Tree Farm Licence 6
Management Plan 11

VERSION 1, JUNE 2026

WESTERN
Forest Products

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Tree Farm Licence 6

MANAGEMENT PLAN 11

June 2026

This Management Plan was prepared by and under the supervision of

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Revision History

Version	Date	Description
1.0	June, 2026	Initial Version

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Table of Contents

List of Tables

List of Figures

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1 Introduction

This is the eleventh Management Plan (MP) prepared for Tree Farm Licence (TFL) 6 and the second MP prepared by Western Forest Products Inc. (Western) in compliance with the Tree Farm Licence Management Plan Regulation (B.C. Reg. 280/2009). Enacted by the provincial government in November 2009, this regulation, along with associated amendments to the *Forest Act*, outlines the content requirements, submission timing, and public review processes for TFL Management Plans.

The regulation supersedes the content requirements specified in previous TFL agreements. Management objectives and strategies for operations within the TFL are detailed in Forest Stewardship Plans (FSPs), in accordance with the *Forest and Range Practices Act* (FRPA). These objectives and strategies are incorporated into the timber supply analysis included in this Management Plan. The analysis will provide information to the Chief Forester of British Columbia (BC) for determining the next allowable annual cut (AAC) for TFL 6.

2 Description of TFL 6

2.1 Location

TFL 6 is situated on the northern part of Vancouver Island, near Quatsino Sound. It spans from Nahwitti Lake to the north to Victoria Lake to the south, and from Winter Harbour in the west to Port McNeill in the east. TFL 6 is comprised of both “Schedule A” (Timber Licences) lands and “Schedule B” (Crown) land (see Figure 1).

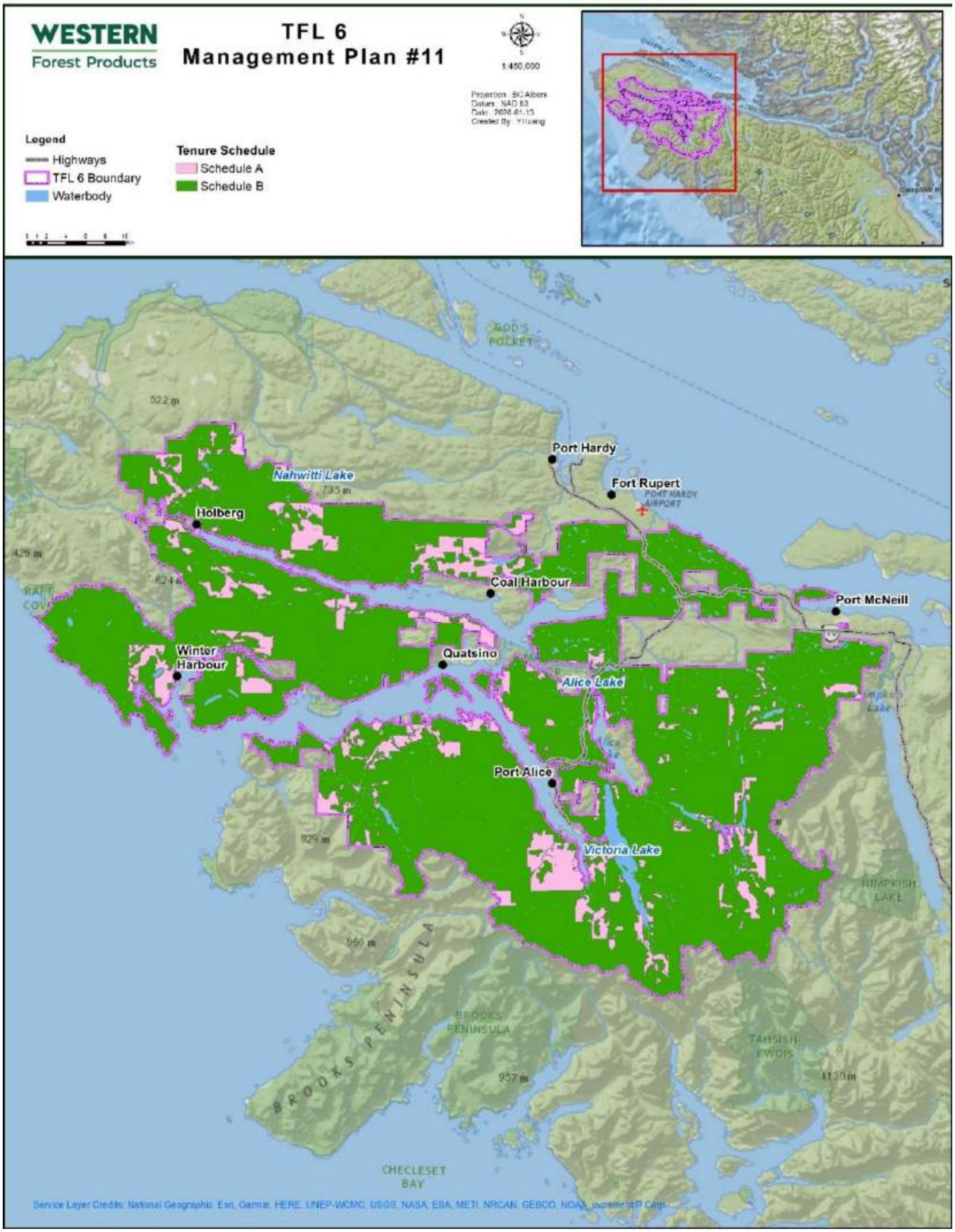

Figure 1 TFL 6 Overview

Larger centres and First Nations communities within or near TFL 6 include:

- Port Hardy/Tsulquate/Tsaxis
- Port McNeill
- Alert Bay/'Yalis
- Port Alice and Jeune Landing
- Fort Rupert
- Coal Harbour/Quatsino Subdivision
- Sointula
- Holberg
- Winter Harbour
- Bull Harbour, Hope Island

Nearby provincial parks, none of which are inside the TFL, include:

- Muqqiwn/Brooks Peninsula Park
- Tahsish-Kwois Park
- Nimpkish Lake Park
- Marble River Park
- Raft Cove Park
- Quatsino Park
- Cape Scott Park
- Lower Nimpkish Park
- Misty Lake Ecological Reserve

2.2 Land Base Composition

The total TFL area is approximately 217,197 hectares and approximately 187,425 hectares is considered productive forest land. Of this, 120,099 hectares is anticipated to be available for timber harvesting (timber harvesting land base or "THLB"), with roughly 67,326 hectares of productive forest assumed not available for harvesting (non-contributing land base or "NCLB"). The THLB is derived by deducting areas not available for harvesting due to:

- legal orders (e.g. ungulate winter range, wildlife habitat area),
- identified to meet legal requirements but not yet legally designated (e.g. proposed Old Growth Management Areas and Wildlife Habitat Areas),
- practice requirements (e.g. riparian management areas, wildlife tree retention areas),
- estimates of areas required to be reserved to manage and conserve non-timber resources at the site-level (e.g. cultural heritage features, karst features, unstable terrain), and

- physical and economic constraints (e.g. inoperable, uneconomic)

Figure 2 and Figure 3 present the age class distribution (by area) and the current volume distribution (by volume class) respectively for the THLB and NCLB.

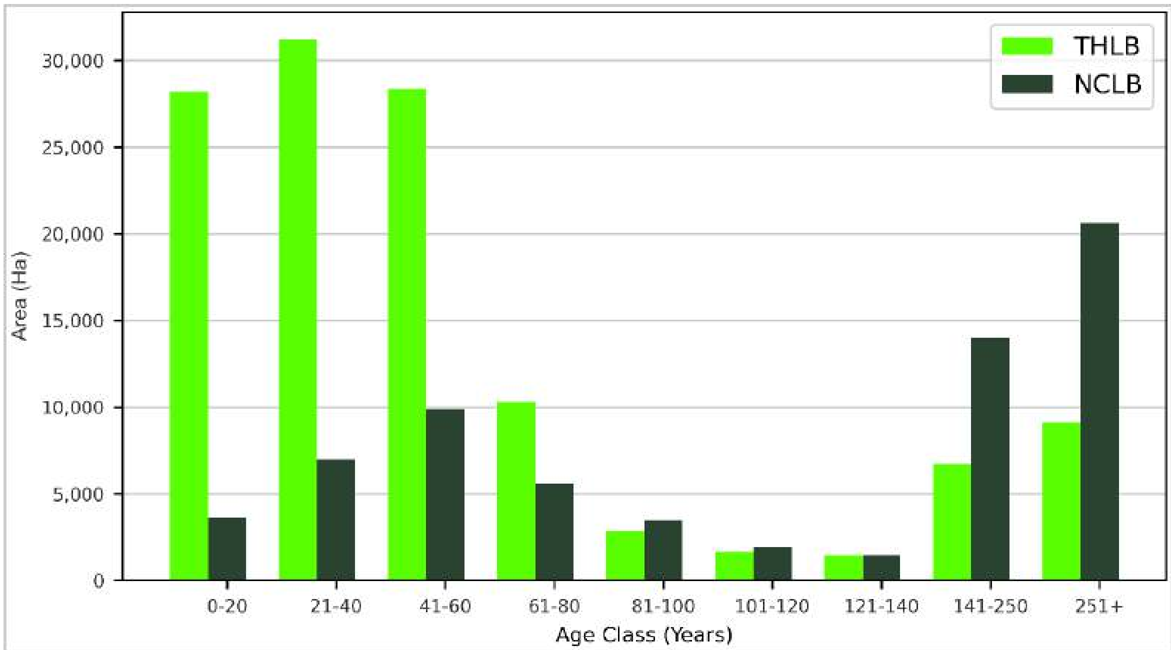

Figure 2 THLB and NCLB Age Class Distributions

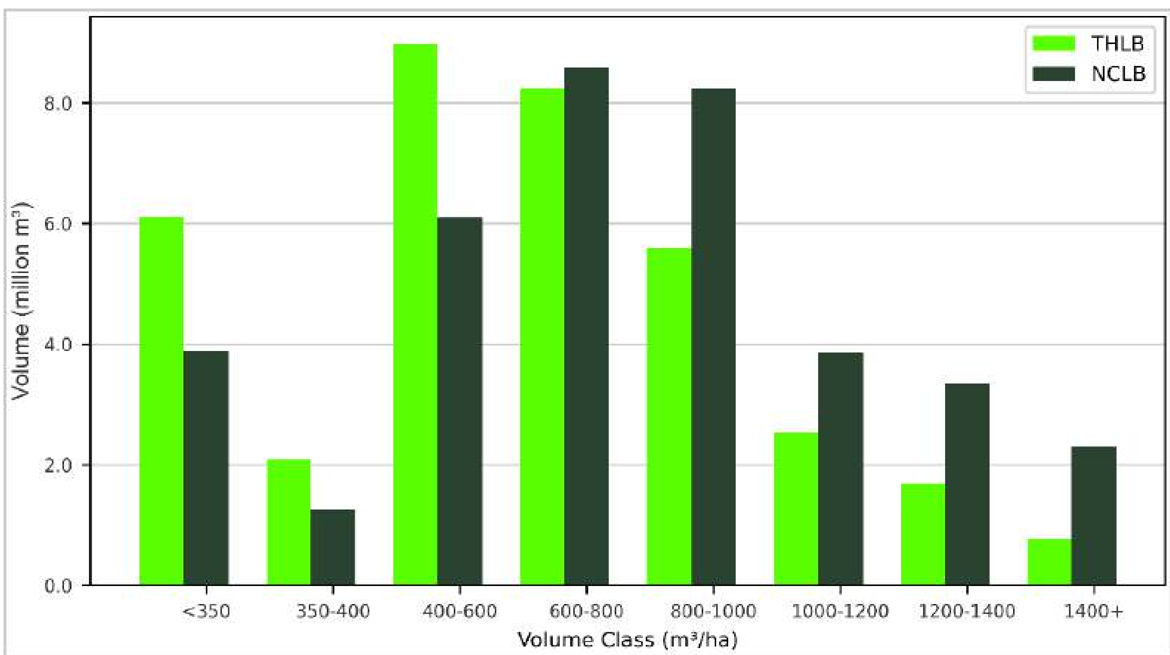

Figure 3 THLB and NCLB Volume Class Distributions

As shown in Figure 2, the NCLB is predominantly composed of older mature and old (141 years old and older) forests. This age distribution reflects the presence of various land base reserves established to maintain other resource values, such as ungulate winter ranges, wildlife habitat areas, and old-growth management areas, which collectively prioritize the preservation of older forests. Figure 3 further illustrates that the NCLB contains a higher proportion of high-volume stands compared to THLB. This pattern is consistent with the greater prevalence of older mature and old forests within the NCLB.

2.3 Ecological Characteristics

The terrain within TFL 6 is highly varied. Mountainous and steep formations dominate the central and inland portions, while rolling, gentle terrain characterizes the eastern and western sections. Numerous rivers and streams drain the licence area, several of which support significant anadromous and resident fish populations. Wildlife is abundant, with large mammals such as Columbia black-tailed deer, cougars, and black bears commonly found throughout the area, along with numerous other mammals, amphibians, and bird species.

Forests within TFL 6 predominantly lie within the wetter maritime Coastal Western Hemlock biogeoclimatic zone. Approximately 84% of the total TFL area is classified as productive forests. The productive forests comprise of leading commercial tree species, predominantly western hemlock, western redcedar, and balsam (amabilis fir). Other species are present in smaller proportions, including Sitka spruce, Douglas-fir, yellow-cedar, red alder, and shore pine. The climate is characterized by mild, wet winters with daily mean minimum temperatures from December to February ranging from 0°C to 2°C, and cool, moist summers with daily mean maximum temperatures during July and August in the 18°C to 20°C range. Annual precipitation levels range from 3,000 to 5,000 mm. Local climatic conditions can vary significantly due to topographic influences and the movement of low cloud and fog from offshore onto northern Vancouver Island.

3 TFL 6 Licence Holder History

Forest Management Licence (FML) No. 6 (Quatsino) was originally awarded in 1950. FMLs were later renamed Tree Farm Licences (TFLs). The licence holder has changed over time with successive corporate name changes, acquisitions and mergers (see Table 1).

Table 1 TFL 6 Licence Holders

Licence	Date listed company became licence holder	Licence Holder	Description
FML 6	October 26, 1950	British Columbia Pulp and Paper Company Limited	Original FML
FML 6	April 25, 1951	Alaska Pine and Cellulose Limited	Company name change
TFL 6	May 22, 1958	Alaska Pine and Cellulose Limited	FMLs become TFLs
TFL 6	October 20, 1959	Rayonier Canada Limited	Company name change
TFL 6	May 25, 1961	Rayonier B.C. Limited	Assignment to subsidiary
TFL 6	September 1, 1961	Rayonier Canada (B.C.) Limited	Company name change
TFL 6	October 31, 1980	Western Forest Products Limited	Corporate purchase
TFL 6	July 13, 2004	Western Forest Products Inc.	Corporate purchase and name change

4 TFL 6 AAC History

Table 2 shows the history of the TFL 6 AAC since the creation in the 1950s. The reductions are mainly due to land base additions and removals, and the additional conservation of forests to protect other forest values.

Table 2 TFL 6 AAC History

Date From	Date To	MP No.	Total TFL 6 AAC (m^3/year)
January 1, 1951	December 31, 1960	1	509,703
January 1, 1961	December 31, 1965	2	730,574
January 1, 1966	December 31, 1968	3	1,200,641
January 1, 1969	December 31, 1970	3	1,050,561
January 1, 1971	December 31, 1971	4	1,367,711
January 1, 1972	December 31, 1974	4	1,328,548
January 1, 1975	December 31, 1975	4	1,357,594
January 1, 1976	December 31, 1978	5	1,209,129
January 1, 1979	December 31, 1981	5, 6	1,180,811
January 1, 1982	December 31, 1986	6	1,320,000
January 1, 1987	November 30, 1995	7	1,300,000
December 1, 1995	September 30, 1998	8	1,288,000
October 1, 1998	August 31, 2001	8	1,490,000
September 1, 2001	January 30, 2007	9	1,460,000
January 31, 2007	July 14, 2009	9	1,343,200
July 15, 2009	February 9, 2012	9	1,260,536
February 10, 2012	December 31, 2014	10	1,160,000
January 1, 2015	Present	10	1,362,000

The AAC determined based on TFL 6 MP #10 in February 2012 was 1,160,000 m^3. Following the transfer of TFL 39 Block 4 to TFL 6, as authorized under Instrument #101 in January 2015, the AAC was subsequently increased to 1,362,000 m^3. In April 2021, the determination of the AAC was deferred for a period of two years.

Of the current AAC of 1,362,000 m^3, the majority, 1,350,422 m^3 or 99.1%, is allocated to Western. The remaining 11,578 m^3 (0.9%), is allocated to the Kwakiutl Forestry GP Corporation, a wholly owned entity of the Kwakiutl First Nation, under forest licence A98197.

When the timber supply analysis dataset was compiled, the total area of TFL 6 was 217,200 hectares. This represents a net increase from the total area of 171,441 hectares reported at the time of the previous AAC determination in February 2012. The increase is attributable to the addition of lands associated with TFL 39 Block 4, as documented under Instrument #101 in January 2015.

5 TFL 6 Consolidations and Subdivisions

In October 1998, Western consolidated TFLs 6, 24, and 25. As part of this consolidation, Block 4 of TFL 25 was removed and amalgamated into TFL 6 as Block 2. This block includes the watersheds along Queen Charlotte Strait between Fort Rupert and Port McNeill, as well as portions of the Quatsino Sound watershed (see Figure 1 and Table 2).

In January 2015, Western consolidated tenure by incorporating Block 4 of TFL 39 into TFL 6. As a result, Block 4 was removed from TFL 39. The added area encompasses the eastern portions of the Marble and Keogh Landscape Units (LUs), as well as a parcel within the Holberg LU, extending from the eastern sides of Alice Lake and Victoria Lake to the Town of Port McNeill.

Table 3 summarizes the dates of these tenure consolidations for TFL 6.

Table 3 TFL 6 Consolidations and Subdivisions

Date	Boundary Change
October 1, 1998	Consolidation of TFL 25 Block 4 into TFL 6 as Block 2
January 1, 2015	Consolidation of TFL 39 Block 4 into TFL 6

6 Major TFL 6 Boundary Changes

Table 4 summarizes all documented boundary changes greater than 200 hectares affecting the TFL 6 land base, along with the date and mechanism of each change. Some historical records have been lost or were unavailable during preparation of this report; therefore, additional undocumented boundary adjustments may have occurred. Numerous smaller (<200 ha) revisions have also taken place since 1950 to incorporate parcels into the TFL or to accommodate other land uses such as gravel pits, electrical distribution infrastructure, and town sites. In addition, several amendments transferred areas between "Schedule A" and "Schedule B" lands without altering the external TFL boundary.

Table 4 TFL 6 Major Boundary Changes

Date	Mechanism	Boundary Change
October 19, 1953	N/A	T.L. 3013 (Winter Harbour) and R/W Lot 320 (Jeune Landing) added to Schedule A.
November 30, 1953	N/A	T.L. 3014 added to Schedule A.
September 9, 1957	Instrument 9	Lots 1 and 2 of Section 1 (Coal Harbour) added to Schedule A.
August 24, 1961	Instrument 21	T.L. 621 added to Schedule A.
April 30, 1962	Instrument 25	Lands formerly covered by Timber Sales added to Schedule B.
March 10, 1966	Instrument 42	Removal of lots and rights-of-way for Department of National Defence base and associated access roads from Schedules A and B.
July 30, 1968	Instrument 49	Addition of five San Josef properties to Schedule A.
February 26, 1973	Instrument 64	Koprino I.R. 10 and part of Section 52, Rupert District, added to Schedule A.
October 30, 1989	Instrument 75	Deletion of Crown land to establish Raft Cove Provincial Park.
July 16, 1992	Instrument 76	Five properties formerly associated with the DND base added to Schedule A.
October 1, 1998	Instrument 82	Deletion of 1,896 hectares from Schedule B near the South Mahatta River for addition to the Kingcome Timber Supply Area as part of the "Strathcona Exchange."
October 1, 1998	Instrument 83	Addition of TFL 25 Block 4 to TFL 6 as Block 2.
January 31, 2007	Instrument 94	Removal of all private land from the TFL.

Date	Mechanism	Boundary Change
July 15, 2009	Instrument 97	Deletion of 11,339 ha for addition to the Pacific Timber Supply Area.
January 19, 2010	Ministerial Order #3(4) 7-3 under *Forest Revitalization Act*	Deletion of 1,072 ha for "Tri-Port Community Forest"
January 1, 2015	Instrument 101	Addition of Block 4 of TFL 39 to TFL 6; all Schedule A and B lands of TFL 39 Block 4 consolidated into TFL 6.

7 TFL 6 Planning Documents

The following are the publicly available planning documents used by Western to guide forest management and operations within TFL 6.

7.1 Vancouver Island Land Use Plan Higher Level Plan Order

Started via the Forest Practices Code of BC Act (Pre-January 31, 2004) and continued under FRPA, the provincial government established a “higher level plan” (HLP) to declare forestry-related components of the Vancouver Island Land Use Plan (VILUP) as legal requirements. Effective December 1, 2000, the HLP established resource management objectives that vary from standard forest management standards (Province of British Columbia, 2000). The HLP enables forest operations to be consistent with the intent of VILUP’s zones, including the special management and enhanced forestry zones which have unique requirements for forestry practices.

Special Management Zones (SMZs) are areas where forest management places a higher emphasis on maintaining special resource values, including visual quality, biodiversity, and important wildlife habitat. Portions of two SMZs occur within TFL 6[1]:

- SMZ 2 – West Coast Nahwitti Lowlands
- SMZ 4 – Koprino

Enhanced Forestry Zones (EFZs) are areas where forest management emphasizes increased timber availability while maintaining environmental stewardship. Portions of TFL 6 fall within four EFZs:

- EFZ 4 – San Josef-Koprino
- EFZ 5 – Holberg
- EFZ 6 – Keogh-Cluxewe
- EFZ 8 – Mahatta-Neuroutsos

[1] Boundary clean-up included correcting minor mapping inconsistencies in the Raft Cove and Quatsino Protected Areas, and a small misalignment in the Brooks Bay SMZ.

Portions of TFL 6 are also located within the Marble General Management Zone (GMZ)[2].

As of May 2026, the Vancouver Island HLP order can be found at:

https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/west-coast/vancouverisland-lup

7.2 Landscape Unit Plans

The San Josef Landscape Unit Plan (2005) provides background information and processes used to identify Old Growth Management Areas (OGMAs) and Wildlife Tree Retention Area (WTRAs) within the San Josef LU. The OGMAs and WTRA requirements are incorporated into an order establishing land use objectives for this LU. The order also establishes mature and old forest requirements for SMZ 2 (West Coast Nahwitti Lowlands) and SMZ 4 (Koprino) within this LU, consistent with Objective 1 of the VILUP Order.

As of May 2026, the Plan can be found at:

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/westcoast-region/northislandcentralcoast-lu/san_josef_lup.pdf

7.3 Land Use Objectives Order

The Land Use Objectives for OGMAs within the Lower Nimpkish, Nahwitti, Tsulquate, and Marble LUs (July 2010) establish legal OGMAs across these four LUs, along with the permissible management activities within them. Only small portions of TFL 6 fall within the Lower Nimpkish, Nahwitti, and Tsulquate LUs, while the Marble LU lies entirely within TFL 6.

As of May 2026, the Land Order can be found at:

https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/west-coast/vancouverisland-lup/northislandcentralcoast-lu

The Gwa'ni Land Use Planning Project was initiated in January 2021 through a Memorandum of Understanding between ʻNa̱mg̱is First Nation and the Province of British Columbia (ʻNa̱mg̱is First Nation and Province of British Columbia, 2021). The project aims to evaluate and update the VILUP to improve management direction for key resource values.

[2] Boundary corrections also addressed minor discrepancies in the Kashutl GMZ, and Marble River Protected Area.

At the time the IP and timber supply model were finalized, public consultation had concluded ('Na̱mg̱is First Nation and Province of British Columbia, 2024), but a legal order had not yet been issued. In January 2026, the Province established the Gwa'ni Land Use Objectives Order (Province of British Columbia, 2026), which designates two Special Management Zones, establishes seral stage targets over 50- and 100-year timeframes, and requires retention silvicultural systems across all harvest areas.

The majority of the Gwa'ni Order area is in the nearby TFL 37, but a small portion (1,245 hectares, or 0.7% of the total Order area) is within TFL 6. The Order specifies that landscape-level objectives must be achieved within each management unit in the Order area, with implementation through Forest Landscape Plans and Forest Stewardship Plans.

As of May 2026, the Land Order can be found at:

https://www2.gov.bc.ca/gov/content/industry/crown-land-water/land-use-planning/regions/west-coast/gwani-lupp

7.4 Forest Stewardship Plans

Forest Stewardship Plans (FSPs) identify areas where forest development activities may occur for a term of up to five years (or up to ten years if extended). An FSP also describes the results, strategies, and measures the licensee will implement to remain consistent with the applicable government objectives for the area covered by the plan. Once approved, FSPs enable the issuance of cutting and road permits, authorizing timber harvesting or road construction activities.

As of May 2026, the FSP applicable to TFL 6 is the Forest Stewardship Plan – Port McNeill and Quatsino Sound 2023–2028. It can be found at:
https://www.westernforest.com/company/sustainability/planning-and-practices/fsp-port-mcneill-and-quatsino-sound/

7.5 Sustainable Forest Management Plan

Operations within TFL 6 are certified to the Canadian Standards Association (CSA) Sustainable Forest Management Standard (CAN/CSA-Z809:16 (R2021)). The CSA standard provides a framework for sustainable forest management that includes criteria for maintaining water quality, biodiversity, wildlife habitat, species at risk, and forests with exceptional conservation value.

A Sustainable Forest Management Plan (SFMP) supports the CSA certification by identifying values, objectives, indicators, and targets established through engagement with the community advisory group, the Vancouver Island North Woodlands Advisory Group (VINWAG). The SFMP also describes the strategies implemented by Western to ensure operations remain compliant with the CSA standard and its associated objectives.

The CSA standard is being phased out and will be replaced by the Programme for the Endorsement of Forest Certification (PEFC) Canada – Sustainable Forest Management Standard by the fall of 2026.

As of May 2026, the most recent CSA SFMP can be found at: https://www.westernforest.com/wp-content/uploads/2026/05/TFL-6-2025-SFMP-Annual-Report.pdf

8 Licensee Forest Management

Western implements an integrated forest management system that incorporates detailed management approaches for a broad range of resource values across its tenures. These approaches directly influence forest management practices and associated timber supply. Key components of this system are summarized below.

8.1 Western Stewardship and Conservation Plan

The Western Stewardship and Conservation Plan (WSCP) provides strategic direction for the management of forest values across the landscape over time, while also identifying key corporate indicators of Sustainable Forest Management. The WSCP aligns and integrates management practices across all planning levels, from strategic to operational and site-specific activities, and establishes a standardized framework for achieving stewardship objectives. The WSCP consists of five key program areas:

- Wildlife & Biodiversity
- Timber & Reforestation
- Fish & Watersheds
- Carbon & Climate Change
- Community

The Wildlife and Biodiversity Program has been completed and is currently implemented across applicable tenures. The Fish and Watershed Program includes established strategies tailored to individual tenures. The remaining program areas are under development and will be implemented as they are finalized.

8.1.1 Wildlife and Biodiversity Program

Western's Wildlife and Biodiversity Program is founded on more than 20 years of local research and adaptive management experience, as summarized in Forestry and Biodiversity – Learning to Sustain Biodiversity in Managed Forests, edited by Dr. Fred Bunnell and Glen Dunsworth (Bunnell & Dunsworth, 2009). The program is designed to achieve three key indicators for the successful management of biodiversity in coastal rainforest ecosystems:

(i) Ecologically distinct ecosystem types are represented in the non-harvestable land base of the tenure to maintain lesser-known species and ecological function.

(ii) The amount, distribution, and heterogeneity of stand and forest structures important to sustain native species richness are maintained over time; and

(iii) The abundance, distribution and reproductive success of native species are not substantially reduced by forest practices.

The program is implemented through the application of defined standards (specifications) embedded within operational processes and procedures. These specifications are organized into seven program components, which link key biodiversity values to forest management practices.

The Wildlife and Biodiversity Program is developed within a CSA certification framework, enabling integration with Western's CSA and Sustainable Forestry Initiative (SFI) Sustainable Forest Management certification systems.

The following sections outline the seven program components:

8.1.1.1 Rare Ecosystems

Western implements a landscape-level approach to identify, assess, and conserve rare forest ecosystems. High-quality occurrences are identified through a phased process that includes desktop assessment, spatial analysis, and field verification. Data from the BC Conservation Data Centre are incorporated in these assessments. These ecosystems are prioritized for conservation based on ecological condition and landscape context, and are managed in alignment with broader biodiversity objectives, including ecosystem representation and old forest retention.

8.1.1.2 Old Forest

Retention of old forest is a foundational component of biodiversity management and is applied as a landscape-level "medium-filter" approach. Western conserves old forest across a range of ecosystem types and patch sizes, while also managing for the recruitment of future old forest conditions. OGMAs are used to maintain and develop key structural attributes associated with old forests over time.

8.1.1.3 Forest Interior Conditions

Forest interior conditions refer to areas of forest that are not significantly influenced by edge effects associated with adjacent disturbances. These conditions provide important habitat for species that rely on closed-canopy environments and are sensitive to edge influences. Western manages and monitors forest interior conditions as an indicator of habitat quality within retained forest areas, with particular emphasis on interior conditions associated with old forest and OGMAs.

8.1.1.4 Forest Structure – Retention Silvicultural System

There is strong scientific evidence for the application of retention silvicultural systems as an effective approach to maintaining biological diversity within managed forest landscapes. Retention silviculture is designed to sustain species and ecological processes following disturbance by maintaining habitat continuity, moderating micro-climatic changes associated with harvesting, and supporting key ecological functions such as soil productivity and nutrient cycling. Retained structures also contribute to landscape connectivity by facilitating the movement and persistence of species associated with mature and old forest conditions.

8.1.1.5 Forest Structure – Stand-level retention

Stand-level retention within Western's operations consists of a combination of retention within harvested areas and the establishment of Wildlife Tree Retention Areas (WTRAs). These elements collectively contribute to biodiversity objectives at both the stand and landscape levels.

The application of retention is guided by forest stewardship zoning derived from VILUP, which defines Special, General, and Enhanced Management Zones. Retention levels are adapted across these zones, with higher retention generally applied in drier ecosystems due to disturbance history and biodiversity values, and lower retention applied in wind-prone areas of western Vancouver Island to reduce windthrow risk.

Key structural elements maintained through retention practices include live trees, large-diameter trees, standing dead trees (snags), coarse woody debris, deciduous components, and understory vegetation. These elements provide essential habitat features and contribute to the maintenance of ecosystem processes.

Overall, Western applies a stand-level "medium-filter" approach, with retention levels adapted across the landscape to balance biodiversity objectives with operational considerations. The overarching goal is to maintain a continuous and well-distributed supply of structural habitat elements that support species diversity and ecological function over time.

8.1.1.6 Forest Structure – Big Trees

A rare feature of coastal British Columbia forests is the presence of exceptionally large, old trees. These trees have significant ecological, cultural, social, and economic values, and play an important role in maintaining forest biodiversity.

Western recognizes the importance of these features and has implemented measures to identify and retain large-diameter and veteran trees within its operating areas. These trees are typically incorporated into stand-level retention as anchor trees or included within Wildlife Tree Retention Areas and other reserve types. Tree species for retention include Douglas-fir, Sitka spruce, western redcedar, yellow-cedar, arbutus, bigleaf maple, black cottonwood, Garry oak, grand fir, Pacific yew, and western white pine.

By retaining big trees as part of the broader retention silvicultural system, Western contributes to the long-term maintenance of structural complexity, wildlife habitat, and landscape connectivity, while also supporting cultural and visual values associated with these iconic forest features.

8.1.1.7 Species at Risk

Species at Risk management is focused on preventing species decline and supporting recovery in accordance with provincial or federal recovery plans.

Species at Risk are identified based on legal designation as Threatened or Endangered under the Federal Species at Risk Act (SARA); and

- for fish species, has a final Federal Recovery Strategy or
- for non-fish species, has a final BC Implementation Plan.

Western incorporates the habitat requirements of these species into forest management practices to support their persistence and recovery across the landscape.

8.1.1.8 Species of Conservation Concern

Over time, species evolve to survive ecological niches. When changes occur in the environment through either natural or man-made processes, a species may become less common. Western's process of determining species of significant concern is based on:

(i) global and provincial risk classification categories,

(ii) species distribution,

(iii) if the species is negatively influenced by forestry,

(iv) BC Conservation Framework priority 1 species, and

(v) if the species population is declining.

While provincially yellow-listed (not at risk),

(i) Columbian black-tailed deer has been added to the list because Western considers significant concern due to a decreasing wild population, and

(ii) Coastal black bear has been added as a species of conservation concern due to their use of old hollow trees for winter denning.

Western incorporates these species into planning by recognizing their ecological requirements and potential vulnerabilities. Selected species may be included based on regional considerations where local population trends or habitat dependencies indicate increased concern.

8.1.1.9 Common Species

Management of common species aims to ensure they remain abundant and widely distributed across the landscape. Western uses indicator species that are sensitive to forest management activities and representative of a range of habitat conditions. Monitoring programs focus on assessing habitat associations and ecological responses, including initiatives that track forest bird populations across different habitat types that relate to different forest bird groupings. These approaches support adaptive management and provide insight into overall ecosystem conditions.

8.1.2 Fish and Watershed Program

The Fish and Watershed component is currently under development. However, the following two sections have been completed.

8.1.2.1 Watershed Management

Western implements a structured, data-driven approach to watershed management. Strategies are informed by periodic inventories of key physical watershed attributes to characterize condition, identify trends, and assess sensitivity and fisheries values. Inventories include:

- landslides,
- road stability hazard,
- sediment delivery potential from roads,
- stream channel type (alluvial, semi-alluvial, nonalluvial), and
- riparian forest condition.

Standardized indicators are used to support consistent evaluation and comparison across watersheds. Risk control measures are developed and implemented based on measurable data on physical watershed processes. These strategies are regularly updated and are integrated into operational planning through established the Terrain Risk Management Strategy (TRMS).

8.1.2.2 Terrain Risk Management

Western applies a terrain risk management framework to translate landscape-level watershed strategies into site-level practices. Landslide risk is assessed by considering both the likelihood of occurrence and the potential consequences to identified values. This risk-based approach informs the need for detailed professional assessments and guides the application of appropriate road construction and harvesting practices to manage site-specific risks effectively.

8.2 Standards and Guidelines

8.2.1 Karst Management

Western implements karst management practices based on the *Karst Management Handbook for British Columbia* (Province of British Columbia, 2003) and BC inventory standards. These practices recognize karst as an interconnected landscape system and focus on protecting karst features, maintaining ecological function, and ensuring worker safety. Field assessments and operational planning are guided by established procedures to manage karst terrain effectively.

8.2.2 Northern Goshawk Management

Western applies a management standard for Northern Goshawk that provides direction for activities near known nest sites. The approach is designed to minimize disturbance and reduce the risk of nest or territory abandonment. Forested reserves and operational timing considerations are applied in the vicinity of active nests in accordance with science-based guidance (McClaren, Mahon, Doyle, & Harrower, 2015).

8.2.3 Eagle Nest Management

Similar to the Northern Goshawk standard, Western's eagle nest management standard aims to maintain nests in a functional state and prevent disturbance to nesting eagles. Nest trees are incorporated into forested reserves, and operational timing constraints are applied for harvesting activities in the vicinity of active nests to minimize impacts during sensitive periods.

8.2.4 Bear Den Management

Western implements a bear den management standard to maintain den structures and minimize disturbance to hibernating bears. Identified dens are retained within forested areas where feasible, and alternative habitat features suitable for den recruitment are maintained where necessary. Proximity restrictions near active dens for harvesting activities are applied during the denning period.

8.2.5 Heron Nest Management

Western implements a heron nest management standard to protect nesting habitat and minimize disturbance during the breeding season. Identified nests are retained within wildlife leave areas, and appropriate buffers and activity restrictions are applied near active nests. Pre-harvest surveys and monitoring are used to confirm nest activity and guide operational planning, ensuring protection objectives are consistently achieved. This standard complements species-specific management measures and contributes to broader biodiversity objectives across the landscape.

8.2.6 Forest Bird Nest Management

Western implements a forest bird nest management standard to protect nesting habitat and prevent disturbance to active nests. Known active nests are not damaged, removed, or disturbed, and temporary no-harvest buffers are applied as appropriate, with input from a qualified professional. Pre-harvest awareness and reporting requirements support the identification and protection of nests, including those of cavity-nesting species such as pileated woodpeckers, which may be incorporated into retention as biological anchors where feasible. These practices help maintain nesting habitat and contribute to broader biodiversity objectives.

8.2.7 Big Trees

Western recognizes the ecological and cultural importance of large trees. Western was one of the first organizations to implement a big tree policy to identify and retain these features (Western Forest Products Inc., 2019). Big trees are incorporated into retention areas, with preference for maintaining them within contiguous forest patches where possible. Western's commitment is to retain all live trees that exceed either:

- 50% of the largest diameter tree (by species referenced in Section 8.1.1.8) in the provincial Big Tree Registry, or
- 80 metres in height.

Identification is supported by Light Detection and Ranging (LiDAR) technology and field verification. Western's practices meet or exceed the requirements of the provincial *Special Tree Protection Regulation* requirements.

8.2.8 Windthrow Management

Western implements a windthrow management standard to assess and mitigate the risk of post-harvest wind damage. Windthrow risk is evaluated during planning, and harvest and road design are adjusted to reduce the likelihood of damage to adjacent forest stands and other values.

Management focuses on maintaining disturbance within acceptable levels, with thresholds varying by the sensitivity of adjacent values such as infrastructure, fish habitat, reserves, and retained forest. This risk-based approach helps protect environmental, social, and operational values while maintaining overall forest structure and function.

9 Public Review Strategy Summary

The opportunity to review and provide comments on the TFL 6 Draft MP #11 followed an updated public review strategy approved by the Regional Executive Director, British Columbia Ministry of Forests (MoFOR) on October 16, 2023. The strategy consisted of three phases. The first phase was an early engagement with First Nations within the TFL 6 area. The second phase is the public review and First Nations' information-sharing of a draft timber supply analysis information package (IP). The third phase is the public review and First Nations' information-sharing of a draft MP that included the accepted IP and the timber supply analysis (TSA) results.

9.1 Early Engagement with Indigenous Groups

An early engagement framework was adopted for MP #11 to support proactive cooperation throughout the plan development. This approach aims to prioritize the involvement of Indigenous groups during the initial stages. It allows for early identification of values and the integration of key management objectives for the timber supply review (TSR).

Prior to the formal commencement of MP #11, Western initiated collaboration with First Nations within the TFL 6 area to support landscape-level planning. In July 2022, Western and Quatsino First Nation signed a Bridging Agreement establishing a shared vision for forest management within Quatsino's unceded territory. This work continues through the development of an Integrated Resource Management Plan (IRMP) aligned with Quatsino's Land Use Plan (Quatsino First Nation and Western Forest Products Inc., 2022).

Western has also drawn on its September 2021 pilot Forest Landscape Plan (FLP) project with 'Na̱mg̱is First Nation in TFL 37 to inform the integration of Indigenous values into the TFL 6 TSR, where territorial overlap exists ('Na̱mg̱is First Nation and Western Forest Products Inc., 2025). 'Na̱mg̱is First Nation was notified and engaged through the TFL 37 FLP correspondence and technical working sessions.

Regular communication with Forest Analysis & Inventory Branch (FAIB) and North Island - Central Coast Natural Resources District (NICCNRD) began on October 27, 2022. Meetings were initially held monthly and increased to bi-weekly in February 2023 to address concerns, provide updates on TSR progress, and enhance coordination. Multiple comments raised by MoFOR staff were effectively addressed during these scheduled discussions.

On April 17, 2023, notification letters announcing the commencement of the TFL 6 TSR and inviting early engagement were provided to the following First Nations:

- Kwakiutl First Nation
- ‘Namgis First Nation
- Quatsino First Nation
- Tlatlasikwala First Nation

And to the following provincial government agencies:

- FAIB, MoFOR
- NICCNRD, MoFOR

On December 8, 2023, Western distributed a digital letter to the Kwakiutl, ‘Namgis, and Tlatlasikwala First Nations and to the provincial agencies identified above. The letter outlined key data inputs, assumptions, and anticipated timelines for the TFL 6 MP #11 IP, including its planned release for First Nations information-sharing and public review. The intent was to provide an early overview and encourage participation in the TSR process.

In lieu of a formal letter, Western delivered detailed presentations of the IP to the Quatsino First Nation via the Quatsino (TFL 6) IRMP technical team on January 11 and 18, 2024. Feedback received informed refinements to data inputs and management assumptions, which were confirmed as adequate for the TSA Base Case on February 12, 2024. Western and Quatsino collaboratively developed and validated a methodology to incorporate cultural heritage values into the TSR, with final confirmation provided on April 19, 2024. The detailed methodology is documented in Section 6.16 of the Information Package.

As indicated in Section 7.5, TFL 6 operations are certified under CSA Z809:2016 (R2021) certification, which includes public participation through the Vancouver Island North Woodlands Advisory Group (VINWAG). VINWAG representing local communities within the Defined Forest Area. On April 4, 2024, Western presented an overview of the MP #11 TSR process, including key steps and timelines, to VINWAG members.

9.2 Review of Draft Information Package

The Public review and First Nations information-sharing of the MP #11 draft IP commenced on May 3, 2024. On May 2, 2024, copies of the draft IP were provided to the following provincial government agencies:

- FAIB, MoFOR

- NICCNRD, MoFOR

On or about May 2, 2024, digital and hard copies of the draft IP were distributed to the following First Nations:

- Kwakiutl First Nation
- ‘Na̲mg̲is First Nation
- Quatsino First Nation
- Tlatlasikwala First Nation

Public notices were published in the *North Island Eagle* on May 3rd and May 10th. The notices indicated that the draft IP was available for review and comment from May 3 to July 3, 2024, at the following locations:

- Western internet site
- Western Port McNeill office
- Western Holberg office
- Western Quatsino Dryland Sort office (Port Alice, BC)
- Western Corporate Campbell River office
- MoFOR NICCNRD office

Contact information (phone and email) was provided for submission of comments.

VINWAG members were provided with a link to the draft IP on May 3, 2024. Western also delivered an IP overview presentation to VINWAG in Port McNeill on May 30, 2024.

On May 30, 2024, NICCNRD staff provided information regarding a fertilization trial within TFL 6. Western responded the same day, noting that relevant growth and yield data were not yet available and that findings would be considered in future TSRs.

On June 20, 2024, Kwakiutl First Nation requested an extension of the review period to July 24, 2024, which Western supported.

On July 5, 2024, FAIB and NICCNRD provided comments regarding the draft IP. Western responded on September 9, 2024.

On July 8, 2024, a member of the public provided comments regarding future planning within TFL 6. Western responded on July 10, 2024. No further comments were received.

On October 20, 2024, a consultant for Kwakiutl First Nation requested additional information. Western provided the requested materials following a meeting on October 28, 2024. No further comments were received.

Version 2 of the IP was submitted on October 31, 2024, incorporating agency feedback. FAIB confirmed the acceptance of the IP on November 27, 2024.

Following acceptance, additional information requests were addressed. On June 2, 2025, Kwakiutl First Nation requested previous correspondence related to draft IP consultation. Western provided the requested materials and additional context. No further comments were received.

On August 11, 2025, Kwakiutl First Nation requested access to the IP. Western provided a link to the accepted IP which incorporated updates made since the draft IP version 1 shared with Kwakiutl in May 2024. No further comments were received.

9.3 Review of Draft Management and Timber Supply Analysis

On May 29, 2025, Western distributed a reminder letter regarding the TSR process, including a link to the accepted IP, to Kwakiutl, 'Namgis, and Tlatlasikwala First Nations. Quatsino First Nation continued to be informed through IRMP technical meetings.

On May 30, 2025, Tlatlasikwala First Nation identified a mapping error in the letter. Western corrected and reissued the letter the same day.

On August 11, 2025, Kwakiutl First Nation requested access to the IP. Western provided a link to the accepted IP on the same day. No further comments were received.

On August 13, 2025, Kwakiutl First Nation requested the final timber supply analysis and related outputs. Western responded on August 14, 2025, indicating the TSR was ongoing and that materials would be shared once available. No further comments were received.

On September 18, 2025, Kwakiutl First Nation requested access to the full Management Plan, analysis report, and supporting datasets. Western responded on September 22, 2025, indicating that the TSR process was still underway. A follow-up on September 23, 2025 confirmed that decision timelines had not yet been finalized. No further comments were received.

The remainder of this section will be completed in the final version of the MP.

9.4 Summary of Revisions made to Documents

This section will be completed in the final version of the MP.

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10 Glossary (Province of British Columbia, 2008)

Allowable Annual Cut (AAC)	The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres per year.
Biogeoclimatic zones and variants (BEC)	A large geographic area with broadly homogeneous climate and similar dominant tree species.
Schedule “A” Land	Crown grant (private) and Crown land subject to timber licences contained within the boundaries of the TFL. Listed in Schedule “A” of the licence document.
Schedule “B” Land	Crown land contained within the boundaries of the TFL. Detailed in Schedule “B” of the licence document.
Timber harvesting land base (THLB)	Forest land within the TFL where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and harvesting technology.
Timber Licence	A licence that describes an area of Crown land within which the licence holder is granted exclusive right during its term to harvest all merchantable timber. For the purposes of defining rights within a timber licence, merchantable timber means timber that on January 1, 1975 was older than 75 years old (*Forest Act* section 1).
Timber supply	The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.

Tree farm licence (TFL)	Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.
Wildlife tree	A standing live or dead tree with special characteristics that provide valuable habitat for wildlife.

11 References

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12 Appendices

Appendix A: Timber Supply Analysis Report

Appendix B: Timber Supply Analysis Information Package

Appendix A: Timber Supply Analysis Report

Tree Farm Licence 6 Management Plan 11

Timber Supply Analysis

VERSION 1, JUNE 2026

WESTERN
Forest Products

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Tree Farm Licence 6

Timber Supply Analysis

In Preparation of

MANAGEMENT PLAN 11

Submitted to the
Ministry of Forests
Forest Analysis & Inventory Branch
Victoria, BC

Version 1
June 2026

WESTERN
Forest Products

Ye Huang, RPF
Timber Supply Forester
Western Forest Products Inc.

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Revision History

Version	Date	Description
1.0	June 2026	Initial Version
0.1	January 2025	An earlier draft of the first three chapters was submitted to Forest Analysis & Inventory Branch (FAIB), Ministry of Forests (FOR) as the "Base Case Description."

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Executive Summary

This Timber Supply Analysis (TSA) report evaluates timber supply projections for Tree Farm Licence (TFL) 6, located on Northern Vancouver Island near Quatsino Sound and managed by Western Forest Products Inc. (Western).

The analysis was conducted using Patchworks, a spatially explicit forest estate model, to assess forest conditions and estimate timber supply under the assumptions and data described in the Management Plan (MP) #11 Information Package (IP). This analysis represents the first comprehensive assessment of TFL 6 as a unified land base following the amalgamation of the former TFL 39 Block 4 in January 2015. The model incorporates forest management practices applied since the last determination, which are designed to protect and maintain resource values such as fish and wildlife habitat, biodiversity, cultural resources, recreation, visual quality, and terrain stability. Timber supply projections are evaluated over a 300-year planning horizon (2024–2323) to ensure long-term sustainability.

Several data inputs and modelling assumptions for this TSA have been updated since MP #10 to reflect land base changes and new information. These updates exert both upward and downward influences on timber supply.
Upward pressures include:

a) Inclusion of the former TFL 39 Block 4 land base.

b) Increases in genetic worth values associated with the planting of genetically improved stock.

c) Refined road width assumptions, informed by measurements derived from recent orthophotos and corroborated through a review of road width assumptions used in adjacent North Island Timber Supply Area data package where resource roads provide direct connectivity to TFL 6.

d) Reduced modelled shading effects on yields due to updated variable retention strategies in windthrow-prone areas.

Downward pressures include:

e) Expanded conservation measures in Old Growth Management Areas (OGMAs) and Wildlife Habitat Areas (WHAs), including compliance with the BC *Marbled Murrelet Order* effective December 2, 2021.

f) Inclusion of additional spatially defined non-timber values: research sites, permanent sample plots, big trees, karst features, and cultural features.

g) Integration of acquired Light Detection and Ranging (LiDAR) data to improve delineation and quantification of productivity, operability, riparian areas, terrain, and Visual Quality Objective (VQO) modelling.

h) Revised information and modelling assumptions, including:

i) Increased existing and future Wildlife Tree Retention Areas (WTRAs).

ii) Adoption of a 95% culmination mean annual increment (CMAI) as the minimum harvest age to align with recent timber supply analyses in other BC coastal regions.

iii) Explicit spatial modelling of adjacency and green-up requirements.

iv) Alignments of site index estimates (SIBEC and TEM-based).

v) More detailed analysis unit criteria using the provincial BEC variants (Version 12 based on Land Management Handbook No. 28) and site series system for both existing managed stands and future stands.

vi) Application of a higher proportion of non-recoverable losses, with a 1.5% reduction from the modelled harvest level to account for biotic and abiotic disturbances.

vii) Explicit modelling of natural disturbances outside of the Timber Harvesting Land Base (THLB).

viii) Implementation of Equivalent Clearcut Area (ECA) limits in disturbed watersheds identified in Western's 2019 TFL 6 Watershed Management Strategies update.

As this is the first assessment incorporating the former TFL 39 Block 4, direct comparison requires aggregation of TFL 6 MP #10 and TFL 39 MP #9. The THLB supporting the current AAC totals 133,665 hectares, while the MP #11 THLB is 120,099 hectares. This represents a reduction of 13,566 hectares (10.1%).

After deducting 1.5% from the modelled harvest level to account for non-recoverable losses, the MP #11 Base Case harvest level is estimated at 1,061,600 m³/year. This corresponds to a decrease of 300,400 m³/year (22.1%) relative to the current AAC of 1,362,000 m³/year. However, considering the 7% projected decline in MP #10 (to 1,266,600 m³/year), the incremental reduction is 205,000 m³/year (16.2%).

Although the THLB decreases by 10.1%, the reduction in harvest level is proportionally greater (16.2% relative to the MP #10 projected decline), indicating that factors beyond land base reduction are contributing to the decline. These factors include:

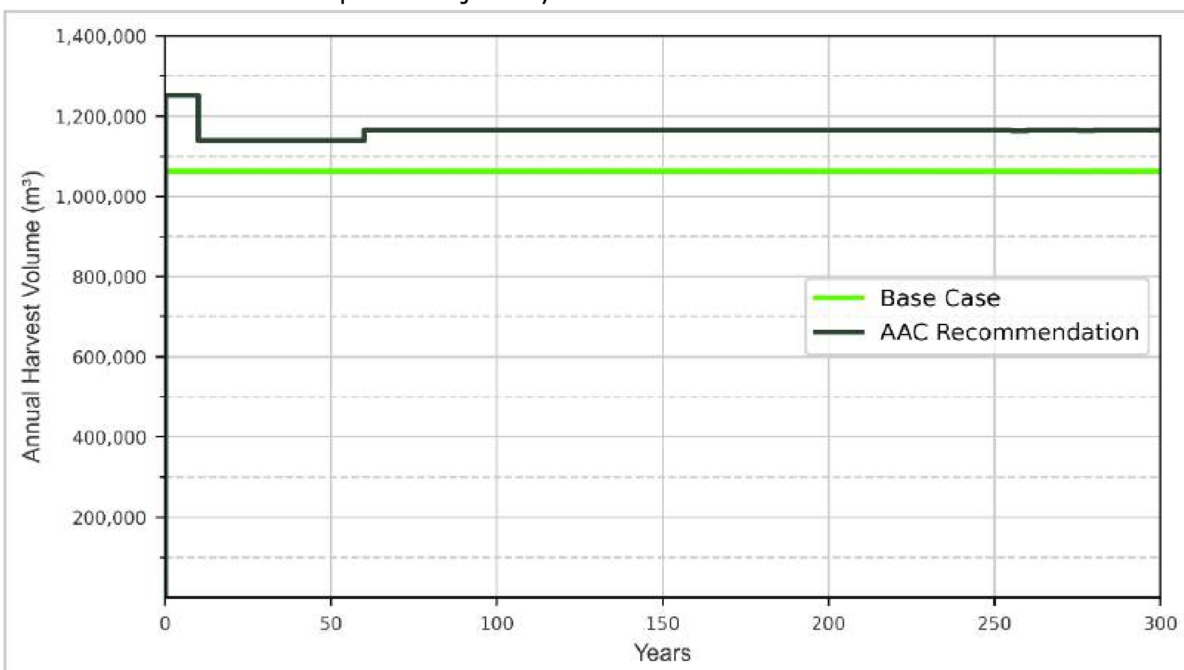
- A transition from a step-down harvest flow, which would have provided a higher short-term AAC, to an even-flow harvest pattern.

- Greater impacts on availability of mature and old timber due to increased conservation measures, such as expanded OGMAs and WHAs.

- The implementation of modelling measures that do not directly reduce the THLB but limit timber harvest levels, such as ECAs for watershed management.

Beyond the Base Case, the timber supply projection evolves through the incorporation of enhanced inventory data and a more flexible harvest flow strategy. The incorporation of LiDAR-based individual tree inventory, LiDAR height-derived site index, and updated operational adjustment factor (OAF) assumptions improves the representation of forest inventory and volume projection. This results in a measurable increase projected harvest levels without altering the underlying land base. Further increases are realized by transitioning from an even-flow approach to a more flexible harvest flow pattern. Collectively, these changes demonstrate that, while the Base Case appropriately reflects current land base and forest management assumptions, the AAC can be responsibly increased through better information and optimized scheduling.

Accordingly, an AAC of 1,252,700 m³/year is proposed for TFL 6 for the next 10-year period. This AAC includes 11,578 m³/year allocated to First Nations. This recommendation balances short-term harvest opportunities with long-term sustainability, while remaining broadly consistent with the anticipated trajectory from MP #10.



Currently, 29% of TFL 6's productive forests are over 250 years old, with 69% of these old forests located outside the THLB. Under the proposed AAC scenario, a minimum of 21.6% of the productive forest is maintained in the old seral stage, with at least 18.5 million m³ of growing stock retained in the old seral stage throughout the 300-year planning horizon. Considering natural disturbances at the current stand-replacing event rates, more than 63,000 hectares (34%) of the productive forest is projected to be in the old seral stage by Year 300.

Over the long term, approximately 118,672 hectares (63% of the productive forest) are expected to be managed primarily for timber values, while 68,753 hectares (37%) are designated for the conservation and management of non-timber values. These areas contribute to biodiversity conservation objectives and complement protected areas adjacent to the TFL.

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Acknowledgements

The signatory gratefully acknowledges the following individuals and organizations for their contributions to the preparation of this document:

- Mike Davis, RPF, for his contributions while at Western Forest Products Inc. (Western), including substantial assistance with the timber supply analysis; application of extensive expertise in historical tenure and prior involvement in management plans; liaison with the Quatsino (TFL 6) Integrated Resources Management Plan (IRMP) working group; detailed technical proofreading; and overall guidance throughout the development of this document.

- The Western Inventory and Analysis Team, particularly Stuart Glen, RPF, and Joel Mortyn, RPF, for their strategic guidance, thorough document review, contribution in LiDAR-based forest inventory validation, and allocation of resources; Liza Rodrigues, RPF, for technical support related to timber supply modelling; Sydney Delany, FIT, for database support and contributions to document templates and formatting; and Marie-Eve Leclerc, RPF for LiDAR-based forest inventory validation and document review.

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- Sarah Germain, RPF, RPBio, of Western, and Rhiannon Poupard, RPF, for collaborative coordination with the Quatsino (TFL 6) IRMP working group.

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Table of Contents

List of Tables

List of Figures

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1 Introduction

1.1 Background

Tree Farm Licence (TFL) 6 is located on northern Vancouver Island, near Quatsino Sound (Figure 1). The ownership of the licence has changed over time due to corporate name changes, acquisitions, and mergers. Western Forest Products Inc. (hereinafter referred to as Western) is the current holder of TFL 6.

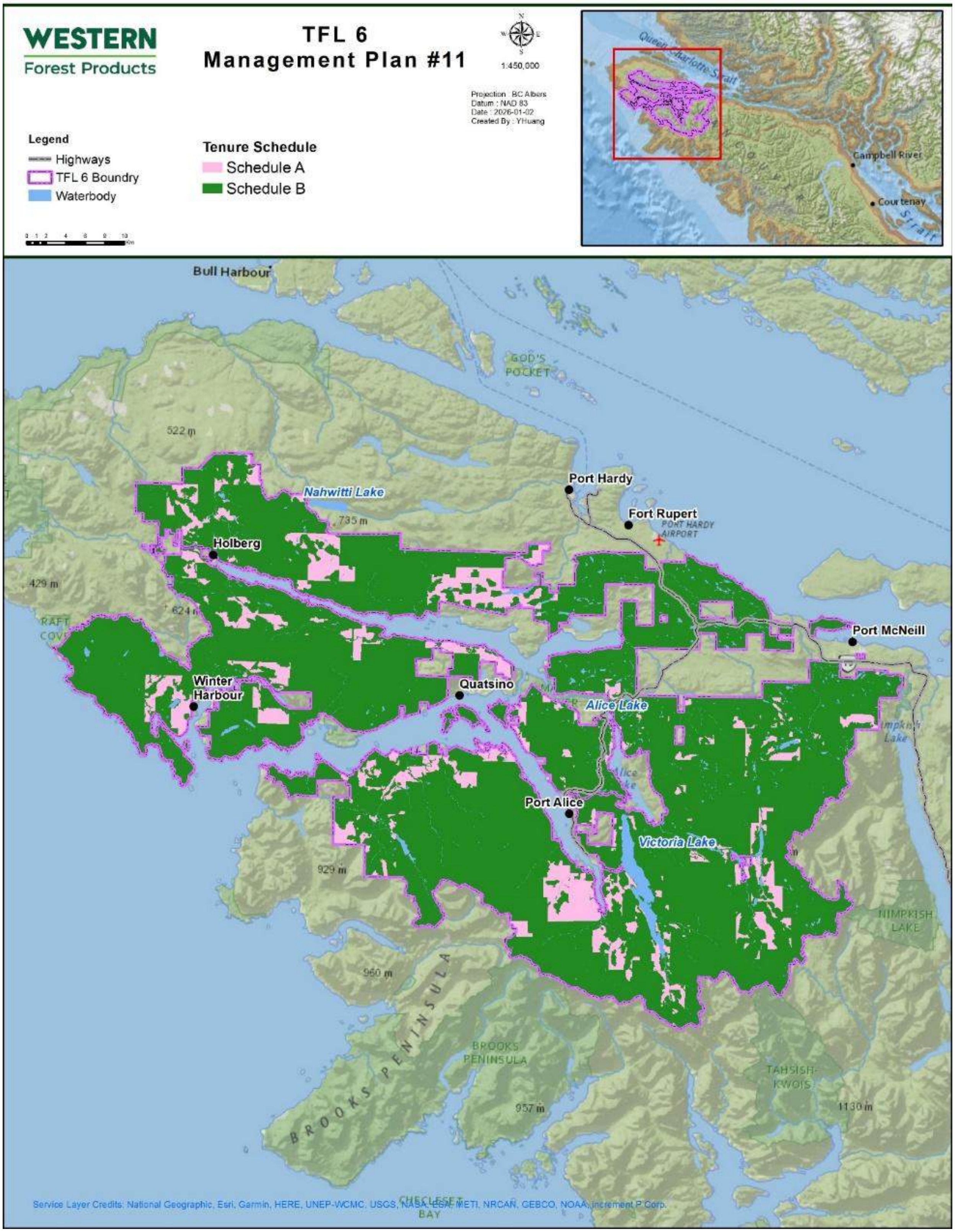


Figure 1 TFL 6 Overview

Larger centres and First Nation communities within or near TFL 6 include:

- Port Hardy/Tsulquate/Tsaxis
- Port McNeill
- Alert Bay/‘Yalis
- Port Alice and Jeune Landing
- Fort Rupert
- Coal Harbour/Quatsino Subdivision
- Sointula
- Holberg
- Winter Harbour
- Bull Harbour, Hope Island

The land upon which the TFL 6 Management Plan (MP) applies is within the traditional territories of the following First Nations:

- Kwakiutl First Nation (Kwakiutl)
- ‘Namgis First Nation (‘Namgis)
- Quatsino First Nation (Quatsino)
- Tlatlasikwala First Nation (Tlatlasikwala)

Nearby provincial parks and protected areas, none of which are inside the TFL, include:

- Cape Scott Park
- Lower Nimpkish Park
- Marble River Park
- Misty Lake Ecological Reserve
- Muqqiwn/Brooks Peninsula Park
- Nimpkish Lake Park
- Quatsino Park
- Raft Cove Park
- Tahsish-Kwois Park

Since the completion of the last MP and Timber Supply Analysis (TSA) report in 2011, changes to the administration of the TFL have occurred. Specifically, on January 1, 2015, former TFL 39 Block 4 was amalgamated into TFL 6 as per Instrument #101 (Instrument #175 for TFL 39).

