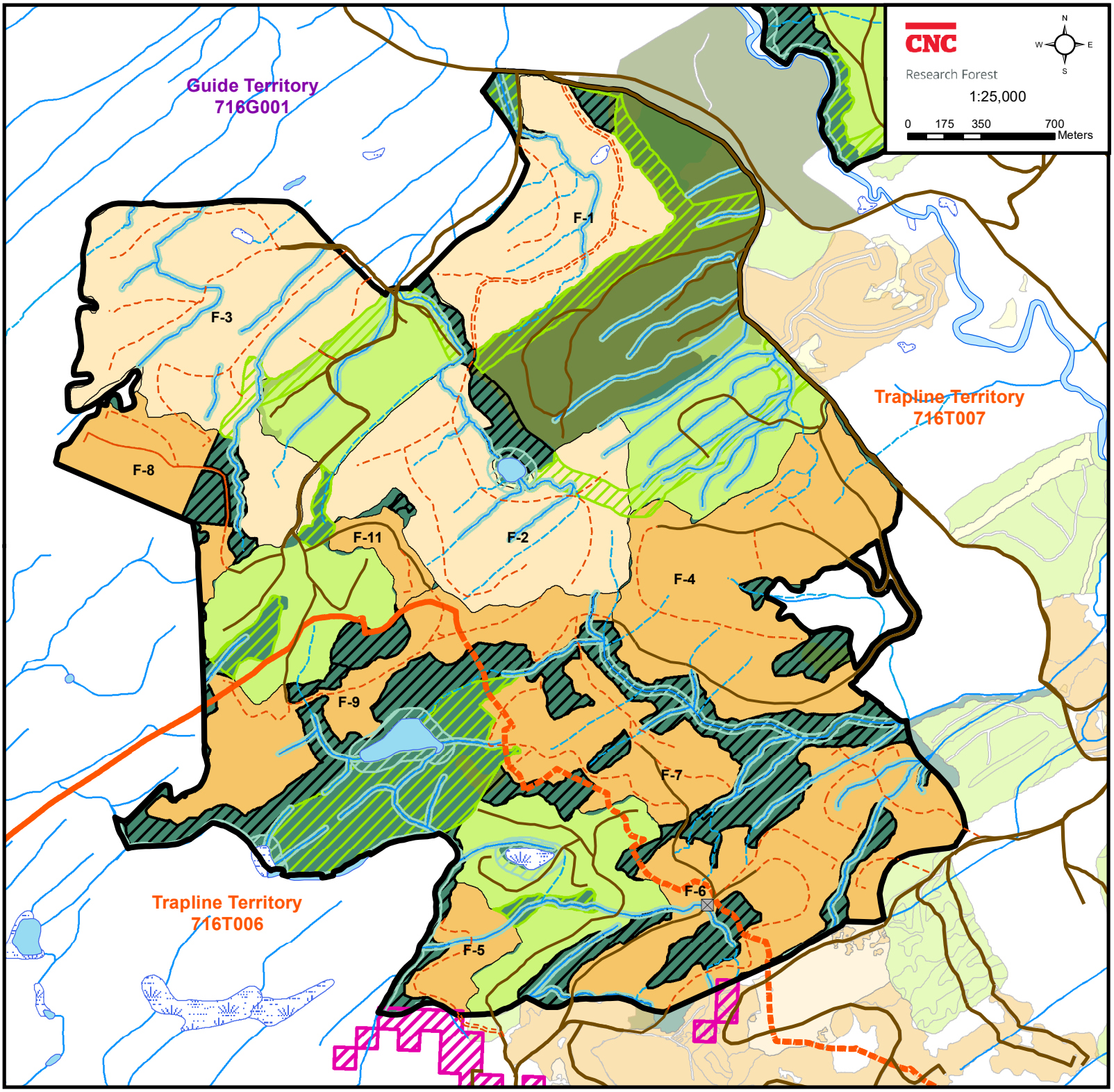
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit F - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Area
- Wildlife Tree Retention Area
- Riparian Reserve Area

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60
- 61+ Years

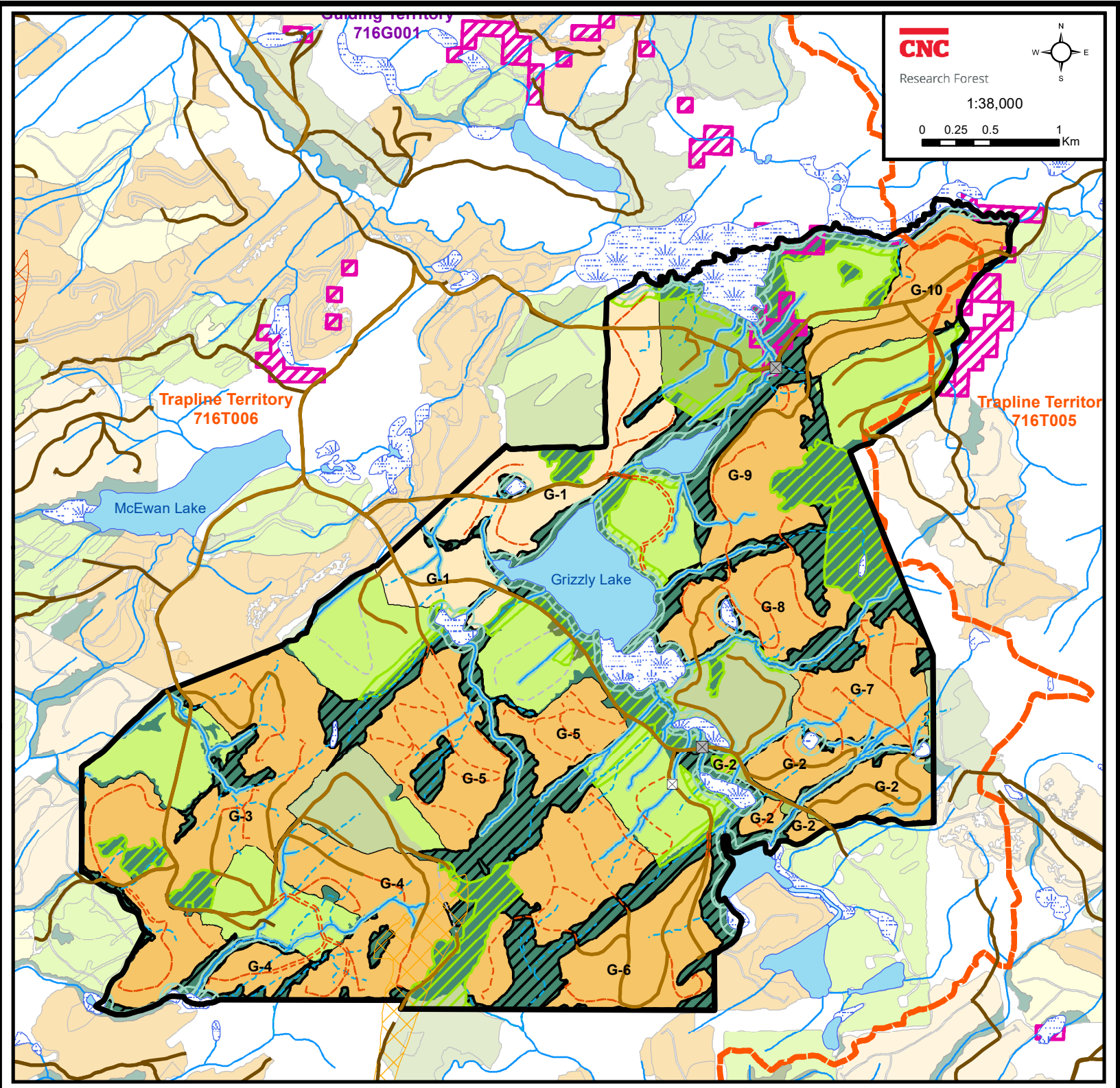
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit G - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Area
- Wildlife Tree Retention Area
- Riparian Reserve Area

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

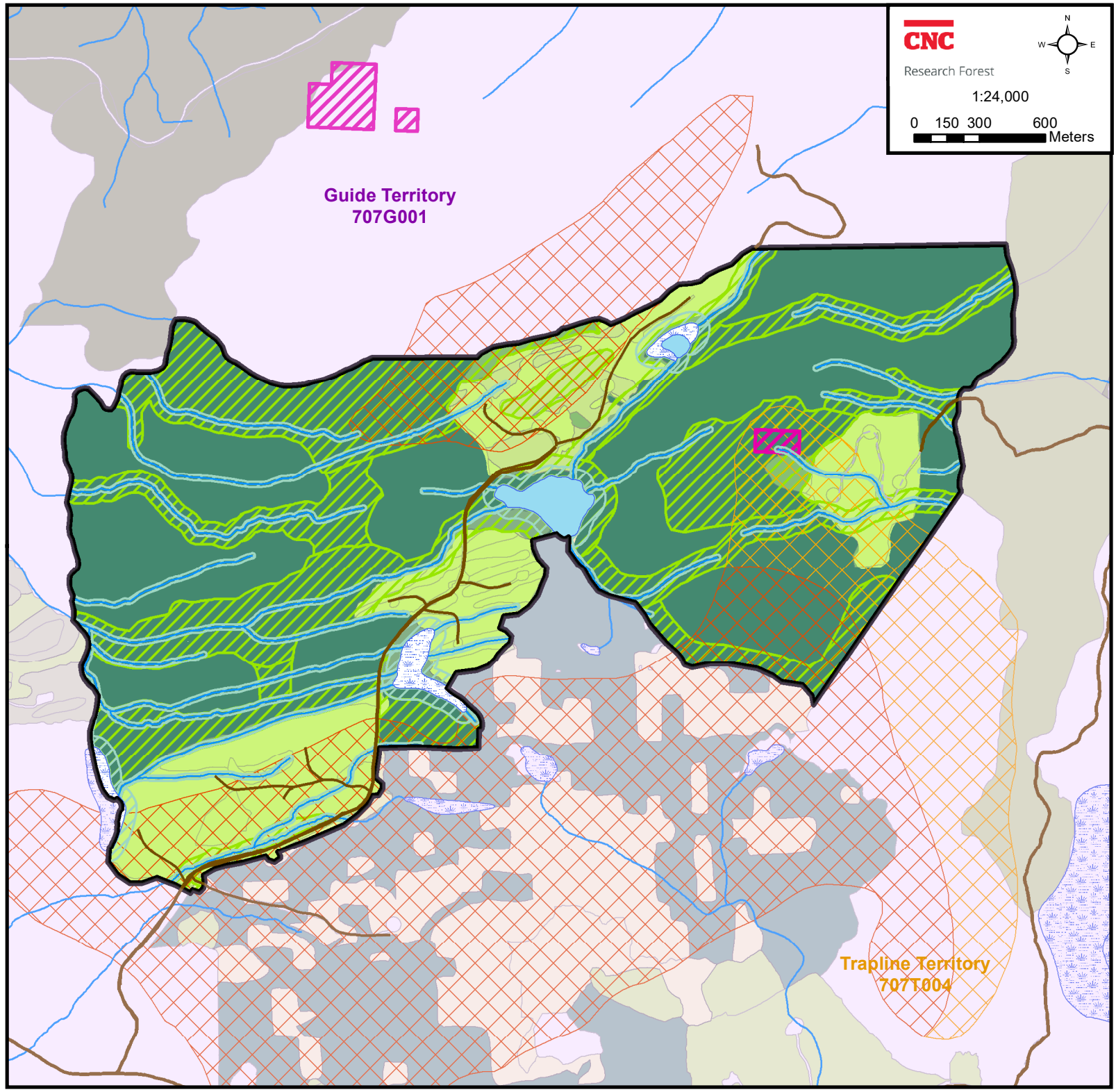
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classifed Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit H - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area
- Riparian Reserve Area

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

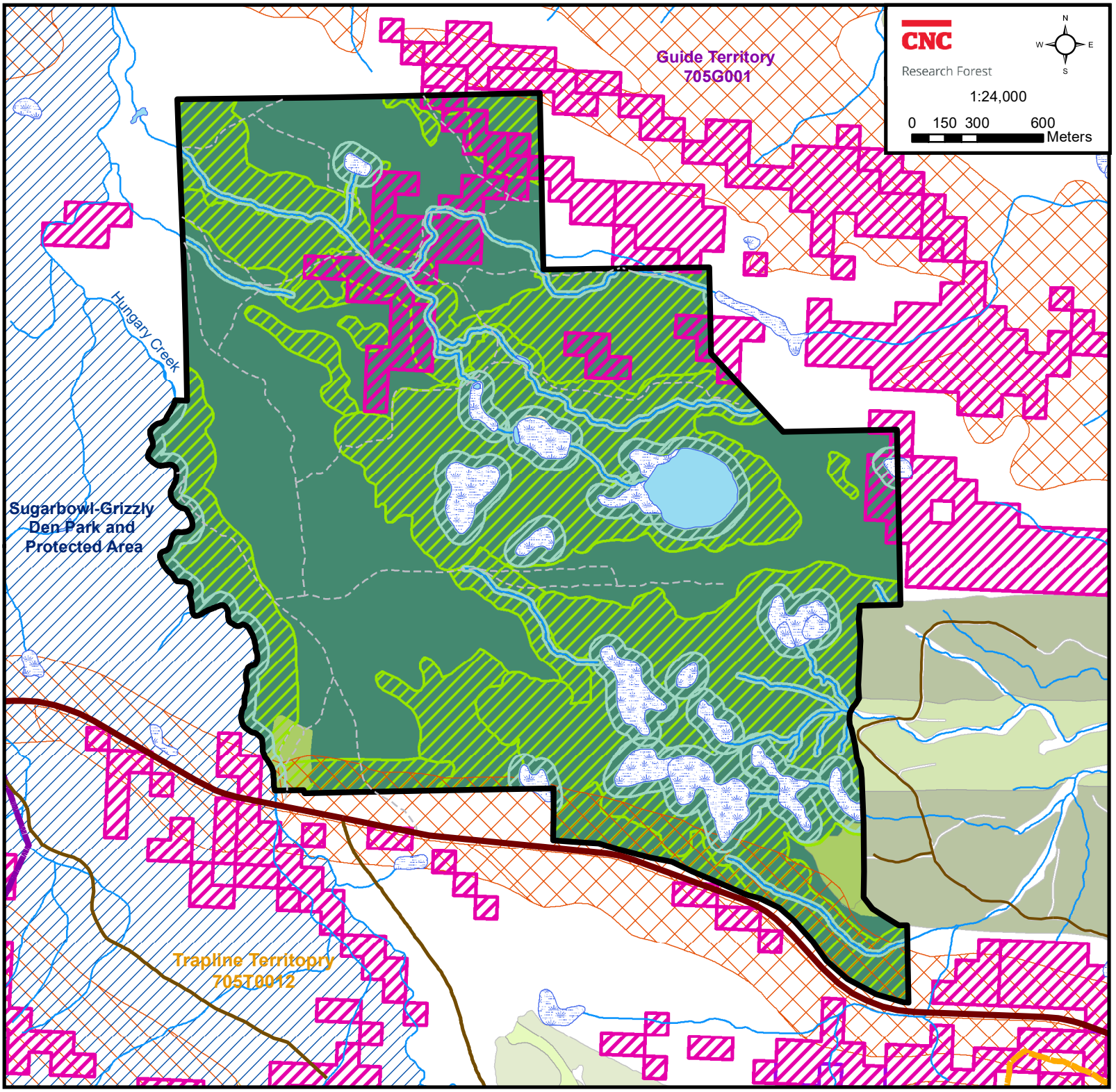
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- Ungulate Winter Range
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit I - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area
- Riparian Reserve Area

- Highway
- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

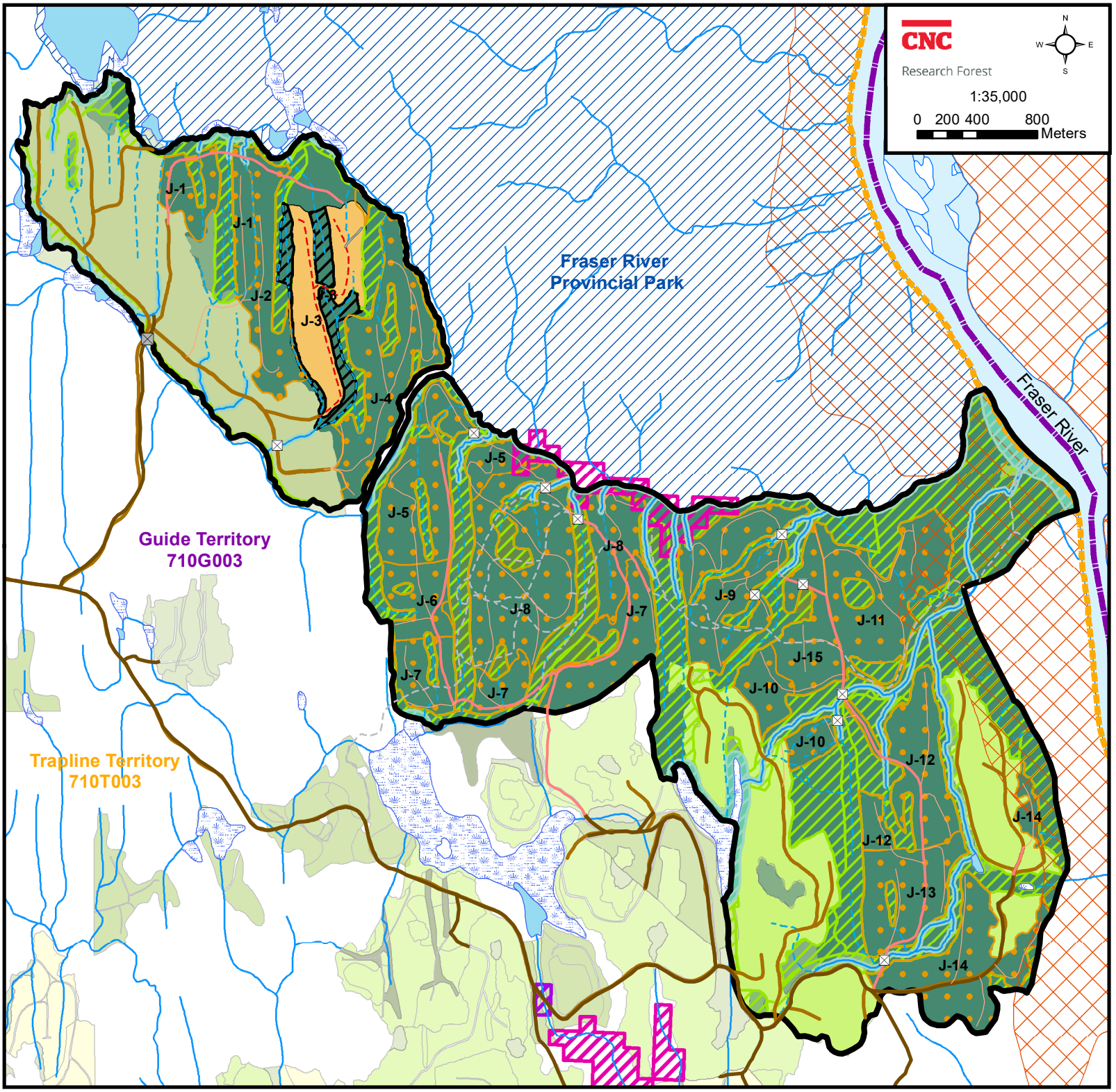
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit J - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area
- Riparian Reserve Area
- Deferred Harvest
- Planned Harvest

- Permitted Road
- Permanent Road
- Deferred Permanent Road
- Deferred Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Deferred Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

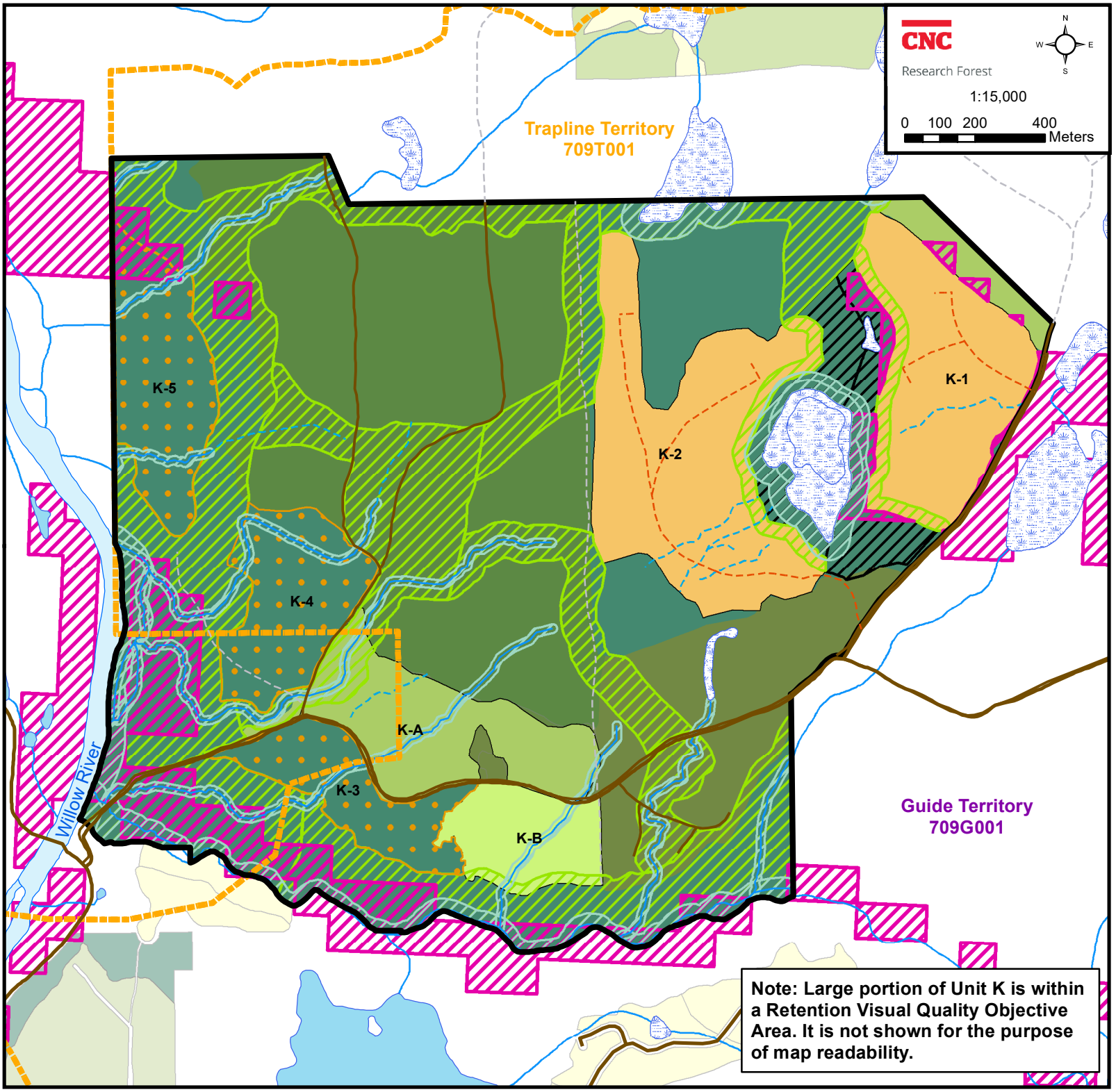
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- Provincial Park Boundary
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit K - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area
- Riparian Reserve Areas
- Deferred Harvest
- Planned Harvest

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

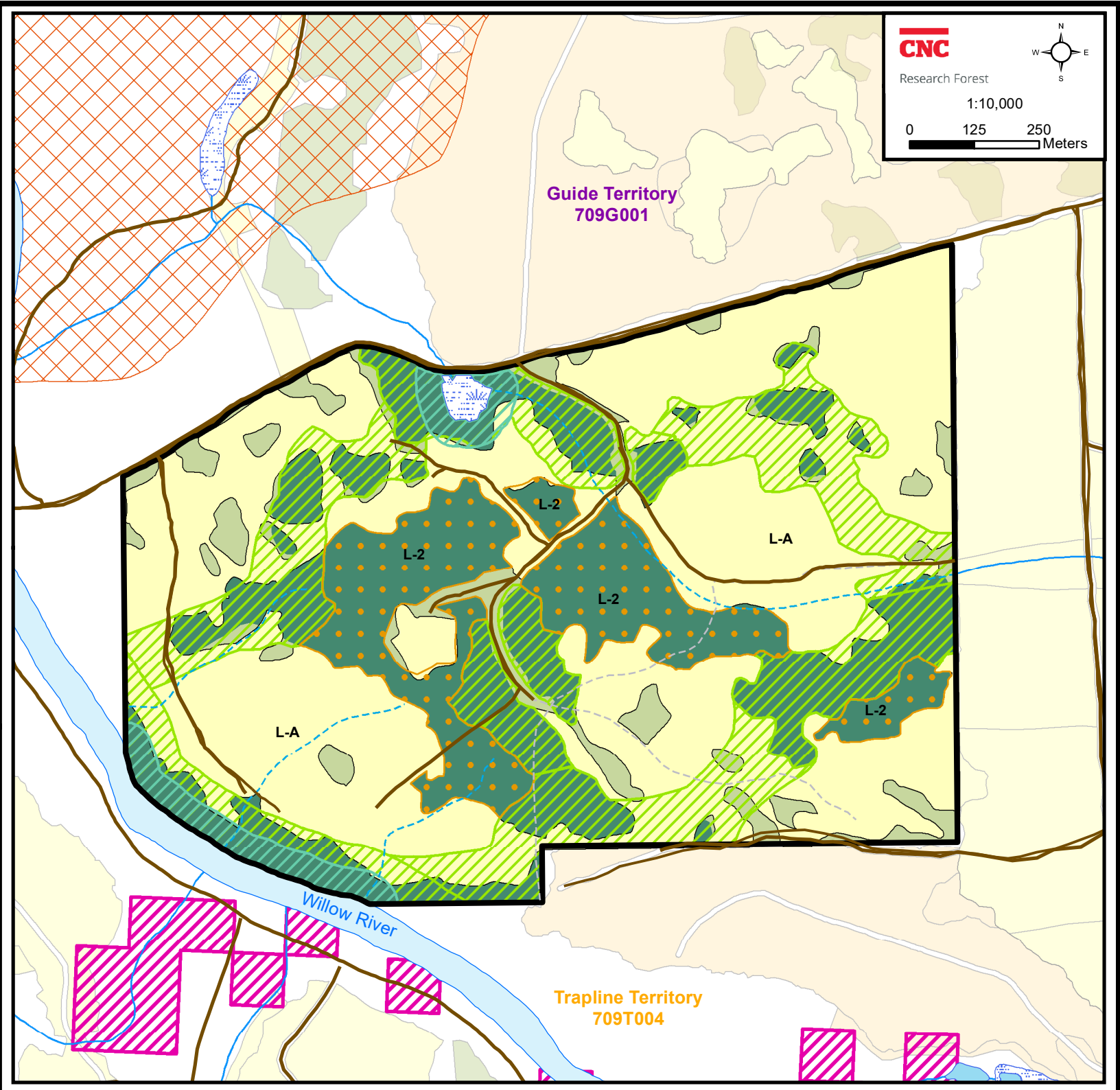
Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

Map Drawn Date: Jan 2023



CNC Research Forest Unit L - Management Plan 2023

- CNC Research Forest
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area
- Riparian Reserve Areas
- Deferred Harvest
- Planned Harvest

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

Stand Ages - CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

Stand Ages - Non-CNC Harvesting

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Priority Big Tree Old Forest
- Remnant Old Forest
- Ancient Forest
- First Nation Reserve Land
- First Nation Land
- Trapline Territory
- Guide Territory

- Retention VQO
- Partial Retention VQO
- Modification VQO
- Lakes
- Wetlands
- Rivers
- Streams
- Non-Classified Drainage

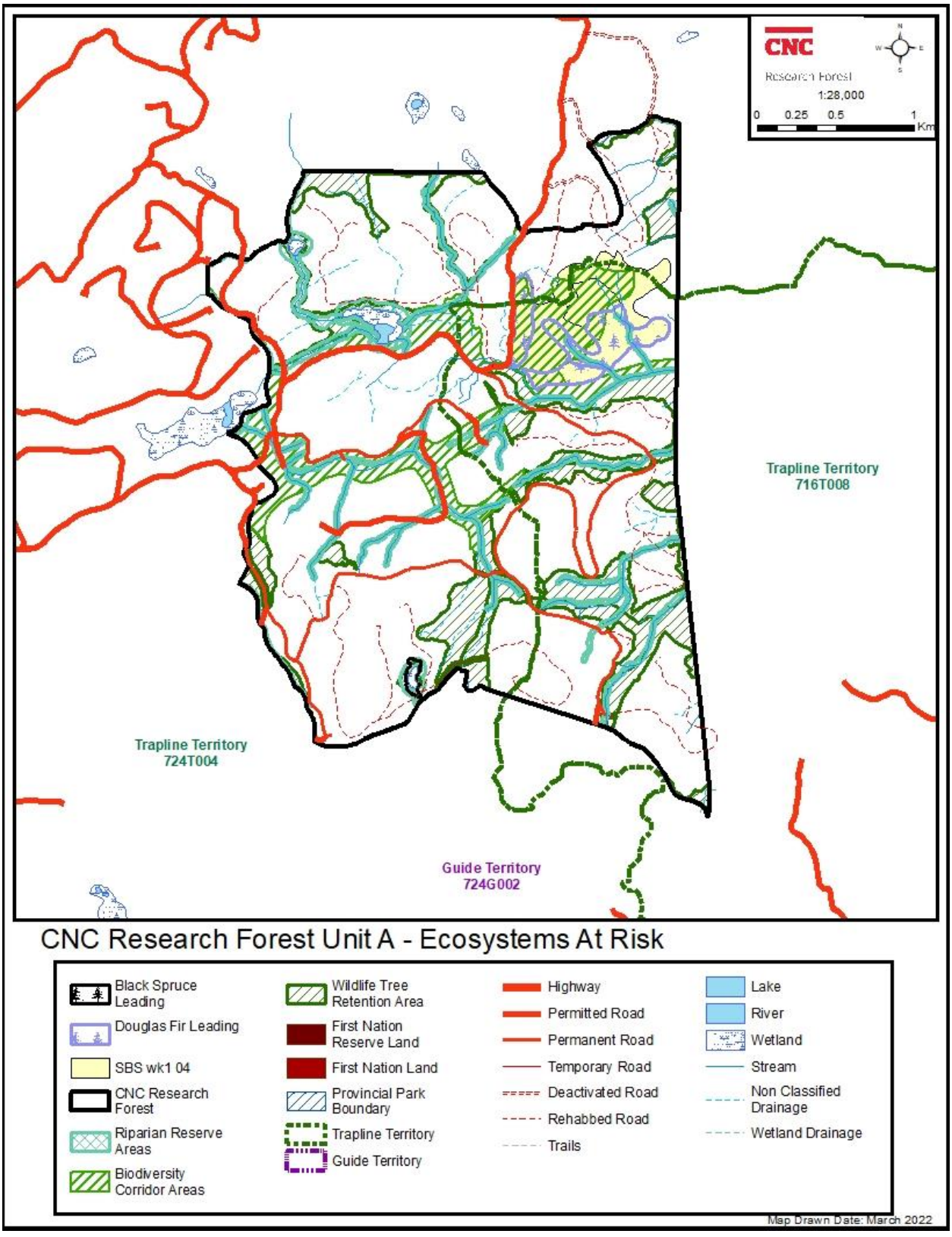
Map Drawn Date: Jan 2023

Appendix B - Ecosystems at Risk Mapping

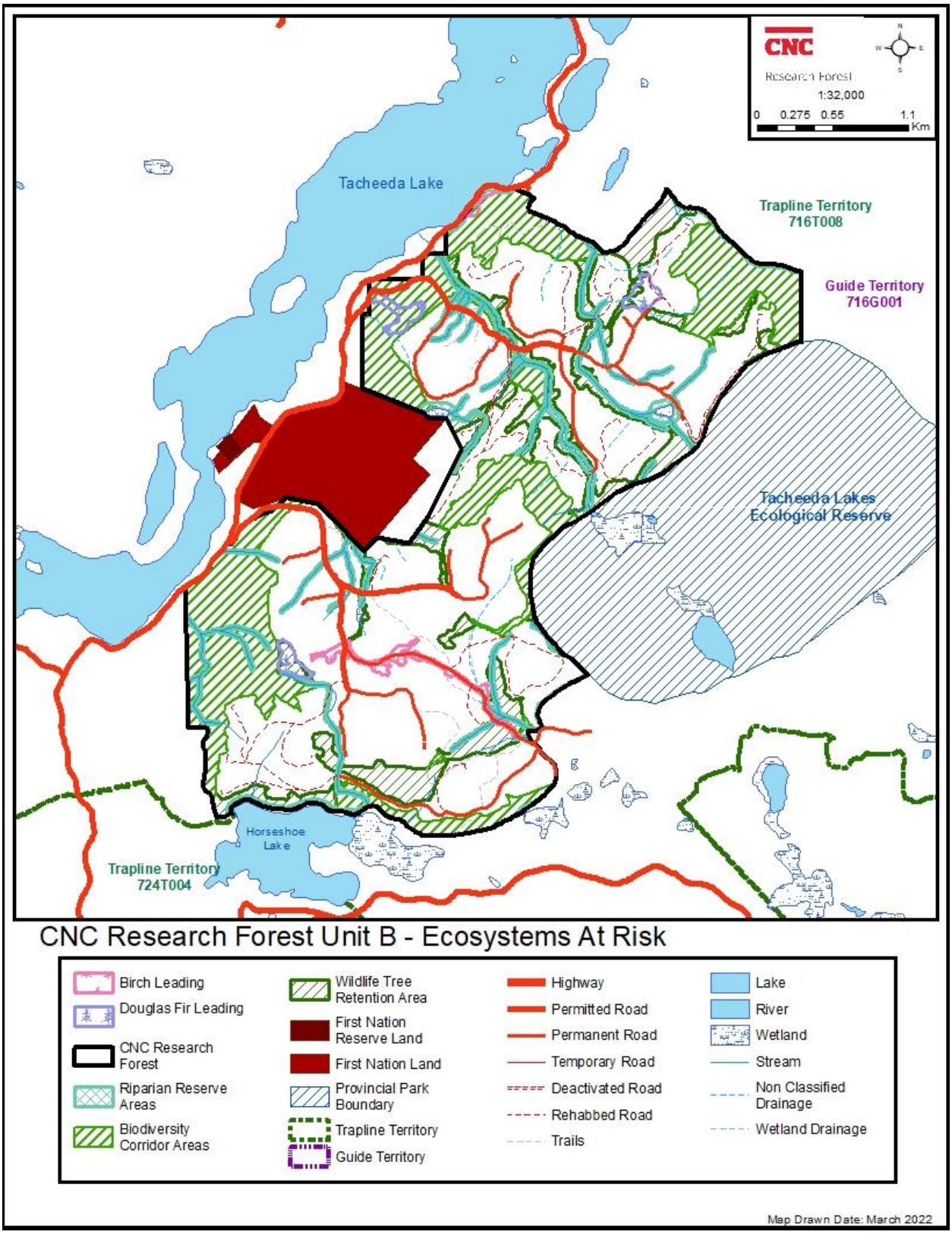
Appendix B: Ecosystems At Risk Maps

The following maps show the location of the provincially recognized ecosystems at risk within each unit of the CNC Research Forest. The maps also include uncommon timber types present within each Research Forest unit.