TFL 6 now encompasses 217,197 hectares, of which 120,099 hectares are expected to be available for timber production. The current allowable annual cut (AAC) for this land base is 1,362,000 m³, of which 99.1% (1,350,422 m³) is allocated to Western. The remaining 0.9% (11,578 m³) is allocated to the Kwakiutl Forestry GP Corporation, owned by the Kwakiutl First Nation, under Forest Licence A98197. The current AAC was extended in 2021 by a

Chief Forester Order to facilitate advanced collaboration with the First Nations. A history of the AAC is provided in Table 1.

Table 1 TFL 6 AAC History

Date From	Date To	MP No.	Total TFL 6 AAC (m^3/year)
01-Jan-51	31-Dec-60	1	509,703
01-Jan-61	31-Dec-65	2	730,574
01-Jan-66	31-Dec-68	3	1,200,641
01-Jan-69	31-Dec-70	3	1,050,561
01-Jan-71	31-Dec-71	4	1,367,711
01-Jan-72	31-Dec-74	4	1,328,548
01-Jan-75	31-Dec-75	4	1,357,594
01-Jan-76	31-Dec-78	5	1,209,129
01-Jan-79	31-Dec-81	5, 6	1,180,811
01-Jan-82	31-Dec-86	6	1,320,000
01-Jan-87	30-Nov-95	7	1,300,000
01-Dec-95	30-Sep-98	8	1,288,000
01-Oct-98	31-Aug-01	8	1,490,000
01-Sep-01	30-Jan-07	9	1,460,000
31-Jan-07	14-Jul-09	9	1,343,200
15-Jul-09	09-Feb-12	9	1,260,536
10-Feb-12	31-Dec-14	10	1,160,000
01-Jan-15	Present	10	1,362,000

1.2 Objective

The primary objective of this report is to estimate the available timber supply and potential timber flows for review and consideration by the British Columbia Office of the Chief Forester in determining the AAC for the term of MP #11. More specifically:

- The management of non-timber values such as fish and wildlife habitat, biodiversity, culture resources, recreation, visual quality, and terrain stability is accounted for. Protection of non-timber values will be satisfied by land base reserves, rate-of-harvest limits and/or by maintaining a percentage of the land base in older stands.

- Timber flow is estimated by considering harvestable inventory, growth potential of current and future stands, silvicultural treatments, potential timber losses, and operational and legislative requirements.

As outlined in Section 1.2 of the associated Information Package (IP), two planning initiatives currently relate to TFL 6: the Quatsino (TFL 6) Integrated Resource Management Plan (IRMP) and the Gwa’ni Land Use Planning Project:

1. Quatsino (TFL 6) IRMP

In July 2022, Quatsino First Nation and Western Forest Products entered into an agreement to collaboratively develop a shared vision and approach for managing forest resources within Quatsino's traditional territory (Quatsino First Nation and Western Forest Products, 2022). This agreement establishes the foundation for ongoing joint stewardship through an IRMP guided by Quatsino's Land Use Plan. The IRMP is intended to support sustainable forest management through an integrated, multi-scale framework that defines outcomes, stewardship practices, and projected harvest patterns.

Pending completion of the IRMP, the Forest Analysis & Inventory Branch (FAIB) has advised that timber supply analysis should reflect past performance and practices. It is recognized, however, that stewardship approaches may evolve as the IRMP progresses and are tested operationally. Accordingly, following IRMP completion, analysis results are expected to be reviewed in coordination with FAIB and updated, as appropriate, to align with the integrated outcomes of the IRMP.

2. Gwa'ni Land Use Planning Project (Gwa'ni Project)

The Gwa'ni Land Use Planning Project was initiated in January 2021 through a Memorandum of Understanding between 'Na̱mg̱is First Nation and the Province of British Columbia ('Na̱mg̱is First Nation and Province of British Columbia, 2021) and includes a small portion of TFL 6. The project aims to evaluate and update the Vancouver Island Land Use Plan (VILUP) to improve management direction for key resource values. Concurrently, 'Na̱mg̱is First Nation and Western are collaborating on a Forest Landscape Plan (FLP) and Forest Operations Plan (FOP) in adjacent TFL 37 ('Na̱mg̱is First Nation and Western Forest Products Inc., 2025), as part of a provincially designated FLP pilot initiative.

At the time the IP and timber supply model were finalized, public consultation had concluded ('Na̱mg̱is First Nation and Province of British Columbia, 2024), but a legal order had not yet been issued. In January 2026, the Province established the Gwa'ni Land Use Objectives Order (Province of British Columbia, 2026), which designates two Special Management Zones, establishes seral stage targets over 50- and 100-year timeframes, and requires retention silvicultural systems across all harvest areas.

The portion of TFL 6 within the Gwa'ni Project is small; therefore, its influence on the overall harvest forecast and contribution to achieving Order objectives is expected to be limited. Any implications for allowable harvest levels will be assessed in a future timber supply review. In the interim, Western remains committed to ongoing collaboration with 'Na̱mg̱is First Nation to support implementation and monitoring of the Order within TFL 6.

1.3 Timber Supply Model

The TFL 6 Timber Supply Analysis was conducted using Patchworks™, a spatially explicit forest management application approved by the Province of British Columbia for use in timber supply reviews (TSRs). This software, developed by Spatial Planning Systems Inc., has been widely applied in timber supply analyses across numerous forest management units within the province. A detailed description of Patchworks is provided in Section 4 of the associated Timber Supply Analysis Information Package (IP).

The forest inventory database used in this analysis was current as of December 31, 2023, reflecting recent harvesting, silvicultural treatments, and assessments. The model employs a 300-year planning horizon, divided into 5-year intervals. This report presents results in 5-year increments, providing a granular view of possible harvest for the immediate 10-year period.

Analysis units (AUs - grouping of forest stands) and associated timber volume yield curves are detailed in Sections 7.3 and Sections 8 of the IP.

Patchworks optimization is used to formulate all harvest schedules presented. This optimization process balances the objectives listed in Section 1.2. The goal is to achieve a long-term sustainable timber supply while preserving other values and minimizing abrupt changes in harvest levels. The model will also project forest growth beyond the timber harvesting land base (THLB), accounting for natural disturbances in the non-contributing land base (NCLB) (refer to Section 9.4 of the IP).

2 Base Case

2.1 Assumptions and Modelling Parameters Overview

The Base Case scenario represents the operational practices and management strategies that have been implemented within TFL 6. It reflects historical performance and established management approaches based on land use designations, such as Vancouver Island Land Use Plan (VILUP) Resource Management Zones (RMZs), and complies with applicable legislation and guidelines, including the *Forest and Range Practices Act* (FRPA) and the approved Forest Stewardship Plan (FSP). This scenario serves as the baseline for comparing different timber supply projections. More details of the Base Case description are provided in the IP.

The assumptions and modelling parameters for the Base Case include:

- The operable land base of forested area is accessible using conventional (ground and cable) and non-conventional (helicopter) harvesting methods. Harvest methods are determined using a spatially delineated physical operability dataset generated through the land base blocking (LBB) process (refer to Section 3.5.2.1 in the associated IP).

- Exclusion of uneconomic mature forest stands.

- Harvesting of both mature and immature (second growth) stands.

- Silviculture is conducted on all regenerated stands to meet free growing requirements, with all harvested areas being planted.

- Known tree improvement gains are applied to existing stands established since 2001 and to future regenerated stands.

- Visual quality objectives (VQO), established by the *Government Action Regulation* (GAR) order of September 24, 2010, for Tree Farm Licence 6 & Block 7, Pacific Timber Supply Area, are modelled individually using *The Procedures for Factoring Visual Resources into Timber Supply Analyses* (Province of British Columbia, 1998) and its subsequent update bulletin (Province of British Columbia, 2003). Each VQO polygon is characterized by its objective, area-weighted slope (derived from Light Detection and Ranging (LiDAR) data), visually effective green-up (VEG) height, visual absorption capability (VAC), and plan-to-perspective (P2P) ratio. These parameters are used to calculate individual permissible percentage alterations.

- Green-up heights for cutblock adjacency are assigned based on RMZs established in VILUP. Special (SMZs) and General Management Zones (GMZs) have a 3-metre green-up requirement, while Enhanced Forestry Zones (EFZs) have a 1.3-metre green-up height.

- Future wildlife tree retention and other stand-level retention within the THLB are accounted for through a percentage area reduction.

- Established Old Growth Management Areas (OGMAs) are excluded from the THLB. Mature seral targets are integrated for the two SMZs in accordance with VILUP. At the landscape unit level, old seral stage targets are assigned to each Biogeoclimatic Ecosystem Classification (BEC) variant (BEC version 12, which is based on Land Management Handbook (LMH) No. 28) and are guided by the *Order Establishing Provincial Non-Spatial Old Growth Objectives* (NSOG), effective June 30, 2004.

- Established Ungulate Winter Ranges (UWRs) plus established and proposed Wildlife Habitat Areas (WHAs) are removed from the THLB.

- Netdowns for terrain stability management are applied based on detailed terrain stability mapping (DTSM) Class 5 and 90+% LiDAR slope model.

- Riparian management based on the FSP results/strategies and a review of riparian management applied on nearly 870 cutblocks harvested or planned between 2012 and 2023.

- Minimum harvest age (MHA) criteria based on 95% culmination of mean annual increment (CMAI) and minimum volume of 350 m^3/hectare. Both minimum age and minimum volume requirements must be met before a stand can be harvested.

- For managed stands, the Operational Adjustment Factor 1 (OAF1; designed to account for non- harvestable features within a stand) is 15%; Operational Adjustment Factor 2 (OAF2; designed to reflect decay/waste/breakage and some forest health issues within a stand) is 5%. Both values are the provincial default.

- A relatively small area of deciduous-leading stands is excluded from the THLB; the volume in these stands does not contribute to timber supply.

- Natural disturbances, such as wildfires, insect outbreaks, and windthrow, are modelled in the NCLB by randomly disturbing stands. The disturbance rates used in the model are based on data from the Old Growth Technical Advisory Panel (Old

Growth Technical Advisory Panel, 2021). Within the THLB, non-recoverable losses resulting from disturbances are accounted for by applying a 1.5% annual deduction to the harvest volume.

2.2 Evolvement of Base Case Since MP #10

The Base Case in this timber supply analysis has evolved greatly since the submission of MP #10. This evolution is attributed to several key factors, including the amalgamation of the former TFL 39 Block 4, compliance with current regulations and guidelines, other land use changes such as more reserves related to biodiversity, wildlife and other non-timber values, improved data such as advanced use of LiDAR, and revised management practices and modelling assumptions. Cumulatively, these changes have resulted in differences in the modelled harvest levels between MP #10 and the current analysis. The updates reflect a comprehensive, data-driven approach that accounts for evolving environmental, regulatory, and technological factors.

2.2.1 Upward pressure

Upward pressure on timber supply results is attributed to:

1. Inclusion of the former TFL 39 Block 4 land base

As previously discussed in Section 1.1, the former TFL 39 Block 4 was integrated into TFL 6 on January 1, 2015. Under TFL 39 MP #9, these areas were assessed to have a productive forest land base (PFLB) of 34,322 hectares, of which 25,854 hectares were classified as THLB.

For this MP, the former TFL 39 Block 4 area is shown to have 22,945 hectares of THLB. While this area increases THLB in TFL 6, the net increase is smaller when compared to MP #9. Refer to Table 2 for a detailed area comparison for PFLB and THLB between the two plans.

Table 2 Land Base Comparison of TFL 39 MP #9 and TFL 6 MP #11 for Former TFL 39 Block 4

Factor	Area (Ha)		Difference (Ha)	Difference (%)
	TFL 39 MP #9	TFL 6 MP #11		
Productive Forest	34,322	34,563	241	0.7%
THLB	25,854	22,945	-2,909	-11.3%

2. Increases in genetic worth values

Projections of average genetic worth (GW) for the two MPs were developed using Western's Saanich Forestry Centre seed inventory (for existing managed AUs) and development plans (for future AUs). Due to genetic improvement efforts, GW in MP #11 has increased across multiple species. Table 3 provides a comparison of GW by species between the two plans. It is important to note that planting of Western hemlock (Hw) in TFL 6 has decreased substantially and is not expected to be planted in significant quantities in the future. Consequently, the GW for Hw for future AUs in MP #11 has been adjusted to reflect natural regeneration without genetic improvements.

Table 3 Comparison of Genetic Gain% by Species

Species	Genetic Gain% for Recently Managed AUs		Genetic Gain% for Future AUs	
	TFL 6 MP #10	TFL 6 MP #11	TFL 6 MP #10	TFL 6 MP #11
Cw	8.0	17.0	8.0	21.0
Fd (low elevation)	10.0	10.6	10.0	16.0
Fd (high elevation)				11.0
Hw (low elevation)	10.0[1]	12.8	10.0	1.7 for CHWvm1 01; 0 for the rest[2]
Hw (high elevation)	6.0		6.0	1.1 for CWHvm2 01; 0 for the rest
Yc	7.0	14.3	7.0	10.0[3]
Dr in CHWvm1*	N/A	11.2 only in CWHvm1 07	N/A	32.0 only in CWHvm1 07

3. More accurate measurement in existing road widths

Road width assumptions for existing roads within MP #11 have been revised using recent orthophotography acquired concurrently with LiDAR data. Specifically, road widths were measured in ArcMap at various sampling points representing different road classes across TFL 6. This analysis was supplemented by a review of road width assumptions documented in the data package for the adjacent North Island TSA. This combined approach provided a comprehensive understanding of the area within managed stands associated with roads with no tree cover, resulting in a smaller reduction of the THLB compared to MP #10. A comparison of road width assumptions for different road classes between the MP #11 and MP #10 is presented in Table 4.

[1] The source GW for Hw are 14% at low elevations and 10% at high elevations. The implemented GW in MP #10 was reduced to reflect natural regeneration.
[2] The source GW for Hw are 17% at low elevations and 11% at high elevations. The implemented GW in MP #11 have been reduced by 90% due to the limited scope of Hw planting.
[3] The source GW for Yc is 21%. The implemented GW in MP #11 has been reduced to reflect approximately 50% of Yc wild seeds.

Table 4 Comparison of Road Width Assumptions

Road Classes	Total Buffer Width (m)	
	TFL 6 MP #10	TFL 6 MP #11
Highway	30	16
Mainline	12	10
Branch	10	8
Spurs	8	8
Unclassified	8	8

4. Implementation of TIPSY yield reduction due to shading effects

The implementation of Western's Stewardship and Conservation Plan (WSCP; formerly the Western Forest Strategy or WFS) Zones, dictates higher levels of stand-level retention across the land base than provincial targets. This retention introduces competition (shading) that affects adjacent regenerating portions of the cutblock. To account for this shading effect, a variable retention adjustment factor (VRAF) is applied. In previous MPs, the VRAFs were based on VILUP RMZ types. However, in MP #11, WSCP zones have been refined to consider wind exposure to mitigate windthrow risk. The net effect of the "windy" WSCP zones, and the associated reduction in stand-level retention within them, results in a slightly lower area-weighted VRAF in this MP (Table 5).

Table 5 Comparison of Variable Retention Adjustment Factor

Western Stewardship and Conservation Plan Zones	TFL 6 MP #11 THLB Area (ha)	Shading Effect Yield Reduction	
		TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11
Enhanced Windy	78,672	2.0%	1.0%
Enhanced Basic	8,098	2.0%	1.7%
General Windy	3,084	3.0%	1.9%
General Basic	21,987	2.0%	2.9%
Special[4]	8,257	5.0%	5.4%
Total / Area-weighted Average	120,099	2.2%	1.7%

2.2.2 Downward pressure

Downward pressure on timber supply results is attributed to:

1. Increased conservation in OGMAs and WHAs

TFL 6 MP #11 incorporates over 7,300 hectares of additional conserved productive forest within legally established and proposed OGMAs and WHAs compared to previous MPs (TFL 6 MP #10 and TFL 39 MP #9 for the former Block 4). This increase includes OGMAs and WHAs proposed to adhere to the *Marbled Murrelet Order*, effective December 2, 2021. Consequently, a larger area of productive forest is excluded from the THLB in this

[4] Shading impacts on the two SMZs established under the January 2026 Gwa'ni Land Use Objectives Order were not included, as the legal order had not yet been issued at the time the analysis.

management plan. A comparison of the areas designated as legal and proposed OGMAs and WHAs is shown in Table 6.

Table 6 Comparison of Legal and Proposed OGMAs and WHAs

Factors	Productive Area (Ha)		Difference (Ha)	Difference (%)
	TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11		
Old Growth Management Areas - Legal	10,714	11,774	1,060	9.9%
Old Growth Management Areas - Proposed	9,066	12,884	3,818	42.1%
Wildlife Habitat Areas - Legal	852	2,654	1,802	211.5%
Wildlife Habitat Areas - Proposed	0	654	654	N/A
Total	20,632	27,966	7,334	35.5%

2. Inclusion of additional land values

TFL 6 MP #11 expands THLB netdowns for values not explicitly addressed in previous MPs, resulting in increased THLB exclusions.

Western has established collaborative research relationships with FAIB, the Forest Science Planning & Practices Branch, and the Forest Improvement and Research Management Branch of the British Columbia Ministry of Forests (FOR). Various permanent sample plots (PSPs) and research sites are located within TFL 6. Between March 2018 and September 2025, the BC Chief Forester issued a series of letters to licensees directing them to consult with FOR staff prior to planning or undertaking any activities that could affect PSPs, in order to ensure the continued viability of the provincial PSP program. While regulations do not necessarily prohibit timber harvesting within these sites, Western proactively consulted with FOR staff from the relevant branches to determine appropriate management assumptions for this MP. These discussions informed the identification of THLB exclusions and harvest deferrals to balance operational objectives with research and monitoring values.

The importance of conserving big trees is more explicitly acknowledged in MP #11 than the previous MPs. Big trees that either (1) are listed on the BC Big Tree Registry under the *Special Tree Protection Regulation* or (2) identified in the field or verified in LiDAR point cloud data and meeting Western's Big Tree Retention Policy are excluded from the THLB.

The values of karst landscapes (e.g., sinkholes and caves) within TFL 6 are recognized through a GAR order in 2007. During early engagement for the IP in spring 2024, the Quatsino First Nation highlighted the cultural significance of karst features on the land base. While the previous MPs assumed that karst features discovered during forestry operations would be protected through Wildlife Tree Retention Areas (WTRAs), and thus no additional timber supply impact was considered, MP #11 includes additional aspatial THLB exclusions within primary and secondary karst likelihood areas in TFL 6 to reflect the cultural importance and align with the GAR order. Table 7 summarizes the productive area and net THLB exclusion areas for these values, which were not specifically accounted for in previous MPs.

Table 7 Productive and THLB Exclusion Areas for Additional Land Base Values in MP #11

Factors	Productive Area (Ha)		TFL 6 MP #11 Net THLB Reduction Area (Ha)
	TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11	
Research Sites	N/A	112	13
Permanent Sample Plots	N/A	167	134
Big Tree Reserves	N/A	83	42
Karst	N/A	24,845	3,721
Total	0	25,207	3,910

3. Utilization of LiDAR data

During the term of MP#10, Western acquired LiDAR data for TFL 6 in multiple phases. LiDAR, which provides a highly accurate three-dimensional representation of the ground surface and vegetation height, and its derived datasets, have been used to support land use planning at both strategic and operational levels. Several inputs and assumptions for MP #11 are based on LiDAR data, including:

a) Site productivity: determined using the LiDAR canopy height model (CHM); for example, identifying small, low-height tree crowns within old forest stands.

b) Physical operability: assessed through land base blocking (LBB) to categorize areas suitable for timber harvesting.

c) Riparian areas: delineated using LiDAR-derived classified streams to develop a comprehensive stream network for the TFL.

d) Steep terrain: identified using a LiDAR-derived slope model, replacing the outdated Environmentally Sensitive Area (ESA) mapping for the former TFL 39 Block 4 area.

Table 8 compares the productive area and net THLB exclusion areas resulting from these factors. The acquisition of LiDAR data for TFL 6 has significantly enhanced the accuracy and detail of this MP.

Table 8 Comparison of Non/Low Productive, Inoperable, Riparian and Steep Areas

Factors	Productive Area (Ha)		THLB Net Reduction Area (Ha)			
	TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11	TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11	Difference (Ha)	Difference (%)
Non-productive and Low Sites[5]	14,703	35,423	14,703	18,735	4,032	27.4%
Inoperable	12,810	30,300	12,810	21,193	8,383	65.4%
Riparian Management	15,060	46,993	13,956	5,479	-8,477[6]	-60.7%
Terrain Stability (TRMS + LiDAR 90%+ Slope	5,052[7]	15,760	1,304	3,812	N/A	N/A
Total	47,625	128,476	42,773	49,588	4,307	10.1%

4. Individual Visual Quality Objective (VQO) polygon modelling: Previous MPs used the upper limit of the percent disturbance range for timber supply analyses (i.e., 5% for Retention (R), 15% for Partial Retention (PR), and 25% for Modification (M)), supplemented by a sensitivity analysis using the midpoint of the disturbance range (i.e., 3% for R, 10% for PR, and 20% for M). The use of the upper limit was justified by the common practice of visual landscape design and visual impact assessment during cutting permit development in sensitive viewscapes. In MP #11, individual VQOs are modelled due to the availability of a detailed LiDAR-derived slope model. The disturbance limit for each VQO polygon is calculated based on LiDAR slope, VEG height, VAC, and P2P ratio.

5. Application of greater non-recoverable losses: Previous MPs assumed non-recoverable losses of 1% of the harvest volume. Following a significant lightning-caused fire event in 2018, a greater loss factor of 1.5% is used in MP #11 to account for both biotic and abiotic disturbances to the merchantable volume.

6. Implementation of Equivalent Clearcut Area (ECA) limits applied to disturbed watersheds: Previous MPs applied a rate-of-cut limit to the "steep" THLB areas within the Colonial, Goodspeed, Hathaway, and Koprino watersheds. These four watersheds were identified as having higher landslide risks in Western's 2007 watershed management strategies. MP #11 reflects Western's 2019 watershed management strategies update, which identifies nine additional watersheds as requiring reduced terrain risk tolerances to address impacts. Furthermore, ECA limits, using improved hydrological recovery curves, are applied to manage harvest activities within the model.

[5] Total areas are presented for non-productive and low-productivity sites.
[6] The reduced net THLB is attributable to areas already excluded as non-productive, low-productivity, or inoperable categories.
[7] Values are shown only for TFL 39-4 from MP #9; TFL 6 MP #10 terrain is managed through rate-of-cut constraints.

7. Modelling natural disturbances outside of the THLB: Previous MPs did not model any disturbances outside of the THLB. This resulted in all productive forests within the NCLB aggregating to an old seral stage by the end of the planning horizon. In reality, natural disturbances occur in NCLB stands. MP #11 incorporates stand-initiating return interval rates by BEC variant, integrating the annual disturbance rate into the model to randomly disturb NCLB stands. This allows the model to forecast the impact of natural disturbance on long-term landscape-level biodiversity (e.g., demonstrating that more old seral stands may need to be preserved to meet landscape-level biodiversity targets if not all NCLB stands can reach or are maintained in old seral stage).

2.2.3 Revised Information and Assumptions

MP #11 applies revised information and timber supply modelling assumptions compared to the previous MPs. These revisions are attributed to 1) changes in forest management practices; 2) different quantification methods for the same factors. The revised information and assumptions, along with explanations, are provided below:

1. Implementation of revised variable retention targets, resulting in increased existing and future WTRAs: In TFL 6 MP #10 and TFL 39 MP #9 (for the former Block 4 area), an aspatial THLB netdown factor was applied based on VILUP RMZ types[8], landscape units, and BEC subzones. In contrast, existing WTRAs are tracked and deducted spatially in MP #11. Furthermore, stand-level retention netdowns were assumed to partially or fully address the management of cultural heritage resources and karst features in previous MPs, whereas MP #11 addresses these two factors separately. Finally, the impact of future stand-level retention is explicitly addressed in MP #11 using an aspatial netdown approach. Table 9 compares the productive area and net THLB exclusion areas for the two plans. The data indicates that MP #11 excludes approximately 10% more existing and future WTRAs than the previous MPs.

[8] Future stand-level retention impacts on the two SMZs established under the January 2026 Gwa'ni Land Use Objectives Order were not included, as the legal order had not yet been issued at the time the analysis.

Table 9 Comparison of Existing and Future WTRAs

Factors	Productive Area (Ha)		THLB Net Reduction Area (Ha)			
	TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11	TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11	Difference (Ha)	Difference (%)
Existing Stand-level Reserves	N/A	7,287	-	3,089	3,089	N/A
Future Stand-level Reserves	N/A	-	6,887	4,488	-2,399	-34.8%
Total	0	7,287	6,887	7,577	690	10.0%

2. Improvements in growth and yield modelling through updated versions of Variable Density Yield Projection (VDYP) and Table Interpolation Program for Stand Yields (TIPSY). MP #11 utilizes the latest stand-level growth and yield modelling software available (Table 10), incorporating enhancements implemented by FOR staff since the previous MPs. Additionally, inventory work was conducted to align the TFL 6 forest inventory with VDYP 7 standards (see Appendix B of the associated IP).

Table 10 Comparison of Growth & Yield Modelling Software

Growth & Yield Modelling Software	TFL 6 MP #10 & TFL 39 MP #9 (Blk 4)	TFL 6 MP #11
VDYP	6.6d	7.33b
TIPSY	4.1	4.6

3. Implementation of 95% CMAI as the MHA: Previous MPs established MHAs based on tree size thresholds and harvest systems or site productivity classes. Stands were considered as harvestable when their average diameter at breast height (DBH) reached a threshold that varied by harvest systems (e.g., 30 cm, 37 cm, and 42 cm for ground, cable, and helicopter systems, respectively). However, average harvested stand DBH can vary due to factors such as equipment capacity, seasonality, and market conditions. Furthermore, operational staff observe that ground and cable systems are often used concurrently within the same cutblock. Therefore, MP #11 analysis sets the MHA at 95% of CMAI, along with a minimum volume requirement of 350 m^3/ha.

4. Utilization of Patchworks' spatial capacity: Previous MPs used Remsoft's Woodstock timber supply model, a pseudo-spatial model that optimized timber supply subject to constraints. The spatial aspects of land use objectives and requirements, such as cutblock adjacency and green-up, were addressed using proxy measures. MP #11 uses the Patchworks spatial timber supply model, which can manage cutblock adjacency spatially. While both models can conduct timber supply analyses, their differing modelling mechanisms and constructs can result in different timber supply projections.

5. Alignments of site index estimates: Site index and ecosystem classification data used in MP #10 were sourced from a local study conducted by Terry Lewis, Ph.D. between 1982

and 1985. For MP #11, the data sources are aligned with provincial sources of Site Index Estimates by BEC Site Series (SIBEC) and Terrestrial Ecosystem Mapping (TEM) based on BEC zone and site series classification system as outlined in LMH No. 28.

6. More detailed AU definitions for both existing and future managed stands: Previous MPs used broad site productivity classes for AU definitions (i.e., the Lewis ecosite classification system in TFL 6 MP #10 and Poor/Medium/Good classes based on species and site index range for the former TFL 39 Block 4). With the implementation of the provincial BEC zone and site series system in MP #11, site productivity is defined in greater detail, resulting in more detailed volume and yield projections for the land base.

Several of the factors discussed above are reflected in the MP #11 THLB, while others are implemented as modelling criteria to be controlled within the timber supply model (e.g., VQOs and ECAs). For a THLB comparison, the MP #11 THLB for TFL 6 is 120,099 hectares; the THLB associated with the current AAC, derived from the TFL 6 MP #10 and TFL 39 MP #9 for the former Block 4, is 133,665 hectares. This represents a decrease of 13,566 hectares, or 10.1%, in the THLB.

2.3 Base Case Harvest Statistics

The Base Case harvest flow is summarized in Table 11 and illustrated in Figure 2. All harvest volumes are rounded down to the nearest 100 m³ and reflect net volumes after applying a 1.5% annual deduction to account for non-recoverable losses within the THLB. These losses include those associated with natural disturbances such as windthrow, wildfire, insect infestation, and disease. The timber supply forecast is modelled using 5-year intervals over a 300-year planning horizon.

Table 11 Base Case Harvest Levels

Period (of 5-year interval)	Start Year	End Year	Annual Harvest Volume (m^3)	% Change from Previous Period
1 to 60	2024	2323	1,061,600	-22.1%

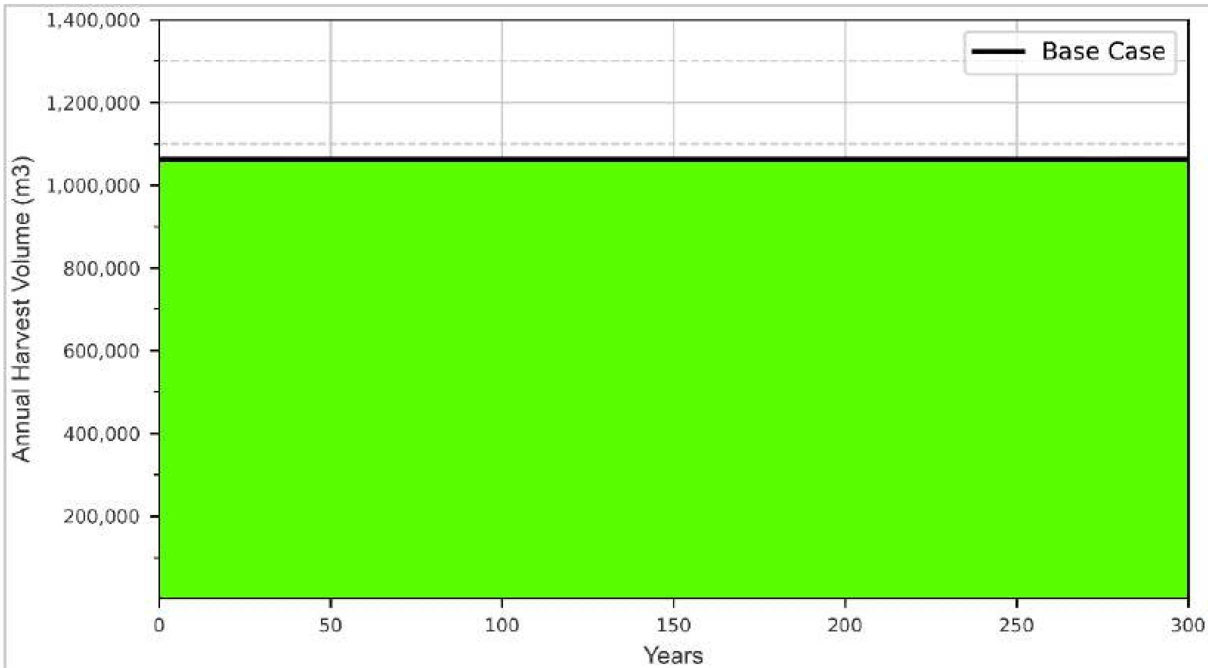


Figure 2 Base Case Harvest Level

The total volume harvested over the 300 years is roughly 318.5 million m^3. For comparative purposes, the Long-Run Sustained Yield (LRSY), representing the maximum sustainable annual harvest under the assumption that all stands are harvested at the CMAI age, is 1,182,900 m^3/year (see Section 10.4.1 of the associated IP). This value is adjusted by a 1.5% reduction to account for non-recoverable losses. The Base Case represents approximately 90% of this adjusted LRSY. In addition to the 95% CMAI utilized as the MHA, other landscape-level objectives, such as the maintenance of old seral biodiversity, marbled murrelet suitable habitat, visual quality, and ECA for watershed management, have further constrained the harvest level relative to the LRSY level.

The harvest level estimate for the next decade represents a decrease of 300,400 m^3/year (22.1%) from the current AAC of 1,362,000 m^3/year. However, the current AAC was projected to decrease by 5% to 7% by the commencement of this MP, as documented in the supporting rationale for the TFL 6 AAC postponement order. Therefore, a more appropriate comparison for the MP #11 projected harvest level is between 1,266,600 m^3/year (7% AAC reduction) and 1,293,900 m^3/year (5% AAC reduction). This translates to an AAC reduction of between 16.2% and 18.0% for the MP# 11 Base Case.

In addition to the 10.1% THLB reduction and revised modelling criteria implemented to reflect current regulations and management practices (Section 2.2), the change in harvest flow pattern is another key factor. While MP #10 employed a step-down pattern designed for short-term harvest maximization, the Base Case for this MP adopts an even-flow harvest schedule due to negligible additional volume being available in the short-term without impacting mid-term timber supply. This is a result of the period of minimal available inventory (i.e. meets minimum harvest criteria) being at the end of Period 3 (15 years). Modelling a step-down flow pattern in MP #11 (discussed in Section 3.2 below) increases the first-decade harvest level by 8.1% to 1,147,700 m³/year. Considering the projected 5% to 7% decline from the current AAC of 1,362,000 m³/year, the modelled step-down pattern represents a difference of 9.4% to 11.3%. This range more closely reflects the impact of the 10.1% THLB reduction.

The THLB growing stock associated with the Base Case harvest level, categorized by a 120-year age threshold, is illustrated in Figure 3. Stands exceeding 120 years of age contribute more significantly to supporting the short-term harvest level. The total THLB growing stock reaches 34.92 million m³ at Year 10, the lowest point in the 300-year projection. As the harvest transitions from natural to managed stands, accelerated growth rates within managed stands result in a gradual increase in THLB growing stock. From approximately Year 90 onward, the THLB growing stock stabilizes at levels exceeding 40.0 million m³ for the remainder of the planning horizon, demonstrating the long-term sustainability of the Base Case harvest level.

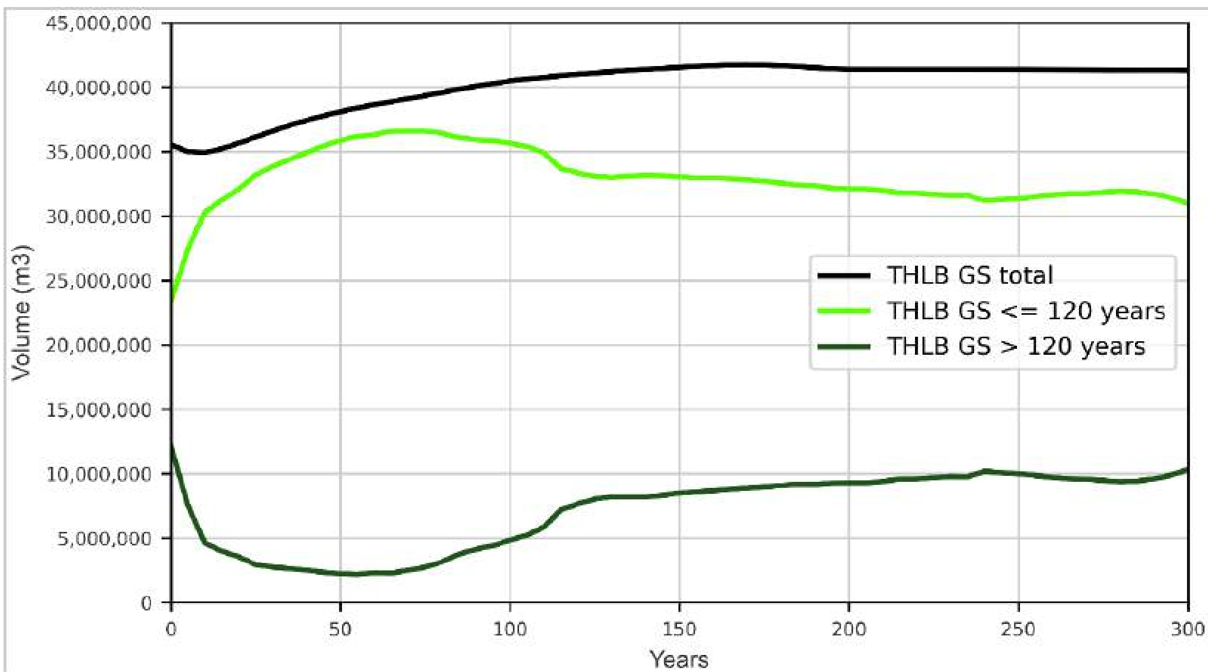


Figure 3 Base Case THLB Growing Stock By 1-120 Years Old And 120+ Years Old Categories

Figure 4 illustrates the contribution to the harvest level by period from each of the three broad stand eras used to define the analysis units. As anticipated, existing natural stands (those greater than 62 years old in 2023, i.e., established prior to 1961) constitute the largest proportion of harvested volume during the initial 15 years. However, their contribution decreases to less than half of the harvested volume by Year 20 and subsequently falls below 10% by Year 30. Existing managed stands, which contribute less than 5% of the harvested volume in the first decade, experience a rapid increase in their contribution, exceeding half of the harvested volume in the subsequent decade. These stands provide the largest proportion of volume after Year 20, as natural stand harvesting continues to decline. Future managed stands begin contributing to harvest volume at Year 65 and become the predominant source of harvested volume by Year 85.

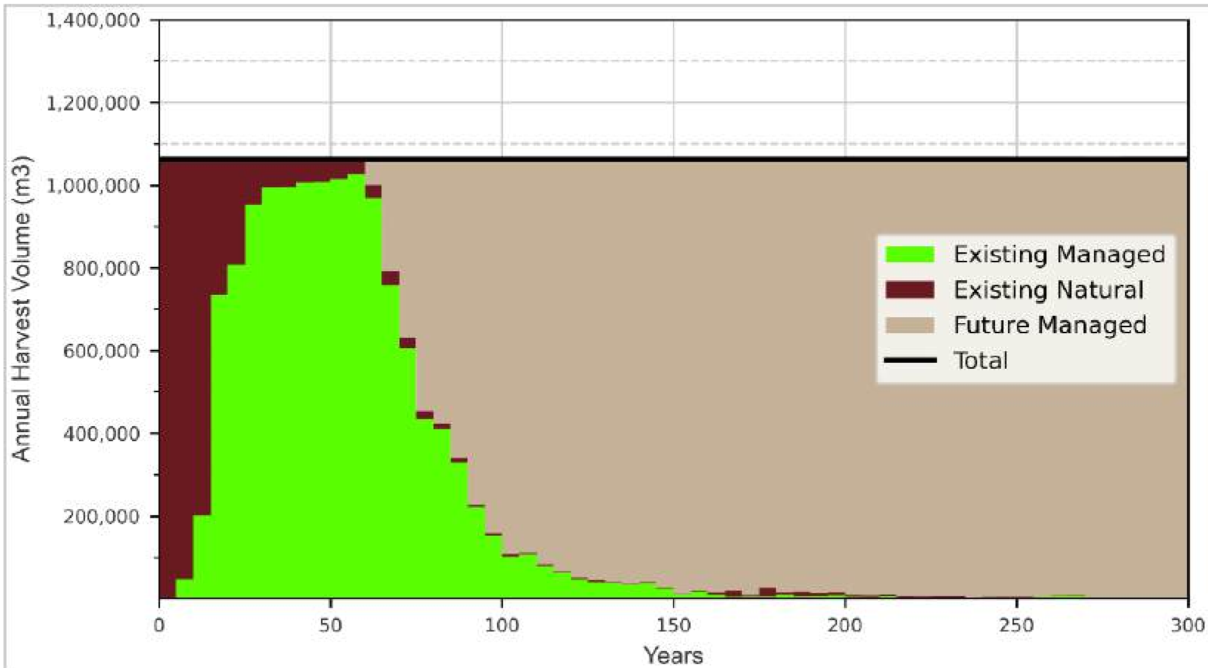


Figure 4 Base Case Harvest by Stand Eras

Figure 5 illustrates the harvest level by seral stages. As anticipated, existing old stands (those greater than 250 years old in December 2023) and older mature stands (121 to 250 years old in December 2023) contribute approximately three-quarters of the harvested volume during the initial 10 years. However, over the subsequent five years, their contribution decreases to below 25% of the harvested volume and rapidly becomes minor after Year 30, accounting for less than 5% of the projected annual harvest level for the next 100 years. Mid-seral stands (40 to 80 years old) provide the largest proportion of volume after Year 20, concurrent with the continued decline in harvesting of older stands. This trend is attributable to the weighted average MHA across future analysis units being 64 years old. Mature seral stand (81 to 120 years old) harvesting becomes a secondary contributor after the older mature and old seral stands' contribution diminishes after Year 10. Its contribution is notable from Year 15 to Year 100, averaging nearly 40% of the harvest level. Beyond Year 100, the harvest is predominantly from mid-seral stands (72%), supplemented by mature stands (20%) and a small proportion of older mature stands (8%) for the remaining 200 years of the planning horizon.

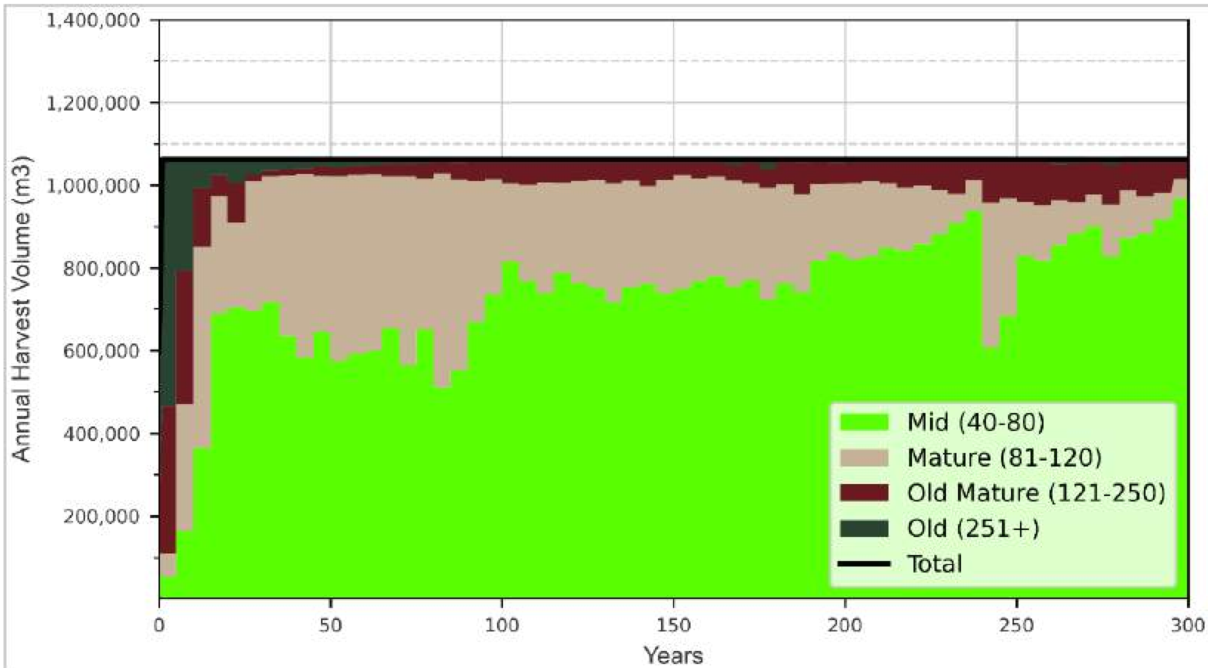


Figure 5 Base Case Harvest Level by Stand Seral Stages

The detailed age-class distributions over time for the productive forest area (THLB and NCLB) are illustrated in Figure 6. Snapshots of the age class distributions are presented at 50-year intervals. At present, the oldest age class currently occupies more than 29,700 hectares, representing 16% of the total productive forest area. Nearly 70% of this area lies outside the THLB. As harvesting of existing old stands occurs within the THLB, the area in the oldest age class initially declines (a short-term trend not evident in Figure 6) before gradually increasing as younger reserved stands mature. By Year 300, the oldest age class expands to more than 64,000 hectares (although only the value at Year 250, exceeding 60,000 hectares, is illustrated in Figure 6). This represents an increase of 215% relative to the current extent of old-seral stands. Concurrently, the proportion of THLB area less than 80 years of age initially increases as harvesting transitions from older natural stands, reaching up to 14% above current levels by Year 25. Over time, the age class structure approaches a more balanced distribution, coincident with the stabilization of the average harvest age (refer to Figure 11). This age class distribution indicates that a sustainable harvest beyond the analysis period is achievable.

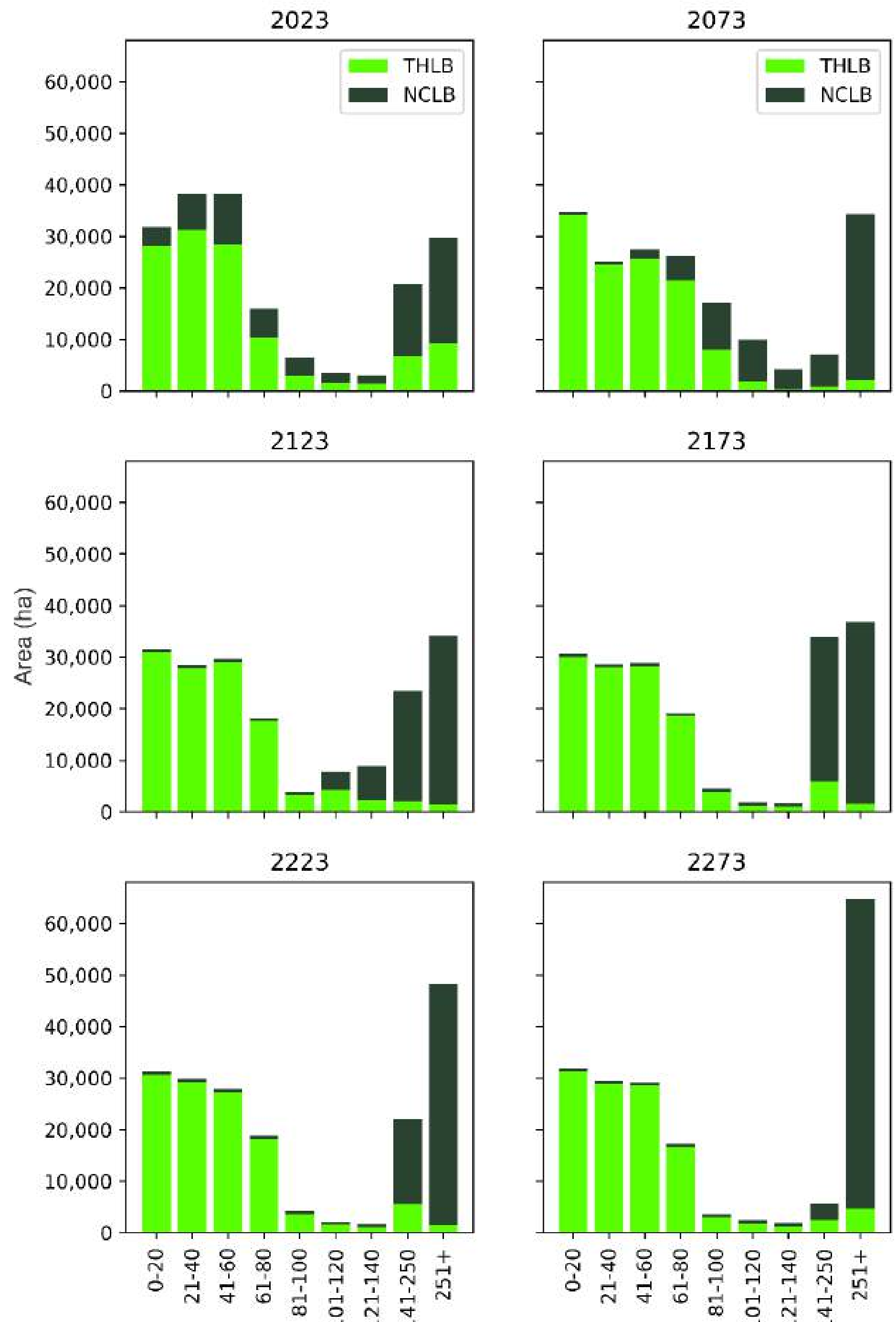


Figure 6 Base Case Age Class Distribution of Productive Forest Area (187,425 ha)

Conventional harvesting systems (ground-based and cable-based) dominate timber harvesting (Figure 7). Helicopter harvesting represents a small proportion of overall harvest volume, averaging 3% over the 300-year planning horizon. However, its contribution is notably higher in the first decade (15%) due to the greater proportion of merchantable volume (11% of the total) and the associated harvesting of mature and old seral stands in helicopter operating areas. Within conventional harvesting, ground-based systems generally account for 15% to 20% more volume than cable-based systems. An exception occurs in the first decade, where cable-based harvesting exceeds ground-based harvesting for the same reason described above (i.e., access to mature and old seral stands). After the first decade, ground-based systems contribute an average of 17% more to the total harvested volume than cable-based systems. Over the 300-year planning horizon, the average harvest system distribution is 57% ground-based, 40% cable-based, and 3% helicopter-based.

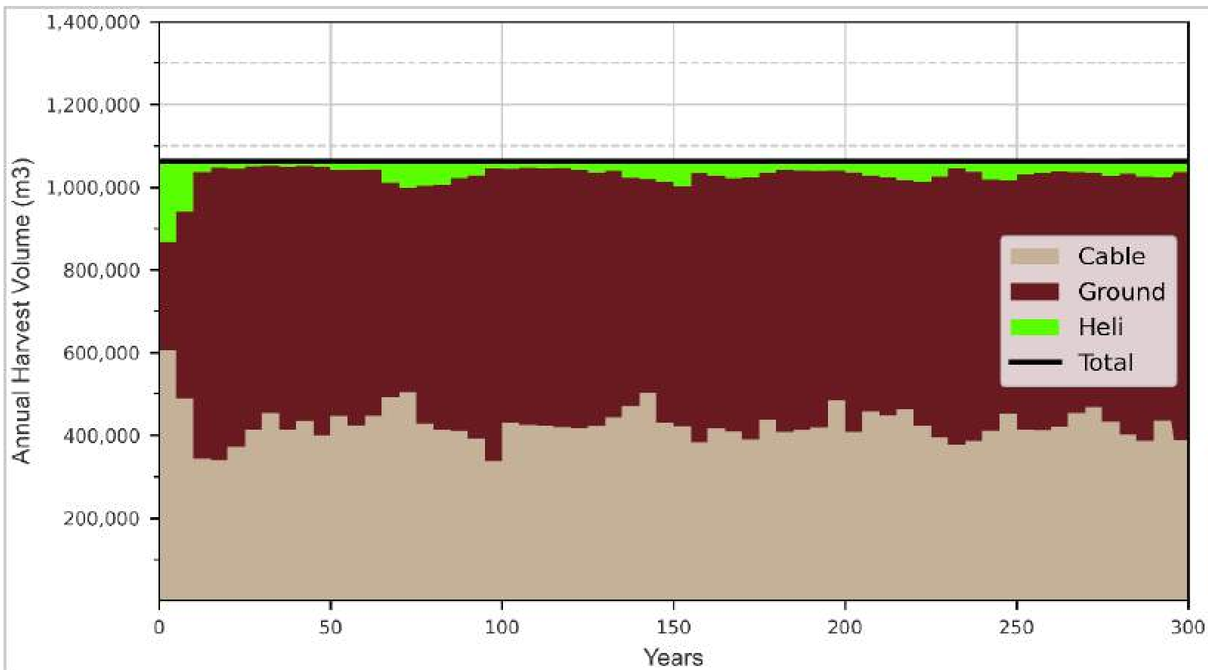


Figure 7 Base Case Harvest Level by Harvest Systems

Figure 8 illustrates the average harvest block size for the Base Case. Within Patchworks, the spatial configuration of the harvest schedule is analyzed such that adjacent or nearby polygons harvested in the same modelling period are treated as a single block. Over the 300-year planning horizon, the average block size is 19.1 hectares, with a range of 15.6 to 24.1 hectares. The median block size for all harvest within TFL 6 between 2012 and 2023 is 28.7 hectares. The average block size in the Base Case is smaller than that observed in recent harvest history and reflects the general trend toward smaller harvest openings on BC coastal regions. Given the dominance of conventional harvesting systems, the overall average block size trend is closely aligned with the ground-based and cable-based system. Cable-based systems have an average block size of 17.1 hectares, approximately 3.8

hectares smaller than ground-based systems, while helicopter-based systems average approximately 5.5 hectares.

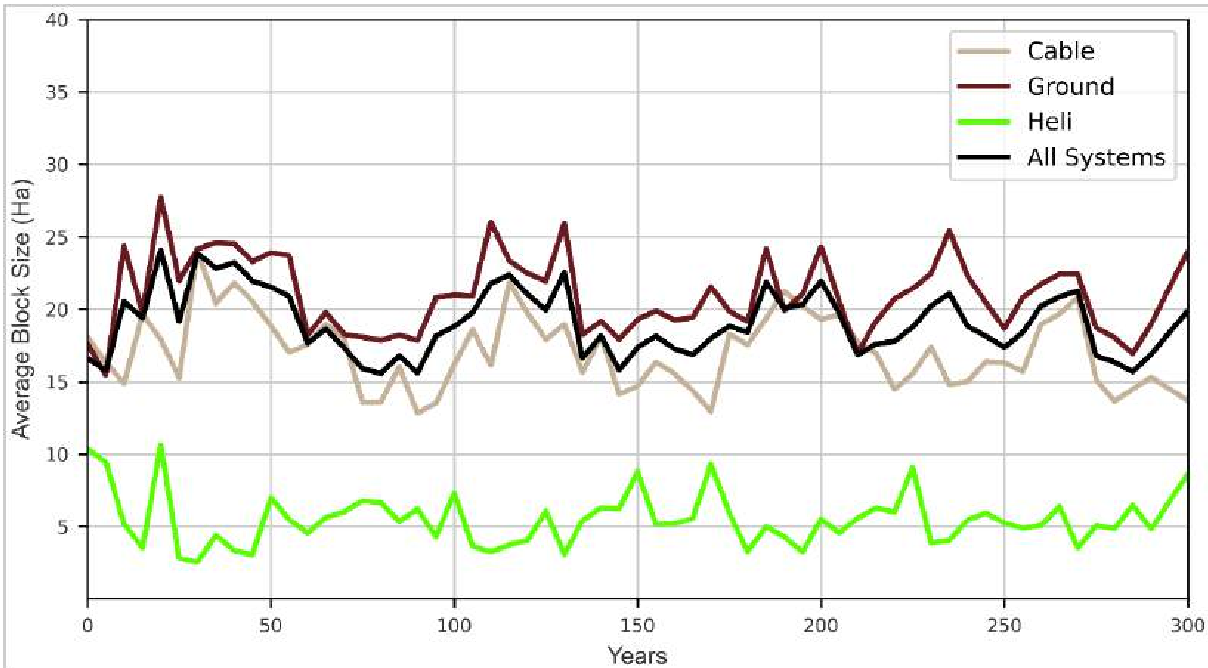


Figure 8 Base Case Average Block Size by Harvest Systems

Figure 9 presents the merchantable (i.e., meeting minimum harvest criteria) and growing stock levels within the THLB, broken down by conventional and helicopter harvesting systems. The initial THLB growing stock level is approximately 35.5 million m³, consistent with the current THLB inventory volume documented in Section 8.4 (Table 60) of the associated IP.

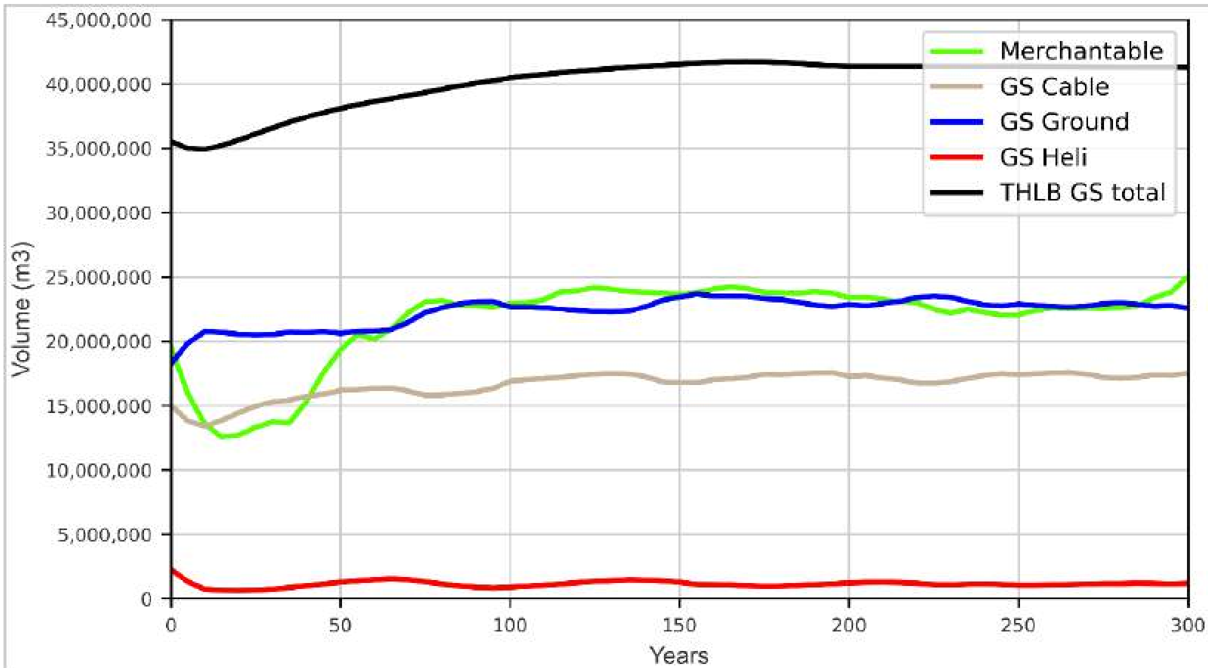


Figure 9 Base Case THLB Growing Stock by Harvest Systems

The total THLB growing stock experiences a decline of up to 1.7% below the initial level over the first 10 years, coinciding with the period where mature and old seral stands contribute the majority of the total harvest. Subsequently, the total growing stock begins to increase as younger existing managed stands acquire volume. This growth continues as future stands acquire merchantable volume, peaking at more than 17% above the initial growing stock level between Years 155 and 185. The growing stock then stabilizes around Year 200 at approximately 16.4% above the initial level. This pattern aligns with the contribution of each stand era or seral stage to the total harvest level over time, as illustrated in Figure 4 and Figure 5. Upon completion of the transition to future managed stands, the THLB growing stock stabilizes above 41.2 million m³.