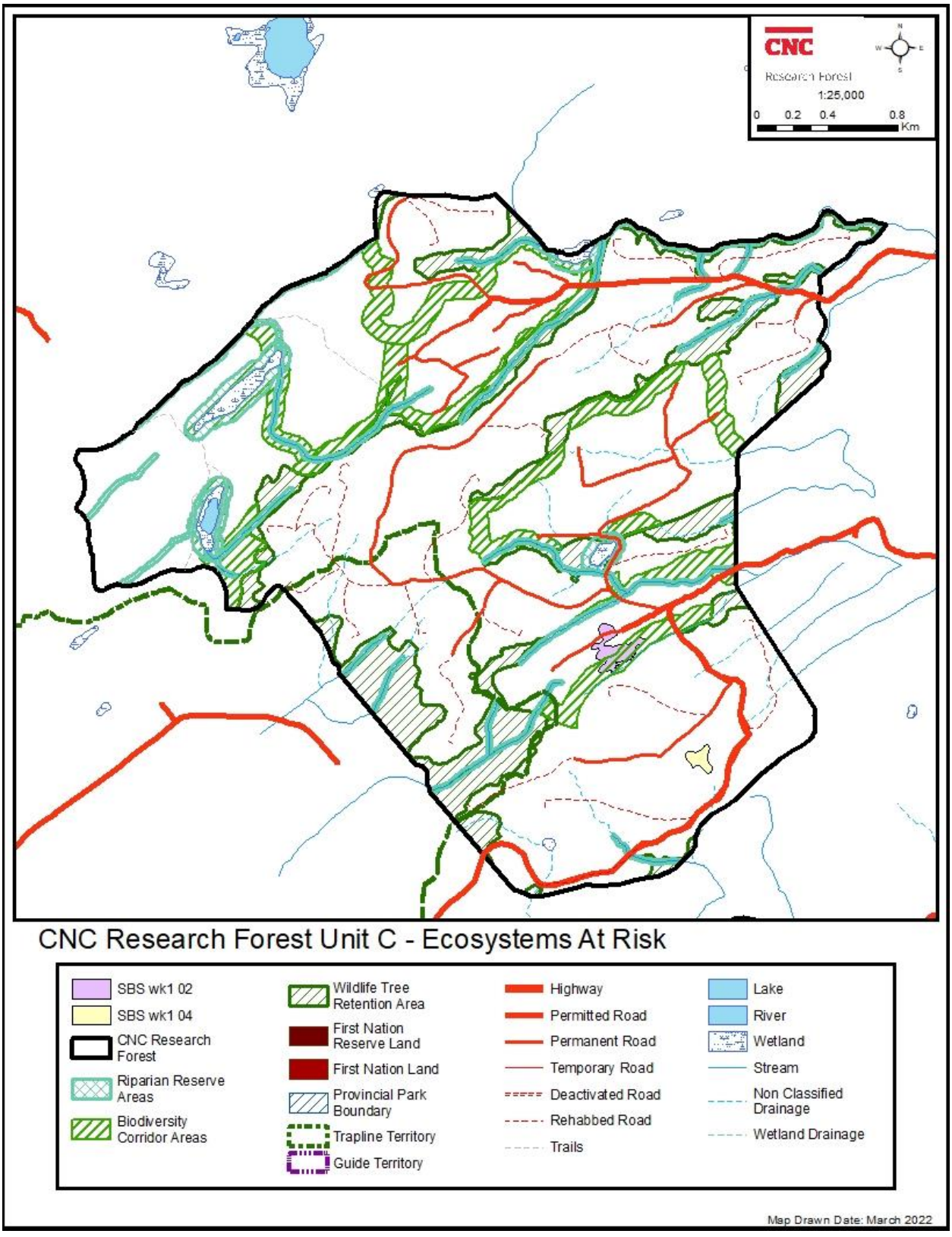
Appendix B: Ecosystems At Risk Maps



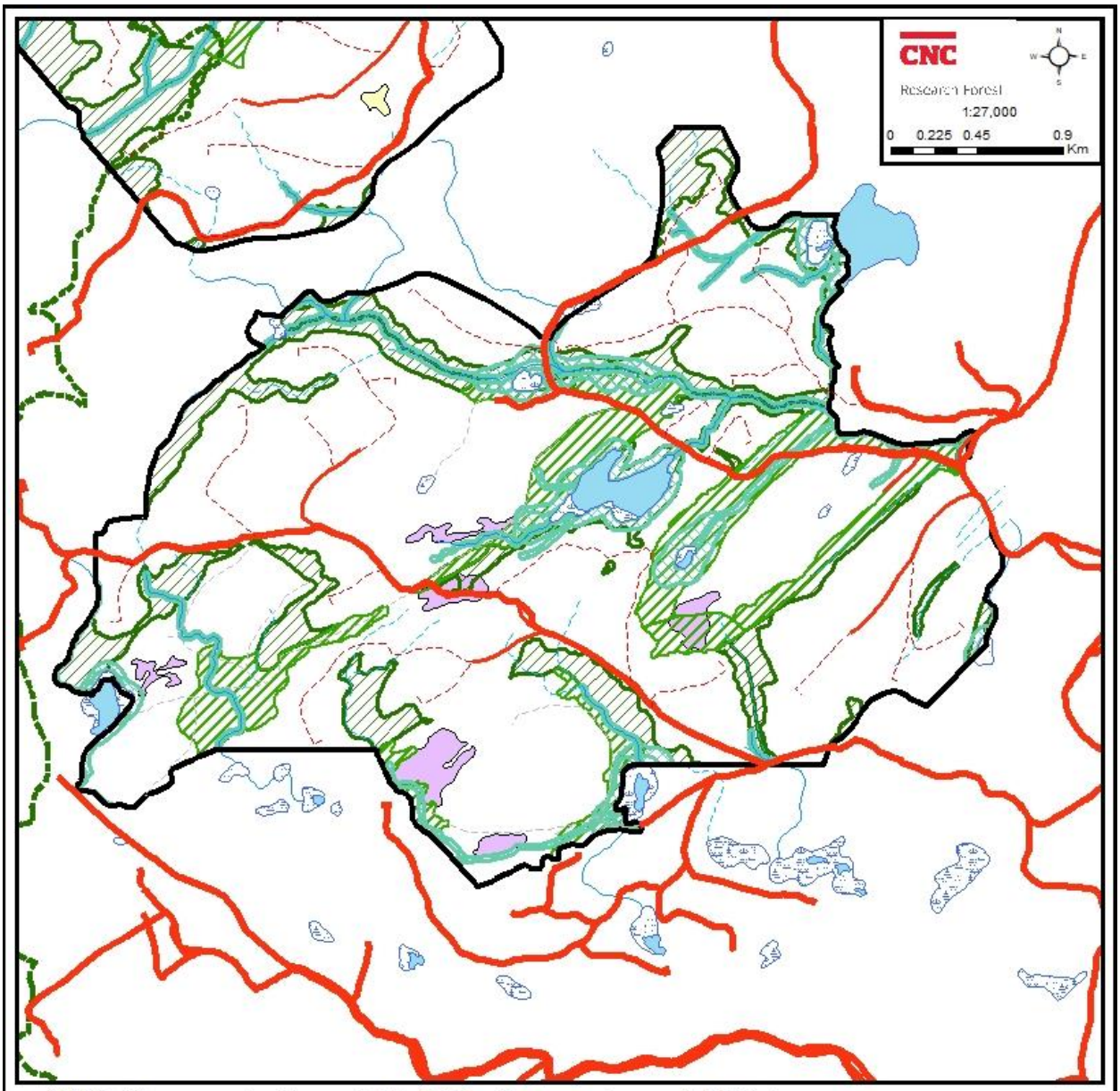
Appendix B: Ecosystems At Risk Maps



Appendix B: Ecosystems At Risk Maps



Appendix B: Ecosystems At Risk Maps

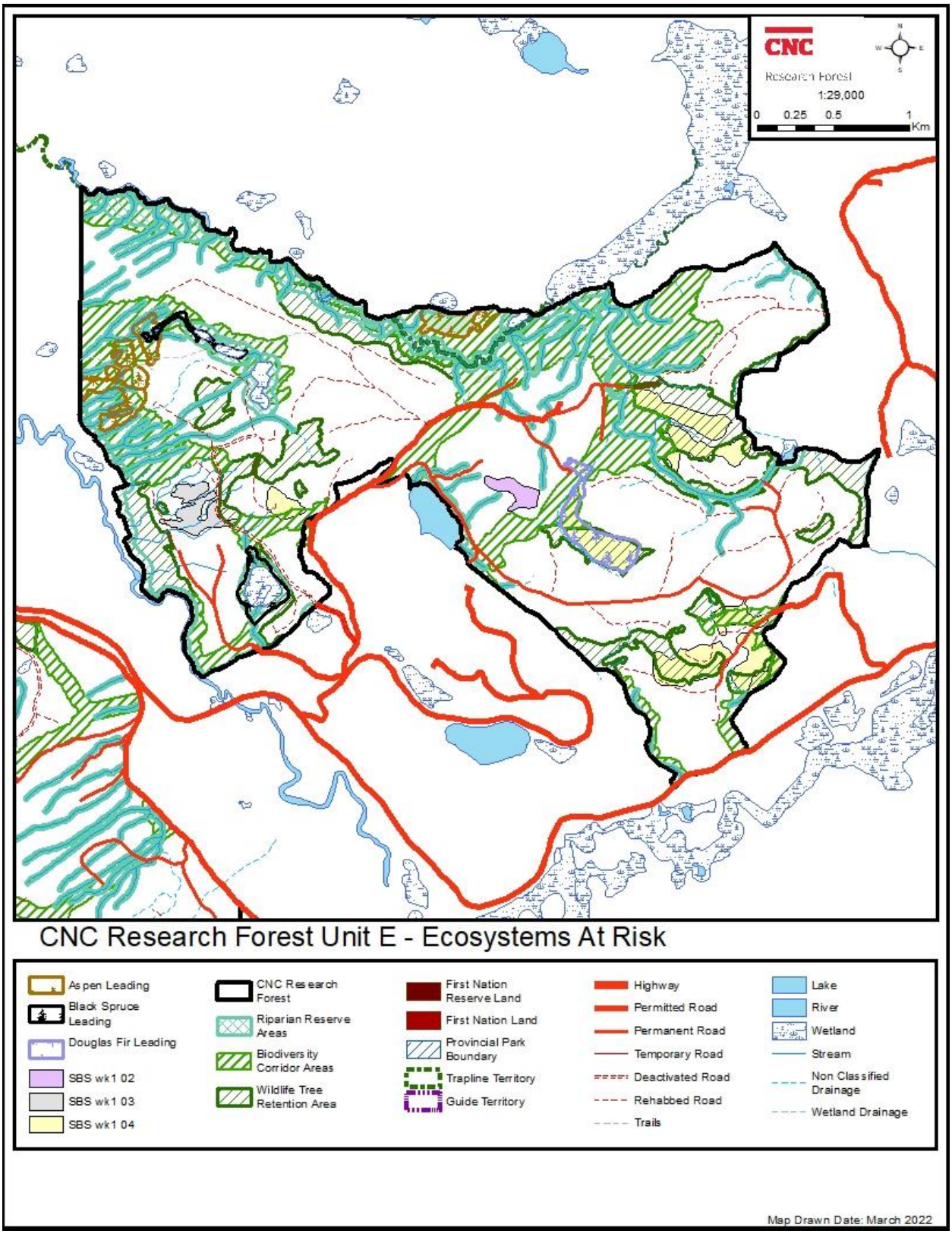


CNC Research Forest Unit D - Ecosystems At Risk

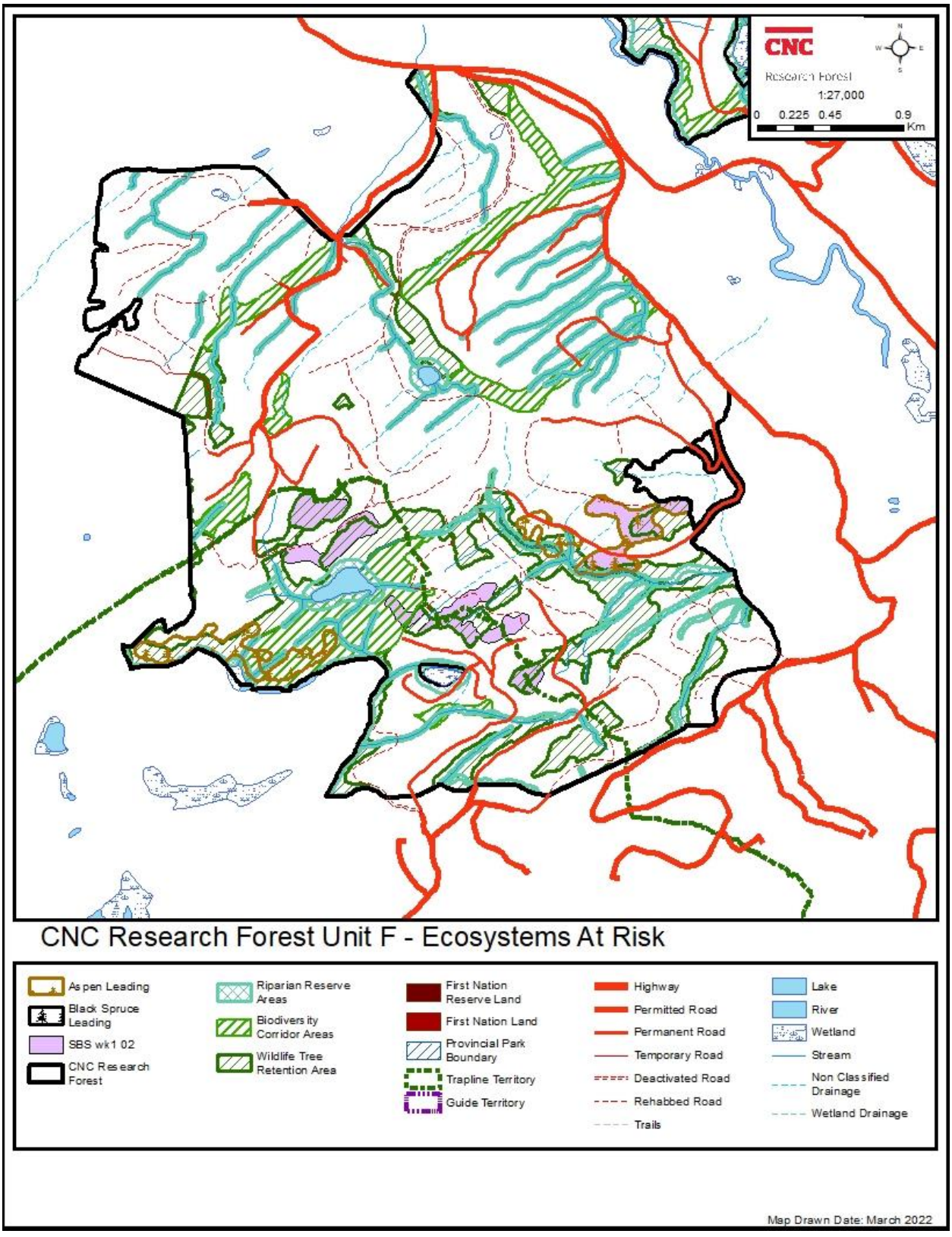
SBS wk1 02
CNC Research Forest
Riparian Reserve Areas
Biodiversity Corridor Areas
Wildlife Tree Retention Area
First Nation Reserve Land
First Nation Land
Provincial Park Boundary
Trapline Territory
Guide Territory
Highway
Permitted Road
Permanent Road
Temporary Road
Deactivated Road
Rehabbed Road
Trails
Lake
River
Wetland
Stream
Non Classified Drainage
Wetland Drainage

Map Drawn Date: March 2022

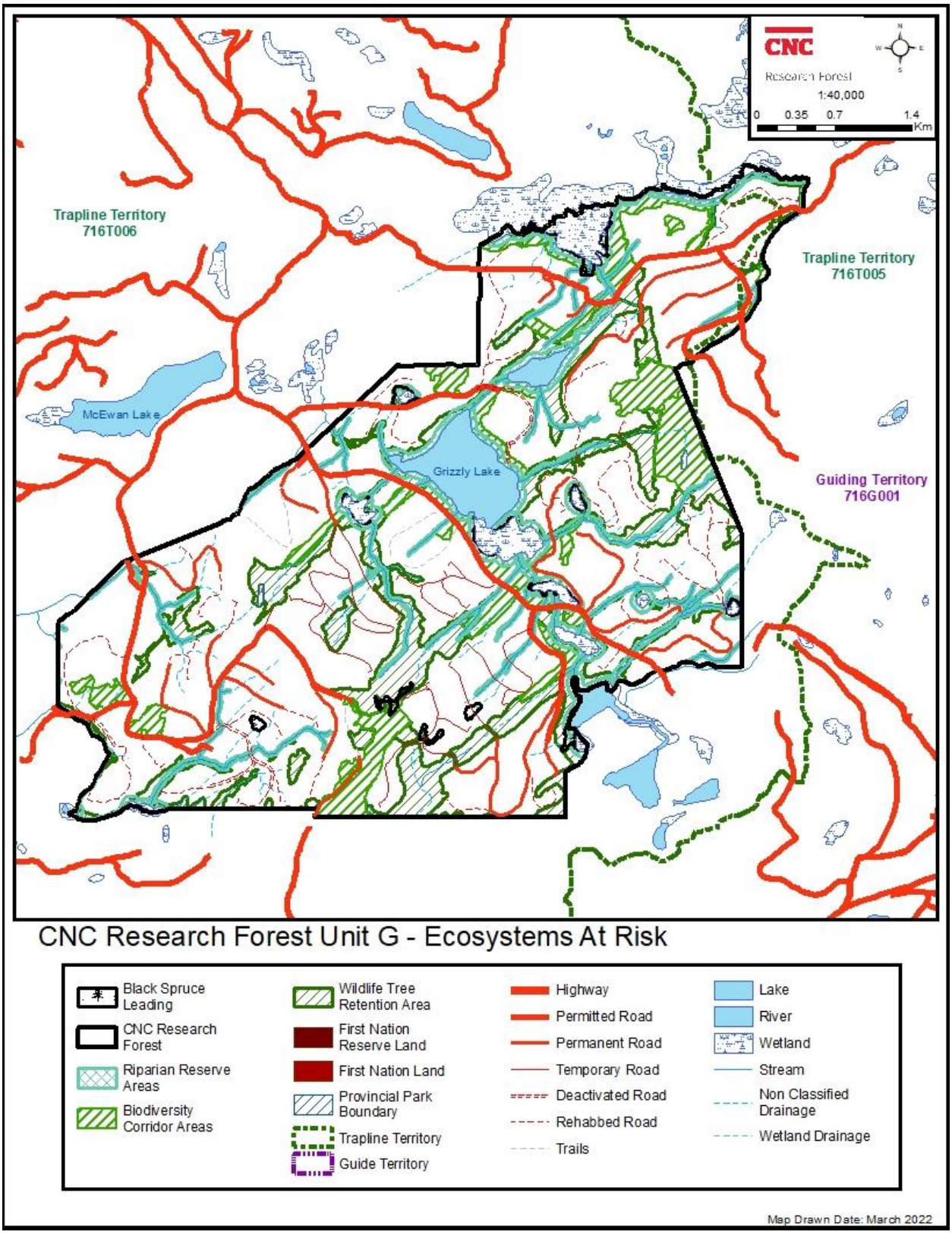
Appendix B: Ecosystems At Risk Maps



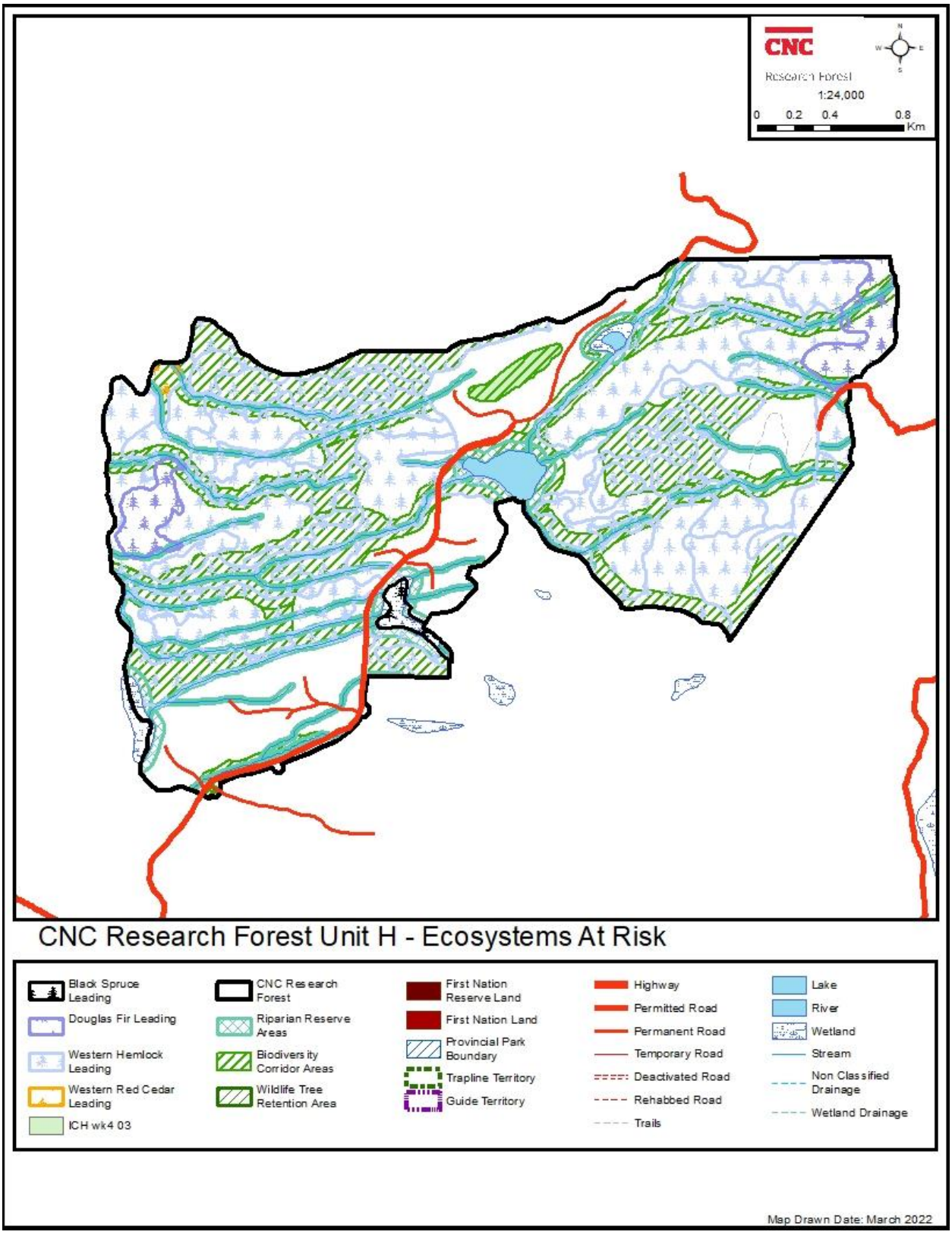
Appendix B: Ecosystems At Risk Maps



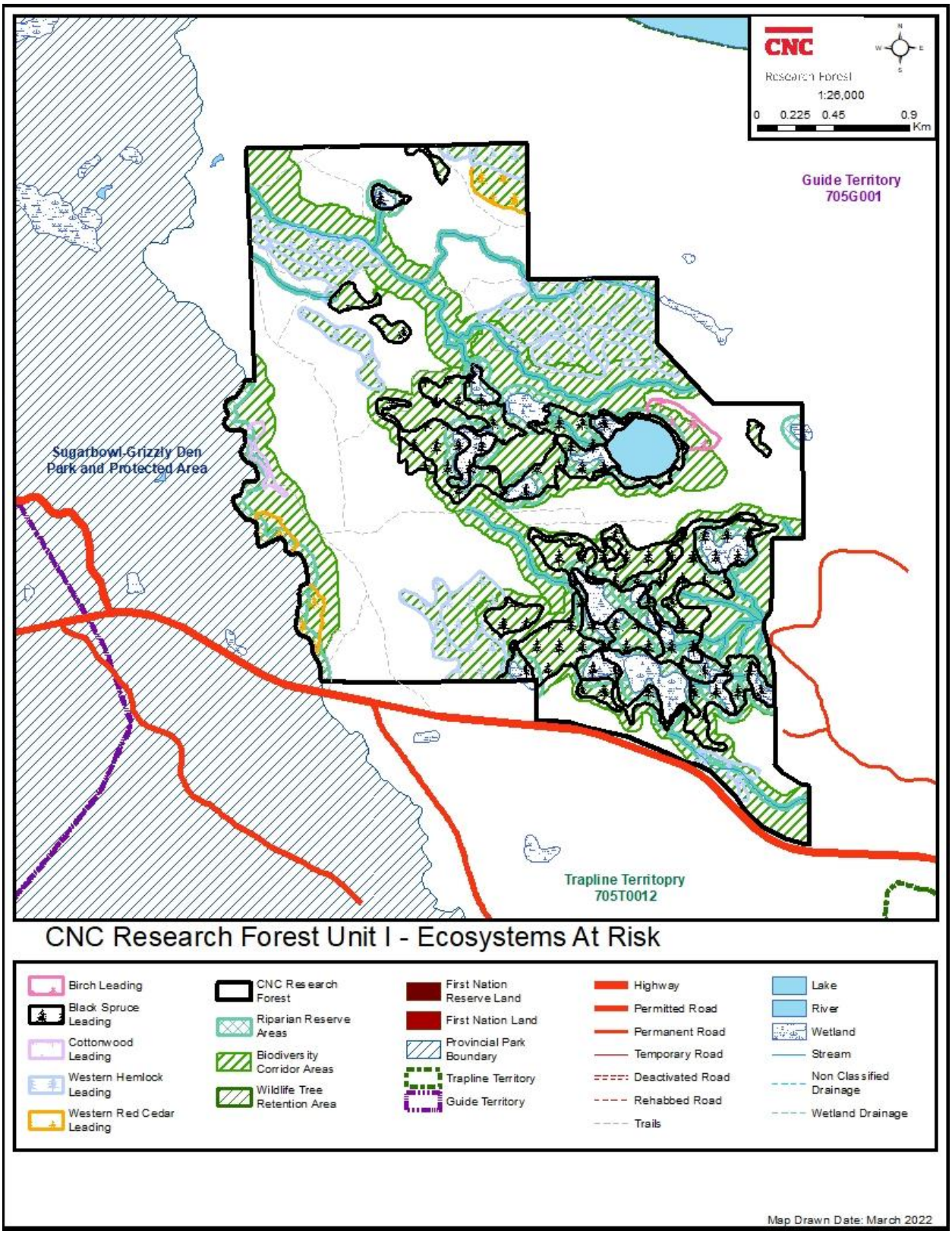
Appendix B: Ecosystems At Risk Maps



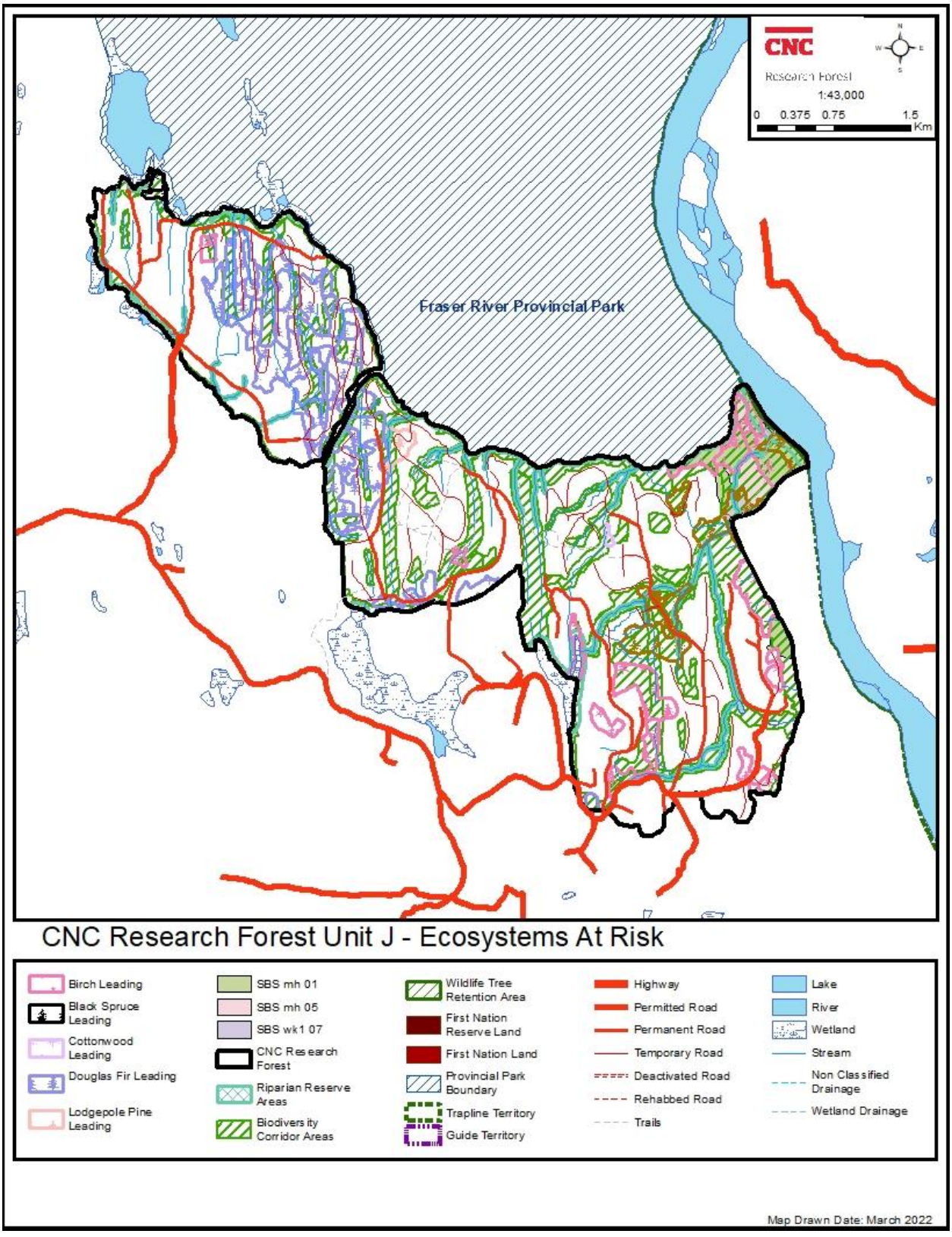
Appendix B: Ecosystems At Risk Maps



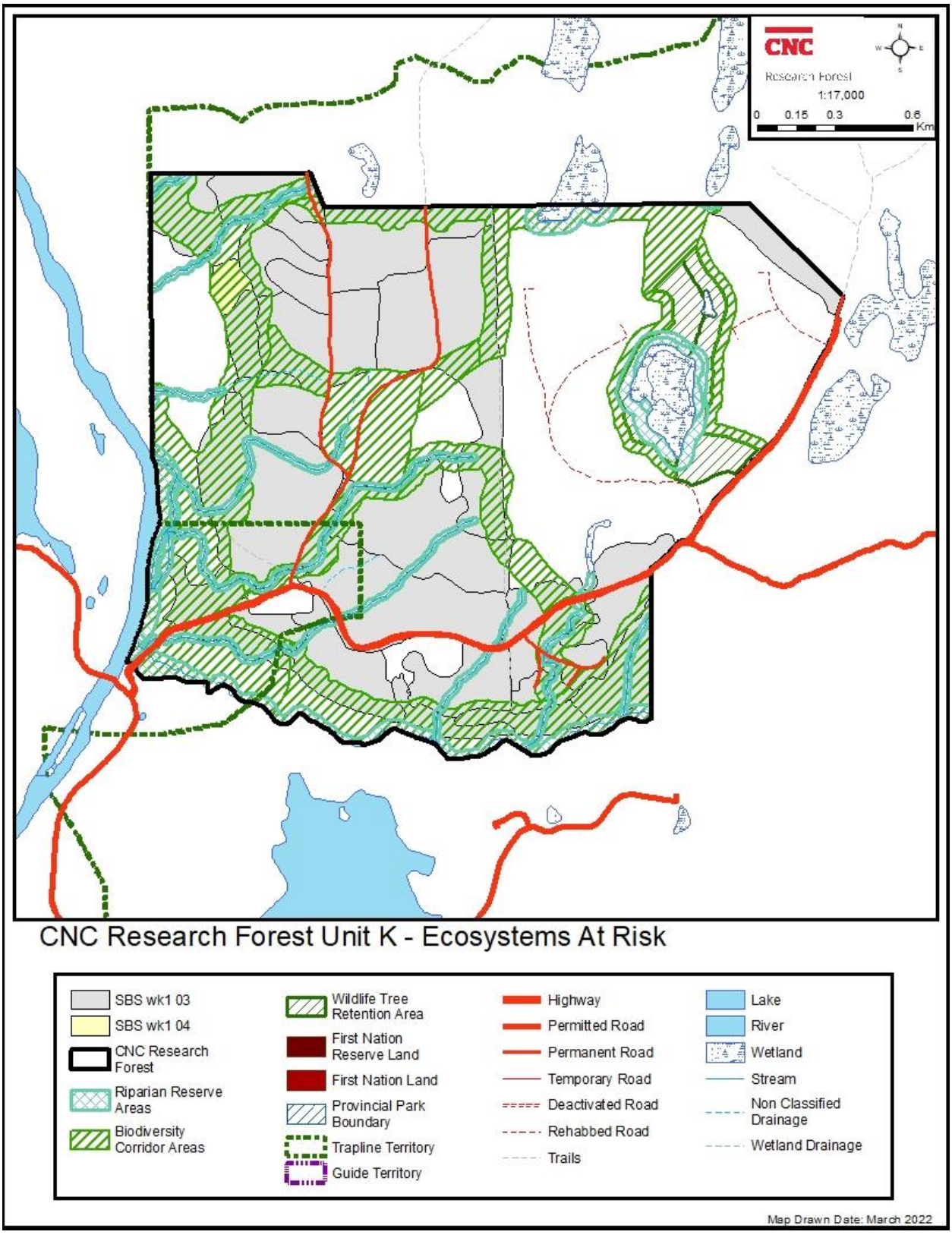
Appendix B: Ecosystems At Risk Maps



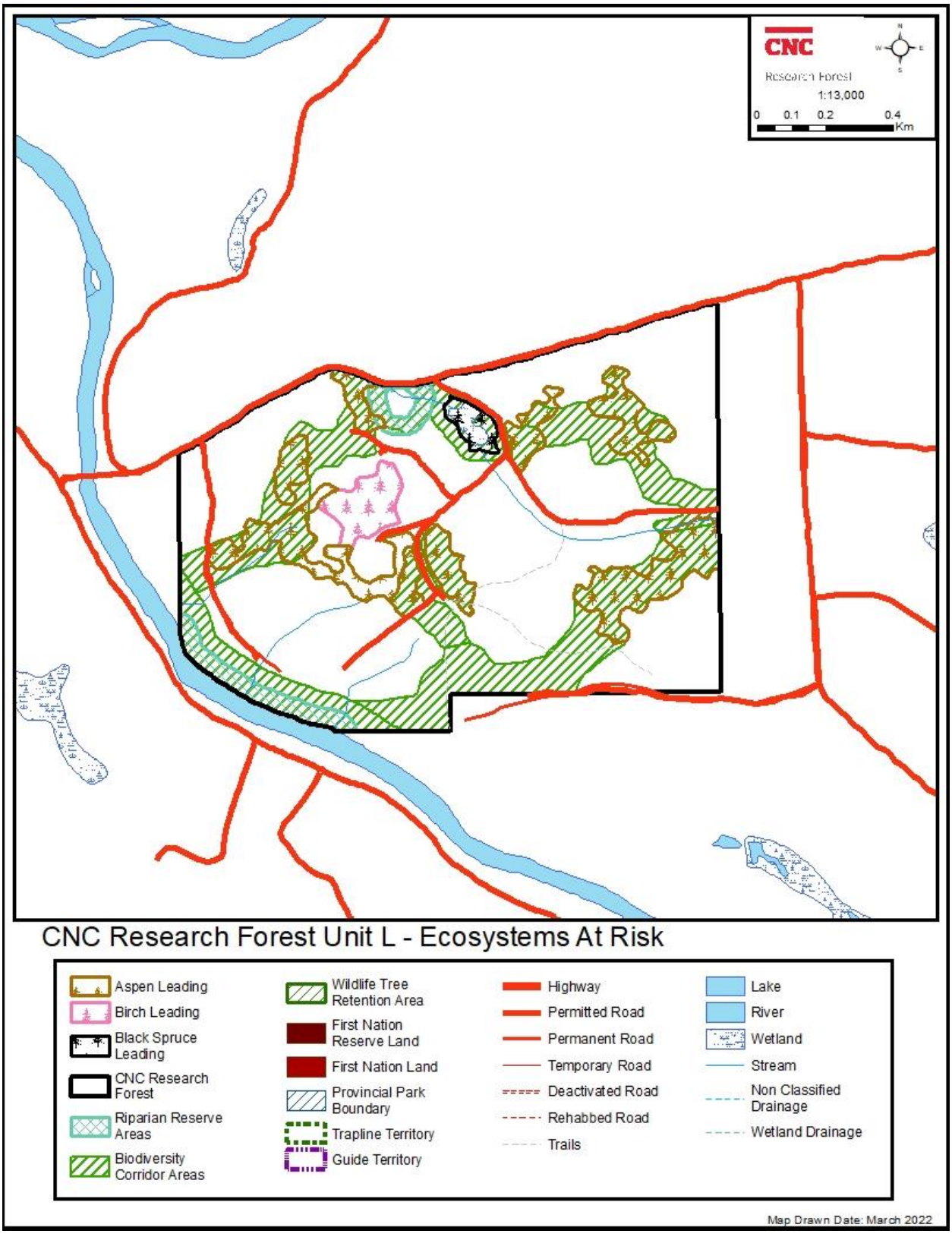
Appendix B: Ecosystems At Risk Maps



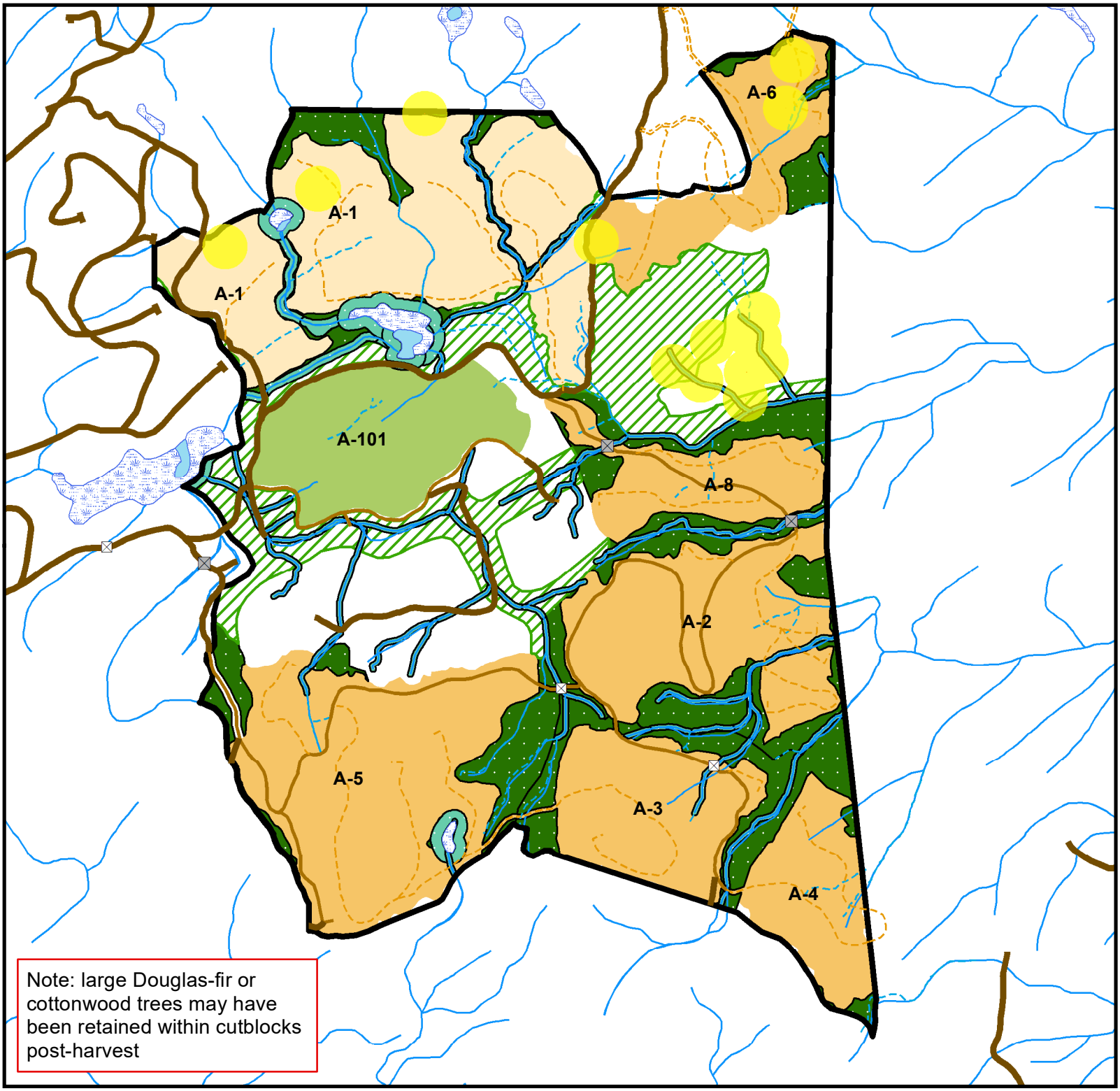
Appendix B: Ecosystems At Risk Maps



Appendix B: Ecosystems At Risk Maps



Appendix C - Special Tree Potential Mapping



CNC Research Forest Unit A - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 33m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

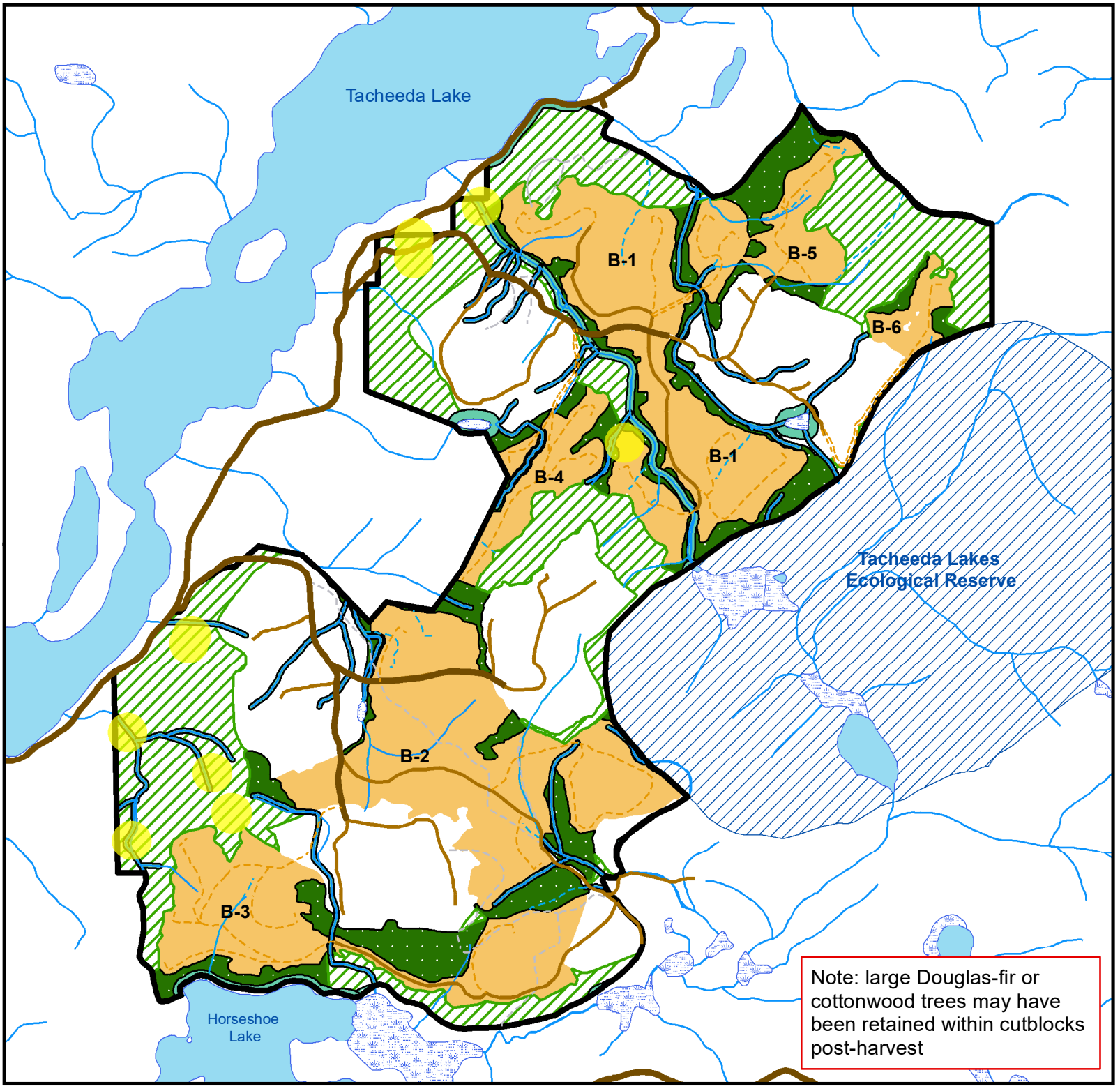
N
W E
S

CNC Research Forest

1:23,500

0 0.2 0.4 0.8 Km

Map Drawn Date: January 2023



CNC Research Forest Unit B - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 48m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

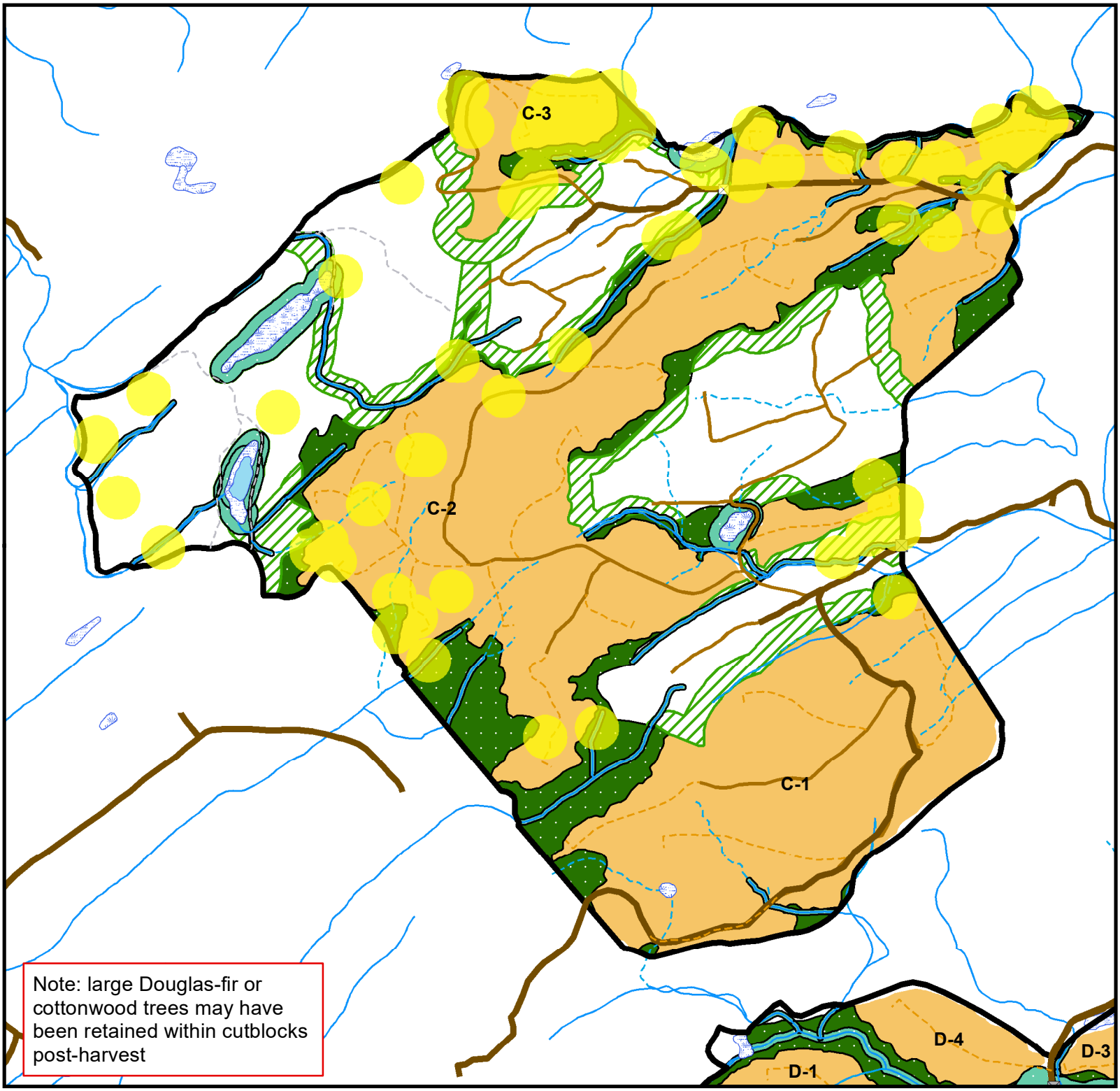
N
W E
S

CNC Research Forest

1:27,000

0 0.225 0.45 0.9 Km

Map Drawn Date: January 2023



CNC Research Forest Unit C - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 42m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

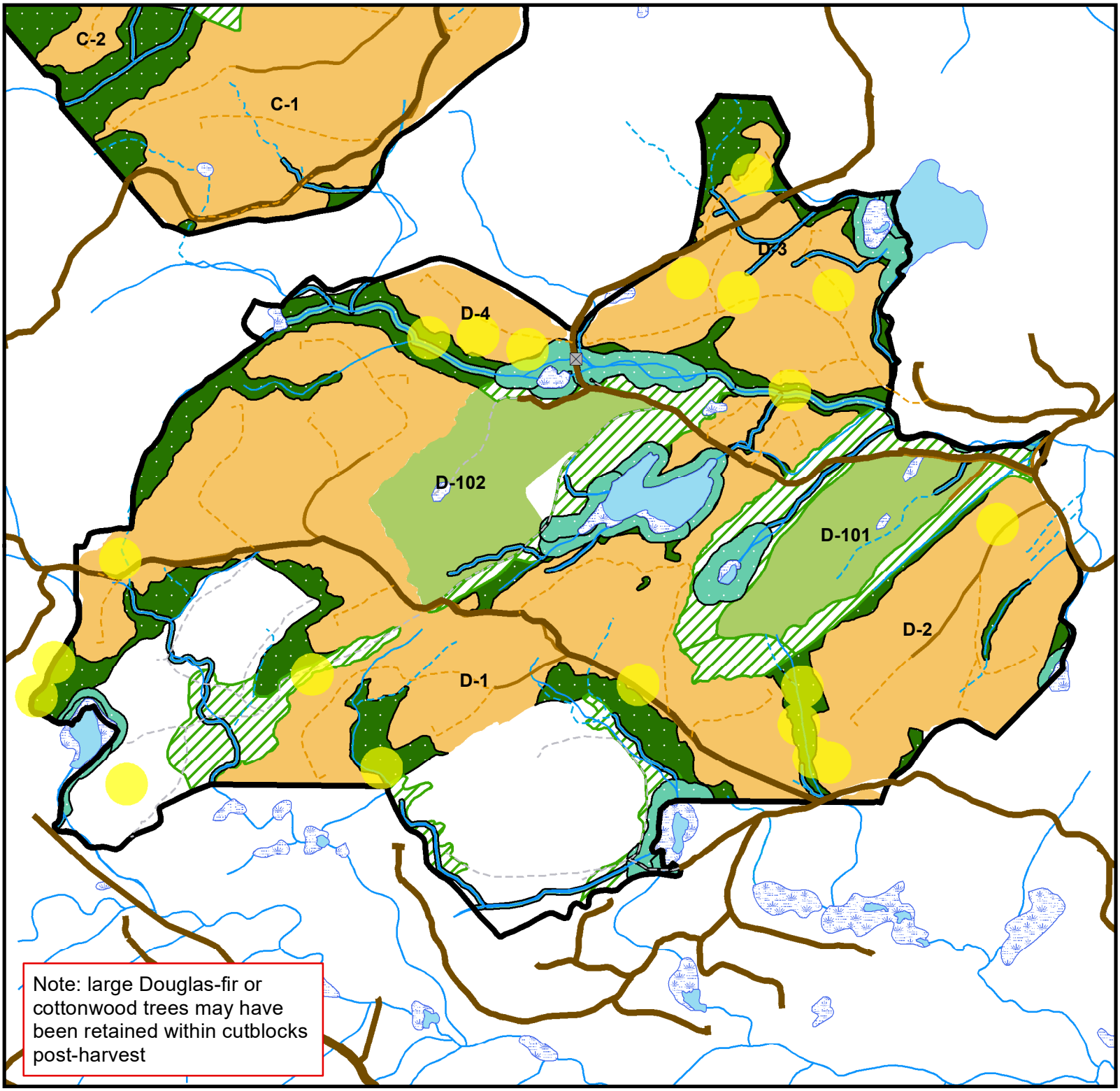
N
W E
S

CNC Research Forest

1:24,000

0 0.2 0.4 0.8 Km

Map Drawn Date: January 2023



CNC Research Forest Unit D - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 45m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

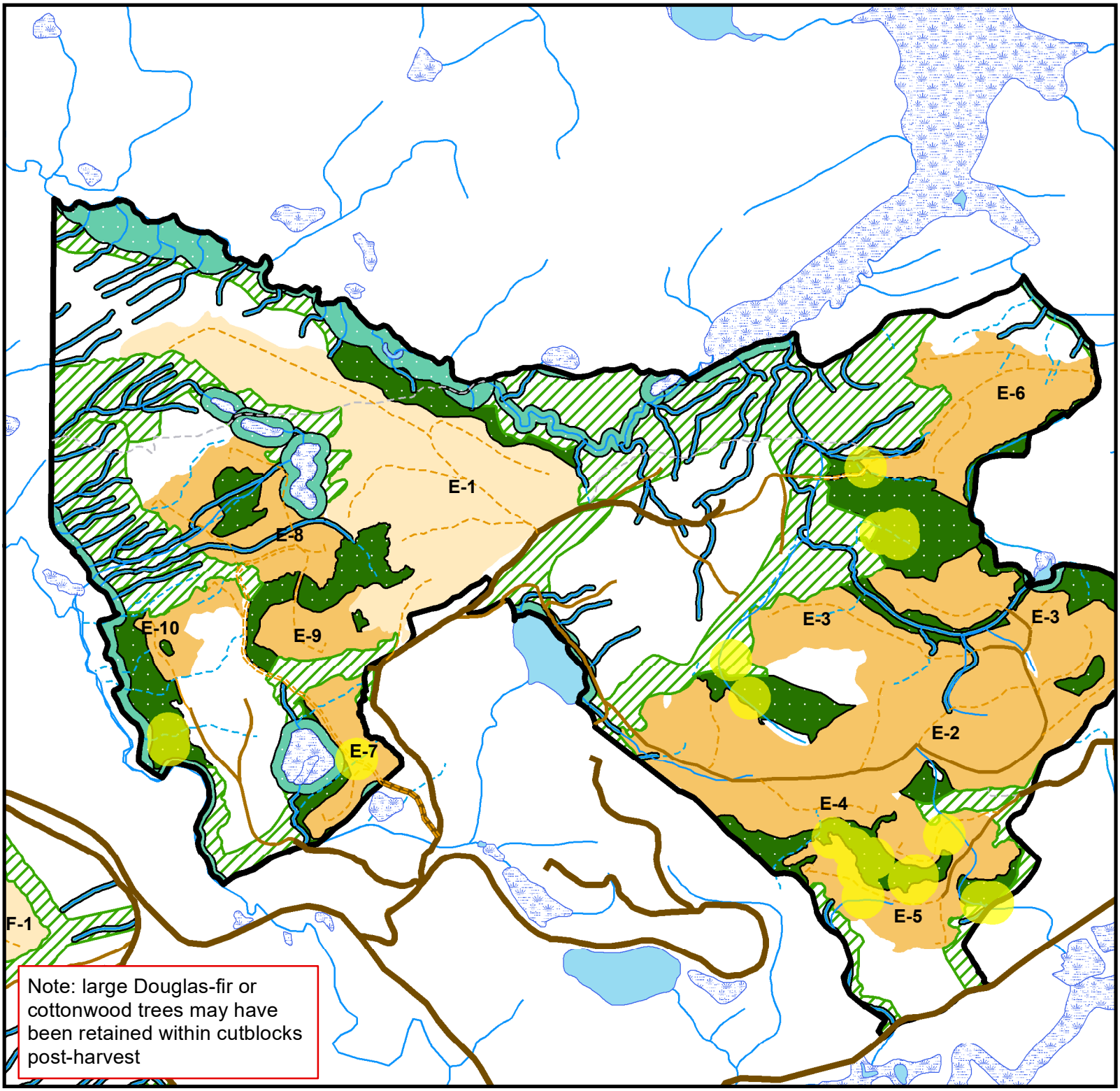
N
W E
S

CNC Research Forest

1:25,000

0 0.2 0.4 0.8 Km

Map Drawn Date: January 2023



CNC Research Forest Unit E - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 45m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

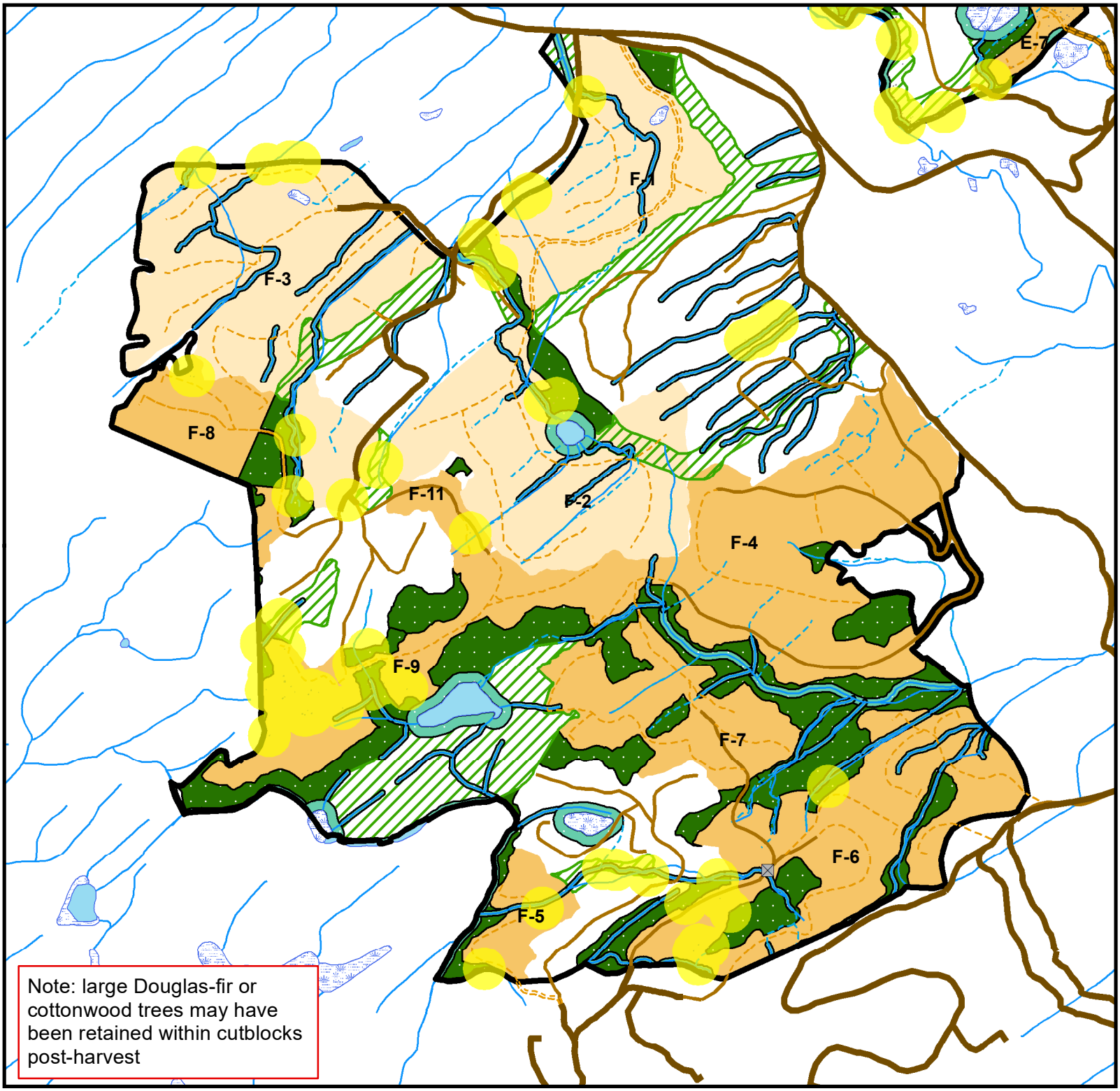
N
W E
S

CNC Research Forest

1:25,000

0 0.2 0.4 0.8 Km

Map Drawn Date: January 2023



Note: large Douglas-fir or cottonwood trees may have been retained within cutblocks post-harvest

CNC Research Forest Unit F - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 42m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

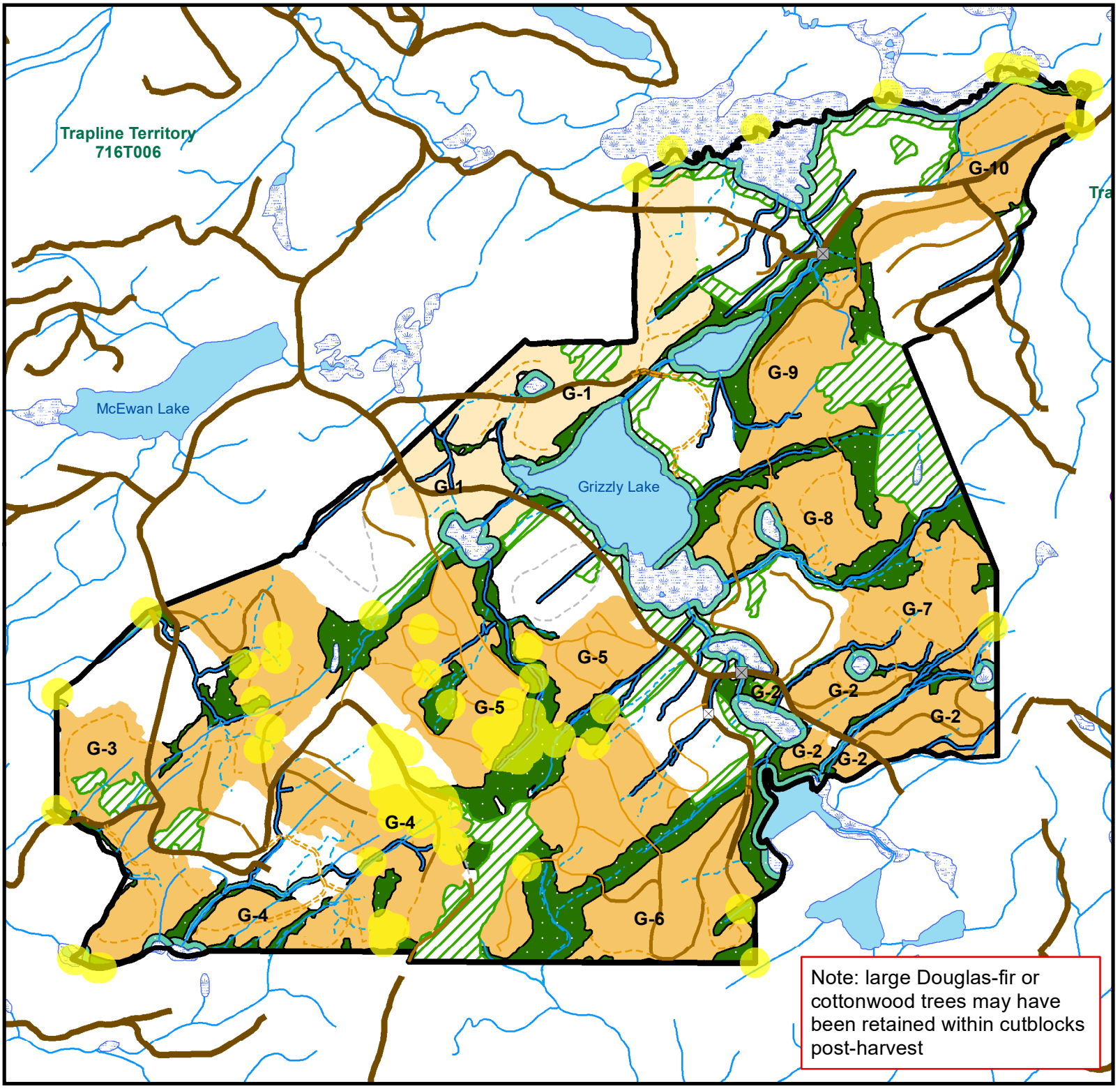
N W E S

CNC Research Forest

1:25,000

0 0.2 0.4 0.8 Km

Map Drawn Date: January 2023



CNC Research Forest Unit G - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 48m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

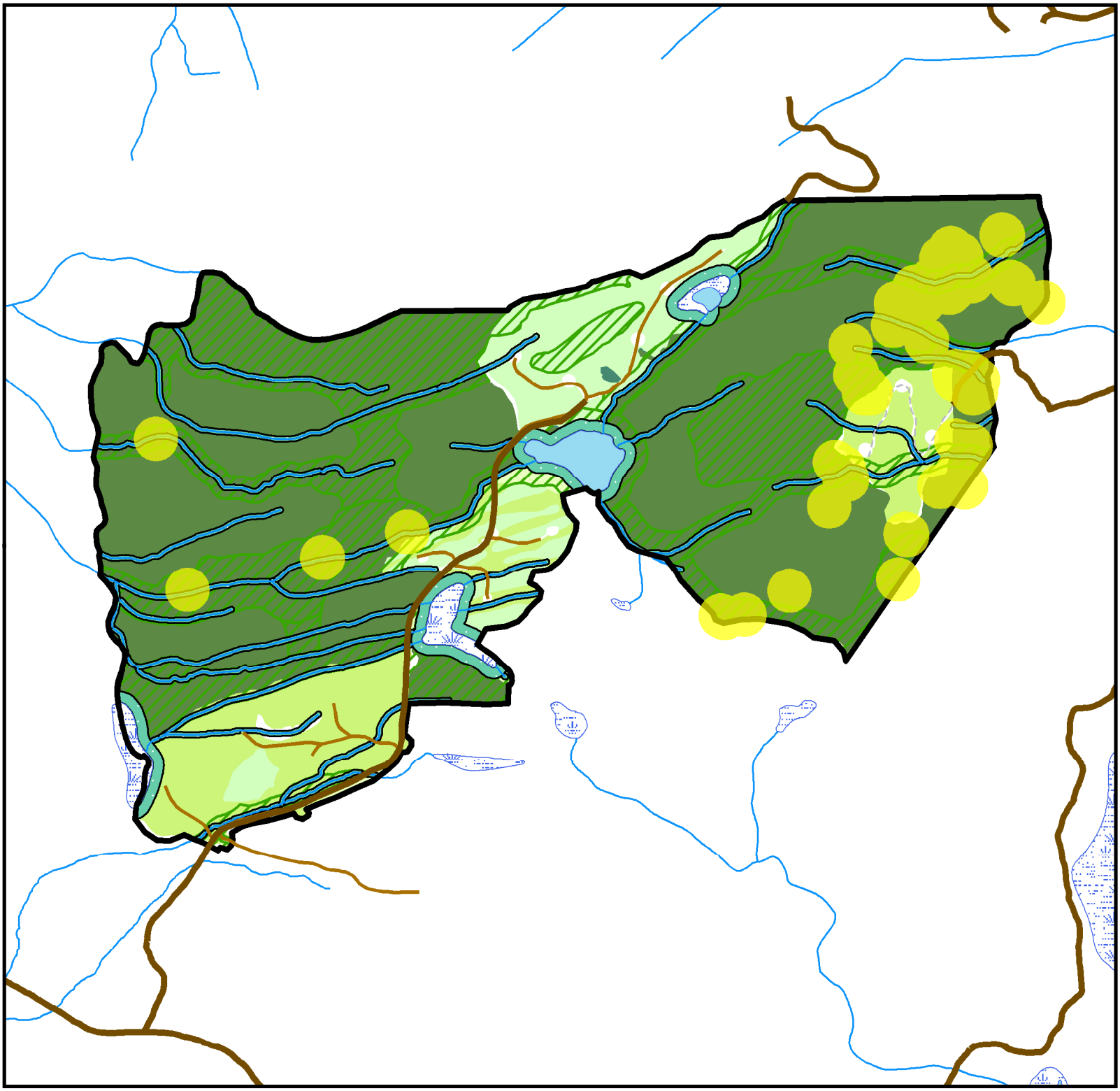
N
W E
S

CNC Research Forest

1:35,000

0 0.3 0.6 1.2 Km

Map Drawn Date: January 2023



CNC Research Forest Unit H - Potential Large Tree Map

CNC Research Forest

100m Buffer for Trees 48m +

Riparian Reserve Areas

Biodiversity Corridor Areas

Wildlife Tree Retention Area

CNC Research Forest Stand Ages

1-5 Years

6-10 Years

11-15 Years

16-20 Years

21-30 Years

31-40 Years

41-50 Years

51-60 Years

61+ Years

Permitted Road

Permanent Road

Temporary Road

Deactivated Road

Rehabbed Road

Trails

Steel Bridge

Log Culvert

Lakes

Wetlands

Streams

Non-Classified Drainage

N

W E

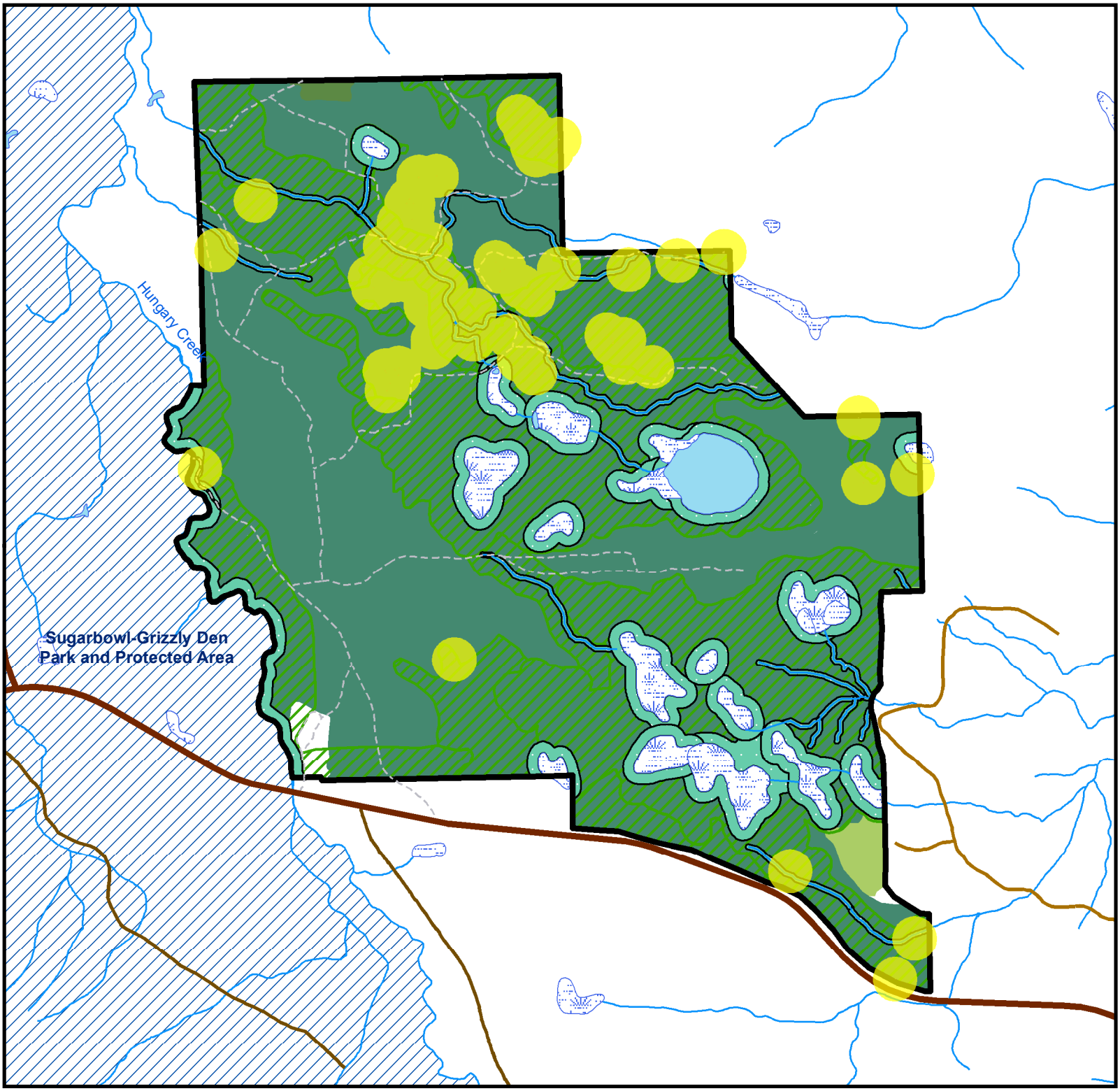
S

CNC Research Forest

1:24,000

0 0.2 0.4 0.8 Km

Map Drawn Date: January 2023



CNC Research Forest Unit I - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 45m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Highway
- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Wetlands
- Streams
- Non-Classified Drainage

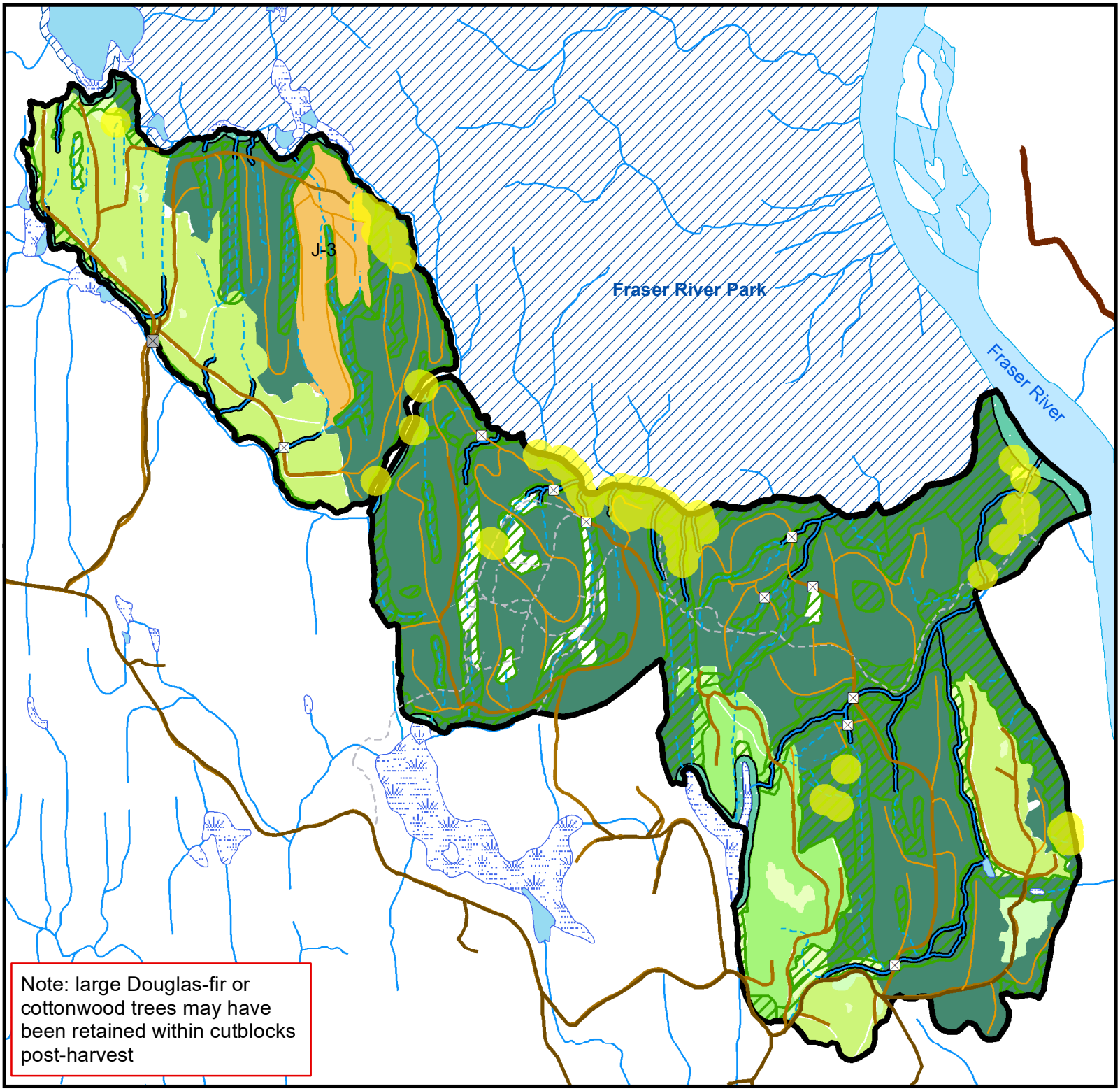
N
W E
S

CNC Research Forest

1:24,000

0 0.2 0.4 0.8 Km

Map Drawn Date: January 2023



CNC Research Forest Unit J - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 45m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Permitted Road
- Permanent Road
- Deferred Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Deferred Log Culvert

- Lakes
- Rivers
- Wetlands
- Streams
- Non-Classified Drainage

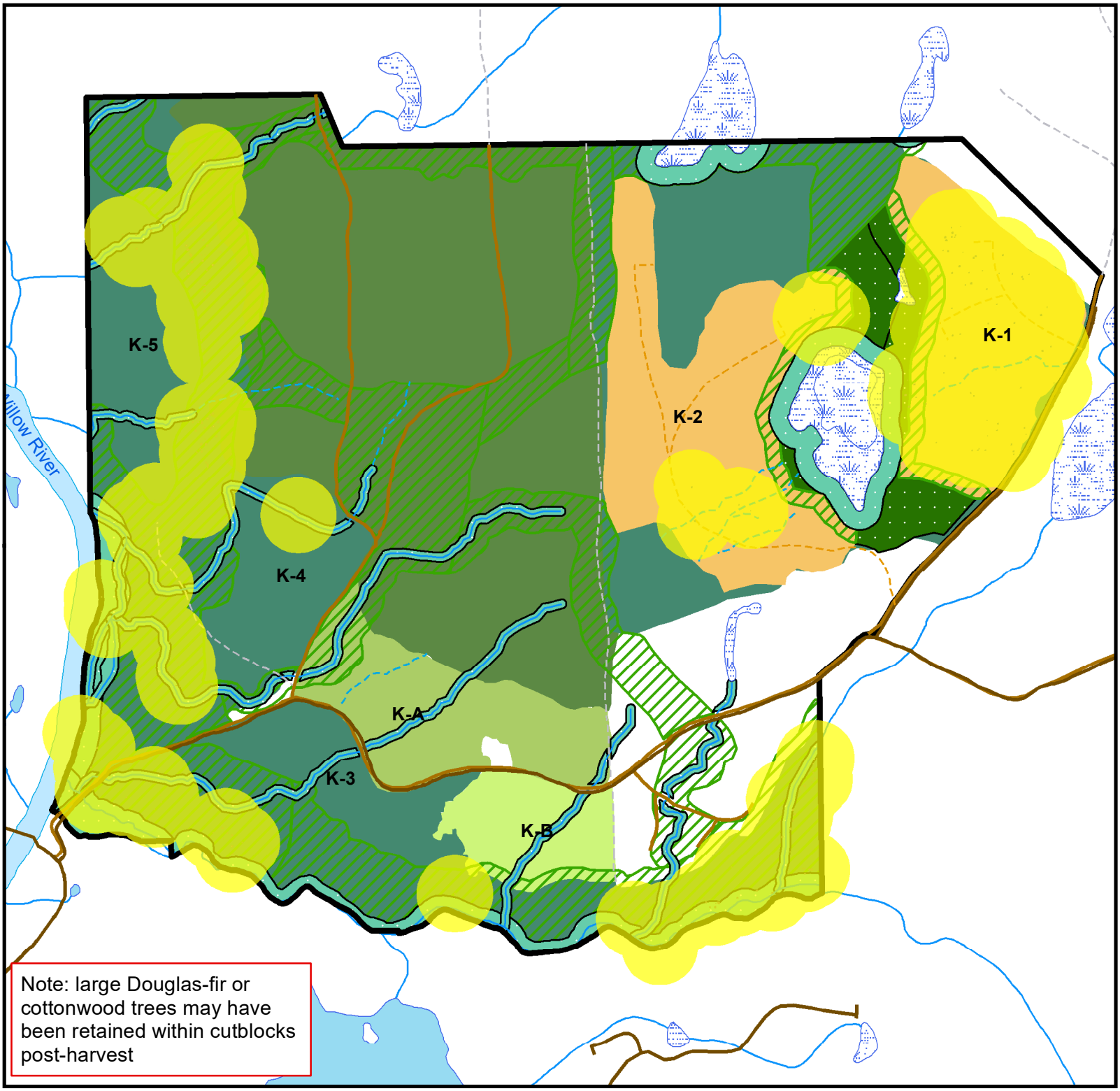
N
W E
S

CNC Research Forest

1:35,000

0 265 530 1,060 Meters

Map Drawn Date: January 2023



CNC Research Forest Unit K - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 42m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Highway
- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Rivers
- Wetlands
- Streams
- Non-Classified Drainage

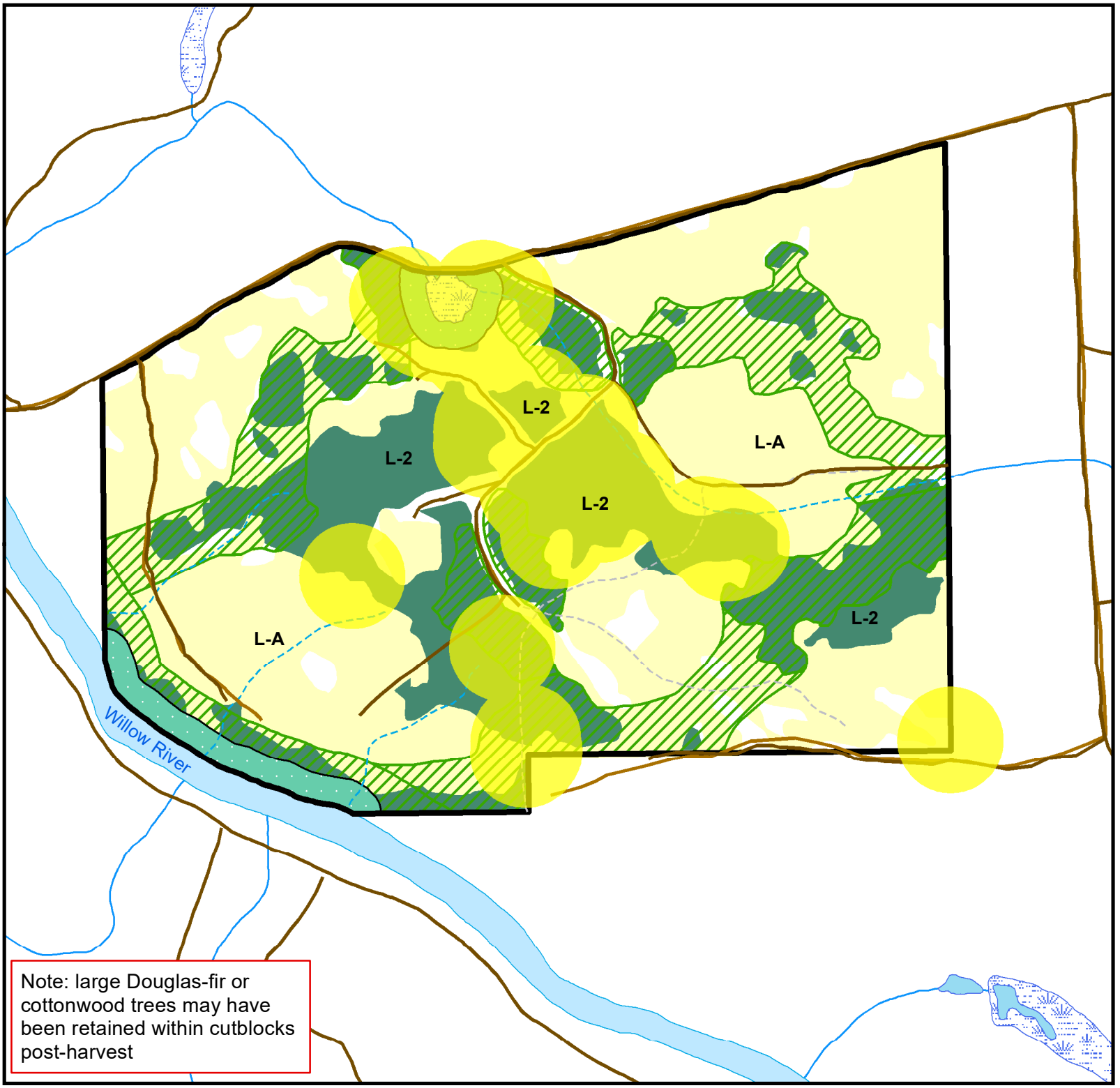
N W E S

CNC Research Forest

1:14,000

0 105 210 420 Meters

Map Drawn Date: January 2023



Note: large Douglas-fir or cottonwood trees may have been retained within cutblocks post-harvest

CNC Research Forest Unit L - Potential Large Tree Map

- CNC Research Forest
- 100m Buffer for Trees 36m +
- Riparian Reserve Areas
- Biodiversity Corridor Areas
- Wildlife Tree Retention Area

CNC Research Forest Stand Ages

- 1-5 Years
- 6-10 Years
- 11-15 Years
- 16-20 Years
- 21-30 Years
- 31-40 Years
- 41-50 Years
- 51-60 Years
- 61+ Years

- Highway
- Permitted Road
- Permanent Road
- Temporary Road
- Deactivated Road
- Rehabbed Road
- Trails
- Steel Bridge
- Log Culvert

- Lakes
- Rivers
- Wetlands
- Streams
- Non-Classified Drainage

N W E S

CNC Research Forest

1:10,000

0 75 150 300 Meters

Map Drawn Date: January 2023

Appendix D - Watershed Mapping

Appendix D: Watersheds within CNC Research Forest

For each Research Unit, all of the assessment-sized watersheds that include Research Forest area, are identified and briefly described in the following sections. These watershed areas were sourced from the Freshwater Atlas dataset available from GeoBC.[1] The approximate percentage of the watershed occupied by the Research Forest is also stated.

Unit A – Weedon-Crooked River and Mid Crooked River Drainages

Watershed Description

The east side of Unit A drains west towards Kerry Lake and the Crooked River via three primary streams and the west side drains west via one stream that drains into a large stream network that flows northward into Weedon Creek.

Unit A occupies the following areas within 3 distinct watersheds:

1) Mid Crooked River: Less than 3% of the lands that drain directly into the Kerry Lake portion of the Crooked River.
2) Mid Crooked River: Approximately 3% of the lands that drain directly into the Crooked River via an unnamed 4th order stream that enters the Crooked River upstream of Kerry Lake.
3) Weedon-Crooked River: Less than 7% of the lands that drain into a large unnamed 5th order stream that flows northward into Weedon Creek.

Unit B – Tacheeda-Parsnip Drainage

Watershed Description

Most of Unit B drains west directly into Tacheeda Lakes via seven stream pathways. The southeast portion of the unit drains towards Horseshoe Lake, which lies to the south and which ultimately drains in Tacheeda Lakes.

Unit B occupies the following areas within 2 distinct watersheds:

1) Tacheeda-Parsnip River: Approximately 14% of the lands that drain directly into the east side of Tacheeda Lakes.
2) Tacheeda-Parsnip River: Approximately 7% the lands that drain into Horseshoe Lake, which is a 4th order watershed that drains into Tacheeda Lakes.

Unit C – Caine-Crooked River and Merton-Lower Salmon River Drainages

The eastern side of Unit C drains via two streams that feed a larger stream network that flows to the northeast into Caine Creek. The western side of Unit C drains towards the Merton Creek system. Unit C occupies the following areas within five distinct watersheds:

1) Caine-Crooked River: Approximately 10% of the lands of a 4th order stream network that drains directly into the lower portion of Caine Creek
2) Caine-Crooked River: Approximately 3% of the lands that drain directly into Caine Creek via small order streams. Unit D also occupies approximately 9% of this same watershed. Caine Creek is a 5th order stream in the mid-lower part of the drainage basin.

[1] GeoBC, Province of British Columbia. 2016. Freshwater Atlas Dataset. http://geobc.gov.bc.ca/base-mapping/atlas/fwa/fwa_data.html

Appendix D: Watersheds within CNC Research Forest

3) Merton-Lower Salmon River: Less than 3% of the lands that drain into Merton Creek upstream of Merton Lake (Merton Creek headwaters). Merton Creek is a 4th order stream.
4) Merton-Lower Salmon River: Less than 6% of the lands that drain directly into Merton Lake or Merton Creek near the outlet of Merton Lake.
5) Merton-Lower Salmon River: Less than 1% of the lands that drain into a 3rd order stream that flows into Merton Creek.

Unit D – Caine-Crooked River Drainage

The northern side of Unit D drains via one primary stream that feeds the upper portion of Caine Creek. The southern side of Unit D drains towards a stream network that feeds the headwaters of Caine Creek.

Unit D occupies the following areas within three distinct watersheds:

1) Caine-Crooked River: Approximately 16% of the lands that form the headwaters of Caine Creek, which is a 3rd order stream within the upper part of the drainage basin.
2) Caine-Crooked River: A negligible amount of lands that drain into a 4th Order stream network that drains directly into the lower portion of Caine Creek.
3) Caine-Crooked River: Approximately 9% of the lands that drain directly into Caine Creek via small order streams. Unit C also occupies less 3% of this same watershed. Caine Creek is a 5th order stream in the mid-lower part of the drainage basin.

Unit E – Chuchinka-Crooked River Drainage

The northern part of Unit E drains to the north into the northern branch of Chuchinka Creek while the southern part drains southward into the southern branch of Chuchinka Creek.

Unit E occupies the following areas within two distinct watersheds:

1) Chuchinka-Crooked River: Approximately 10% of the lands that drain directly into the northern branch of Chuchinka Creek, which is a 5th order stream in the lower-mid section of the northern drainage basin.
2) Chuchinka-Crooked River: Approximately 9% of the lands that drain directly into the mid and lower section of the southern branch of Chuchinka Creek, which is a 6th order stream. Combined with Unit F, the Research Forest occupies approximately 23% of this watershed.

Unit F – Chuchinka-Crooked River and Angusmac-Crooked River Drainages

The northern majority of Unit F drains into the southern branch of Chuchinka creek via three separate stream networks. The southern portion of Unit F drains via one primary stream pathway into Angusmac Creek.

Unit F occupies the following areas within two distinct watersheds:

1) Chuchinka-Crooked River: Approximately 14% of the lands that drain directly into the mid and lower section of the southern branch of Chuchinka Creek, which is a 6th order stream. Combined with Unit E, the Research Forest occupies approximately 23% of this watershed, therefore the combined influence of both units must be considered
2) Angusmac-Crooked River: Approximately 6% of the lands that drain directly into the mid and lower section of Angusmac Creek which is a 4th order stream prior to its confluence with Chuchinka Creek.

Appendix D: Watersheds within CNC Research Forest

Unit G – Mid-Upper Crooked River and Angusmac-Crooked River Drainages

The western quarter of Unit G drains via two streams into a large unnamed stream network that flows north into the Crooked River. The majority of Unit G drains via the internal Lakes and wetland system into the mid portion of Angusmac Creek.

Unit G occupies the following areas within four distinct watersheds:

1) Angusmac-Crooked River: Approximately 21% of the lands that drain directly into the mid-section of Angusmac Creek, which is 4th order stream. Less than 1% of the lands that drain directly into the mid and lower section of Angusmac Creek which is a 4th order stream prior to its confluence with Chuchinka Creek.
2) Mid-Upper Crooked River: Approximately 8% of the lands that drain directly into a large unnamed 4th order stream system that flows northward into the Crooked River. The interim Stream Flow Hazard Score is low and the interim Sediment Hazard Score is low
3) Mid-Upper Crooked River: Approximately 2% of the lands that drain into a large 4th order stream system that ultimately drains into the Crooked River.

Unit H – Bowron River Drainage

The western majority of Unit H drains into two primary streams that flow directly into the Bowron River. The eastern end of Unit H drains to the east into a separate watershed that drains north towards the Bowron River.

Unit H occupies the following areas within two distinct watersheds:

1) Bowron River: Approximately 6% of the lands that drain directly into the lower Bowron River via small order streams.
2) Bowron River: Approximately 3% of the lands that drain directly into a large, unnamed 3rd order stream system that drains northward into the lower Bowron River.

Unit I – Hungary-Fraser River and Fraser River Drainages

The southeast corner of Unit I drains into one stream that flows directly into the Fraser River. The rest of Unit I drains via two streams into Hungary Creek.