Cable THLB growing stock initially declines due to the proportionally larger harvest of current mature and old seral stands. However, as second growth stands begin acquiring more merchantable volume, the cable THLB growing stock surpasses initial levels by Year 30, subsequently averaging approximately 17 million m³, roughly 14% above the starting cable THLB growing stock.

In contrast, ground THLB growing stock exhibits steady growth throughout the planning horizon. Once future managed stands provide the largest proportion of volume at Year 80, the ground THLB averages approximately 22.6 million m³, approximately 23% above the initial ground THLB growing stock.

Similar to the cable THLB, the helicopter THLB growing stock initially declines as existing natural stands are harvested. The lowest projected growing stock level occurs around Year 20, coinciding with the periods of lowest harvest contribution from the helicopter system (Figure 7). The growing stock then recovers to a long-term average of 1.2 million m³, approximately 50% of the initial level.

A detailed overview of merchantable THLB growing stock by harvest system is provided in Figure 10. The total merchantable THLB volume begins at 19.6 million m³ and declines over the first 15 years as existing natural stands are harvested and replaced by managed stands. Following the completion of the transition to future managed stand harvesting around Year 100, merchantable volume fluctuates between 22.0 and 25.0 million m³, averaging approximately 23.2 million m³. The merchantable volume for each harvest system exhibits a similar trend. Initially, 11% of the total merchantable volume is designated for helicopter-based harvest systems, while 89% is designated for conventional (ground and cable-based) harvest systems. This higher initial proportion of helicopter-based merchantable volume is reflected in its greater contribution to the harvest level during the first decade (Figure 7). Upon stabilization of the merchantable growing stock under future managed stand conditions, the average distribution of merchantable volume by harvest system is projected to be 54% ground-based, 43% cable-based, and 3% helicopter-based. This distribution is consistent with the harvest system contributions to the Base Case THLB area.

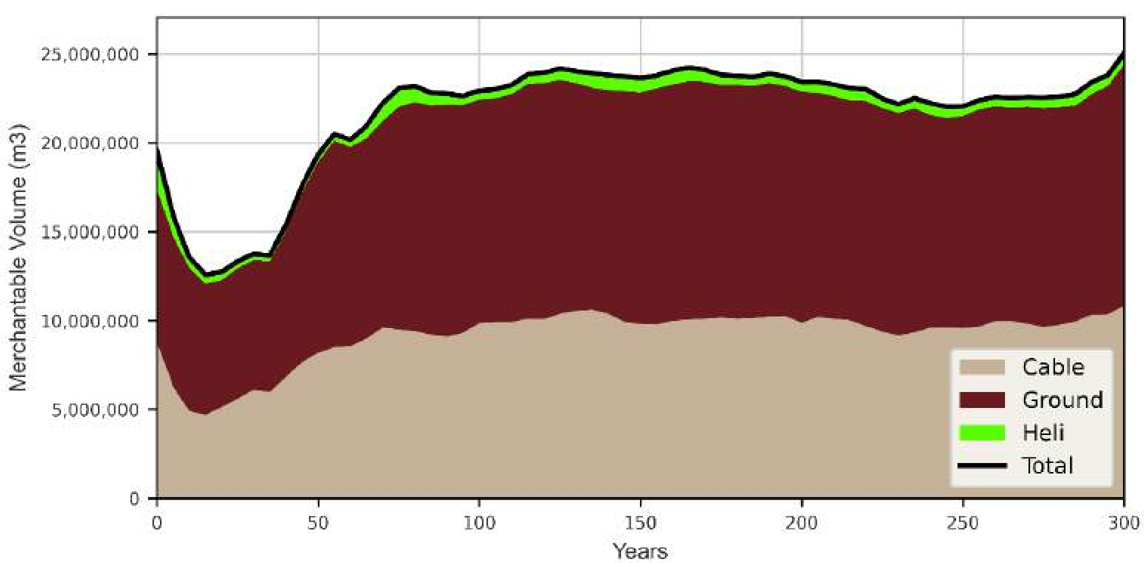


Figure 10 Base Case Merchantable Growing Stock by Harvest Systems

Figure 11 provides average statistics for timber harvested throughout the planning horizon. As anticipated, the mean age of harvested stands (orange line) decreases sharply during the transition to managed stands. The average age (displayed on the secondary y-axis in Figure 11) begins at 250 years old and declines to 89 years old by Year 30. Subsequently, it stabilizes between 66 and 89 years old for the remaining 270 years of the planning horizon. The annual harvested area (dark green line) generally fluctuates between 1,340 and 1,600 hectares, with a long-term average of 1,430 hectares. The merchantable volume per hectare harvested (light green line) ranges from 662 to 803 m³/ha, with a long-term average of 755 m³/ha.

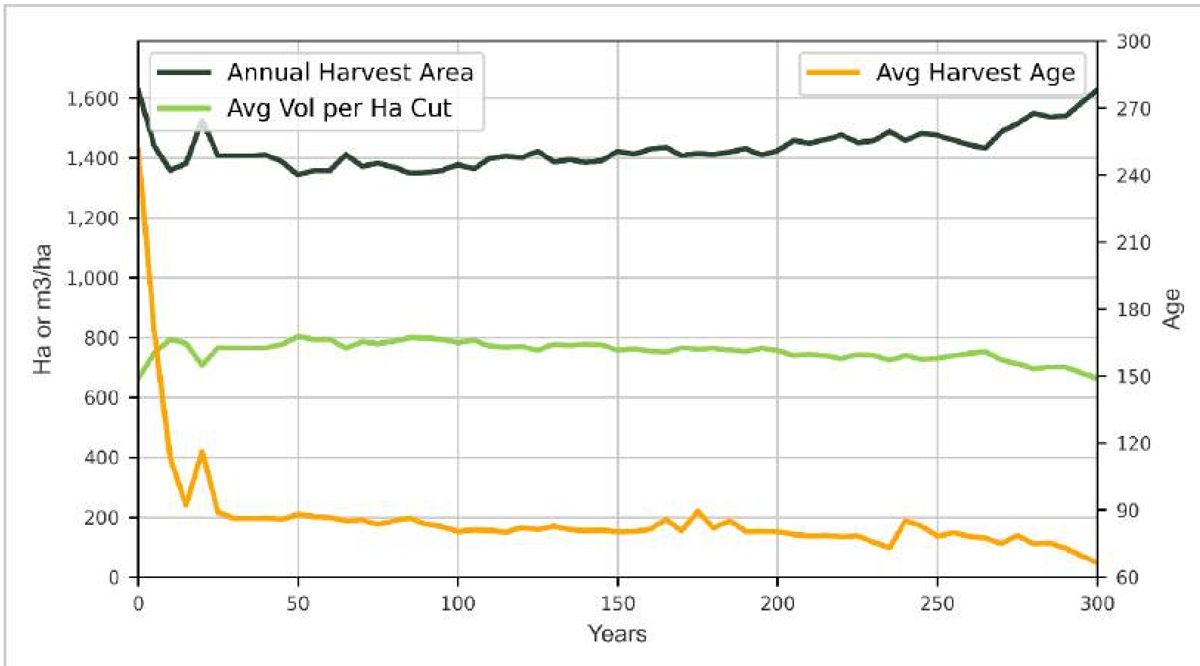


Figure 11 Base Case Harvest Statistics

Figure 12 illustrates the species composition of harvested volume in the Base Case.

Hemlock and balsam (HemBal) are the dominant species in the harvested volume for both existing natural and existing managed stand eras. As future managed stands become the primary source of harvested volume, the proportion of HemBal gradually decreases, although it consistently remains above one-third of the harvested volume in all periods.

Western red cedar contributes slightly over 10% of the harvested volume in the short term. However, due to increased emphasis on cedar in reforestation strategies, with the transition to harvesting future managed stands, its contribution increases to approximately 35% of the long-term harvested volume.

Douglas-fir is present in only small quantities in both natural and existing managed stands. However, its presence is promoted in reforestation efforts for future managed stands, resulting in an average contribution of approximately 15% to the long-term harvested volume.

In the short term (until Year 20), HemBal comprises approximately 80% of the harvest, with red cedar, Douglas-fir, and yellow cedar contributing approximately 12%, 3%, and 2%, respectively. As more managed stands with a greater proportion of red cedar and Douglas-fir reach merchantable size, their contribution to the harvest level steadily increases, while the contribution of HemBal gradually declines. Once harvest is dominated by future managed stands at around Year 100, HemBal, red cedar, and Douglas-fir consistently account for approximately 39%, 38%, and 16% of the harvested volume, respectively.

Yellow cedar constitutes a small proportion (averaging 3%) of the harvested volume over the 300-year planning horizon due to its limited presence in both natural and managed stands. Other minor coniferous species (e.g., spruce and pine) and deciduous species (e.g., red alder) account for approximately 4% of the harvested volume.

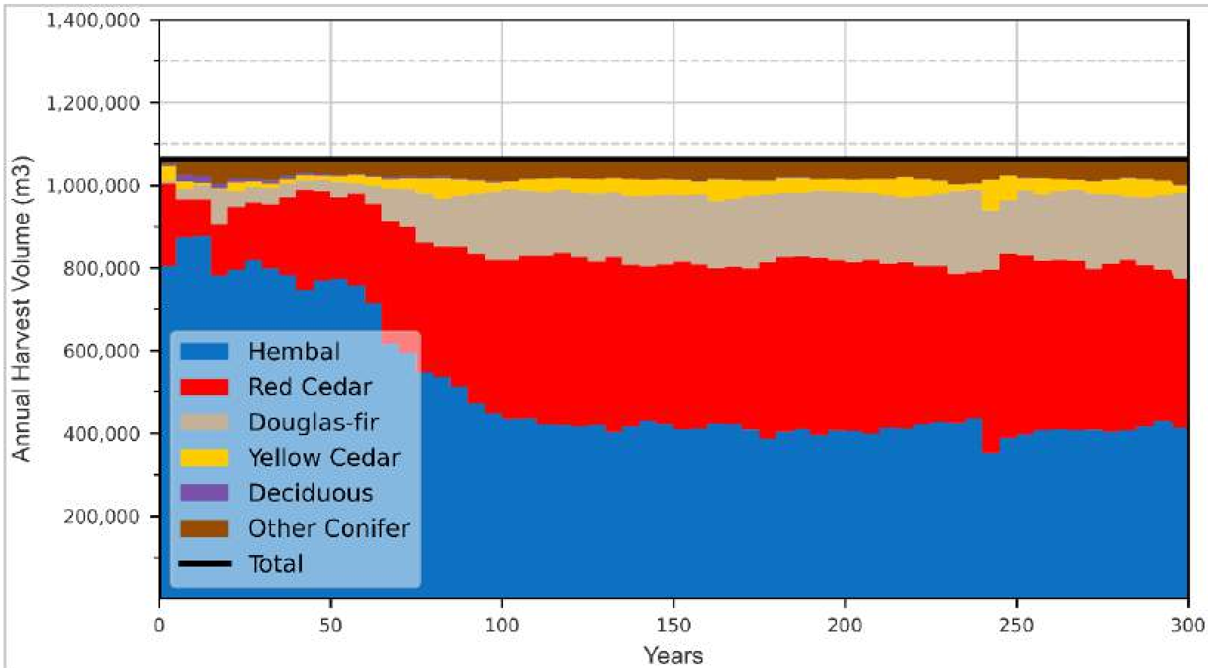


Figure 12 Base Case Harvest by Species Composition

Figure 13 presents the proportion of total harvest volume contributed by three elevation bands in the Base Case: less than 300 m (generally operable year-round), 300–800 m (generally operable from spring to early winter), and greater than 800 m (generally operable from summer to early winter). Over the 300-year planning horizon, harvest contributions from the two lower elevation bands remain relatively stable, with small year-to-year variability. Harvest from elevations greater than 800 m is consistently minor throughout the planning period, with a slightly higher contribution in the first decade, reflecting the availability of existing mature and old seral stands at higher elevations early in the planning horizon. On average, elevations less than 300 m contribute approximately 60% of the total harvest, elevations between 300 and 800 m contribute approximately 35–40%, and elevations above 800 m contribute less than 5%.

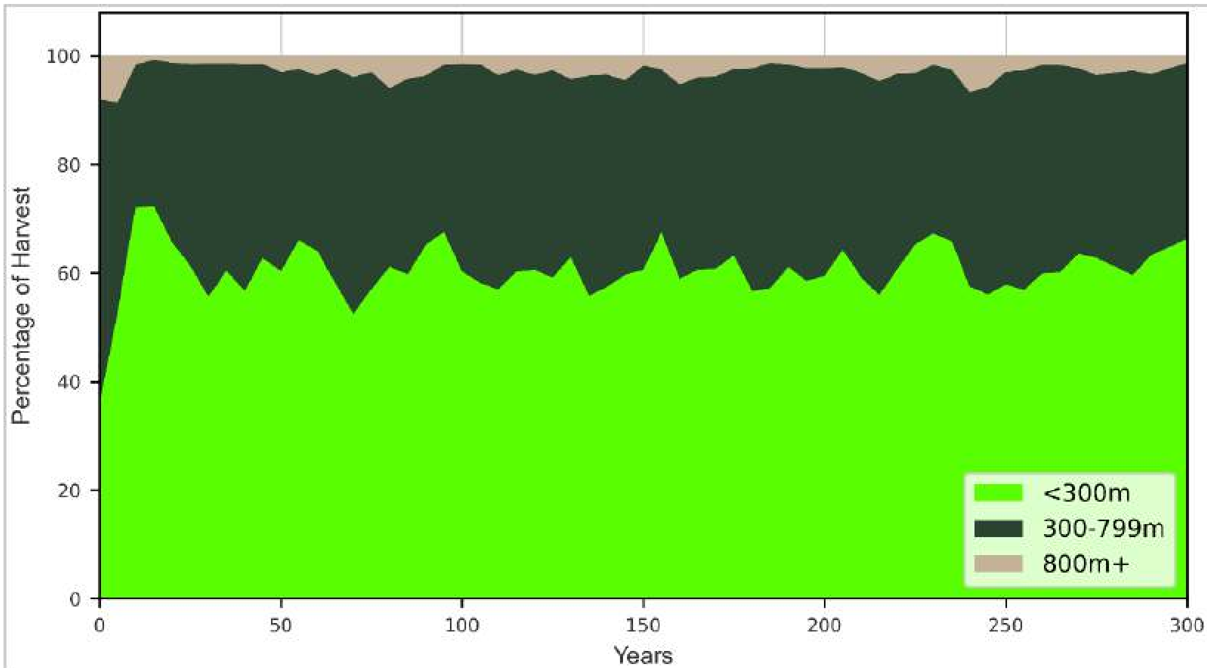


Figure 13 Base Case Harvest by Elevation Bands

Multiple landscape-level values are incorporated as modelling parameters in this MP, including VQOs, landscape-level biodiversity old seral requirements (refer to Section 10.3.3 of the associated IP), community watersheds (Section 10.3.4 of the associated IP), watershed ECAs, mature and old seral requirements for VILUP special management zones[9], and Marbled Murrelet suitable habitat (Section 6.12.3 of the associated IP). These objectives are not achieved through THLB netdowns; rather, the timber supply model dynamically addresses these objectives considering all variables. Consequently, THLB stands may be withheld from harvesting to achieve these objectives. Furthermore, natural disturbances within the NCLB are modelled in this MP (Section 9.4 of the associated IP). This modelling approach implies that not all stands within the NCLB will develop into or remain as old seral stage in perpetuity. Therefore, compared to previous MPs where no disturbances were modelled within the NCLB, a greater proportion of THLB stands are required to remain unharvested to meet these landscape-level requirements.

Under the Base Case scenario, 4,674 hectares of THLB remain unharvested at the end of the planning horizon, representing 3.9% of the total long-term THLB within the TFL. Of these unharvested areas, approximately 17% consists of existing natural stands (greater than 62 years in age), while the remaining 83% comprises managed stands. The underlying reasons for THLB remaining unharvested are summarized in Table 12, using a hierarchical approach to address overlaps between categories (e.g., areas designated for Marbled Murrelet value are classified outside of the VQO). As shown in Table 12, the largest proportion of unharvested THLB is attributable to the need to meet VQOs, followed by

[9] Forest seral targets for the two SMZs established under the January 2026 Gwa'ni Land Use Objectives Order are not included, as the legal order had not yet been issued at the time the analysis.

27.1% allocated to satisfying landscape-level biodiversity old seral targets, and 13.2% reserved to meet watershed ECA thresholds. Collectively, these three constraints account for approximately 92% of the total unharvested THLB. The remaining 8.0% of unharvested THLB area is associated with a combination of additional management objectives, including the fulfillment of mature and old seral requirements within VILUP special management zones, harvest patch size objectives, Marbled Murrelet suitable habitat targets, and community watershed objectives.

Table 12 Base Case Unharvested THLB

Values protected	THLB Unharvested (Ha)	THLB Unharvested (%)
VQO	2,420	51.8%
Marbled Murrelet	23	0.5%
Watershed ECA	615	13.2%
Community Watershed	17	0.4%
VILUP Special Management Zone 25% Mature/Old	248	5.3%
Patch Size	86	1.8%
Old Seral landscape level biodiversity	1,266	27.1%
Total	4,674	100.0%

2.4 Western Red Cedar and Yellow Cedar Projections

The traditional and cultural uses of cedar (western red cedar and yellow cedar) are important to First Nations. Opportunities for First Nations to access and manage cedar have increased through the allocation of AAC to First Nations. Enhancing information related to cultural heritage values for timber supply analysis was identified as an implementation item in the 2021 TFL 6 AAC Postponement Order.

Harvested cedar also holds significant cultural value. The harvest profile of cedar, presented in Figure 12, indicates increased cedar availability for harvest in the Base Case projections.

A large cedar conservation strategy has been developed through a comprehensive big tree retention policy, and this strategy has been incorporated into existing and future stand-level retention netdowns. Another factor influencing the availability of cedar is the total cedar volume on the land base, considering the projected harvest schedule in the Base Case.

Figure 14 illustrates the estimated volumes of western red cedar (Cw) and yellow cedar (Yc) within the THLB and NCLB under the Base Case harvest schedule. The sum of these two land base categories represents the total Cw and Yc volume within the productive forest.

Implementation of a cedar-focused reforestation strategy is projected to increase the combined cedar proportion of the productive forest to approximately 27% by Year 100, with levels remaining at or above this threshold for the remainder of the planning horizon. As a result, total cedar volume is expected to exceed 24 million m³, a level that is projected to be sustained until the end of the planning horizon. This outcome represents more than a twofold increase relative to the initial cedar volume across the productive forest land base.

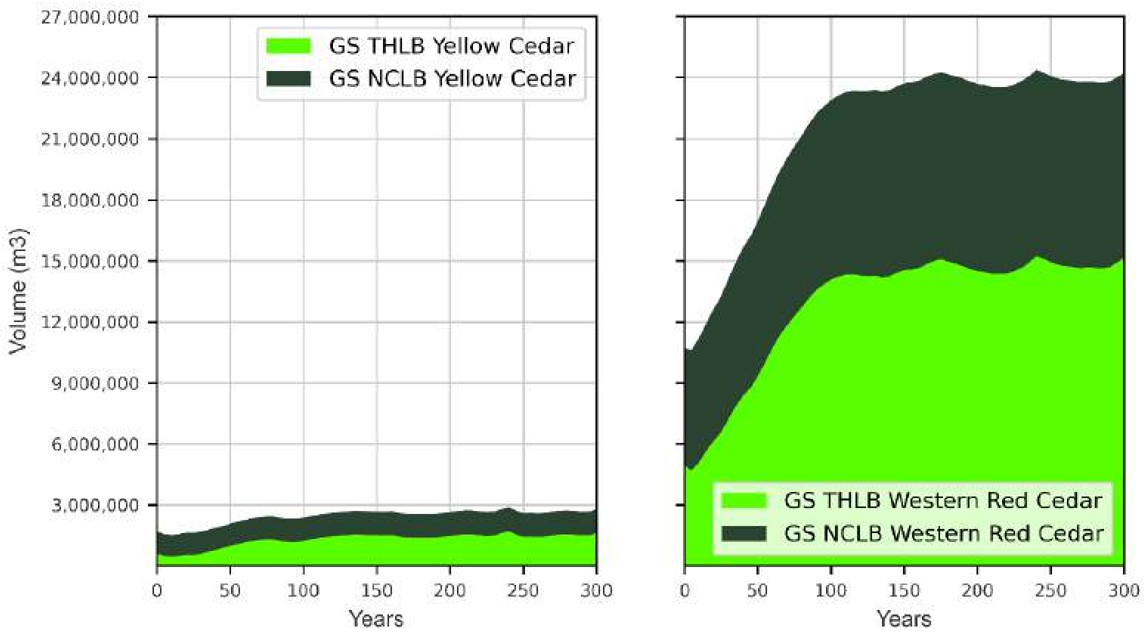


Figure 14 Base Case Cedar Inventory in Productive Forests

At present, Cw and Yc together account for approximately 17% of the total productive forest growing stock, with a combined volume of 12.4 million m³. Of this total, Cw comprises 10.7 million m³, while Yc contributes 1.7 million m³. Both cedar species experience a minor decline in volume during the initial periods of the planning horizon, reflecting harvest activity concentrated in the oldest stands. These initial reductions are relatively small for Cw (0.9%) but slightly more pronounced for Yc (10.4%).

Cw inventory responds quickly following the initial decline. By Year 10, Cw volumes recover to levels exceeding the initial growing stock, driven primarily by its substantial presence within the THLB and relatively high MAI during early- and mid-seral stages. By Year 85, the Cw volume and its proportion of total THLB growing stock more than double relative to initial conditions, indicating a significant accumulation of Cw within existing managed stands. This trend is further reinforced by recent reforestation strategies that prioritize Cw, resulting in a higher representation of the species in regenerating stands (recent existing and future managed) compared to earlier planting regimes. After Year 100, total productive forest cedar volume, dominated by Cw, stabilizes at more than double the current level, averaging over 25 million m³ through to the end of the planning horizon.

Yc represents a smaller but stable component of the growing stock. Yc volume accounts for approximately 1% to 4% of the THLB growing stock and 2% to 3% of the NCLB growing stock. Following a modest decline during the first decade, Yc volume recovers more gradually than Cw, surpassing 140% of its initial growing stock by approximately Year 70. Thereafter, Yc volumes remain relatively stable for the remaining 230 years of the planning horizon. YC has a long-term persistence within the productive forest land base despite lower overall representation.

Old cedar (i.e., stands greater than 250 years old) holds significant cultural value for First Nations. Figure 15 illustrates the total standing volume of Cw and Yc exceeding 250 years of age within the productive forest. At present, the combined volume of old cedar is estimated at 4.3 million m³. A short-term decline in old cedar volume occurs early in the planning horizon, reflecting harvest activity within existing mature and old seral stands. Following the transition away from harvesting older mature and old stands at Year 15 (Figure 5), old cedar volume increases rapidly, reaching approximately 5.8 million m³ by Year 25, an increase of 33.7% relative to current levels. This early increase is largely attributable to the aging of existing older mature cedar stands (220 to 250 years old) that are already present on the land base. After this peak, total old cedar volume gradually declines over an extended period of approximately 150 years, stabilizing at or near 5.0 million m³. This long-term decline is driven primarily by natural disturbances affecting the NCLB, as harvesting within old-seral stands remains minimal throughout this period (Figure 5). From approximately Year 180 onward, old cedar volume begins to increase steadily as currently reserved early- to mid-seral stands transition into the old seral age class. By the end of the planning horizon, the productive forest is projected to contain more than 10.8 million m³ of cedar older than 250 years, representing nearly a 1.5-fold increase compared to current old cedar volumes.

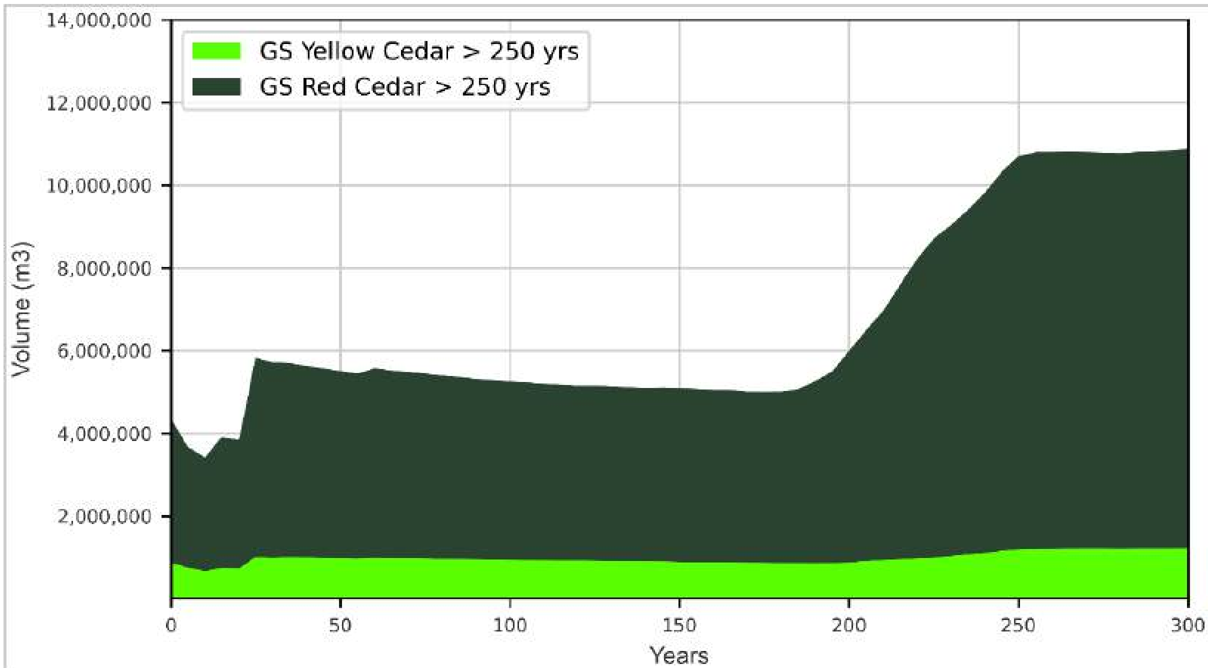


Figure 15 Base Case Old Cedar Inventory in Productive Forests

2.5 Landscape Level Biodiversity

The NSOG Order applies to landscape units (LUs) that lack legally established OGMAs. Within TFL 6, this applies to LUs designated under the Low Biodiversity Emphasis Option (BEO), including Holberg, Keogh, Mahatta, and Neroutsos LUs. For these LUs, the old seral target is modelled to be reduced to one-third of the full target during the first rotation (80 years). By the end of the second rotation (160 years), the target is set at two-thirds of the full target, with the full old seral target achieved by the end of the third rotation (240 years).

An exception applies within the CWHvm1 portion of the Keogh LU located in General Management Zone (GMZ) 7 (Marble). In this area, two-thirds of the full old seral target is required during the first and second rotations, with the full target achieved by the end of the third rotation. This requirement is mandated under VILUP Objective 10 and has been incorporated into the modelling assumptions.

The TFL 6 boundary also overlaps a small portion of the Lower Nimpkish LU, which is designated under a Low BEO. However, as Lower Nimpkish already contains legally established OGMAs that are sufficient to meet the full old seral targets independently of TFL 6 contributions, no additional old-seral requirements are applied to this LU within the current modelling exercise.

Figure 16 illustrates the projected old seral proportions for the Holberg LU over the 300-year planning horizon under the Base Case scenario. Solid lines represent projected old seral proportions by BEC variants, while dashed lines indicate the corresponding drawdown targets. Although initial short-term deficits are observed due to past harvest history, full old-seral targets for the CWHvh1, CWHvm2, and MHmm1 variants are achieved by Year 25. The CWHvm1 variant meets the two-thirds drawdown target by Year 25 and achieves full target by Year 160.

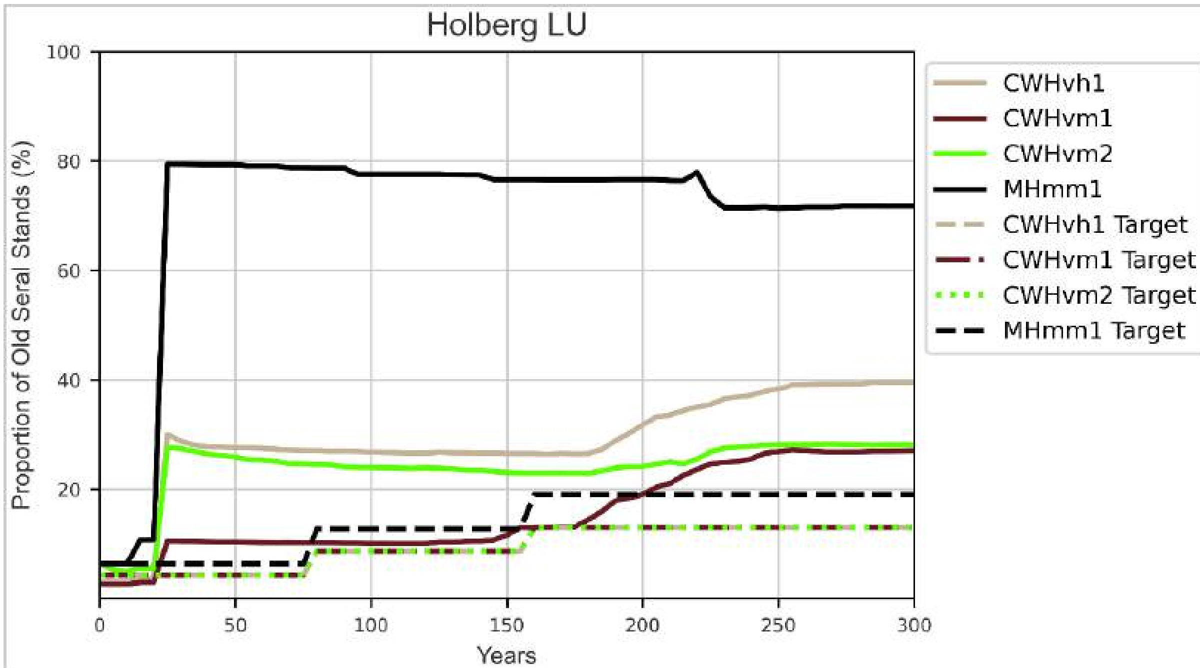


Figure 16 Projection of Old Seral Forest Proportions for Holberg LU

Figure 17 presents the projected old seral proportions for Keogh LU over the 300-year planning horizon. The CWHvm2 and MHmm1 variants meet their full old seral targets at the outset of the modelling and remain compliant throughout the 300-year projection period

Within the CWHvm1 variant located in GMZ 7 (Marble), old seral proportions increase gradually over time, reflecting historical harvesting activities. Full target achievement is projected by approximately Year 190. For CWHvm1 in the remaining zones, old seral proportions experience a minor decline by Year 5. However, all drawdown targets are consistently met. Significant increases in old seral area are observed at approximately Years 25 and 60, with full target attainment achieved by Year 160.

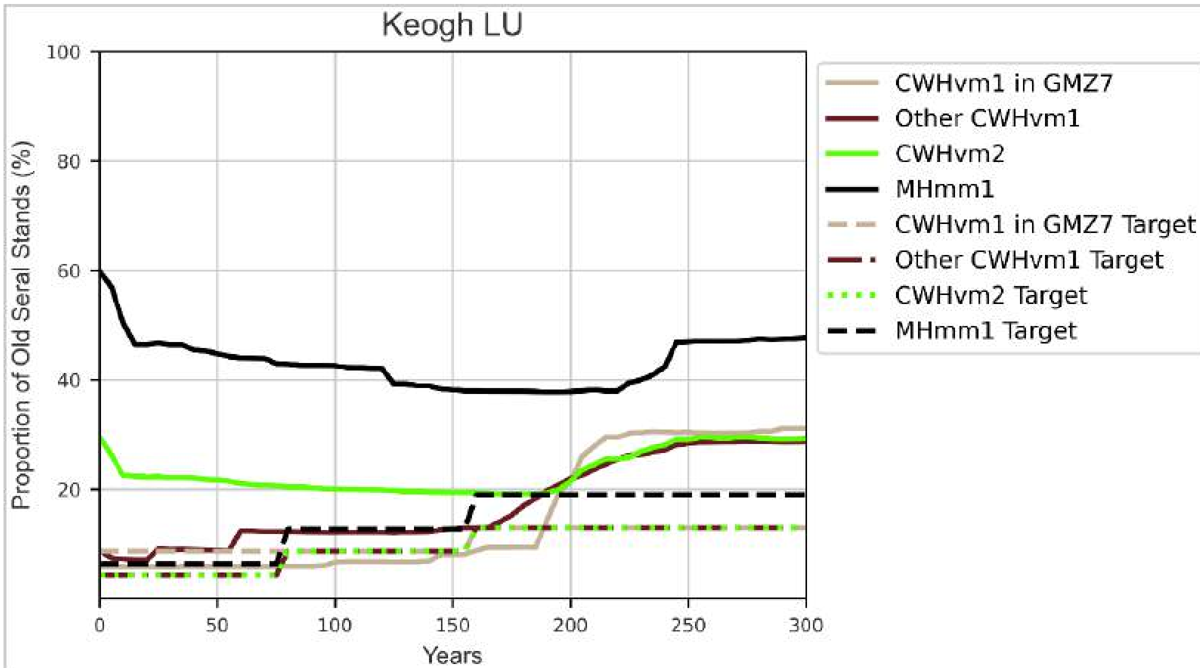


Figure 17 Projection of Old Seral Forest Proportions for Keogh LU

Figure 18 illustrates the projected old seral proportions for the Mahatta LU over the 300-year planning horizon. All four BEC variants meet their full old seral targets at the outset of the projection and remain compliant throughout the planning horizon.

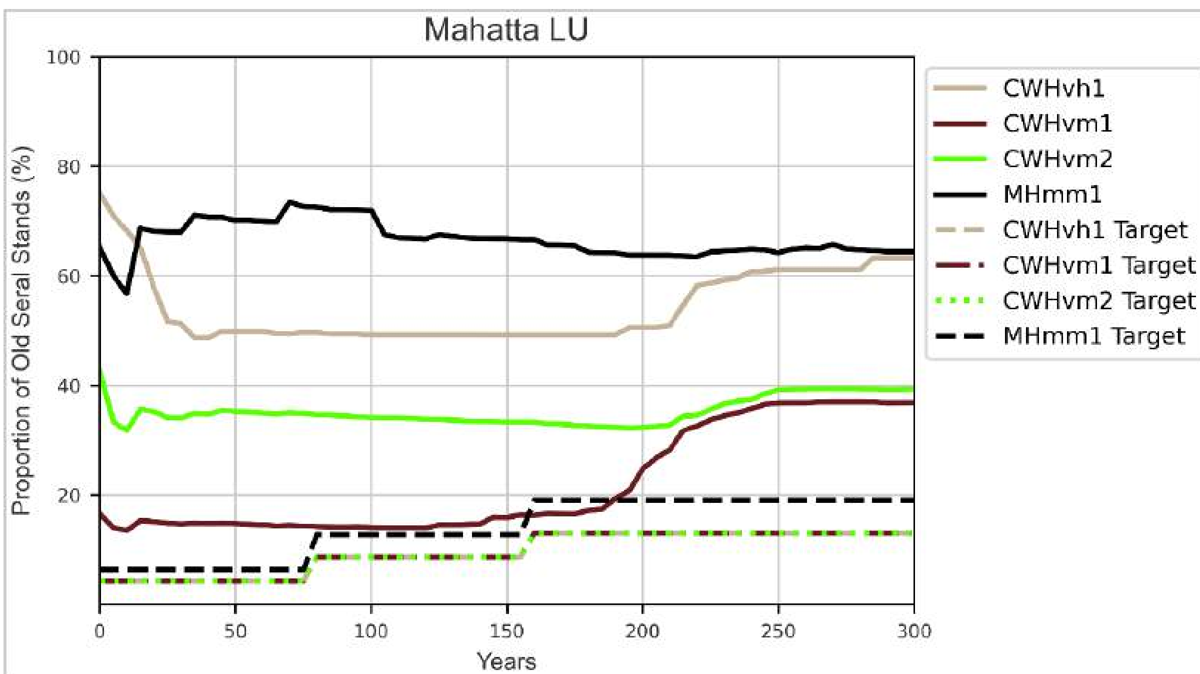


Figure 18 Projection of Old Seral Forest Proportions for Mahatta LU

A similar pattern is observed in the Neroutsos LU (Figure 19), where all three BEC variants also meet their full old seral targets immediately and maintain compliance over the duration of the projection.

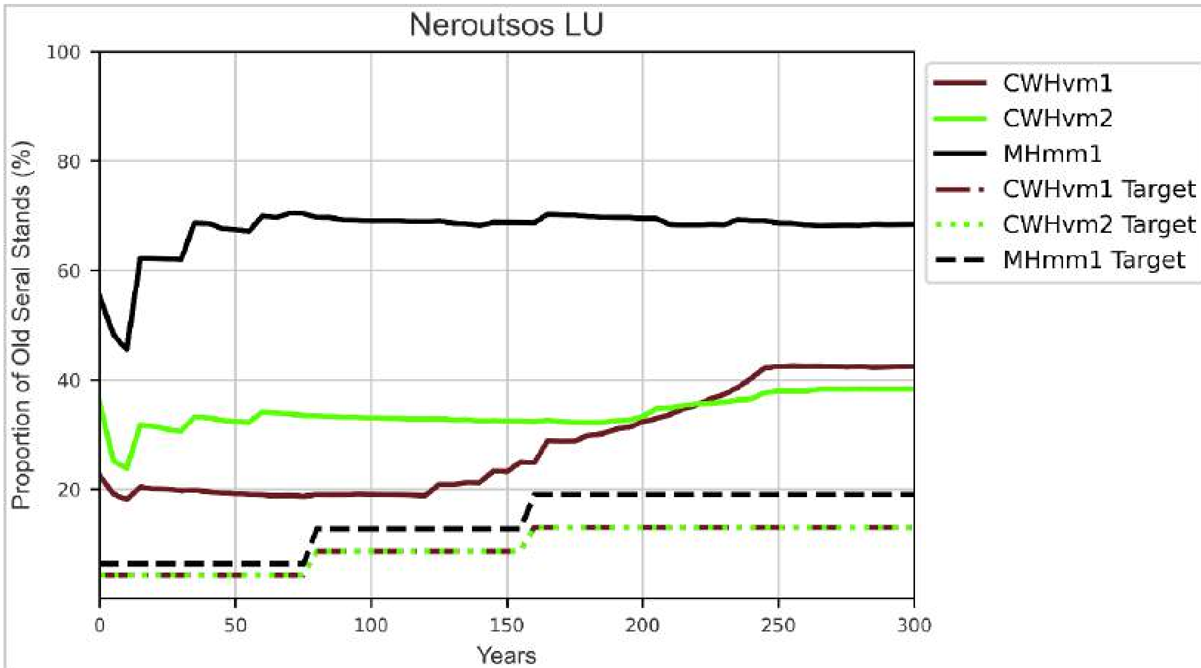


Figure 19 Projection of Old Seral Forest Proportions for Neroutsos LU

2.6 Timber Supply Impacts

In summary, Figure 20 presents the influence of key changes since MP #10 and the selection of harvest flow patterns on the AAC. The analysis shows a transition from the MP #10 AAC determination of 1,362,000 m^3/year to the MP #11 Base Case harvest level of 1,061,600 m^3/year for the upcoming 10-year timber supply period. The current AAC is first reduced by 95,400 m^3/year (7%) to account for the forecast decline identified in MP #10, resulting in a level of 1,266,600 m^3/year. A further decrease of 118,900 m^3/year (9.4%) reflects updated THLB and revised modelling assumptions in MP #11 under the step-down harvest flow pattern applied in MP #10 (as described in Section 3.2 below), resulting in a level of 1,147,700 m^3/year. Finally, transitioning to an even-flow harvest flow pattern reduces the harvest by an additional 86,100 m^3/year (7.5%), resulting in the MP #11 Base Case harvest level of 1,061,600 m^3/year. Compared to the current AAC, this represents a 22.1% reduction. However, accounting for the scheduled 7% decline identified in MP #10, the MP #11 Base Case represents a 16.2% reduction relative to the adjusted benchmark.

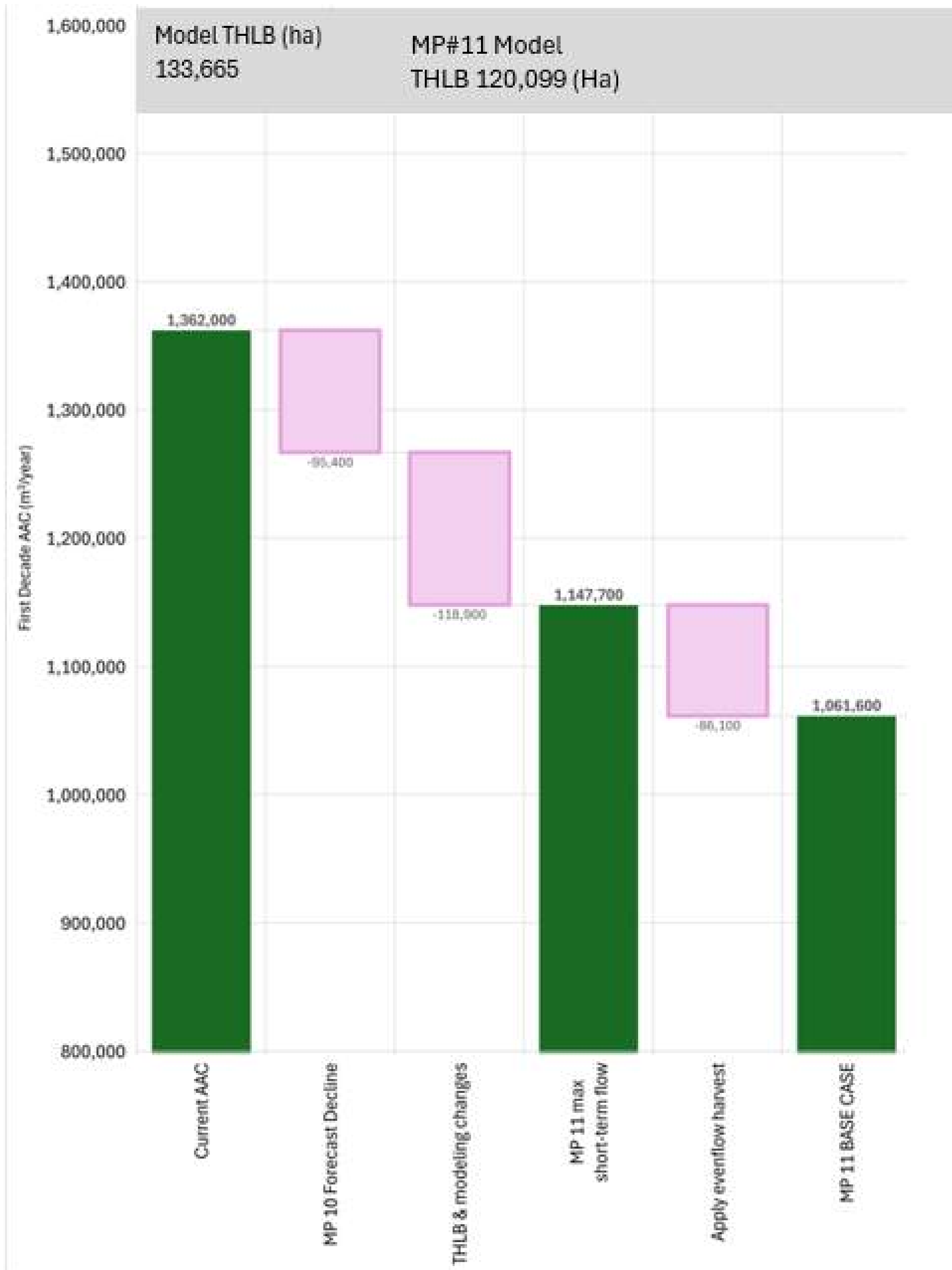


Figure 20 Timber Supply Impacts since MP #10 to Base Case

3 Alternate Harvest Flows

This section examines two alternate flow scenarios:

- Maintain current AAC for 10 years
- Maximum short-term harvest

Similar to the Base Case harvest level reported in Section 2.3, harvest volumes for these two alternate harvest flows are rounded down to the nearest 100 and are net of the non-recoverable losses of 1.5% per year. The harvest levels are modelled using 5-year intervals over a 300-year planning horizon.

3.1 Maintain Current AAC for 10 Years

Table 13 and Figure 21 illustrate the projected outcomes of maintaining the current AAC for an additional 10 years. Extending the current AAC produces a short-term increase in timber harvest, followed by a significant mid-term decline in timber supply. During the first decade, harvest volumes are substantially higher than the Base Case, with an estimated additional 3.0 million m³ harvested to sustain existing AAC levels. However, this short-term gain is more than offset in the mid term, as reduced timber availability results in harvest levels well below the Base Case for several decades. Over the subsequent 55 years, cumulative harvest is approximately 5.8 million m³ lower than the Base Case. Although harvest volumes gradually recover and eventually converge with the Base Case in the long term, the long-term harvest levels remain slightly reduced. Over the full 300-year projection period, this scenario yields 4.3 million m³ (–1.3%) less total harvested volume compared to the Base Case.

Table 13 Harvest Levels Maintaining Current AAC

Period (# of 5-year Intervals)	Year	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
				MP #11 Base Case	Maintaining AAC for 10 Yrs	Difference	
1-2	5-10	2024	2033	1,061,600	1,361,600	300,000	28.3
3	15	2034	2038	1,061,600	881,700	-180,000	-17.0
4	20	2039	2043	1,061,600	820,300	-241,300	-22.7
5	25	2044	2048	1,061,600	902,300	-159,300	-15.0
6	30	2049	2053	1,061,600	943,500	-118,200	-11.1
7	35	2054	2058	1,061,600	960,300	-101,400	-9.5

Period (# of 5-year Intervals)	Year	Start Year	End Year	Annual Harvest Volume (m³)			% Difference
				MP #11 Base Case	Maintaining AAC for 10 Yrs	Difference	
8	40	2059	2063	1,061,600	967,100	-94,600	-8.9
9	45	2064	2068	1,061,600	978,500	-83,200	-7.8
10	50	2069	2073	1,061,600	992,700	-69,000	-6.5
11	55	2074	2078	1,061,600	1,007,400	-54,300	-5.1
12	60	2079	2083	1,061,600	1,021,200	-40,500	-3.8
13	65	2084	2088	1,061,600	1,045,800	-15,900	-1.5
14-60	70-300	2089	2323	1,061,600	1,055,200	-6,400	-0.6

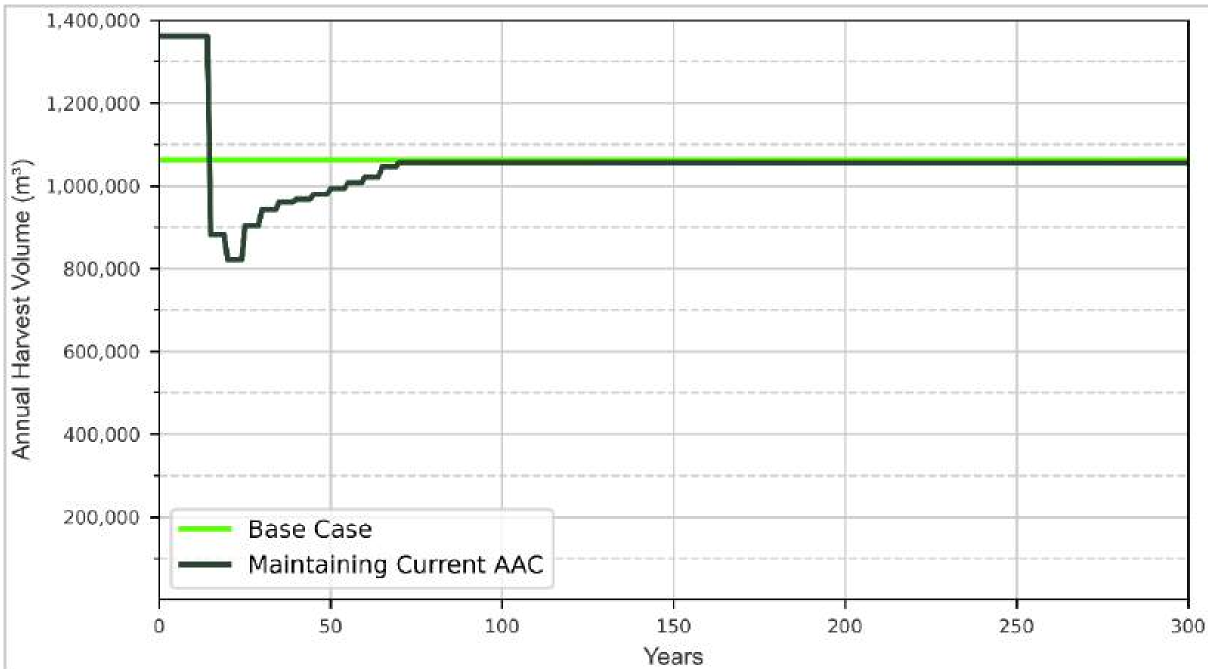


Figure 21 Harvest Levels Maintaining Current AAC

3.2 Maximize Short-Term Harvest

Table 14 and Figure 22 compare the MP #11 Base Case with an alternative harvest flow designed to maximize short-term harvest while constraining mid-term impacts. This alternative harvest flow aims to increase short-term harvest levels while limiting mid-term reductions to no more than 2% relative to the Base Case and allowing harvest level declines of up to 10% per decade.

Under this scenario, harvest levels increase in the first decade, with the annual harvest rising to 1,147,700 m³/year, an increase of 86,100 m³/year (+8.1%) compared to the Base Case. In the mid term (Periods 3–12; 2029–2083), harvest levels decline to 1,043,400 m³/year, representing a 1.7% reduction relative to the Base Case and remaining within the target constraint of a maximum 2% mid-term impact. In the long term, harvest levels recover and exceed the Base Case by 33,900 m^3/year (+3.2%).

Overall, this scenario demonstrates that meaningful short-term harvest gains can be achieved through a controlled and limited mid-term reduction while maintaining long-term sustainability objectives. Over the 300-year planning horizon, cumulative harvest volume under this scenario is 8.1 million m^3 (2.5%) higher than in the Base Case. The increase in long-term harvest level is partly influenced by the fact that the Base Case does not attempt to increase harvest levels beyond the minimum point of timber supply, which defines the even flow harvest level.

Table 14 Harvest Levels Maximizing Short-Term Harvest

Period (# of 5-year Intervals)	Year	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
				MP #11 Base Case	Maximize Short-Term	Difference	
1-2	5-10	2024	2033	1,061,600	1,147,700	86,100	8.1
3-12	10-60	2029	2083	1,061,600	1,043,400	-18,300	-1.7
13-60	65-300	2084	2323	1,061,600	1,095,500	33,900	3.2

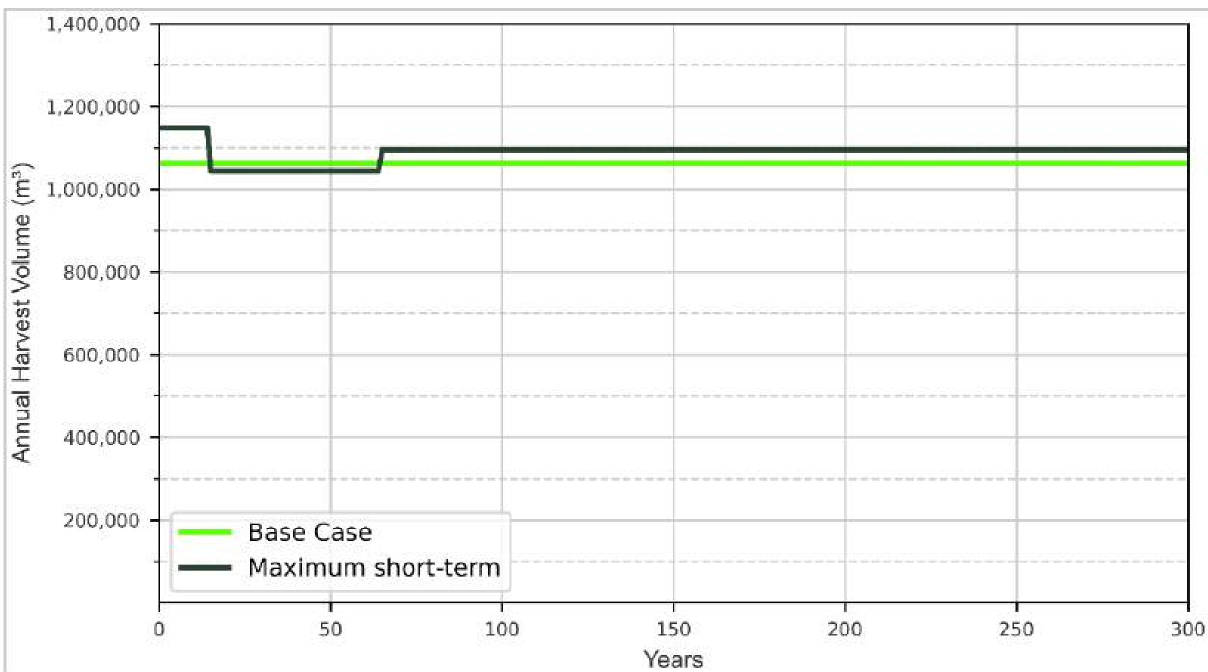


Figure 22 Harvest Levels Maximizing Short-Term Harvest

4 Sensitivity Analyses

Sensitivity analyses were conducted on the Base Case to evaluate the potential impacts of uncertainties associated with their underlying assumptions. By developing and testing a range of sensitivities, it is possible to identify the variables that most significantly influence the results of the timber supply analysis. This information informs management decision-making under conditions of uncertainty. As Patchworks was used as the simulation and optimization tool to generate the Base Case, the model outputs are expected to be responsive to changes in input assumptions.

To ensure meaningful and consistent comparisons, each sensitivity analysis only adjusted the assumption(s) under evaluation, while all other inputs and modelling parameters were held constant relative to the Base Case.

The sensitivity issues examined are summarized in Table 15. This list has been updated since the publication of the associated IP to incorporate additional factors that emerged during the modelling process, as well as feedback received through the IP review and consultation. The timber supply impacts of these sensitivity scenarios are presented in Sections 4.1 through 0. Consistent with the Base Case harvest level reported in Section2.3, harvest volumes for these sensitivity scenarios are rounded down to the nearest 100 m^3 and are reported net of non-recoverable losses of 1.5% per year. All periods are conducted using five-year modelling intervals.

The Base Case employs an even-flow harvest pattern, in which harvest levels are maintained at a constant rate over time, determined by the lowest annual harvest level in the 300-year planning horizon. Consequently, the apparent long-term impacts observed in some sensitivity analyses may be partially overstated due to this modelling choice. Specifically, harvest levels in these scenarios are constrained to remain at the lowest even-flow level and are not permitted to increase in subsequent periods. In practice, if harvest levels were allowed to rise following the lowest point as timber availability improves, these sensitivity analyses would be expected to recover toward, and potentially converge with, the Base Case harvest level over the long term. As demonstrated in Section 3.2, allowing greater flexibility in harvest flow can support higher long-term harvest levels than the even-flow level, without compromising long-term sustainability objectives.

Table 15 Current Management Sensitivity Analyses

Issue Tested	Sensitivity Analysis Description	Section
Growth and Yield	Increase natural stand yields by 10%	4.1
	Decrease natural stand yields by 10%	4.2
	Increase managed stand yields by 10%	0
	Decrease managed stand yields by 10%	4.4
Forest Inventory	Use LiDAR-based individual tree inventory (ITI) volumes for natural stands	4.5
	Use ITI volumes for natural stands, LiDAR-derived height and site index value for early managed stands	4.6
	Use ITI volumes for natural stands, LiDAR-derived height and site index value for early managed stands, and apply OAF1 of 10% for all managed stands	4.7
Forest Management / Silviculture	Exclude genetic gain adjustments	4.8
Biodiversity	Retain old seral forests to full targets in NSOG Order	4.9
Minimum Harvest Criteria	Add 10 years to the minimum harvest ages	4.10
	Subtract 10 years from the minimum harvest ages	4.11
Operability	Exclude helicopter operable land base	4.12
THLB	Increase THLB within all polygons by 10%	4.13
	Decrease THLB within all polygons by 10%	0

4.1 Increase Natural Stand Yields by 10%

The sensitivity of timber supply to volume estimates in existing natural stands (older than 62 years) was evaluated by increasing (this section) and decreasing (Section 4.2) these volumes by 10%. The volumes for these stands are derived from the forest inventory attributes and assumptions described in Section 8 of the associated IP document, using the FOR's Variable Density Yield Projection (VDYP) version 7.33b.

Increasing natural stand yields by 10% results in approximately 2.05 million m^3 (5.8%) more inventory on the THLB at the beginning of the analysis period, relative to the Base Case. Of this additional volume, more than 2.2 million m^3 (11.4%) is merchantable immediately (i.e., meets minimum harvest criteria).

Figure 23 and Table 16 summarize and compare the modelling results for this sensitivity analysis against the Base Case. The increase in natural stand yields leads to a 13,700 m^3/year (1.3%) higher harvest level than the Base Case. Over the full 300-year planning horizon, cumulative harvest volume is approximately 4.1 million m^3 (1.3%) greater than the Base Case.