Unit I occupies the following areas within two distinct watersheds:

1) Fraser River: Approximately 7% of the lands that drain directly into the south side of the Fraser River from small order streams.
2) Hungary-Fraser River: Approximately 7% of the lands that drain directly into Hungary creek via small order streams. The lower section of Hungary Creek is a 4th order stream.

Appendix D: Watersheds within CNC Research Forest

Unit J - Fraser River Drainage

Except for the southern end of Unit J, all of the unit drains into one mapped stream tributary that flows along the north edge of Unit J and directly into the Fraser River across from Naver Creek. The southern end drains into Porter Creek, which flows directly into the Fraser River, across from Naver Creek.

Unit J occupies the following areas within two distinct watersheds:

1) Fraser River: Approximately 27% of the lands that drain directly into the unnamed, 4th order stream that flows along the boundaries of unit J directly into the Fraser River. The interim Stream Flow Hazard Score is low and the interim Sediment Hazard Score is moderate.
2) Fraser River: Approximately 12% of the lands that drain directly into the west side of the Fraser River from small order streams.

Unit K – Pitoney-Willow River and Willow River Drainages

The eastern side of Unit K drains via two streams into Pitoney Creek. The western part of Unit K drains via two streams directly into the Willow River.

Unit K occupies the following areas within two distinct watersheds:

1) Willow River: Approximately 2% of the lands that drain directly into the east side of the Willow River from small order streams. Combined with Unit L, the total area occupied is approximately 4% of this watershed.
2) Pitoney-Willow River: Approximately 6% of all the lands that drain into Pitoney Creek, which is a 5th order stream at its confluence with the Willow River.

Unit L – Willow River Watershed

Unit L has limited terrain and only one principle intermittent stream, which flows to the northwest and drains directly into the Willow River.

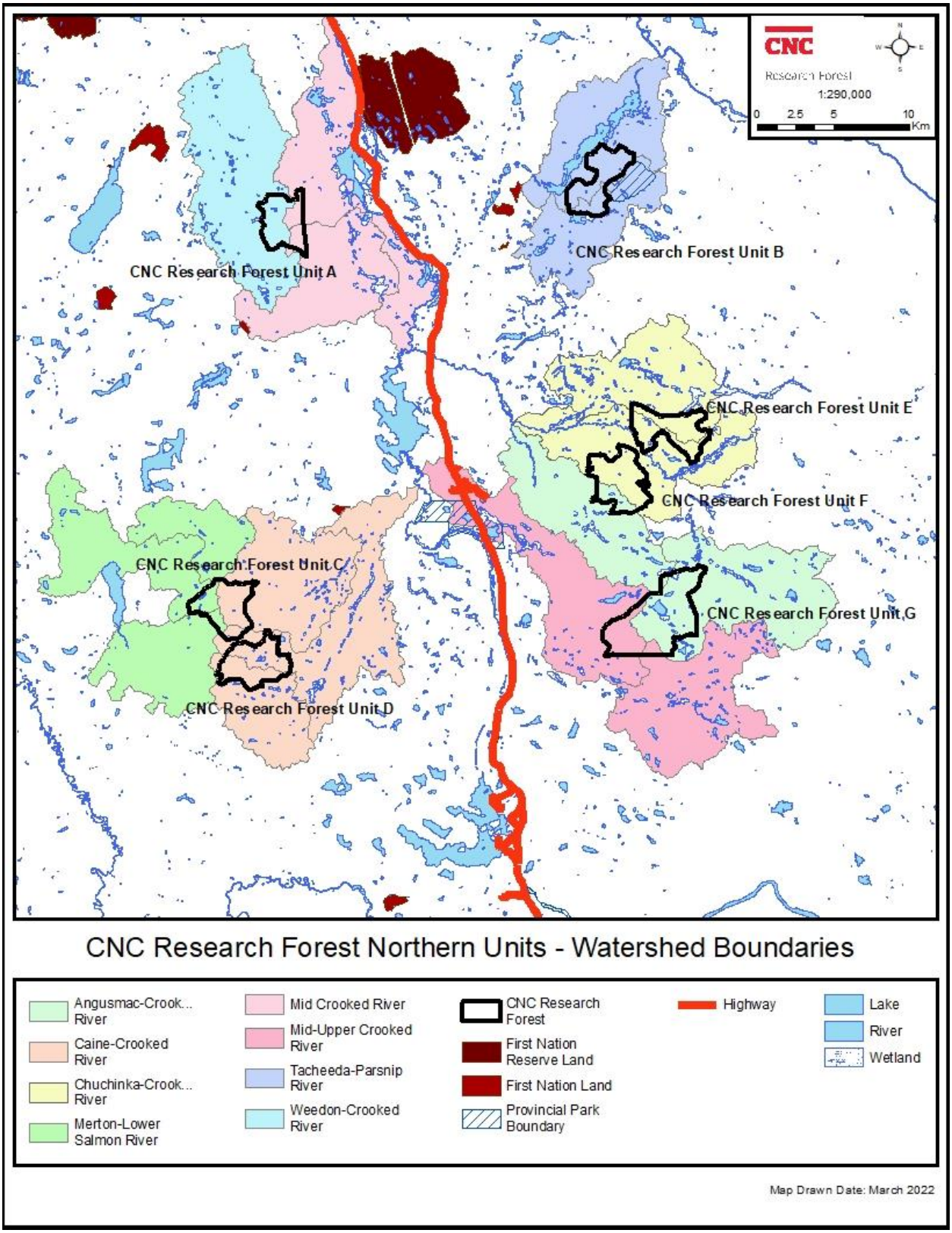
Unit L occupies the following areas within one distinct watershed:

1) Willow River: Approximately 2% of the lands that drain directly into the east side of the Willow River from small order streams. Combined with Unit K, the total area occupied is approximately 4% of this watershed.

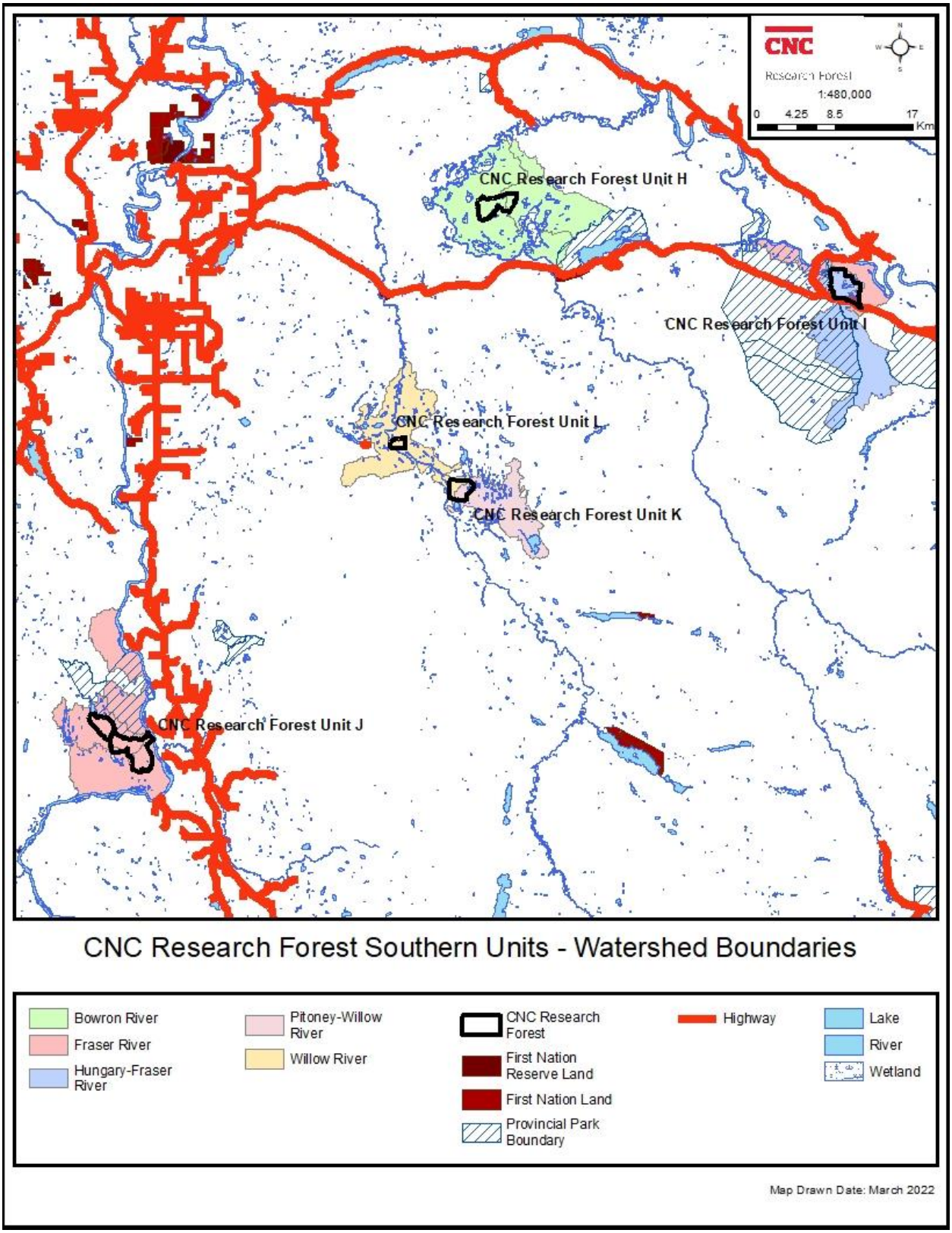
Watershed Boundary Maps

The following two maps show all of the individual assessment-sized watersheds and the area-occupied by each Research Forest Unit. There is one map for the northern Research Forest Units (A to G), and another map for the southern Research Forest Units (H to L).

Appendix D: Watersheds within CNC Research Forest



Appendix D: Watersheds within CNC Research Forest



Appendix E - Legal Requirements Pertaining to Wildlife Trees, Coarse Woody Debris, Roads, and Visual Quality

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

This Appendix provides the regulatory requirements for the following forest resource values as specified under the Forest Planning and Practices Regulation at the time of writing this Management Plan:[1]

- Wildlife Trees
- Coarse Woody Debris
- Roads
- Visual Quality

All regulatory content is shown in italicized text.

Wildlife Tree Retention

Wildlife tree retention

66 *(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) A fibre recovery tenure holder is exempt from this section.

Restriction on harvesting

67 *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.*

[1] Province of British Columbia. 2022. Forest Planning and Practices Regulation available via BC Laws Website as sourced May 2022. https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14_2004

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

Coarse Woody Debris Retention

Coarse woody debris

68 *(1) An agreement holder who carries out timber harvesting must retain at least the following logs on a cutblock:*

(b) 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.

(2) An agreement holder is exempt from subsection (1) if

(a) the holder's agreement or an enactment requires the holder to act in a manner contrary to that set out in subsection (1),

(b) the holder carries out on the cutblock a controlled burn that is authorized under an enactment, or

(c) the holder is a fibre recovery tenure holder.

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

Road Use, Construction, Maintenance and Deactivation

Roads and associated structures

72 *A person who constructs or maintains a road must ensure that the road and the bridges, culverts, fords and other structures associated with the road are structurally sound and safe for use by industrial users.*

Design of bridges

73*A person who builds a bridge for the purpose of constructing or maintaining a road must ensure that the design and fabrication of the bridge*

(a) meets or exceeds standards applicable to roads at the time the design or fabrication is done, in respect of

(i) bridge design, as established by the Canadian Standards Association, Canadian Highway Bridge Design Code, CAN/CSA-S6, and

(ii) soil properties, as they apply to bridge piers and abutments, as established by the Canadian Foundation of Engineering Manual, and

(b) takes into account the effect of logging trucks with unbalanced loads and off-centre driving.

Peak flow

74*(1) A person who builds a bridge across a stream or installs a culvert in a stream for the purpose of constructing or maintaining a road must ensure that the bridge or culvert is designed to pass the highest peak flow of the stream that can reasonably be expected within the return periods specified below for the length of time it is anticipated the bridge or culvert will remain on the site:*

Anticipated period the bridge or culvert will remain on the site	***Peak flow return period***
For a bridge or culvert that will remain on site for up to 3 years	*10 years*
For a bridge that will remain on site from 3 to 15 years	*50 years*
For a bridge that will remain on site for over 15 years	*100 years*
For a culvert that will remain on site for over 3 years	*100 years*
For a bridge or culvert within a community watershed that will remain on site for over 3 years	*100 years*

(2) A person may build a bridge that will not conform to the requirements of subsection (1) if

(a) the bridge will pass the flow that will occur during the period the bridge remains on the site,

(b) the construction of the bridge occurs during a period of low flow, and

(c) the bridge, or a component of the bridge that is vulnerable to damage by high flow, is removed before any period of high flow begins.

(3) A person may install a culvert that will not conform to the requirements of subsection (1) if

(a) the installation is temporary and the person does not expect to subsequently install a replacement culvert at that location,

(b) the stream in which the culvert is being installed is not a fish stream,

(c) the culvert will pass the flow that will occur during the period the culvert remains on the site,

(d) the installation of the culvert occurs during a period of low flow, and

(e) the culvert is removed before any period of high flow begins.

Structural defects

75*A person who maintains a road must do one or more of the following if a structural defect or deficiency occurs on a bridge that is part of that road:*

(a) correct the defect or deficiency to the extent necessary to protect

(i) industrial users of the bridge, and

(ii) downstream property, improvements or forest resources that could be affected if the bridge fails;

(b) close, remove or replace the bridge;

(c) restrict traffic loads to a safe level;

(d) place a sign, on each bridge approach, stating the maximum load capacity of the bridge.

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

Culvert fabrication

76 *A person who builds a culvert for the purpose of constructing or maintaining a road must fabricate all permanent culvert materials according to*

(a) culvert fabrication standards, as established by the Canadian Standards Association, Corrugated Steel Pipe Products, CSA G401 and Plastic Nonpressure Pipe Compendium, section B182.8 of the B1800 Series, that are applicable to roads at the time of the fabrication, or

(b) standards that ensure at least the same strength and durability as the standards referred to in paragraph (a).

Retaining information

77*(1) A person who builds a bridge or major culvert for the purpose of constructing or maintaining a road must do all of the following:*

(a) prepare or obtain

(i) pile driving records,

(ii) for new materials used to build the bridge or major culvert, mill test certificates, in-plant steel fabrication drawings, and concrete test results,

(iii) soil compaction results, and

(iv) other relevant field and construction data;

(b) prepare as-built drawings of the bridge or major culvert;

(c) retain the information referred to in paragraphs (a) and (b) until the earlier of the date that

(i) the bridge or major culvert is removed, and

(ii) the person is no longer required to maintain the road.

(2) Subject to subsection (3), a person responsible for maintaining a road must retain a copy of inspection records for a bridge or major culvert associated with the road for at least one year after the bridge or major culvert is removed from the site.

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

(3) Unless the road has been deactivated, a person must submit to the district manager or the timber sales manager, as applicable, the documents, drawings and records described in subsections (1) and (2) in respect of a road if the person is no longer required to maintain the road because the district manager or timber sales manager

(a) cancelled the road permit, road use permit or special use permit for the road, and

(b) does not require the road to be deactivated.

Clearing widths

78*A person who constructs or maintains a road must ensure clearing widths are at least the minimum width necessary to accommodate the road, having regard to all of the following:*

(a) the safety of industrial users;

(b) the topography of the area;

(c) the drainage of water in the area;

(d) the stability of terrain in the area;

(e) operational requirements, including

(i) the placement of pits, quarries, landings or waste areas,

(ii) the storage of bridge or culvert material,

(iii) the amount of area required to operate equipment within the clearing width, including equipment turnaround sites,

(iv) snow removal, and

(v) fencing and other ancillary structures.

Road maintenance

79*(1) A person may maintain a road only if authorized or required to do so under the Act or this regulation.*

(2) A person who is authorized in respect of a road must maintain the road, including bridges, culverts, fords and other structures associated with the road, until

(a) the road is deactivated,

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

(b) the district manager notifies the person that the road should not be deactivated due to use or potential use of the road by others,

(c) a road permit or special use permit for the road is issued to another person, or

(d) the road is declared a forest service road under the Forest Act.

(3) Subject to subsection (4), the government must maintain a forest service road, including bridges, culverts, fords and other structures associated with the road, until the road is deactivated.

(4) The district manager may order the holder of a road use permit that authorizes the use of a forest service road to assume all or part of the responsibility to maintain the road, including bridges, culverts, fords and other structures associated with the road.

(6) A person required to maintain a road must ensure all of the following:

(a) the structural integrity of the road prism and clearing width are protected;

(b) the drainage systems of the road are functional;

(c) the road can be used safely by industrial users.

(7) A holder of a road use permit required to maintain a forest service road under subsection (4), on giving the district manager at least 30 days notice, may do one or more of the following in respect of the forest service road:

(a) build a bridge;

(b) install a major culvert;

(c) install a culvert in a fish stream.

(8) Within 30 days of receiving a notice referred to in subsection (7), the district manager may impose requirements respecting a bridge or culvert referred to in that subsection, and the holder of the road use permit must comply with those requirements.

(9) If the district manager does not impose requirements under subsection (8), the holder of the road use permit may proceed in accordance with the notice given under subsection (7).

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

Wilderness roads

81*Despite section 22.2 [non-industrial use of a road] of the Act and section 79 [road maintenance], if a forest service road, or a road authorized under a road permit, a cutting permit, a timber sale licence that does not provide for cutting permits, a special use permit or a woodlot licence is not being used by industrial users,*

(a) section 79 (6) (a) and (b) apply to that road only to the extent necessary to ensure there is no material adverse effect on a forest resource, and

(b) section 79 (6) (c) does not apply to that road.

Road deactivation

82*(1) A person who deactivates a road must do the following:*

(a) barricade the road surface width in a clearly visible manner to prevent access by motor vehicles, other than all-terrain vehicles;

(b) remove bridge and log culvert superstructures and stream pipe culverts;

(c) remove bridge and log culvert substructures, if the failure of these substructures would have a material adverse effect on downstream property, improvements or forest resources;

(d) stabilize the road prism or the clearing width of the road if the stabilization is necessary to reduce the likelihood of a material adverse effect in relation to one or more of the subjects listed in section 149 (1) of the Act.

(2) A person may submit to the district manager, in writing, a request for an exemption from the requirements of subsection (1) (a) if

(a) the person has not begun deactivating the road, and

(b) the road does not contain any bridges or major culverts.

(3) The minister, in a notice given to a person who submits a request under subsection (2), may exempt the person if the minister is satisfied that the effectiveness of the works described in subsection (1) will not be negatively impacted by motor vehicle use.

Hazard warning

83 *At all times while a road is being deactivated, a person must have a sign posted that warns users of the deactivation.*

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

Notice of use of forest service road or road authorized under permit or licence

22.12 *(1) A person who intends to use a forest service road for a timber harvesting purpose, silviculture purpose or natural resource development purpose must provide notice to the following, in accordance with subsection (3):*

(a) the minister;

(b) if applicable, the holder of a road use permit to whom the obligation to maintain the forest service road has been transferred.

(2) If a road is authorized under any of the following permits or licences, a person who intends to use the road for a timber harvesting purpose, silviculture purpose or natural resource development purpose must provide notice to the holder of the permit or licence, in accordance with subsection (3):

(a) a road permit;

(b) a cutting permit;

(c) a woodlot licence;

(d) a timber sale licence;

(e) a special use permit.

(3) A notice required under subsection (1) or (2) must

(a) be given on or before the earlier of the following:

(i) the date that is 6 days before the date on which the person will begin to use the road;

(ii) the prescribed date, if any,

(b) be given in the prescribed form and manner, if any, and

(c) specify the date on which the person will begin using the road.

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

Notification of timber harvesting or road construction

85*(1) An agreement holder must notify the district manager before*

(a) beginning

(i) timber harvesting, or

(ii) construction of a road that is not a temporary access structure, and

(b) re-starting the activities described in paragraph (a) (i) and (ii) in a cutblock after an inactive period of 3 months or more.

(2) A notice under subsection (1) must specify

(a) the location of the timber harvesting or road, including any administrative identifier that relates to the location,

(b) a contact name and contact information, and

(c) the projected date for beginning timber harvesting or road construction.

Notice of requirement for payment by user of road

22.3 *(1) In this section, "person responsible for maintaining a road" means the following:*

(a) in relation to a road authorized under a road permit, the holder of the permit;

(b) in relation to a road authorized under a woodlot licence, the holder of the licence;

(c) in relation to a forest service road, the holder of a road use permit to whom the obligation to maintain the forest service road has been transferred, if applicable;

(d) in relation to a prescribed forest service road, the minister.

(1) By written notice in accordance with this section, the person responsible for maintaining a road may require payment, within the limits imposed under subsection (2) (b), from a person who uses the road for

(a) a timber harvesting purpose, silviculture purpose or natural resource development purpose, or

(b) a prescribed purpose.

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

(1.1) The holder of a road use permit to whom the obligation to maintain a forest service road has been transferred may give a notice under subsection (1) in relation to the forest service road only in the prescribed circumstances.

(2) A written notice under subsection (1) must specify

(a) that payment is required, and

(b) the amount of the payment, which amount must be limited to one or more of the following:

(i) a reasonable contribution to the expense of maintaining the road;

(ii) the reasonable expense of modifying the road to accommodate the special needs of the person;

(iii) the reasonable expense of repairing any damage to the road caused by the person's use of the road.

Appendix E: Practice Requirements under the Forest Planning and Practices Regulation

Visual Quality Definitions

The objectives that may apply to a mapped visual quality polygon are classified as one of the following: Preservation, Partial Retention, Modification or Maximum Modification. The regulatory definitions that continually apply to the visibility of all harvesting and road building, within a visual polygon are provided immediately below.

(a) preservation: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is

(i) very small in scale, and

(ii) not easily distinguishable from the pre-harvest landscape;

(b) retention: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is

(i) difficult to see,

(ii) small in scale, and

(iii) natural in appearance;

(c) partial retention: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is

(i) easy to see,

(ii) small to medium in scale, and

(iii) natural and not rectilinear or geometric in shape;

(d) modification: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint,

(i) is very easy to see, and

(ii) is

(A) large in scale and natural in its appearance, or

(B) small to medium in scale but with some angular characteristics;

(e) maximum modification: consisting of an altered forest landscape in which the alteration, when assessed from a significant public viewpoint,

(i) is very easy to see, and

(ii) is

(A) very large in scale,

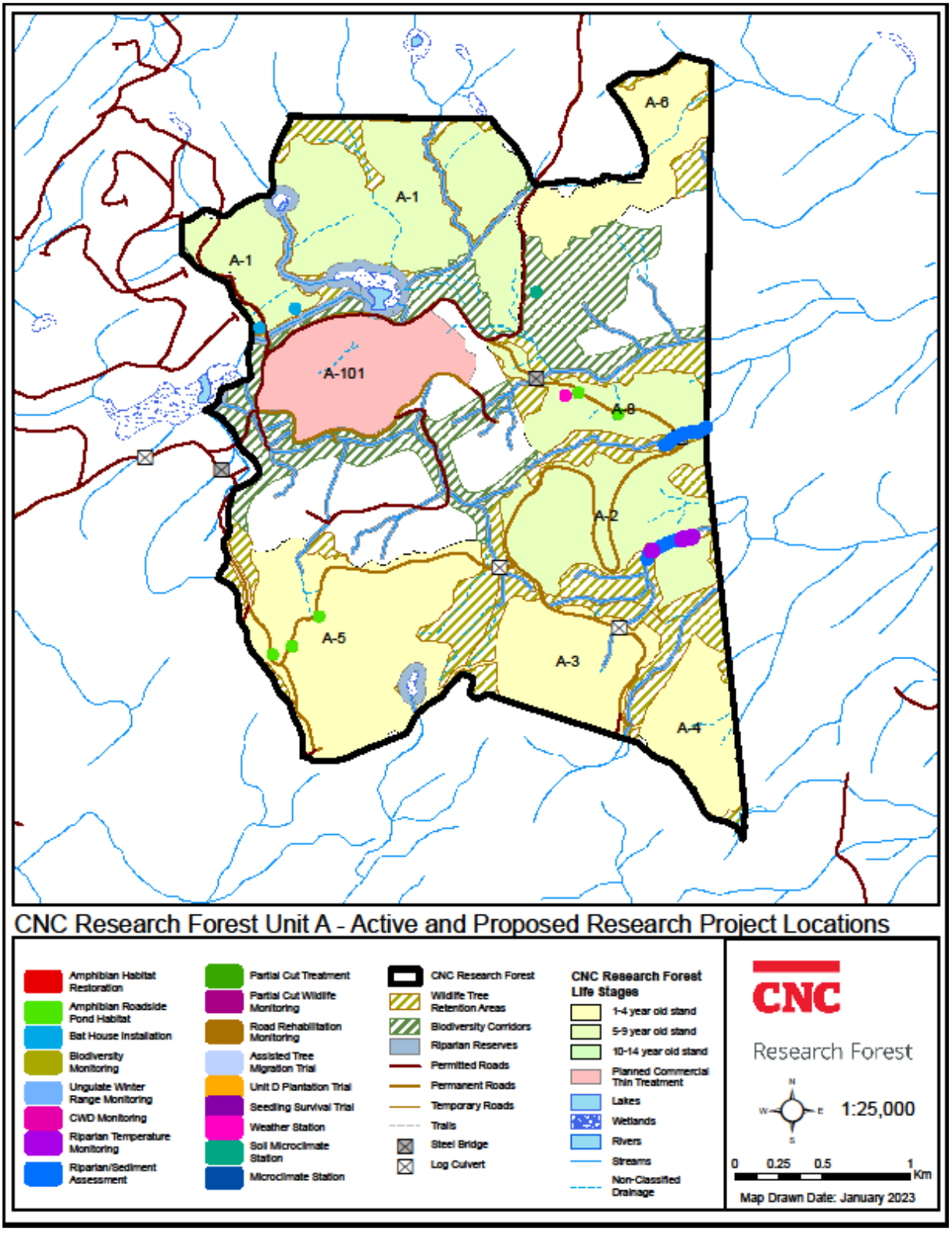
(B) rectilinear and geometric in shape, or

(C) both.

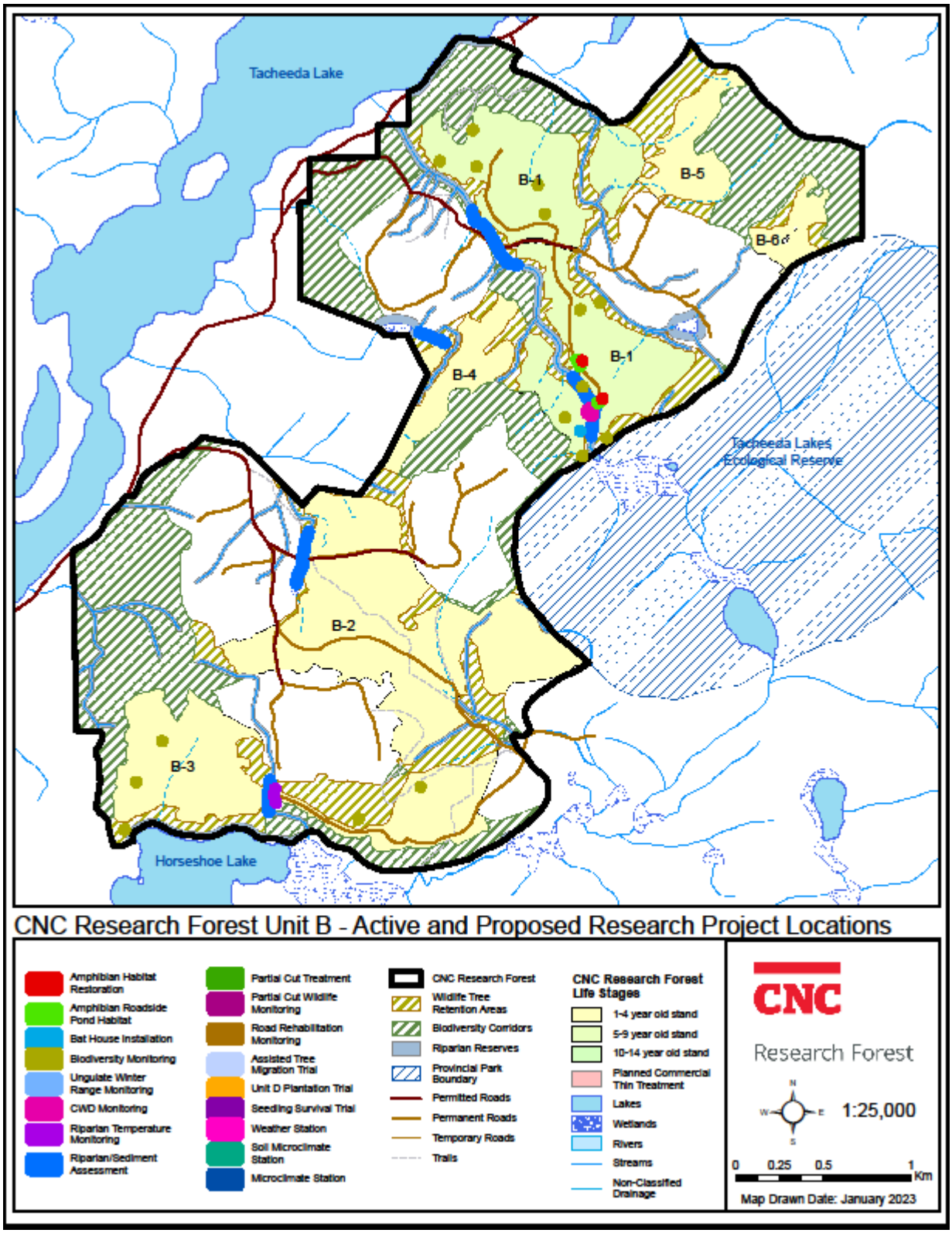
Appendix F - Research Project Mapping

Appendix F: Research Project Location Maps

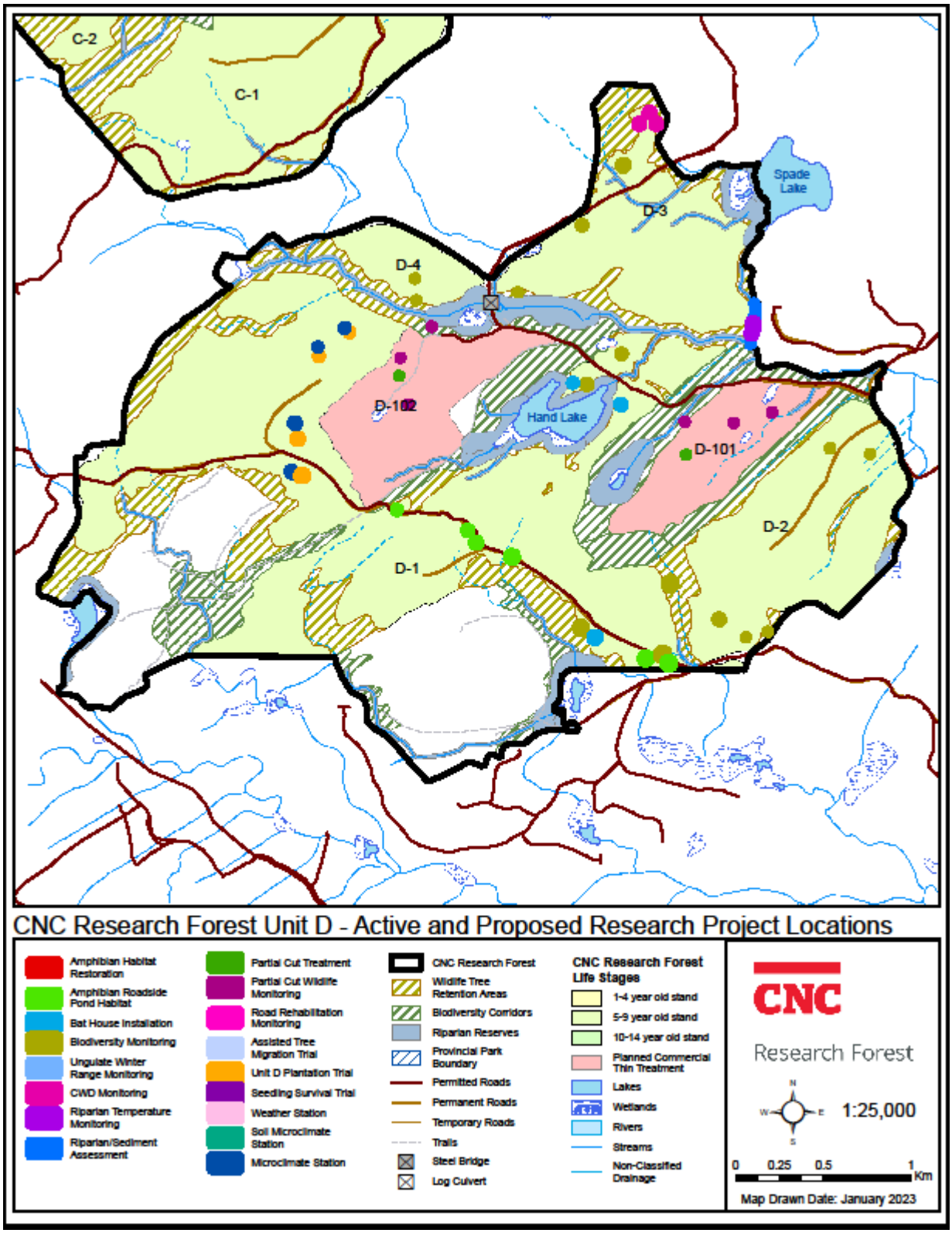
The following maps show the location of both planned and active research sites within and immediately adjacent to the CNC Research Forests.



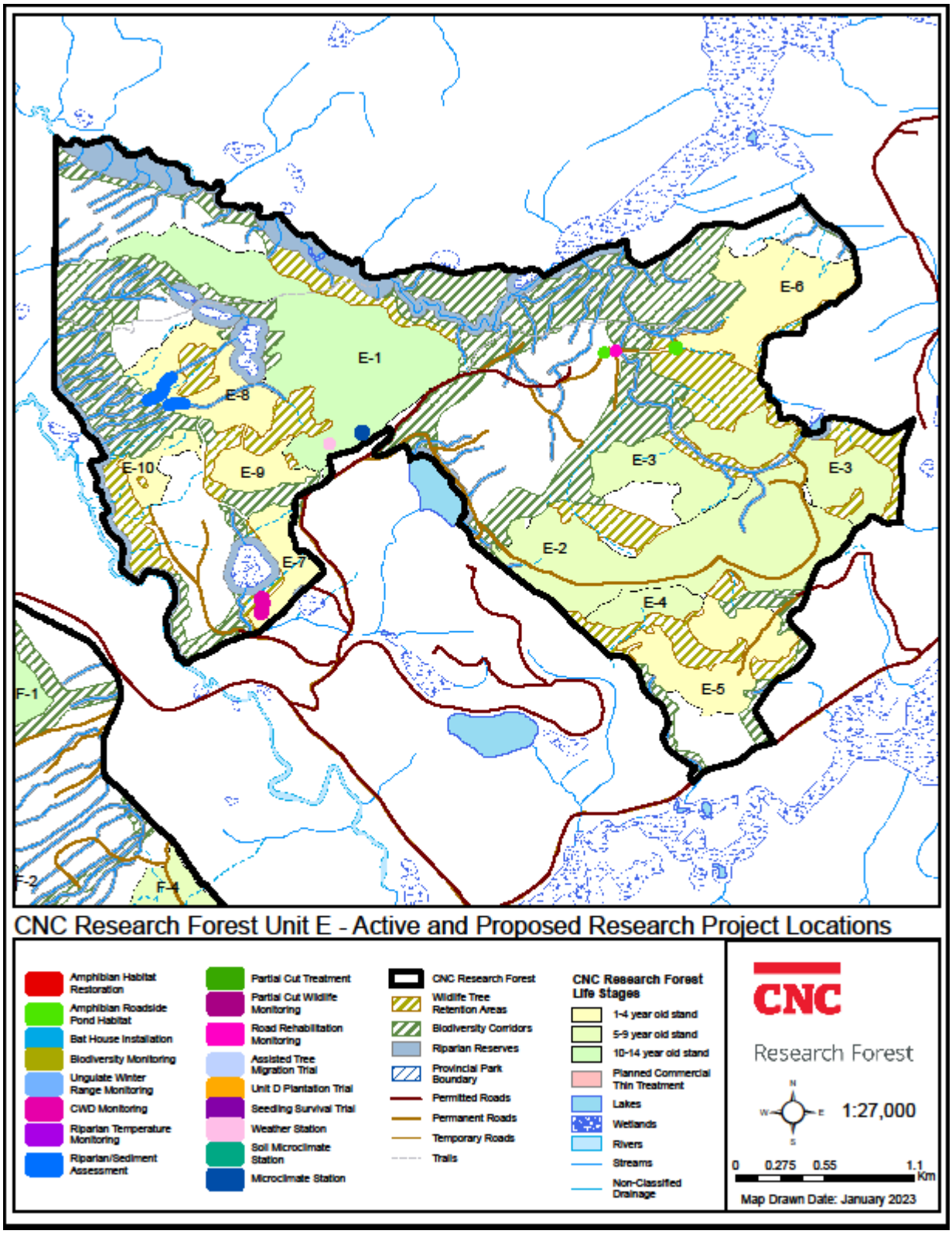
Appendix F: Research Project Location Maps



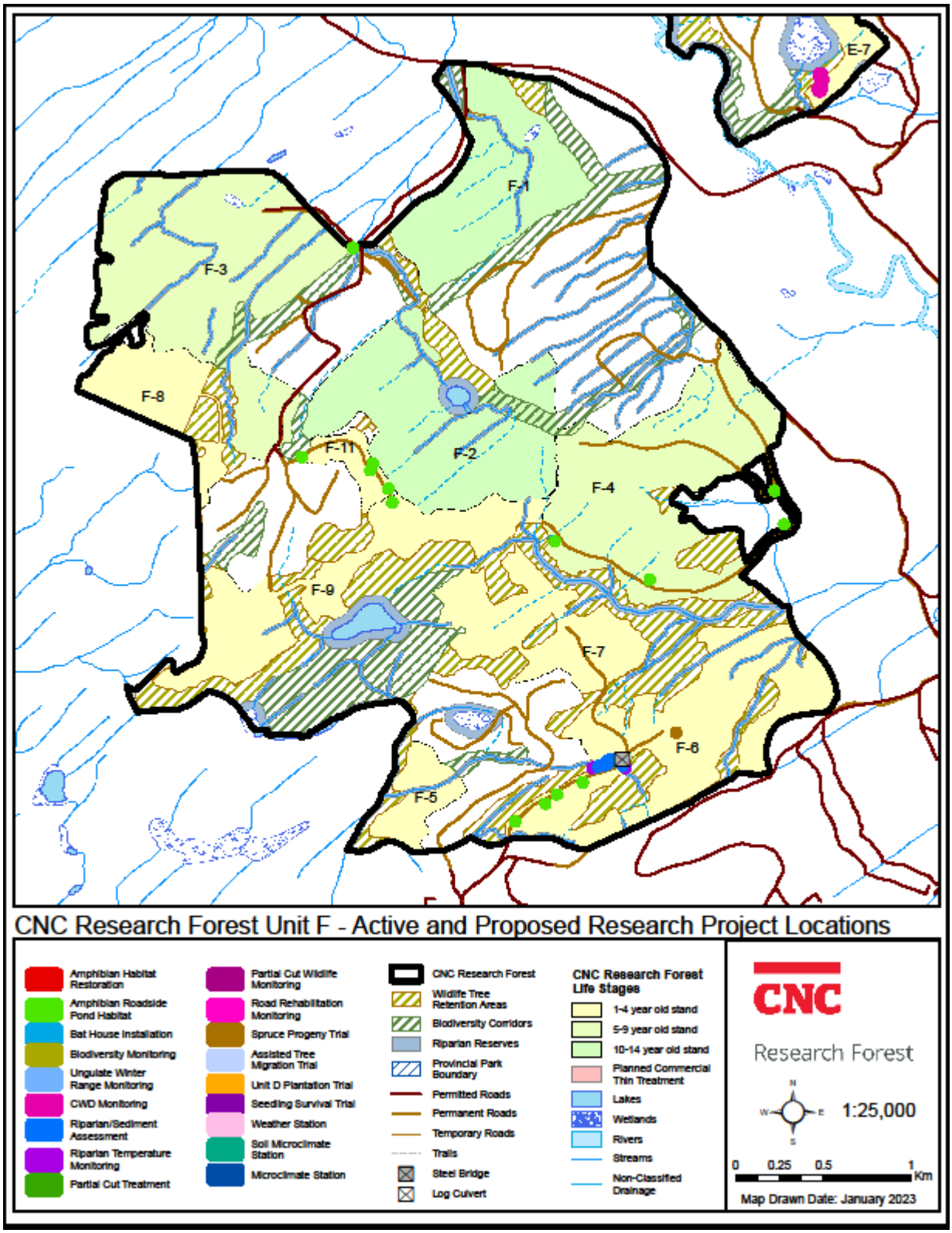
Appendix F: Research Project Location Maps



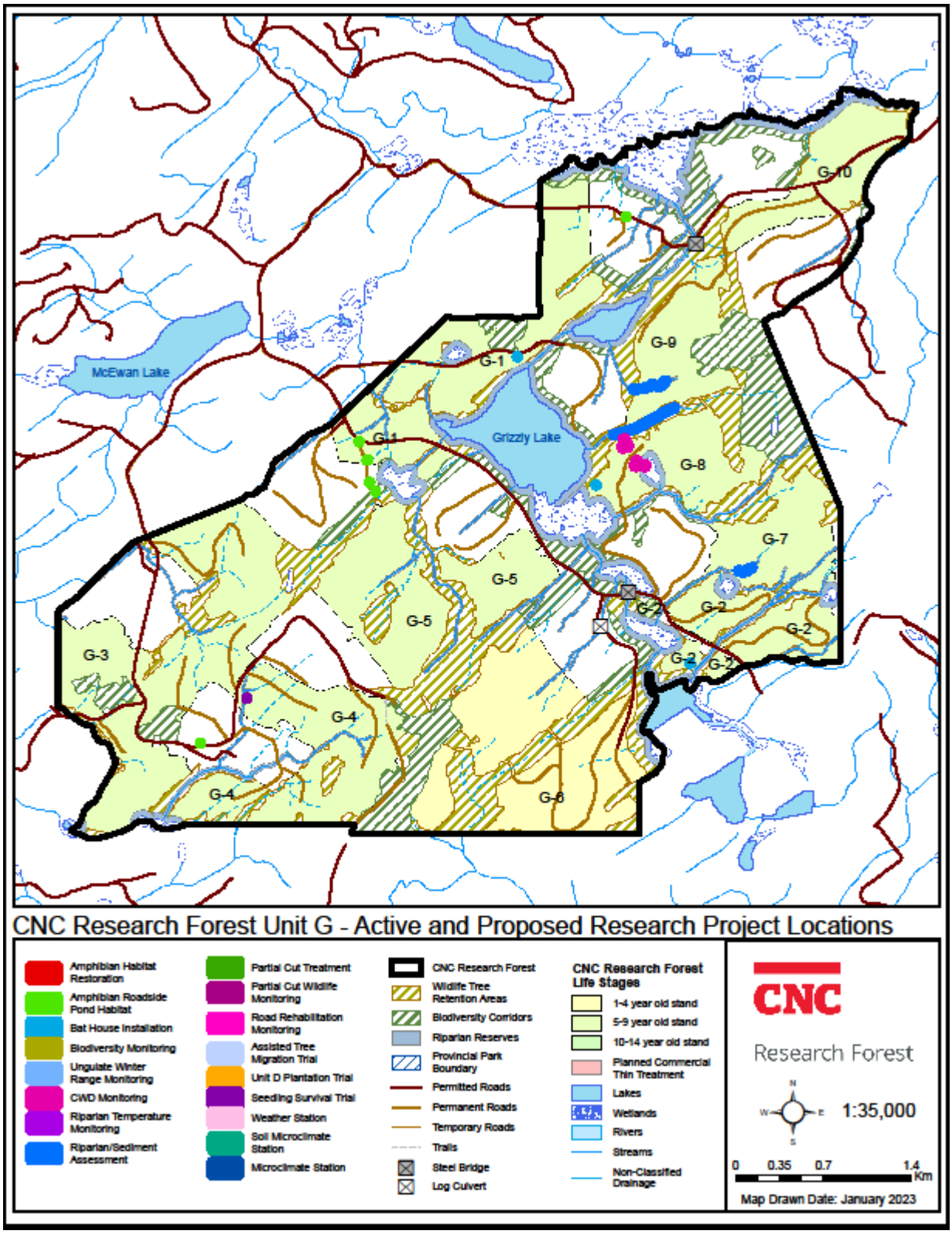
Appendix F: Research Project Location Maps



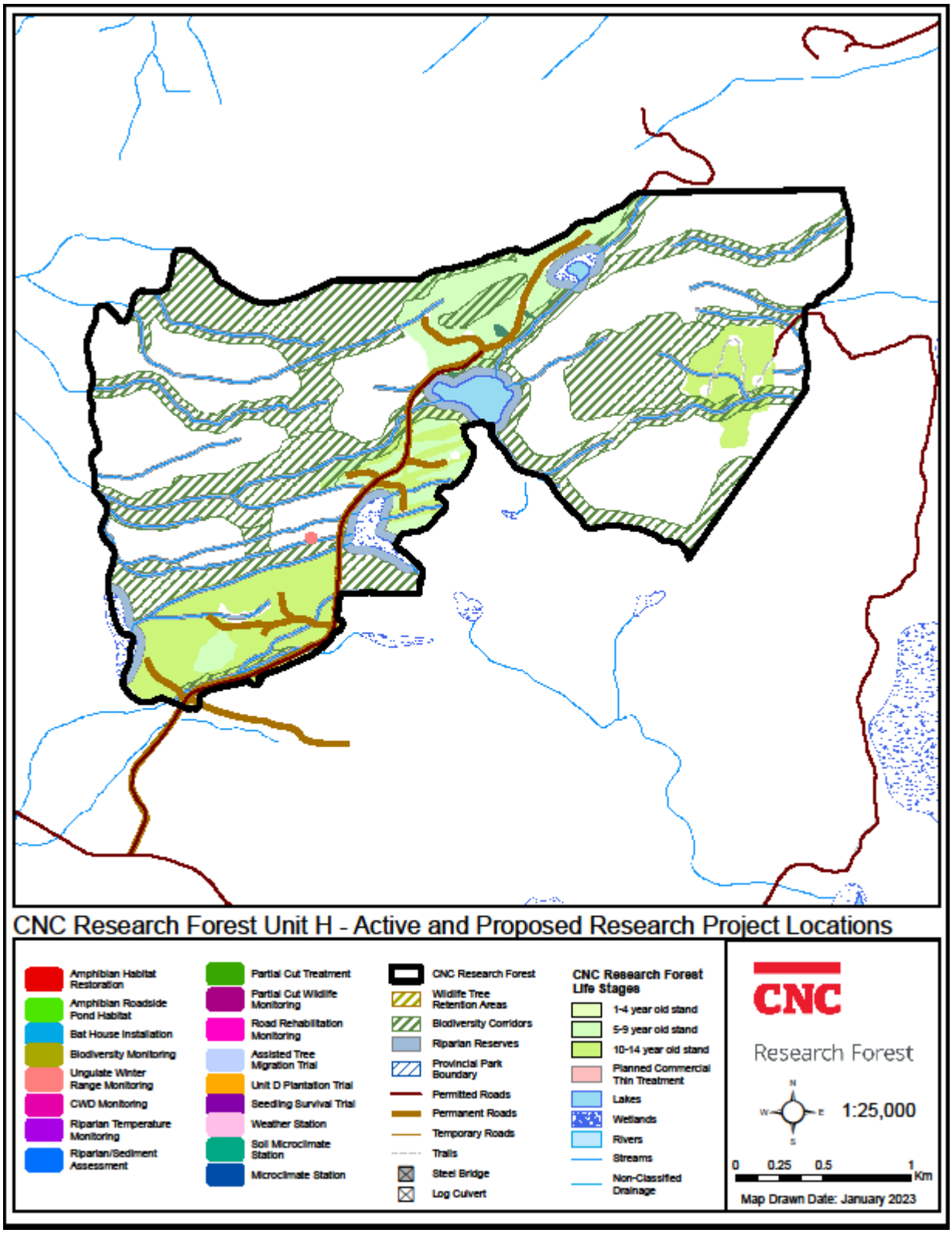
Appendix F: Research Project Location Maps



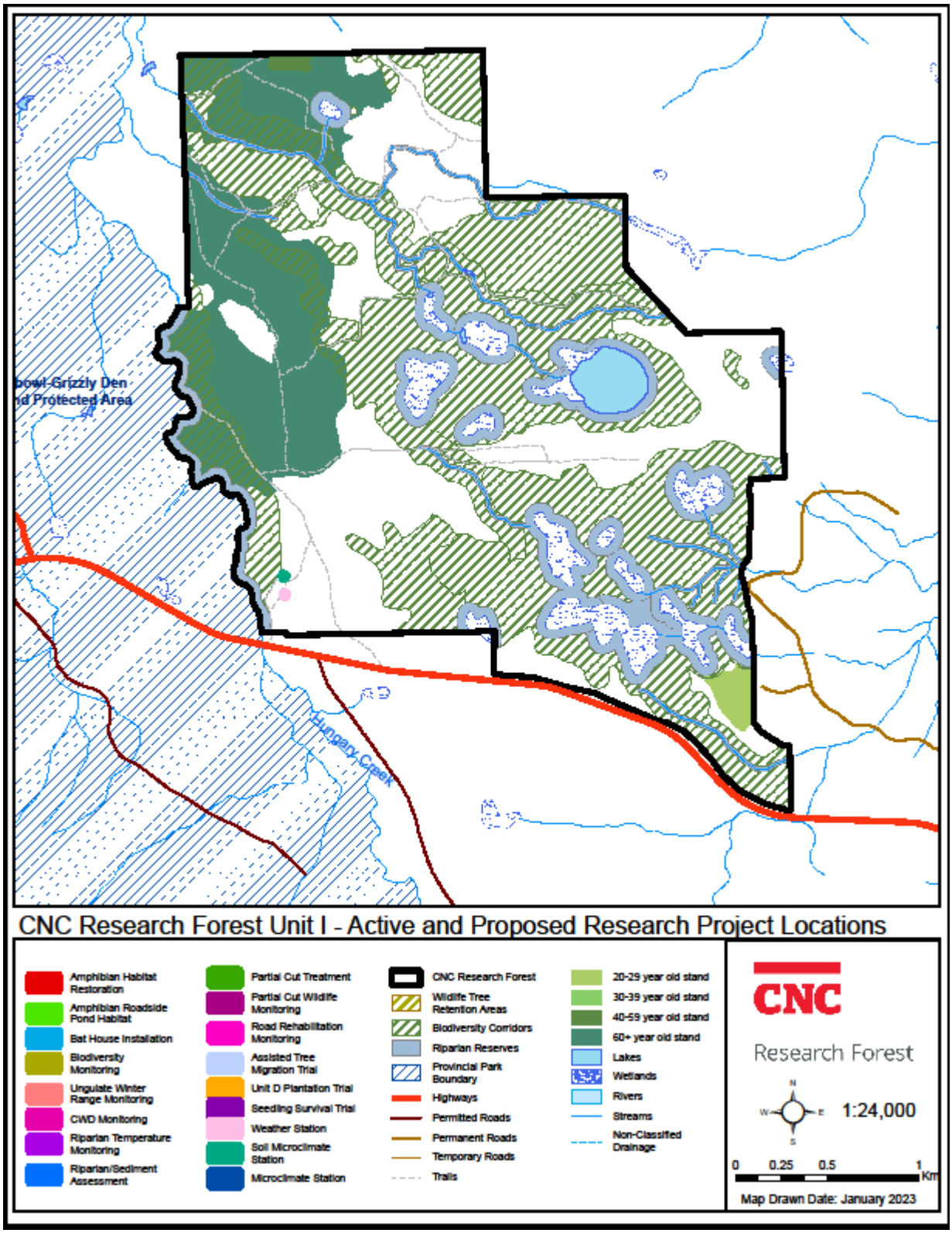
Appendix F: Research Project Location Maps



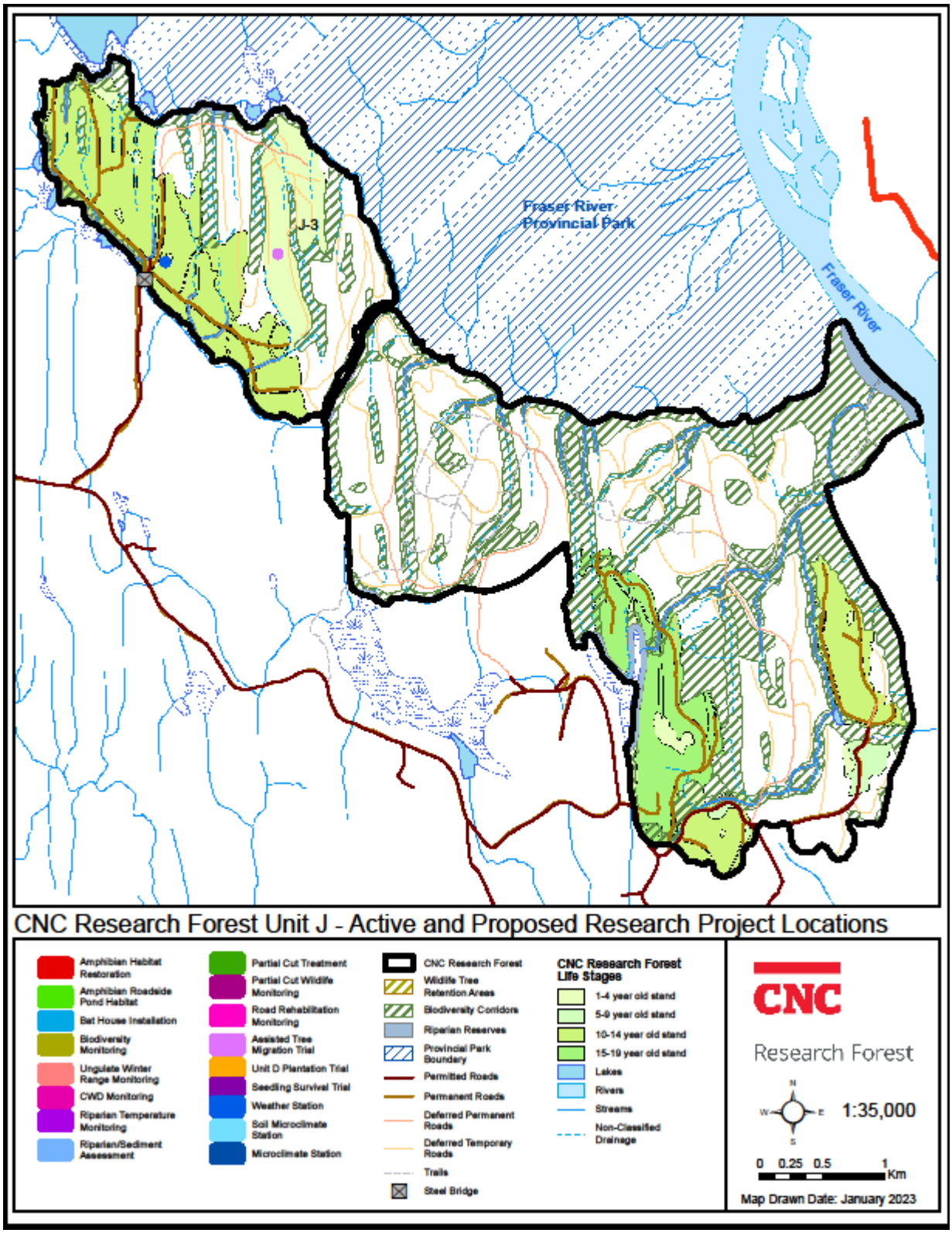
Appendix F: Research Project Location Maps



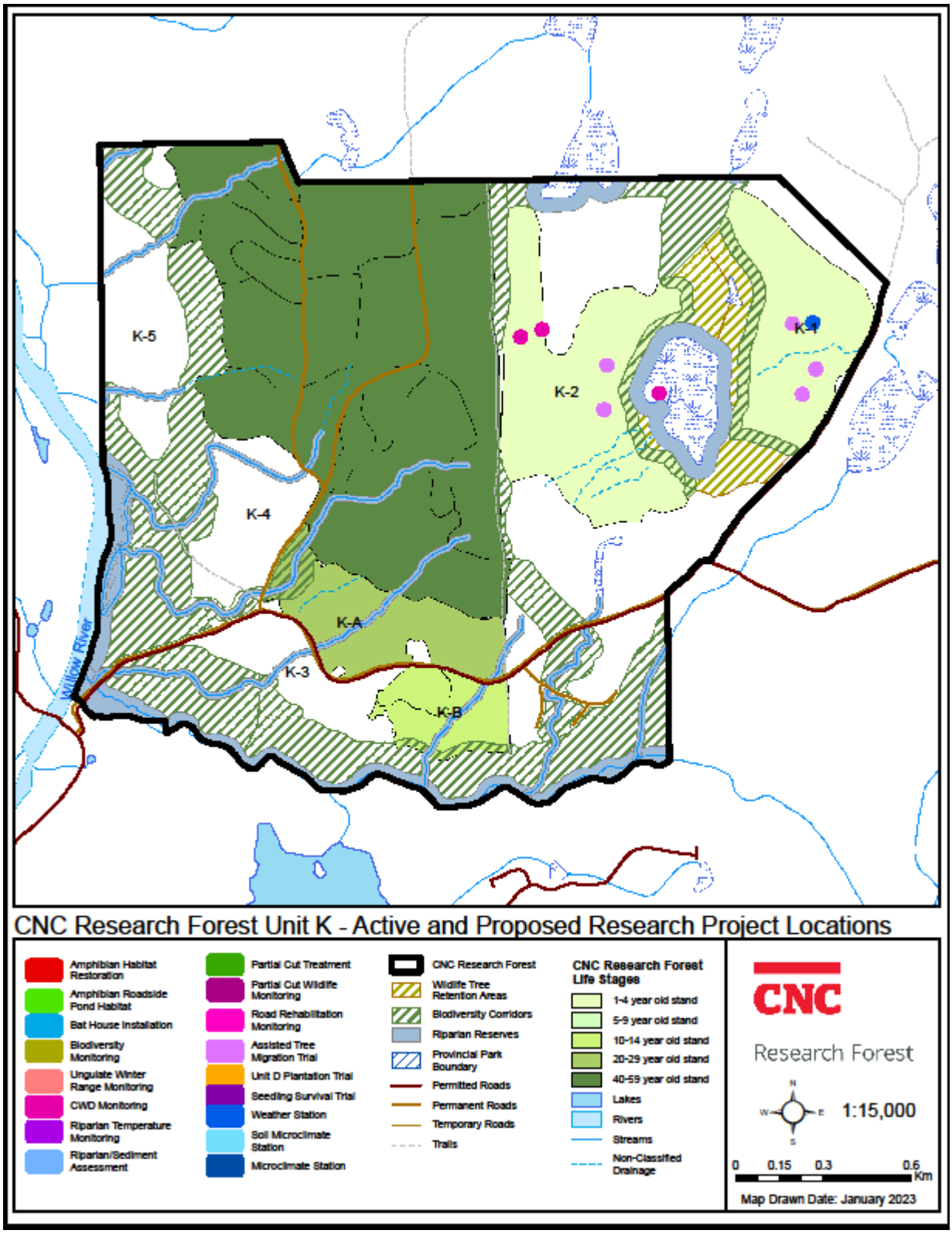
Appendix F: Research Project Location Maps



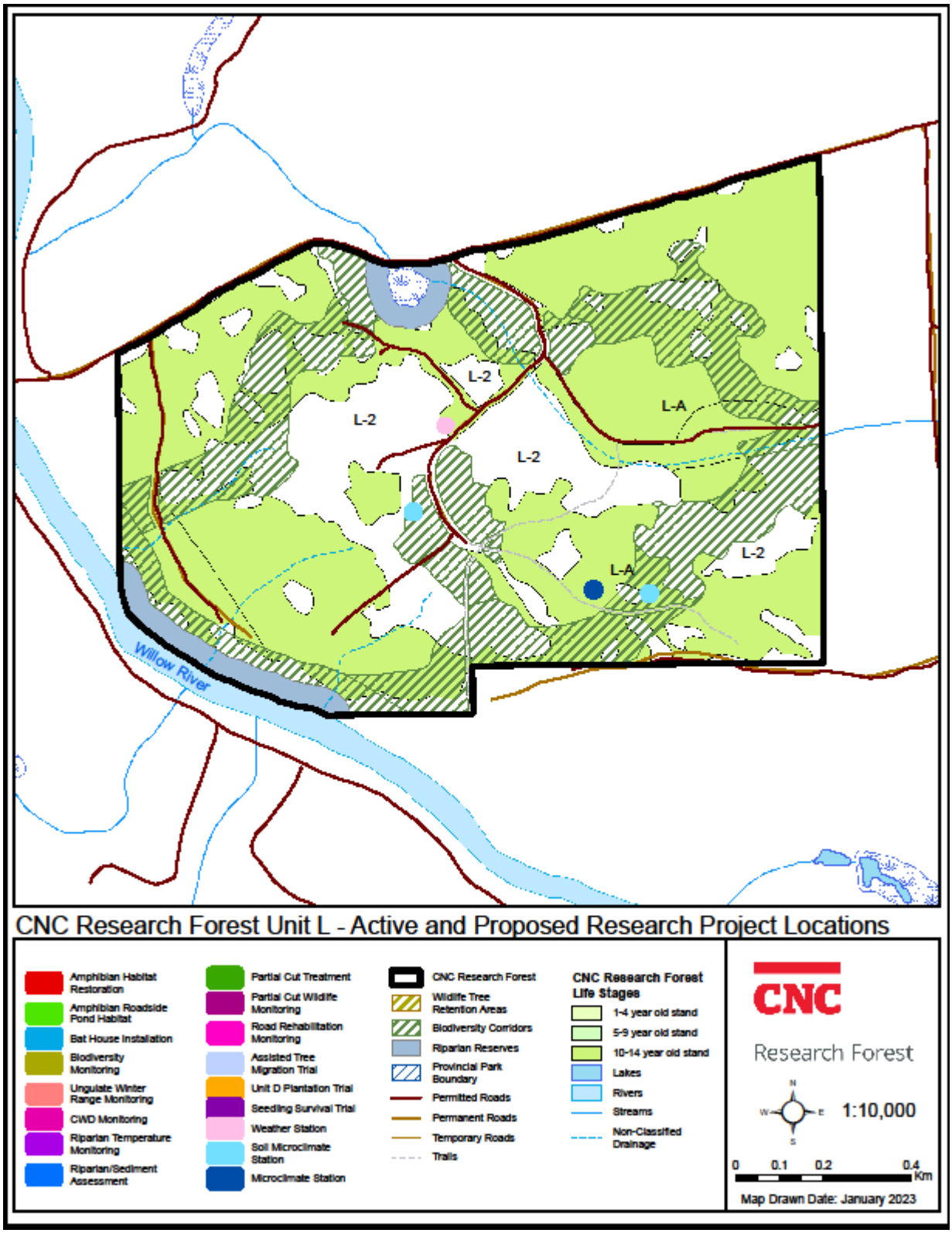
Appendix F: Research Project Location Maps



Appendix F: Research Project Location Maps



Appendix F: Research Project Location Maps



Appendix G - Timber Supply Review

College of New Caledonia
Research Forest

Timber Supply Analysis Report

Version 7b

June 17, 2022

Submitted by:
Carl Pollard, RPF
College of New Caledonia

Completed by:
Wyatt Klopp, FIT
Industrial Forestry Service Ltd.

Table of Contents

Table of Figures

List of Appendices

1. Introduction

A timber supply analysis was conducted to assess the short- and long-term timber supply implications of alternative levels of harvesting and management practices for the College of New Caledonia (CNC)'s Research Forest.

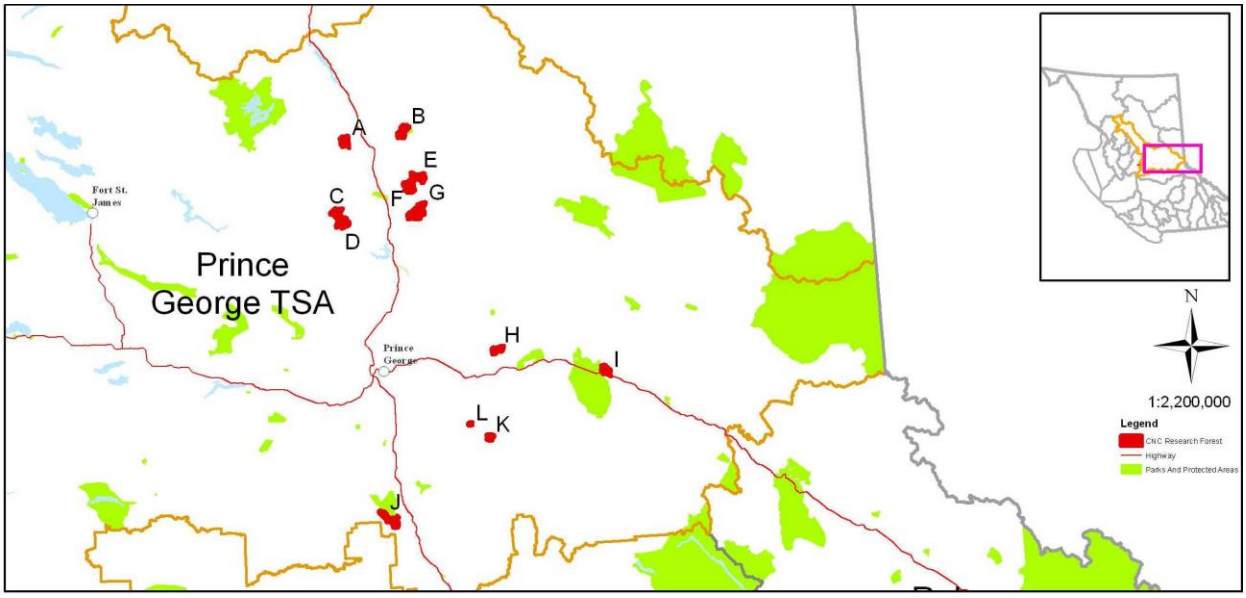
The Base Case scenario for the Research Forest is described in this report along with various harvest and management metrics.

This report also describes the sensitivity analyses that were performed in the forest estate model. This was done to test the sensitivity of the model to various assumptions made on the Research Forest.

2. Description and History of CNC's Research Forest

CNC manages a Research Forest that comprises of 12 individual research units (i.e., Units A to L) that are located north, south, and east of Prince George, British Columbia (Map 1). These units when combined yield a gross area of 12,562.3 ha.

Map 1. Key Map of CNC's Research Forest



3. Information Preparation for the Timber Supply Analysis

The detailed process of creating the timber harvesting land base (THLB) and setting up the forest estate model for the Research Forest is described in the appended Information Package report (Appendix I) and summarized in the table below (

Table ***1***).

Maps showing the land base classifications in the individual Research Forest units can be found appended to this report (Appendix II).

Table 1. Timber Harvesting Land Base Definition

Land Base Classification	Net Area (ha)	Gross Area (ha)
Total Area	**12,562.4**	**12,562.4**
Less:		
Non-Forest / Non-Productive	439.2	443.9
Existing Roads, Trials & Landings	117.6	123.6
Crown Forested Land Base	**12,005.6**	
Less:		
Physically Inoperable / Steep Slopes	536.4	547.9
Low Productivity	95.6	95.6
PFT - Hemlock & Cedar Leading	431.8	491.1
Riparian Reserve Zones	692.0	941.7
Initial Timber Harvesting Land Base	**10,249.7**	
Less Aspatial Netdowns		
Future WTRAs (4% THLB)	410.0	
Future Permanent Roads (1.5% THLB)	153.7	
Future Harvesting Land Base	**9,686.0**	

Figure 1 displays the land base classifications of the Research Forest separated by Unit.

Figure 1. Land Base Classification by Research Forest Unit

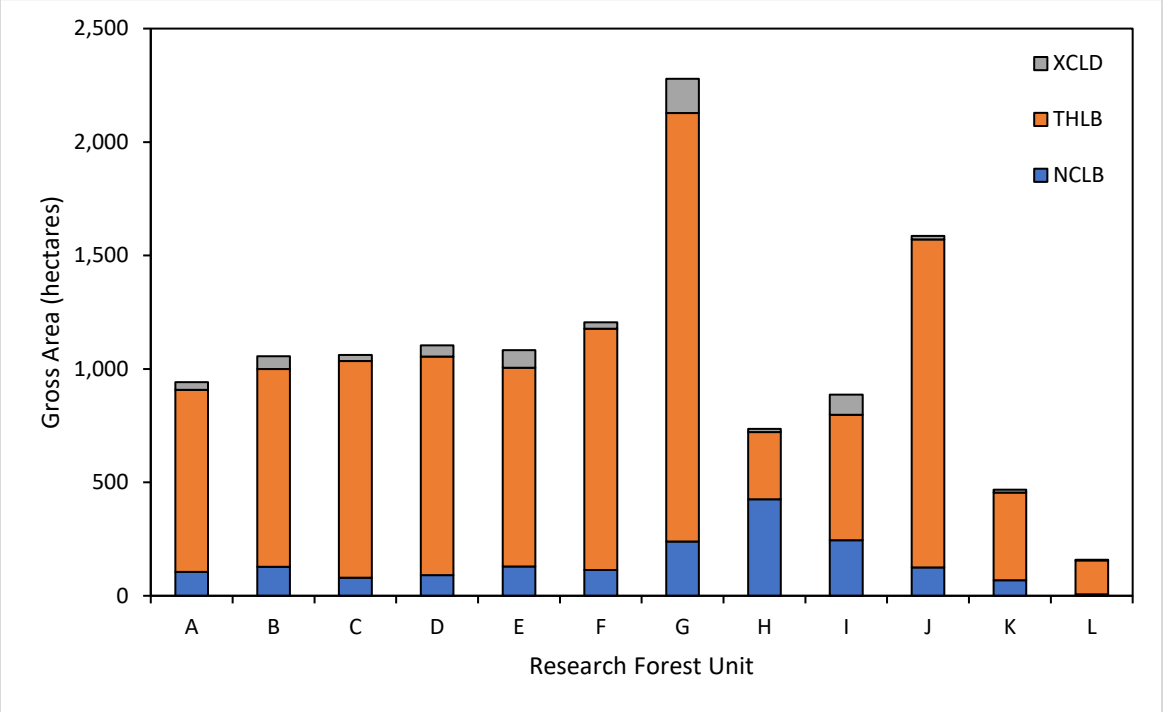


Figure 2 displays the current leading tree species in the crown forest (CFLB), timber harvesting (THLB), and non-contributing (NCLB) land bases.

Figure 2. Distribution of species by leading timber type

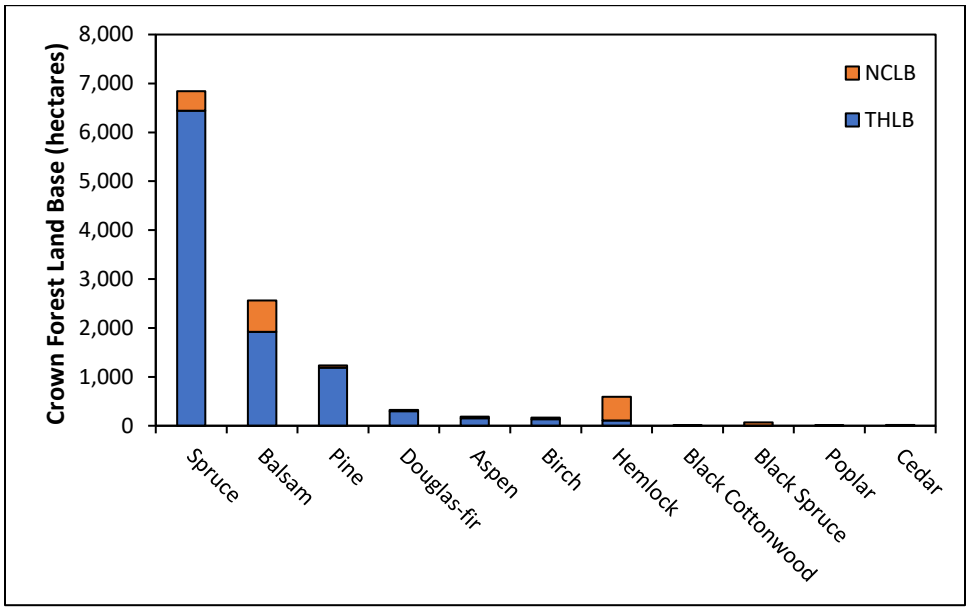
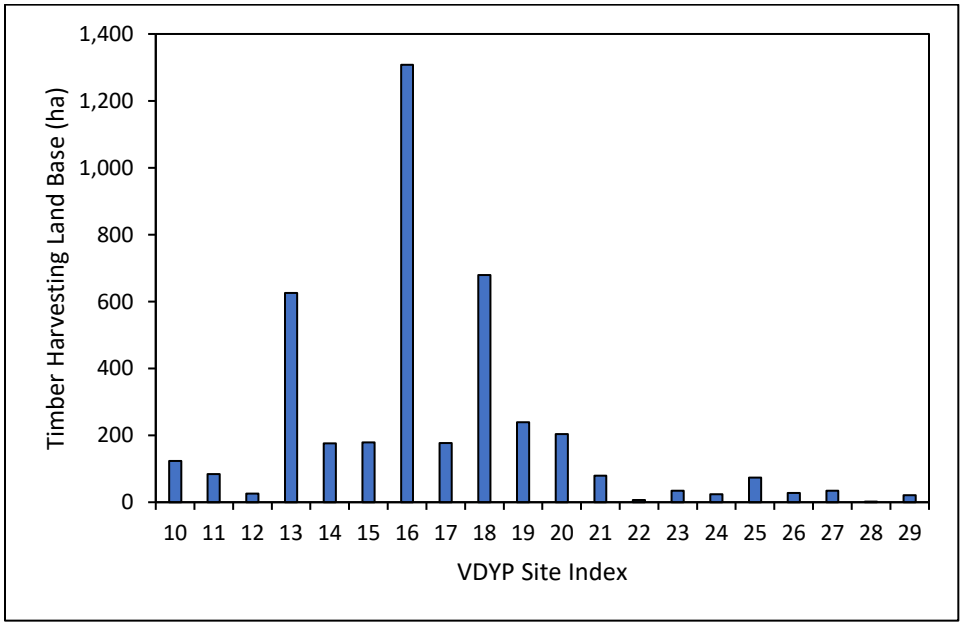


Figure 3 displays the site index of the remaining unmanaged stands in the Research Forest.

Figure 3. Distribution of VDYP-generated Site Index for Unmanaged Stands

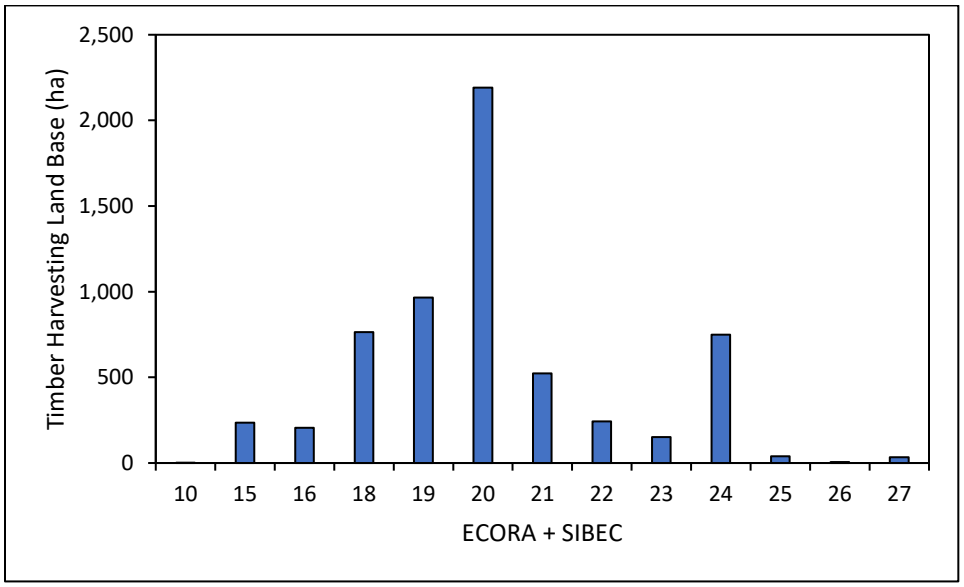


Managed and future managed stands were assigned adjusted SIBEC site indexes based on CNC site sampling within the Research Forest (Table 2, Figure 4).

Table 2. Site Index Adjustments

BEC Zone	Leading Species	Research Forest Unit	Adjustment to SIBEC
SBSwk1, SBSvk	Spruce	A to G	+21.0%
SBSwk1, SBSvk	Pine	A to G	+3.6%
SBSmk1, SBSwk1, SBSdw3	All	J, K, L	+4%

Figure 4. Distribution of adjusted SIBEC-generated Site Indexes for Future Managed Stands



In the last decade, CNC has harvested a significant portion of the Research Forest in response to pine- and spruce-beetle outbreaks (Figure 5). This has resulted in land base with a skewed age class distribution (Figure 6).

Figure 5. Harvest History by Decade

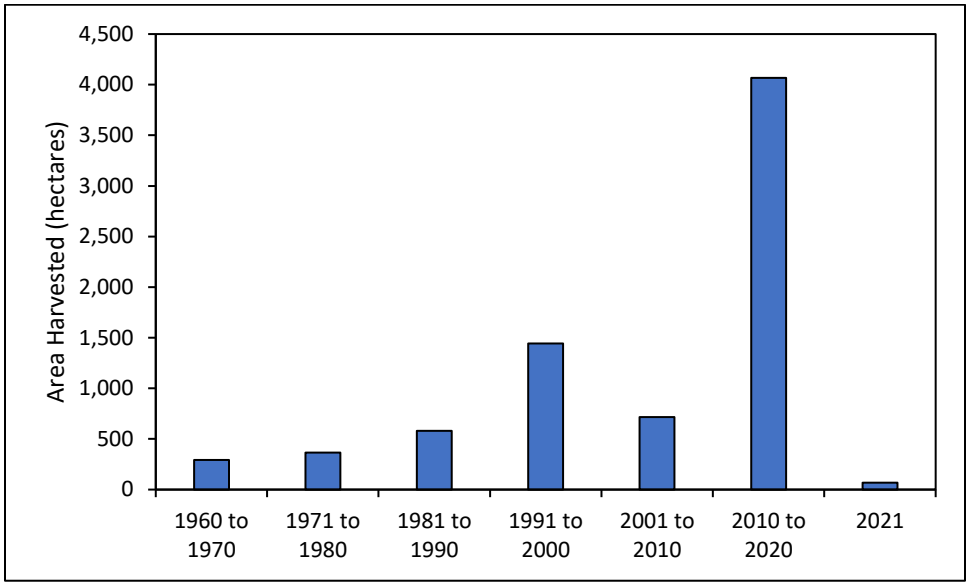
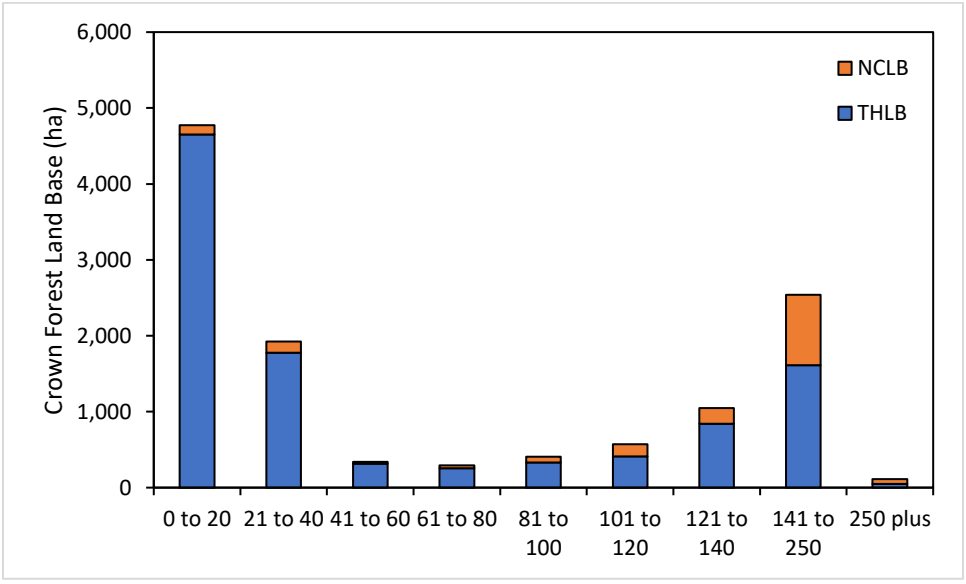


Figure 6. Current Age Class Distribution



4. Timber Supply Analysis Methods

The timber supply analysis was conducted in three phases: (1) forest inventory aggregation, (2) growth and yield, and (3) forest estate modeling. See CNC's *Information Package* for more details (Appendix I).

Forest inventory aggregation was completed using geographic information system (GIS) to overlay the various spatial features relevant to the management of the Research Forest. The GIS used in the TSR was ArcGIS version 10.8.1.

Growth and yield tables were created to existing and future growth of stands within the forest

estate model. The tables were based on the existing forest inventory data and existing/proposed silvicultural management. The yield tables were synthesized using Variable Density Yield Projection (VDYP) version 7.0 for unmanaged stands; and (Batch) Table Interpolation Program for Stand Yields (TIPSY) version v4.4 for managed and future managed stands.

Forest estate modeling compiled the forest inventory aggregation and growth and yield information; and integrated other forest management assumptions. The forest estate modeled used in the TSR analysis was Remsoft's Woodstock Optimization Studio version 2021.3, which is a linear programming model that maximizes harvest flow in consideration of management objectives/constraints, such as visual sensitive polygons, biodiversity corridors, and old-growth forests.

5. Base Case Scenario

5.1. Harvest Flows

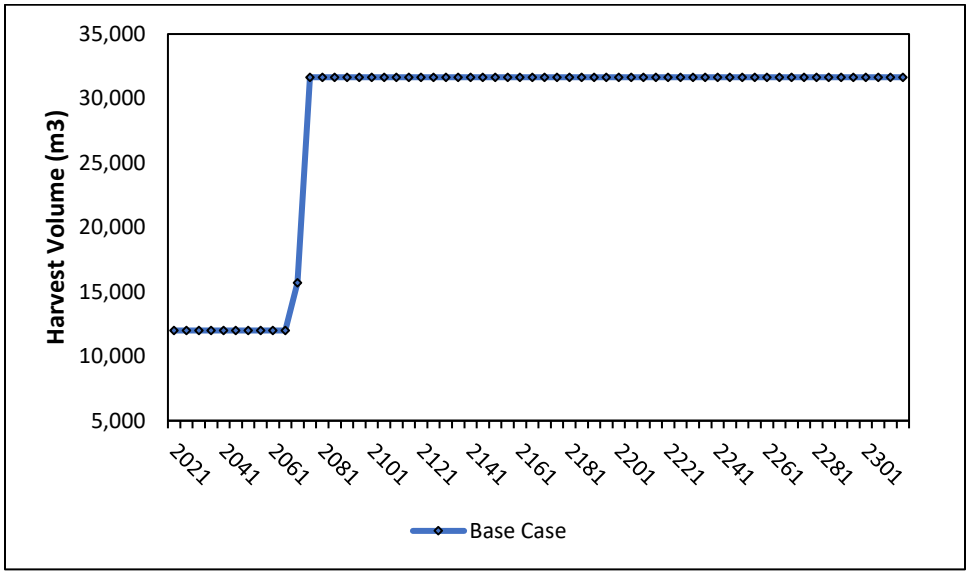
The base case scenario harvest level for the Research Forest was derived using three harvest constraints, which were:

1. From 0 to 25 years, an even-flow harvest was assumed in the Research Forest.
2. From 25 to 100 years, the harvest objective was changed to a non-declining yield harvest to allow harvesting to capture the increasing availability of managed stands.
3. From 100 to 200 years, the harvest objective reverted to an even-flow harvest. The harvest was also constrained so that the THLB growing stock was relatively stable and not liquidated as it nears the end of the modeling planning horizon.

5.2. Harvest Forecast in Base Case

The harvest flow is the forecasted net harvest (minus non-recoverable losses), and it is forecast on a 300-year planning horizon (Figure 7). The net initial harvest level is forecast at 12,000m3/year for 40 years. The net long-term harvest level of 31,650 m3/year is reached after 50 years.

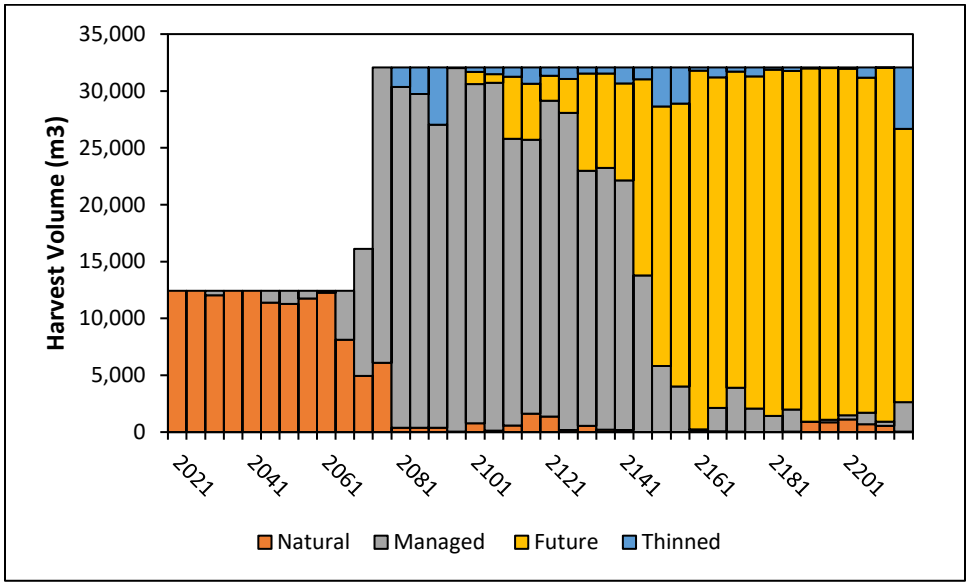
Figure 7. Harvest Level of the Base Case Forecast



The harvest in the next 50 years will continue to focus on unmanaged stands in the Research Forest (Figure 8). Managed stands become increasingly available after 2071 which results in an uplift to the annual harvest.