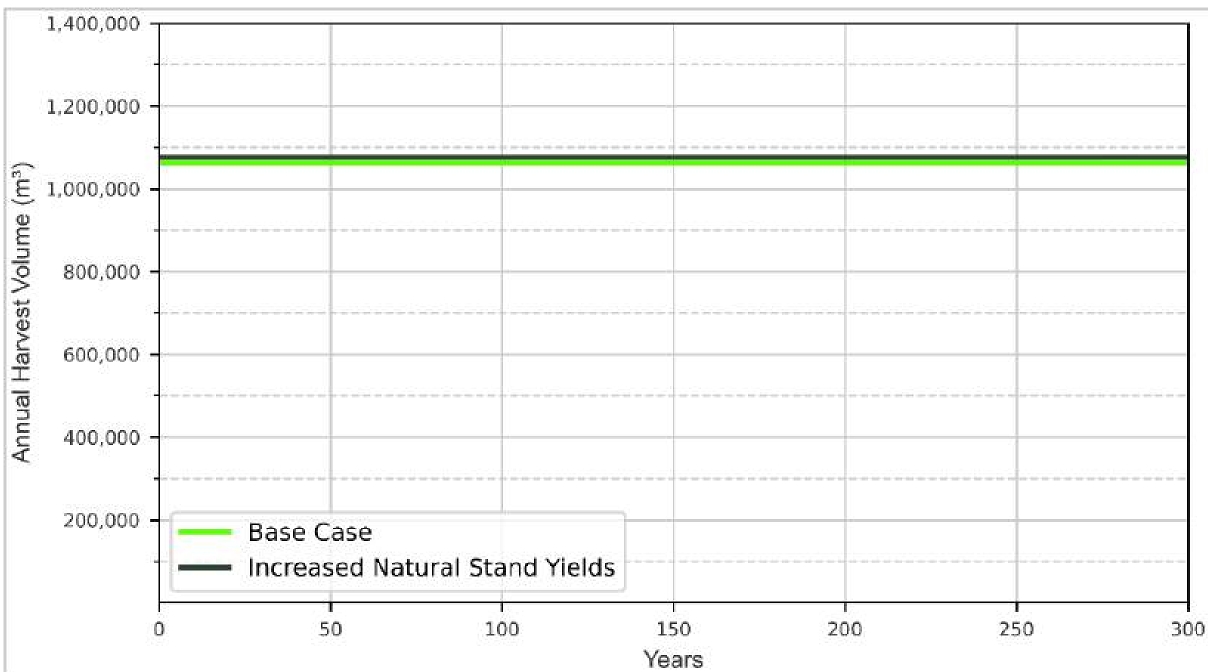


Figure 23 Harvest Levels with Increased Natural Stand Yields

Table 16 Harvest Levels with Increased Natural Stand Yields

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Increased Natural Yields	Difference	
1 to 60	2024	2323	1,061,600	1,075,300	13,700	1.3

4.2 Decrease Natural Stand Yields by 10%

Reducing natural stand yields by 10% results in approximately 2.0 million m³ (5.8%) less inventory on the THLB today compared to the Base Case at the beginning of the analysis period. This reduction in available growing stock directly affects the volume of harvestable timber available over the planning horizon.

Figure 24 and Table 17 compare the outcomes of this sensitivity analysis with the Base Case. Under this scenario, the resulting even-flow harvest level is 25,000 m^3 (2.4%) lower than the Base Case. Over the 300-year planning horizon, cumulative harvest volume is approximately 7.5 million m³ (2.4%) lower than the Base Case

Consistent with the discussion above regarding even-flow harvest pattern choice, the long-term differences shown here may somewhat overstate the sustained impact. In practice, some recovery toward Base Case harvest levels could be expected over time.

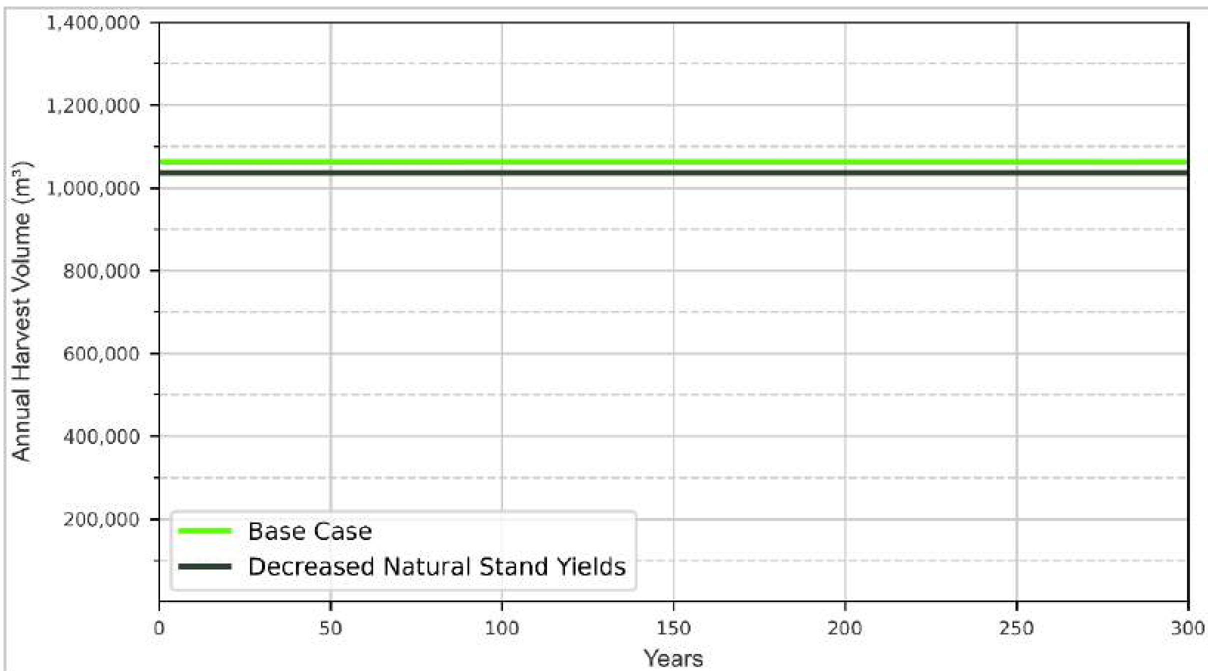


Figure 24 Harvest Levels with Decreased Natural Stand Yields

Table 17 Harvest Levels with Decreased Natural Stand Yields

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Decreased Natural Yields	Difference	
1 to 60	2024	2323	1,061,600	1,036,600	-25,000	-2.4

4.3 Increase Managed Stand Yields by 10%

The sensitivity of timber supply to volume estimates in managed stands (less than 62 years of age) was evaluated by increasing (this section) and decreasing (Section 4.4) these volumes by 10%. Volumes in managed stands are estimated using forest inventory attributes and assumptions described in Section 8 of the associated IP document, using the FOR's Table Interpolation Program for Stand Yields (TIPSY) version 4.6.

Increasing managed stand yields by 10% results in an increase of approximately 1.5 million m^3 (4.2%) in the initial THLB inventory relative to the Base Case. This additional volume primarily reflects higher projected yields from younger managed stands over the planning horizon. Figure 25 and Table 18 compare the outcomes of this sensitivity analysis with the Base Case. The resulting harvest schedule indicates an even-flow harvest level approximately 77,200 m^3/year (7.3%) higher than the Base Case. Over the entire 300-year planning horizon, cumulative harvest under this scenario is approximately 23.2 million m^3 (7.3%) greater than the Base Case.

Consistent with the discussion above regarding even-flow harvest assumptions, the long-term response shown here may somewhat understate the full effect of the yield increase. In practice, allowing harvest levels to surpass the lowest harvest volume would likely result in a greater long-term increase, more closely reflecting the magnitude of the assumed yield change.

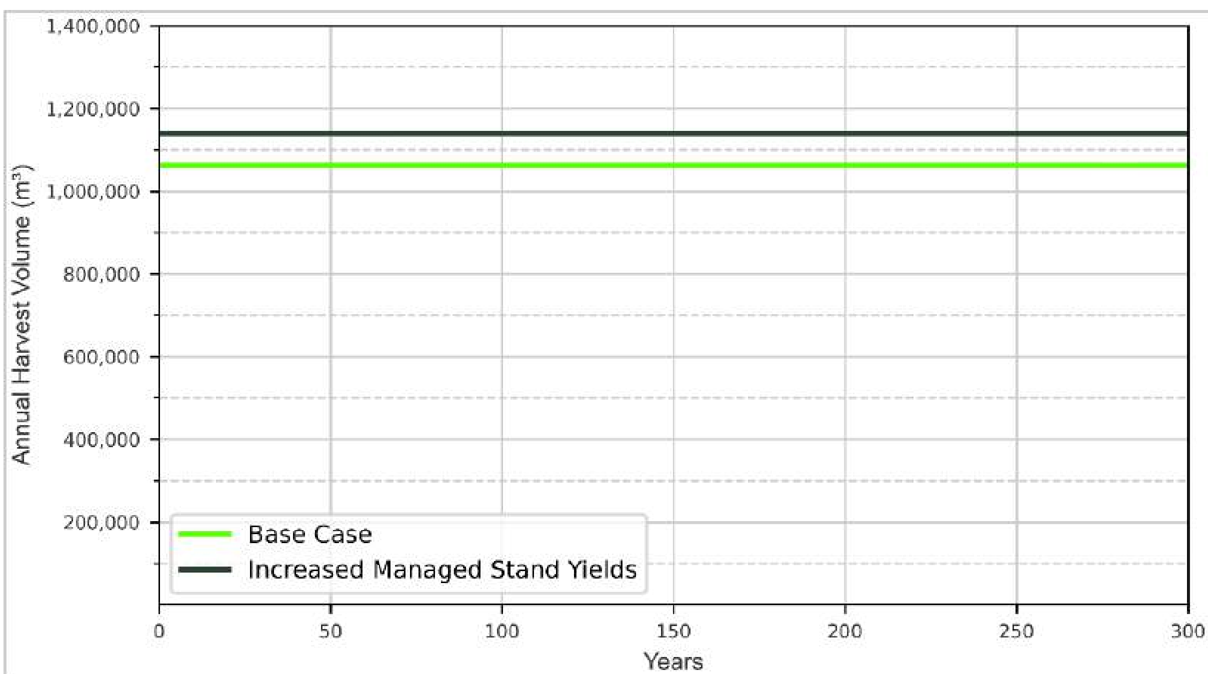


Figure 25 Harvest Levels with Increased Managed Stand Yields

Table 18 Harvest Levels with Increased Managed Stand Yields

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Increased Managed Yields	Difference	
1 to 60	2024	2323	1,061,600	1,138,900	77,200	7.3

4.4 Decrease Managed Stand Yields by 10%

To assess the sensitivity of timber supply to uncertainty in managed stand yield assumptions, managed stand yields (stands less than 62 years of age) were reduced by 10% relative to the Base Case. Reducing managed stand yields by 10% results in a decrease of approximately 1.5 million m³ (4.2%) in the initial THLB inventory compared to the Base Case. The resulting harvest schedule, shown in Figure 26 and Table 19, indicates a 90,700 m^3 (8.5%) reduction in harvest levels relative to the Base Case. Over the full 300-year planning horizon, cumulative harvest volume is approximately 27.2 million m³ (8.5%) lower than the Base Case.

Overall, the two sensitivity scenarios demonstrate that timber supply is notably more responsive to changes in managed stand yield assumptions than to comparable changes in natural stand yields. Relative to equivalent percentage reductions in natural stand productivity, decreases in managed stand yields result in larger proportional reductions in both annual and cumulative harvest levels, particularly as the forests in THLB transition toward second-growth stands.

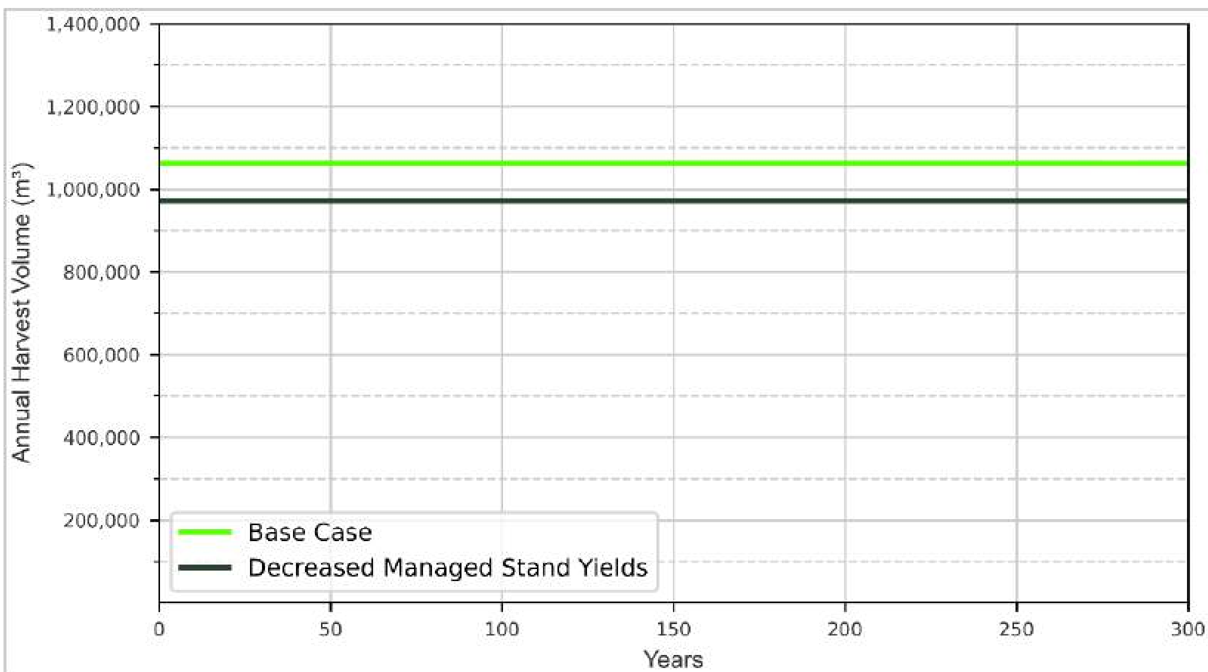


Figure 26 Harvest Levels with Decreased Managed Stand Yields

Table 19 Harvest Levels with Decreased Managed Stand Yields

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Decreased Managed Yields	Difference	
1 to 60	2024	2323	1,061,600	970,900	-90,700	-8.5

4.5 Use LiDAR-based Individual Tree Inventory (ITI) Volumes for Natural Stands

Western acquired LiDAR data for TFL 6 in multiple phases: initially as part of a pilot project in early 2012, followed by subsequent acquisitions in 2016 and 2021–2022. Building on these datasets, Western has undertaken extensive research and development in LiDAR-based forest inventory, resulting in the development of an individual tree inventory (ITI). Additional details are provided in Section 5.2.4 of the associated the IP.

To address systemic underestimation of understory forest volume associated with LiDAR-derived inventories (Sparks & Smith, 2022), Western proposed an adjustment factor to correct ITI volume estimates. In collaboration with FAIB, Western implemented a field sampling and volume validation program across TFL 6 and selected TFLs (TFL 37, TFL 44 and TFL 64) on Vancouver Island. This program evaluated adjusted ITI-derived volumes against field-measured volumes across both the THLB and NCLB areas.

Validation studies for TFL 37, TFL 44, and TFL 64 (Mortyn, 2024b) (Mortyn, 2024c) (Mortyn, 2024d) were submitted to FAIB for review in 2024. A preliminary validation study for TFL 6 (Mortyn, 2024a) was also submitted, and later updated (Mortyn, 2025). At the time of the IP development and submission, however, the full field validation program for TFL 6 had not yet been completed. The preliminary study was nonetheless provided as supporting information in the IP, given that validation results from the other TFLs demonstrated consistent and comparable outcomes.

On December 4, 2024, the Deputy Chief Forester of BC accepted ITI as the most accurate estimate of stand volume for TFL 37, 44 and 64. For TFL 6, the Deputy Chief Forester directed that a dedicated field validation program be completed prior to acceptance. The relevant correspondence is provided in Appendix A: Deputy Chief Forester's Letter of December 4, 2024 regarding TFL 6 ITI Validation.

A field sampling program for TFL 6 was subsequently completed during the 2025 field season. The resulting analysis demonstrated that adjusted ITI volumes produce stand-level volume estimates that are both more accurate and more precise than estimates based on forest cover inventory. The full validation report is included in Appendix B: Tree Farm Licence 6 LiDAR Forest Inventory Validation Report.

In November 2025, FAIB reviewed the results of the TFL 6 ITI validation and concluded that the adjusted ITI volumes provide an improvement in volume estimation relative to the existing forest inventory for TFL 6. The complete review is included in Appendix C: FOR's Review of Western's TFL 6 LiDAR Forest Inventory Validation Report.

In light of these developments and the recognizing the evolving role of LiDAR -derived inventories in timber supply analyses, a series of sensitivity analyses incorporating adjusted ITI volumes for natural stands were completed. The results of these analyses are presented in Sections 4.5.2, 4.6 and 4.7.

4.5.1 Natural Stands Yield Table Adjustment

These sensitivity analyses adjust the natural yield tables used in the Base Case to volumes derived from adjusted ITI. Stands older than 62 years of age (i.e., established prior to 1961) are classified as natural stands and are assumed to have regenerated naturally following harvesting or natural disturbance events.

In the Base Case, stand volume for these stands is projected using VDYP version 7.33b, based on forest cover inventory attributes associated with each polygon within the productive forest land base. For the sensitivity analyses, the VDYP-derived volume for 2016 is adjusted to align with the adjusted ITI merchantable volume for each polygon. The adjustment process involves aggregating merchantable volumes from individual ITI tree points to their corresponding forest cover polygons and dividing the total volume by the polygon area to derive volumes in cubic metres per hectare (m^3/ha). A correction function is then applied to the ITI volume to account for identified under-estimation.

The ITI volume adjustment for TFL 6 (Mortyn, 2025) is as follows:

$$Iadj = I + 1.0545A$$

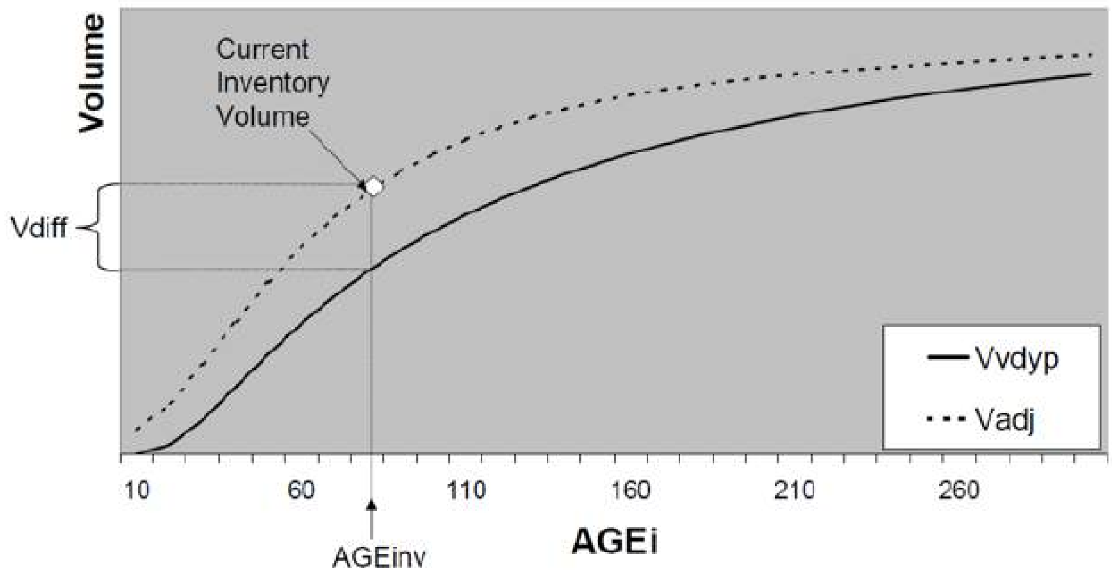
Where:

Iadj = Adjusted ITI net merchantable volume (m^3/ha)

I = ITI net merchantable volume (m^3/ha)

A = Projected age in 2016 from Western’s forest cover inventory, which was the acquisition year of the LiDAR used to derive the ITI

Following this adjustment, VDYP growth and yield curves are updated to pass through the corresponding adjusted ITI volume–age point using the method described by Pienaar and Rheney (Pienaar & Rheney, 1995). This approach has also been applied in previous timber supply analyses, including TFL 37 MP #9 (Canadian Forest Products Ltd., 2004) and TFL 44 MP #6 (Tsawak-qin Forestry Limited Partnership, 2023). Figure 27 provides a conceptual illustration of yield curve adjustment using this methodology. This curve-fitting approach is preferred over the application of a uniform multiplier, as it preserves the underlying growth trajectory represented by the original VDYP curves while ensuring consistency with observed inventory conditions at the adjustment point. By maintaining convergence toward the unadjusted curve on either side of the reference point, this method reduces the potential for systematic bias. In other words, this approach reduces the risk of overestimation of future volumes in younger stands (which primarily affects mid- and long-term timber supply projections) and in older stands (which has greater implications for short-term harvest levels).



$V_{ADJi} = V_{VDYPi} + V_{DIFF} * A_1 * A_2$

$A_1 = Age_i / Age_{inv}$

$A_2 = e/e\text{\^{}}(Age_i / Age_{inv})$

Where:

V_{ADJi} is the adjusted volume at any age i on the yield curve;

V_{VDYPi} is the unadjusted volume from the VDYP yield curve at any age i;

V_{DIFF} is the difference between the inventory volume and the VDYP yield curve at inventory age, Age_{inv};

Age_{inv} is the inventory age of the polygon, and the age at which V_{DIFF} is measured;

Age_i is the x-axis of the yield curve; and

e is the base of the natural logarithm, with a numerical value of 2.71828.

Figure 27 A Generic Yield Curve Adjustment (Pienaar & Rheney, 1995)

Figure 28 illustrates additional examples of applying this adjustment method to modify VDYP yield curves. The four panels demonstrate different relationships between known adjusted ITI volumes and VDYP estimates across seral stages:

1. Top left: Known adjusted ITI volume exceeds VDYP yield for a stand older than approximately 330 years of age (old seral).

2. Top right: Known adjusted ITI volume is higher than VDYP yield for a stand around 60 years of age (mid seral).

3. Lower left: Known adjusted ITI volume is lower than VDYP yield for a stand near 100 years of age (mature seral).

4. Lower right: Known adjusted ITI volume is substantially lower than VDYP yield for a stand around 230 years of age (old mature seral).

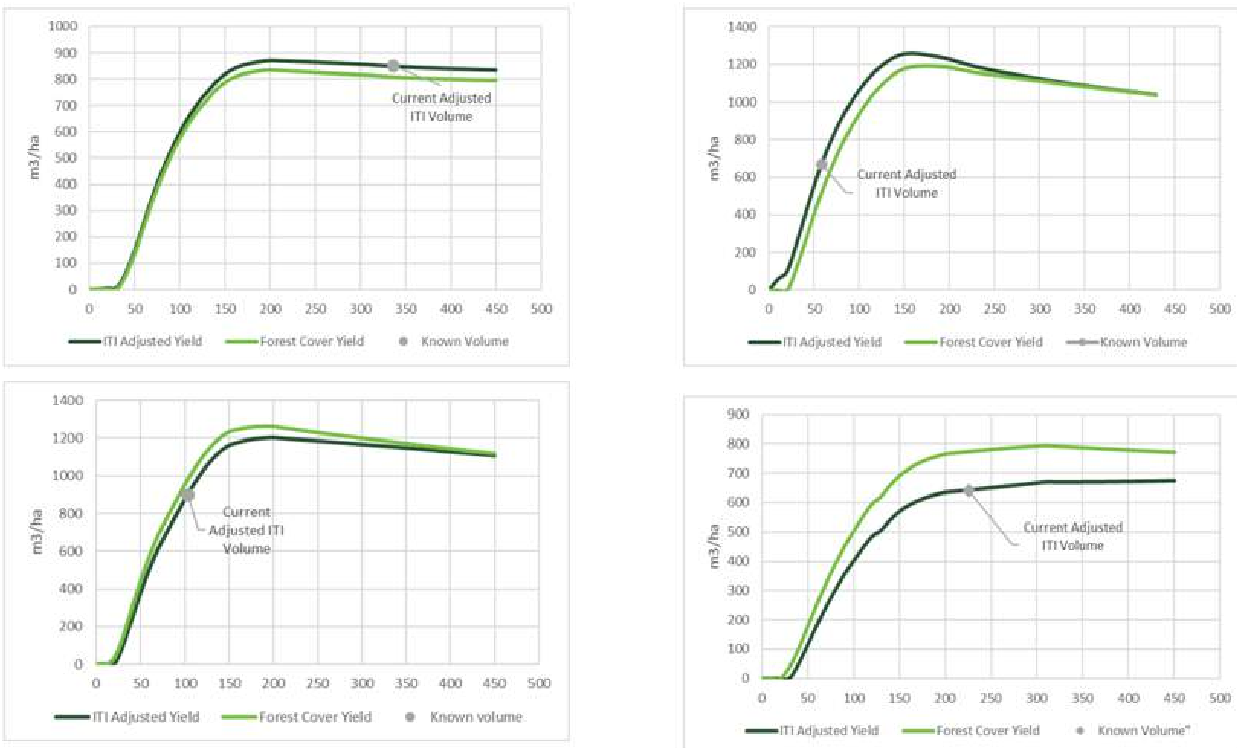


Figure 28 Examples of Implementing the Pienaar & Rheney Adjustment Formula for VDYP Yield Curves using Known Adjusted ITI Volume

4.5.2 Sensitivity Analysis Results

Using VDYP curves altered to pass through the adjusted ITI volumes for 2016 results in an increase of approximately 3.0 million m³ (8.5%) in the initial THLB inventory relative to the Base Case. This increase is primarily attributed to higher estimated volumes in stands older than 62 years, which represent a significant portion of the current THLB.

Figure 29 and Table 20 compare the outcomes of this sensitivity analysis with the Base Case. The additional THLB inventory supports a higher even-flow harvest level, increasing by approximately 17,400 m³/year (1.6%) to 1,079,000 m³/year. Over the 300-year planning horizon, cumulative harvest under this scenario is approximately 5.2 million m³ (1.6%) greater than the Base Case.

Although the increase in initial THLB inventory is relatively large, the corresponding long-term increase in harvest levels is modest. This reflects the gradual transition of the THLB from older natural stands to managed stands over time. As harvest activities proceed, an increasing proportion of stands are regenerated and subsequently projected using future managed stand yield curves (TIPSY), which are not subject to ITI and VDYP yield adjustments applied in this sensitivity. As a result, the influence of the adjusted ITI yields diminishes over the long term.

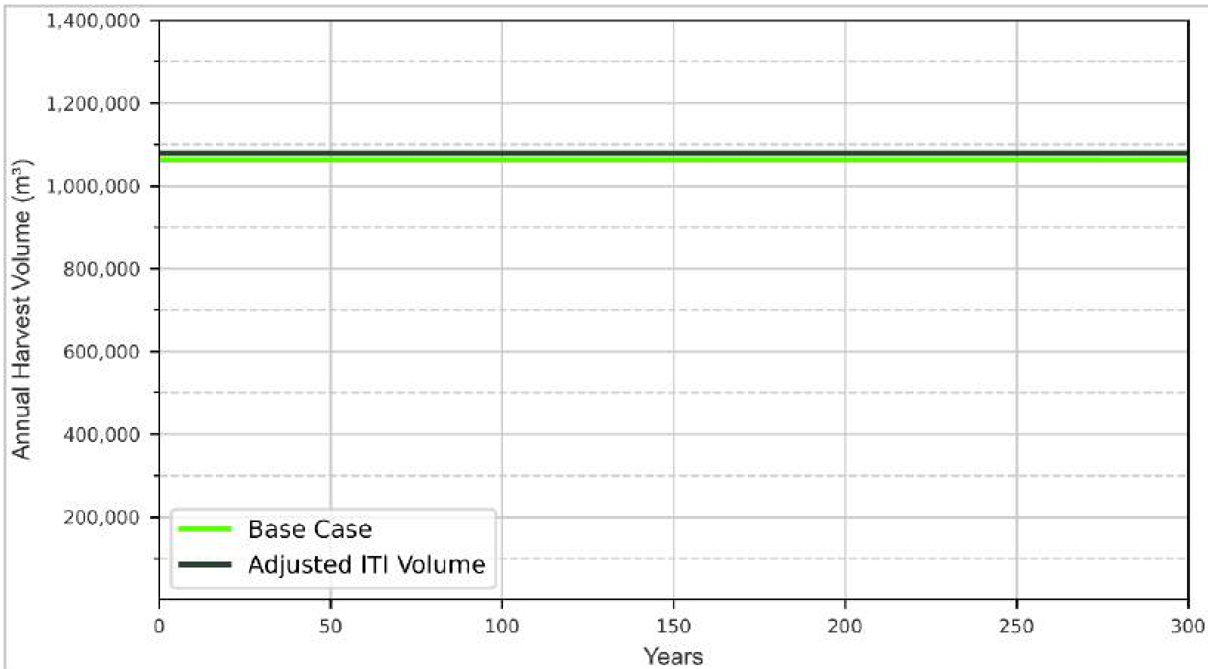


Figure 29 Harvest Levels with Adjusted ITI Stand Yields

Table 20 Harvest Levels with Adjusted ITI Stand Yields

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Adjusted ITI Yields	Difference	
1 to 60	2024	2323	1,061,600	1,079,000	17,400	1.6

4.6 Use ITI Volumes for Natural Stands, LiDAR-derived Height and Site Index Value for Early Managed Stands

This LiDAR Enhanced Forest Inventory (LEFI) height and site index sensitivity introduces a new set of yield tables for managed stands in the early managed (EM) era (stands established from 1961 to 2000; Age 23-62 years). These new yield tables were generated using TIPSY and differ from the Base Case only in the site index for the leading species. All other analysis unit attributes remain unchanged.

The LEFI height metric provides an appropriate representation of stand height, particularly for even-aged stands within larger polygons characteristic of the EM era. However, because the LEFI methodology captures only trees taller than 10 metres, stands younger than 23 years are not reliably represented. Therefore, younger stand yields remained unchanged from the Base Case for this sensitivity analysis.

The revised site index values were derived from the area-weighted averages of site index estimates produced by inputting the LEFI stand heights into Site Tools. LEFI heights were calculated as described in Section 5.2.2 of the associated IP document. Where available, each forest cover inventory polygon was assigned a LEFI-derived height, which, in combination with its corresponding age and species composition, was processed through Site Tools to generate updated site index estimates.

The resulting Site Tools outputs were then reviewed and filtered. For this sensitivity analysis, only site index values between 7 and 50 were retained, and the updated values were applied exclusively to polygons within the EM era. Table 21 presents a comparison of average LEFI-derived heights and site index values with those from the forest inventory for stands aged 30 to 59 years. Although this age range differs slightly from that used in applying the LEFI-based site indices, it provides an appropriate indication of the relative magnitude of differences between LEFI-derived and inventory-based site index estimates.

Table 21 Comparison of LEFI and Forest Inventory Site Index

Age Class (years)	Average Age (years)	Average LEFI Height (m)	Average Forest Inventory Height (m)	Average LEFI Site Index (m)	Average Forest Inventory Site Index (m)	SI Difference (m)	Total Area (ha)
30-39	34	17.86	17.21	27.8	26.1	1.7	22,139
40-49	45	22.88	22.21	27.2	25.4	1.8	22,552
50-59	54	27.09	25.45	27.5	25.5	2.0	16,930

Using VDYP curves altered to pass through the adjusted ITI volumes for 2016 for natural stands, together with LiDAR-based site index values for early managed stands, results in an increase of approximately 3.9 million m^3 (10.9%) in the initial THLB inventory relative to the Base Case. Incorporating LiDAR-derived site index values for early managed stands result in approximately 0.9 million m^3 more initial THLB inventory than the sensitivity in Section 4.5.2.

Figure 30 and Table 22 compare the outcomes of this sensitivity analysis with the Base Case. The combined effect of the adjusted ITI natural stand yields and improved site productivity estimates in early managed stands increases the even-flow harvest level by approximately 33,600 m^3/year (3.2%) to 1,095,200 m^3/year. Compared to the scenario described in Section 4.5.2, this represents an additional increase of 16,200 m^3/year attributable to the updated site index values for managed stands. Over the 300-year planning horizon, cumulative harvest under this scenario is approximately 10.1 million m^3 (3.2%) greater than the Base Case, or about 4.8 million m^3 (1.5%) higher than the previous sensitivity scenario.

Although the initial increase in THLB inventory is relatively substantial (10.9%), the long-term increase in harvest levels is more moderate (3.2%). This reflects the transition of both natural and early managed stands to future managed stands, which are not subject to the ITI adjustments or LiDAR-based site index values. The modest difference in long-term harvest levels relative to Section 4.5.2 should therefore be interpreted in the context of the even-flow harvest pattern choice. As discussed above, even-flow harvest levels are determined by the lowest annual harvest level in the 300-year timber supply projections and are not permitted to increase thereafter. The higher starting inventory in this scenario increases the lowest annual harvest level, which in turn sets a higher even-flow level. As a result, the model reports a higher long-term harvest level, even though future managed stand yields are unchanged.

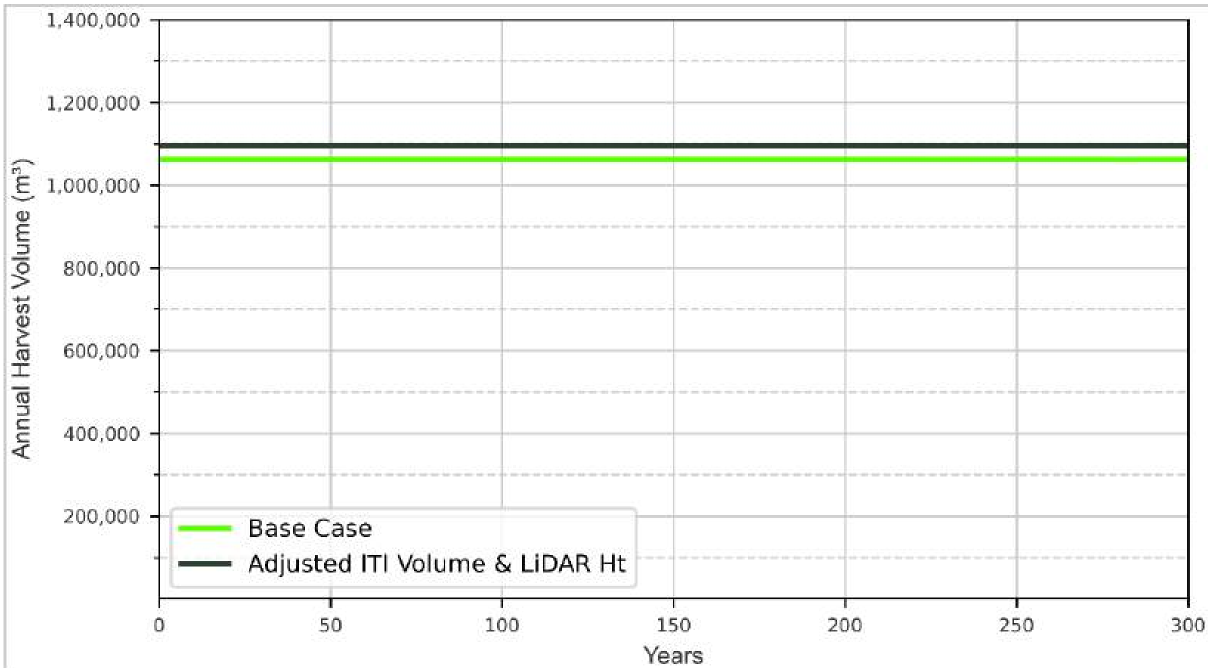


Figure 30 Harvest Levels with ITI adjusted volumes and LiDAR-derived Height and Site Index

Table 22 Harvest Levels with ITI adjusted volumes and LiDAR-derived Height and Site Index

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Adjusted ITI & LEFI SI Yields	Difference	
1 to 60	2024	2323	1,061,600	1,095,200	33,600	3.2

4.7 Use ITI Volumes for Natural Stands, LiDAR-derived Height and Site Index value for Early Managed Stands, and apply OAF1 of 10% for all Managed Stands

This sensitivity builds on the previous two sensitivities by utilizing an Operational Adjustment Factor 1 (OAF1) of 10% for managed stands yields, rather than the provincial default of 15%. Utilizing the default OAF1 of 15% does not recognize the detailed identification of non-productive and low-productivity areas derived from LiDAR data used in defining the Base Case THLB (see Sections 6.6 and 6.7 in the associated IP document). Applying both an area netdown and a yield reduction to account for the same factors would constitute double counting and is therefore inappropriate.

With the availability of LiDAR data for TFL 6, an analysis was undertaken to quantify gaps in crown cover as a proxy for non-productive areas within managed stands, which portions of OAF1 is intended to represent. The results indicate that the TIPSY default OAF1 of 15% may overestimate the extent of non-productive area when high-resolution LiDAR-derived datasets are used to define the land base. Where strong alignment exists between forest inventory polygons and LiDAR data, an OAF1 value of 10% appears more appropriate for TFL 6. A detailed description of this analysis is provided in Appendix D: LiDAR Review of OAF1 in Managed Stands.

Using VDYP curves altered to pass through the adjusted ITI volumes for 2016 for natural stands, together with LiDAR-based site index values for early managed stands and an OAF1 of 10% for all managed stands, results in an increase of approximately 4.9 million m^3 (13.9%) in the initial THLB inventory relative to the Base Case.

4.7.1 Non-Declining Even Flow

Figure 31 and Table 23 compare the outcomes of this sensitivity analysis with the Base Case. The combined effect of these assumptions increases the even-flow harvest level by approximately 88,700 m^3/year (8.4%) to 1,150,300 m^3/year. Over the 300-year planning horizon, cumulative harvest under this scenario is approximately 26.6 million m^3 (8.4%) greater than the Base Case.

Relative to the scenario described in Section 4.6, the reduction in OAF1 results in an additional increase in harvest levels of approximately 55,100 m^3/year (5.2%), or about 16.5 million m^3 (5.2%) over the 300-year planning horizon. This increase is directly attributable to the five percent higher effective yields in managed stands associated with the lower OAF1 value. The reduced OAF1 influences both existing managed stand yields and future yield projections. Consequently, the proportional increase in harvest levels closely corresponds to the magnitude of the reduction in OAF1. The resulting increase in overall timber availability, particularly as managed stands represent a growing proportion of total volume over time, increases the lowest annual harvest level in the harvest flow. This, in turn, enables a higher long-term even-flow harvest level.

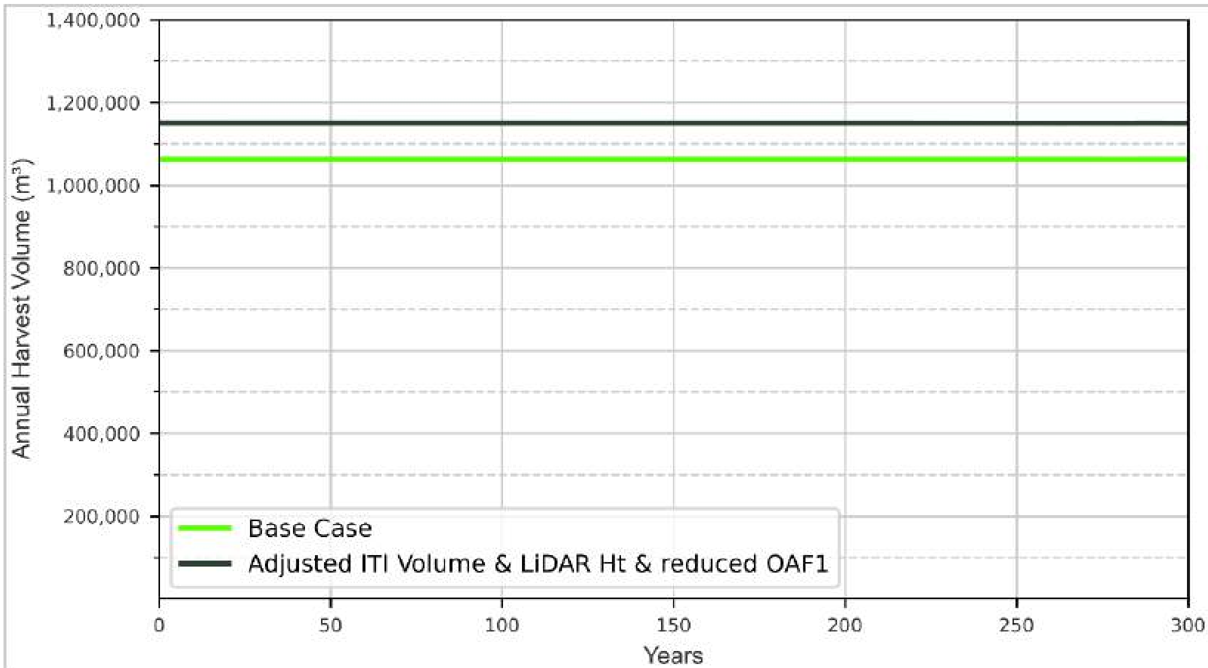


Figure 31 Harvest Levels with ITI adjusted volumes, LiDAR-derived Height and Site Index, and reduced OAF1

Table 23 Harvest Levels with ITI adjusted volumes, LiDAR-derived Height and Site Index, and reduced OAF1

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	LiDAR Adjusted Yields	Difference	
1 to 60	2024	2323	1,061,600	1,150,300	88,700	8.4

4.7.2 Maximize Short-Term Harvest

As illustrated in the previous sensitivity analyses, the even-flow harvest pattern is limited by the lowest timber supply occurring over the 300-year planning horizon. Allowing harvest level to vary within a reasonable range introduces greater flexibility and provides additional timber supply options. This sensitivity was designed to increase short-term harvest levels while limiting mid-term reductions to 1% relative to the even-flow scenario and permitting harvest declines of up to 10% per decade.

The resulting harvest schedule, shown in Figure 32 and Table 24, indicates an overall increase in harvest levels relative to both the Base Case and the even-flow counterpart.

During the first decade, harvest levels are projected to be 1,252,700 m³, approximately 191,000 m³ (18.0%) higher than the Base Case, and 102,400 m³ (9.6%) higher than the even-flow level. Over the following 50 years, harvest levels decline by 9.1% from the initial decade to approximately 1,138,800 m³, representing a modest 1.08% reduction relative to the even-flow scenario, while remaining about 77,100 m³ (7.3%) above the Base Case. From Year 65 onward, harvest levels increase and stabilize at approximately 1,164,200 m³, which is about 102,500 m³ (9.7%) above the Base Case, and 13,900 m³ (1.3%) above the even-flow level for the remainder of the planning horizon. Over the full 300-year period, cumulative harvest volume is approximately 30.4 million m³ (9.5%) higher than the Base Case, and 3.8 million m³ (1.2%) higher than the even-flow scenario.

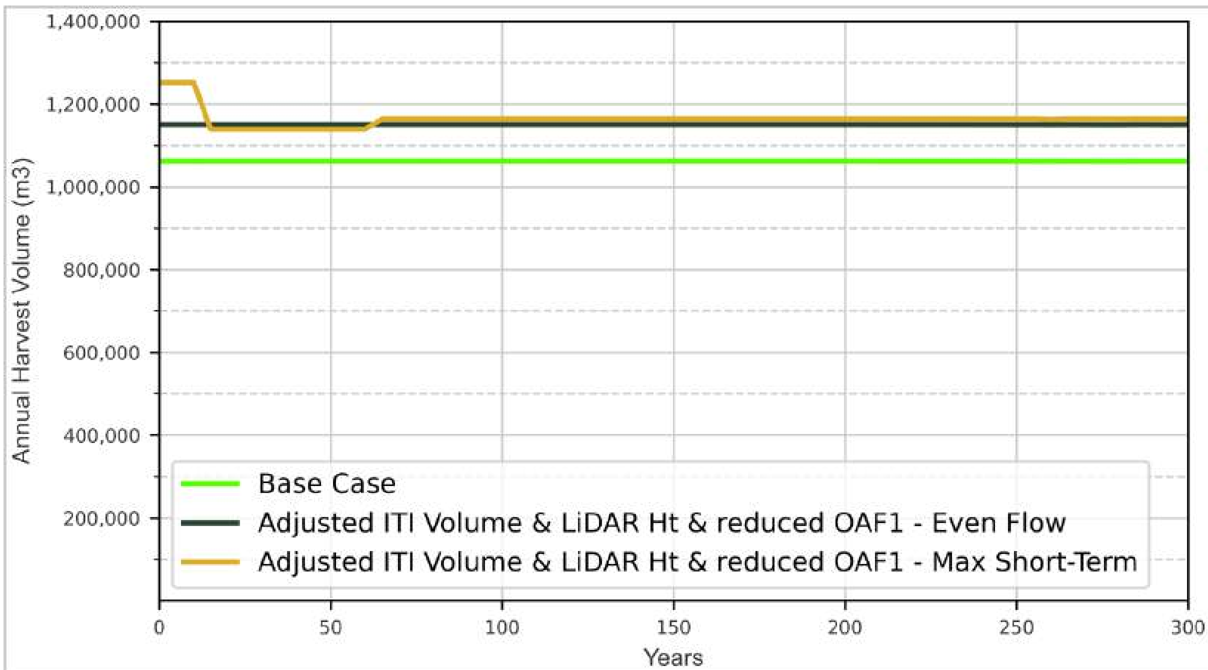


Figure 32 Comparison of Harvest Scenarios: Base Case vs. Two Flows on ITI-Adjusted Volume with Reduced OAF1 Scenario

Table 24 Comparison of Harvest Scenarios: Base Case vs. Two Flows on ITI-Adjusted Volume with Reduced OAF1 Scenario

Period (# of 5-year Intervals)	Year	Start Year	End Year	Annual Harvest Volume (m³)			% Difference	Annual Harvest Volume (m³)		% Difference
				MP #11 Base Case	Step Down - Adjusted ITI & LEFI SI Yields & Reduced OAF1	Difference		Even Flow - Adjusted ITI & LEFI SI Yields & Reduced OAF1	Difference	
1-2	5-10	2024	2033	1,061,600	1,252,700	191,100	18.0	1,150,300	102,400	9.6
3-12	10-60	2029	2083	1,061,600	1,138,800	77,100	7.3	1,150,300	-11,500	-1.08
13-60	65-300	2084	2323	1,061,600	1,164,200	102,500	9.7	1,150,300	13,900	1.3

4.8 Exclude Genetic Gain Adjustments

The Base Case incorporates yield improvements associated with genetic gain from selected seed produced at Western's Saanich Forestry Centre. Long-term tree breeding programs are designed to produce well-adapted, selectively bred seeds that yields trees with improved growth, volume, and wood quality, while maintaining the genetic diversity present in natural populations. This sensitivity analysis evaluates the impact on timber supply in the absence of these silvicultural investments.

Genetic gain is reflected in the yield tables for managed stands in the Recent Managed (RM) era (stands established between 2001 and 2023; Age 1-22 years), as well as in future managed stands. Removing the effects of genetic gain reduces the current THLB inventory by approximately 35,000 m^3 relative to the Base Case (a difference of 0.1%), as the affected stands contribute minimally to near-term harvest levels. However, as RM and future managed stands comprise an increasing proportion of the harvest profile over time, the reduced growth rates associated with the absence of genetic gain have a more pronounced effect. In particular, the lowest annual harvest level is significantly lower than suggested by the initial inventory reduction of 0.1%. As the long-term even-flow harvest level is limited by this lowest point, the resulting harvest level is reduced accordingly.

As illustrated in Figure 33 and summarized in Table 25, harvest levels decrease by approximately 57,600 m^3/year (5.4%) relative to the Base Case. Over the full 300-year planning horizon, the cumulative harvest volume is approximately 17.2 million m^3 (5.4%) lower than the Base Case.

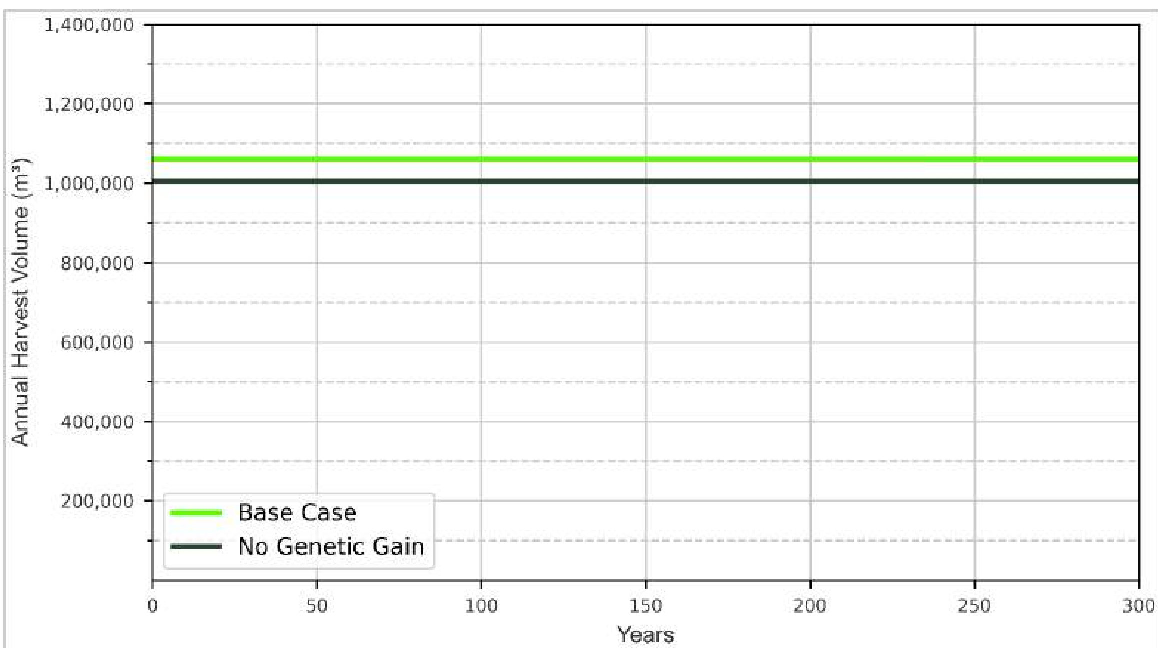


Figure 33 Harvest Levels with No Genetic Gain

Table 25 Harvest Levels with no Genetic Gain

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	No Genetic Gain	Difference	
1 to 60	2024	2323	1,061,600	1,004,100	-57,600	-5.4

4.9 Retain Old Seral Forests to Full Targets in NSOG Order

The Base Case utilizes a two-thirds drawdown of old seral targets in Landscape Units (LUs) that do not have established OGMAs, but are designated as low BEO, as permitted under Objective 5 of the NSOG Order. The implementation of this approach and the model outputs in the Base Case is described in Section 2.5. This sensitivity examines the implications of applying the full old seral target within the applicable LUs: Holberg, Keogh, Mahatta, and Neroutsos.

Applying the full old seral targets in these four low BEO LUs introduces additional short-term harvest restrictions, particularly within the following Landscape Unit/BEC variant combinations:

- Holberg CWHvm2
- Keogh CWHvm1 (outside GMZ 7)
- Mahatta CWHvm1

These additional limitations result in a reduction in harvest levels of approximately 12,200 m^3/year (1.1%) relative to the Base Case. Over the 300-year planning horizon, the cumulative harvest volume is approximately 3.7 million m^3 (1.15%) lower than projected in the Base Case.

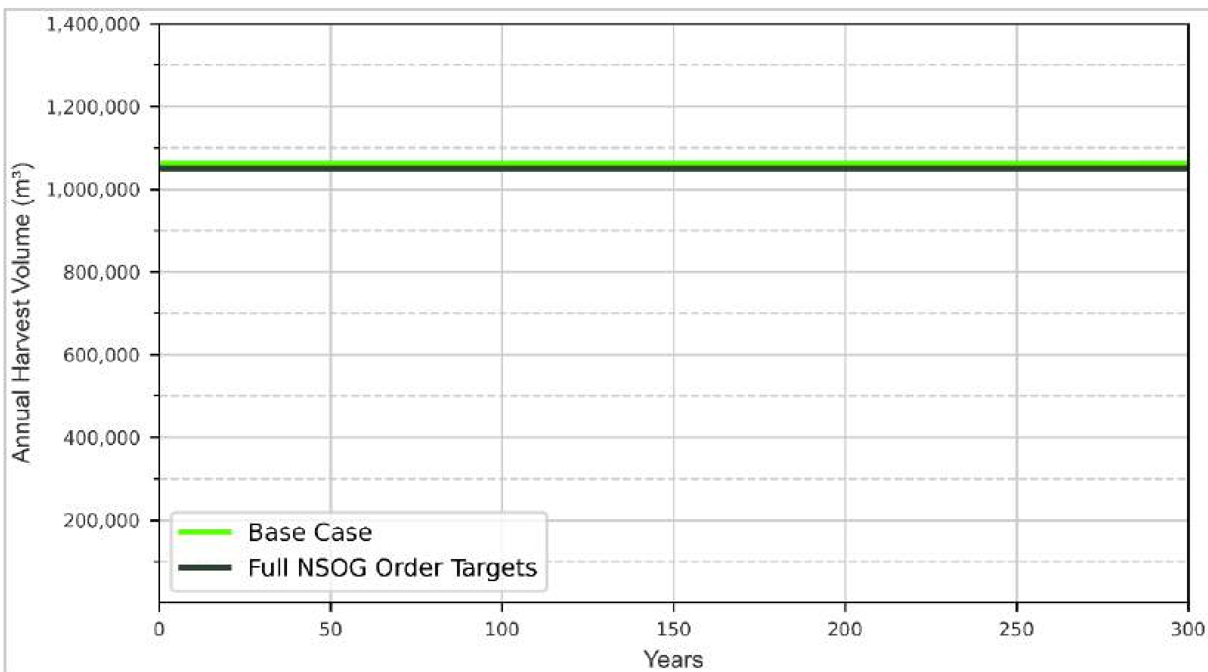


Figure 34 Harvest Levels with Full NSOG Order Targets

Table 26 Harvest Levels with Full NSOG Order Targets

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Full NSOG Targets	Difference	
1 to 60	2024	2323	1,061,600	1,049,400	-12,200	-1.1

4.10 Add 10 Years to the Minimum Harvest Ages

Minimum harvest criteria are used within the timber supply model to determine stand eligibility for harvest (i.e., merchantability). In other words, stands are not available for harvest until the specified criteria are met. In operational practice, however, some stands may be harvested below these thresholds, while others may remain unharvested well beyond them due to the management of other resource values, as well as limitations related to harvest timing and rate. Minimum harvest criteria are typically defined using a combination of stand age and a minimum merchantable volume per hectare.

In this timber supply analysis, the minimum harvest criteria include both minimum harvest ages and minimum stand volumes (see Section 10.4.1 of the associated IP document). In the Base Case, the minimum harvest age is defined as the age at which stands reach 95% of culmination mean annual increment (CMAI), reflecting the general principle that more productive stands can be harvested earlier. This sensitivity modifies that assumption by increasing the minimum harvest age to ten years beyond the 95% CMAI age.

This increase in minimum harvest age reduces the initial merchantable THLB volume by approximately 1.1 million m^3 (5.8%). More notably, it results in a reduction of approximately 7.3 million m^3 in the mid-term merchantable THLB inventory (Year 25), when timber supply is more reliant on existing managed stands. The restraint on mid-term inventory availability decreases the lowest point in the harvest flow, which in turn reduces the even-flow harvest level. As a result, the even-flow harvest level decreases by approximately 105,600 m^3/year (10.0%) relative to the Base Case. Over the full 300-year planning horizon, cumulative harvest volume is approximately 31.7 million m^3 (10.0%) lower than the projected harvest volume under the Base Case.

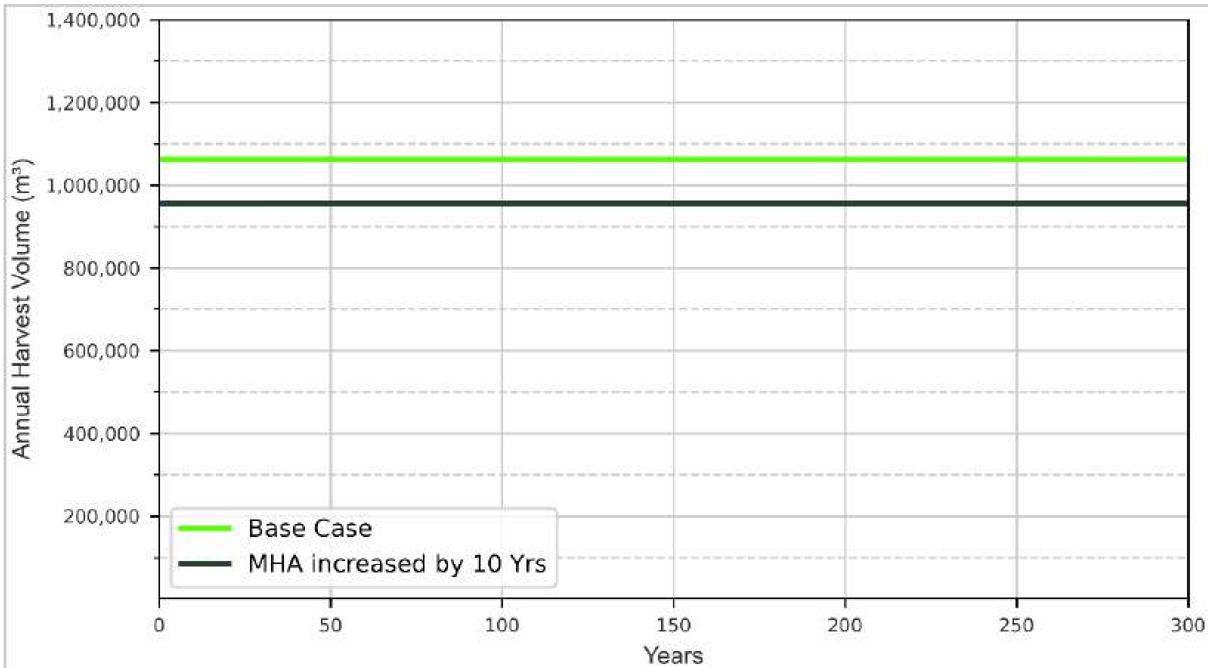


Figure 35 Harvest Levels with MHA Increased by 10 Years

Table 27 Harvest Levels with MHA Increased by 10 Years

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Older MHA	Difference	
1 to 60	2024	2323	1,061,600	956,000	-105,600	-10.0

4.11 Subtract 10 Years from the Minimum Harvest Ages

Complementary to the sensitivity analysis discussed in Section 4.10, this analysis evaluates the effect of reducing the minimum harvest age applied in the Base Case by ten years. This adjustment increases the initial available merchantable volume by approximately 2.9 million m^3 (14.9%). However, the impact on the even-flow harvest level is limited, with an increase of only approximately 12,300 m^3/year (1.2%). Over the 300-year planning horizon, cumulative harvest volume is approximately 3.8 million m^3 (1.2%) higher than in the Base Case.

The relatively small increase in the even-flow harvest level reflects the distribution of gains across time. While reducing minimum harvest age increases short-term merchantable THLB inventory, it does not materially improve availability during the more constrained mid-term periods when timber supply transitions to second-growth stands that remain subject to biological maturity and other management objectives.

This dynamic is evident in the comparison of merchantable THLB inventory between the Base Case and this sensitivity. In addition to the 2.9 million m^3 (14.9%) more in the initial merchantable THLB inventory, early declines are substantially moderated. Around the Base Case low point for merchantable THLB inventory (approximately 12.6 million m^3) in Year 15, this sensitivity maintains approximately 20.6 million m^3, an increase of about 8.0 million m^3 (over 60%).

Despite these gains, the additional volume is largely redistributed within the harvest profile over time, rather than resolving the most limiting conditions. The merchantability constraints in later periods are only modestly alleviated as inventory levels between the two scenarios gradually converge. As a result, the overall increase in the even-flow harvest level remains small relative to the improvement in short-term merchantable THLB inventory.