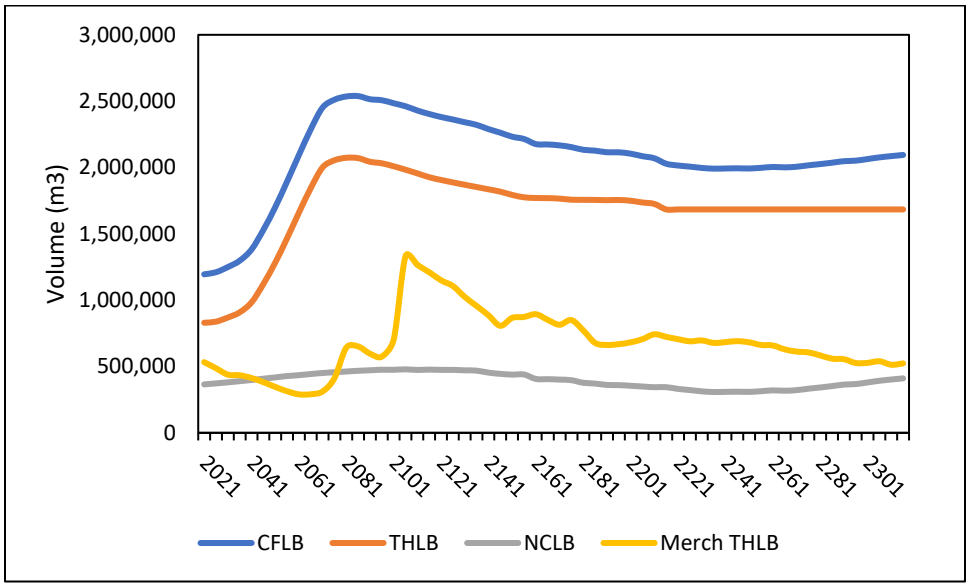
Future managed stands really begin to contribute to the harvest in 2131 (or 110 years) and become a major part of the harvest in 2151 (or 125 years).

Figure 8. Stand Management Change in the Base Case Forecast



The growing stock in the Research Forest has a sharp incline in the first 100 years before stabilizing throughout a 300-year planning period (Figure 9). This is likely the result of the recent elevated harvest in response to the pine- and spruce-beetle outbreaks in the Research Forest. The early rapid increase in growing stocks reflects the incoming growth of these newly planted stands. The later but steady decrease in the growing stock is the progression towards a more stable growing stock. The planning horizon was extended from 200- to 300-year planning horizon to show the stocks stabilizing over time.

Figure 9. Growing Stock Inventory in the Base Case Forecast



The amount of area harvested during the first 50 years average about 50 hectares per year and then jumps to about 90 hectares during the harvest uplift (Figure 10).

The volume per hectare begins at around 150-260 cubic metres per year but steadily increases throughout the planning period (Figure 11).

The average stand age decreases slowly over time to an average age of 100 years (Figure 12).

Figure 10. Harvest Area in the Base Case Forecast

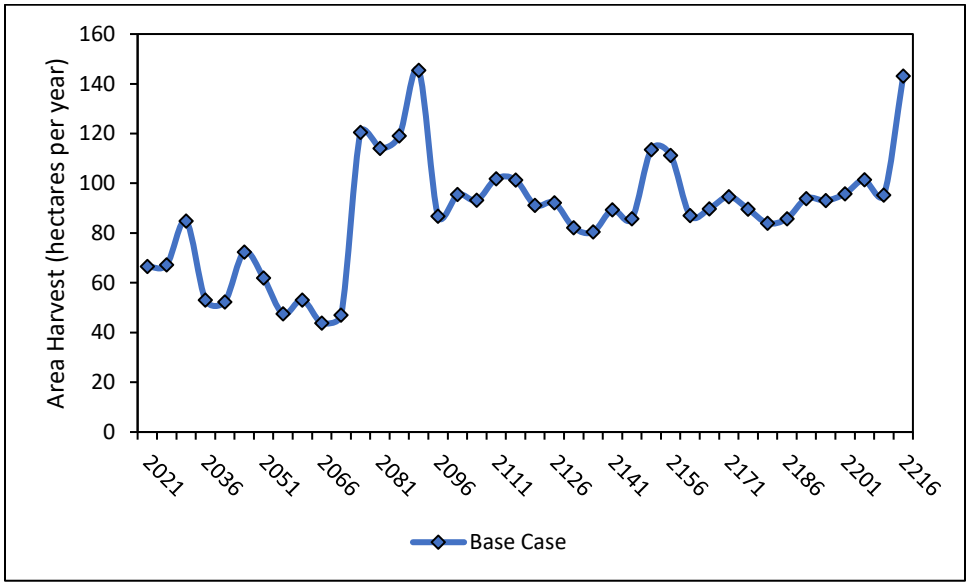


Figure 11. Average Stand Volume at Harvest in the Base Case Forecast

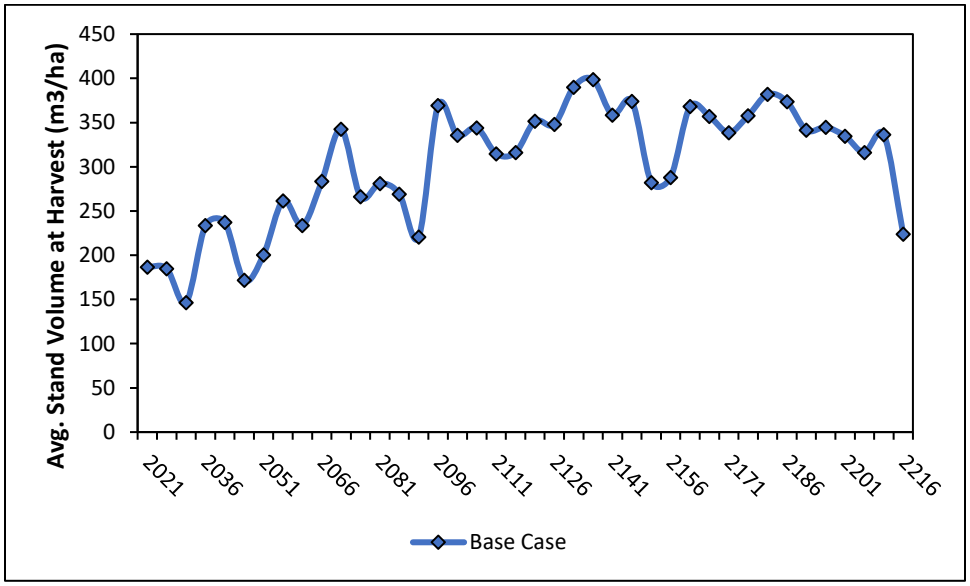
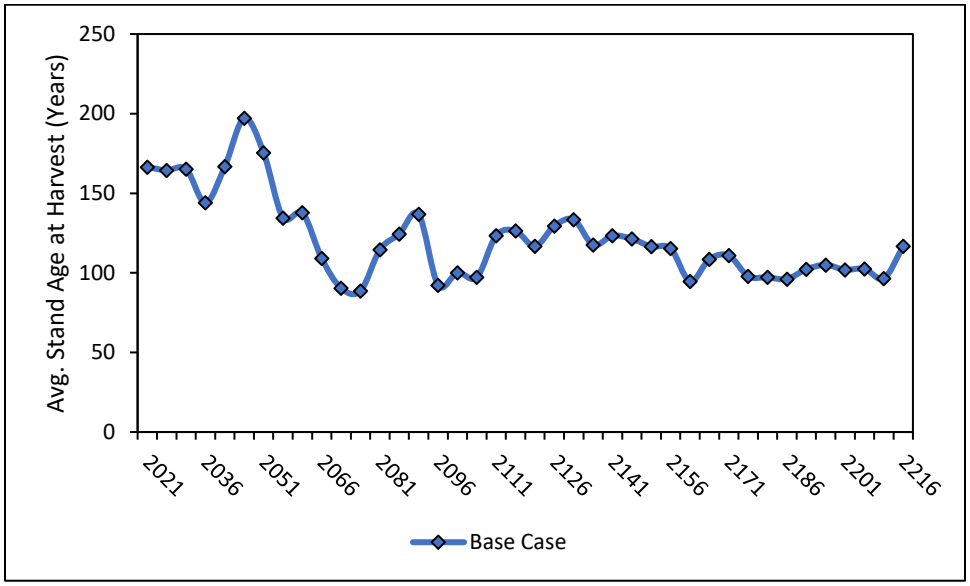


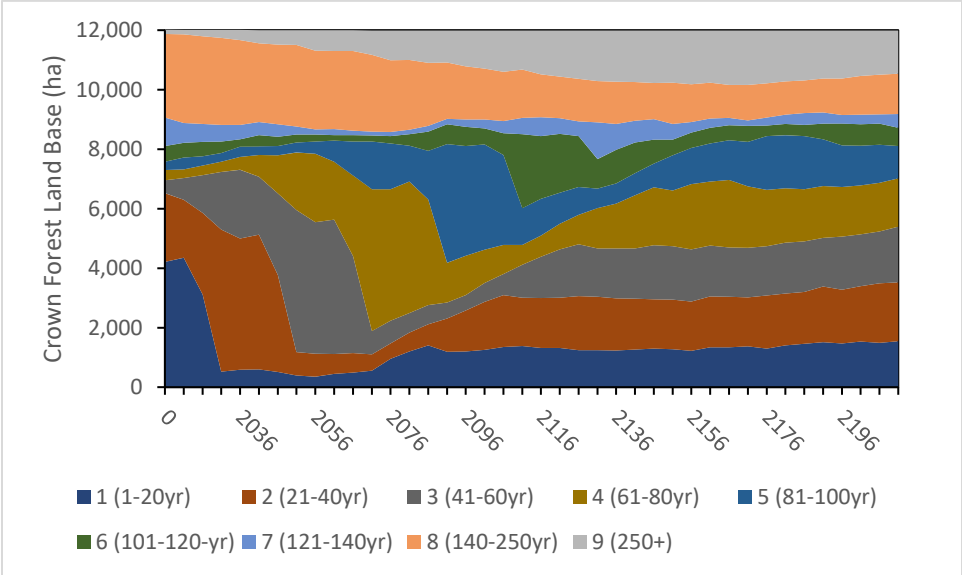
Figure 12. Average Stand Age at Harvest in the Base Case Forecast



The age class distribution demonstrates large transitions in the age class structure in the Research Forest throughout the planning period (Figure 13). It is currently comprised of young immature stands (i.e., age classes 1 and 2) and very old stands (i.e., age class 8). Many of the old stands are reserved to meet the old-growth targets, and therefore, limit the amount of mature timber available for harvest.

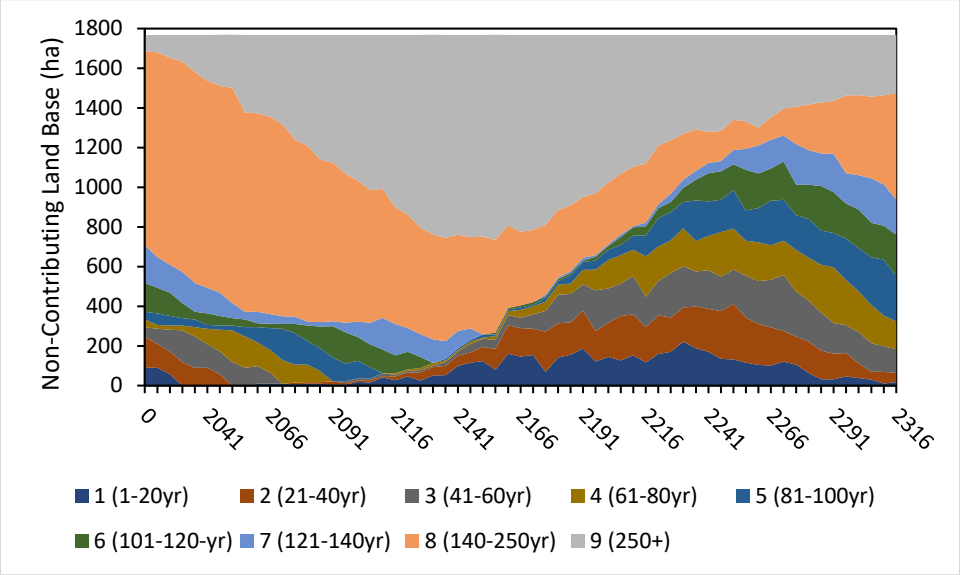
The age class distribution begins to stabilize in 2146 (or in 125 years).

Figure 13. Age Class Distribution in the Crown Forest Land Base of the Base Case Forecast



The lifespan of old trees in the non-contributing land base can be seen in Figure 14. This figure demonstrates that old-trees are being killed in the forest estate model and that these stands are being regenerated as natural stands in the earlier age classes (i.e., age class 1 and 2).

Figure 14. Age Class Distribution in the Non-Contributing Land Base of the Base Case Forecast



Unmanaged stands that are harvest and replanted in the Research Forest with tree species that have a slightly different profile (

Table ***3***,

Figure ***15***). Unmanaged stands by default use the leading species information from the VRI. One of the legacies of this classification is seen in the unmanaged balsam-leading stands which diminish but persist throughout the planning horizon due to their involvement in meeting old-growth retention targets. Balsam leading stands are also replanted with a “leading” spruce but also contain a significant balsam component.

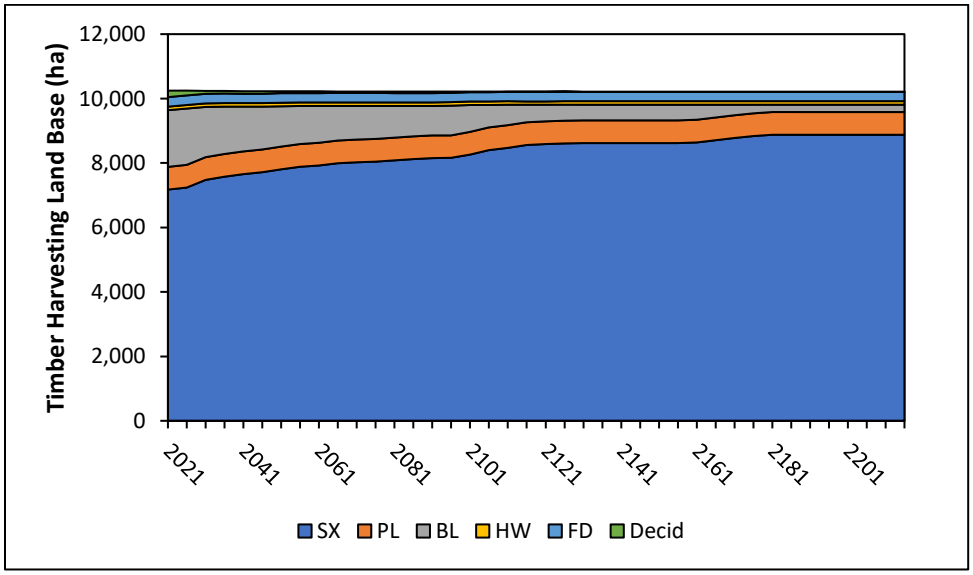
Old-growth retention are met in the research forest as demonstrated in Figure 16 and Figure 17. In these charts the old growth area target is represented by the dotted line. The amount of old growth is represented by the red line. As is seen, the amount of old growth is always forecast to exceed the minimum are required.

Table 3. Regeneration Assumptions in Managed and Future Managed Stands

Analysis Unit	AU Description	Research Units	Leading Species	Planting Mix
BL_G	Balsam Good	All Units	SX	SX5BL4PL1
BL_M	Balsam Moderate	All Units	SX	SX5BL4PL1
BL_VG	Balsam Very Good	All Units	SX	SX5BL4PL1
DEC_CON	Deciduous	All Units	SX	SX7PL2BL1
FDI_H	All Douglas-fir	Unit H	FD	FD3PL3HW3SX1
FDI_OTR	All Douglas-fir	All Units (except H)	FD	FD3SX3PL3BL1
HW	All Hemlock	All Units	HW	HW2SX2FD2CW2PL2
PLI_G	Pine Very Good	All Units	PL	PL7SX2FD1
PLI_VG	Pine Very Good	All Units	PL	PL7SX2FD1
SX_G_H	Spruce Good	Unit H	SX	HW2SX2FD2CW2BL1Pl1
SX_G_OTR	Spruce Good	All Units (except H)	SX	SX7PL2BL1
SX_M_H	Spruce Moderate	Unit H	SX	HW2SX2FD2CW2BL1PL1
SX_M_OTR	Spruce Moderate	All Units (except H)	SX	SX7PL2BL1
SX_P_M_H	Spruce Poor Moderate	Unit H	SX	HW2SX2FD2CW2BL1PL1
SX_P_M_OTR	Spruce Poor Moderate	All Units (except H)	SX	SX7PL2BL1
SX_P_OTR	Spruce Poor	Unit H	SX	SX7PL2BL1
SX_VG_OTR	Spruce Very Good	All Units (except H)	SX	SX7PL2BL1

Note: Leading species information from the Rank 1 Species in the VRI was used for unmanaged stands.

Figure 15. Leading Species Distribution over Time



CNC identified old-growth retention targets for the Research Forest. These targets are displayed in the table below. These targets are the amount of crown forest land base (CFLB) required to be above 120 years of age.

Table 4. Landscape Level Biodiversity Old Seral Retention Targets

Research Forest Unit	Minimum Percentage of Old Forest within the CFLB
A – Kerry Lake	17%
B – Tacheeda Lakes	26%
C – Caine Creek	12%
D – Caine Creek	12%
E – Chuchinka Creek	26%
F – Chuchinka Creek	26%
G – Augusmac Creek	26%
H – Purden Mountain	53%
I – Hungary Creek	53%
J – Fraser River	17%
K – Willow River	30%
L – Willow River	12%
Total for all Units	19%

In the Base Case, many of the Research Forest Units are currently at or slightly exceed the old-growth retention target (Figure 16, Figure 17). Unit F is currently deficit in old-growth and it is in a recruiting phase for most of the forecast (Figure 16). Unit H and J are currently in surplus of old-growth and they are brought down to their retention target – quickly in the case of Unit J and slower in case of Unit H.

Figure 16. Old-Growth Retention Targets for Units A to G

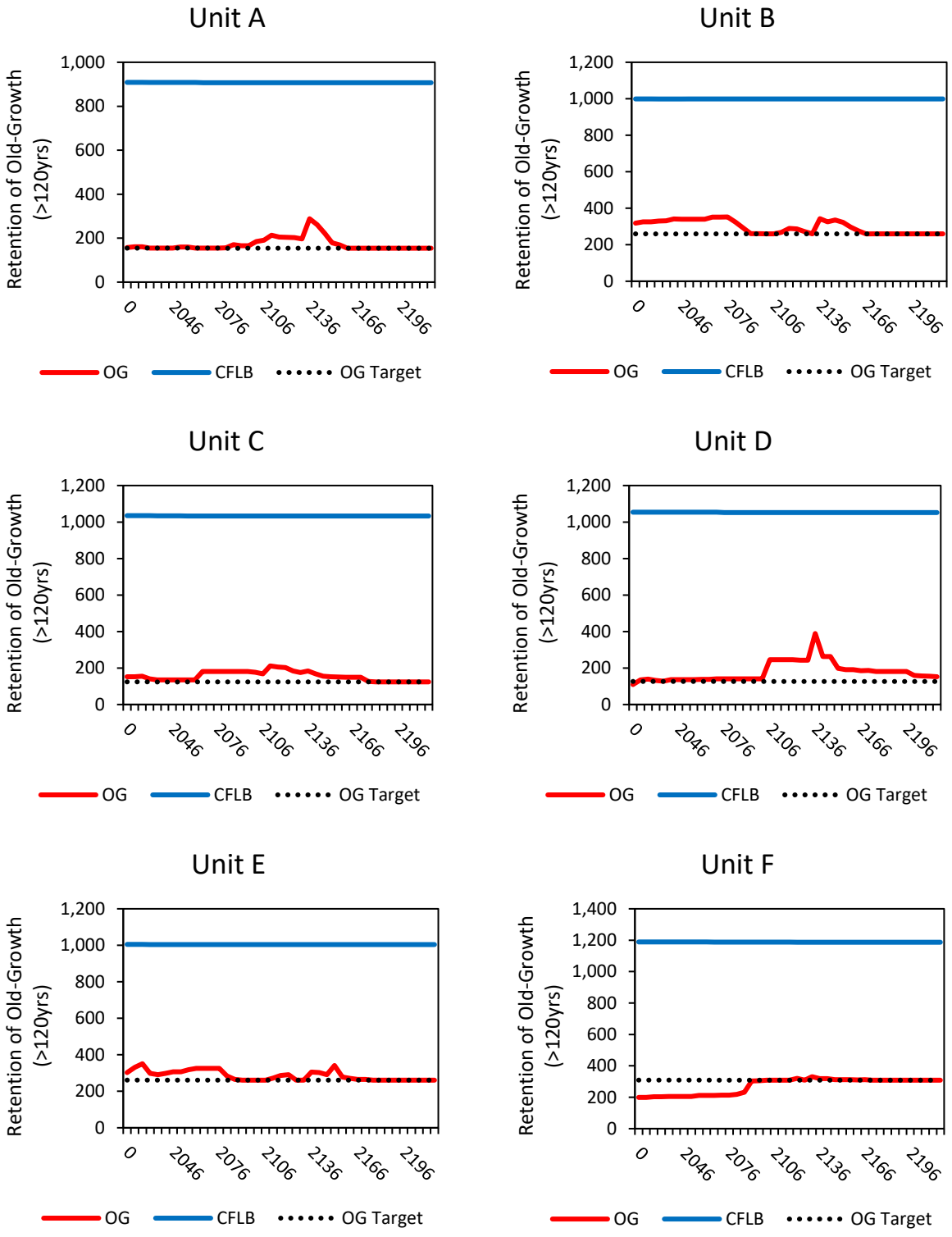
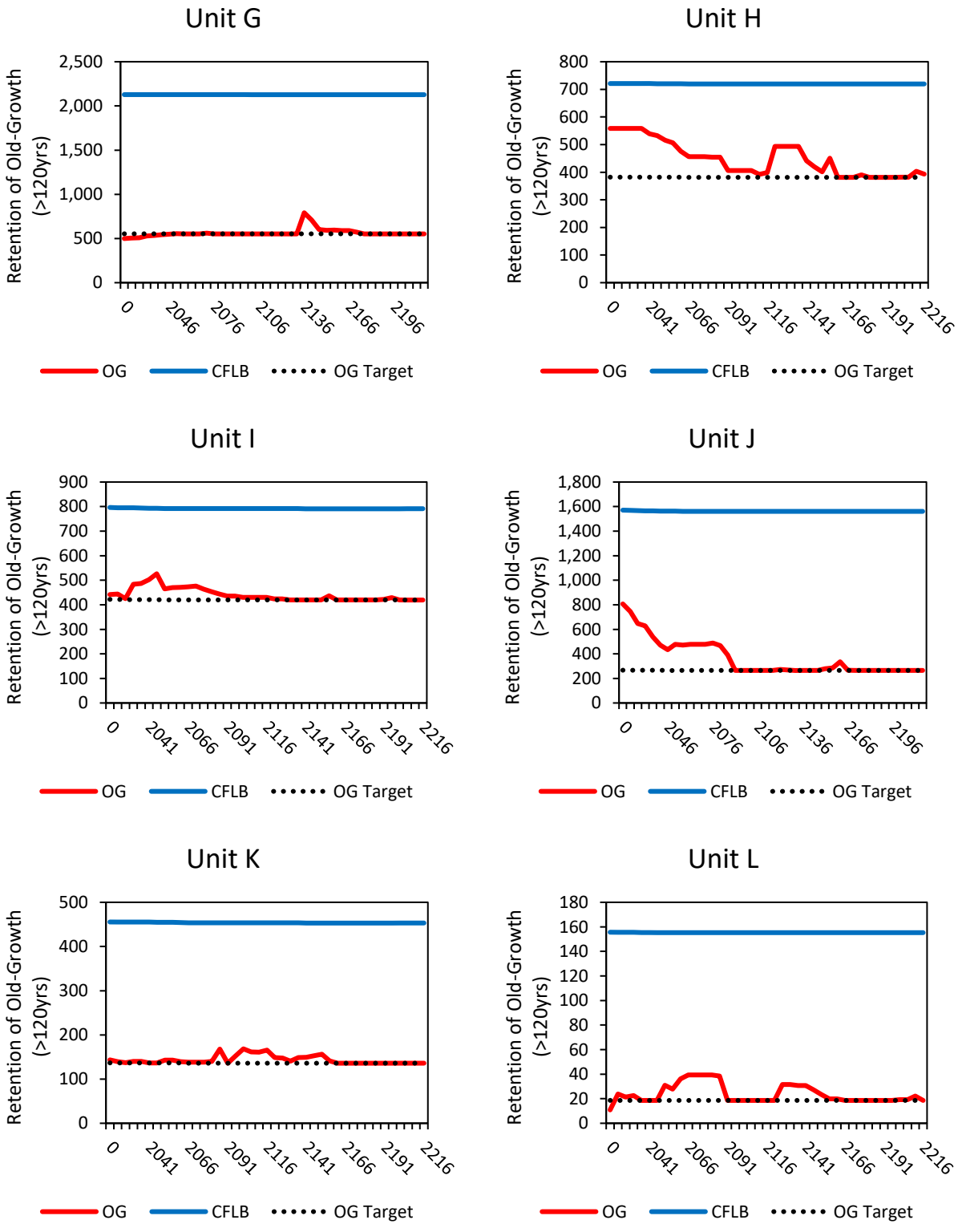


Figure 17. Old Growth Retention Targets for Units G to L



Base Case Discussion

At 12,000 m3/yr, the Base Case harvest level for the Research Forest is lower than the current AAC of 108,000 m3/year and lower than the previous midterm forecast of 18,800 m3/yr.[1]

The rationale for this lower AAC is partly attributed to greater conservation in the Biodiversity Corridors and old-growth retention targets, but also a reflection of the change in the age class distribution of the stands comprising the Research Forest in wake of salvaging logging efforts post-beetle attack.

This analysis was completed with a new timber supply inventory that accurately describes the forest in a post-beetle attacked landscape.

Uncertainties in the role of management assumptions are addressed in the following section outlining sensitivity analyses run on the forest estate model.

6. Sensitivity Analysis

Additional analyses were performed to determine the sensitivity of the forest estate model to various assumptions made in the Base Case forecast. The sensitivities tested are discussed in the following subsections and their results are summarized in a table at the end of the report (Table 8). Below is a tabular list of the sensitivity analysis.

Table 5. Sensitivity Analysis Scenarios and Assumptions

#	Modeling Assumption	Feature Tested
0	Base Case	N/A
1	Old-Growth	use previous TSR old-growth retention targets
2	Old-Growth	limit the amount of immature (<41yrs) forests for old-growth and watershed functioning
3	Corridor	decrease the amount of mature (>61yrs) forests retained in Corridor
4	Corridor	increase the amount of mature (>61yrs) forests retained in Corridor
5	WTP	increase WTP to 7%
6	WTP	increase WTP to 10%
7	Corridor Lock	remove corridor lock in units A,C,D,F,G
8	Culmination Age	remove culmination age requirement
9	Natural Yields	increased natural yields by 10%
10	Natural Yields	decreased natural yields by 10%
11	Managed Yields	increased managed yields by 10%
12	Managed Yields	decreased managed yields by 10%
13	VQO Constraints	removed VQO constraints
14	VQO Constraints	increased VQO constraints by 5%
15	Old-Growth	increased old-age from 121 to 141 years old
16	Land Classification	increased THLB by 5%
17	Land Classification	decreased THLB by 5%
18	Corridor	replace thinning with clearcutting in corridors
19	20-Year Harvest Plan	added operational block constraints
20	Old-Growth, Cul Age	limit the amount of immature (<41yrs) forests for old-growth and watershed functioning, remove culmination age

[1] College of New Caledonia. Management Plan #3 Amendment #1: 2017 to 2022. https://cnc.bc.ca/docs/default-source/research-forest/cncrf-man-plan-3-amend-1-final.pdf?sfvrsn=4e53c780_2 [Accessed on March 2, 2022].

6.1. Management Assumptions

Sensitivity analyses were run on several management assumptions to quantify and/or validate the impact of management considerations on Harvest Levels.

6.1.1. Adopt previous TSRs old-growth retention targets

To demonstrate the impact of CNC's current old-growth retention targets, a sensitivity run was performed on the model using the previous old-growth retention targets (Table 6). CNC supplied the current old-growth retention targets used in the Base Case and the previous targets were taken from CNC's last TSR report. The impact on the harvest level is shown as "Old TSR Retention" in Figure 18.

The adoption of the previous TSRs old-growth retention targets increased the short- and long-tern harvest levels (Figure 18).

Table 6. Old-growth retention targets from previous TSR report

Unit	Scenario 1 Old TSR OG Retention
	% CFLB greater than 120 years
A	10%
B	14%
C	10%
D	10%
E	10%
F	10%
G	10%
H	25%
I	25%
J	10%
K	25%
L	10%
Research Forest*	19%

*The Research Forest (as a whole) must contain at least 19% old-growth.

6.1.2. Adopt natural-like age distribution

Sensitivity was run that focused on the reducing the amount of immature forest in individual Research Forest Units (i.e., natural-like age distribution;

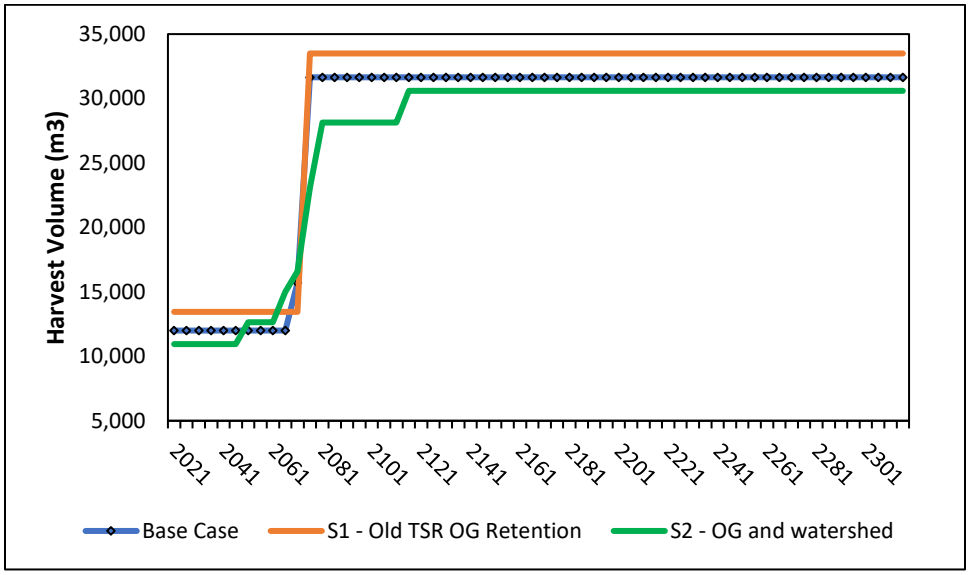
Table ***7***). CNC supplied the retention targets and the purpose was to explore the impact of imposing a constraint for watershed health. The impact on the harvest level is shown as "S2 – OG & Watershed" in Figure 18.

The replacement of constraints on immature stands for watershed health in lieu of old-growth retention targets has a notable impact on the harvest level. The short-term harvest level is lower (10,950 m3/year) than the Base Case. The mid-term harvest allows for a bit more volume to be cut sooner (i.e., Year 30 instead of Year 50 in the Base Case) but it is much more gradual of an ascent to its long-term harvest level.

Table 7. Immature forest constraints for watershed health

Unit	Scenario 2 Watershed Constraint
	% CFLB less than 41 years
A	36%
B	24%
C	36%
D	36%
E	24%
F	24%
G	24%
H	11%
I	11%
J	36%
K	24%
L	36%

Figure 18. Base case comparison with old TSR OG targets and watershed constraints



6.1.3. Add a low old-growth cover constraint in the biodiversity corridor

The amount of old-growth cover (> 120 years old) in the Biodiversity Corridor was constrained to a minimum of 34% old-growth to show the impact of a lower old-growth retention criteria on the harvest level.

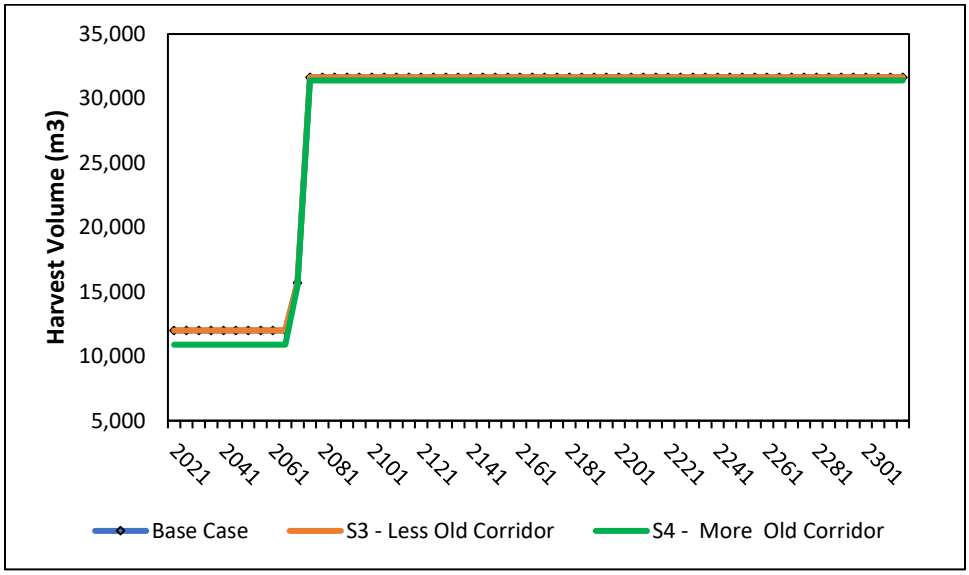
The impact on the harvest level is show as "S3 – Less Old Corridor" (Figure 19). In the short-term and long-term, there is no difference in the harvest.

6.1.4. Add Increase mature cover in biodiversity corridor

The amount of old-growth cover (>120 years old) in the Biodiversity Corridor was constrained to a minimum of 75% old-growth to show the impact of a higher old-growth retention criteria on harvest level.

The impact on the harvest level is show as "S4 – More Old Corridor" (Figure 19). In the short-term, there is a slight difference in the harvest.

Figure 19. Base Case comparison with less and more old-growth constraints in Corridor



6.1.5. Increase WTRA retention by 7 percent

The impact of increasing WTRA retention on the Harvest Level, was tested by increasing WTRA retention to 7 percent.

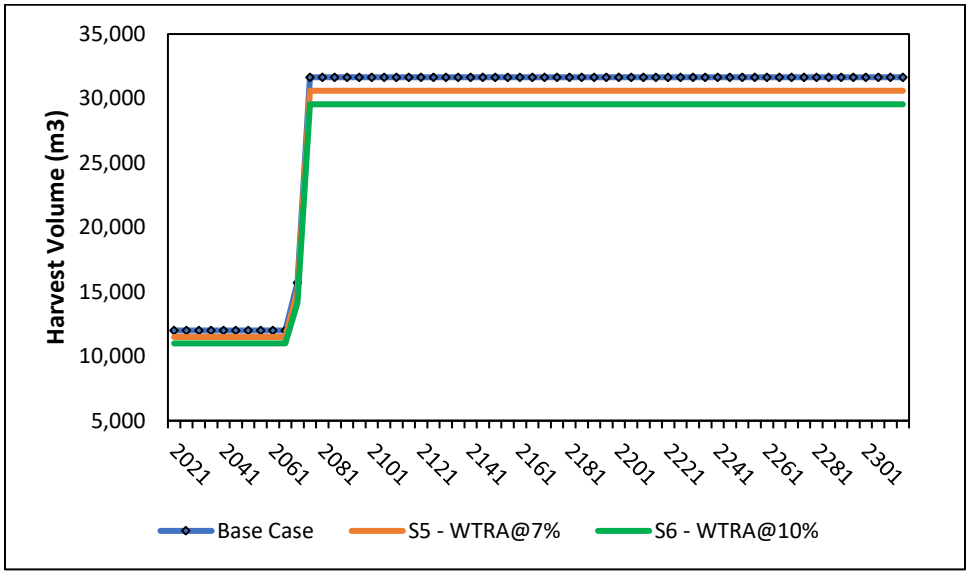
The impact on the harvest level is a slight decrease to the Base Case (Figure 20).

6.1.6. Increase WTRA retention by 10 percent

The impact of increasing WTRA retention on the Harvest Level, was tested by increasing WTRA retention to 10 percent.

The impact on the harvest level is a slight decrease to the Base Case (Figure 20).

Figure 20. Base Case comparison with increases of WTRA retentions to 7 and 10 percent

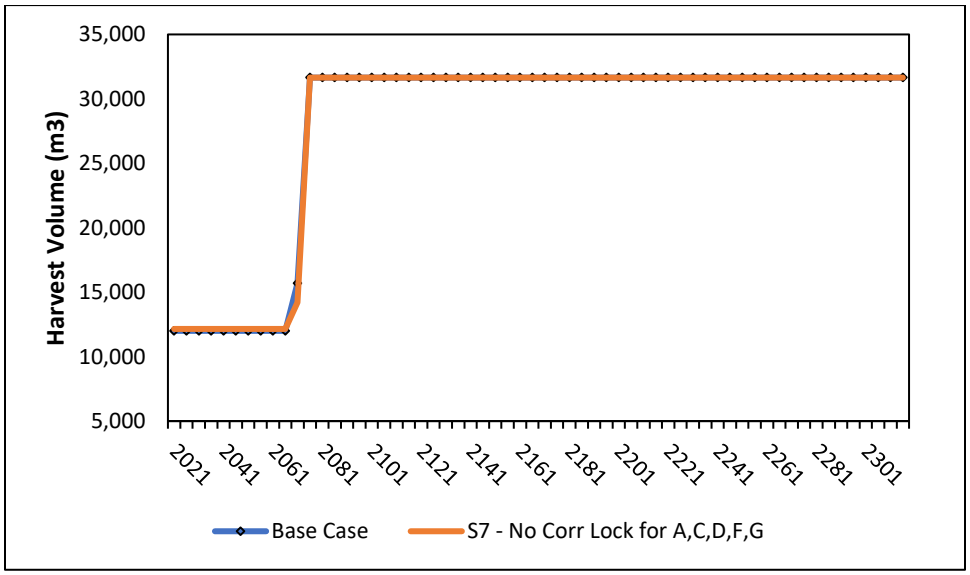


6.1.7. Remove 20-year corridor lock in Units A, C, D, F, and G

The impact of the 20-year preservation in Biodiversity Corridors in Units A, C, D, F, and G on the Harvest Level in the Base Case was tested by removing it.

The impact of removing the 20-year preservation for the previously noted blocks had minimal impact on the Harvest Level (Figure 21).

Figure 21. Base Case comparison with the removal of 20-year corridor lock

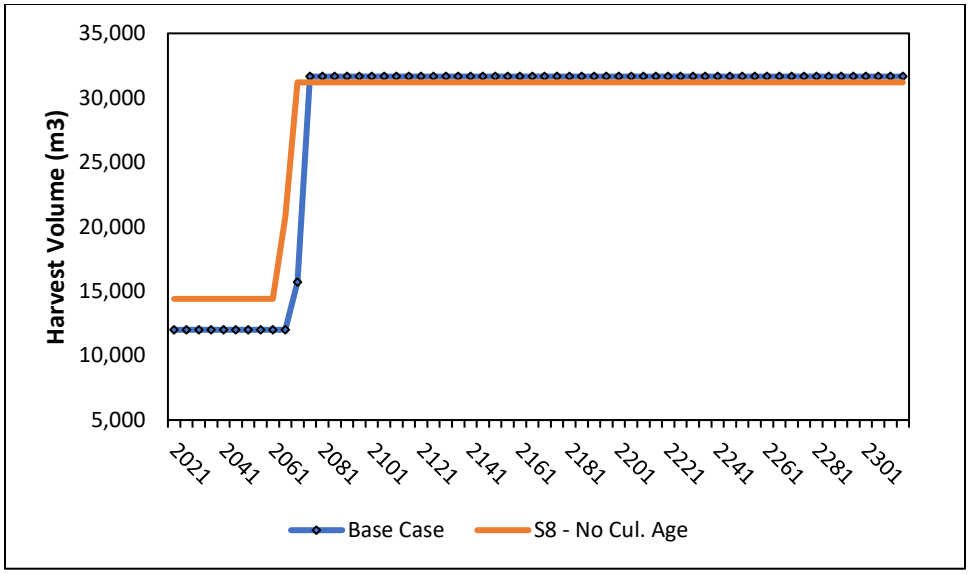


6.1.8. Remove culmination age requirement for minimum harvest criteria

The impact of using culmination age as a minimum harvest criteria was tested by removing it for all harvesting actions in the Research Forest.

The impact of removing culmination age has an immediate impact on the short-term harvest (Figure 22).

Figure 22. Base Case comparison with the removal of culmination age



6.1.9. Other Common Sensitivity Analysis Runs

A couple of common sensitivity analyses were run on the forest estate model to test the robustness of the model and are simply reported in the following section (Table 8).

7. Summary of Analysis Results

The table below provides a tabular summary of the harvest results for each of the harvest scenarios (

Table ***3***). The harvest level is the net harvest (after removing non-recoverable losses) and it is rounded to the nearest 50 cubic metres.