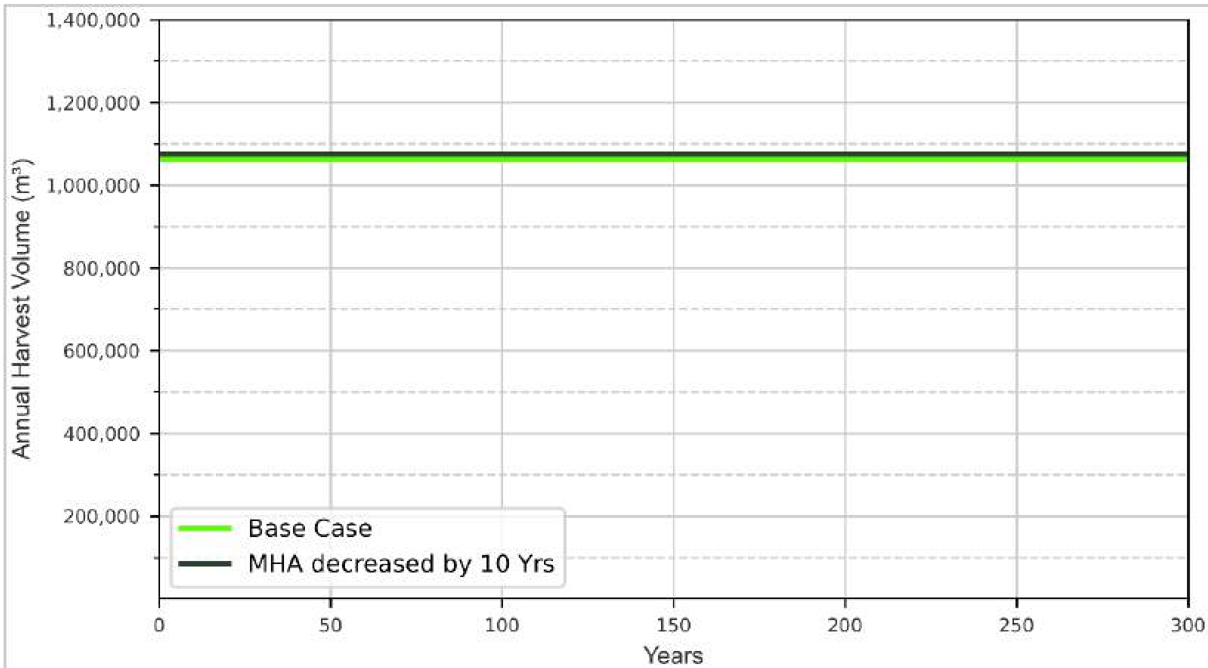


Figure 36 Harvest Levels with MHA Decreased by 10 Years

Table 28 Harvest Levels with MHA Decreased by 10 Years

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	Younger MHA	Difference	
1 to 60	2024	2323	1,061,600	1,074,300	12,300	1.2

4.12 Exclude Helicopter Operable Land Base

Conventional harvesting systems (ground-based and cable-based) account for the majority of timber harvesting for TFL 6. However, a notable proportion of initial merchantable THLB inventory (approximately 11% of the total) is located within helicopter-operable areas, where harvesting is often associated with mature and old-seral stands. As described in the Base Case (Section 2.3), this land base contributes approximately 15% of the harvest in the first decade, although helicopter harvesting represents a relatively small share of the overall harvest profile, averaging about 3% over the 300-year planning horizon.

Excluding helicopter-operable areas reduces the THLB by approximately 3,700 hectares (3.1%) and 2.2 million m³ of merchantable THLB inventory (6.2%). This results in a reduction in harvest levels of approximately 39,700 m³/year (3.7%) relative to the Base Case. Over the 300-year planning horizon, cumulative harvest volume is approximately 11.9 million m³ (3.7%) lower than projected under the Base Case. This impact is generally consistent with the proportional contribution of helicopter-operable areas to the overall THLB.

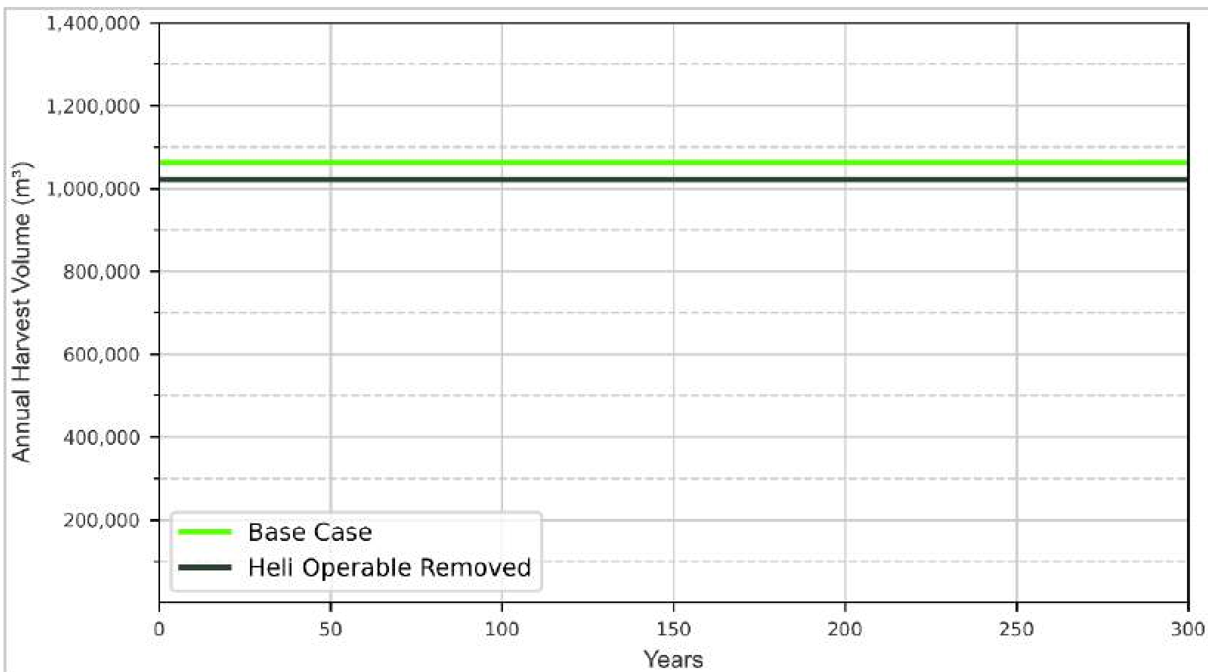


Figure 37 Harvest Levels with Helicopter Operable Land Base Excluded

Table 29 Harvest Levels with Helicopter Operable Land Base Excluded

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m³)			% Difference
			MP #11 Base Case	No Heli	Difference	
1 to 60	2024	2323	1,061,600	1,021,900	-39,700	-3.7

4.13 Increase THLB Factor within Polygons by 10%

In this sensitivity, the THLB factor applied to model polygons was increased by up to 10%, subject to a maximum of 100% of each polygon being available for harvest. Consequently, polygons already classified as 100% THLB in the Base Case were unchanged, while polygons with lower THLB proportions were increased only to the extent that they did not exceed full availability (e.g., a polygon with 95% THLB could increase by a maximum of 5%). As a result of this cap, the 10% increase applied at the polygon level does not translate directly into a 10% increase in total THLB area. A portion of the land base—specifically polygons already at or near 100% THLB in the Base Case—does not contribute to the increase, thereby limiting the overall gain.

Overall, this adjustment increases total THLB area by approximately 7,600 hectares (6.4%) and raises the initial merchantable THLB volume by approximately 2.5 million m^3 (7.0%). This additional area and volume support an increase in the even-flow harvest level to 1,118,200 m^3, representing a gain of 5.3% relative to the Base Case. Over the 300-year planning horizon, cumulative harvest volume is approximately 17.0 million m^3 (5.3%) higher than projected under the Base Case.

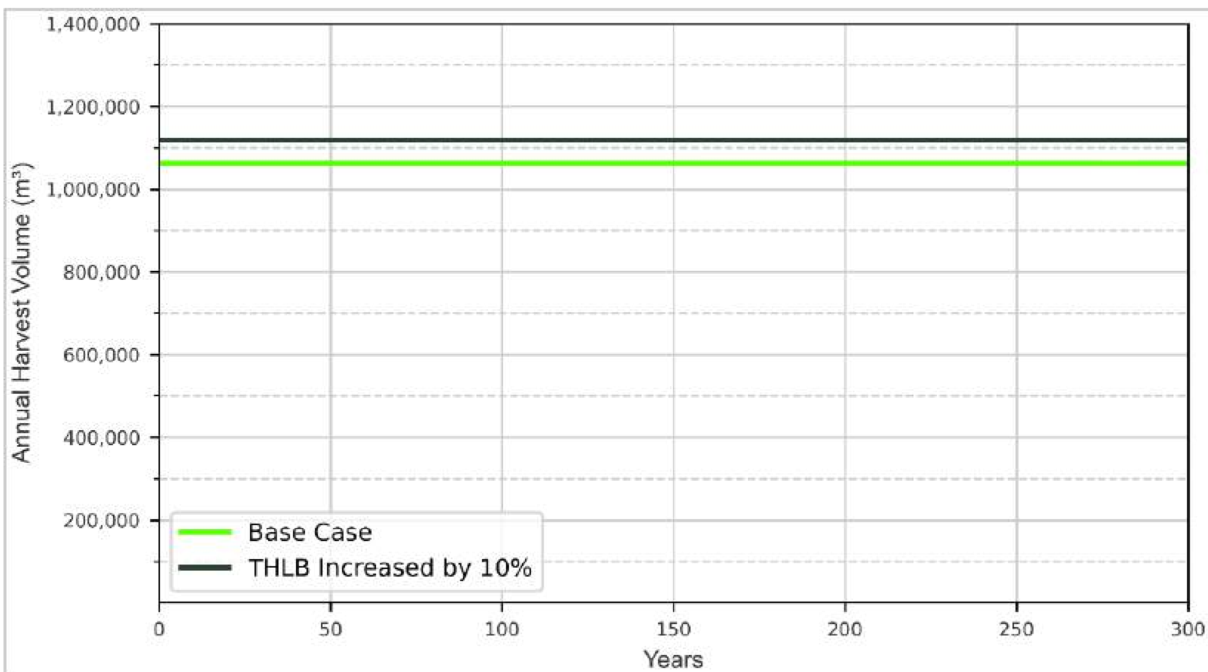


Figure 38 Harvest Levels with 10% THLB Increases

Table 30 Harvest Levels with 10% THLB Increases

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	+10% THLB	Difference	
1 to 60	2024	2323	1,061,600	1,118,200	56,600	5.3

4.14 Decrease THLB Factor within Polygons by 10%

Complementary to the sensitivity discussed in Section 4.13, this analysis evaluates the effect of decreasing the THLB factor within stand polygons by up to 10%. For example, a polygon that was 95% available for harvest in the Base Case is reduced to 85% in this sensitivity, while polygons with THLB factor of 10% or less are effectively removed from the THLB under this assumption.

Although the same cap applies as in the +10% THLB sensitivity, the resulting impact is not symmetric. In the 10% increased THLB sensitivity, a large proportion of stands already at or near 100% THLB are unaffected or do not receive the full adjustment. In contrast, the decrease is applied broadly across nearly all productive stands, including those with the highest THLB contributions. While a large area of low-THLB stands (0–10%) is removed, these areas contribute relatively little merchantable THLB inventory. Consequently, the overall reduction is driven primarily by proportional decreases applied to higher-contributing stands, resulting in a slightly greater proportional decline in both THLB area and merchantable THLB inventory.

Overall, THLB area is reduced by approximately 13,300 hectares (11.1%), and initial merchantable THLB inventory declines by approximately 4.0 million m³ (11.3%). As shown in Figure 39 and Table 31, this translates to an even-flow harvest level of approximately 953,500 m³/year, a reduction of 10.2% relative to the Base Case. Over the 300-year planning horizon, cumulative harvest volume is approximately 32.4 million m³ (10.2%) lower than in the Base Case.

The smaller reduction in harvest level, relative to the decline in THLB area and inventory, reflects the distribution of impacts over time. Although the THLB reduction is applied broadly, its effect on merchantable THLB inventory is not concentrated in the most limiting periods of the harvest level. In addition, some of the reduced inventory occurs in periods where supply exceeds harvest requirements and therefore does not influence the harvest level. As a result, the decrease in harvest levels more closely aligns with the nominal 10% adjustment than with the total proportional reduction in THLB area and merchantable THLB inventory.

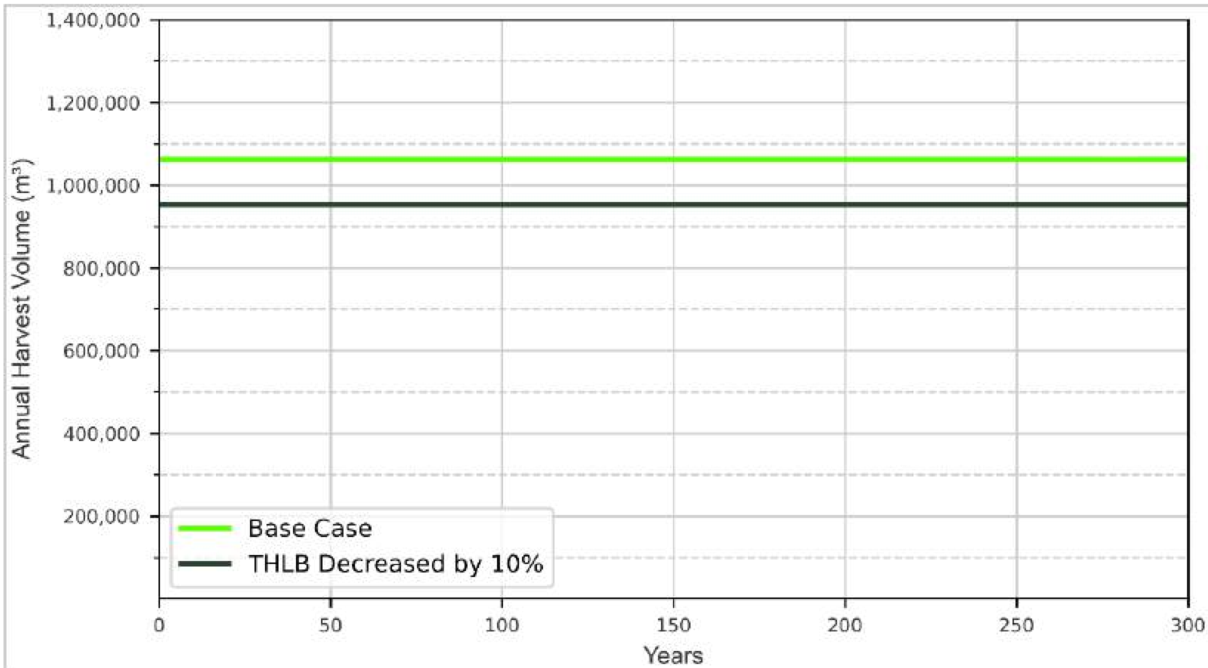


Figure 39 Harvest Levels with 10% THLB Decreases

Table 31 Harvest Levels with 10% THLB Decreases

Period (# of 5-year Intervals)	Start Year	End Year	Annual Harvest Volume (m^3)			% Difference
			MP #11 Base Case	-10% THLB	Difference	
1 to 60	2024	2323	1,061,600	953,500	-108,100	-10.2

4.15 Summary of Sensitivity Impacts

Table 32 summarizes the impacts of the sensitivity analyses relative to the Base Case. The reported values represent aggregate differences in harvested volume over the defined time periods (short-, mid-, and long-term) and are rounded to the nearest tenth of a percent. Positive percentage values indicate that the net harvested volume under a given sensitivity exceeds that of the Base Case during the specified period. Minor variations (typically within ±0.1%) across time periods may occur due to rounding of the even-flow harvest levels. Additional details and interpretations for each sensitivity are provided in Section 5.3.

It is important to note that the Base Case applies an even-flow harvest flow pattern, whereby harvest levels are held constant over time based on the lowest level achieved within the 300-year planning horizon. As a result, the mid- and long-term impacts shown in Table 32 may be moderated by this modelling choice. Specifically, once a lower harvest level is reached in a sensitivity analysis, harvest levels are not permitted to increase in later periods, even if timber supply conditions improve. In practice, greater operational flexibility would likely allow harvest levels to recover over time, reducing differences relative to the Base Case and, in some cases, converging toward it. Therefore, the reported mid- and long-term impacts should be interpreted with consideration of the limiting effect of the even-flow harvest pattern.

Table 32 Summary of Sensitivity Analyses

Issue / Sensitivity	Section	1-10	11-100	101-300
Base Case total harvest (m^3)		10,616,300	95,551,200	212,323,000
Growth and Yield				
Natural yield +10%	Section 4.1	1.3%	1.3%	1.3%
Natural yield –10%	Section 4.2	-2.4%	-2.4%	-2.3%
Managed yield +10%	Section 4.3	7.3%	7.3%	7.3%
Managed yield –10%	Section 4.4	-8.5%	-8.5%	-8.5%
Forest Inventory				
Adjusted ITI (Natural Stands)	Section 4.5	1.6%	1.6%	1.6%
Adjusted LiDAR ITI (Natural Stands) + LiDAR SI (EM Stands)	Section 4.6	3.2%	3.2%	3.2%
Combined Adjusted ITI + LiDAR SI + OAF1	Section 4.7	8.4%	8.4%	8.4%
Forest Management / Silviculture				
No genetic gain	Section 4.8	-5.4%	-5.4%	-5.4%
Biodiversity				
Full Old Seral Targets	Section 4.9	-1.2%	-1.2%	-1.1%
Minimum Harvest Criteria				
Min Harvest Age +10 yrs	Section 4.10	-10.0%	-10.0%	-9.9%
Min Harvest Age –10 yrs	Section 4.11	1.2%	1.2%	1.2%
Operability				
No Helicopter THLB	Section 4.12	-3.7%	-3.7%	-3.7%
THLB				
THLB +10%	Section 4.13	5.3%	5.3%	5.3%

Issue / Sensitivity	Section	1-10	11-100	101-300
THLB -10%	Section 4.14	-10.2%	-10.2%	-10.2%

5 Analysis Summary And Proposed AAC

5.1 Changes since MP #10

Significant changes have occurred in the TFL 6 land base and timber supply analysis assumptions since MP #10. These changes are detailed in Section 2.2 and reflect updated inventory information, evolving regulatory requirements, improvements in data quality (particularly through LiDAR), and refinements in forest management practices and modelling approaches. Collectively, these updates represent a more comprehensive and data-driven assessment of timber supply. Key changes include:

- Incorporation of the former TFL 39 Block 4 land base: this tenure amalgamation increased the overall land base. However, the associated THLB contribution is lower than previously estimated.

- Increased conservation and land base exclusions: additional OGMAs and WHAs, including those associated with the Marbled Murrelet Order, as well as expanded recognition of values such as karst, big trees, research sites, and permanent sample plots, have resulted in increased THLB exclusions.

- Application of LiDAR-informed resource datasets: LiDAR data has improved the identification and spatial representation of non-productive areas, low productive areas, operability, riparian features, and steep terrain, resulting in more accurate but generally larger THLB netdowns.

- Refined forest management and modelling assumptions: updates include revised variable retention assumptions, improved spatial representation of WTRAs, and more detailed modelling of VQOs and watershed restrictions.

- Adoption of 95% CMAI as the minimum harvest age: this replaces previous diameter-based thresholds and provides a more consistent, biologically based definition of harvest timing.

- Improved growth and yield projections: updated versions of VDYP and TIPSY, along with the use of BEC variant and site series as analysis units, provide more refined and spatially detailed yield estimates for both existing and future managed stands.

- Implementation of an even-flow harvest schedule: the Base Case applies an even-flow harvest approach, resulting in a stable long-term harvest level limited by periods of lowest timber availability.

- Application of higher non-recoverable losses and modelling of natural disturbances: non-recoverable losses have been increased to better reflect observed disturbance levels, and natural disturbances are now explicitly modelled outside the THLB.

- Utilization of a spatial timber supply modelling software: a spatially explicit harvest scheduling model (Patchworks) is used in place of the pseudo-spatial model applied in MP #10, allowing for improved representation of spatial constraints such as adjacency and operability.

5.2 MP #11 Base Case Harvest

The even-flow harvest level of 1,061,600 m^3/year for the Base Case reflects the changes implemented since MP #10, as detailed previously. Specifically:

- The current TFL 6 AAC of 1,362,000 m^3/year is based on a step-down harvest flow and was forecast to decrease by 5% to 7% in 2025. A 7% reduction from the current AAC would result in a harvest level of 1,266,600 m^3/year.

- This forecast AAC reduction accounts for several changes outlined in Section 2.2, including the 10.1% reduction in the THLB and the shift to an even-flow harvest schedule from the step-down pattern used previously.

- Between 2014 and 2023, a total of 10.8 million m^3 was harvested, including waste and residue.

5.3 Sensitivity Analyses

Sensitivity analyses were conducted to examine the timber supply impacts of key uncertainties on an individual basis. Table 32 summarizes the short-term (Years 0–10), mid-term (Years 11–150), and long-term (Years 151–300) impacts relative to the Base Case. The analyses addressed the following factors:

Sensitivity analyses have explored timber supply impacts of several uncertainties individually. This includes:

- Yield projections and growth-related uncertainties: several analyses evaluated the effects of variations in volume projections, as well as management and other factors influencing forest growth. Key observations include:

  - Harvest flow is relatively insensitive to changes in natural stand yields (stands older than 62 years as of 2023). These stands contribute primarily within the first 15 years of the planning horizon, after which available inventory reaches its lowest point and effectively constrains the even-flow harvest level.

  - Timber supply is comparatively sensitive to managed stand yields (stands younger than 63 years as of 2023 and future stands). A 10% increase in yields results in a 7.3% increase in harvest levels, while a 10% decrease in yields results in an 8.5% decrease in harvest. This sensitivity reflects the significant role of managed stands during periods of minimum available inventory.

  - Eliminating the yield contributions from both deployed and future genetic gains reduces the even-flow harvest level by 5.4%. This demonstrates the benefits of tree improvement initiatives over recent decades.

- Minimum harvest age: the sensitivity of timber supply to minimum harvest age was assessed by varying this assumption by +/- 10 years. Increasing the minimum harvest age by 10 years reduces harvest levels by 10%, while decreasing it by 10 years results in a 1.2% increase in harvest. The reduction associated with delayed harvest reflects the dependence on managed stands during periods of limited inventory. Harvest levels must be reduced to allow additional time for managed stands to reach minimum harvest age to sustain harvest during this time.

- Full old seral forest targets in NSOG Order: Restricting any further drawdown of old seral forest in low BEO LUs, where targets under the NSOG Order are not currently achieved, results in a 1.1% reduction in harvest.

- Helicopter operable land base: Excluding the helicopter-operable land base (representing 3.1% of the THLB area and 6.2% of THLB volume) reduces harvest levels by 3.7%.

- THLB area adjustments: A 10% increase in THLB area across applicable polygons results in a 5.3% increase in harvest, while a 10% decrease results in a 10.2% reduction. The asymmetry in these impacts is attributable to the limited number of polygons eligible for area increases (as THLB area would exceed polygon area), compared to the broader applicability of area reductions across nearly all THLB polygons.

5.4 LiDAR Data Review of Assumptions

Western acquired LiDAR data for TFL 6 in multiple phases: initially for selected areas as part of a 2012 pilot project, followed by coverage of the remaining portions of the TFL in 2016, and subsequently a complete re-acquisition across the entire TFL in 2021/2022. These LiDAR datasets were used to develop ITI, with the 2016 ITI forming the basis for a series of sensitivity analyses from Section 4.5 to Section 4.7.

A field sampling program for TFL 6 was conducted during the 2025 field season. Subsequent analysis demonstrated that ITI volumes, adjusted to account for the tendency of LiDAR to underestimate understory tree coverage, produce stand-level volume estimates that are both more accurate and more precise than those derived from conventional forest cover inventories. FAIB reviewed the methodology and reached conclusions consistent with these findings. Applying adjusted ITI volumes to natural stands increased the even-flow harvest level by approximately 17,400 m^3 (1.6%).

The application of LiDAR-derived LEFI heights to assign site index values to early managed stands resulted in a further increase of approximately 16,200 m^3 (1.6%).

In addition, the use of LiDAR data in defining THLB allows for improved identification of small, non-productive or low-productivity areas that are not captured in the forest inventory. As a result, a reduction in OAF1 applied within TIPSY is justified. Analysis indicated that an OAF1 value of 10% is more appropriate under these conditions. Incorporating this adjustment into managed stand yield tables increased the even-flow harvest level by a further 55,100 m^3 (5.2%).

Finally, adopting a non-even-flow harvest pattern that allows for greater flexibility, rather than constraining harvest levels to the lowest long-term supply, results in an increase of approximately 102,400 m^3 (9.6%) in the initial decade over the even-flow counterpart. This is followed by a short-term (50-year) reduction of approximately 9.1%, after which harvest levels recover and stabilize at approximately 13,900 m^3 (1.3%) higher than the corresponding even-flow-based scenario over the long term.

5.5 Conclusions and Recommendations

Compared to the MP #10 analysis forecast, the MP #11 Base Case incorporates improved data (e.g., LiDAR), revised information and assumptions (e.g., spatial representation and quantification of land values), and land use changes (e.g., a reduced THLB due to increased conservation). Although the addition of the former TFL 39 Block 4 increases the total land base, its THLB contribution is lower than previously estimated and does not offset the combined effects of expanded conservations, refined inventory, and updated modelling assumptions. Consequently, the overall THLB is reduced and, under an even-flow harvest schedule, results in lower long-term harvest levels.

The even-flow harvest pattern further restricts harvest levels to the lowest point of the timber supply within the 300-year planning horizon. Additionally, the even-flow harvest pattern does not allow for increases in later periods as timber availability improves, potentially understating the capacity of the timber supply over time. In contrast, a step-down harvest flow allows for higher initial harvest levels supported by existing inventory, followed by a reduction to a mid-term minimum, and subsequent recovery as stands regenerate and timber availability increases. As illustrated in Section 4.7.2, the step-down harvest pattern maintains sustainability objectives while demonstrating the potential for long-term harvest levels to recover to, and exceed, the Base Case level. This more flexible approach better reflects operational conditions and the dynamic nature of timber supply. It is also consistent with the previous TFL 6 MPs.

Based on the use of LiDAR as the best available information, the step-down scenario indicates an AAC of 1,252,700 m^3 for TFL 6 for the next 10 years (see section 4.7.2). As detailed harvest statistics were not provided in that section, they are presented here. Overall, the statistics are similar to those of the Base Case but reflect greater initial inventory volumes.

Figure 40 presents the THLB growing stock over time relative to the Base Case (Figure 3). The initial total THLB growing stock is approximately 4.9 million m^3 higher than the Base Case, with most of the increase concentrated in ≤120-year-old stands. This scenario maintains a more stable overall growing stock profile across the planning horizon, with a narrower range and fewer mid-term fluctuations than the Base Case. The long-term total THLB growing stock is similar to, but marginally lower than, the Base Case, while supporting a higher harvest level.

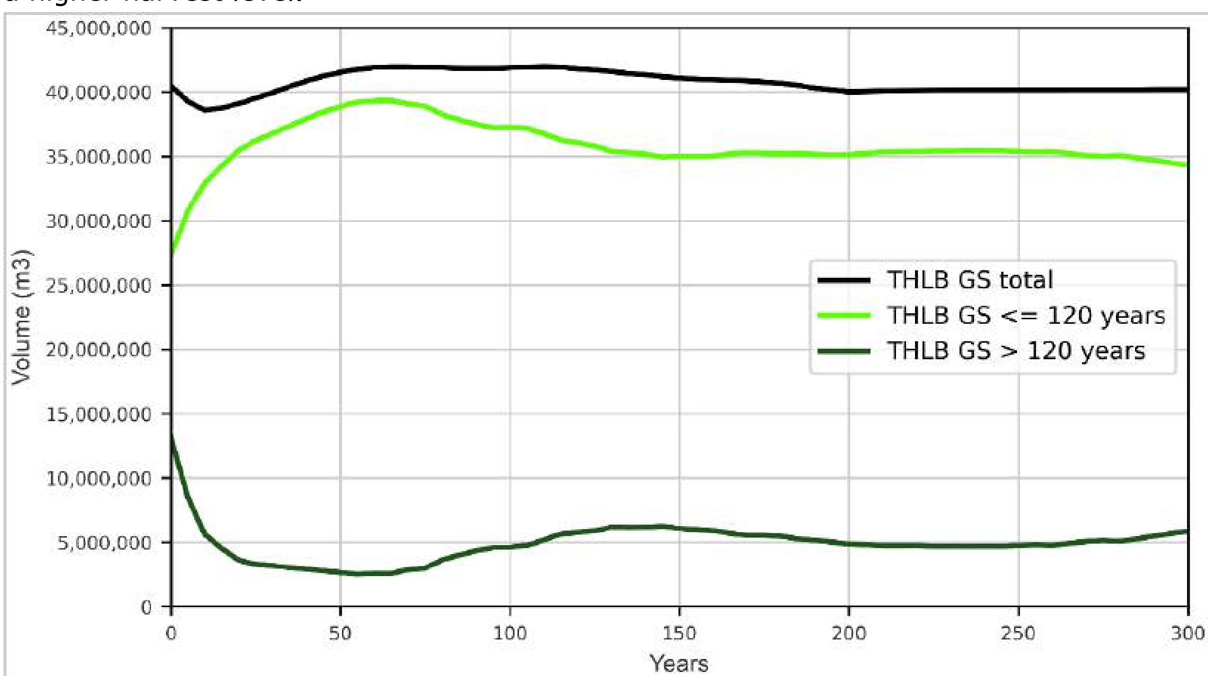


Figure 40 AAC Recommendation THLB Growing Stock By 1-120 Years Old And 120+ Years Old Categories

Figure 41 illustrates the THLB growing stock by harvest system, including merchantable volume, relative to the Base Case (Figure 9). Across the planning horizon, growing stock trends by system remain consistent with the Base Case trajectory. The initial merchantable THLB growing stock is approximately 3.7 million m³ higher than the Base Case, representing about 18% more volume. Following an initial drawdown to support elevated short-term harvest levels, these volumes stabilize. Ground-based systems continue to contribute the largest share of growing stock, followed by cable, with helicopter systems remaining a very small component in both scenarios. Over time, growing stock levels by harvest system converge toward those of the Base Case, with a slightly more stable profile and similar long-term distribution across systems.

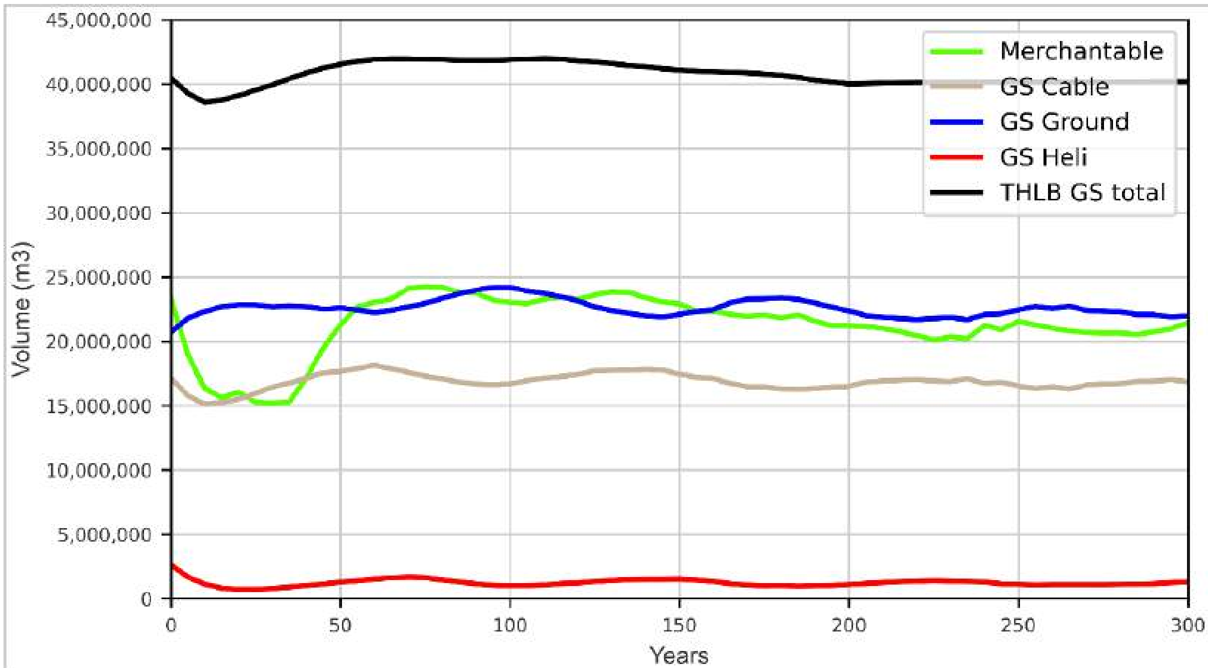


Figure 41 AAC Recommendation THLB Growing Stock by Harvest Systems

Figure 42 presents the merchantable THLB growing stock by harvest system over time relative to the Base Case (Figure 10). This higher initial growing stock supports elevated harvest levels in the near term compared to the Base Case. Across the planning horizon, the overall merchantable growing stock follows a similar trend to the Base Case but remains slightly lower through the mid- to long-term period. In the long term, merchantable THLB growing stock converges toward levels similar to the Base Case while maintaining comparable harvest system contributions.

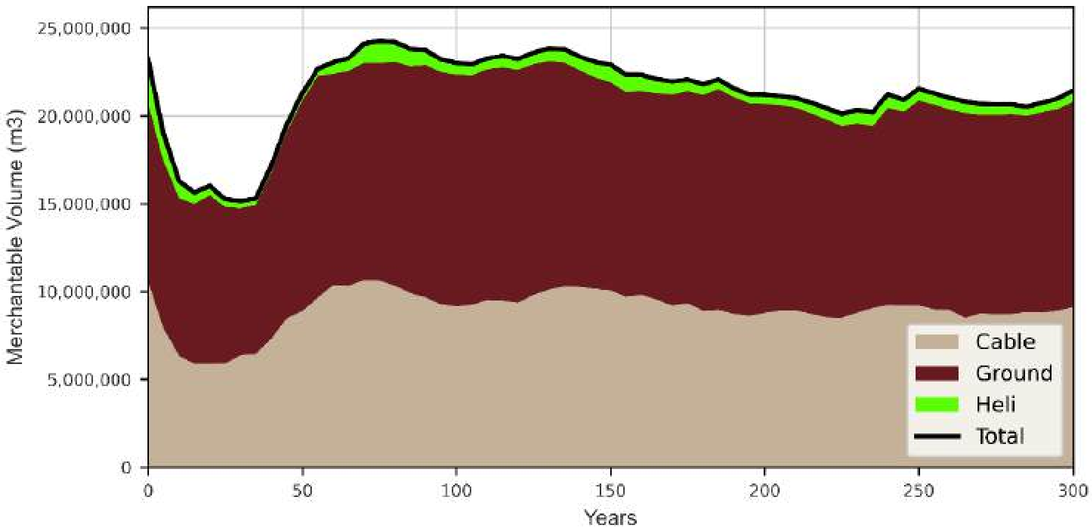


Figure 42 AAC Recommendation Merchantable Growing Stock by Harvest Systems

Figure 43 presents the contribution to total harvest volume by stand era over time relative to the Base Case (Figure 4). The overall contribution profile is similar to the Base Case across the planning horizon, despite differences in harvest flow and inventory levels. Existing natural stands provide a slightly smaller and shorter-lived contribution in the early periods, declining more rapidly and dropping below minimal levels earlier than in the Base Case due to higher short-term harvest levels. This reflects a faster transition to second growth harvesting under this scenario, with future managed stands dominating the harvest profile sooner. As a result, the contribution from future managed stands increases more quickly and stabilizes earlier, while maintaining a similar long-term structure to the Base Case.

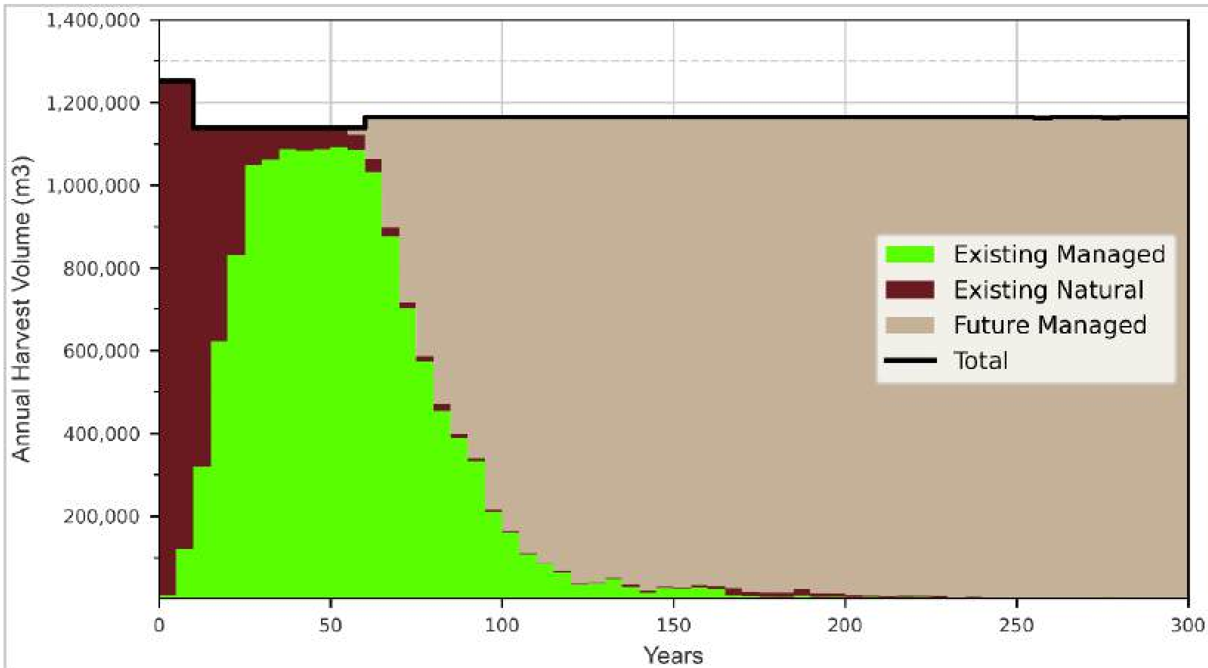


Figure 43 AAC Recommendation Harvest by Stand Eras

Figure 44 illustrates the harvest level by stand seral stages over time relative to the Base Case (Figure 5). The overall contribution pattern is broadly similar to the Base Case across the planning horizon, despite differences in harvest flow and inventory. In the initial periods, harvest contributions from older age classes (121+ years) decline more rapidly than in the Base Case. This trend reflects an accelerated transition away from older stands, necessitated by a corresponding increase in the harvest of mid-aged stands (40–80 years) earlier in the planning horizon. Over time, the distribution stabilizes and converges toward a profile similar to the Base Case, with comparable long-term contributions across seral stages.

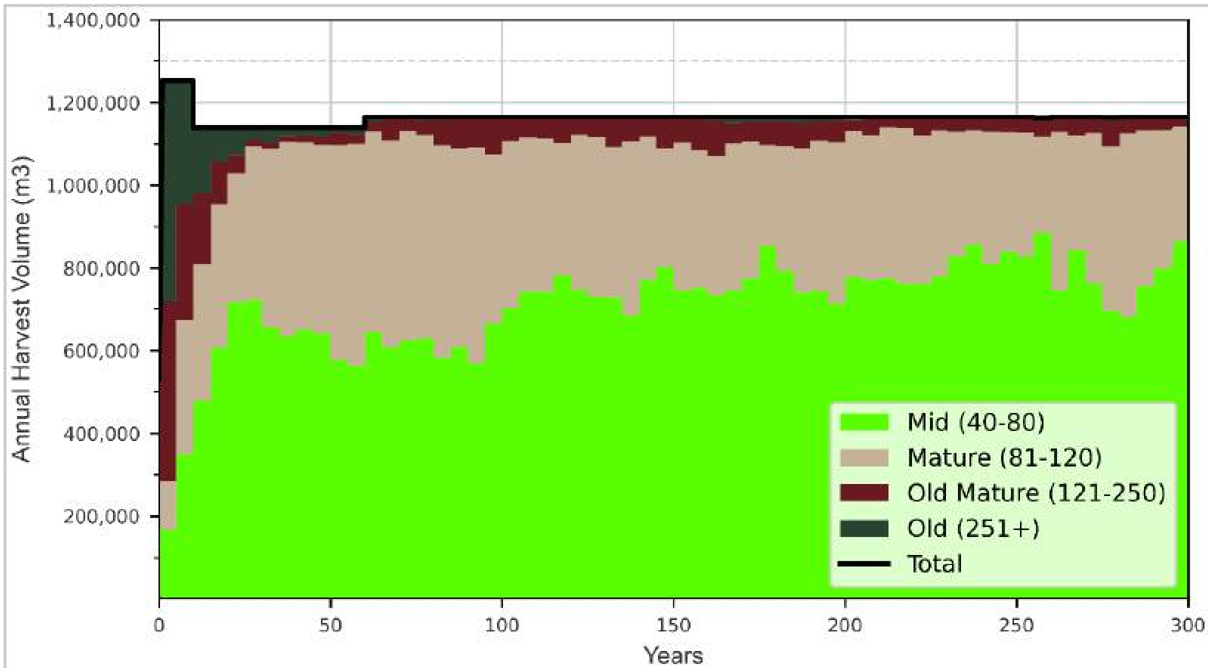


Figure 44 AAC Recommendation Harvest Level by Stand Seral Stages

Figure 45 presents the productive forest age class distribution over time relative to the Base Case (Figure 6). The age class distribution follows a very similar pattern to the Base Case, with only minor differences across the planning horizon. As harvesting continues, the older THLB stands move over to the younger age classes. Over time, both scenarios converge toward a balanced age class distribution, with stable conditions achieved around the mid-point of the planning horizon. In the long term, the overall distribution closely matches the Base Case, with a comparable proportion of older forest maintained outside the THLB and a well-regulated younger age class structure within the THLB.

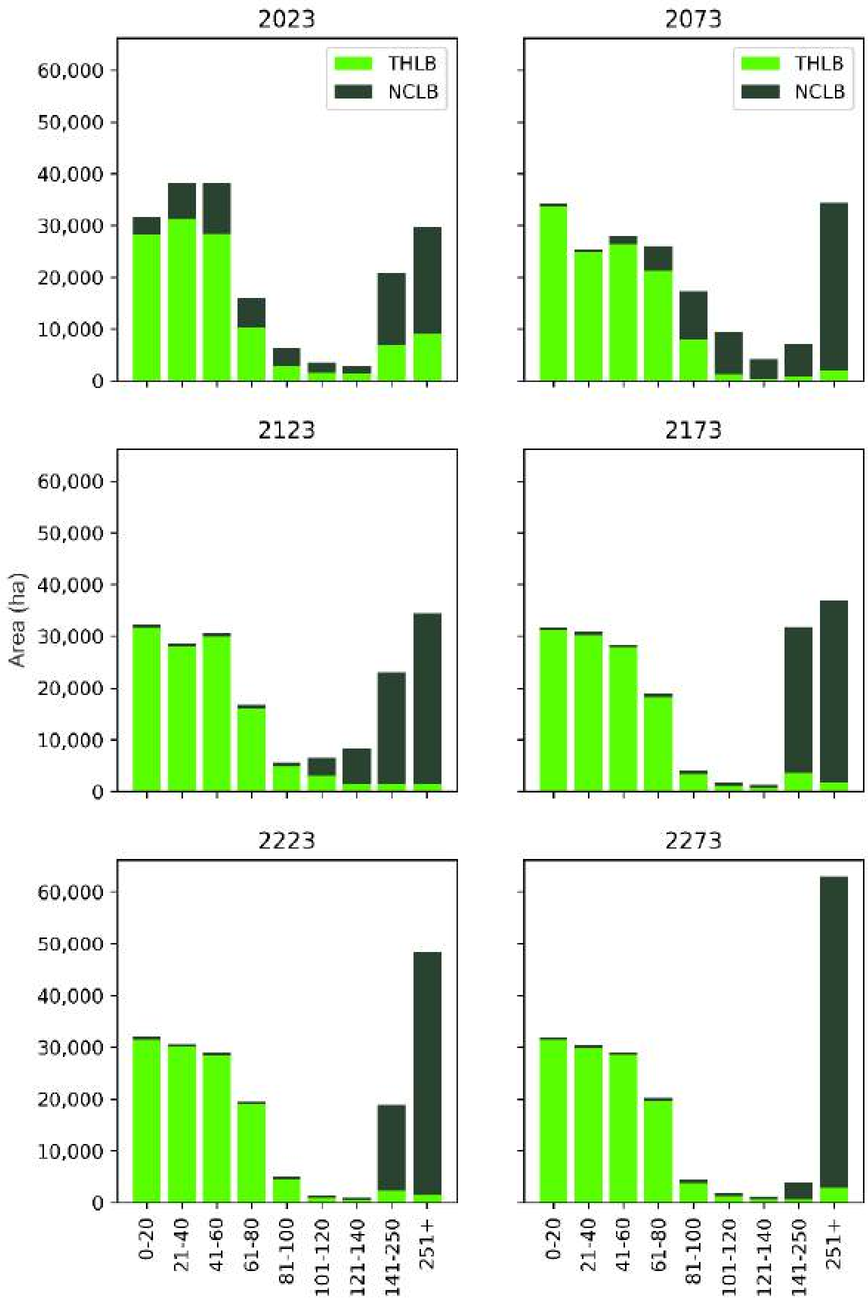


Figure 45 AAC Recommendation Age Class Distribution of Productive Forest Area (187,425 ha)

Figure 46 presents the harvest level by harvest systems over time relative to the Base Case (Figure 7). The overall harvest system breakdown is very similar to the Base Case across the planning horizon, with conventional systems (cable and ground) continuing to dominate the harvest. The elevated short-term harvest levels projected in this scenario are supported by modest increases in contributions from both cable and ground systems. The helicopter component remains a small proportion of the total harvest and follows a pattern comparable to the Base Case. In the long term, the distribution of harvest by system converges to levels consistent with the Base Case, maintaining a similar overall composition.

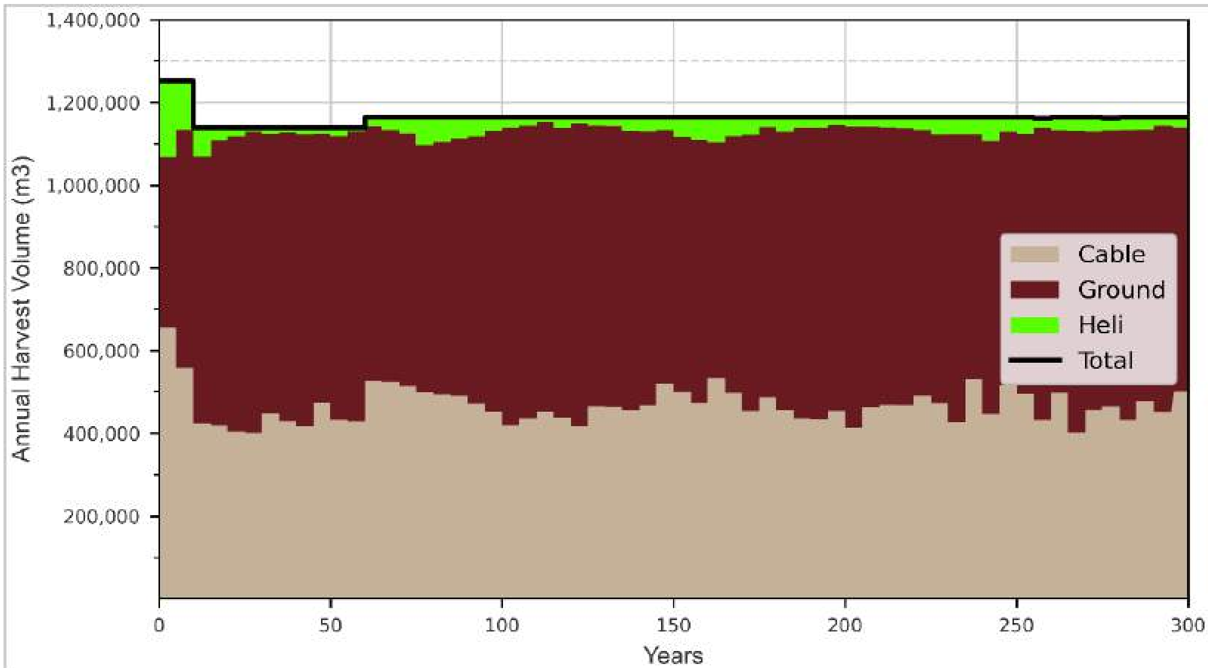


Figure 46 AAC Recommendation Harvest Level by Harvest Systems

Figure 47 presents the average block size by harvest system over time relative to the Base Case (Figure 8). The overall pattern is similar to the Base Case across the planning horizon, with comparable relative differences between cable, ground, and helicopter systems. This scenario shows slightly more stable average block sizes, with reduced variability particularly in the early and mid-term periods. Ground-based harvesting continues to exhibit the largest average block sizes, followed by cable, while helicopter systems remain consistently smaller in both scenarios. In the long term, average block sizes converge to levels closely aligned with the Base Case, maintaining a similar distribution across harvest systems.

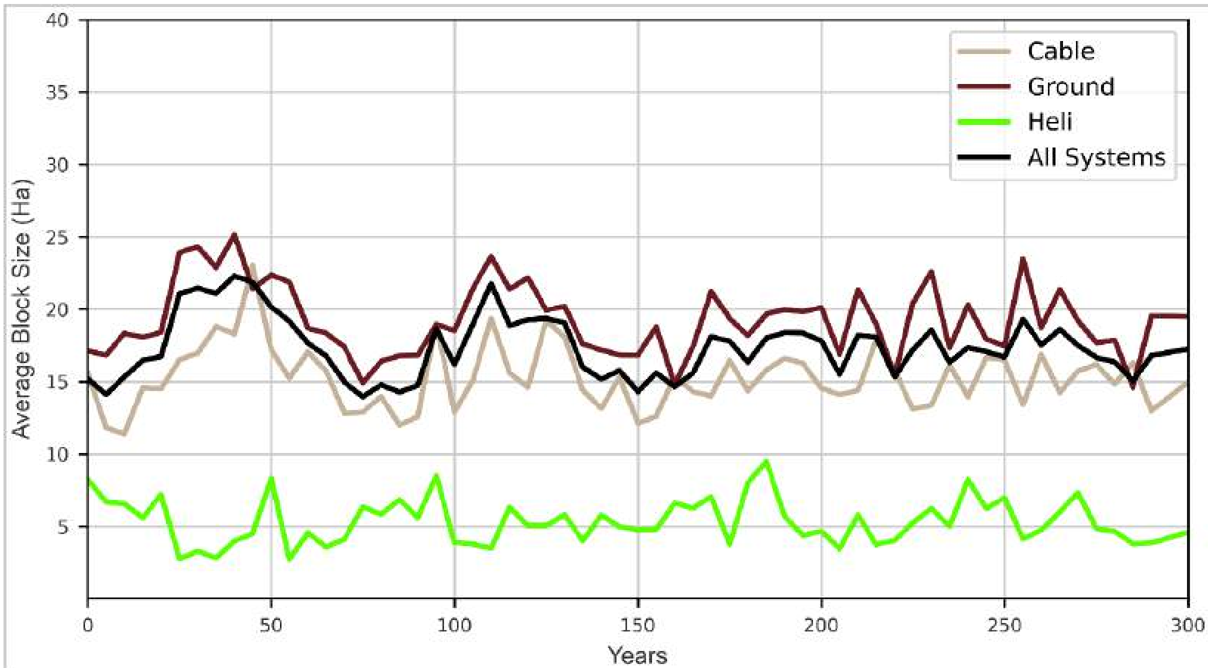


Figure 47 AAC Recommendation Average Block Size by Harvest Systems

Figure 48 illustrates the projected trends for average harvest area, average harvest age, and average volume per hectare relative to the Base Case (Figure 11). While the overall patterns remain consistent with the Base Case across the planning horizon, there are modest differences in magnitude driven by the specific harvest flow of this scenario. This scenario shows a slightly higher average harvested area, particularly in the short- and long-term periods, which directly reflects the elevated harvest levels. Average harvest age is slightly younger than the Base Case, reflecting an accelerated transition from natural stands contribution driven by the higher initial harvest level. In contrast, the average harvested volume per hectare is slightly reduced relative to the Base Case. Over the long term, all three metrics stabilize and remain broadly consistent with the Base Case, with minor variances reflecting the sustained, slightly higher harvest levels in the long run.

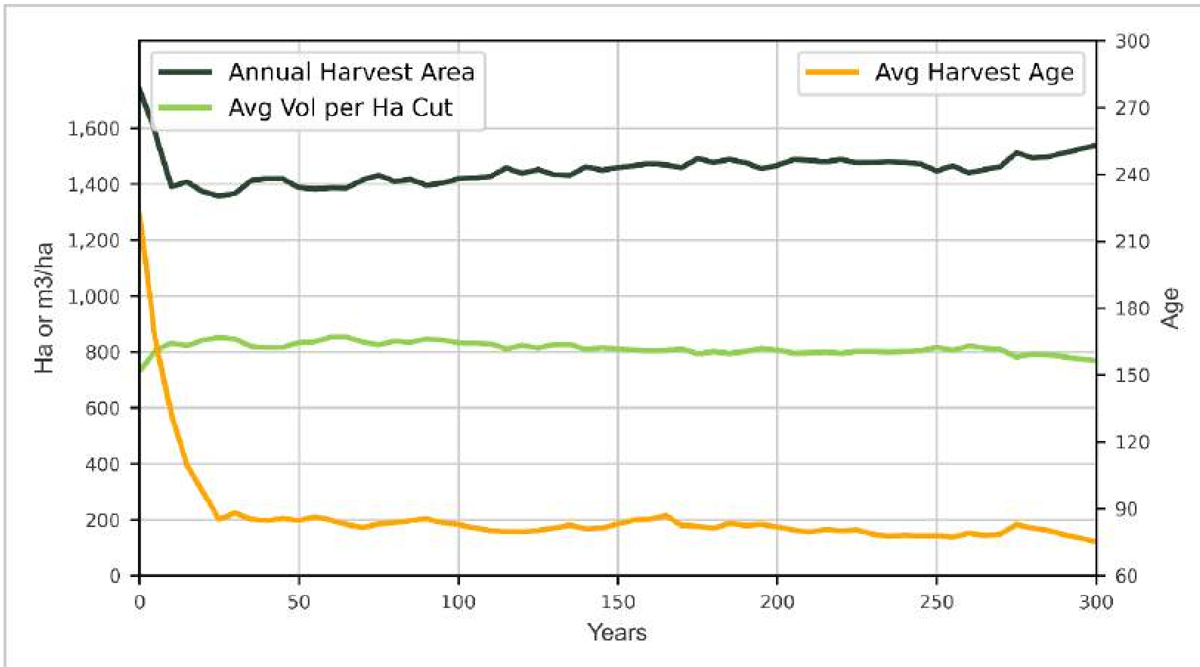


Figure 48 AAC Recommendation Harvest Statistics

Figure 49 presents the species composition of the harvest volume over time relative to the Base Case (Figure 12). The overall species mix is very similar to the Base Case across the planning horizon, particularly in the mid- and long-term periods. Differences are primarily observed in the early periods, where slightly higher harvest levels result in a greater contribution from HemBal and a corresponding shift among other species. As the harvest transitions into second growth, the species composition stabilizes and aligns closely with the Base Case. In the long term, HemBal, western red cedar, and Douglas-fir remain the dominant contributors, with yellow cedar and other species making up a relatively small proportion of the total harvest.

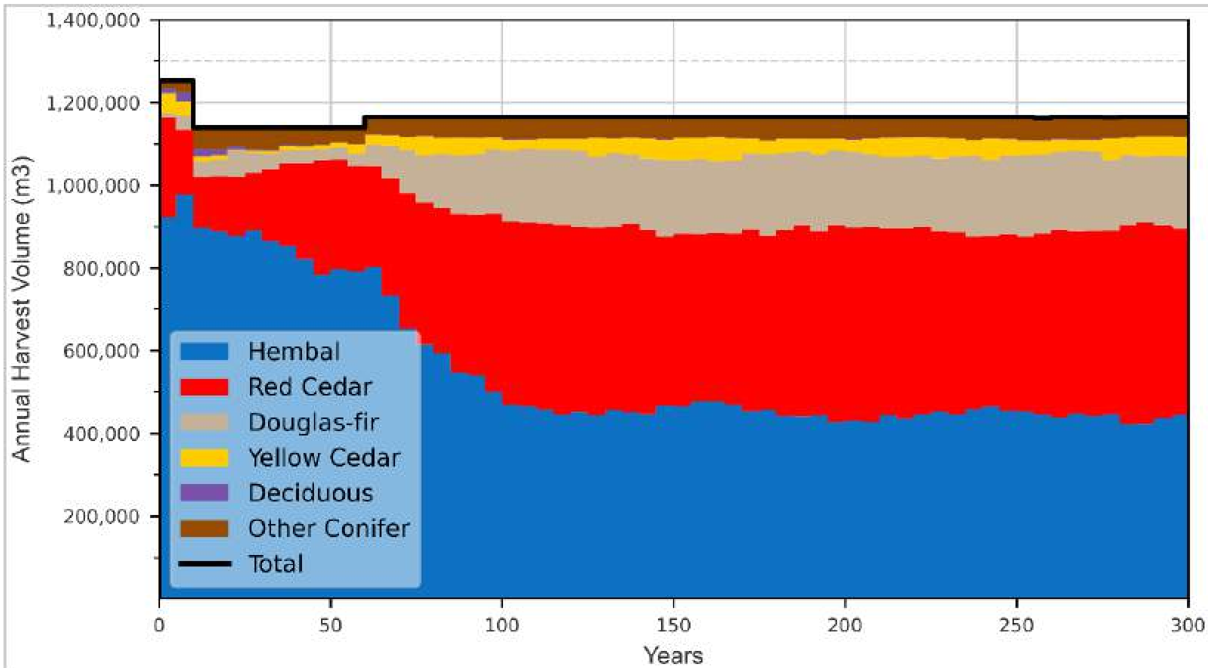


Figure 49 AAC Recommendation Harvest by Species Composition

Figure 50 presents the projected harvest distribution by elevation band over time relative to the Base Case (Figure 13). The overall elevation profile is very similar to the Base Case across the planning horizon, with the majority of the harvest (approximately 60%) occurring within the winter harvest zone (<300 m band). This scenario shows a slightly higher and more stable contribution from lower elevation stands in the early and mid-term periods, with a corresponding minor reduction in the transitional harvest zone (300–799 m band). Harvest from higher elevations, which are accessible during summer only (800 m+), remains a minor component in both scenarios. In the long term, the distribution across elevation bands converges closely with the Base Case, maintaining a similar overall composition.