Table 8. Summary results for the base case and alternative harvest scenarios

#	Modeling Assumption	Feature Tested	Net Initial Harvest		Net Long-Term Harvest	
			Annual Harvest (m3/yr)	% change from Base Case	Long-Term Harvest (m3/yr)	% change from Base Case
0	Base Case	N/A	12,000	N/A	31,650	0%
1	Old-Growth	use previous TSR old-growth retention targets	13,450	12%	33,500	6%
2	Old-Growth	limit the amount of immature (<41yrs) forests for old-growth and watershed functioning	10,950	-9%	30,600	-3%
3	Corridor	decrease the amount of mature (>61yrs) forests retained in Corridor	12,000	0%	31,650	0%
4	Corridor	increase the amount of mature (>61yrs) forests retained in Corridor	10,900	-9%	31,400	-1%
5	WTP	increase WTP to 7%	11,500	-4%	30,600	-3%
6	WTP	increase WTP to 10%	11,000	-8%	29,550	-7%
7	Corridor Lock	remove corridor lock in units A,C,D,F,G	12,150	1%	31,650	0%
8	Culmination Age	remove culmination age requirement	14,400	20%	31,200	-1%
9	Natural Yields	increased natural yields by 10%	13,050	9%	31,650	0%
10	Natural Yields	decreased natural yields by 10%	10,950	-9%	31,650	0%
11	Managed Yields	increased managed yields by 10%	12,250	2%	31,200	-1%
12	Managed Yields	decreased managed yields by 10%	11,700	-3%	32,000	1%
13	VQO Constraints	removed VQO constraints	11,950	0%	31,900	1%
14	VQO Constraints	increased VQO constraints by 5%	11,900	-1%	31,700	0%
15	Old-Growth	increased old-age from 121 to 141 years old	11,400	-5%	31,050	-2%
16	Land Classification	increased THLB by 5%	12,350	3%	33,050	4%
17	Land Classification	decreased THLB by 5%	12,000	0%	31,650	0%
18	Corridor	replace thinning with clearcutting in corridors	11,300	-6%	32,800	4%
19	20-Year Harvest Plan	added operational block constraints	6,650	-45%	31,600	0%
x0	Base Case	added current WTPs to corridors	12,000	0%	31,650	0%
X8	Culmination Age	remove culmination age requirement	14,400	20%	31,200	-1%
X2	Old-Growth	limit the amount of immature (<41yrs) forests for old-growth and watershed functioning	10,950	-9%	30,600	-3%
20	Old-Growth & Cul. Age	limit the amount of immature (<41yrs) forests for old-growth and watershed functioning, remove culmination age	11,050	-8%	29,800	-6%

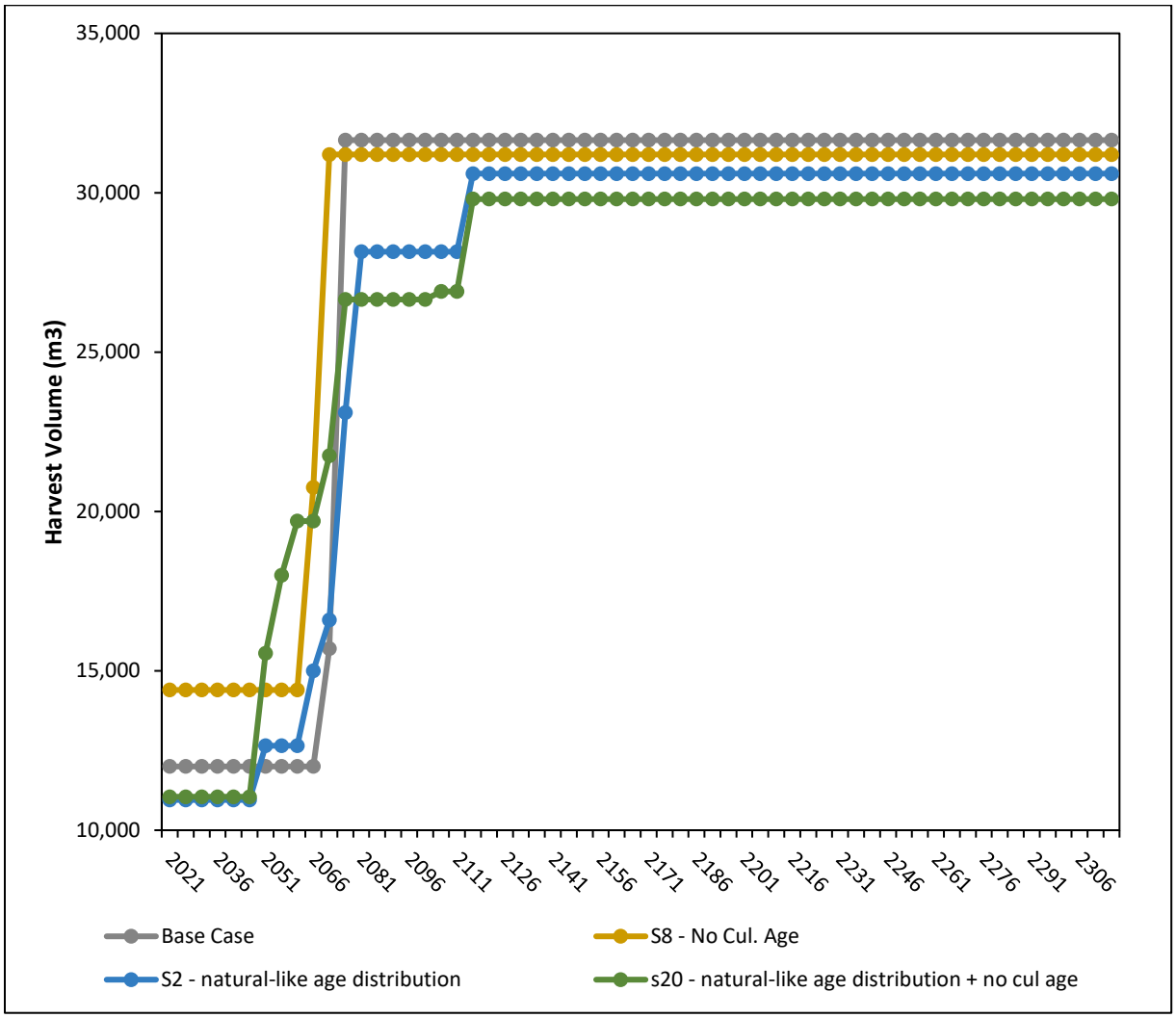
8. Harvest Scenarios

Four harvest scenarios were selected for greater examination (Figure 23).

These included:

- Base Case
- No Culmination Age
- Natural-like Age Distribution
- Natural-like Age Distribution with No Culmination Age

Figure 23. Harvest Scenarios for the Research Forest



Appendix I. CNC Information Package

Attached separately.

Appendix II. Land Base Classification Maps

https://www.dropbox.com/s/f0iytmym9n4u2en/CNC_Appendix_Maps.zip?dl=0

Appendix III. Forest Management Maps

https://www.dropbox.com/s/f0iytmym9n4u2en/CNC_Appendix_Maps.zip?dl=0

Appendix IV. 20-year Harvest Plan Maps

https://www.dropbox.com/s/zuy5xxz0rsvg6ga/map_cnc_harvest_plan_May24_2022.zip?dl=0

College of New Caledonia Research Forest

Data Package

Version 7b

June 17, 2022

Submitted by:
Carl Pollard, RPF
College of New Caledonia

Completed by:
Wyatt Klopp, FIT
Industrial Forestry Service Ltd.

INDUSTRIAL FORESTRY SERVICE LTD.
1595 Fifth Avenue
Prince George BC
V2L 3L9
250 564 4115

Table of Contents

List of Figures

List of Tables

1 Introduction

The purpose of this information package is to: (a) provide a summary of the data inputs, assumptions and modelling procedures used in conducting a timber supply analysis; (b) evaluate various harvest options for increasing harvest levels in 30 years' time (when managed forests begin to form a greater portion of the annual harvest level); and (c) provide opportunity for the FLNRORD to comment on analysis assumptions prior to carrying out the timber supply analysis of the College of New Caledonia's (CNC) Research Forest.

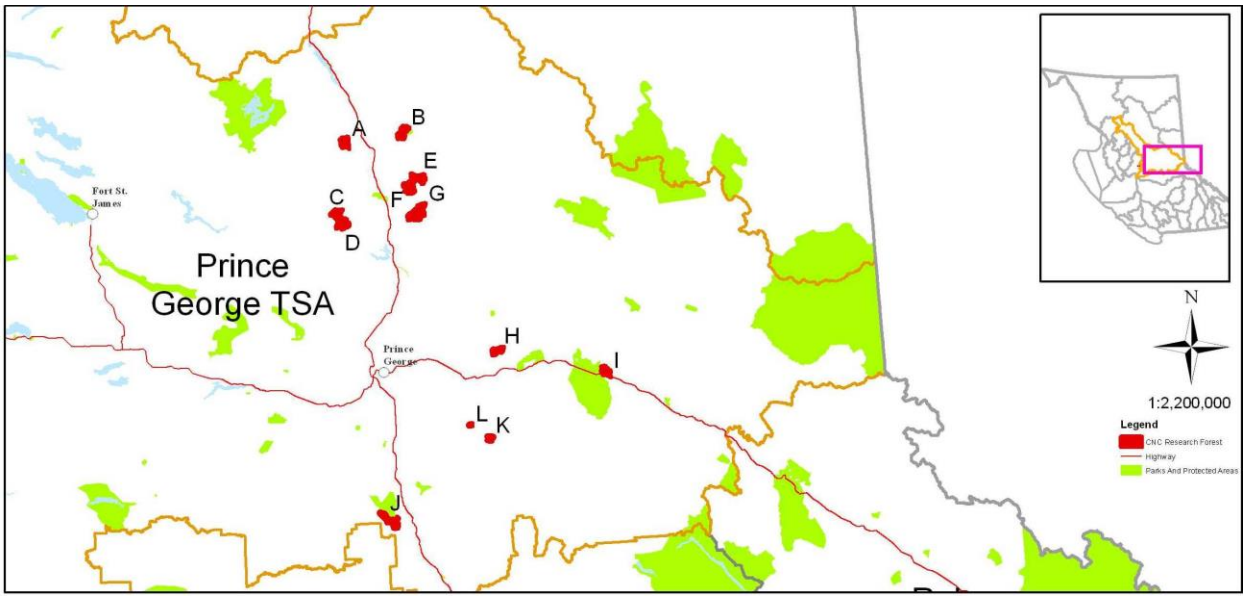
The function of this document is to provide information for consideration in the determination of a new allowable annual (AAC) for the Research Forest. The information within this document represents the current practices and performance on the Research Forest using the best available information and knowledge at this time.

2 Overview of the Area and Tenure

2.1 Description of the Area

The Research Forest is comprised of twelve (12) individual units (See Figure 1) which are located in the Prince George Forest District. These units when combined together comprise a gross area of 12,562.3 hectares (ha).

Figure 1. Key Map illustrating the location of twelve units that make up the Research Forest



The various Research Forest units differ slightly in their terrain, climate and biogeoclimatic (BEC) zones. The predominant BEC zone in the Research Forest is SBSwk1 (and occurs in Units A to G). Other BEC zones are dominant in some of the smaller units, such SBSmh and SBSdw3 in Unit J, SKSmk1 in Unit L, ICHwk4 in Unit H, and ICHvk2 in Unit I.

The leading tree species in the Research Forest is spruce (57%) followed by balsam (21%) and pine (6%). Recently, many of the mature spruce trees within the Research Forest were attacked by spruce beetle during a spruce beetle outbreak. As much as possible, these dead trees have been salvage-harvested in the Research Forest.

The nearest community to the Research Forest is Prince George, British Columbia. Prince George contains a large forestry industry and is home to CNC's college campus. The local forestry industry is composed of 5 large sawmills (Polar, Canfor PG, Lakeland, Carrier Lumber, Dunkley), 1 pellet plant (Drax Meadowbank), 2 pulp mills and 1 pulp and paper mill.

The Research Forests overlaps with Treaty 8 First Nations and other non-Treaty Nations. The Treaty 8 Nations are Halfway River, West Moberly, and Doig River Nations. The non-Treaty Nations are: McLeod Lake Indian Band, Lheidli T'enneh First Nation, and Nazko First Nation.

3 Current Forest Management Considerations and Issues

3.1 Inventories and Data Sources

The inventories and data sources that were used to establish a timber harvesting landbase (THLB) and represent current management activities in the Research Forest are shown in Table 1.

Table 1. Inventory and Data Sources

Layer Name	Source	File Name	Vintage
Vegetation Resource Inventory, Disturbance History	Ecora	cnc_2021_vrims.mdb	2015 & 2016*
Biodiversity Corridor	CNC	CNC_Bio_Corridors_All_Updated_Sept2021_inventory_Final.shp	2016
Ecosystem Mapping	CNC	cnc_eco_deliver.shp	2016
Slope Polygon Mapping	CNC	Terrain Mapping (LiDAR derived)	2016
Net Cutblock Area	CNC	Net_Blocks_3.shp	2021
Permanent Road, Trail Sections	CNC	CNC_Perm_Roads Trails_Aug2021_1.shp	2021
Prescribed WTRA	CNC	CNC_WTRA.shp	2021
Riparian Reserve	CNC	RF_Riparian_Reserves_Rd_Trail_clip_0830.shp	2021
Streams	CNC	STREAMS_UPDATE_2021_V6.shp	2021
CNC Boundary	CNC	CNC_Research.shp	2009
Landscape Units of British Columbia	BCGW	WHSE_LAND_USE_PLANNING.RMP_LANDSCAPE_UNIT_SVW	2021
Visual Landscape Inventory	BCGW	WHSE_FOREST_VEGETATION.REC_VISUAL_LANDSCAPE_INVENTORY	2021
Provincial Site Productivity Layer	BCGW	Site_Prod_BC.gdb	2021

*VRI reference year was projected to 2021 and disturbance history was updated to 2021 by Ecora and CNC.

3.1.1 LiDAR Enhanced Forest Inventory

CNC has enhanced its research forest's forest inventory, such that it exceeds the provincial VRI standard. LiDAR data was collected in summer 2016 and was used to update the VRI for tree attributes (e.g., tree heights, leading species, site index), as well as, 1m contour mapping, hill-shade modeling, slope, aspect theming and refining opening boundaries. The forest inventory was established using 2015 provincial high-resolution photos, except in Unit J, which was covered in 2013 provincial photos.

4 Inventory Aggregation

4.1 Analysis Units

Analysis units (AUs) are used to aggregate similar forest types into common units to simplify growth and yield modeling.

For this analysis, forest stands were aggregated according to their leading tree species, site productivity and silvicultural treatment, into specific Research Forest Units (

Table 2).

Each analysis unit has three sets of yield tables that reflect (1) natural (i.e., unmanaged) stands yield, (2) current managed stand yield, and (3) future managed stand yield. The yield tables for natural stands are derived using the Variable Density Yield Prediction (VDYP) model version 7. The yield tables for current and future managed stands are derived using the Batch Table Interpolation Program for Stand Yields (TIPSY) version 4.4 software.

Table 2. Analysis Unit Identifiers

Analysis Unit	Leading Species	Site Index	Research Units	THLB (ha)			Average Site Index (based on THLB area)		
				Natural Stands	Current Managed Stands	Future Managed Stands	Natural Stands	Current Managed Stands	Future Managed Stands
BL_G	Balsam fir	≥18<22	all	205.7	69.1	274.8	19.1	20.3	20.6
BL_M	Balsam fir	<18	all	1,561.5		1,561.5	14.5		19.4
BL_VG	Balsam fir	≥22	all	40.2	41.1	81.3	24.3	22.0	22.1
DEC_CON	Deciduous	all	all	222.1		222.1	18.3		22.2
FDI_All_H	Douglas-fir	all	H	16.8	5.6	22.4	16.0	16.2	16.1
FDI_All_OTR	Douglas-fir	all	all (excl. H)	253.0	20.9	273.9	18.0	20.9	21.0
HW	Hemlock	all	all	109.0		109.0	13.1		18.6
PLI_G	Pine	<22	all	76.4	601.8	678.2	19.3	19.9	20.0
PLI_VG	Pine	≥22	all	21.3	5.9	27.2	25.5	23.0	23.2
SX_G_H	Spruce	≥21<24	H		88.1	88.1		21.9	21.9
SX_G_OTR	Spruce	≥21<24	all (excl. H)	82.5	624.9	707.4	21.9	21.7	21.8
SX_M_H	Spruce	≥18<21	H	4.4	57.6	62.0	19.9	18.9	19.4
SX_M_OTR	Spruce	≥18<21	all (excl. H)	260.6	3,338.6	3,599.3	18.5	19.3	19.4
SX_P_M_H	Spruce	<18	H	19.0		19.0	14.1		14.1
SX_P_M_OTR	Spruce	≥12<18	all (excl. H)	1,054.2	428.2	1,482.4	16.2	15.4	18.8
SX_P_OTR	Spruce	<12	all (excl. H)	95.0	2.5	97.5	10.3	10.0	14.7
SX_VG_OTR	Spruce	≥24	all (excl. H)	120.0	823.8	943.7	26.4	24.2	24.0
NonForest	N/A	N/A	129.5						
Grand Total			**12,562.3**	**4,141.7**	**6,108.1**	**10,249.7**			

Note:
Unit H was separated due to different regeneration assumptions.

5 Description of the Land Base

5.1 Timber Harvesting Land Base (THLB)

The objective of land base classification is to determine a timber harvesting land base (THLB), that is both legal and economic to harvest, either currently or in the future, based on past performance history and for use in a timber supply model.

The land base classification requires a net down process which is used to define a gross land base, non-forested land base, crown forest land base (CFLB) and timber harvesting land base. The following subsections examine each of the net down criteria in detail.

Table 3 summarizes the land base definitions and the resultant area net-down in the order in which they were applied in a derivation of the THLB.

Table 3. Timber Harvesting Land Base Definition

Land Base Classification	Net Area (ha)	Gross Area (ha)
Total Area	**12,562.4**	**12,562.4**
Less:		
Non-Forest / Non-Productive	439.2	443.9
Existing Roads, Trials & Landings	117.6	123.6
Crown Forested Land Base	**12,005.6**	
Less:		
Physically Inoperable / Steep Slopes	536.4	547.9
Low Productivity	95.6	95.6
PFT - Hemlock & Cedar Leading	431.8	491.1
Riparian Reserve Zones	692.0	941.7
Initial Timber Harvesting Land Base	**10,249.7**	
Less aspatial constraints		
Future WTRAs (4% THLB)	410.0	
Future Permanent Roads (1.5% THLB)	153.7	
Future Harvesting Land Base	**9,686.0**	

5.1.1 Age Class Distribution

The current age class distribution is described in the table below (Table 4).

Table 4. Age Class Distribution

Age Class	Non-Contributing Land Base (NCLB)	Timber Harvesting Land Base (THLB)	Crown Forest Land Base (CFLB)
	hectares (ha)		
1 (0 to 20 years)	119.5	4,652.6	4,772.0
2 (21 to 40 years)	146.7	1,777.2	1,923.9
3 (41 to 60 years)	24.4	315.9	340.4
4 (61 to 80 years)	37.9	254.4	292.3
5 (81 to 100 years)	75.0	332.5	407.5
6 (101 to 120 years)	157.6	412.3	569.9
7 (121 to 140 years)	205.6	841.2	1,046.8
8 (141 to 250 years)	926.2	1,613.1	2,539.4
9 (250 plus years)	62.9	50.5	113.4
Grand Total	**1,755.9**	**10,249.7**	**12,005.6**

5.2 Exclusions from the Timber Harvesting Land Base

5.2.1 Total Area

The total area of the Research Forest is 12,562.4 hectares.

Table 5. Gross Area of the Research Forest Units

Research Unit	Gross Area (ha)
A	941
B	1,056
C	1,061
D	1,104
E	1,082
F	1,205
G	2,278
H	736
I	886
J	1,586
K	468
L	159
Total	**12,562.4**

5.2.2 Land Ownership Exclusions

The Research Forest was examined for other land ownerships present inside its boundaries, but found no land classifications to exclude based on the codes shown in the table below.

Table 6. Land Ownership Codes and Descriptions

Land Classification Code
40 – Private Land
52 – Indian Reserves
54 – Federal Parcels
61 – Crown Reserves for Use, Recreation and Enjoyment of the Public (UREP)
62 – Crown Forest Management Unit (TSA)
66 – Crown Provincial Park Class C
67 – Crown Provincial Park or Equivalent
68 – Crown Biodiversity, Mining and Tourism Area (BMTA)
69 – Crown Miscellaneous Reserve
77 – Crown and Private Woodlots
78 – Crown Tenure First Nation Woodland Licence
79 – Crown Tenure Community Forest Agreement
80 – Municipal Parcels
91 – Unknown Ownership
99 – Miscellaneous Leases

5.2.3 Non-Forest and Non-Productive

Non-forest and non-productive areas were identified using British Columbia's Land Cover Classification Scheme (BCLCS), the definitions for which are housed in the Vegetation Resource Inventory (VRI). These areas are incapable of producing enough treed vegetation for a variety of reasons (e.g., terrain, low productivity), and as a result, they do not contribute to THLB or forest management objectives such as old growth for biodiversity.

Non-forest and non-productive area were excluded from the THLB using the logic described in the table below.

Table 7. Non-Forest and Non-Productive Land Base Definition

Definition	Classification Logic
Non-Treed	BCLCS_1 = "N" AND no logging history
Vegetated, Non-Treed Wetlands and Alpine	BCLCS_lv_1 = "V" AND BCLS_lv_2 <>"T" and BCLCS_lv_3 = "A" or "W", AND no logging history
Vegetated, Treed Wetlands	BCLCS_lv_1 = "V" AND BCLCS_lv_2 = "T", AND BCLCS_lv_3 = "W". AND no logging history
Vegetated, Non-Treed Uplands	BCLCS_lv_1 = "V" AND BCLCS_lv_2 = "N" AND BCLCS_lv_3 = "U", AND no logging history
Boreal Altai Fescue Alpine	BEC Classification = BAFA AND no logging history

BCLCS_lv_1: Vegetated (V), Non-Vegetated (N)
BCLCS_lv_2: Treed (T), Non-Treed (N)
BCLCS_lv_3: Wetland (W), Upland (U), and Alpine (A)

Some adjustments were made to select VRI polygons to align with forestry field experience. These additions and removals are appended to this report (Appendix 1).

5.2.4 Existing Roads, Trails and Landings

Existing roads, trails, and landings were removed from the THLB using CNC's road inventory file, which were already buffered so no additional buffers were applied to this layer.

Some adjustments were made to the road inventory file to include additional landings and roads that were absent from CNC's road, trails and landing layer, but observed using satellite imagery. These additions are appended to this report (Appendix 1).

5.2.5 Operability Restriction – Steep Slopes

Steep slopes were calculated by CNC using LiDAR and this steep slope layer was provided to IFS for this analysis.

If there was no logging history or old logging history (i.e., non-CNC cutblocks), steep slopes greater than 45% and 25 metres wide were removed from the THLB. Any remaining individual polygons less than 0.1ha and greater than 45% were also removed as steep slope.

5.2.6 Low Productivity

Low productivity stands were excluded from the THLB if they had an estimated VDYP site index of less than 10, or they could not achieve 140 cubic metres per hectare (m^3/ha) when the yield of each polygon was projected 250 years into the future.

5.2.7 Problem Forest Types

5.2.7.1 Western Hemlock

All stands with greater than 50% hemlock were removed from the THLB.

Additional cedar/hemlock leading polygons with an undesirable species mix and lack of commercial potential as a result of insufficient Douglas-fir and/or spruce were spatially identified and removed as problem forest types. These polygons removals are appended to this report (Appendix 1).

5.2.8 Old Growth Management Areas (OGMA)

There are no old growth management areas (OGMA) currently identified within any of the management units of the Research Forest.

5.2.9 Riparian Management Areas (RMA)

Riparian reductions to the THLB were specific to the riparian reserve zone (RRZ) layer supplied by CNC (Table 8). This layer came buffered and so no additional buffers were applied to it. In all cases, the RRZ meets and exceeds the minimum regulated requirements for riparian reserves.[1]

Table 8. Riparian Classification Criteria

Riparian Classification	Description	Riparian Reserve Zone width per side (metres)
S1	Fish Stream, width >20m	50
S2	Fish Stream, width >5m	30
S3	Fish Stream, width >1.5m	20
S4	Fish Stream, width <1.5m	12
S5	Non-Fish Stream, width >3m	20
S6	Non-Fish Stream, width <3m	12
L1-B	Lake, 5 to 1000ha	50
L3	Lake, 1 to 5ha	50
W1 or W5	Wetland, > 5ha	50
W3	Wetland, 1 to 5ha	50

5.2.10 Recreation Trails, Points and Sites

There are currently no recreation trails, points or recreation sites identified within the Research Forest.

5.3 Wildlife Habitat

There are no known wildlife habitat features that require area-specific deductions within the Research Forest at this time.

Wildlife habitat is conserved within riparian reserves, problem forest types, and other areas removed from future commercial forest operations in the THLB net-down; more specifically, wildlife habitats are actively managed in the establishment of Long-Term Biodiversity Corridors, Prescribed Wildlife Tree Retention Areas (WTRA), and Landscape-Level Old Forest and Biodiversity objectives that are modeled as part of the integrated resource management assumptions (see *Integrated Resource Management*).

Future wildlife tree patch deductions are factored into the analysis using a downward adjustment of 4% to the yield tables representing forests outside the Biodiversity Corridor.

5.4 Long-Term Biodiversity Corridors

CNC has spatially identified Long-Term Biodiversity Corridors to provide mature forest wildlife

[1] Forest Planning and Practices Regulation 47
https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/14_2004#division_d2e9829
(Accessed January 25, 2022)

habitat connectivity, conservation of species-at-risk habitat and conservation of uncommon forest types.

A portion of the Corridor area is planned for future WTRAs (similar to other areas in the Research Forest) but the majority of it will be managed through commercial thinning operations that maintain a mature (>60 years) canopy over time (see *Integrated Resource Management* for more information on the modeling assumptions).

Research Forest Units A, C, D, F, and G are preserved for 20 years to allow these beetle savaged areas to recover before thinning operations are allowed to proceed. This was modelled by placing a 20-year lock on the corridor in these units.

5.5 Cultural Heritage Resource Reductions

There is one known archaeological site within Research Forest Unit L and it is located within the riparian reserve of the Willow River.

CNC will respect and conserve First Nations cultural or heritage values according to *Heritage Conservation Act* and will consult First Nations and FLNRORD, if and when, they become known.

5.6 Future Permanent Roads

Future permanent roads are factored into the analysis by removing 1.5% of THLB area in existing unmanaged stands after harvesting.

6 Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Utilization Standards

Utilization standards identify the species, dimensions and quality of the trees that are eligible for harvest. The utilization standards used in this analysis to calculate merchantable volumes for mature and immature stands are shown in the table below.

Table 9. Utilization Standards (unmanaged and managed stands)

Species	Minimum Diameter at Breast Height (DBH)	Maximum Stump Height	Minimum Top Diameter
	centimeters (cm)		
Lodgepole Pine	12.5	30.0	10.0
Other Conifer	17.5	30.0	10.0
Deciduous	17.5	30.0	10.0

6.1.2 Minimum Harvestable Volume

The minimum harvestable volume is the amount of merchantable volume required for a stand to be considered eligible for harvest.

Stands will only be considered eligible for Commercial Harvest once they have achieved a net merchantable volume of 140 m^3/ha and reached 95% of the culmination age.

Stands will be considered eligible for Commercial Thinning if they exist in the Biodiversity Corridor and their age is greater than 60 years. Once a stand is thinned, no additional thinning is allowed for 60 years to ensure understory regeneration and continuous mature tree cover over time.

6.1.3 Harvest Priority

There is no harvest priority other than to maintain an even-flow harvest.

CNC has historically been effective in prioritizing harvesting in disturbed forests caused by mountain pine beetle and spruce beetle outbreaks. No harvest priorities will be forecast for damaged forests moving forward.

In the remaining stands with a dead pine component, the amount and merchantability of dead pine is valued less than that of the remaining live layer. These stands are increasingly seen as having an incidental benefit of providing important wildlife habitat and diversity in landscapes otherwise modified by spruce beetle outbreaks and large-scale salvage logging. Consequently, the dead pine component of unmanaged stands is not included in the merchantable yield estimate for these stands.

In the spruce beetle attacked stands that have not been salvaged to-date, the majority of them are within riparian reserves, future wildlife tree patches and the Biodiversity Corridor. These stands will not be harvested. The dead spruce component of stands within the THLB was removed from the yield estimates for these stands.

6.1.4 Silviculture Systems

Mature stands will be harvested using clearcut with reserves, which is the dominant silvicultural system currently used in the Research Forest.

Commercial thinning will be performed in eligible stands in the Biodiversity Corridor.

6.2 Natural Disturbances

6.2.1 Life Span

All stands in the Research Forest's CFLB will be modelled using a 350-year lifespan.

6.2.2 Historic Natural Disturbances

The Research Forest has some legacy impacts from a previous mountain pine beetle (MPB) outbreak, and the more recent, spruce beetle outbreak.

6.2.2.1 Mountain Pine Beetle Outbreak

The MPB outbreak peaked in the Research Forest between 2005 to 2008. During this time, it caused significant mortality to stands containing mature pine and their harvest was subsequently prioritized in the Research Forest.

In 2016, the forest inventory was updated to include a dead pine layer that described the remaining pine and its mortality in relation to its forest cover. This meant that many of the

remaining dead pine-leading stands were converted to a younger forest cover. The dead pine component is now considered marginal (after 15 years post-attack); and these stands are increasingly valued for their transitional role in habitat, forest biodiversity and as a source of mid-term timber supply. The dead layer does not contribute to short term timber supply.

There are no further adjustments to the MPB-attacked stands as the outbreak and their salvage logging have concluded in the Research Forest.

6.2.2.2 Spruce Beetle Outbreak

The Research Forest was impacted by a recent spruce beetle outbreak. In response, most of the spruce-attacked forests were prioritized for harvest in Units A to G, but there does remain some area with mature spruce-leading stands having heavy spruce beetle attack. Consequently, the VRI was recently updated to reflect the loss due to mortality with updated live and dead tree layers.

In this adjustment it was assumed that any remaining spruce in the spruce-attacked stands had a mortality of 83- 90% which depended on the Research Forest Unit.

CNC has found that the sawlog volume from salvage-logging dead spruce experiences a rapid decline in lumber recovery within 3 years post-attack. This decline in sawlog recovery (i.e., shelf life) was assumed to follow a linear function at a loss of 17% of stand volume per year starting in the year following mass attack year and lasting a maximum of 6 years. The mass attack year used to assign shelf-life functions to dead spruce in each Research Forest Unit are shown in the table below.

The net effect of this is that since the model was run using 5-year periods and because yield tables cannot project growth in dead stands, only the green (live) component of these stands were used in the analysis. Salvage of any dead trees in the next 5 years should be dealt with as a harvest partition or integrated as part of the green harvest.

Table 10. Average Mass Attack Year by Research Forest Unit

Research Forest Unit	Average Mass Attack Year
Unit A	2018
Unit B	2019
Unit C	2017
Unit D	2017
Unit E	2019
Unit F	2019
Unit G	2018

6.2.3 Non-Recoverable Losses (NRLs)

Non-recoverable losses (NRLs) account for the loss of merchantable volume due to natural disturbances. They reflect the volume not expected to be recovered or salvaged in the THLB. NRLs will be modeled in the Research Forest by applying the NRL data and logic from the *Prince*

George TSA Technical Summary[2]; and using it to forecast natural disturbance regimes in the Timber Harvesting Land Base. The PG TSA Technical Summary used a NRL of 400,000 m3/yr with an approximate long-range sustained yield (LRSY) of 10,000,000 m3/yr for natural stands and then used a NRL of 112,000m3/yr for managed stands as forecast harvesting transitions from natural to managed stands. The latter NRL reflects an assumption made in the PGTSA that managed forests would only deal with fire and wind events and no beetle disturbances. NRLs will be modeled using the latter NRL for managed stands (i.e., 1.12%) considering it is unlikely for the Research Forest to sustain additional damages caused by another beetle outbreak as natural stands. The NRL for the Research Forest was calculated using a LRSY of 37,894 cubic metres per year and multiplying it by 1.12% and by 5 (to fit a 5-year period). This calculation amounts to a NRL of 2,125 cubic metres per 5-year period.

6.2.4 Not Satisfactorily Restocked (NSR)

There was no backlog or not satisfactorily restocked areas identified in the Research Forest.

7 Integrated Resource Management

7.1 Long-Term Biodiversity Corridors

Long-Term Biodiversity Corridors have been spatially defined in the Research Forest. Commercial thinning is the only silvicultural treatment that will be applied in the Biodiversity Corridor. It is applied to stands greater than 60 years old and it removes 40% of a stand's volume. Thinned stands are preserved for 60 years following harvest to allow for regrowth and ensure that continuous mature tree cover (>60 years old) is maintained through repeat thinning activities.

7.2 Prescribed Wildlife Tree Retention Areas

All current wildlife tree retention areas (WTRA) in the Research Forest and will be unavailable for harvest until 60 years has passed since the harvest of their associated cutblocks. The prescribed WTRA areas also become apart of the Long-Term Biodiversity Corridor and treated as such (i.e., repeat thinning with mature tree cover retention).

All future WTRAs are accounted for by adjusting yield curves down by 4 percent.

7.3 Landscape-Level Old Forest and Biodiversity

A minimum amount of Old Forest will be continuously maintained in the CFLB of the Research Forest throughout the timber supply modeling period. Old Forest is defined here as $\geq$121 years old and its target will be met using the Crown Forest Land Base (CFLB). The minimum Old Forest retention targets were provided by CNC and are defined in the table below.

[2] **Prince George TSA Timber Supply Analysis Technical Summary**, Ministry of Forests and Range, Forest Analysis and Inventory Branch, October 2017.

Table 11. Landscape Level Biodiversity Old Seral Retention Targets

Research Forest Unit	Minimum Percentage of Old Forest in CFLB
A – Kerry Lake	17%
B – Tacheeda Lakes	26%
C – Caine Creek	12%
D – Caine Creek	12%
E – Chuchinka Creek	26%
F – Chuchinka Creek	26%
G – Augusmac Creek	26%
H – Purden Mountain	53%
I – Hungary Creek	53%
J – Fraser River	17%
K – Willow River	30%
L – Willow River	12%
Total for all Units	19%

An overarching constraint will be placed on the Research Forest (as a whole) for its CFLB to contain at minimum 19% old-forest > 120 years.

7.4 Adjacency Constraints

Cutblock adjacency is used to ensure that the structural characteristics of the forest, as a result of harvesting, are consistent with the temporal and spatial distribution of openings that would result from a natural disturbance.

Adjacency will initially be assured using a green-up constraint in each Unit such that no more than 20% of the unit is less than a 20-year green-up age.

Once the harvest has been optimized, a spatial 20-year harvest plan will be constructed using the block size requirements in the Research Forest (Table 12). These blocks will be reintegrated into the harvest model as part of the sensitivity analysis in the timber supply analysis.

Table 12. Block Size and Adjacency Constraint Description

Research Forest Units	Constraint Description
A, B, C, D, E, F, G, J, K, and L	• The target block size is 15ha with a maximum size of 60ha. • Individual blocks up to 30m of each other are considered the same block.
H and I	• The target block size is 6ha with a maximum size of 25ha. • Individual blocks up to 60m of each other are considered the same block.

7.5 Visual Quality Objectives (VQO)

Visual quality objectives (VQO) are polygons which have scenic and visual requirements that must be incorporated into forest management. All known visual quality objective polygons in the Research Forests are listed in the table below.

Table 13. Visual Quality Objectives

VQO Number	VQO Code	Slope Category	Allowable Denudation (%)	VEG Height (m)	Years to Achieve Veg height (rounded to 5-yr)	CFLB (ha)	THLB (ha)
22	PR	15.1-20	14.7	4.5	4	439.8	400.2
305	PR	15.1-20	14.7	4.5	4	44.4	24.2
312	M	25.1-30	34.7	5.5	4	53.9	27.7
321	PR	15.1-20	14.7	4.5	4	80.5	42.5
604	R	15.1-20	2.7	4.5	4	105.5	81.4
1208	PR	15.1-20	14.7	4.5	4	16.3	16.2
1213	PR	20.1-25	13.1	5	4	3.0	2.3
1220	M	25.1-30	34.7	5.5	5	58.0	43.8
1229	M	20.1-25	38.3	5	4	170.8	146.7
1359	M	20.1-25	38.3	5	4	32.4	28.1
1567	PR	40.1-45	8.5	6.5	5	0.3	0.0
1585	PR	20.1-25	13.1	5	4	0.4	0.0
1593	PR	5.1-10	7.7	7	6	49.2	28.6
1703	R	20.1-25	2.4	5	4	75.1	48.7
1730	PR	15.1-20	14.7	4.5	4	131.9	100.4
1795	R	30.1-35	2.0	6	5	77.0	49.6
1797	PR	25.1-30	11.8	5.5	4	232.1	189.7

The allowable denudation in plan view for individual VQO polygons was calculated by: (1) measuring the average slope of the CFLB inside individual VQO polygons; (2) assigning them a plan to perspective (P2P) ratio based on their slope and P2P slope categories (Table 14)[3]; and (3) multiplying the P2P ratio of individual VQO polygons by the midpoint value for the percent alteration in perspective view by a polygon's VQO code (e.g., R, PR, M).

Table 14. P2P Ratios and VEG Heights

Modified Visual Unit Slope Classes for Plan-to Perspective Ratios (P2P) and Visually Effective Green-up (VEG) Tree Heights															
Slope %	**≤5**	**>5 to ≤10**	**>10 to ≤15**	**>15 to ≤20**	**>20 to ≤25**	**>25 to ≤30**	**>30 to ≤35**	**>35 to ≤40**	**40 to ≤45**	**45 to ≤50**	**50 to ≤55**	**55 to ≤60**	**60 to ≤65**	**65 to ≤70**	**>70**
P2P Ratios	4.68	4.23	3.77	3.41	3.04	2.75	2.45	2.22	1.98	1.79	1.6	1.45	1.29	1.17	1.04
VEG height (m)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	6.5	7.0	7.5	8.0	8.5	8.5	8.5

[3] Table 30. Prince George TSA TSR Data Package.

Table 15. VQO Objectives Based on Percent Alteration

Visual Quality Objective	Permissible % Alteration in Perspective View (Range)	Proposed % Alteration in Perspective View (Midpoint)
Preservation (P)	0	0
Retention (R)	0 – 1.5	0.8
Partial Retention (PR)	1.6 – 7.0	4.3
Modification (M)	7.1 – 18.0	12.6
Maximum Modification (MM)	18.1 – 30.0	24.1

7.6 Ungulate Winter Range for Moose

An ungulate winter range (UWR) surrounds Research Forest Unit H. CNC's intent is to meet or exceed the UWR designation requirements in this Unit as they apply to harvesting, road building, and silvicultural practices.

To address the UWR requirements in the forest estate model, cut blocks were limited to a maximum size of 25 hectares in Unit H – in the 20-year harvest plan sensitivity analysis; and AUs in Unit H will meet silvicultural requirements for tree species diversity (See *Analysis Units*).

8 Growth and Yield

8.1 Site Index Assignments

Site indices for natural (unmanaged) stands utilized site index values derived from VDYP v.7.

Site indices for current (pre-2021) and future (post-2021) managed stands used the Provincial Site Productivity Layer (i.e., SIBEC) which are based upon the BEC classification system. CNC has performed some site index sampling and these were used in lieu of SIBEC values where applicable (Table 16).

One exception in managed stands was the use of VDYP generated site index for managed Douglas-fir leading AUs. The SIBEC value was seen as a poor fit compared to the VDYP-generated value due to its high SI assignment (i.e., ~26) compared to VDYP (i.e., ~22).

Table 16. Site Index Adjustments

BEC Zone	Leading Species	Research Forest Unit	Adjustment to SIBEC
SBSwk1, SBSvk	Spruce	A to G	+21.0%
SBSwk1, SBSvk	Pine	A to G	+3.6%
SBSmk1, SBSwk1, SBSdw3	All	J, K, L	+4%

Note: Note that polygons that had their site indexes sampled (and their SI already adjusted in the VRI file) were ineligible for an additional adjustment.

8.2 Decay, Waste and Breakage (DWB)

Decay, waste, and breakage (DWB) in Natural (unmanaged) Stands was modeled according to the default DWB factors in VDYP (version 7) model.

8.3 Operational Adjustment Factors (OAFs)

Operational Adjustment Factors (OAFs) are used to adjust yield estimates to account for operational conditions in TIPSY model. There are two mechanisms to account for these conditions OAF1 and OAF2.

OAF1 is a constant percentage reduction to account for small unproductive areas within stands, uneven stem distribution, endemic losses and other random risk factors such as snow press and rust. In the yield curve creation for managed stands, a OAF1 value of 20% was applied to pine-leading AUs and AUs within Unit H (due to the heavy hemlock component); and a value of 15% (i.e., TIPSY default) was used for all other AUs.

OAF2 increases over time (% per 100yrs) to account for decay, waste and breakage. In the yield curve creation for managed stands, a OAF2 value of 5% was applied to all AUs.

8.4 Volume Reductions

Yield curves were adjusted down by 4% to meet the future WTRA objective and by 40% in biodiversity corridors (natural and managed stands) to account for volume removal as a result of stand thinning.

8.5 Yield Table Development

8.5.1 Natural (Unmanaged) Stand Yield Tables

Natural (unmanaged) stands had their growth and yield information calculated using the VDYP v.7 model on a polygon basis. The yield tables from each polygon were aggregated into AUs, based upon their THLB area.

Existing mature and immature natural (unmanaged) stands will be assumed to grow on the same VDYP yield curve.

8.5.1.1 Existing Timber Volume Check

To ensure that significant error did not result in aggregating natural stand polygons into AUs (

Table 17), the yield tables were checked against the original stand volume. For each polygon, using its current age in 5-year increments, the analysis unit yield table volume was quantified. This was then compared to the original volume for the polygon. The results shown in the table following demonstrate that the aggregation is reasonable across the entire Research Forest.

Table 17. Timber Volume Check of Natural Stands in the Research Forest

Analysis Unit Label	Analysis Unit Description	Total Polygon Volume (m3)	VDYP Volume (m3)	Percent Difference
BL_G	Balsam Good	41,689	44,957	8%
BL_M	Balsam Moderate	251,618	270,208	7%
BL_VG	Balsam Very Good	9,439	9,112	-3%
DEC_CON	Deciduous Leading	40,306	38,745	-4%
FDI_All_H	Douglas-fir Good (Unit H)	7,756	7,760	0%
FDI_All_OTR	Douglas-fir Good (All non-H Units)	66,901	67,679	1%
HW	Hemlock	36,371	36,340	0%
PLI_G	Pine Good	8,440	9,365	11%
PLI_VG	Pine Very Good	2,599	2,428	-7%
SX_G_OTR	Spruce Good (All non-H Units)	5,143	3,835	-25%
SX_M_H	Spruce Moderate (Unit H)	1,368	1,366	0%
SX_M_OTR	Spruce Moderate (All non-H Units)	63,797	63,651	0%
SX_P_M_H	Spruce Poor Moderate (Unit H)	4,439	4,483	1%
SX_P_M_OTR	Spruce Poor Moderate (All non-H Units)	207,515	195,840	-6%
SX_P_OTR	Spruce Poor (All non-H Units)	12,714	11,997	-6%
SX_VG_OTR	Spruce Very Good (All non-H Units)	17,930	16,989	-5%
Total		**778,023**	**784,755**	**0.87%**

8.5.2 Current and Future Managed Stand Yield Tables

The current managed stands and future managed stands in the Research Forest is calculated using batch TIPSY v4.4 model (Appendix 3, Appendix 4).

8.5.2.1 Regeneration Delay

The regeneration delay was assumed to be 1 year.

8.5.2.2 Regeneration Assumptions and Species Conversion

AU	Planted Species and Percent	Planting Density	Regen. Type	Site Index			OAF 1	OAF 2	Regen. Delay
				Natural	Current	Future			
BL_G	SX5BL4PL1	1,600	P	19.1	20.3	20.6	0.85	0.95	1
BL_M	SX5BL4PL1	1,600	P	14.5		19.4	0.85	0.95	1
BL_VG	SX5BL4PL1	1,600	P	24.3	22.0	22.1	0.85	0.95	1
DEC_CON	SX7PL2BL1	1,600	P	18.3		22.2	0.85	0.95	1
FDI_All_H	FD3PL3HW3SX1	1,600	P	16.0	16.2	16.1	0.80	0.95	1
FDI_All_OTR	FD3SX3PL3BL1	1,600	P	18.0	20.9	21.0	0.85	0.95	1
HW	HW2SX2FD2CW2PL2	1,600	P	13.1		18.6	0.80	0.95	1
PLI_G	PL7SX2FD1	1,600	P	19.3	19.9	20.0	0.80	0.95	1
PLI_VG	PL7SX2FD1	1,600	P	25.5	23.0	23.2	0.80	0.95	1
SX_G_H	HW2SX2FD2CW2PL2	1,600	P		21.9	21.9	0.80	0.95	1
SX_G_OTR	SX7PL2BL1	1,600	P	21.9	21.7	21.8	0.85	0.95	1
SX_M_H	HW2SX2FD2CW2PL2	1,600	P	19.9	18.9	19.4	0.80	0.95	1
SX_M_OTR	SX7PL2BL1	1,600	P	18.5	19.3	19.4	0.85	0.95	1
SX_P_M_H	HW2SX2FD2CW2PL2	1,600	P	14.1		14.1	0.80	0.95	1
SX_P_M_OTR	SX7PL2BL1	1,600	P	16.2	15.4	18.8	0.85	0.95	1
SX_P_OTR	SX7PL2BL1	1,600	P	10.3	10.0	14.7	0.85	0.95	1
SX_VG_OTR	SX7PL2BL1	1,600	P	26.4	24.2	24.0	0.85	0.95	1

8.6 Forest Estate Model

The timber supply analysis will be completed using the Woodstock Optimization Studio version 2021.03. The analysis will be performed using linear goal programming which is solved using the MOSEK solver.

8.6.1 Planning Horizon

The timber supply analysis will be run over 300 years, using 5-year periods. Hence the model will forecast growth and yield over 60 periods.

8.6.2 Forest Management Themes

The Woodstock model was generated using 10 Themes. A description of each of these themes and their applicability to the timber supply model is described below.

Table 18. Remsoft Woodstock Themes

Theme #	Name	Description / Rationale
1	AU	Analysis unit by species and site quality and Unit ID, used to link to yield tables and set minimum harvest volume and minimum harvest age constraints
2	Land Class	Used to define the THLB versus NCLB vs excluded areas
3	Management	Used to distinguished natural from managed stands
4	Unit	Identifies the 12 units comprising the Research Forest
5	Corridor	Used to separate the corridor from the non-corridor areas
6	BEC	Old-Growth
7	VQO	Used to assign VQO and VQO polygon number
8	Leading Species	Used to report the leading species over time.
9	NRL	Non-Recoverable Losses.
10	WTP	Used to retain and prevent harvest of current WTRAs for 60 years.

8.6.3 Sensitivity Analysis

A list of the sensitivity analyses run on the forest estate model can be found in the table below.

Table 19. Sensitivity Analyses run on the Forest Estate Model

#	Modeling Assumption	Feature Tested
0	Base Case	N/A
1	Old-Growth	use previous TSR old-growth retention targets
2	Old-Growth	limit the amount of immature (<41yrs) forests for old-growth and watershed functioning
3	Corridor	retain 34% of the old-growth forests (>121yrs) retained in Corridor
4	Corridor	retain 75% of the old-growth forests (>121yrs) retained in Corridor
5	WTRA	increase WTRA to 7%
6	WTRA	increase WTRA to 10%
7	Corridor	remove corridor lock in units A, C, D, F, and G
8	Culmination Age	remove culmination age requirement
9	Natural Yields	Increase natural yield by 10%
10	Natural Yields	Decrease natural yield by 10%
11	Managed Yields	Increase managed yield by 10%
12	Managed Yields	Decrease managed yield by 10%
13	VQO Constraints	Remove VQO constraints
14	VQO Constraints	Increase VQO constraints by 5%
15	Old-Growth	Increase classification of old-stands from 121 to 141 years old
16	Land Classification	Increase THLB by 5%
17	Land Classification	Decrease THLB by 5%
18	Corridor	replace thinning with clearcutting in corridors
19	20yr Harvest Plan	Added operation block constraints
20	Old-Growth, Cul Age	limit the amount of immature (<41yrs) forests for old-growth and watershed functioning, remove culmination age

Appendix 1. Manual Adjustment to Land Base Classification

A1 Non-Forest / Non-Productive Adjustments

Figure A 1. Polygon in Unit A was dropped from non-productive and added back into net-down sequence as it appears productive from satellite imagery.

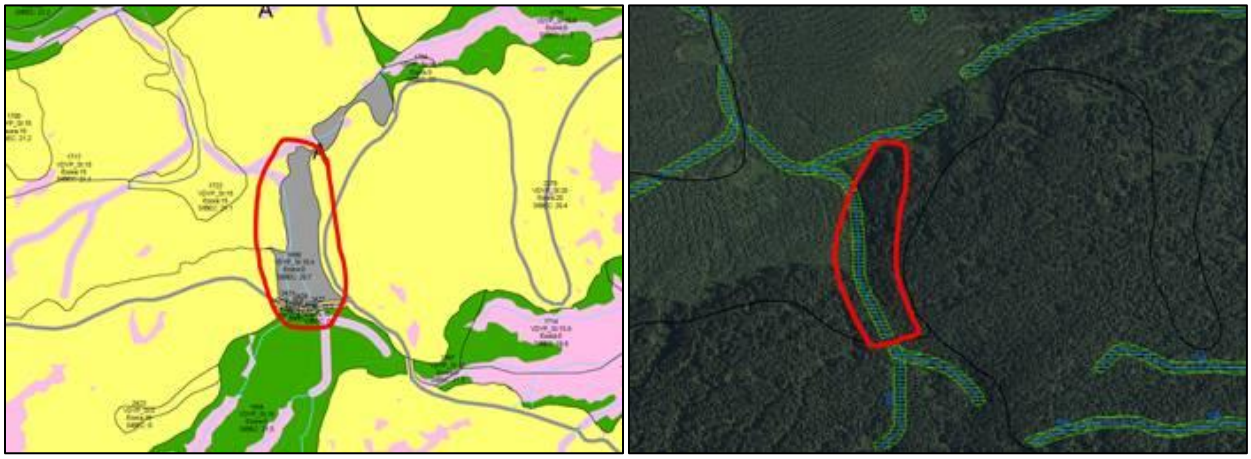


Figure A 2. Polygon in Unit B was dropped from non-productive and added back into net-down sequence as it appears productive from satellite imagery.

Figure A 3. Polygon in Unit D was dropped from non-productive and added back into net-down sequence as it appears productive from satellite imagery.

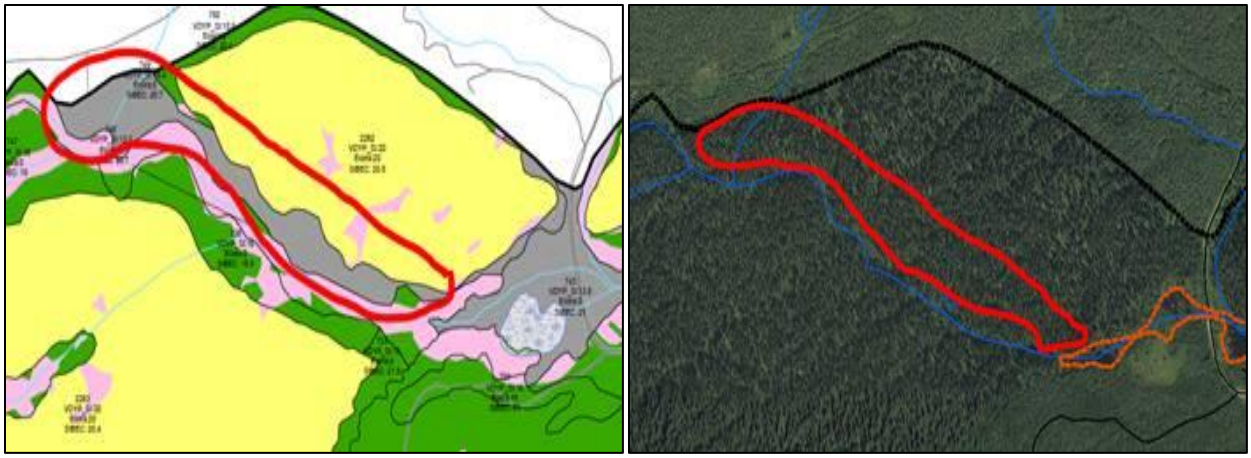
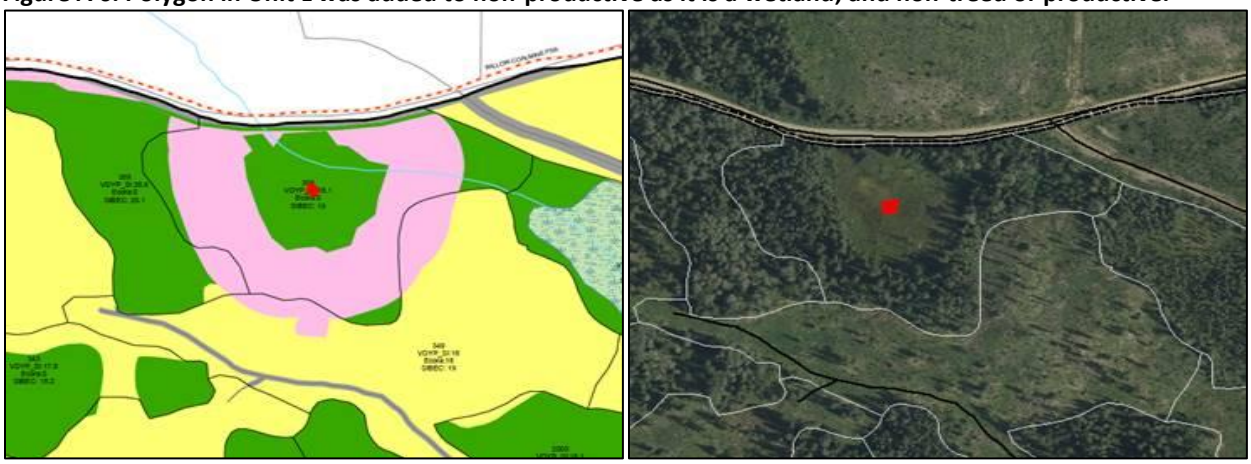


Figure A 4. Polygon in Unit D was dropped from non-productive and added back into net-down sequence as it appears productive from satellite imagery.

Figure A 5. Polygon in Unit I was added to non-productive as is heavily bladed and compacted as a result of use by the Ministry of Transportation and Highways in sourcing gravel.

Figure A 6. Polygon in Unit L was added to non-productive as it is a wetland; and non-treed or productive.



A2 Existing Roads, Trails, and Landings

Figure A 7. Old landings absent from spatial files in Unit B were added to Existing, Trails, and Landings.

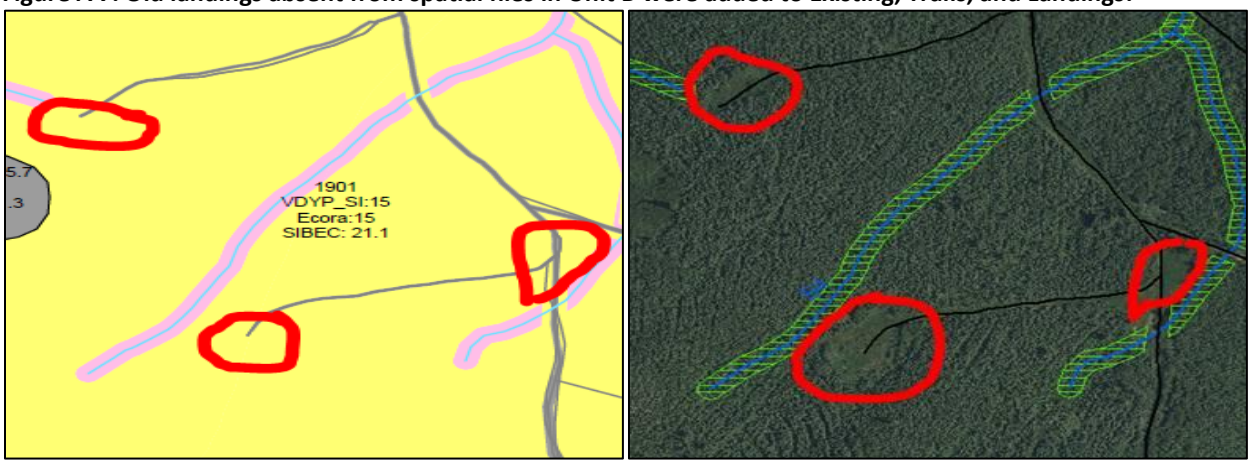


Figure A 8. The buffer for this old road (built by Canfor/Tano T'enneh) in Unit C was absent from spatial files and was buffered according to adjoining and known segments of the road. The buffered road area was removed as Existing Road, Trails and Landings.

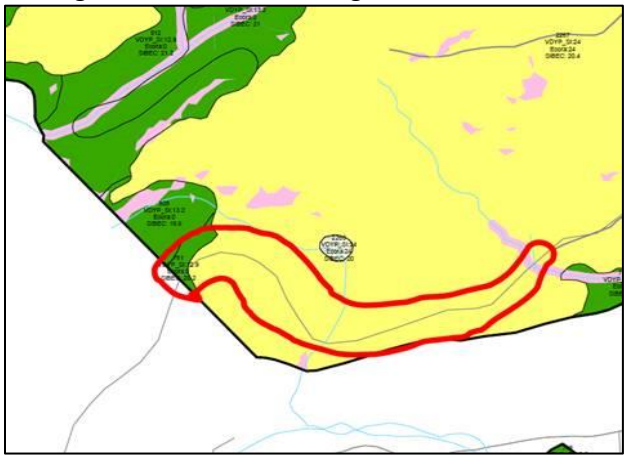
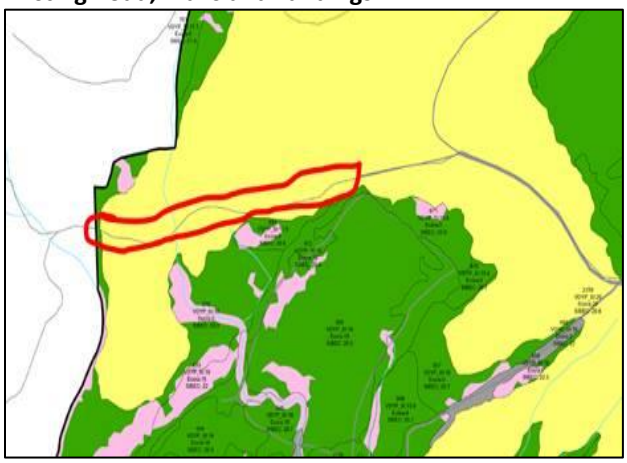


Figure A 9. The buffer for this old road (built by Canfor/Tano T'enneh) in Unit D was absent from spatial files and was buffered according to adjoining and known segments of the road. The buffered road area was removed as Existing Road, Trails and Landings.



A3 Problem Forest Types

Figure A 10. The green hashed polygons in Unit H were removed from the THLB based on their high percentages of a combination of trees species that are undesirable and lack of potential for feasible spruce and D-fir volume.

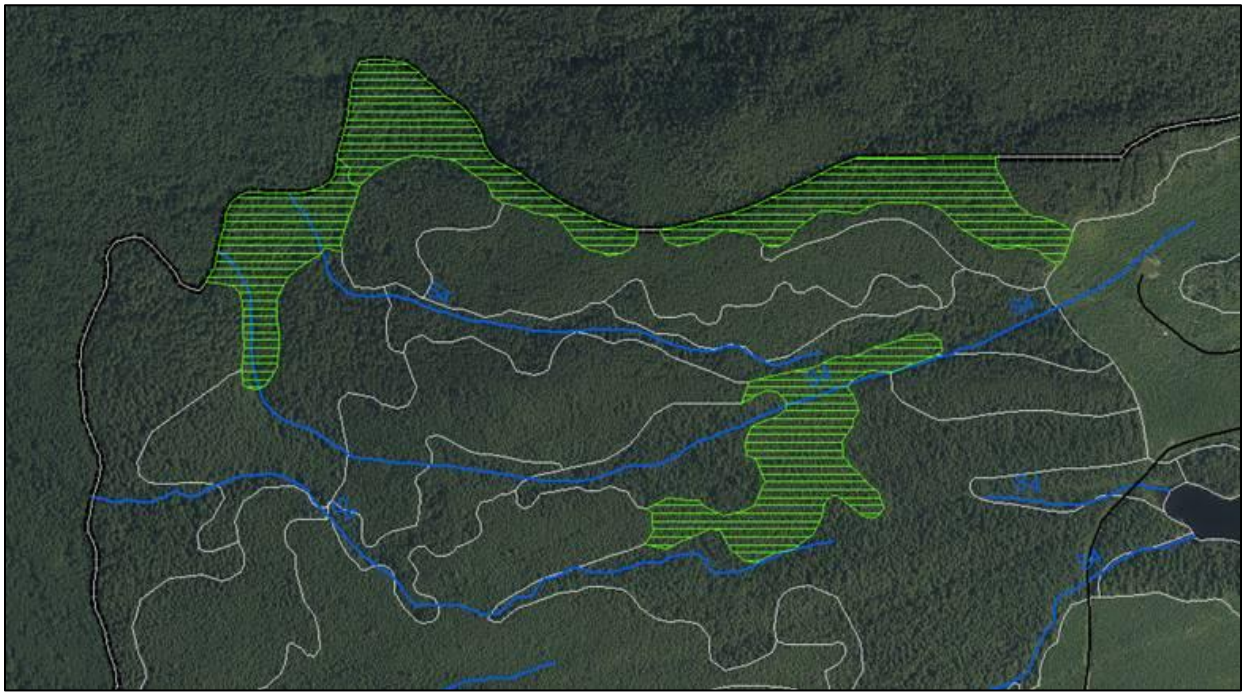


Figure A 11. The red hashed polygons in Unit H stayed in the THLB due their potential for feasible spruce and Douglas-fir volume over a significant part of the type.

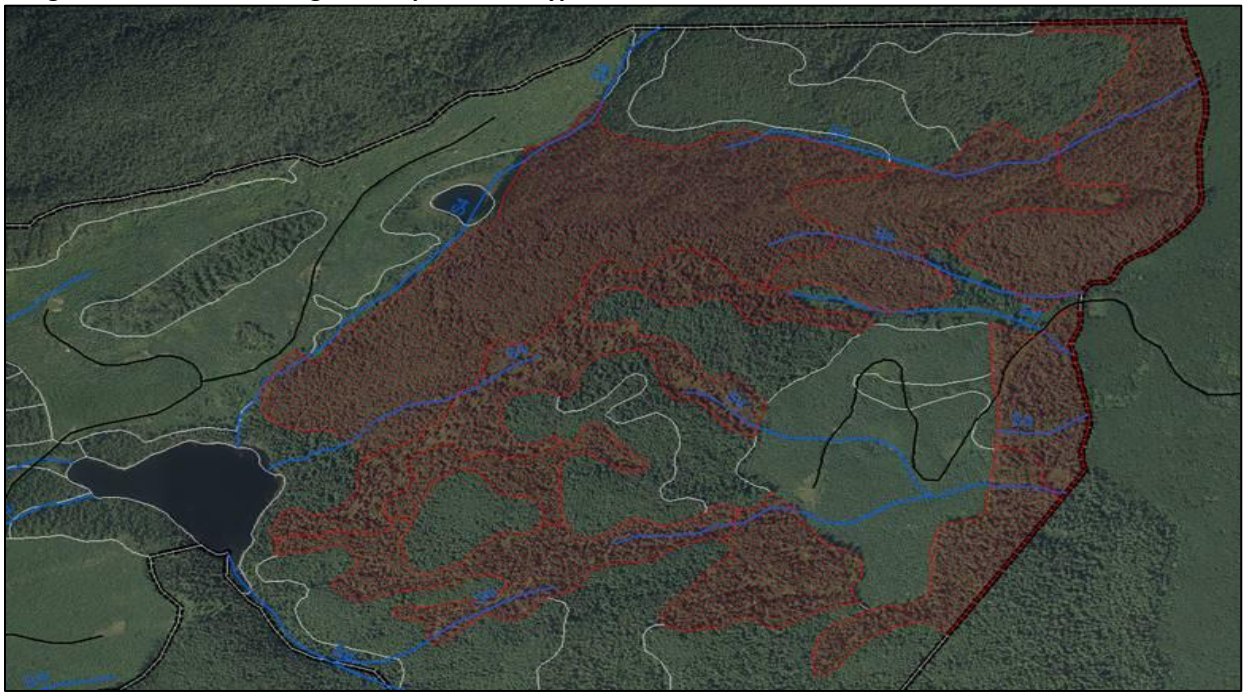
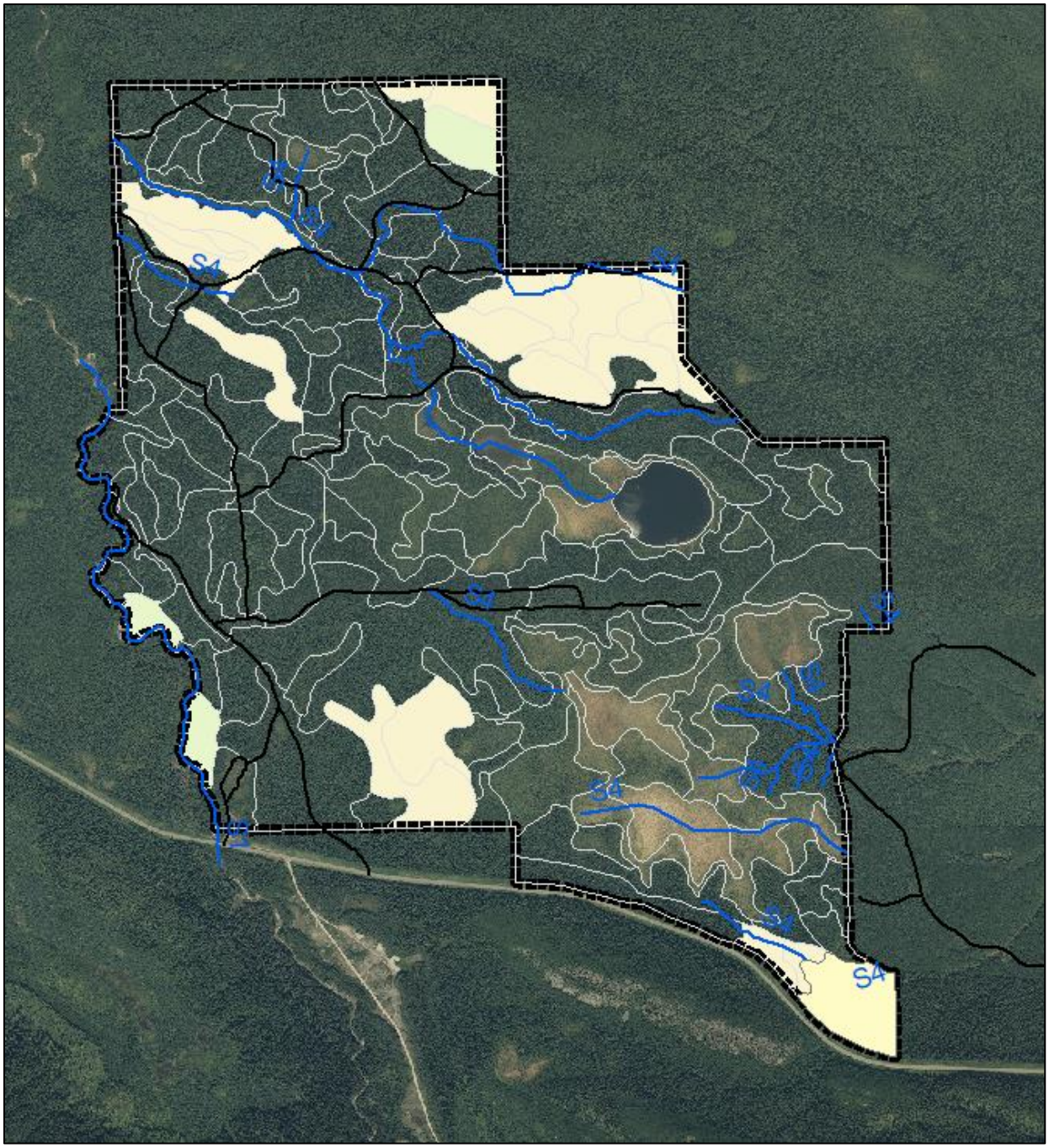


Figure A 12. The white filled polygons (presenting undesirable hemlock/cedar types) in Unit I were removed from the THLB.



Appendix 2. Natural (Unmanaged) Yield Tables

AU	BL_G	BL_M	BL_VG	DEC_CON	FDI_G_H	FDI_G_OTR	HW	PLI_G
5	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
20	0	0	0	2	0	0	0	0
25	0	0	5	8	0	0	0	12
30	0	0	29	18	0	5	0	60
35	11	0	62	33	8	12	0	85
40	29	3	106	52	17	21	1	111
45	55	8	150	71	29	33	14	137
50	84	16	198	90	44	47	25	162
55	114	26	249	107	64	62	39	185
60	142	38	298	123	87	78	55	207
65	171	51	343	136	112	95	72	227
70	199	65	384	148	138	111	91	245
75	224	78	421	158	166	127	110	262
80	247	91	454	166	193	143	132	277
85	269	103	483	174	219	157	152	291
90	288	115	510	180	244	171	171	303
95	305	125	533	185	268	184	189	315
100	320	134	554	189	291	196	207	325
105	334	143	573	193	312	207	223	333
110	346	151	590	196	332	218	238	341
115	357	158	604	198	351	228	253	347
120	366	165	616	200	368	238	266	353
125	374	171	626	202	385	247	278	359
130	380	176	634	203	400	256	290	363
135	386	181	641	203	415	265	301	367
140	391	186	646	203	429	274	311	371
145	394	190	649	203	440	283	319	374
150	397	193	651	202	450	290	326	376
155	398	195	651	200	458	297	331	377
160	399	197	650	198	465	302	335	378
165	399	198	649	196	470	307	338	379
170	399	199	648	193	474	311	340	379
175	398	200	646	191	477	314	341	379
180	397	200	644	189	480	316	342	379
185	397	201	643	186	482	318	342	379
190	395	201	641	184	483	320	341	378
195	394	201	640	181	484	320	340	377
200	393	200	638	179	484	321	339	376
205	391	200	636	176	482	320	337	375
210	389	199	634	174	481	320	336	373
215	388	198	633	171	479	319	334	372
220	386	198	631	169	478	318	332	370
225	384	197	629	167	476	317	331	368
230	382	196	627	165	475	317	329	367
235	381	195	626	163	473	316	327	365
240	379	195	624	161	472	315	326	363
245	378	194	622	159	470	314	324	362
250	376	193	621	157	469	313	323	360
255	375	193	619	155	467	312	321	359
260	373	192	618	153	466	311	319	357
265	372	192	616	151	464	311	318	355
270	370	191	615	149	464	310	316	354
275	369	190	613	148	463	309	315	352
280	367	190	611	146	463	308	314	350
285	366	189	610	144	463	307	312	349
290	365	189	608	143	463	306	311	347
295	363	188	607	141	462	305	309	345
300	362	187	606	139	462	304	308	344
305	361	187	604	138	462	303	307	342
310	359	186	603	137	461	302	305	341
315	359	186	602	136	461	301	304	339
320	358	186	600	135	460	300	303	338
325	357	185	599	134	459	299	302	336
330	357	185	598	132	459	298	301	335
335	356	185	597	131	458	297	300	334
340	356	184	596	130	457	296	299	332
345	355	184	595	129	456	295	298	331
350	354	184	594	128	455	294	297	329

Natural (Unmanaged) Stand Yield Tables (continued)

AU	PLI_VG	SX_G_OTR	SX_M_H	SX_M_OTR	SX_P_M_H	SX_P_M_OTR	SX_P_OTR	SX_VG_OTR
5	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
20	8	0	0	0	0	0	0	0
25	23	0	0	0	0	0	0	0
30	47	3	0	0	0	0	0	20
35	76	13	4	0	0	0	0	54
40	114	33	12	6	0	1	0	102
45	154	59	27	18	3	6	0	158
50	193	86	48	35	9	16	0	212
55	231	115	73	56	19	30	0	266
60	267	144	100	80	33	47	1	316
65	299	174	126	105	50	67	4	363
70	329	202	151	130	69	88	9	404
75	356	229	173	153	88	108	18	441
80	380	254	192	174	106	128	29	474
85	401	277	209	193	123	146	41	502
90	421	298	225	209	139	163	53	528
95	438	317	238	224	153	179	66	550
100	454	335	250	237	167	193	78	569
105	467	351	260	248	179	206	90	587
110	480	365	269	257	189	218	101	601
115	491	378	277	266	199	229	111	614
120	502	390	284	272	208	239	120	625
125	511	401	290	278	217	248	128	634
130	520	411	296	283	224	257	135	641
135	528	420	300	288	230	265	142	648
140	535	428	304	292	236	273	149	654
145	541	434	310	295	241	279	154	658
150	546	439	313	296	244	284	158	661
155	550	442	316	297	247	288	161	662
160	552	444	319	297	248	291	163	662
165	554	444	320	296	249	292	164	660
170	555	444	321	295	249	293	165	658
175	556	443	322	293	249	294	165	656
180	556	441	322	292	249	294	165	653
185	555	440	322	290	248	293	165	650
190	554	438	321	288	247	293	164	647
195	552	435	320	286	246	292	164	643
200	551	433	319	284	245	291	163	640
205	548	429	317	281	243	289	162	636
210	546	426	316	278	242	287	161	631
215	543	423	314	275	240	285	160	627
220	540	419	312	273	239	283	159	623
225	538	416	311	271	238	281	158	619
230	535	413	309	268	238	279	158	615
235	532	410	307	266	237	277	157	612
240	530	407	306	264	236	275	156	608
245	527	404	304	261	235	273	155	604
250	525	402	303	259	234	272	155	601
255	522	399	301	257	234	270	154	597
260	519	396	300	255	233	268	153	594
265	517	394	298	253	232	267	153	591
270	514	391	297	251	231	265	152	587
275	512	388	295	249	231	263	151	584
280	509	386	294	247	230	262	151	581
285	507	384	293	245	229	260	150	578
290	504	381	291	243	228	259	150	575
295	502	379	290	242	227	257	149	572
300	499	376	289	240	227	256	148	569
305	497	374	287	238	226	254	148	566
310	495	372	286	236	226	253	147	563
315	493	370	285	235	225	252	147	561
320	491	370	285	234	225	251	146	560
325	489	369	284	233	224	251	146	558
330	487	368	284	233	224	250	146	557
335	485	368	283	232	224	249	146	555
340	483	367	283	231	224	249	145	554
345	481	366	283	230	223	248	145	552
350	479	366	282	230	223	248	145	551

Appendix 3. Current Managed Stand Yield Tables

AU	BL_G	BL_VG	FDI_G_H	FDI_G_OTR	PLI_G	PLI_VG	SX_G_H
5	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
20	0	0	0	0	0	2	0
25	0	0	0	1	2	21	2
30	1	4	0	8	18	59	17
35	9	21	1	28	48	107	54
40	29	53	4	63	84	158	100
45	61	94	12	104	122	209	149
50	98	139	26	147	161	257	199
55	137	183	47	188	200	300	244
60	177	225	71	226	237	336	285
65	214	263	95	261	270	367	326
70	248	296	119	292	300	393	364
75	278	326	143	318	325	415	398
80	305	352	166	343	348	433	430
85	330	375	186	365	368	449	458
90	352	395	206	384	384	461	484
95	371	413	224	401	399	473	508
100	388	429	240	418	412	483	532
105	403	443	256	432	423	492	555
110	417	457	270	446	432	500	577
115	430	469	283	458	440	506	597
120	441	479	296	470	448	512	616
125	451	489	307	480	455	518	632
130	461	498	318	490	460	523	648
135	469	506	328	499	465	527	663
140	477	514	338	508	470	530	677
145	484	521	346	516	474	532	690
150	491	527	354	523	478	535	702
155	497	532	362	530	480	537	714
160	503	537	369	536	483	539	725
165	508	541	376	542	486	539	736
170	513	545	382	547	489	539	745
175	517	548	388	552	491	539	752
180	521	551	393	557	493	539	759
185	524	553	398	561	494	539	759
190	528	555	403	564	494	540	759
195	530	558	407	568	495	540	759
200	533	560	412	571	495	540	759
205	535	562	416	574	496	540	759
210	536	564	420	576	496	540	759
215	538	565	424	579	496	540	759
220	539	566	427	582	497	540	759
225	540	567	430	584	497	541	759
230	541	568	434	586	498	541	759
235	542	569	437	588	498	541	759
240	543	570	440	589	498	541	759
245	544	570	442	591	498	541	759
250	545	571	445	593	499	541	759
255	546	571	448	594	499	542	759
260	547	571	450	595	499	542	759
265	548	571	452	596	500	542	759
270	548	571	454	597	500	541	759
275	548	571	456	598	500	541	759
280	548	571	458	599	500	541	759
285	547	571	460	600	501	541	759
290	547	571	462	601	501	541	759
295	547	571	464	602	501	541	759
300	547	571	464	602	501	541	759
305	547	571	464	602	501	541	759
310	547	571	464	602	501	541	759
315	547	571	464	602	501	541	759
320	547	571	464	602	501	541	759
325	547	571	464	602	501	541	759
330	547	571	464	602	501	541	759
335	547	571	464	602	501	541	759
340	547	571	464	602	501	541	759
345	547	571	464	602	501	541	759
350	547	571	464	602	501	541	759

Current Managed Stand Yield Tables (continued)

AU	SX_G_OTR	SX_M_H	SX_M_OTR	SX_P_M_OTR	SX_P_OTR	SX_VG_OTR
5	0	0	0	0	0	0
10	0	0	0	0	0	0
15	0	0	0	0	0	0
20	0	0	0	0	0	0
25	0	0	0	0	0	2
30	6	3	1	0	0	19
35	25	13	7	0	0	59
40	62	41	24	2	0	111
45	106	76	54	8	0	167
50	154	114	91	20	0	223
55	201	154	130	41	0	272
60	245	193	170	65	1	315
65	283	230	208	92	3	352
70	317	262	243	121	7	384
75	347	294	274	149	14	411
80	374	324	303	177	22	435
85	396	353	328	203	34	455
90	416	380	351	228	47	474
95	434	404	371	250	61	491
100	449	427	389	270	76	506
105	463	447	404	289	91	519
110	476	466	418	306	107	530
115	488	483	430	322	122	541
120	499	500	442	337	137	551
125	508	517	453	350	152	559
130	517	534	462	362	166	566
135	524	549	471	373	180	572
140	532	563	479	383	193	578
145	538	576	487	392	205	582
150	544	588	493	400	216	586
155	549	599	499	407	227	589
160	554	610	504	414	238	592
165	558	620	509	420	248	595
170	561	629	514	426	257	598
175	564	638	519	432	266	600
180	566	646	523	438	274	602
185	567	654	527	443	281	603
190	569	661	530	447	289	605
195	570	668	532	452	296	606
200	572	674	535	455	302	607
205	573	680	537	459	308	608
210	574	686	539	462	313	610
215	576	692	541	465	318	611
220	577	697	542	467	323	611
225	578	701	544	470	328	610
230	578	706	545	472	333	608
235	578	710	546	474	337	607
240	579	714	546	476	340	605
245	579	717	547	478	344	604
250	579	720	547	480	347	603
255	580	724	548	481	350	602
260	580	727	548	483	354	602
265	580	730	548	484	356	602
270	580	732	549	486	359	602
275	579	735	549	487	362	602
280	579	735	549	488	364	602
285	579	735	550	489	367	602
290	579	735	550	490	369	602
295	579	735	550	490	369	602
300	579	735	550	490	369	602
305	579	735	550	490	369	602
310	579	735	550	490	369	602
315	579	735	550	490	369	602
320	579	735	550	490	369	602
325	579	735	550	490	369	602
330	579	735	550	490	369	602
335	579	735	550	490	369	602
340	579	735	550	490	369	602
345	579	735	550	490	369	602
350	579	735	550	490	369	602

Appendix 4. Future Managed Stand Yield Tables

AU	BL_G	BL_M	BL_VG	DEC_CON	FDI_G_H	FDI_G_OTR	HW	PLI_G
5	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0
25	0	0	0	1	0	1	0	3
30	1	0	5	8	0	8	2	19
35	11	5	22	30	1	29	10	49
40	33	19	55	70	4	64	36	86
45	66	46	96	118	10	105	68	125
50	105	78	142	167	23	148	106	165
55	146	115	186	215	43	190	144	204
60	186	152	228	258	66	228	183	240
65	223	188	266	297	90	262	219	274
70	257	222	299	331	113	293	252	303
75	287	252	329	361	137	320	282	329
80	314	280	355	386	159	345	313	352
85	339	305	378	408	180	366	341	371
90	360	328	398	428	199	386	368	388
95	379	348	416	445	217	403	393	403
100	396	365	432	460	234	419	415	415
105	411	381	446	474	249	434	436	426
110	424	396	460	488	263	447	454	435
115	437	408	471	499	276	460	472	443
120	448	420	482	509	288	471	488	451
125	458	431	492	518	300	482	505	457
130	468	441	500	526	311	491	521	463
135	476	450	509	534	321	501	536	468
140	484	458	516	542	330	510	550	473
145	491	465	523	548	339	518	564	476
150	498	472	529	554	347	525	576	480
155	504	478	535	558	355	532	587	483
160	510	484	539	562	362	538	598	486
165	515	489	543	566	369	544	607	489
170	519	494	547	569	375	549	616	491
175	523	499	550	571	381	554	625	493
180	526	504	553	574	387	558	634	494
185	529	507	555	575	391	562	641	494
190	532	510	558	577	395	565	649	494
195	534	513	560	579	399	569	656	495
200	536	516	562	581	403	572	663	495
205	537	519	564	583	407	575	669	496
210	539	521	566	584	410	578	675	496
215	540	523	567	585	414	580	681	496
220	541	525	568	586	417	582	686	497
225	542	526	569	586	420	585	690	497
230	543	527	570	587	424	587	695	497
235	544	528	571	587	426	589	699	497
240	546	529	572	588	429	590	703	498
245	546	530	572	588	432	592	707	498
250	547	531	572	588	434	594	710	498
255	548	531	573	588	436	595	713	498
260	548	532	573	589	439	596	716	499
265	548	532	573	589	441	597	719	499
270	548	533	573	589	443	598	722	499
275	548	533	573	589	445	599	724	499
280	548	534	573	589	446	600	727	500
285	548	534	573	589	448	601	729	500
290	548	534	573	589	450	602	732	500
295	548	535	573	588	452	602	734	500
300	548	535	573	588	452	602	734	500
305	548	535	573	588	452	602	734	500
310	548	535	573	588	452	602	734	500
315	548	535	573	588	452	602	734	500
320	548	535	573	588	452	602	734	500
325	548	535	573	588	452	602	734	500
330	548	535	573	588	452	602	734	500
335	548	535	573	588	452	602	734	500
340	548	535	573	588	452	602	734	500
345	548	535	573	588	452	602	734	500
350	548	535	573	588	452	602	734	500

Future Managed Stand Yield Tables (continued)

AU	PLI_VG	SX_G_H	SX_G_OTR	SX_M_H	SX_M_OTR	SX_P_M_H	SX_P_M_OTR	SX_P_OTR	SX_VG_OTR
5	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0
20	2	0	0	0	0	0	0	0	0
25	23	2	0	0	0	0	0	0	1
30	63	17	6	4	1	0	0	0	18
35	112	54	26	18	7	1	5	0	56
40	163	100	63	48	26	2	20	1	107
45	216	149	108	85	56	7	47	4	162
50	264	199	156	125	94	18	81	13	217
55	306	244	203	166	134	37	118	27	266
60	343	285	246	207	174	58	156	49	310
65	373	326	285	242	212	82	194	72	347
70	400	364	319	275	247	107	229	97	379
75	420	398	349	308	278	132	260	124	407
80	438	430	375	340	306	157	288	150	430
85	454	458	398	369	332	181	314	176	451
90	466	484	417	395	354	203	337	200	470
95	477	508	435	420	374	224	358	223	487
100	488	532	450	442	392	243	375	243	502
105	496	555	464	462	407	262	392	262	515
110	504	577	478	480	421	281	406	280	527
115	511	597	490	498	433	299	419	296	537
120	517	616	500	517	444	316	430	311	547
125	522	632	509	534	455	332	441	325	556
130	527	648	518	550	465	347	451	338	563
135	530	663	525	566	474	361	460	350	569
140	533	677	533	580	482	375	468	360	575
145	536	690	539	592	489	387	476	370	580
150	538	702	545	604	496	398	482	379	583
155	540	714	550	615	501	408	489	386	587
160	541	725	555	626	507	418	494	394	590
165	542	736	559	636	512	427	499	400	593
170	542	745	562	645	516	436	504	406	595
175	543	752	565	654	521	445	508	412	598
180	544	759	567	662	525	454	512	418	599
185	545	759	568	670	528	463	516	423	600
190	546	759	570	677	531	471	519	428	602
195	547	759	572	684	534	479	522	432	603
200	547	759	573	691	536	486	525	436	604
205	548	759	574	698	538	494	527	440	605
210	548	759	576	703	540	500	530	443	606
215	549	759	577	708	542	506	532	446	607
220	549	759	578	714	544	511	534	449	608
225	549	759	579	718	545	516	535	452	608
230	549	759	580	722	546	521	537	455	607
235	550	759	580	726	547	526	538	457	605
240	550	759	580	730	547	530	540	459	604
245	550	759	581	734	548	535	540	461	603
250	550	759	581	737	548	539	541	463	601
255	550	759	582	741	549	543	541	465	600
260	550	759	582	744	549	546	542	466	599
265	550	759	582	744	550	550	542	468	599
270	549	759	581	744	550	553	542	469	599
275	549	759	581	744	550	556	543	471	599
280	549	759	581	744	550	559	543	472	599
285	549	759	581	744	551	562	543	473	599
290	548	759	581	744	551	564	543	474	599
295	548	759	581	744	551	567	543	476	599
300	548	759	581	744	551	567	543	476	599
305	548	759	581	744	551	567	543	476	599
310	548	759	581	744	551	567	543	476	599
315	548	759	581	744	551	567	543	476	599
320	548	759	581	744	551	567	543	476	599
325	548	759	581	744	551	567	543	476	599
330	548	759	581	744	551	567	543	476	599
335	548	759	581	744	551	567	543	476	599
340	548	759	581	744	551	567	543	476	599
345	548	759	581	744	551	567	543	476	599
350	548	759	581	744	551	567	543	476	599