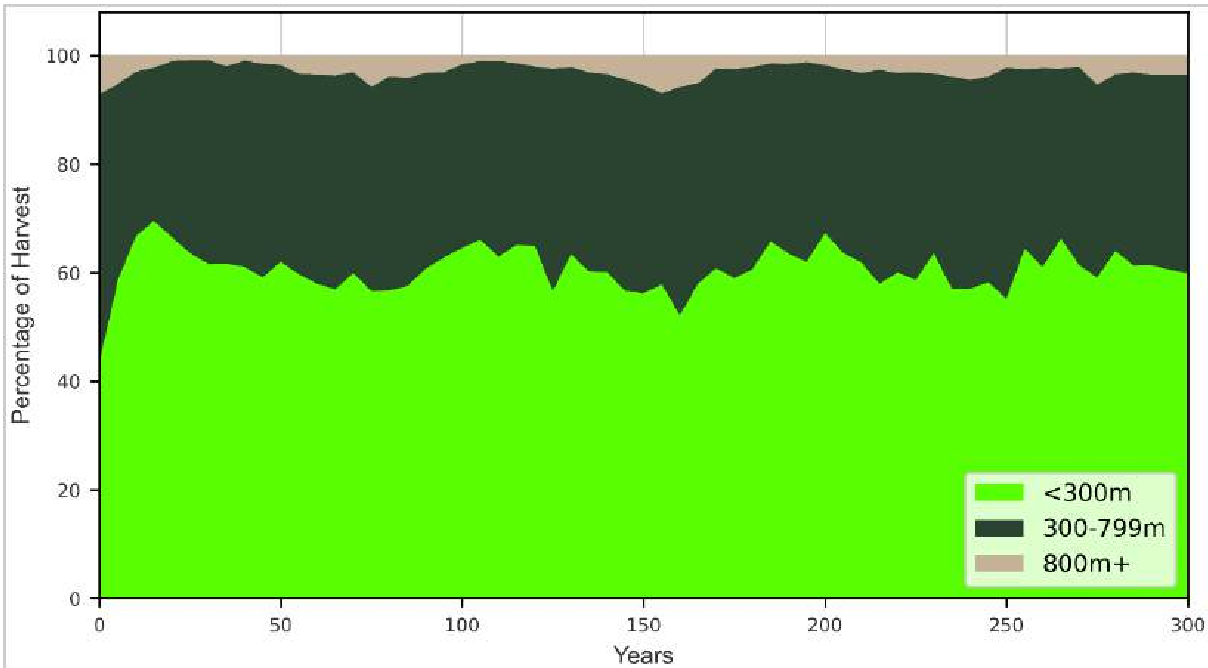


Figure 50 AAC Recommendation Harvest by Elevation Bands

Figure 51 presents the cedar inventory (western red cedar and yellow cedar) within the THLB and NCLB over time, relative to the Base Case (Figure 14). The overall cedar inventory trends are similar to the Base Case across the planning horizon, with comparable initial conditions and long-term trajectories. Both western red cedar and yellow cedar inventories increase during the early periods as existing stands accrue volume, followed by a relatively stable trajectory in the long term. Despite the modest volume differences, the overall distribution between THLB and NCLB and the long-term cedar inventory profile remain consistent with the Base Case.

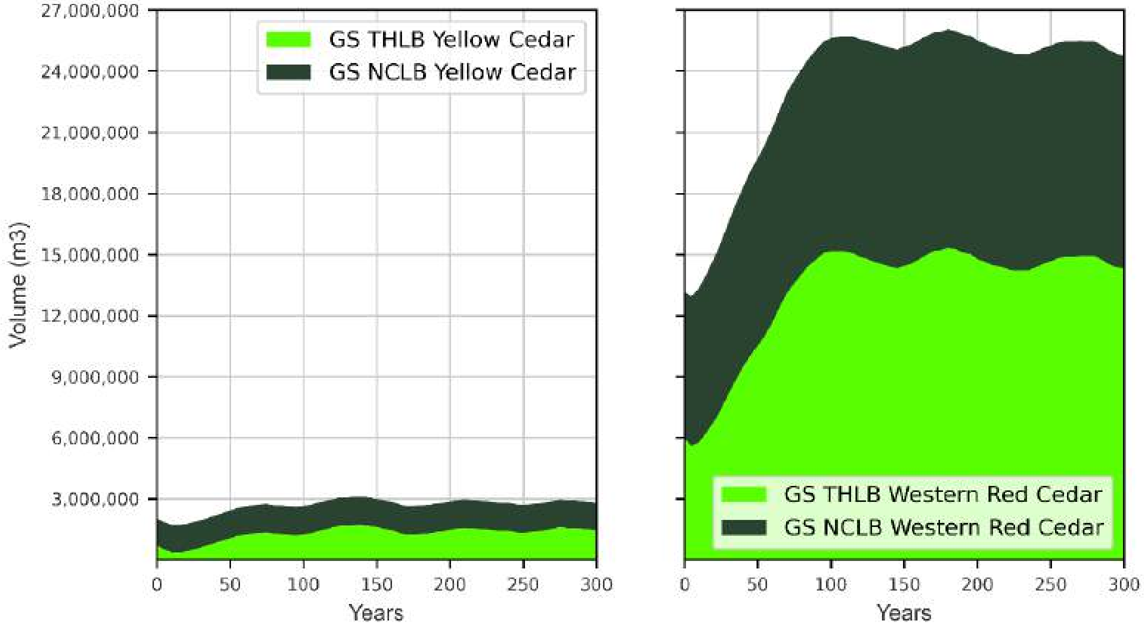


Figure 51 AAC Recommendation Cedar Inventory in Productive Forest

Figure 52 presents the volume of old cedar (greater than 250 years) in the productive forest over time relative to the Base Case (Figure 15). The overall pattern is similar to the Base Case across the planning horizon, with an initial decline in old cedar volume in the early periods due to harvesting of older stands. This scenario starts with slightly lower old cedar volume and maintains a modest deficit relative to the Base Case through the mid-term. As the land base transitions into second growth, old cedar volume stabilizes in both scenarios before increasing steadily in the long term as stands age into older classes. By the end of the planning horizon, old cedar volume remains somewhat lower than the Base Case but follows a similar trend, resulting in comparable long-term dynamics.

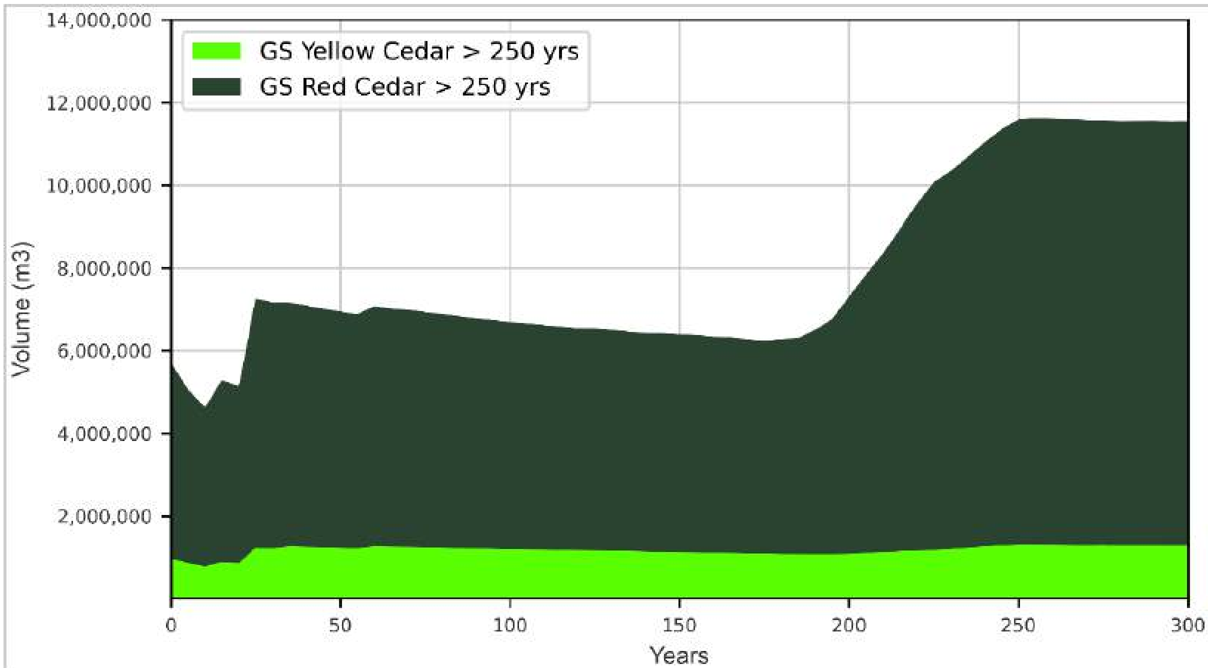


Figure 52 AAC Recommendation Old Cedar Inventory in Productive Forest

Figure 53 to Figure 56 present the projected old seral forest proportions for landscape biodiversity objectives in Holberg, Keogh, Mahatta, and Neroutsos LUs over time under this scenario relative to the Base Case (Figure 16 to Figure 19). Across all four landscape units, the projected patterns are consistent with the Base Case, acknowledging the initial short-term deficits in some BEC variants due to existing age structure and harvest history. These deficits are progressively resolved, with most variants meeting or exceeding their drawdown targets by the mid-term period. In Holberg LU, most variants meet their targets by approximately Year 25, with the remaining variant achieving full target by the mid- to long-term. Similarly, in Keogh LU, targets are generally achieved by approximately Year 150–200. For Mahatta and Neroutsos LUs, all variants meet or exceed the full targets and remain above target levels throughout the planning horizon. Overall, this scenario successfully meets adheres to the old seral drawdown targets across all low BEO LUs that lack established OGMAs.

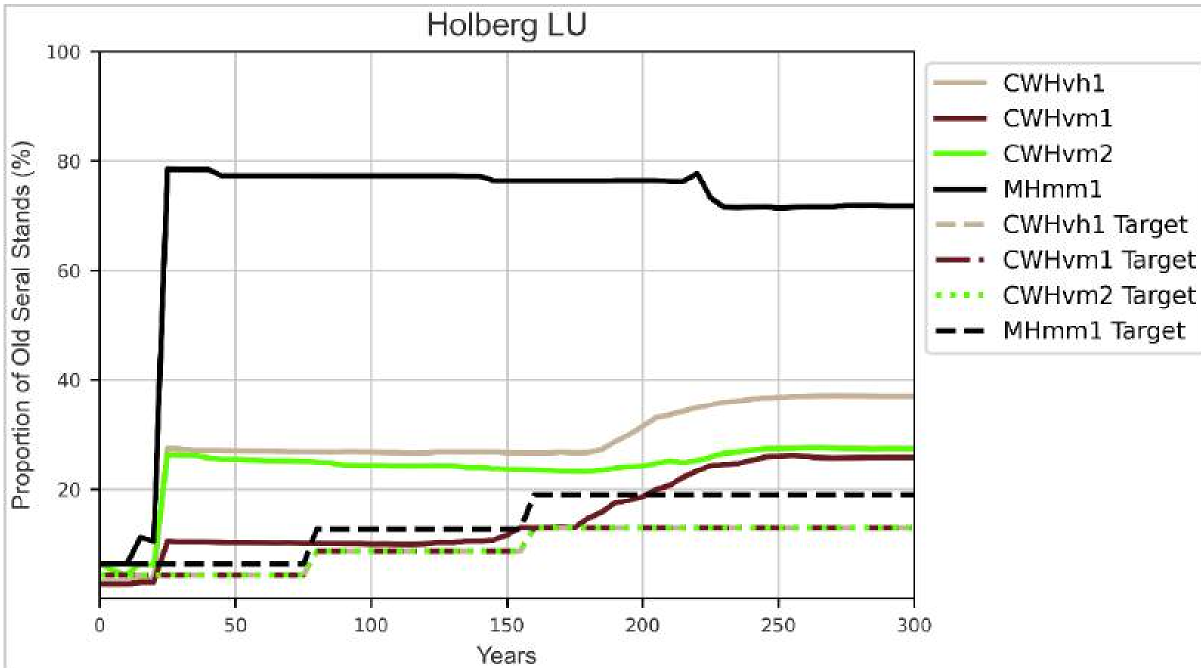


Figure 53 AAC Recommendation Projection of Old Seral Forest Proportions for Holberg LU

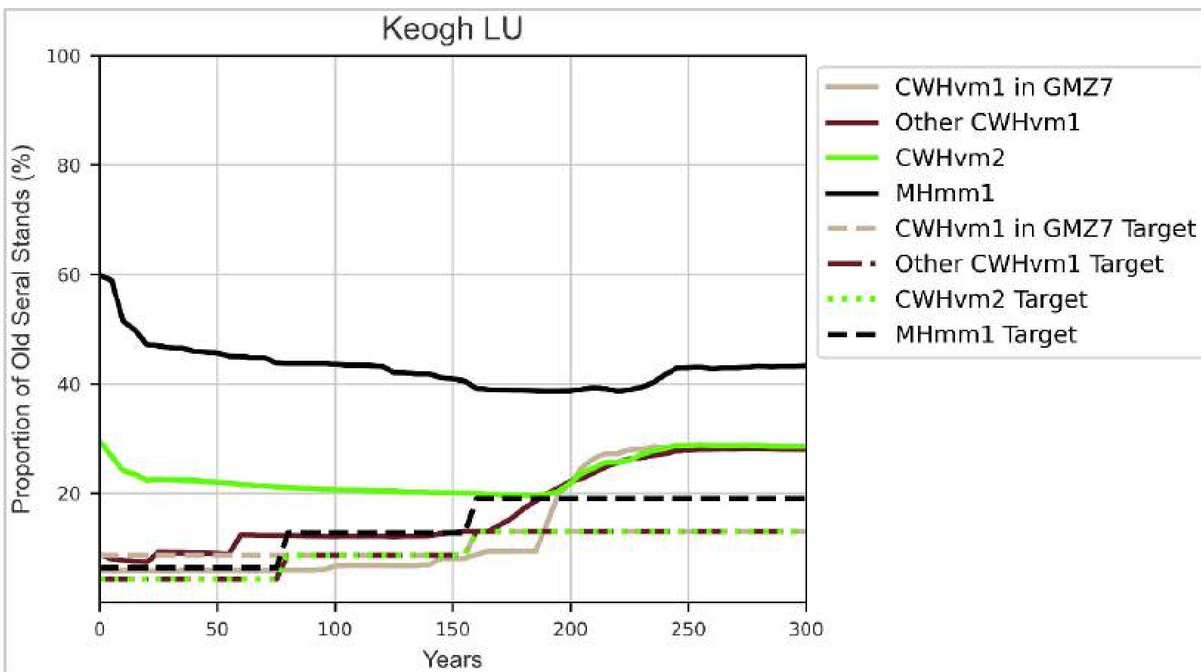


Figure 54 AAC Recommendation Projection of Old Seral Forest Proportions for Keogh LU

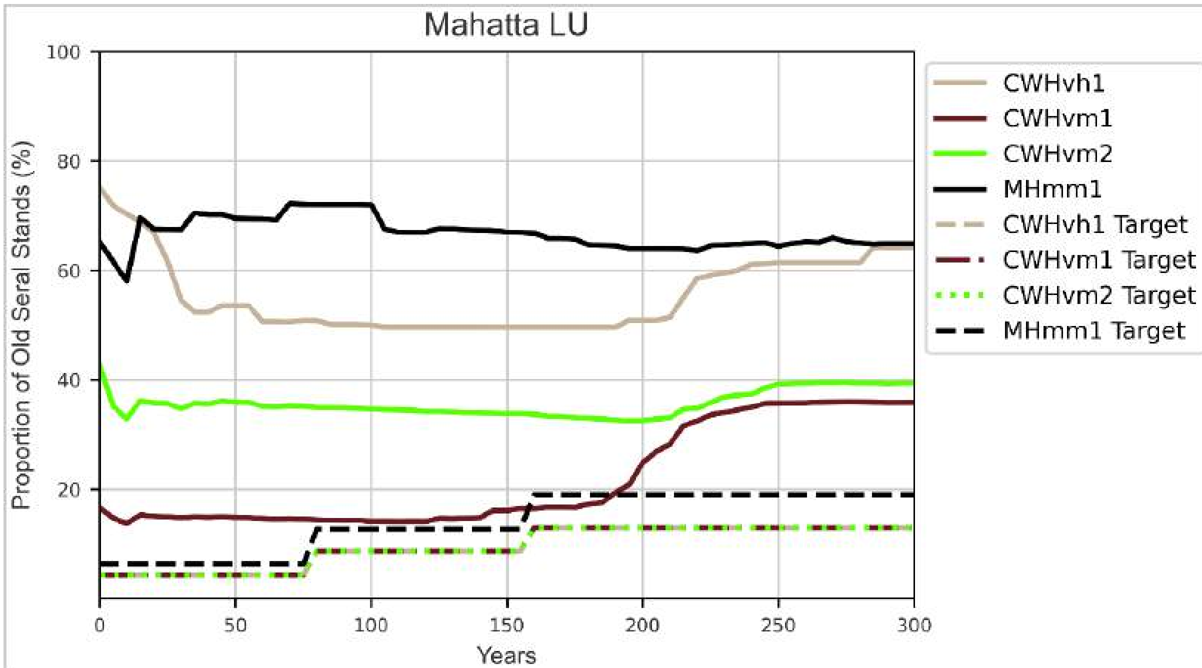


Figure 55 AAC Recommendation Projection of Old Seral Forest Proportions for Mahatta LU

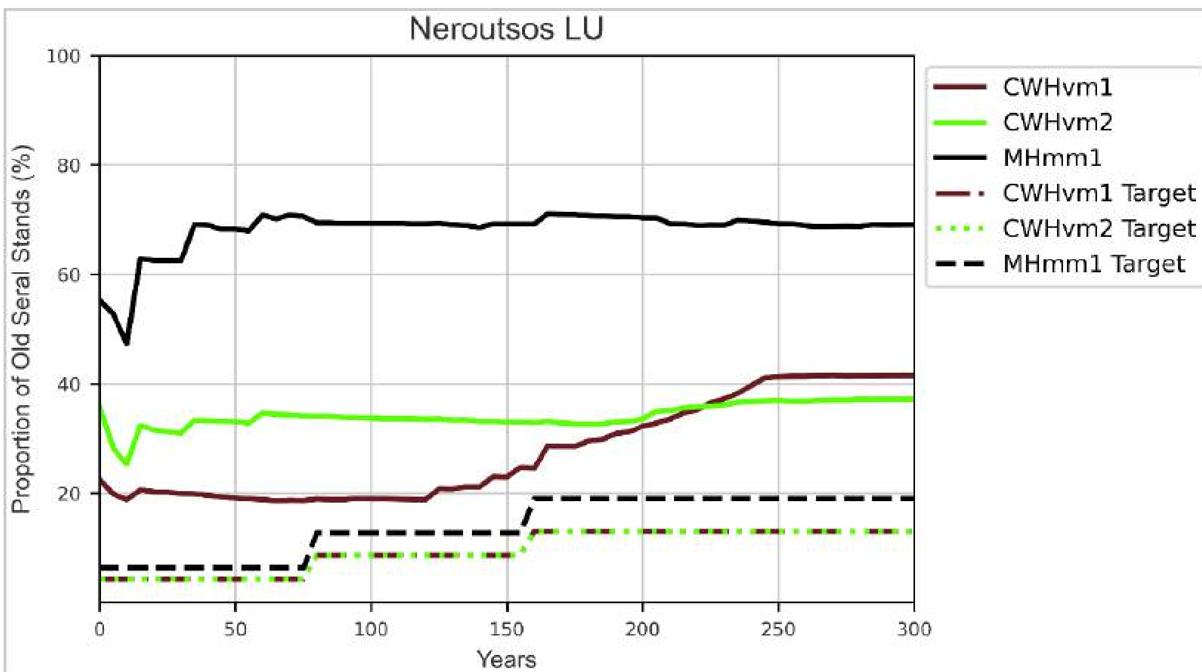


Figure 56 AAC Recommendation Projection of Old Seral Forest Proportions for Neroutsos LU

When quantifying the timber supply impact since MP #10, Figure 57 shows an updated illustration in terms of 10-year AAC change for this scenario. This figure builds on the Base Case results presented in Figure 20 (Section 2.6). Starting from the MP #11 Base Case AAC of 1,061,600 m³/year, the incorporation of LiDAR-based inventory, LEFI height-derived site index, and OAF adjustments increases the harvest level by 88,700 m³/year (8.4%), resulting in a harvest level of 1,150,300 m³/year. By adopting a more flexible harvest flow pattern, a further increase of 102,400 m³/year (8.9%) is achieved, leading to a final harvest level of 1,252,700 m³/year.

While earlier reductions from MP #10 were primarily driven by updated THLB estimates and revised modelling assumptions, this analysis demonstrates that a higher, yet sustainable harvest level can be realized through improved inventory inputs and harvest flow optimization. The harvest level of 1,252,700 m³/year is closely aligned with the scheduled decline identified in MP #10 (1,266,600 m³/year), representing a marginal difference of approximately 1.1% lower than that benchmark.

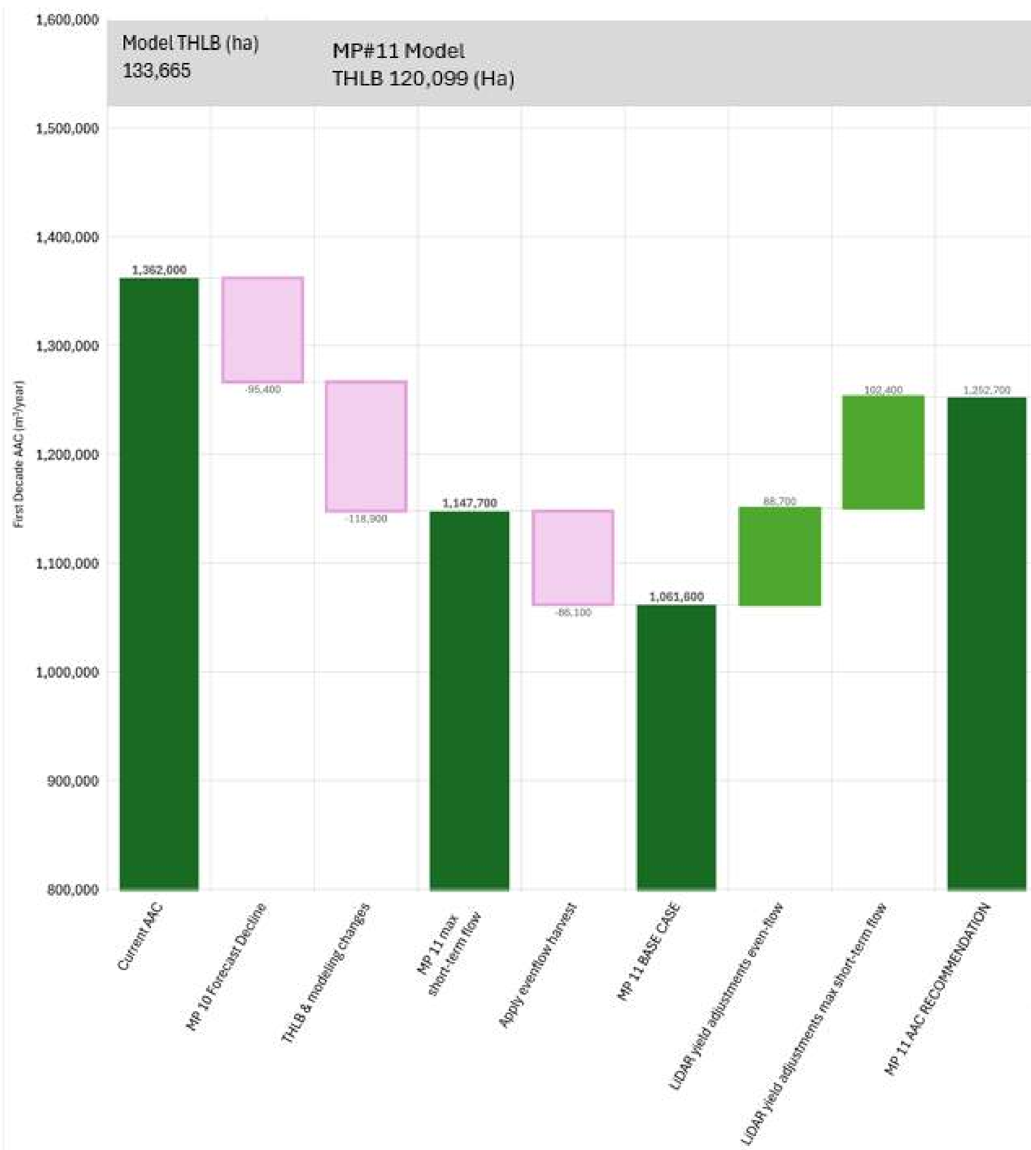


Figure 57 Updated Timber Supply Impacts Since MP #10

Therefore, an AAC of 1,252,700 m^3/year is proposed for TFL 6 for the next 10-year period. This AAC includes 11,578 m^3/year allocated to First Nations.

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7. Appendices

Appendix A: Deputy Chief Forester's Letter of December 4, 2024 regarding TFL 6 ITI Validation

Appendix B: Tree Farm Licence 6 LiDAR Forest Inventory Validation Report

Appendix C: FOR's Review of Western's TFL 6 LiDAR Forest Inventory Validation Report

Appendix D: LiDAR Review of OAF1 in Managed Stands

Appendix A: Deputy Chief Forester's Letter of December 4, 2024 regarding TFL 6 ITI Validation

Reference: 280265

December 4, 2024

VIA EMAIL: JMortyn@westernforest.com

Joel Mortyn, RPF
Manager, Inventory and Analysis
Western Forest Products Ltd.
4644 Adelaide Street
Port Alberni, British Columbia
V9Y 6N4

Dear Joel Mortyn:

Thank you for your submission of July 17, 2024, regarding validation of the Individual Tree Inventories (ITI) for Tree Farm Licence (TFL) 44, TFL 37 and TFL 64, as well as your submission of September 20, 2024, regarding the evaluation of the ITI for TFL 6.

In reviewing the four studies and your correspondence I understand that you have made the following 3 recommendations:

1. Accept the results and conclusions of the ITI validation studies indicating that the ITI is the most accurate estimate of stand volume for TFL 37, TFL 44 and TFL 64;
2. Redetermine the Allowable Annual Cut (AAC) for TFL 44 using the timber supply projection based on the adjusted-ITI inventory; and
3. Accept the adjusted-ITI inventory without additional field validation for TFL 6.

I have reviewed the above-mentioned submissions with support from specialists at Forest Analysis and Inventory Branch (FAIB) and have reached the following conclusions:

Regarding the ITI validation studies for TFL 44, TFL 37 and TFL 64, I accept the results and conclusions of the studies indicating that the ITI is the most accurate estimate of stand volume available for these three management units.

Regarding the request to redetermine the AAC for TFL 44, I have reviewed the results of the sensitivity analysis that incorporated the Lidar inventory as well as the adjusted minimum harvest age criteria (Table 49 and Figure 55 of the Timber Supply Analysis Report in the Management Plan 6). Applying the applicable adjustments from the 2023 AAC determination to that sensitivity analysis results in an initial term timber supply (10-year) of 674 900 cubic metres, that is approximately 5.0 percent above the current AAC of 642 800 cubic metres. Although I note that while short-term timber supply increased, across the entire planning horizon timber supply was 6.0 percent below the base case.

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In considering these factors I have determined that use of the adjusted Lidar inventory does substantively change the timber supply characteristics of TFL 44. Based on this information a review of the AAC for TFL 44 is warranted and I will direct FAIB staff to schedule a timber supply review for TFL 44 as soon as possible.

Regarding the TFL 6 adjusted-ITI inventory, I have been advised by FAIB staff that prior to the recent ITI, the inventory for TFL 6 represented a mix of photo-interpreted forest cover with recent lidar updates and enhancements and they have reviewed that work and are confident in its accuracy. While I acknowledge the improved accuracy of the ITI inventories for TFL 37, TFL 44 and TFL 64, I am concerned that without field verification the adjusted-ITI inventory may not represent an improvement to the current TFL 6 inventory. Based on this, I recommend field validation sampling of the TFL 6 adjusted-ITI inventory.

Forest Analysis and Inventory Branch continues to work toward establishing a set of provincial standards for lidar inventories. In the interim, staff have prepared a guidance document for the validation of forest inventories based on lidar data. For future validation projects this guidance will supersede the recommendations provided for TFL 44, TFL 37 and TFL 64. For your reference, I have included this guidance document as an attachment.

Yours truly

Albert Nussbaum, RPF
Deputy Chief Forester

Attachment

pc: Shane Berg, Assistant Deputy Minister and Chief Forester
Jim Brown, Director, Forest Analysis and Inventory Branch
Tamara Brierley, Manager, Forest Analysis and Data management, Forest Analysis and Inventory Branch
Chris Butson, Manager, Forest Inventory, Forest Analysis and Inventory Branch
Mark Perdue, Senior Analyst - TFLs, Forest Analysis and Inventory Branch

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Appendix B: Tree Farm Licence 6 LiDAR Forest Inventory Validation Report

WESTERN
Forest Products

Tree Farm Licence 6

LiDAR Forest Inventory Validation

Version 1

"Marie-Eve Leclerc, RPF"

Marie-Eve Leclerc, RPF
Inventory and Carbon Forester
Western Forest Products Inc.

WESTERN
Forest Products

EXECUTIVE SUMMARY

This study evaluates the accuracy of Western Forest Products' forest cover and Individual Tree Inventory (ITI) in Tree Farm License (TFL) 6. The intent of this study is to guide decisions around inventory assumptions for the upcoming Timber Supply Review (TSR).

This study uses field data collected through a stratified sampling plan aligned with the Forest Analysis and Inventory Branch (FAIB) LiDAR Inventory Verification Requirements. 40 sample plots were established across volume quartiles to assess inventory performance in predicting stand volume and species composition throughout TFL 6. Each plot was established in a separate inventory polygon and consisted of one Integrated Plot Center and 4 auxiliary plots, 50m in each cardinal direction.

Each plot compares the volume, height, stem density and basal area measured from each sample plot to the predicted values from forest cover and ITI. The 2016 ITI was grown to 2024 with an adjustment applied to account for missing understory trees. The adjustment was developed from a previous study in TFL 6 comparing inventories to cruise plots.

Results show that the grown and adjusted ITI provides more accurate and precise volume estimates than forest cover, particularly in stands 60 years and older. While both inventories underestimated volume, the adjusted ITI had a lower mean error and standard deviation. Forest cover was stronger at predicting stem density and basal area values. Both inventories' height estimate errors were similar.

These findings for volume are consistent with previous inventory validation studies across other TFLs, all of which support the use of volumes from adjusted ITI over forest cover. Based on this evidence, it is recommended that the adjusted ITI be adopted for net merchantable volume estimates in the current TSR for stands aged 60 and older, while forest cover be used for stands <60. Given the strong results from forest cover's species prediction, it is recommended its species composition be used. This will ensure the most accurate and defensible estimates of timber volume.

WESTERN
Forest Products

CONTENTS

List of Figures

List of Tables

INTRODUCTION

Western Forest Products began flying LiDAR in 2012 over part of Tree Farm Licence (TFL) 6 and expanded coverage to the remainder of TFL 6, and TFLs 19, 25, 37, 39 and 44 by 2016. From the data collected through LiDAR, ground samples and stereo-imagery, an Individual Tree Inventory (ITI) was developed by Forsite Consultants Ltd. In 2021, an inventory evaluation in TFL 44 using cruise plots showed that adjusting ITI data to account for missing understory trees improved volume prediction and accuracy when compared to cruise data (Western Forest Products, 2021). The adjusted ITI estimated volume more accurately and precisely than WFP's photo interpreted forest cover and the provincial government's Vegetation Resources Inventory (VRI). Follow-up studies using stratified random field samples in TFLs 37, 44, and 64 confirmed consistent ITI underestimating volume bias across regions, with adjusted-ITI providing the most accurate and precise volume estimates (Mortyn 2024a, Mortyn, 2024b; Mortyn, 2024c). However, the accuracy of species estimates varied by TFL (Mortyn, 2024a; Mortyn, 2024b; Mortyn, 2024c).

These findings were presented to the Forest Analysis and Inventory Branch (FAIB) to validate using adjusted ITI inventory in landscape level planning for TFLs 44, 37, 64 and 6. The ITI was approved for all TFLs (44, 37 and 64) that underwent field verification (Nussbaum, 2024). The recommendation was to conduct field verification for TFL 6 before getting approval for use in further analysis. In 2024, FAIB published formal guidelines outlining the required field verification procedures and subsequent analysis (FAIB, 2024). A sampling plan was setup in TFL 6 in 2025 to complete the field verification process.

This study will evaluate the accuracy of the net merchantable volume, height, stem density, basal area, and species predicted by WFP's forest cover and ITI inventories compared to the data collected through the field verification sample plan. The VRI was not included in this analysis as it is effectively WFP's forest cover and produced almost identical results as the forest cover in previous analysis.

METHODOLOGY

Area of Interest

The sampling plan was established in TFL 6, located in northern Vancouver Island. It covers an area of 217,196ha with a forested area of 196,233ha (Huang, 2024). A total of 40 plots were distributed across TFL 6 (Figure 1). As part of the verification process, 5 plots were randomly selected for an external audit to meet the minimum requirement for operational cruising (Ministry of Forests, 2025). Once in the field, the auditor opted to verify an additional plot to show the forester in charge examples of what was previously found for a total of 6 audited plots.

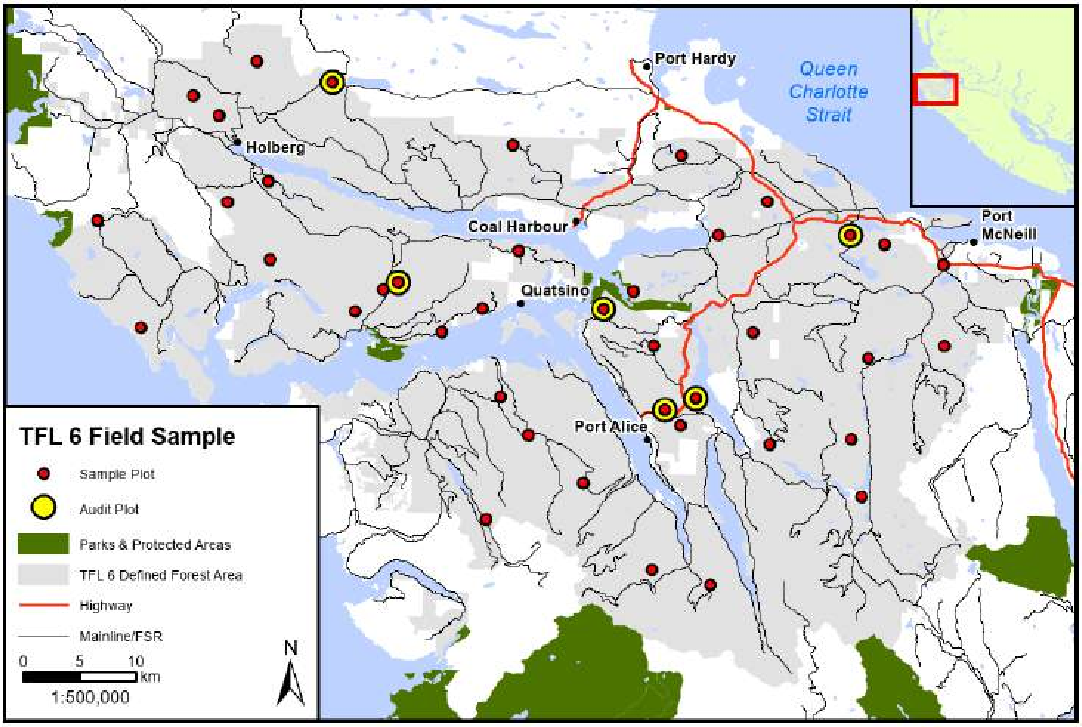


Figure 1 Location of field sample plots

Sample Plan

To meet the LiDAR Inventory Verification Requirements, a stratified sampling approach was used to select 40 plots across TFL 6 based on volume. Using WFP's 2023 forest cover, the TFL 6 land base was split into 10 volume quartiles, per the Lidar Inventory Verification Requirements (FAIB, 2024). Polygons without trees were omitted as were polygons under the age of 20, to ensure areas included in the project were of free to grow status. For each volume quartile, 4 polygons were randomly selected to establish 1 plot per polygon, for a total of 40 plots. Polygons were reviewed to ensure they were large enough to contain all sample plots without placing any plots near the edge of a different stand type or adjacent to non-forested areas. Selected plots were omitted if they intersected a stream or road. Additional polygons were selected as secondary options in the event the primary polygons were inaccessible by the field crews.

The field sampling followed the requirements established by FAIB (FAIB, 2024). For each plot, an Integrated Plot Center (IPC) was established, with 4 auxiliary plots, 50m in each cardinal direction (Figure 2). Each of these plots were established as variable radius using prisms. The prism was selected to average between 6 to 8 trees for the whole cluster, unless the tree density was so sparse and didn't allow for that, which was not uncommon in the lower volume quartiles. Only standing tree attributes were collected as only standing trees would be presumably collected from the LiDAR. Species, height, DBH and crown class of each counted tree was collected for each IPC and auxiliary plot.

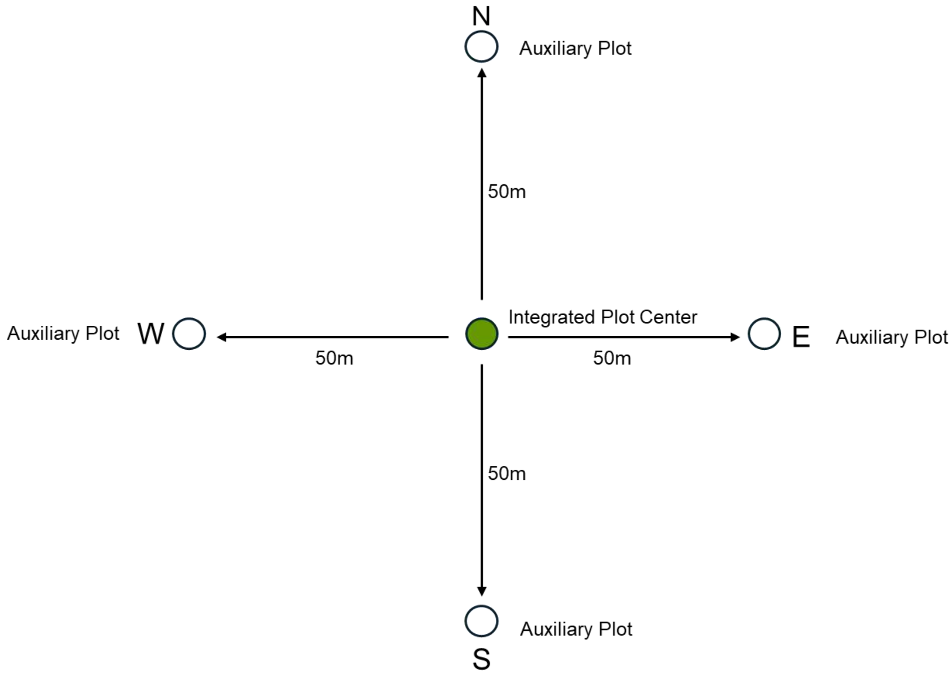


Figure 2 Configuration of sampling for each plot

Analysis

The field data was compiled as a Loss Factor cruise, following coastal DBH utilization standards (12.0cm for immature stands <121 years old, 17.5cm for mature stands >120 years old) (Ministry of Forests, 2025). Dead useless trees were omitted, per operational cruise compilation standards (Ministry of Forests, 2025).

The cruise data was compared to the 2016 ITI and the 2024 forest cover. The 2016 ITI volume was grown to 2024, to account for the almost 10 years difference between the time the LiDAR was flown and when the field verification occurred. It was predicted that the younger stands would have grown a considerable amount, potentially impacting the findings.

Following the assumptions from the TFL 6 information package, yield curves were developed to grow the 2016 ITI volume to 2024 to match the 2024 forest cover. Natural stands were grown using the Ministry of Forest's Variable Density Yield Projection (VDYP) (Ministry of Forests, 2023). Given the findings from previous studies comparing the ITI inventory, the adjustment factor to account for missed understory was incorporated directly into the new yield curves. The adjustment factor was derived from TFL 6's complete inventory analysis (Mortyn, 2025: Appendix).

To build the new volume adjusted curves, VDYP curve's shape was used and the 2016 ITI volume for each stand at the specific age as a starting point. The rest of the curve is then built using a yield curve adjustment formula derived from Piennar & Rheney (1995):

$$V_{Adj} = V_{VDYP} + V_{DIFF} * A_1 * A_2$$

$$A_1 = \frac{Age_i}{Age_{Inv}}$$

$$A_2 = e/e^{Age/Age_{Inv}}$$

Where:

V_{Adj} = Adjusted volume at any age

V_{VDYP} = Unadjusted volume from the VDYP yield curve

V_{DIFF} = Difference between the ITI volume and the VDYP yield curve volume

Age_{Inv} = Inventory age of the sample, and the age at which V_{VDYP} is measured

Age_i = x-axes of the yield curve

e = base of the natural logarithm

For managed stands, the yield curves used were grown in Table Interpolation Program for Stand Yields (TIPSY) 4.6 (Ministry of Forests, 2024), using 2016 LiDAR derived heights and site index as inputs (Huang, 2024). No ITI adjustments were added to stands <60 years, as there is less understory in younger stands and is assumed the volume is accurately captured by the LiDAR.

Following the requirements from FAIB, three statical analysis were performed to test the inventories against the established standards. A normalized mean absolute error was calculated using:

$$relative\ MAE = \frac{\sum(|\hat{y}_i - y_i|)/n}{(\sum y_i)/n}$$

Where:

$\hat{y}_i$ = inventory prediction

y_i = sample plot measurements

A 95% confidence interval was calculated using the ratio of means, where the sample plot measurements were divided by the inventory prediction.

According to FAIB's requirements an inventory could be considered unreliable if the normalized mean absolute error is >10%, or if the confidence interval exceeds 50% (0.5, 1.5) (FAIB, 2024).

A Region of Practical Equivalence (ROPE) was also run to assess if the predicted inventory is close to the sample plot measurements. 10% is a standard acceptance threshold to consider the predicted inventory being close to the sample plot measurements.

The species composition was tested using a confusion matrix based on the leading species of each sample. To meet FAIB's requirements, each species must score over 50% in accurately predicting the leading species (FAIB, 2024).

RESULTS

Landbase

With volume being the only required stratification for the establishment of the sampling plan, other attributes of the landbase such as age or harvestable landbase were not factored. As such, plots fell in these areas randomly. 90% of the plots fell within the timber harvestable landbase and 80% fell in stands < 200 years old (Table 1).

Table 1 Distribution of Plots on the Landbase

Attribute	Number of plots	Proportion of Sampling Plan
Landbase	**40**	**100%**
Timber Harvestable	36	90%
Non Timber Harvestable	4	10%
Age	**40**	**100%**
<60 years old	16	40%
60-199 years old	16	40%
200+ years old	8	20%

Net Merchantable Volume

Both forest cover and adjusted ITI inventories underpredicted volume in TFL 6 (Table 2). Overall, the grown and adjusted ITI was the most accurate and practically was the most precise, tied with the adjusted

ITI. The ITI pre-adjustment underestimated the volume on average by 251m^3/ha, while the adjusted ITI underestimated the volume by 162m^3/ha. On average, the grown and adjusted ITI had the best estimate and underpredicted by 100m^3/ha, while forest cover underpredicted by 168m^3/ha. The grown and adjusted ITI also had better precision with a standard deviation of 220m^3/ha vs the forest cover's standard deviation of 341m^3/ha. In all inventories, the older stands were less accurately estimated than younger stands.

Table 2 Comparison of inventory and field sample volumes sample plots.

Inventory	Sample Plots	Sample Volume (m^3/ha)	Inventory Volume (m^3/ha)	Mean Error (m^3/ha)	St. Dev. Error (m^3/ha)
Forest Cover	**40**	**679.3**	**511.2**	**-168.1**	**340.9**
<60 years	16	375.6	319.0	-56.6	188.6
≥60 and ≤ 120 years	15	832.7	608.6	-224.1	314.1
> 120 years	9	963.6	690.6	-273.2	533.4
ITI	**40**	**679.3**	**427.7**	**-251.7**	**233.4**
<60 years	16	375.6	192.7	-182.9	180.2
≥60 and ≤ 120 years	15	832.7	617.6	-215.1	194.2
> 120 years	9	963.6	528.8	-434.9	298.4
ITI Adjusted	**40**	**679.3**	**516.7**	**-162.6**	**219.4**
<60 years	16	375.6	192.7	-182.9	180.2
≥60 and ≤ 120 years	15	832.7	696.1	-136.7	188.5
> 120 years	9	963.6	793.9	-169.9	331.0
ITI Grown and Adjusted	**40**	**679.3**	**579.1**	**-100.2**	**220.1**
<60 years	16	375.6	298.9	-76.8	173.9
≥60 and ≤ 120 years	15	832.7	761.0	-71.7	189.3
> 120 years	9	963.6	774.1	-189.7	324.5

When plotting the net merchantable volume estimate error, it is apparent the grown and adjusted ITI is more precise when estimating volume, shown by the smaller spread in the points around the x-axis than forest cover (Figure 3). Without adjustment, ITI underestimates volume in the older stands more consistently than in the younger stands.

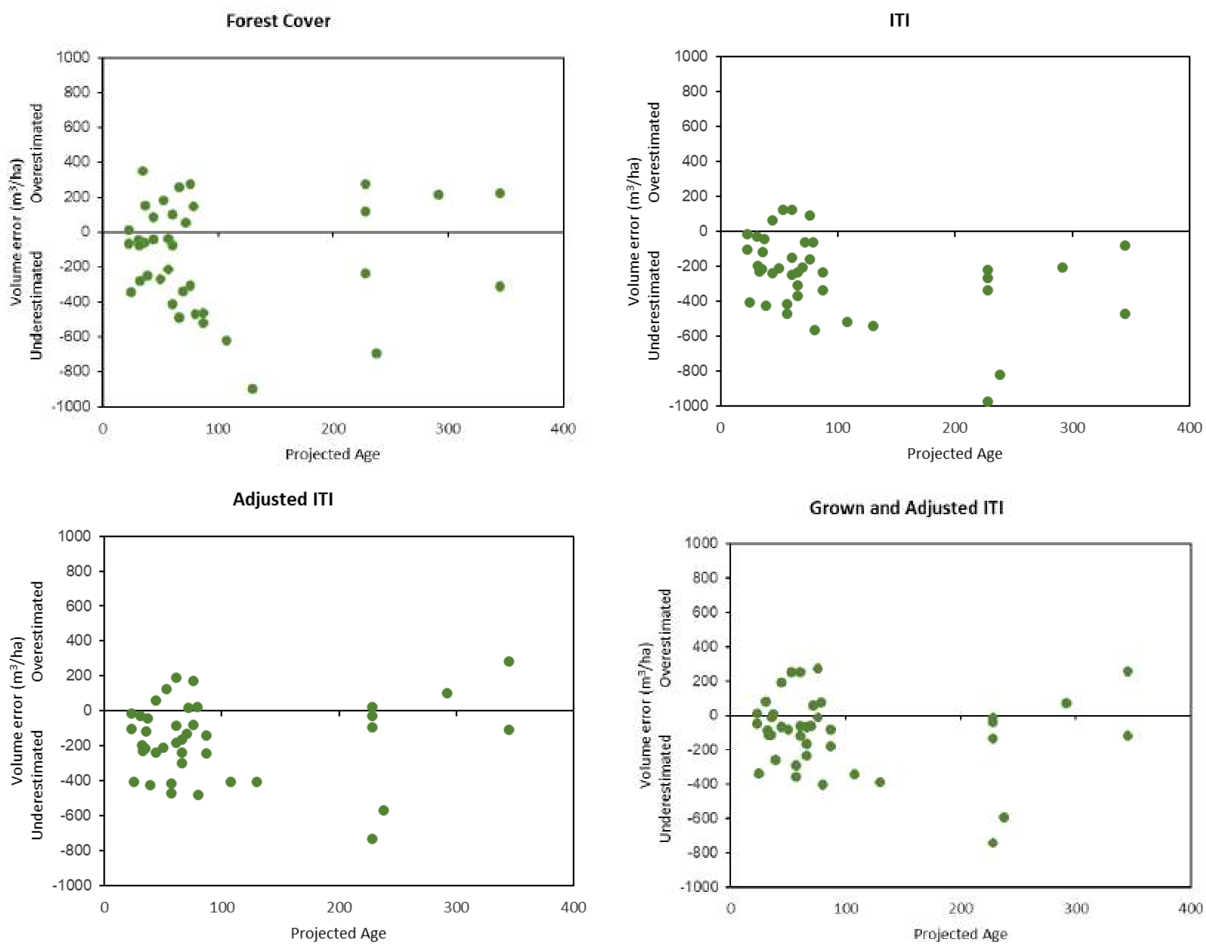


Figure 3 Residual plots of predicted net merchantable volume by age for TFL 6 inventories using sample plots.

All inventories had normalized mean absolute errors above 10% (Table 3), indicating bias. The grown and adjusted ITI had the lowest error (26%), followed by the adjusted ITI (31%), while forest cover had the highest (43%). For all ITI inventories, errors were lower in stands ≥60 years than in younger stands.

A ratio of means >1 indicates volume underestimation, and <1 indicates overestimation. All inventories underestimated volume, with ITI and adjusted ITI showing the largest errors (Table 3). Their confidence intervals had negative lower bounds in stands <60 years due to wide intervals and low means, though ratios can't be negative in practice. Forest cover and grown/adjusted ITI also underestimated volume but to a lesser extent. Forest cover's confidence interval partially met the 50% threshold, while the grown and adjusted ITI nearly fully met it. All inventories performed better in stands ≥60 years, with adjusted and grown/adjusted ITI meeting the threshold.

Table 3 The normalized mean absolute error, ratio of means and 95% confidence interval for net merchantable value for forest cover and ITI. These metrics were assessed for the whole sample (bold) and as a subset.

Net Merchantable Volume	Sample Plots	Forest Cover	ITI	Adjusted ITI	Grown and Adjusted ITI
Normalized Mean Absolute Error (%)	**40**	**43**	**40**	**31**	**26**
<60 years	16	41	55	55	39
≥60 years	24	43	36	25	23
Ratio of Means (%) [95% Confidence Interval]	**40**	**1.63 [1.24, 2.02]**	**31.0 [-13.6, 75.6]**	**30.5 [-14.1, 75.2]**	**1.30 [1.04, 1.56]**
<60 years	16	1.64 [0.87, 2.41]	74.4 [-41.4, 190.3]	74.4 [-41.4, 190.3]	1.51 [0.85, 2.16]
≥60 years	24	1.62 [1.16, 2.07]	2.10 [1.18, 3.01]	1.26 [1.09, 1.42]	1.17 [1.02, 1.31]

A ROPE test was run for the ITI, adjusted ITI, the grown and adjusted ITI, and forest cover. For all inventories, the test came back as inconclusive since the confidence interval fell partially within the ROPE threshold of 10% (0.9-1.1) (Figure 4). This indicates it is uncertain if the inventories' net merchantable volume predictions are close to the sample plot measurements.

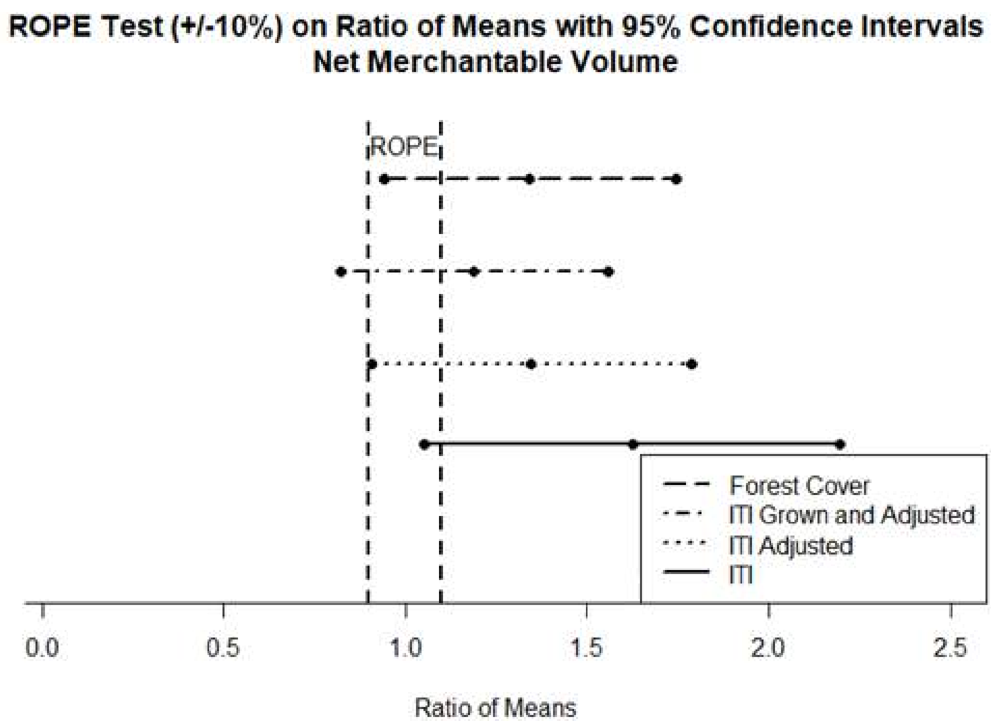
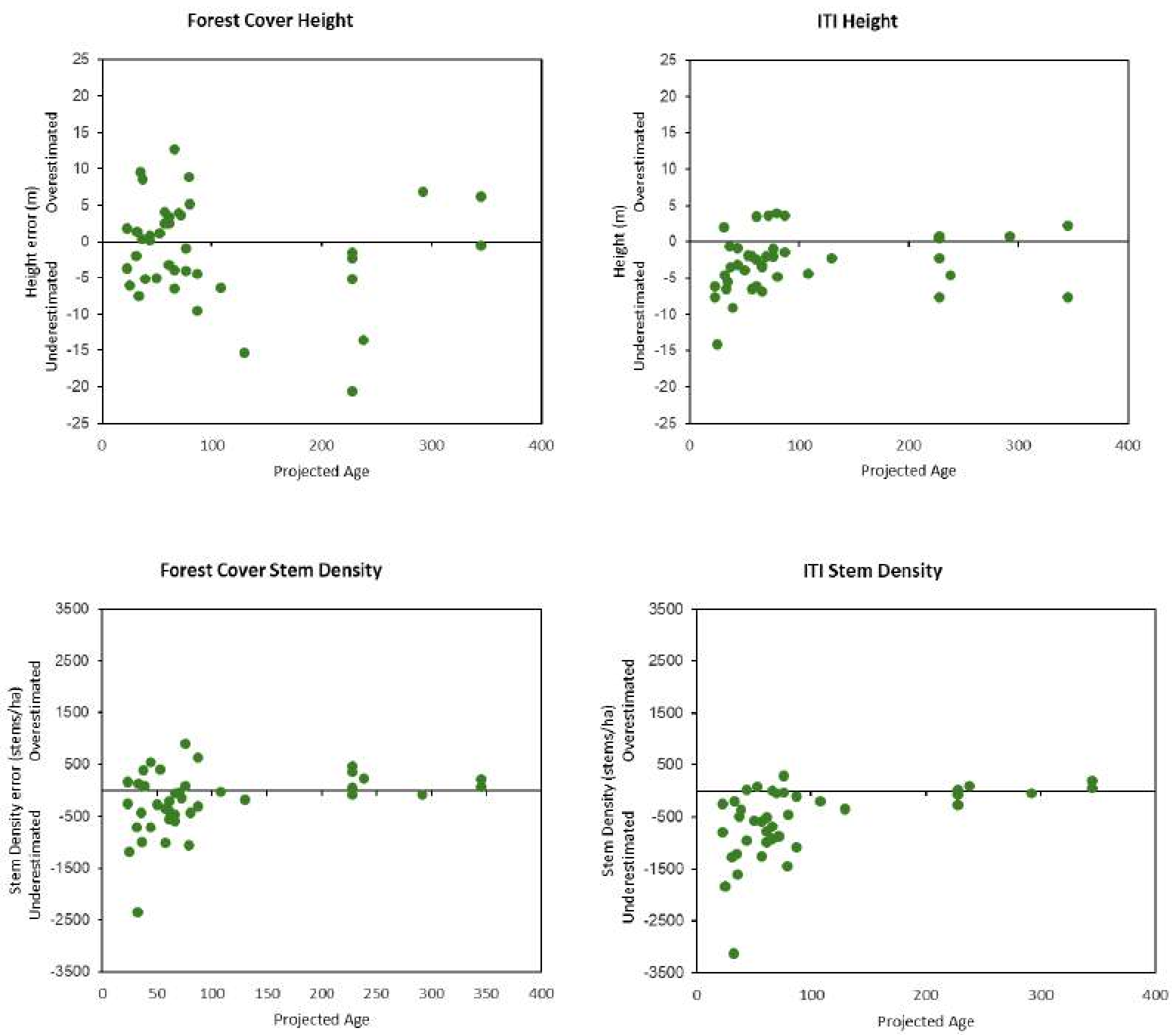


Figure 4 A Region of Practical Equivalence (ROPE) test for the inventories' prediction of net merchantable volume, to determine if they are acceptably close to the sample plots measurement.

Other Attributes

Overall, when looking at residuals of height, stem density and basal area, both inventories' predictions underestimated (Figure 5). Furthermore, ITI underestimated more than forest cover in all attributes. For height, ITI had a smaller spread of data than forest cover. For stem density, ITI underestimated more than forest cover particularly in the younger stands, which is also reflected in the residual plot for basal area.



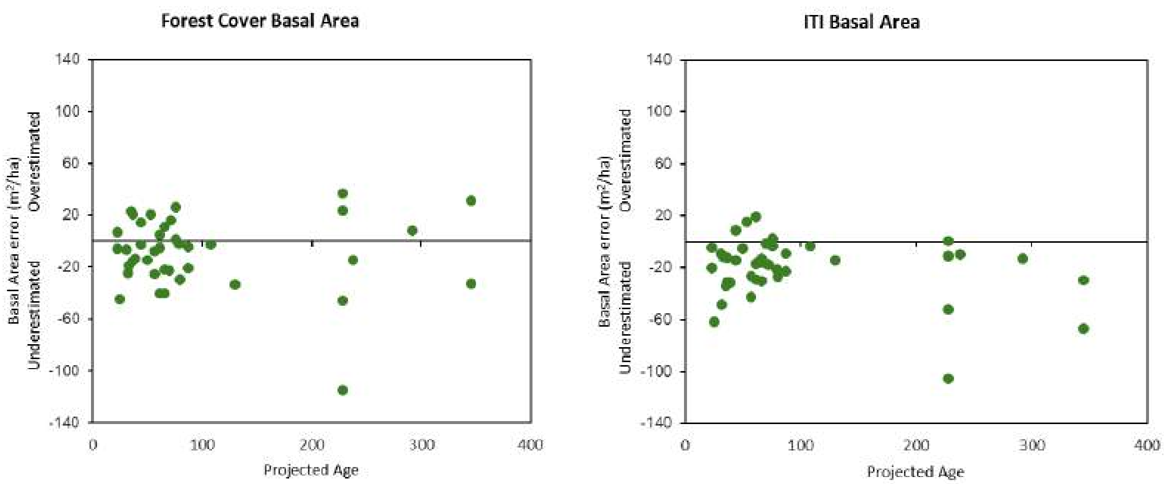


Figure 5 Residual plots of predicted height, stem density and basal area by age for TFL 6 inventories using sample plots.

Height had the lowest normalized mean absolute errors for both forest cover (18%) and ITI (14%), with ITI meeting the threshold in stands ≥60 years (10%) (Table 4). Stem density had the highest errors, especially for ITI (67% overall, 78% in stands <60 years), while forest cover performed better (48% overall). Basal area errors were similar overall (ITI 35%, forest cover 33%), but ITI had higher error in younger stands (52% vs. forest cover's 37%). For all attributes, both inventories performed better in stands ≥60 years than in younger stands.

All inventories underestimated each attribute, with ITI showing the largest errors in stem density and basal area, especially in stands <60 years (Table 4). ITI's basal area confidence interval had a negative lower bound due to its wide range and low mean, though a negative ratio of means isn't practically possible. In stands ≥60 years, ITI's ratios were closer to forest cover but still showed greater underestimation and wider intervals. For height, both inventories met the 50% threshold, as did forest cover for stem density and basal area.

Table 4 The normalized mean absolute error, ratio of means and 95% confidence interval tested for height, stem density and basal area for forest cover and ITI inventories. These metrics were assessed for the whole sample (bold) and as a subset.

	Sample plots	Height		Stem Density		Basal Area	
		Forest Cover	ITI	Forest Cover	ITI	Forest Cover	ITI
Normalized Mean Absolute Error (%)	**40**	**18**	**14**	**48**	**67**	**33**	**35**
<60 years	16	18	23	53	78	37	53
≥60 years	24	19	10	43	56	31	28
Ratio of means (%) [95% Confidence Interval]	**40**	**1.07 [0.97-1.16]**	**1.25 [1.09-1.42]**	**1.30 [1.05-1.56]**	**82.0 [8.31-155.6]**	**1.28 [1.07-1.5]**	**29.4 [-3.48-62.4]**
<60 years	16	1.03 [0.89-1.16]	1.52 [1.13-1.91]	1.56 [1.04-2.09]	200.7 [21.7-379.7]	1.29 [0.88-1.7]	70.8 [-12.7-154.2]
≥60 years	24	1.09 [0.96-1.22]	1.08 [1.00-1.16]	1.13 [0.88-1.38]	2.84 [0.82-4.85]	1.28 [1.03-1.53]	1.90 [0.94-2.86]

ROPE tests were run for ITI and forest cover on height, stem density, and basal area (Figure 6). Predictions for height (both inventories), and forest cover's stem density and basal area were inconclusive, with confidence intervals partially within the 10% ROPE threshold. ITI's stem density and basal area fell outside the threshold, indicating they were practically different from sample plot measurements.

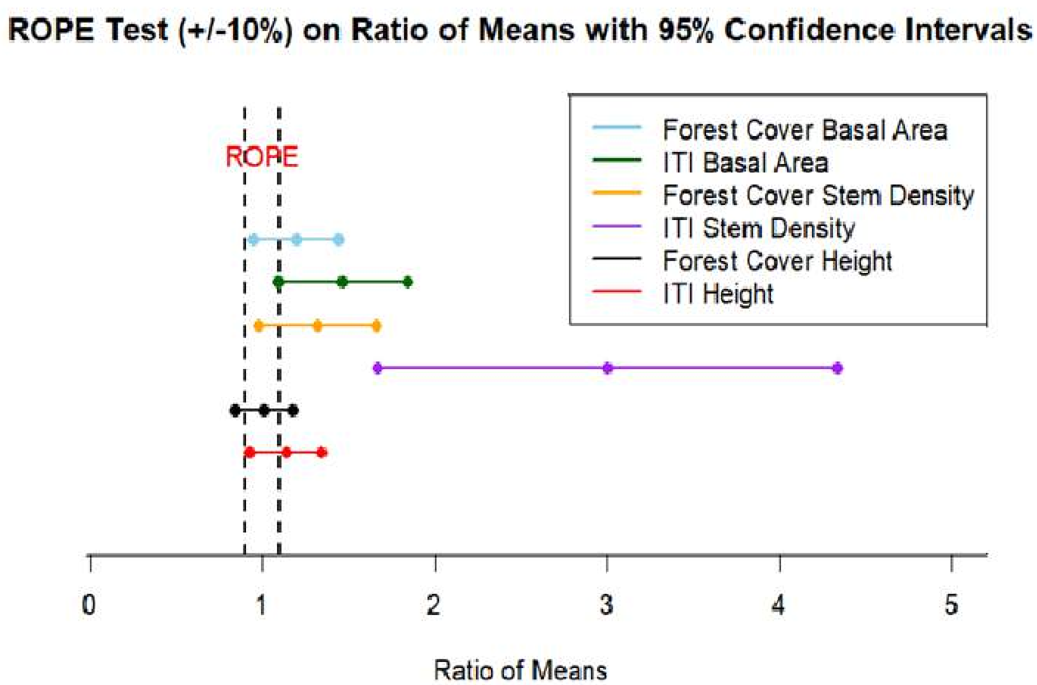


Figure 6 A Region of Practical Equivalence (ROPE) test for the inventories' prediction of various attributes, to determine if they are acceptably close to the sample plots measurement.

Species

Confusion matrices of the predicted versus measured leading species were developed for each of the sample plots using both ITI and forest cover. ITI correctly identified the leading species for 70% of plots compared with 88% for forest cover (Table 5, Table 6). Forest cover more accurately predicted species than the ITI in the sample plan. To meet FAIB's requirements, each ITI leading species needs to score over 50% to be considered accurate, which was not the case.

Table 5 Comparison of predicted leading species by ITI versus sampled leading species for all sample plots.

	ITI Leading Species								
Cruise Leading Species	**Ba**	**Cw**	**Fd**	**Hw**	**Ss**	**Yc**	**D**	**Total**	**% Correct**
Ba		1		1				2	**0%**
Cw		**5**		2			1	8	**63%**
Fd				1				1	**0%**
Hw	1	4		**23**				28	**82%**
Ss								0	
Yc		1						1	**0%**
D								0	
Total	1	11	0	27	0	0	1	40	
% Correct	**0%**	**45%**		**85%**			**0%**		**70%**

Table 6 Comparison of predicted leading species by forest cover versus sampled leading species for all sample plots.

	Forest Cover Leading Species								
Cruise Leading Species	**Ba**	**Cw**	**Fd**	**Hw**	**Ss**	**Yc**	**D**	**Total**	**% Correct**
Ba	**2**							2	**100%**
Cw		**6**		2				8	**75%**
Fd			**1**					1	**100%**
Hw		1	1	**26**				28	**93%**
Ss								0	
Yc		1						1	**0%**
D								0	
Total	2	8	2	28	0	0	0	40	
% Correct	**100%**	**75%**	**50%**	**93%**					**88%**

However, when breaking down the confusion matrix by <60 years and ≥ 60 years old, it is apparent the ITI scores better in stands ≥ 60 years old with over 50% of each leading species (Table 7). However, the forest cover still scored higher overall (Table 8).

Table 7 Comparison of predicted leading species by ITI versus sampled leading species for plots ≥ 60 years old.

	ITI Leading Species								
Cruise Leading Species	**Ba**	**Cw**	**Fd**	**Hw**	**Ss**	**Yc**	**D**	**Total**	**% Correct**
Ba				1				1	**0%**
Cw		**4**		2				6	**67%**
Fd								0	
Hw		1		**15**				16	**94%**
Ss								0	
Yc		1						1	**0%**
D								0	
Total	0	6	0	18	0	0	0	24	
% Correct		**67%**		**83%**					**79%**

Table 8 Comparison of predicted leading species by Forest Cover versus sampled leading species for plots ≥ 60 years old.

	Forest Cover Leading Species								
Cruise Leading Species	**Ba**	**Cw**	**Fd**	**Hw**	**Ss**	**Yc**	**D**	**Total**	**% Correct**
Ba	**1**							1	**100%**
Cw		**4**		2				6	**67%**
Fd								0	
Hw				**16**				16	**100%**
Ss								0	
Yc		1						1	**0%**
D								0	
Total	1	5	0	18	0	0	0	24	
% Correct	**100%**	**80%**		**89%**					**88%**

In the <60 plots, the ITI accurately predicted western hemlock 89% of the time, but it was the only species that scored over 50% (Table 9). Forest cover correctly predicted all its species over 50% and scored higher overall with 88% (Table 10).

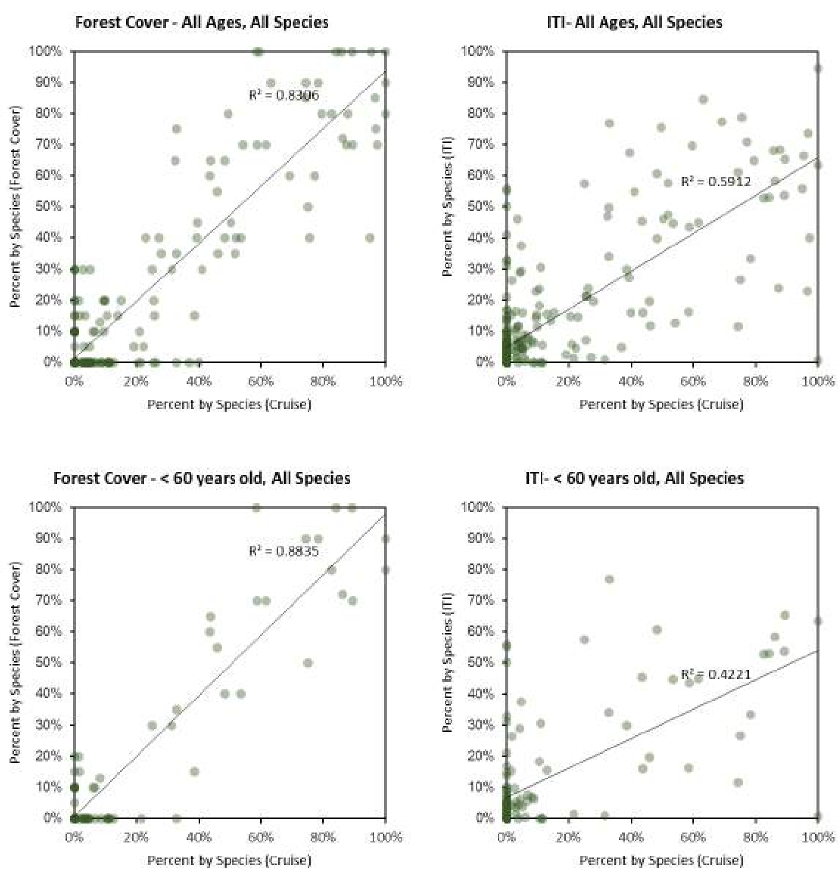
Table 9 Comparison of predicted leading species by ITI versus sampled leading species for plots < 60 years old.

	ITI Leading Species								
Cruise Leading Species	**Ba**	**Cw**	**Fd**	**Hw**	**Ss**	**Yc**	**D**	**Total**	**% Correct**
Ba		1						1	**0%**
Cw		**1**					1	2	**50%**
Fd				1				1	**0%**
Hw	1	3		**8**				12	**67%**
Ss								0	
Yc									
D								0	
Total	1	5	0	9	0	0	1	16	
% Correct	**0%**	**20%**		**89%**			**0%**		**56%**

Table 10 Comparison of predicted leading species by Forest Cover versus sampled leading species for plots < 60 years old.

	Forest Cover Leading Species								
Cruise Leading Species	**Ba**	**Cw**	**Fd**	**Hw**	**Ss**	**Yc**	**D**	**Total**	**% Correct**
Ba	**1**							1	**100%**
Cw		**2**						2	**100%**
Fd			**1**					1	**100%**
Hw		1	1	**10**				12	**83%**
Ss								0	
Yc								0	
D								0	
Total	1	3	2	10	0	0	0	16	
% Correct	**100%**	**67%**	**50%**	**100%**					**88%**

Forest cover showed a stronger correlation with cruise data for species composition by plot, with an overall coefficient of determination of 83% compared to ITI's 59% (Figure 7). In stands <60 years, forest cover performed significantly better (88% vs. ITI's 42%). While ITI improved in stands ≥60 years (71%), forest cover still had a higher correlation at 79%.



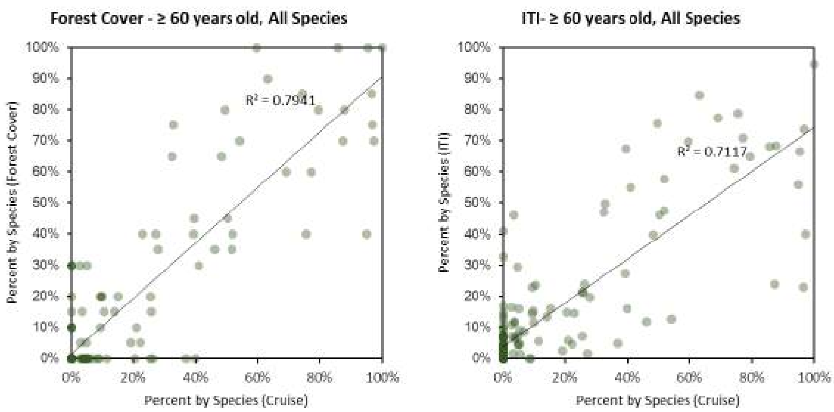


Figure 7 Overall species composition comparison between forest cover and ITI to plot data by all ages, plots < 60 years old and ≥ 60 years old

DISCUSSION

The grown and adjusted ITI, accounting for tree growth since 2016, was the most accurate and precise inventory tested for net merchantable volume. It had the lowest mean error, one of the lowest standard deviation errors, the lowest normalized mean absolute error, and its ratio of means confidence interval met the 50% threshold. However, the ROPE test found the predictions inconclusive, as the volume was still underestimated.

These findings support the analysis done using cruise data in TFL 6, which found the adjusted ITI had better accuracy and precision for net volume estimates than forest cover (Mortyn, 2025). Despite accounting for tree growth, the sampling plan revealed that the grown and adjusted ITI still underestimated volume and had a larger standard deviation than the prior study. This discrepancy is likely due to the cruise data having more plots per harvest block, whereas the field sample had only five plots within a 50 m radius in one inventory polygon, limiting its ability to capture within-polygon variability.

This is WFP's first study exploring the ITI's accuracy for younger stands (<60 years). The findings suggest the ITI underestimates volume, stem density, and basal area. This is likely because the 2016 ITI excludes trees under 10 m tall. Many of the younger stands in the sample likely had trees below this threshold when the LiDAR was collected, resulting in their omission from the inventory. Additionally, as these stands approach 30–40 years and enter the self-thinning phase, some understory trees may be missed by LiDAR—a known limitation in older stands.

For younger stands, forest cover outperformed the ITI in predicting volume, stem density, and basal area. Unlike older stands (≥60 years), younger ITI stands do not receive adjustment factors to account for missed understory trees, since the adjustment factor was derived from stands ≥60 years. In contrast, forest cover volume predictions for these stands are based on managed stand yield curves, which may be more accurate than natural stand curves. Furthermore, younger managed stands benefit from more current and detailed data in forest cover, contributing to improved predictions for both stem density and basal area.

In stands ≥60 years old, the ITI generally underestimated stem density and basal area, likely due to LiDAR missing understory trees. It also tends to underestimate diameters—Figure 3 shows two older stand points underestimated because of large-diameter cedars, which the ITI's DBH algorithm may not capture well. This issue is likely more pronounced in TFL 6's rich sites, especially in older stands, reinforcing the need to adjust ITI volume for missing stems.

Overall, forest cover more accurately predicted stem density and basal area than the ITI, with a lower normalized mean absolute error and a ratio of means confidence interval within the 50% threshold. However, the ROPE test remained inconclusive, and both attributes were still underestimated. In contrast, the ITI's ROPE test showed it was significantly different from sample plot measurements, making forest cover the better option for these predictions.

Height was the best-predicted attribute by both forest cover and ITI, with the lowest normalized mean absolute error and a ratio of means confidence interval within the 50% threshold. The ITI underestimated height, likely because its data is based on 2016 LiDAR, nearly a decade before sample plot measurements. Underestimation was greater in younger stands, consistent with their faster growth rates. However, the ROPE test found both predictions inconclusive, leaving uncertainty about their closeness to actual measurements. ITI height prediction is the better option for older stands since it had a lower normalized mean absolute error than forest cover. It is possible that the ITI would've also better predicted height in younger stands had the tree height been grown for the analysis.

The ITI performed worse than forest cover in predicting species composition, both in the confusion matrix and overall accuracy. According to FAIB standards, ITI results from field verification did not meet the required threshold. This lower performance in stands <60 years old is likely due to less developed crowns, making species identification via LiDAR—based on geometry, point density, and reflectivity—less reliable. In contrast, forest cover uses survey data for planted stands, which is typically more accurate than ortho-imagery interpretation.

The ITI species prediction in stands ≥ 60 years old also had a lower correlation than the forest cover in the overall species composition and in predicting leading species in the confusion matrix. This contradicts Mortyn (2025) which found that ITI was accurate 84% of the time at predicting the leading species of a block, whereas forest cover was 79%. In that study, the species composition predicted in both the forest cover and the ITI are averages over the entire area of a block whereas the field verification sample plots only represent one specific area within a polygon. From previous studies, it is known that ITI is better at predicting species over a larger scale, like the block level rather than the plot level. A better way to capture the polygon's species composition would be to establish more plots methodically throughout the polygon, following operational cruise methodology (Ministry of Forests, 2025).

CONCLUSION

This field validation study reinforces that the grown and adjusted ITI provides more accurate and precise estimates of stand volume than WFP's forest cover inventory in TFL 6. While both inventories underestimated volume, the grown and adjusted ITI outperformed forest cover for stands ≥ 60 years. These findings align with previous studies across multiple TFLs, confirming the reliability of adjusted ITI as a preferred inventory source. Forest cover consistently performed better in predicting leading species both overall and in the confusion matrix.

Based on these findings, it is recommended for the Timber Supply Review that the grown and adjusted ITI be used for net merchantable volume predictions for stands ≥ 60 years. Forest cover should be used for the species' prediction for all stands. This will ensure the most accurate and defensible estimates of standing timber volume and species composition to support landscape level forest management decisions.

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EVALUATION OF VOLUME AND SPECIES ACCURACY OF FOREST INVENTORIES

Version 2
August 2025

"Joel Mortyn, RPF"

Joel Mortyn, RPF
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REVISION HISTORY

Version	Date	Description
1	Sept 20, 2024	Initial version
2	August 7, 2025	• Analysis re-run to correct errors in block area. Volumes (m^3/ha) for cruise, forest cover and ITI were incorrectly being calculated based on the same net block shape. Cruise volumes were recalculated based on the cruised block area and ITI volumes recalculated based on the net block area buffered -10m. • Added leading species confusion matrix.

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EXECUTIVE SUMMARY

This study was conducted to test the accuracy of volume and species estimates of Western's forest cover inventory and individual tree inventory (ITI) in Tree Farm License (TFL) 6. This is to identify which forest inventory is best to use in ongoing TFL 6 Timber Supply Review and Quatsino Integrated Resource Management Plan.

An analysis was conducted using cruise data from 394 cut blocks, consisting of 6,975 individual cruise plots and representing an area of 6,907 ha. The analysis was conducted at the cut block level and blocks were randomly assigned into two datasets: training and testing. The training dataset was used to assess the accuracy and precision of forest cover and ITI volume estimates, and to develop an adjustment factor to ITI to account for missing stems. The testing dataset was used to independently test whether forest cover or the adjusted-ITI were more accurate and precise at estimating stand volume.

Data from all 394 blocks were used to evaluate the species accuracy of forest cover and ITI.

The study found that when adjusted to account for missing understory trees, that ITI is more accurate and precise than forest cover at predicting stand volume in TFL 6. The study also found that ITI generates more accurate species estimates than forest cover. At an individual species level, ITI generated more accurate species predictions for all species other than Douglas fir and yellow cedar.

This is the eleventh such analysis conducted in TFLs managed by Western since 2021. None of these studies have found that forest cover generates more accurate or more precise volumes than an adjusted-ITI. Eight of these studies, including this one, have been based on cruise plot data. It is recognized that cruise plots are not representative of the entire forested land base and over-represent the harvestable portion. As a result, three studies were based on randomly sampled stands in both the timber harvesting land base and non-contributing land base. These studies validated the findings of the cruise-based analyses, mitigating concerns that cruise plots lead to invalid conclusions.

It is recommended that the adjusted-ITI be used as the inventory to predict both stand volumes and species compositions in both the TFL 6 Timber Supply Review and in the Quatsino Integrated Resource Management Plan (IRMP). This should generate the most accurate estimates of standing timber volumes by species to support the AAC determination and to support land management decisions being made in the IRMP.

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CONTENTS

List of Tables

List of Figures

INTRODUCTION

Background

Tree Farm Licence (TFL) 6 is located in northern Vancouver Island around the communities of Port McNeill, Holberg and Port Alice. It covers an area of 217,196 ha with a forested area of 196,233 ha (Huang, 2024).

Forest Inventories

Western's forest cover inventory for TFL 6 is based on 1:15,000 colour aerial photography flown in 1995 that was photo-interpreted in 1999. In 2001, ground sample plots were randomly established in the TFL in polygons considered operable for harvesting to develop statistical adjustments for height, age and net merchantable volume (Phase II adjustments). Stands established since 1961 were not adjusted as establishment attributes in these stands are known. The inventory is updated annually to account for stand growth, harvesting, other silviculture activities, wildfire and survey results.

In 2012, Western Forest Products (Western) acquired light detection and ranging (LiDAR) for a portion of TFL 6 and in 2016 it captured LiDAR for the remainder. In 2018, Western acquired a derived individual tree inventory (ITI) for the TFL. This inventory was developed by Forsite Consultant Ltd., and used the LiDAR data, ground samples and stereo-imagery to estimate the location, size (height, diameter at breast height, gross volume, net merchantable volume) and species of individual trees.

In 2018, the province acquired Western's forest cover inventory for TFL 6 to incorporate into the Vegetation Resources Inventory (VRI). Photo-interpreted estimates for height, age, site index and net merchantable volume are utilized in VRI rather than the Phase II adjusted values that are in Western's forest cover.

Recent History of Inventory Evaluations

In 2021, an inventory evaluation using cruise plots was conducted in TFL 44 (Western Forest Products 2021). It used a training set of data to develop an adjustment factor for ITI to account for missing understory trees. When tested against an independent set of testing data, it concluded that the adjusted-ITI was equally accurate but more precise at estimating volume and more accurate at estimating species percent than Western's forest cover. Subsequent studies in 2022 and 2023 using the same methodology were carried out in TFLs 37, 39-1 and 64 (previously TFL 39-2). Separate ITI adjustment factors were developed in each TFL, although the factors ended up being very consistent (TFL 37=0.625, TFL 39-1=0.627, TFL 44=0.624, TFL 64=0.676), indicating that the ITI volume bias was consistent across broad areas. When tested against independent cruise data, all studies found that the adjusted-ITI generated more accurate and precise volume estimates than Western's forest cover. The accuracy of ITI species estimates relative to forest cover varied by TFL.

As a result of the findings in TFL 44, a sensitivity was included in Management Plan #6 using the adjusted-ITI volumes, which formed the recommended scenario proposed by Ƈ̓awak ʔqin Forestry

(Huang 2023). However, in the rationale to support the TFL 44 allowable annual cut (AAC) determination, the Provincial Deputy Chief Forester recommended that the adjusted-ITI inventory be evaluated using a random sample of field plots, as the cruise samples on which the analysis was based were not considered to be representative of the entire productive forest area (Nussbaum 2023).

Field studies were subsequently conducted in TFLs 37, 44 and 64 in 2024 where a series of stratified random field samples were measured. All three studies confirmed the original findings based on the cruise plots, that the adjusted-ITI was accurate and precise at predicting standing volume than Western's forest cover (Mortyn 2024a, 2024b, 2024c). In addition, in all three studies, the ITI-adjusted volumes were tested against cruise data collected since the original analyses. These also found that the adjusted-ITI generated more accurate and precise stand volume estimates than forest cover in all three TFLs.

In summary, ten separate studies across four TFLs have been conducted since 2021. Seven of these have used cruise data independent of the data used to develop the adjustment factors. Recognizing that cruise plots may be biased, as they are established in areas planned for harvest, three additional studies were conducted using random samples collected in both the timber harvesting land base (THLB) and non-contributing land base (NCLB). Nine studies have found that the adjusted-ITI is more accurate than forest cover at estimating stand volume (the tenth found it was equally accurate), while all have found that it is more precise.

Purpose

The purpose of this study is to evaluate the accuracy of the volume and species estimates from the forest cover and ITI inventories using cruise plots that have been collected since the LiDAR was captured in TFL 6 in 2012 and 2016. The accuracy of VRI was not considered since it is based off Western's forest cover, and results from other TFLs showed almost identical results between VRI and forest cover.

METHODOLOGY

Cut blocks were used as the base unit for comparison of the three inventories. 394 cut blocks, consisting of 6,975 individual cruise plots and representing an area of 6,907 ha were used in this analysis. These were plots cruised since LiDAR was flown in 2012 or 2016. The cut block data was separated into two datasets: 1) training and 2) testing. The training dataset consisted of 310 randomly selected blocks, comprised of 5,580 cruise plots that were used to test the inventories and to develop an ITI volume adjustment factor. An independent set of 84 randomly selected blocks, comprised of 1,395 cruise plots were then used to test the accuracy of the inventories, including the volume adjusted ITI inventory.

The 394 blocks were well distributed across TFL 6 (Figure 1).

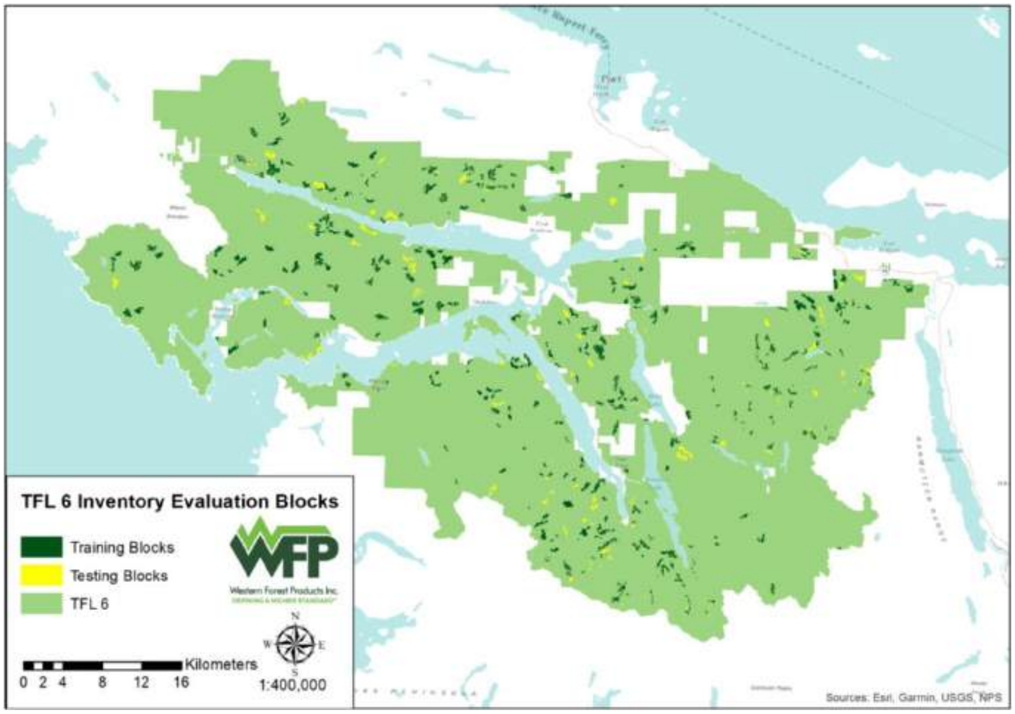

Figure 1 Location of training and testing blocks

All cruise plots within a block were compiled using the loss factor (LF) method in CruiseComp.

Western's 2023, 2019, 2015 and 2013 forest cover inventories were used for this analysis, which represent the forest as of December 31st of each year. As many blocks had been harvested in the years since cruise data was collected, the most recent forest cover inventory representing the stand prior to harvest was used. The area weighted volume (m^3/ha), age and species composition (%) of each sample polygon was used.

Western's ITI inventory, which represents the estimated tree points in either 2012 or 2016 was used. The forest cover polygons were buffered inward by 10m to remove any edge effects which can be caused by differences between the linework and the stand edge in the LiDAR point cloud. The combined net merchantable volume of each tree was divided by the area of the buffered polygon to give a net merchantable volume of the stand (m^3/ha). The combined volumes by species were used to generate species composition (%). The ITI inventory is not updated annually, so these records did not account for growth since LiDAR capture.

RESULTS

Net Merchantable Volume

Training Dataset

Both Western's forest cover inventory and ITI underpredicted volume in TFL 6 (Table 1). On average, both inventories underpredicted volume by approximately 200 m^3/ha, however ITI was considerably more precise, with a standard deviation of 196.6 m^3/ha versus 266.5 m^3/ha. ITI was more accurate than forest cover for stands ≤120 years of age but less accurate for older stands.

Table 1 Comparison of inventory and cruise volumes for training set of cut blocks.

		Cruise	Forest Cover		ITI	
	Blocks	Plots	Mean	St. Dev.	Mean	St. Dev.
≤120 years	98	2,195	-265.4	239.2	-73.2	132.9
>120 years	212	3,385	-167.2	272.2	-252.5	194.8
Total	**310**	**5,580**	**-195.4**	**266.5**	**-201.1**	**196.6**

Scatter plots of residuals show that ITI tended to increasingly underpredict volume with stand age, a similar pattern as seen in all other studies since 2021 in other TFLs (Figure 2). This is likely a result of the ITI failing to properly identify understorey trees, a consistent problem with LiDAR-derived inventories. In contrast, the scatter plot for forest cover shows an even spread around the x-axis, indicating consistent results across age classes. However, the points show much greater variability around the x-axis than ITI, reflecting the lower precision.

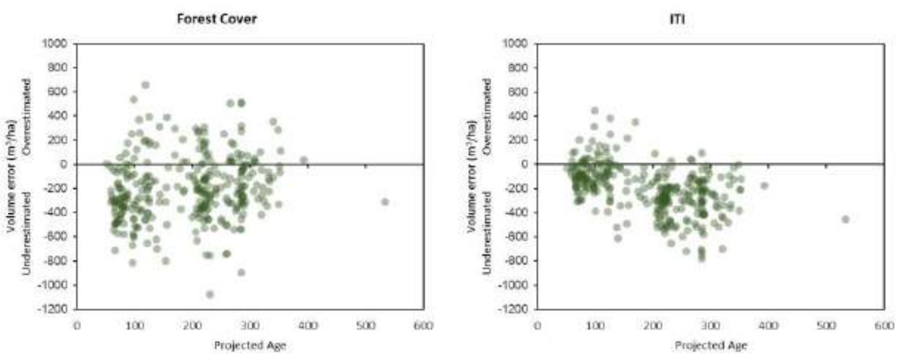

Figure 2 Residual plots of predicted volume by age for TFL 6 inventories using training blocks

Volume Adjustment

To account for ITI underpredicting volume in older stands, a linear regression model was fit to the ITI residuals using R version 4.2.1. The relationship between the ITI residuals and age appeared linear, so a two-parameter linear model was fitted but the intercept was found to be not significantly different from zero. Therefore, a single parameter linear model was applied. The impact of the LiDAR year (2012 and 2016) was tested but found not to be significant. The resulting model satisfied the assumptions of linear regression: linearity, homoskedasticity, lack of autocorrelation and normality (Table 2, Figure 3).

Table 2 Parameters for linear regression to ITI residuals versus age

Parameter	Estimate	Std. Error	t value	Pr(>|t|)
t1	-1.0545	0.0467	-22.56	< 2e-16

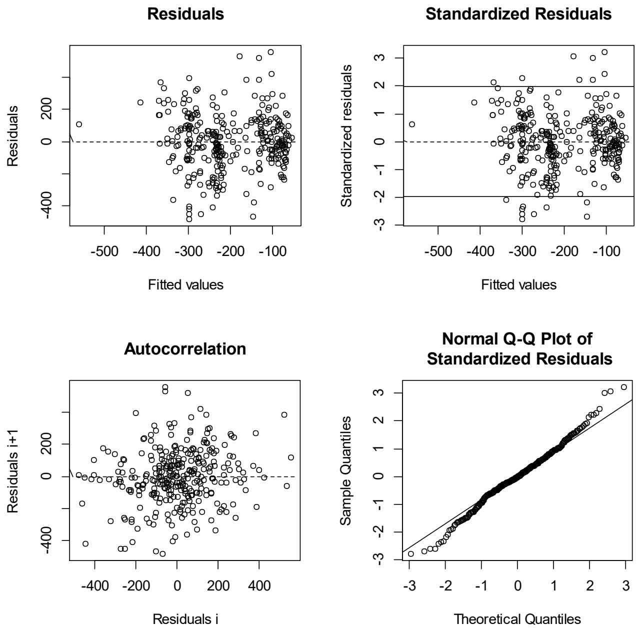

Figure 3 Plots showing linear model satisfied assumptions of linear regression

The ITI volume adjustment for TFL 6 is as follows:

$I_{adj} = I + 1.0545A$

Where:

I_{adj} = Adjusted-ITI net merchantable volume (m³/ha)

I = ITI net merchantable volume (m³/ha)

A = Projected age from Western's forest cover inventory

Testing Dataset

The net volume adjustment to ITI was tested using 84 independent cut blocks, consisting of 1,395 plots that were not used to develop the adjustment factor. The results showed that the adjusted-ITI inventory was both the most accurate and most precise at predicting stand volume (Table 3).

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Table 3 Comparison of inventory and cruise volumes for testing blocks.

		Cruise	Forest Cover		ITI		Adjusted-ITI	
	Blocks	**Plots**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**	**Mean**	**St. Dev.**
≤120 years	22	480	-291.9	198.7	-167.2	190.7	-19.4	120.4
>120 years	62	915	-194.7	263.3	-30.7	202.2	-8.8	174.2
Total	**84**	**1,395**	**-219.0**	**251.2**	**-133.1**	**201.4**	**-11.4**	**161.8**

Residual scatter plots show that the adjusted-ITI estimates are evenly spread around the x-axis across age classes, showing no bias (Figure 4). The residuals are also less spread than the forest cover chart, showing that the adjusted-ITI is more precise.

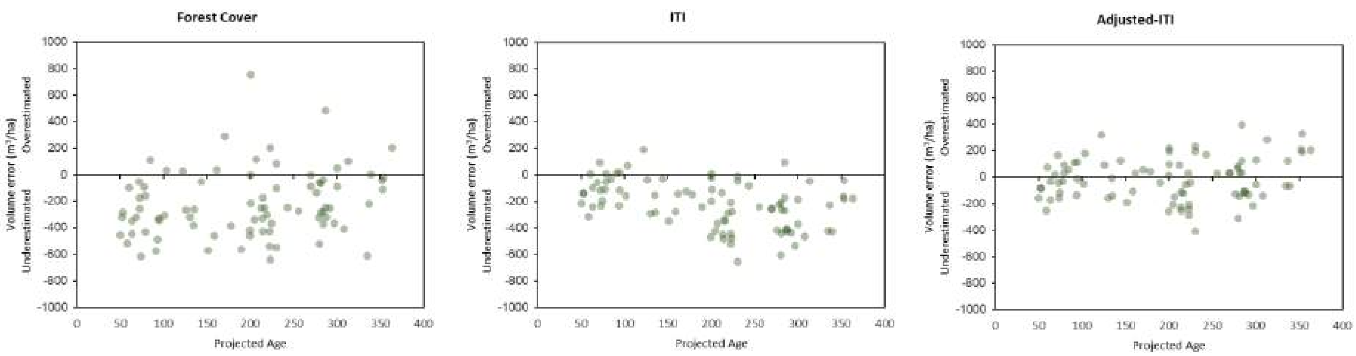

Figure 4 Residual plots of predicted volume by age for TFL 6 inventories using testing blocks

Species Composition

The species percentages by cut block from ITI were more well correlated with the species percentages from cruise data than forest cover (Figure 5). When considered by individual species, the species compositions from ITI were more well correlated with the measured species from cruise for all species other than Douglas fir and yellow cedar (Figure 6).

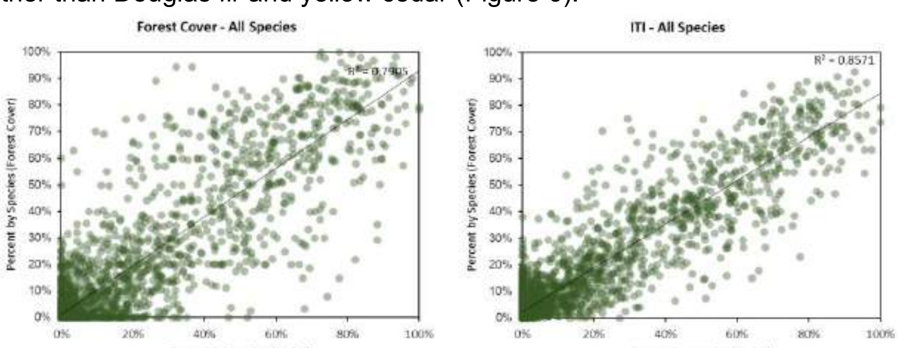

Figure 5 Predicted vs. cruised species percentages using forest cover and ITI for all blocks and all species

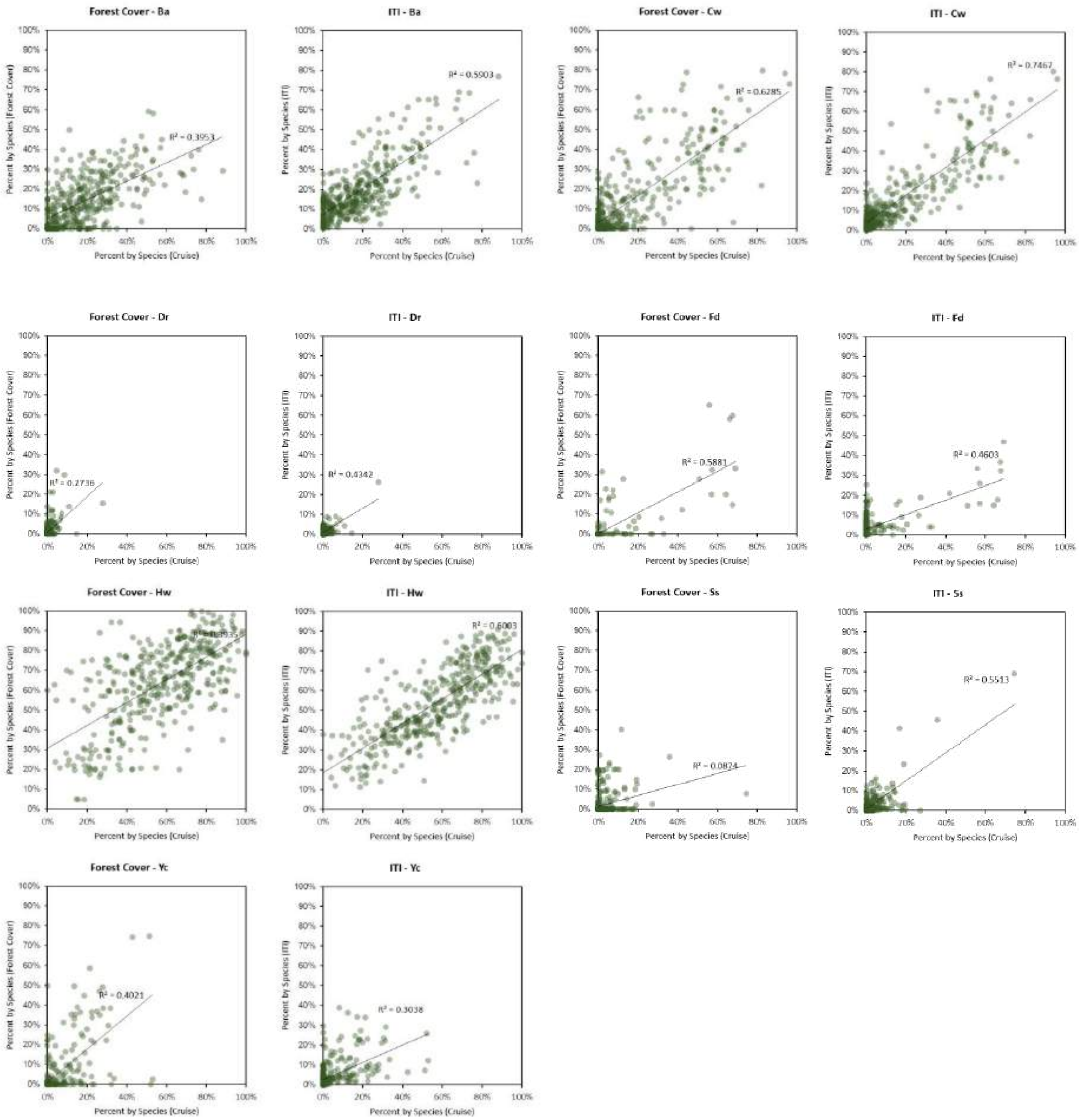

Figure 6 Predicted vs. cruised species percentages using forest cover and ITI for all blocks by species

Confusion matrices of the predicted versus cruised leading species were developed for each of the 394 cut blocks using both ITI and forest cover. ITI correctly identified the leading species for 84% of blocks compared with 79% for forest cover (Table 4, Table 5).

Table 4 Comparison of predicted leading species by ITI versus cruised leading species for all cut blocks.

	ITI Leading Species							
Cruise Leading Species	Ba	Cw	Fd	Hw	Ss	Yc	Total	% Correct
Ba	19			10		1	30	**63%**
Cw		46		21		1	68	**68%**
Fd			2	7			9	**22%**
Hw	15	3		262	1	1	282	**93%**
Ss					1		1	**100%**
Yc		2		2			4	**0%**
Total	34	51	2	302	2	3	394	
% Correct	**56%**	**90%**	**100%**	**87%**	**50%**	**0%**		**84%**

Table 5 Comparison of predicted leading species by forest cover versus cruised leading species for all cut blocks.

	Forest Cover Leading Species							
Cruise Leading Species	Ba	Cw	Fd	Hw	Ss	Yc	Total	% Correct
Ba	4			26			30	**13%**
Cw		34		29		5	68	**50%**
Fd			3	5	1		9	**33%**
Hw	2	10		268		2	282	**95%**
Ss				1			1	**0%**
Yc				2		2	4	**50%**
Total	6	44	3	331	1	9	394	
% Correct	**67%**	**77%**	**100%**	**81%**	**0%**	**22%**		**79%**

DISCUSSION

This analysis found that when adjusted to account for missing understory trees, ITI generates more accurate and precise volume estimates than forest cover in TFL 6. These conclusions are based off cruise data independent of the data used to develop the ITI volume adjustment. This study also found that ITI generates more accurate species estimates than forest cover, and for all individual species other than Douglas fir and yellow cedar.

This is the eleventh analysis testing the accuracy of ITI and forest cover since 2021 in TFLs managed by Western. None have found that forest cover generates more accurate or precise volume estimates than an adjusted-ITI inventory (Table 6). The accuracy of species estimates varies by TFL. Eight analyses have been based on cruise plots, including this one. As noted in rationale to support the AAC decision in TFL 44, cruise plots are not representative of the entire forested land base (Nussbaum, 2023). However, studies conducted in three TFLs using random samples in both the THLB and NCLB validated the findings of the earlier cruise plot studies (Mortyn 2024a, 2024b, 2024c), mitigating concerns that the conclusions based on cruise plot data are invalid.

Table 6 Summary of inventory analyses conducted by Western since 2021

TFL	Year	Samples	Sampled	Independent testing data?	Volume accuracy	Volume precision	Species accuracy	Reference
44	2021	Cruise Plots	THLB	Yes	Equal	Adjusted-ITI	ITI	Western Forest Products 2021
37	2022	Cruise Plots	THLB	Yes	Adjusted-ITI	Adjusted-ITI	Forest cover	Mortyn 2024b, Appendix 1
39-1	2022	Cruise Plots	THLB	Yes	Adjusted-ITI	Adjusted-ITI	Forest cover	Not published
64	2023	Cruise Plots	THLB	Yes	Adjusted-ITI	Adjusted-ITI	Equal	Mortyn 2024c, Appendix 1
44	2024	PPSWR Samples	THLB and NCLB	Yes	Adjusted-ITI	Adjusted-ITI	Forest cover	Mortyn 2024a
37	2024	PPSWR Samples	THLB and NCLB	Yes	Adjusted-ITI	Adjusted-ITI	Forest cover	Mortyn 2024b
64	2024	PPSWR Samples	THLB and NCLB	Yes	Adjusted-ITI	Adjusted-ITI	Equal	Mortyn 2024c
44	2024	Cruise Plots	THLB	Yes	Adjusted-ITI	Adjusted-ITI	ITI	Mortyn 2024a
37	2024	Cruise Plots	THLB	Yes	Adjusted-ITI	Adjusted-ITI	Forest cover	Mortyn 2024b
64	2024	Cruise Plots	THLB	Yes	Adjusted-ITI	Adjusted-ITI	ITI	Mortyn 2024c
6	2024	Cruise Plots	THLB	Yes	Adjusted-ITI	Adjusted-ITI	ITI	This study

CONCLUSION

It is in the public's interest that the most accurate forest inventories be used to support AAC determinations. Based on this study and earlier studies, the clear conclusion is that an adjusted-ITI inventory should generate more accurate and more precise volume estimates than Western's forest cover inventory. Across 11 studies spanning four years, there has been zero evidence to the contrary. This is not surprising; Western's forest cover inventory consists of multiple inventories that are approaching 30 years old, whereas ITI was developed in the last decade. In TFL 6, Western's forest cover was developed from photo-interpretation with field sampling for calibration, whereas ITI is based on a complete LiDAR coverage of the entire TFL. The ITI volume adjustment is based off data from 5,580 cruise plots collected over a decade.

It is recommended that the adjusted-ITI be used as the inventory to predict both stand volumes and species compositions in both the TFL 6 Timber Supply Review and in the Quatsino Integrated Resource Management Plan (IRMP). In the IRMP, accurate estimates for different species, and especially western red cedar, are vitally important. This analysis found that ITI generates more accurate estimates for all species other than yellow cedar.

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Mortyn, J. 2024a. Tree Farm Licence 44 - Validation of LiDAR Derived Individual Tree Inventory, Version 1, July 2024, C̓awak ʔqin Forestry Limited Partnership. 15pp.

Mortyn, J. 2024b. Tree Farm Licence 37 - Validation of LiDAR Derived Individual Tree Inventory, Version 1, July 2024, Western Forest Products. 25pp.

Mortyn, J. 2024c. Tree Farm Licence 64 - Validation of LiDAR Derived Individual Tree Inventory, Version 1, July 2024, La-kwa sa muqw Forestry Limited Partnership. 28pp.

Nussbaum, A. 2023. Tree Farm Licence 44 held by Tsawak-qin Forestry Limited Partnership Rationale for Allowable Annual Cut (AAC) Determination. Effective June 26, 2023. British Columbia Ministry of Forests. 37pp.

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Appendix C: FOR's Review of Western's TFL 6 LiDAR Forest Inventory Validation Report

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REVIEW OF WESTERN FOREST PRODUCT'S VALIDATION OF A LIDAR FOREST INVENTORY FOR TFL 6

FOR, Forest Analysis and Inventory Branch:
Remote Sensing and Geospatial Applications Team

The intent of this document is to review the validation report of a lidar derived forest inventory built for Tree Farm License 6, and report findings to the manager of the Inventory section of FAIB (Chris Butson). The analysis undertaken by Wester Forest Products Limited is intended to align with Forest Analysis and Inventory Branch (FAIB) recommendations for Enhanced Forest Inventories (EFI).
https://nrs.objectstore.gov.bc.ca/pfifor/LIDAREFI_product_delivery_v2_1_4.pdf
As per the EFI standards established by FAIB, any inventory that is intended to be considered as a potential input for analysis that would impact policy, including timber supply review, must be accompanied by an independent validation report. Western Forest Products are recommending that the Forest Cover layer be used in the current TSR apart from net merchantable volume estimates in stands over 60 yrs which should use the grown and adjusted ITI.

The inventories being evaluated in the WFP report are the Forest Cover inventory (FC) which was originally adapted from the VRI and lidar derived Individual Tree Inventory (ITI). The ITI was built from lidar surveys spanning the years from 2012 to 2016. The ITI was built by Foresite Consultants Limited in 2016. The report provides details on how the 2016 ITI was projected to the year 2024. The report also explains that the ITI was adjusted based on a factor, this factor was derived from errors found in an ITI for TFL44 relative to cruise plots collected in 2021. The adjusted ITI inventory (ITIadj) was also evaluated in the report as well as the projected and adjusted ITI inventory (ITIgrown_adj). WFP used ground reference data to support the inventory evaluation.

The sample type was selected as an integrated plot center (IPC) with four auxiliary plots at 50m from the IPC in the cardinal directions. At each of the five subplots prism sweeps were conducted, selecting a prism that would average 6-8 trees for the whole cluster. The sampling collected species, height, diameter and crown class for only standing trees. The sample size selected was 40 in total and the sampling population was the treed land base with stand ages greater than 20 years. The sample was distributed along the volume gradient of TFL6 according to the 2023 WFP Forest Cover inventory. The volume stratification binned the gradient into 10 intervals and from each bin four random selections were made. Samples were rejected and replaced in the following circumstances: intersections with stream or roads, near stand boundaries and minimum size requirements. Although the report does not detail the results of an audit campaign, there is mention of an external audit selection of six total plots.

Ground sample data were compiled as Loss Factor Cruise plots. Only live trees were considered with age dependent utilizations (12cm for stands <121 years old, 17.5cm for stands >120 years old). The report provides some details around the projection of the 2016 ITI to 2024. Natural stands were grown with VDYP and manage stand yield curves were built with TIPSY with lidar heights and site index. The afore-mentioned adjustment factor was incorporated into the yield curves but were only applied to stands greater than 60yrs.

The analysis intended to follow the recommendations made by FAIB for EFI evaluations. The EFI standards document suggests reporting on the relative mean absolute error, the 95% quantile interval of the relative error and a Region of Practical Equivalence (ROPE) test for the Ratio of Means (ROM) per inventory attribute. The standards document also states that leading species should be evaluated with a confusion matrix that reports estimates of users and producers' accuracy for individual species as well as overall species prediction accuracy.

The report documents the computed statistics for mean standard deviation for volume errors. In order of best to worst the report suggests the grown and adjusted ITI is most accurate followed by ITIadj, FC and lastly the unadjusted ITI. In terms of standard deviation of the errors the ITIadj is most precise followed by the grown and adjusted ITI, ITI, FC (note only all ages are being presented). According to the relative errors reported by WFP the grown and adjusted ITI is the most accurate followed by ITIadj, ITI, and lastly FC. The ROPE tests for the ROM produced all inconclusive results apart from the ITI stem density which was practically different from the ground sample. Finally, the results of the species confusion matrices were presented which suggested the FC was slightly more accurate for leading species. It should be noted however that the sample was not designed to balance species and that is reflected in the in the frequency of species. The species result is bias to the more abundant classes and should also be considered with caution.

The analysis put some effort into a secondary stratification based on age, where the analysis was computed for all ages, then stratified by ages less than 60yrs, 60-120years and finally greater than 120ys. However, this secondary stratification reduced the already small sample size which undermines the inferential statistics being applied. Therefore, any conclusions based on age strata should be considered with caution. This analysis is supported by an email dialogue with WFP dated Oct 27, 2025. The email discourse indicated there was some confusion with the analysis methods, WFP provided FAIB with a data table and the standard procedure was applied (appendices). The results of these analyses agreed with the conclusions stated in the report. Suggesting there is evidence for a marginal improvement in volume estimates over the WFPs Forest cover inventory.

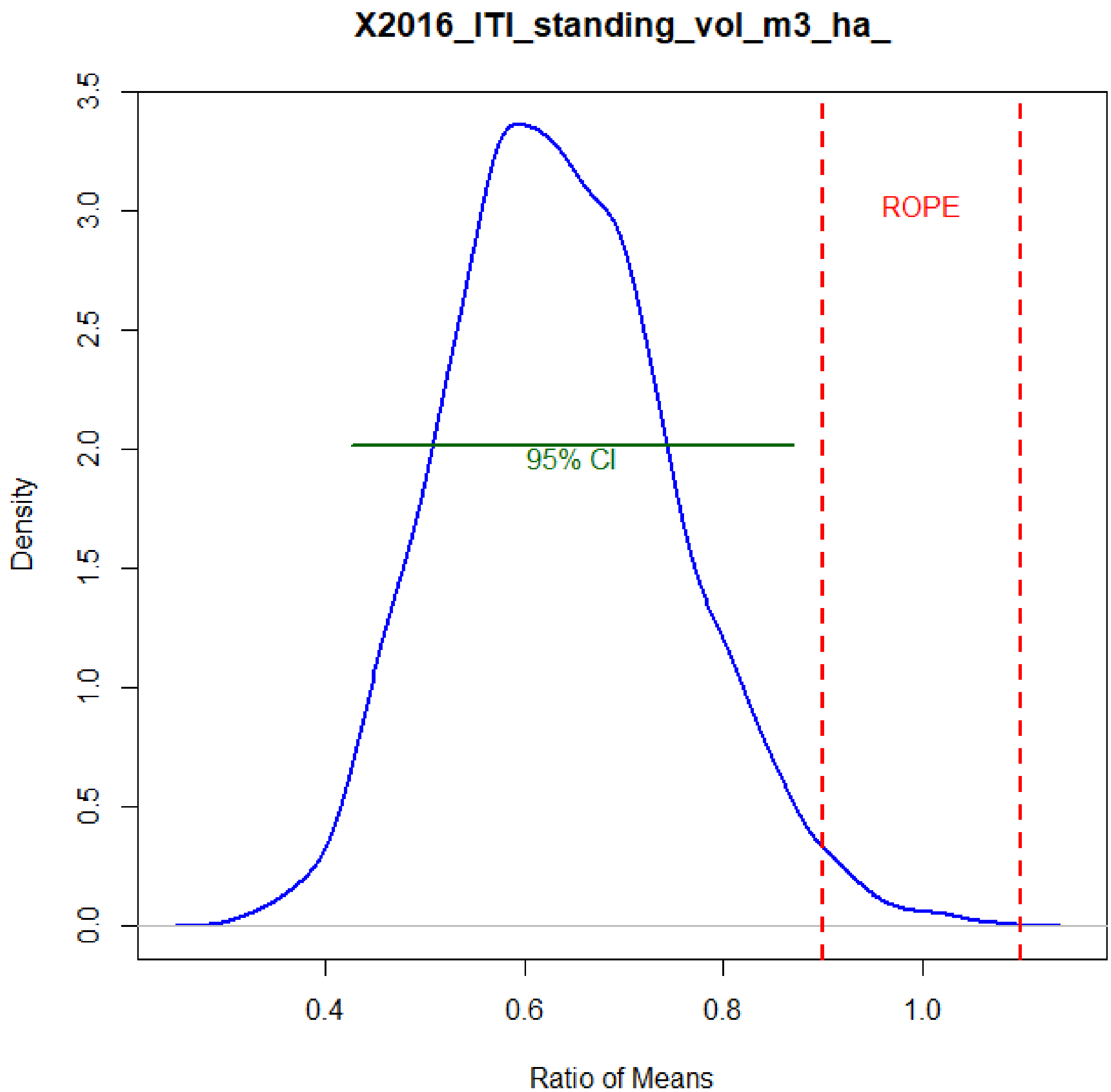
APPENDICIES

Basic statistics were computed to infer the agreement between the inventory estimates and the ground sampled attributes. Only Volume is evaluated below.

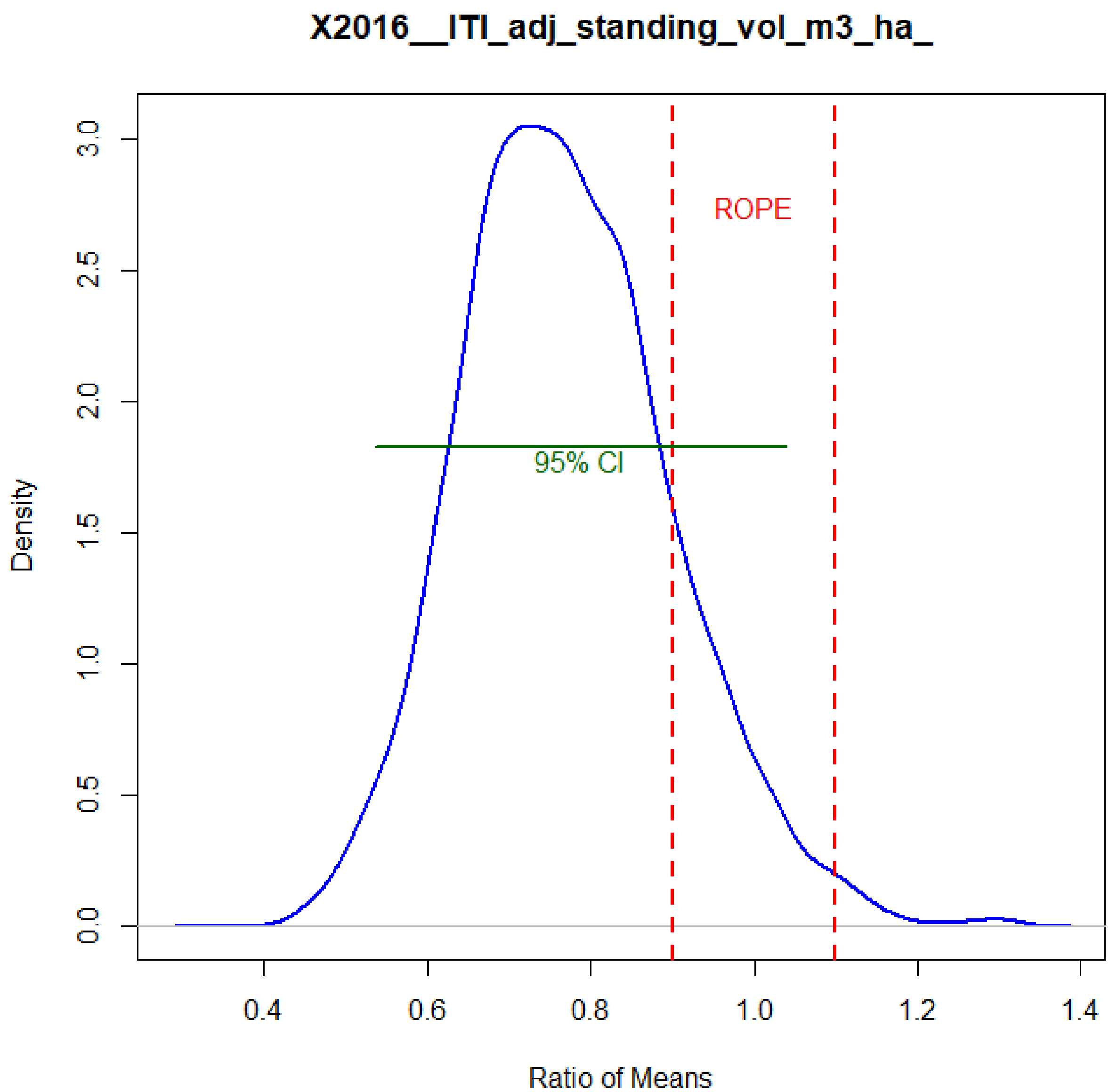
Precision results rank: ITIadj, ITIgrn_adj, ITI, FC
Accuracy results rank: ITIgrn_adj, ITIadj, FC, ITI

Inventory	ROM (ROPE)	Bias mu(inv-grnd)	Relative bias abs(mu(inv-grnd))/mu(grnd)	95% absolute relative error abs(inv/grnd)
ITI	0.43-0.87 (D)	-251.7	0.37	0.01-1.33
adjusted	0.54-1.04 (I)	-162.7	0.24	0.01-1.37
grown adjusted	0.61-1.13(I)	-100.3	0.15	0.46-1.76
Forest cover	0.52-1.00(I)	-168.2	0.25	0.17-2.51
ROM-ROPE D=practically significant difference, I=Inconclusive				

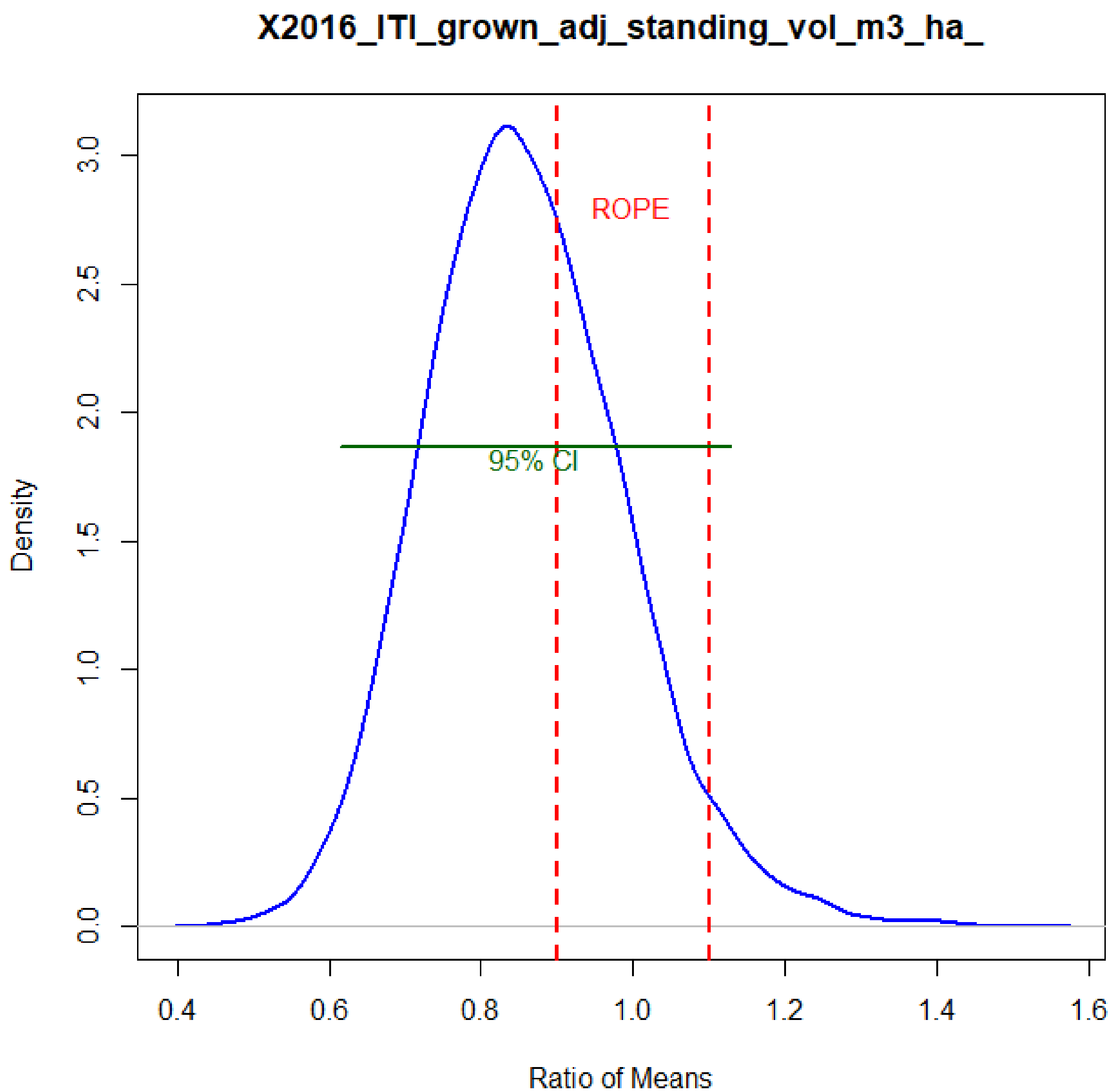
2016 ITI volume is practically lower than the ground sample with a 95% confidence interval of the ratio of means 0.43-0.87:



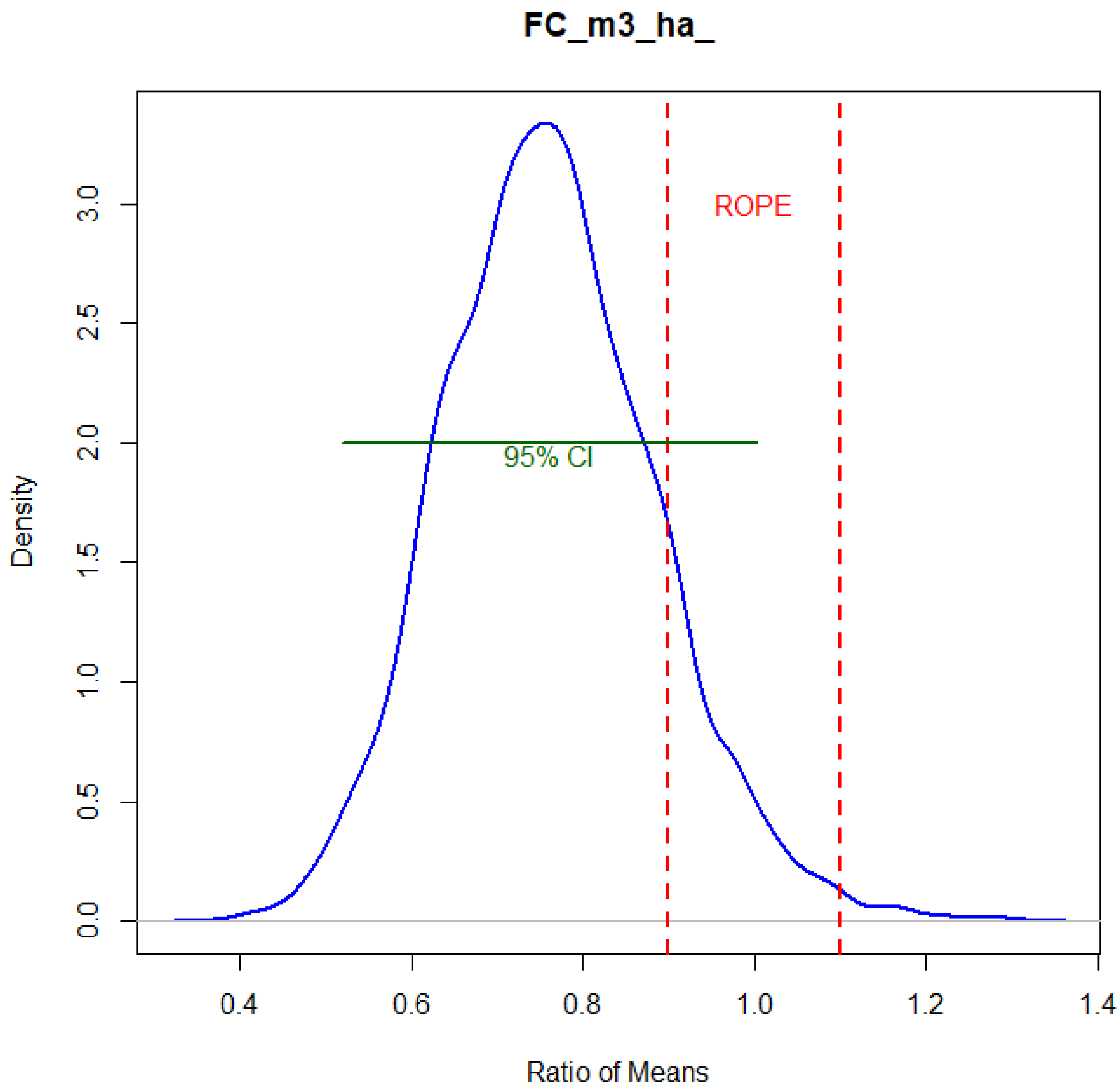
2016 ITI adjusted volume difference with ground sample is inconclusive with a 95% confidence interval of the ratio of means 0.54-1.04



2016 ITI grown adjusted volume difference with ground sample is inconclusive with a 95% confidence interval of the ratio of means 0.61-1.13



The forest cover inventory volume difference with ground sample is inconclusive with a 95% confidence interval of the ratio of means 0.52-1.00



The Bayesian ROM ROPE test output:

```
[1] "X2016_ITI_standing_vol_m3_ha_"
# Proportion of samples inside the ROPE [0.90, 1.10]:

Inside ROPE
-----------
0.00 %

[1] "Practically significant difference"
95% HDI: [0.43, 0.87]
[1] "X2016__ITI_adj_standing_vol_m3_ha_"
# Proportion of samples inside the ROPE [0.90, 1.10]:

Inside ROPE
-----------
13.74 %

[1] "Inconclusive test"
95% HDI: [0.54, 1.04]
[1] "X2016_ITI_grown_adj_standing_vol_m3_ha_"
# Proportion of samples inside the ROPE [0.90, 1.10]:

Inside ROPE
-----------
32.92 %

[1] "Inconclusive test"
95% HDI: [0.61, 1.13]
[1] "FC_m3_ha_"
# Proportion of samples inside the ROPE [0.90, 1.10]:

Inside ROPE
-----------
10.97 %

[1] "Inconclusive test"
95% HDI: [0.52, 1.00]
```

```
> for(i in 17:20){
+ print(paste0(names(dat)[i], " Bias: ", round(mean(dat[,i]),3)))
+ flush.console()
+ }
[1] "X2016_ITI_standing_vol_m3_ha__err Bias: -251.707"
[1] "X2016__ITI_adj_standing_vol_m3_ha__err Bias: -162.654"
[1] "X2016_ITI_grown_adj_standing_vol_m3_ha__err Bias: -100.268"
[1] "FC_m3_ha__err Bias: -168.158"
>
> for(i in 17:20){
+ print(paste0(names(dat)[i], " RelBias: ", round(abs(mean(dat[,i]))/mean(dat[,2]),3)))
+ flush.console()
+ }
[1] "X2016_ITI_standing_vol_m3_ha__err RelBias: 0.37"
[1] "X2016__ITI_adj_standing_vol_m3_ha__err RelBias: 0.239"
[1] "X2016_ITI_grown_adj_standing_vol_m3_ha__err RelBias: 0.148"
[1] "FC_m3_ha__err RelBias: 0.248"
>
>
> for(i in 17:20){
+ print(paste0(names(dat)[i], " Bias: ", round(mean(dat[,i]),3)))
+ flush.console()
+ }
[1] "X2016_ITI_standing_vol_m3_ha__err Bias: -251.707"
[1] "X2016__ITI_adj_standing_vol_m3_ha__err Bias: -162.654"
[1] "X2016_ITI_grown_adj_standing_vol_m3_ha__err Bias: -100.268"
[1] "FC_m3_ha__err Bias: -168.158"
>
> for(i in 21:24){
+ print(paste0(names(dat)[i], " relative error: P2.5%: ", round(quantile(dat[,i],0.025),3)," P97.5%
+ flush.console()
+ }
[1] "X2016_ITI_standing_vol_m3_ha__absrelerr relative error: P2.5%: 0.009 P97.5%: 1.326"
[1] "X2016__ITI_adj_standing_vol_m3_ha__absrelerr relative error: P2.5%: 0.009 P97.5%: 1.366"
[1] "X2016_ITI_grown_adj_standing_vol_m3_ha__absrelerr relative error: P2.5%: 0.455 P97.5%: 1.763"
[1] "FC_m3_ha__absrelerr relative error: P2.5%: 0.172 P97.5%: 2.506"
```

```
> range(dat$X2016_ITI_standing_vol_m3_ha__err)
[1] -972.7577  126.0215
> range(dat$X2016__ITI_adj_standing_vol_m3_ha__err)
[1] -732.3317  281.3224
> range(dat$X2016_ITI_grown_adj_standing_vol_m3_ha__err)
[1] -744.9892  273.3678
> range(dat$FC_m3_ha__err)
[1] -1145   351
> quantile(dat$X2016_ITI_standing_vol_m3_ha__err, c(0.25, 0.975))
      25%     97.5%
-376.9861  123.7678
> quantile(dat$X2016_ITI_adj_standing_vol_m3_ha__err, c(0.25, 0.975))
  25% 97.5%
   NA    NA
> quantile(dat$X2016__ITI_adj_standing_vol_m3_ha__err, c(0.25, 0.975))
      25%     97.5%
-257.1145  192.6204
> quantile(dat$X2016_ITI_grown_adj_standing_vol_m3_ha__err, c(0.25, 0.975))
      25%     97.5%
-194.9428  256.5228
> quantile(dat$FC_m3_ha__err, c(0.25,0.975))
     25%    97.5%
-361.850  277.875
> 
```

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Appendix D: LiDAR Review of OAF1 in Managed Stands

Summary

With the availability of LiDAR data for TFL 6, a detailed analysis was undertaken to quantify gaps in crown cover as a proxy for non-productive areas within managed stands. These areas are typically accounted for through Operational Adjustment Factor 1 (OAF1) in growth and yield modelling.

The results indicate that the TIPSY default OAF1 value of 15% is likely to overestimate the extent of non-productive area when high-resolution LiDAR-derived datasets are used to define the land base. Where strong spatial alignment exists between forest inventory polygons and LiDAR data, an OAF1 value of 10% is considered more appropriate for TFL 6.

Background

OAF1 is applied within TIPSY growth and yield modelling to account for reductions in projected yields due to both abiotic and biotic factors.

- Abiotic factors include small, unmapped non-productive areas (e.g., rock outcrops, wetlands) as well as weather-related stocking losses such as windthrow, snow, and ice damage.
- Biotic factors include irregular stand establishment, competition from non-commercial vegetation, and endemic forest health impacts.

The provincial default OAF1 value of 15% is applied uniformly across all stand ages. Conceptually, OAF1 can be partitioned into four components (Nussbaum, 2001):

1. Non-productive inclusions within stands that are too small to be delineated through conventional inventory methods.
2. Gaps caused by irregular stand establishment and competition from non-commercial brush or species, resulting in lower effective stocking than assumed in TASS/TIPSY.
3. Losses due to endemic disease and insect impacts over the life of the stand (e.g., weevil, rusts, needle casts).
4. Other random risk factors, such as windthrow, top damage, and snow press.

For the TFL 6 TSR, LiDAR-derived CHM data provide improved spatial resolution for identifying small non-productive areas and stocking gaps. These datasets reveal localized openings that are often difficult to detect through traditional air photo interpretation.

In addition, many larger non-productive areas are already excluded from the THLB through spatial processes such as Land Base Blocking (see Section 5.2.1 of the associated IP). As such, re-assessing OAF1 using LiDAR is warranted to avoid potential double counting of non-productive areas in both spatial land base delineation and yield-level adjustments.

Process and Methodology

The analysis focused on operable managed stands aged 50–80 years, representing stands near rotation age where crown closure is expected to reflect site occupancy. In these stands, canopy gaps are assumed to indicate low- or non-productive areas.

This age class was intentionally selected to provide a conservative estimate, as current silviculture practices typically achieve higher stocking levels than those observed in older stands.

Step 1: Stand Selection

Forest cover polygons meeting the age and operability criteria were selected as the base dataset. Figure 58 illustrates an example stand with corresponding forest cover attributes and orthophoto imagery.

Figure 58 An Example Stand With Orthophoto and Forest Cover Attribute

Step 2: Integration with LiDAR CHM

Selected stands were spatially intersected with LiDAR CHM data. Figure 59 presents the same stand extent overlaid with the CHM layer.

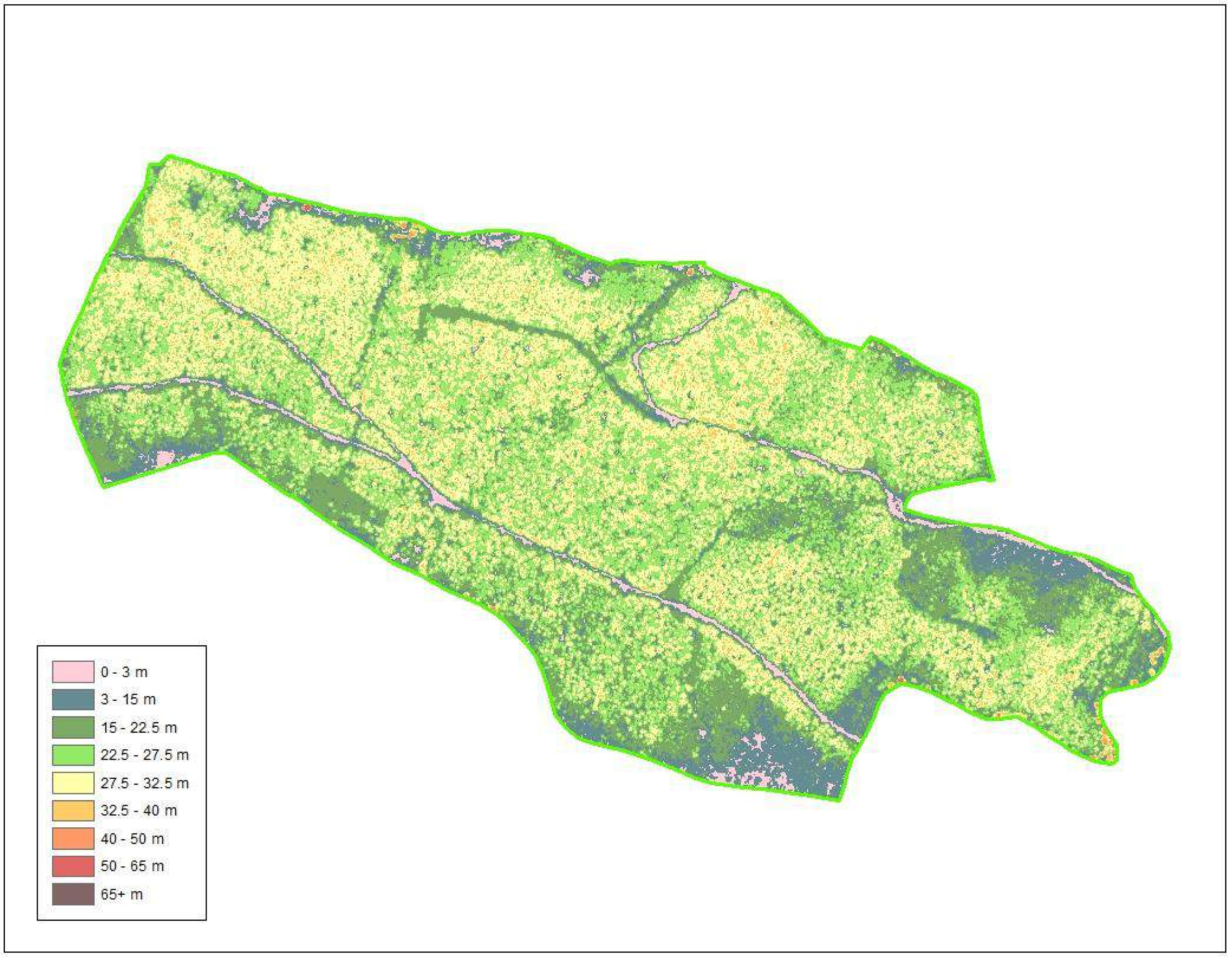

Figure 59 Crown Height Model from LiDAR for The Same Stand

Step 3: Gap Identification

The CHM raster was converted to vector format, and areas with vegetation height less than 10 m were identified. This threshold is based on the VRI ground sampling procedures (Province of British Columbia, 2018), which distinguish between tree layer (>10 m) and tall shrub layer (<10 m).

Roads and other mapped features were accounted for separately to avoid inflating gap estimates. Figure 60 conceptually illustrates the gap identification approach.

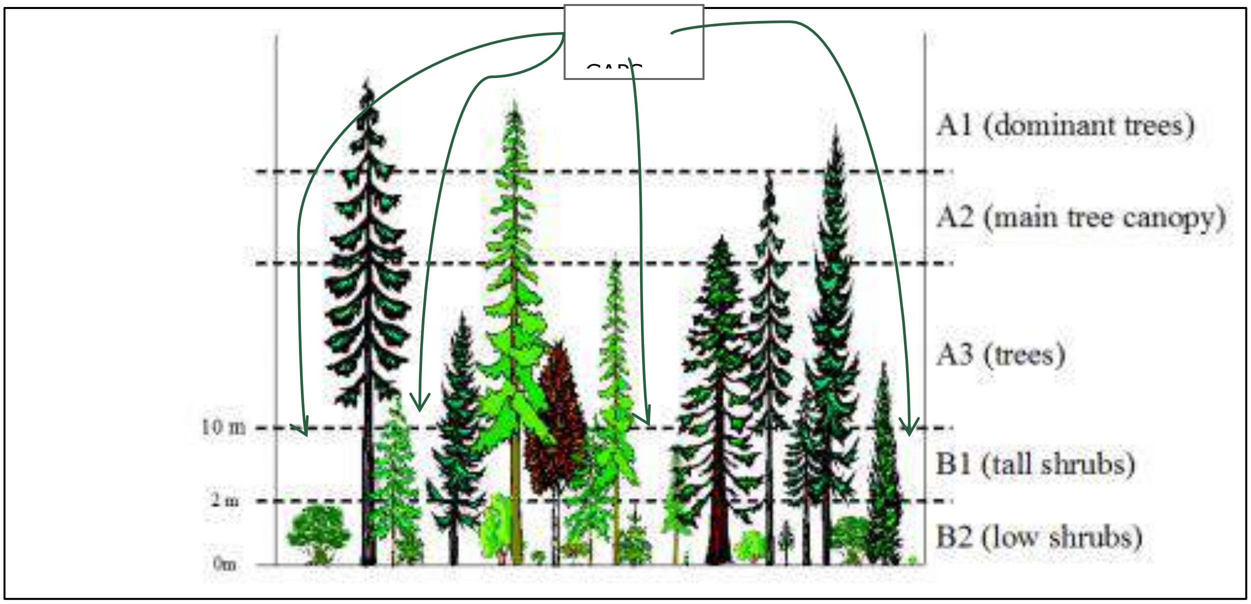

Figure 60 Diagram of Identifying Gaps, adapted from VRI Ground Sampling Procedures (Province of British Columbia, 2018)

Step 4: Gap Quantification

For each polygon, the proportion of area below the 10 m threshold was calculated to estimate a gap factor, representing non-productive or understocked areas. Figure 61 shows the resulting gap distribution for the example stand.

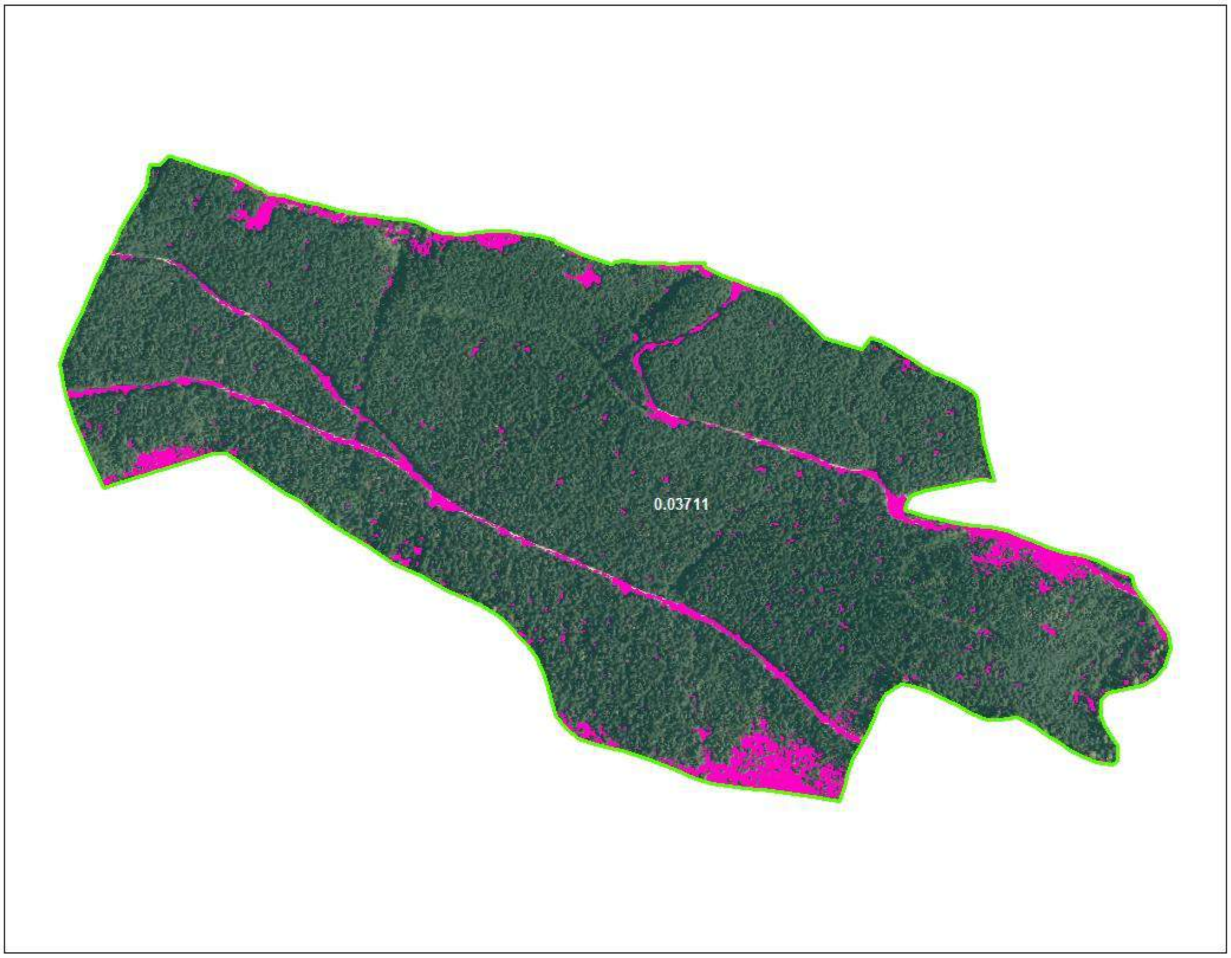

Figure 61 Orthophoto with Inventory Polygon and LIDAR Gap Factor

Results

Across operable stands aged 50–80 years within TFL 6, the area-weighted average gap factor was estimated at approximately 8%.

While this metric primarily captures non-productive openings, it is recognized that some components of OAF1, such as disease impacts or physical damage, may also manifest as reduced tree height (<10 m) and therefore be partially reflected in this estimate.

Given that OAF1 is intended to capture a broader range of factors beyond observable canopy gaps, an OAF1 value of 10% is considered appropriate for TFL 6. This value:

- Reflects the improved spatial representation of non-productive areas provided by LiDAR
- Avoids double counting of excluded areas already removed from the THLB
- Provides a conservative adjustment consistent with observed stand conditions

This conclusion is further supported by similar LiDAR-based assessments conducted by other licensees, where a 10% OAF1 assumption has been accepted by the Chief Forester, including in the recent AAC determination for TFL 49 (Province of British Columbia, 2025).

Conclusion

LiDAR-derived datasets provide a material improvement over traditional photo-interpreted inventory by enabling fine-scale, stand-level characterization of canopy structure and gaps.

This analysis quantified the proportion of area within managed stands (aged 50–80 years) that does not support trees exceeding 10 m in height, providing a proxy for low- or non-productive areas.

Within TIPSY growth and yield modelling, OAF1 is used to account for these factors. While the default value of 15% is typically applied, the availability of high-resolution LiDAR data provides a more defensible basis for refinement.

Based on the results, an OAF1 value of 10% is recommended for TFL 6. This adjustment better reflects actual stand conditions and is likely conservative, as the sampled stands originated under historical management regimes that generally achieved lower stocking than current practices.

Overall, the use of LiDAR supports a more accurate and evidence-based representation of productive forest area, improving the reliability of growth and yield projections.

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Appendix B: Timber Supply Analysis Information Package

Reference: 280394

November 27, 2024

VIA EMAIL: yhuang@westernforest.com

Mr Ye Huang, RPF
Timber Supply Forester
Western Forest Products Inc.
8010 Island Highway
Campbell River, British Columbia
V9W 4B2

Dear Mr Ye Huang:

Thank you for submitting the final version of the Timber Supply Analysis Information Package (Version 2), dated October 31, 2024, prepared for Tree Farm Licence (TFL) 6 Management Plan 11. I have reviewed the documents with specialists at the Ministry of Forests (the ministry). As the ministry Timber Supply/Geomatics Forester responsible for reviewing the information package, I accept the document for use in the timber supply analysis for TFL 6.

I wish to point out that this letter does not mean that the ministry endorses every aspect of this information package. During the allowable annual cut (AAC) determination meeting, ministry staff will advise the (deputy) chief forester regarding the technical validity of the analysis and the implications of its assumptions and results. The chief forester will consider this advice, along with your analysis, when determining the AAC for TFL 6.

I request that the timber supply analysis report and the management plan reflect this version (Version 2) of the final information package.

Yours truly,

Loreen Hodgkinson, RPF
Timber Supply/Geomatics Forester
Forest Analysis and Inventory Branch

pc: Mark Perdue, Senior Analyst, TFLs, Forest Analysis and Inventory Branch

Tree Farm Licence 6 Management Plan 11

Timber Supply Analysis
Information Package

VERSION 4, JANUARY 2026

WESTERN
Forest Products

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Tree Farm Licence 6

Timber Supply Analysis

Information Package

In Preparation of

MANAGEMENT PLAN 11

Submitted to the
Ministry of Forests
Forest Analysis & Inventory Branch
Victoria, BC

Version 4
January 2026

"Ye Huang"

Ye Huang, RPF
Timber Supply Forester
Western Forest Products Inc.

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Revision History

The following revisions were made to Version 1 (April 2024) of the Information Package to create this document

Version	Date	Description
4.0	January, 2026	• Updated Section 1.2 to clarify linkages between Timber Supply Review (TSR) and Quatsino (TFL 6) Integrated Resources Management Plan (IRMP). • Updated Section 1.2 and Section 1.3 to include the description of the legally established Gwa'ni Land Use Objective Order and its implication within the TFL. • Separated the tables for Landscape Units (LUs) and Resource Management Zones (RMZs) in Section 1.3, and included the two Special Management Zones (SMZs) created under the Gwa'ni Land Use Objective Order. • Updated Section 3.5.2.5 to improve conciseness and clarity, and to better reflect the early engagement communication model, and integration with ongoing IRMP development. • Resolved inaccuracies in the THLB netdown associated with the Riparian Management Zone (Section 6.9). This revision was formally communicated to the Forest Analysis and Inventory Branch (FAIB) via memorandum dated February 4, 2025. • Updated Section 6.16 to clarify the processes regarding surveys on culturally modified trees. • Corrected an attribution error in the TFL terrain schedule (Section 6.19). • Updated all THLB-related tables throughout the document to reflect the correct inputs and assumptions. • Corrected typographical errors in Table 3 and Section 7.2. • Revised the list of sensitivity analyses in Table 5 and Section 3.2 to ensure consistency with the final set of analyses presented in the Timber Supply Analysis report. • Added a clarifying footnote in Section 8.4 regarding the use of Version 3 values for inventory volume and initial growing stock comparisons. • Removed references to Shiny app implementation for TFL 37 in Section 3.4.1, as that section was removed from the source file due to identified uncertainties. • Updated document formatting and the licensee's acronym to align with licensee's current branding standards. • Updated the content related to the use of Individual Tree Inventory (ITI) in Section 3.5.2.3, with corresponding clarifications added in Section 3.2 and Section 5.2.4 to explain the ITI-related sensitivity analyses. • Included the minimum harvest patch size in Base Case description in Section 3.1. • Clarified that Biogeoclimatic Ecosystem Classification (BEC) used is version 12, which is based on Land Management Handbook (LMH) No. 28. • Clarified Section 6.23.2 to note that future Wildlife Tree Retention Areas (WTRAs) in the Lower Nimpkish Landscape

Version	Date	Description
		Unit are modelled under the Enhanced Forestry Zone (EFZ), as the two SMZs from the January 2026 Gwa'ni Land Use Objectives Order were not yet legally established at the time of analysis. • Updated Section 7.1 to clarify that the two SMZs resulting from the Gwa'ni Land Use Objectives Order were not included, as the legal order had not been issued at the time of analysis. • Updated Section 10.3.8 clarify that forest seral stage targets associated with the two SMZs established under the January 2026 Gwa'ni Land Use Objectives Order were not included in the analysis, as the legal order had not been issued at the time of finalizing the IP and timber supply model. • Updated the acronym for Ministry of Forests to FOR. • Removed the acronym "TSA" for timber supply analysis to improve clarity. • Updated document template and standardized the use of the acronym "Western" to reflect the licensee's rebranding.
3.0	January 21, 2025	• Revised Section 3.1 on how the VQO polygons are individually modelled in the Base Case. • Removed redundant rows from the AAC history table in Section 6.1. • Corrected Table 72 in Section 10.4.1 to accurately reflect the LRSY values.
2.0	October 31, 2024	• Updated Figure 1 in Section 1.1 to match the description. to align with its description, clarifying that the Chief Forester Order on the current AAC remains effective. • Updated the acronym for the *Declaration on the Rights of Indigenous Peoples Act* to "Declaration Act"; documented the Gwa'ni Project's progress and implications for TFL 6 in Section 1.2. • Expanded the list of larger centers and nearby First Nation communities within or near TFL 6; clarified in Section 1.3 that TFL 6 does not intersect with parks. • Corrected a typo in indexing in Section 3.1. • Removed visual management from sensitivity scenarios since LiDAR-derived slope data from individual Visual Landscape Inventory polygons have been incorporated into the model. Clarified the description and application of LiDAR-related scenarios and added section numbers for additional details on each sensitivity scenario. Updated wording on factors impacting downward and upward pressure in Section 3.2. • Added recent developments regarding the ITI validation reports for TFL 37, 64, and 44 in Section 3.5.2.1. • Categorized updates since MP #10 by thematic area in Section 3.6. • Added inventory history from former TFL 39 Block 4 in Section 5.1. • Detailed LiDAR inventory sensitivity analysis scenarios in Section 5.2.4.

Version	Date	Description
		• Added a table of AAC history in Section 6.1. • Corrected typos and data inconsistencies, leading to minor adjustments in land base classification and THLB/NCLB values in Section 6. • Corrected a netdown calculation error for productive forest in Section 6.6. • Corrected a netdown calculation error for shoreline buffers in Section 6.9. • Clarified the relationship to physical operability in Section 6.13. • Removed known cultural features overview map in Section 6.16 due to sensitivity. • Refined the LiDAR slope layer resolution to a coarser scale, addressing internal voids in the data and reporting terrain netdown by class code and LiDAR slope in Section 6.19. • Added a rationale for withholding specific PSP location details in Section 6.20. • Utilized TIPSY version 4.6 for growth and yield estimates in managed and future stands in Section 8.2. • Revised the productive forest and THLB area for existing and future Analysis Units (AUs) in Section 8.2 due to the changes above. • Updated the western hemlock fertilization project managed by the Ministry of Forests and Stand Management Cooperative. to include the western hemlock fertilization project managed by the Ministry of Forests and Stand Management Cooperative in Section 8.2.3. • Updated the actual implemented genetic gain values for Hw, accounting for natural ingress, in Section 8.2.7.2. • Included a comparison between inventory volume and initial growing stock in the timber supply model in Section 8.4. • Revised Table 62 to align with updated NCLB areas in Section 9.4. • Enhanced Table 64 to list all datasets used, including their sources and dates in Section 10.2. • Update texts to reflect increased old seral targets for CWHvm1 within General Management Zone 7 in Keogh LU, as specified by VILUP Objective 10 in Section 10.3.3. • Aligned watershed management strategies and modelling methods with the current (2019) Western Terrain Risk Management Strategy in Section 10.3.6. • Updated texts to detail compliance with VILUP Objectives 10, 15, and 16 in Section 10.3.8. • Added CMAI and LRSY data for future AUs in Section 10.4.1. • Discussed harvest patch size targets, ensuring isolated THLB stands are excluded from harvest projections in Section 10.4.2.3. • Discussed Old Growth Deferral Areas from the Technical Advisory Panel in Section 10.5. • Included Section 11 to outline next steps.
1.0	April 30, 2024	• Initial version

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Acknowledgements

The signatory extends sincere gratitude to the individuals or parties listed below for their valuable contributions towards the creation of this document:

- Mike Davis, RPF of Western Forest Products Inc. (Western), for his extensive expertise in historical tenure, substantial assistance in timber supply analysis, past involvement in management plans, proofreading, and overall guidance.

- Western Inventory and Analysis Team, particularly Stuart Glen, RPF and Joel Mortyn, RPF for various high-level guidance, document review and resource allocation; Liza Rodrigues, RPF for land base and analysis unit definition, data manipulation, and script testing, Sydney Delaney for GIS data processing, and contributions to document templates and formatting, Steve Platt, RFT for Land Base Blocking and LiDAR stream classification work, Marie-Eve LeClerc, RPF for forest cover inventory background, and Janice Cheng for graphic support.

- Loreen Hodgkinson, RPF, Mark Perdue, RPF, and April Bilawchuk, RPF from the Forest Analysis & Inventory Branch (FAIB), British Columbia Ministry of Forests (FOR), along with Jessica Garrick, Paul Barolet, RPF, and Murray Estlin, RPF from the North Island-Central Coast Natural Resources District (NICCNRD), FOR for dedicating their time and effort to review essential assumptions, datasets, provide feedback, and facilitate the public review and consultation with First Nations on the Information Package.

- Sarah Germain, RPF from Western, and Rhiannon Poupard, RPF from Quatsino for their joint coordination with the Quatsino (TFL 6) Integrated Resource Management Plan (IRMP) working group.

- Jim McDowell, RPF, Jonathan Flintoft, RPF and Nick Russell, RPF, from Western for their operational insights and guidance.

- John Deal, RPF, RPBio from Western for his assistance with wildlife management assumptions.

- Annette Van Niejenhuis, RPF from Western for her support with genetic worth values and stand tending activity assumptions.

- Aidan Wischnewski, RPF from Forsite Consultants Ltd. for support in growth and yield and earlier version of the timber supply model construction.

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Table of Contents

List of Tables

List of Figures

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1 Introduction

1.1 Background

Tree Farm Licence (TFL) 6 is situated on northern Vancouver Island, near Quatsino Sound. It spans from Nahwitti Lake in the north to Victoria Lake in the south, and from Winter Harbour in the west to Port McNeill in the east, as illustrated in Figure 1.

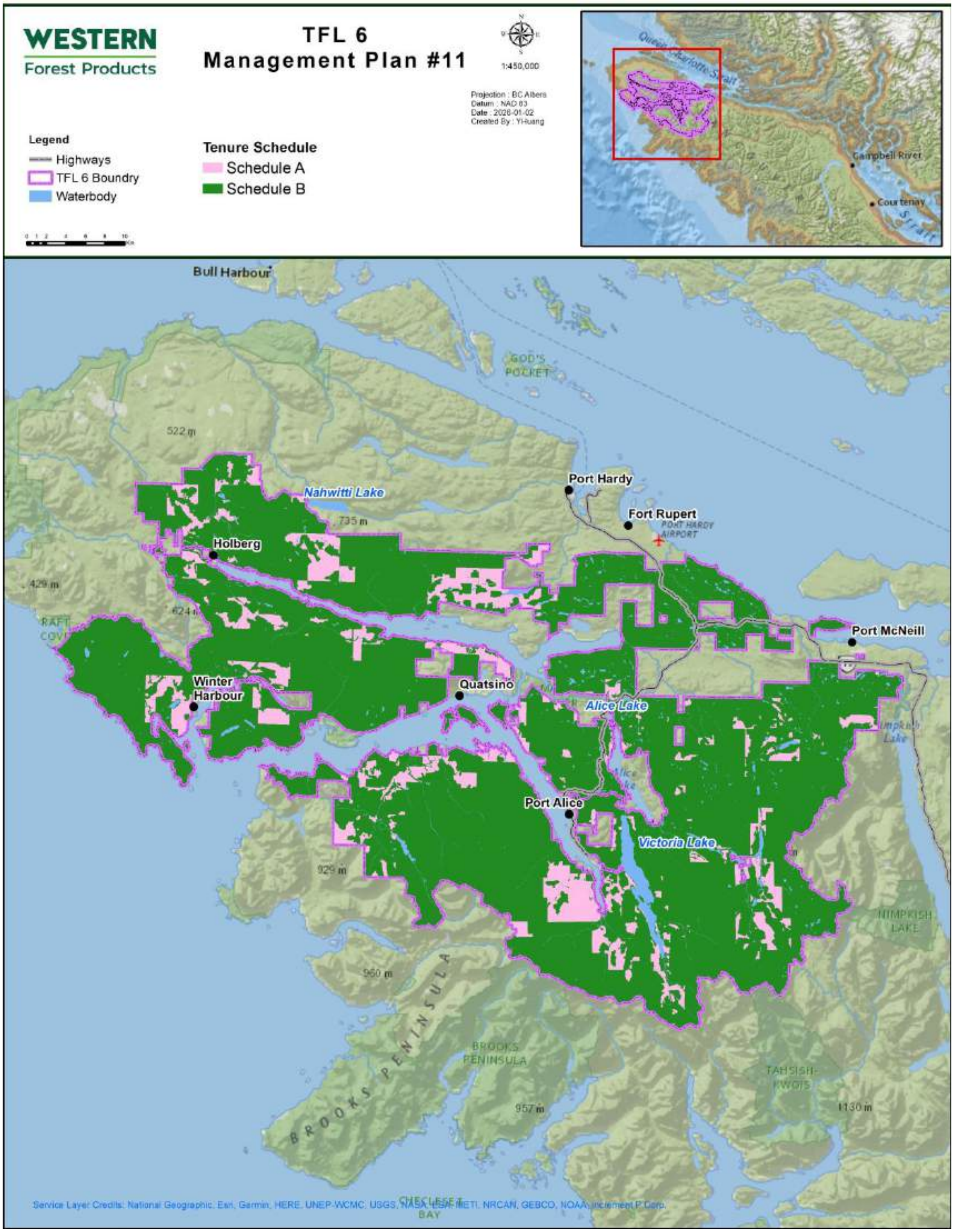

Figure 1 TFL 6 Overview

Forest Management Licence (FML) No. 6 (Quatsino) was initially granted in 1950 to the British Columbia Pulp and Paper Company Limited. FMLs were subsequently renamed as Tree Farm Licences (TFLs). Western Forest Products Inc. (hereinafter referred to as Western) is the holder of TFL 6. Since 1950, there have been ten Management Plans (formerly called 'Management and Working Plans') for the TFL.

The Information Package (IP) offers a condensed overview of the data, assumptions, and modelling methods suggested for incorporation into the Timber Supply Review (TSR) for Management Plan (MP) #11. Its purpose is to provide a comprehensive explanation of the elements connected to timber supply, which the provincial Chief Forester takes into account when establishing an Allowable Annual Cut (AAC), including an explanation of how the elements were employed in the analysis.

The latest TSR for this TFL was concluded in 2011 and documented in TFL 6 MP #10, submitted by Western (Western Forest Products Inc., 2011). The corresponding AAC was established by the Chief Forester at 1,160,000 m^3/year in 2012. In January 2015, TFL 39 Block 4 was incorporated into TFL 6 through Instrument 54, leading to an increase in AAC to 1,362,600 m^3/year. This AAC was extended in 2021 by the Chief Forester, anticipating improvements in forest inventory through Light Detection and Ranging (LiDAR) and substantial collaboration with First Nations. This extension remains in effect.

In parallel with this TSR, Quatsino First Nation (Quatsino) and Western have been collaboratively developing an Integrated Resource Management Plan (IRMP) for the portion of TFL 6 within Quatsino traditional territory. The IRMP is a values-based approach to planning that is multi-scale and designed to inform an integrated outcome incorporating objectives for a wide range of values. Following completion of the IRMP, the plan is to review and update the timber supply analysis in coordination with Forest Analysis & Inventory Branch (FAIB).

The timber supply analysis estimates timber harvest over a 300-year planning horizon, divided into five-year planning periods. The harvest forecast evaluates the future timber supply recognizing legal environmental protections, management practices, higher-level plans, operational requirements of the *Forest and Range Practices Act* (FRPA), approved Forest Stewardship Plan (FSP), legal orders, and other regulations and guidelines relevant to timber supply. Sensitivity analyses are used to explore the effects of different management scenarios and assess the relative importance of variations in assumptions. These scenarios might involve actions that change the Timber Harvesting Land Base (THLB), implement forest cover constraints, or modify growth and yield (G&Y) estimates. The timber supply forecast balances achieving long-term sustainable harvest levels with minimizing disruptions during the shift from current harvesting rates to levels for the mid-term and long-term.

1.2 First Nations Interests

First Nation values and interests are integral to the current forestry practices within TFL 6. First Nations with an interest in TFL 6 are summarized in Table 1 The total area of TFL 6 in relation to each territory is based on information available to Western.

Table 1 TFL 6 Area Indigenous Groups

First Nation Name	Total Area within Territory (Ha) – Contain Overlaps	Proportion of TFL 6 relative to the Territory (%)
Quatsino	186,096	86%
Kwakiutl	30,849	14%
Tlatlasikwala	9,890	5%
‘Na̱mg̱is	4,016	2%
TFL 6 Total	*217,197*	*N/A*

There is one collaborative planning initiative underway through the Quatsino (TFL 6) IRMP and one Land Use Planning initiative through the Gwa’ni Land Use Planning Project that relate to TFL 6.

1. Quatsino (TFL 6) IRMP

   In July 2022, Quatsino and Western, reached an agreement to work collaboratively on a vision and approach to sharing opportunities related to forest resources in Quatsino's traditional territory (Quatsino First Nation and Western Forest Products Inc., 2022). This agreement lays the groundwork for ongoing collaboration in land use and stewardship decisions through an IRMP guided by Quatsino's Land Use Plan. The IRMP represents a shared commitment to sustainable forest management through an integrated and multi-scale planning framework that defines clear outcomes, stewardship practices, and a forecast of the resulting harvest pattern.

   Until the IRMP is finalized, guidance from FAIB is for the timber supply analysis is to reflect past performance and practices. It is recognized however, that as the IRMP progresses, stewardship practices that differ from recent performance and practices may be implemented and evaluated in the field. In recognition of this, following completion of the IRMP, the plan is for the analysis results to be reviewed in coordination with FAIB so that it can be updated consistent with the integrated outcome of the IRMP.

2. Gwa’ni Land Use Planning Project (Gwa’ni Project)

   In January 2021, the Gwa’ni Project was formally launched through a Memorandum of Understanding for Modernized Land Use Planning between ‘Na̱mg̱is First Nation (‘Na̱mg̱is) and the Province (‘Na̱mg̱is First Nation and Province of British Columbia, 2021). The project area encompasses most of the Nimpkish Valley and includes a small portion of TFL 6 (1,245 hectares, representing 0.7% of the total project area).

The Gwa’ni Project goals include evaluating the existing Vancouver Island Land Use Plan (VILUP), to provide more effective management direction for the resource values found within the project area. In parallel, ‘Na̱mg̱is and Western have been collaborating on the development of a Forest Landscape Plan (FLP) and a Forest Operations Plan (FOP) within the adjacent TFL 37 (‘Na̱mg̱is First Nation and Western Forest Products Inc., 2025). This work forms part of one of four provincially designated FLP pilot projects in British Columbia.

At the time the accepted version of the IP and timber supply model were prepared, the public consultation phase for the Gwa’ni Project had been concluded ('Na̱mg̱is First Nation and Province of British Columbia, 2024). However, a formal legal order had not yet been issued. In January 2026, the Province established the Gwa’ni Land Use Objectives Order (Province of British Columbia, 2026). The Order designates two Special Management Zones (SMZs) within the project area and establishes seral stage targets to be achieved across the SMZs over 50- and 100-year time horizons. The Order also includes an expectation that retention silvicultural systems will be applied to 100% of harvest blocks.

The portion of TFL 6 within the Gwa’ni Project is at the north end of Nimpkish Lake, extending into the Pink/Hump watershed. It represents approximately 0.6% of the total TFL area and 0.7% of the total Order area. As such, the influence of the Gwa’ni Order on the overall harvest forecast for TFL 6, as well as the contribution of TFL 6 to achieving Order objectives, is anticipated to be limited. Potential implications for the allowable harvest level will be evaluated in a future TSR. In the interim, Western remains committed to ongoing collaboration with ’Na̱mg̱is (refer to Section 3.5.2.5) to support the implementation and monitoring of the Gwa’ni Order within TFL 6.

Table 2 details the sections in this document where discussions on First Nations interests are presented.

Table 2 Sections Discussing First Nations Interests

First Nations Interests	Section
Cultural Heritage	Section 3.5.2 Implementation Instructions from 2021 TFL 6 AAC Postponement Order
	Section 6.16 Cultural Heritage Resources
	Section 6.22 Karst
Fish Habitat	Section 6.9 Riparian Management Areas
	Section 10.3.4 Community Watersheds
	Section 10.3.6 Other Watersheds
Wildlife	Section 6.10 Ungulate Winter Ranges

	Section 6.12 Wildlife Habitat Areas
Old Growth and Biodiversity	Section 5.3 Current Age Class Distribution Section 6.11 Old Growth Management Areas Section 6.17 Existing Stand-Level Reserves Section 6.21 Big Tree Reserves Section 6.23 Future Stand-Level Retention Section 7.1 Resource Management Zones Section 7.2 Landscape Units Section 10.3.8 Higher Level Plan Section 10.4.3 Silvicultural Systems Section 10.5 Old Growth Deferral Areas
Visual Quality	Section 10.3.1 Visual Quality

1.3 Analysis Area

The majority of the forests in TFL 6 are situated in the maritime variants of the Coastal Western Hemlock (CWH) and Mountain Hemlock (MH) biogeoclimatic (BEC) zones, with Coastal Mountain-heather Alpine (CMA) at high elevation. The annual precipitation varies between 3,000 and 5,000 mm. The climate is characterized by mild and wet winters, with daily mean minimum temperatures ranging from 0 °C to 2°C between December and February. Summers are generally cool and moist, with daily mean maximum temperatures in July and August typically ranging from 18°C to 20°C. However, local climates within TFL can vary significantly due to topographical influences and the movement of low cloud and fog from offshore onto northern Vancouver Island.

Larger centres and First Nations communities within or near TFL 6 include:

- Port Hardy/Tsulquate/Tsaxis
- Port McNeill
- Alert Bay/'Yalis
- Port Alice and Jeune Landing
- Fort Rupert
- Coal Harbour/Quatsino Subdivision
- Sointula
- Holberg
- Winter Harbour
- Bull Harbour, Hope Island

Nearby provincial parks, none of which are inside the TFL, include:

- Muqqiwn/Brooks Peninsula Park
- Tahsish-Kwois Park
- Nimpkish Lake Park
- Marble River Park
- Raft Cove Park
- Quatsino Park

- Cape Scott Park
- Lower Nimpkish Park
- Misty Lake Ecological Reserve

TFL 6 is situated within eight Landscape Units (LUs), as summarized in Table 3.

Table 3 Landscape Units for TFL 6

Landscape Unit	Biodiversity Emphasis Options (BEO)
Holberg	Low
Keogh	Low
Klaskish	Low
Lower Nimpkish	Low
Mahatta	Low
Marble	Intermediate
Neroutsos	Low
San Josef	Intermediate

TFL 6 is also situated within 10 Resource Management Zones (RMZs) designated by the Vancouver Island Land Use Plan (VILUP)[1] (Province of British Columbia, 2000) and the Gwa’ni Land Use Objectives Order (Province of British Columbia, 2026). The summary of these Resource Management Zones is provided in Table 4.

Table 4 Resource Management Zones for TFL 6

Resource Management Zone	Resource Management Zone Type
‘mał̱ik	Special
dza̱'wa̱n	Special
Holberg	Enhanced
Keogh-Cluxewe	Enhanced
Klaskish	General
Koprino	Special
Mahatta-Neuroutsos	Enhanced
Marble	General
San Josef-Koprino	Enhanced
West Coast Nahwitti Lowlands	Special

The Vancouver Island Land Use Plan Higher Level Plan Order (VILUP), implemented in 2000, assigned legal objectives under the *Forest Practices Code of British Columbia Act* and

[1]Although the spatial data might indicate slight overlaps with the following LUs (Nahwitti and Tsulquate) and RMZs (Brooks Bay, Kashutl, Marble River, Nahwitti-Tsulquate, Nimpkish, Quatsino, Raft Cove, Tahsish, and Tahsish-Kwois), these overlaps are likely due to discrepancies between the data and real-world conditions. In reality, these "sliver" LUs and RMZs do not correspond to the actual height-of-land or the TFL boundary.

continued under FRPA. These objectives supplement the broader FRPA requirements that apply across the entire area, including Enhanced Forestry Zones, General Management Zones, and Special Management Zones.

The ʽmał̲ik and dza̱ꞌwa̱n Special Management Zones were established in January 2026 through the Gwa’ni Land Use Objectives Order. As noted in Section 1.2, the Gwa’ni Land Use Objectives Order had not been formally established at the time the accepted version of the IP and associated timber supply model were prepared. Because the revised RMZs and RMZ types applicable to the portion of TFL 6 within the Gwa’ni Project were still under development during that planning process, the implementation of the ʽmał̲ik and dza̱’wa̱n SMZs has not been incorporated into the current TSR. These changes will be evaluated and incorporated in future TSRs.

Some LUs and RMZs partially intersect with the boundary of TFL 6. Additionally, minor variations exist in the spatial data used to create the Geographic Information System (GIS) geo-database, even when representing the same real-world features. This can lead to challenges when applying management restrictions based on RMZ types to these small overlapping areas, often referred to as "slivers." More information on RMZs and LUs can be found in Section 7.1 and 7.2.

2 Process

This section details the administrative and technical procedures used to conduct the timber supply analysis for TFL 6. It defines the workflow for the IP approval, the modelling strategies employed to forecast timber supply under various scenarios, and the geospatial data preparation methods used to ensure the reliability of the underlying land base information.

2.1 Overview

This Information Package is submitted for review to the Timber Supply/Geomatics Forester at FAIB within the British Columbia Ministry of Forests (FOR). Once approved, the IP will serve as a guide for the timber supply analysis and will be appended to MP #11 along with the timber supply analysis report. These documents will play a role in the Chief Forester's decision on determining the new AAC for TFL 6. Two opportunities for review and comment will be offered, allowing input from the public and other stakeholders include reviewing this initial draft IP and the draft MP. These opportunities are in addition to the collaborative planning and early engagement actively underway with First Nations.

2.2 Analysis Approach

The intricacies of timber supply necessitate more than a single forecast to adequately depict the timber supply potential for TFL 6. Due to uncertainties surrounding how well the assumptions in the analysis align with the actual timber availability, operational planning, and the various options for adjusting harvest levels in response to the timber supply dynamics, a series of modelled forecasts will be developed. These forecasts aim to illustrate the impacts and dynamics of uncertainties in the timber supply process or alternative management practices. The forecasts include:

- **Base Case**: This represents the current knowledge, performance, and forest management practices in TFL 6. Other forecasts will be compared against the Base Case.
- **Sensitivity Analyses**: These analyses are employed to quantify the risks associated with uncertainties in the assumptions or data used in the analysis. Conducted through variable-controlling methods, sensitivity analyses involve modifying one area of uncertainty and assessing the implications of the change on various aspects of the land base.

2.3 Data Preparation and Missing Data

Western constructed a GIS geo-database by utilizing various resource inventory spatial datasets through a series of ArcGIS geo-processing procedures. Each polygon in this master database is assigned a unique identification number, and all the summaries and values in this IP document are derived from this database.

The reliability of the data in this document is contingent upon the source data used during processing, and the data sources are listed in each section of the IP document. Despite efforts to ensure data accuracy, an exact match was not always achievable among various datasets with overlapping coverages. Some datasets had to be manipulated to approximate the best fit. For example, watersheds and landscape unit boundaries might differ in the GIS data used for the master database, even though they are defined by the same height-of-land in reality. While the final resultant is a close approximation of the actual landscape, caution should be exercised when viewing geographic data results on a large scale.

Western reserves the right to modify any data, netdown order, or calculation in the future if it improves the accuracy of the analysis. Any such modifications will be documented in subsequent versions of the IP.

3 Timber Supply Forecasts and Sensitivity Analyses

This section outlines the management scenarios that will be incorporated into the timber supply analysis. It provides information on the details, assumptions, and sensitivities associated with each scenario.

3.1 Base Case

The Base Case depicts the present operational needs and managerial approaches adopted in the TFL. The prediction of existing forest management practices takes into account the established land use designations, such as VILUP Resource Management Zones, current regulations, and guidelines, including the FRPA and approved FSPs. This option serves as the foundation for assessing various timber supply projections.

Current management of TFL 6 includes:

- The operable land base of forested area accessible using conventional (ground and cable) and non-conventional (helicopter) harvesting methods. Harvest methods are based on a spatially delineated physical operability dataset via Land Base Blocking (LBB) process (Section 5.2.1) for TFL 6.
- Exclusion of uneconomic mature forest stands (Section 6.13).
- Harvesting of both mature and immature/second-growth stands.
- Silviculture carried out on all regenerated stands to meet free growing requirements. All harvested areas are planted (Section 7.3.1.2).
- Known tree improvement gains will be applied to existing stands established since 2001 and future regenerated stands (Section 8.2.7.2).
- Visual quality objective (VQO) polygons established by the Government Action Regulation (GAR) order of September 24, 2010, for Tree Farm Licence 6 & Block 7, Pacific Timber Supply Area, are individually modelled using *The Procedures for Factoring Visual Resources into Timber Supply Analyses* (Province of British Columbia, 1998) and its subsequent update bulletin (Province of British Columbia, 2003) (Section 10.3.1).

- Green-up heights for cutblock adjacency are assigned based on Resource Management Zones established in the Vancouver Island Higher Level Plan. Special and General Zones have a 3-metre green-up requirement while Enhanced Zones have a 1.3-metre green-up height (Section 10.3.2).
- Future wildlife tree retention and other stand-level retention within the THLB are accounted for by a percentage area reduction (Section 6.23).
- Established Old Growth Management Areas (OGMAs) are excluded from the THLB (Section 6.11). Mature seral targets are integrated into the two Special Management Zones in accordance with VILUP (Section 10.3.8). Regarding landscape units, old seral stage targets are assigned to each BEC variant (BEC version 12, which is based on Land Management Handbook (LMH) No. 28), guided by the *Order Establishing Provincial Non-Spatial Old Growth Objectives* (NSOG) effective June 30, 2004 (Section 10.3.3).
- Established Ungulate Winter Ranges (UWRs), established and proposed Wildlife Habitat Areas (WHAs) are removed from the THLB (Section 6.10 and Section 6.12).
- Netdowns for terrain stability management depending on mapped classification and LiDAR slope model (Section 6.19).
- Riparian management based on the FSP results/strategies and a review of riparian management applied on nearly 870 cutblocks harvested or planned between 2012 and 2023.
- Minimum harvest age criteria based on 95% Culmination of Mean Annual Increment (CMAI) and minimum 350 m^3/hectare (Section 10.4.1). Both minimum age and minimum volume requirements must be met before a stand can be harvested.
- Minimum harvest patch size of 2 hectares enforced based on historical data (2012–2023), excluding smaller isolated THLB areas from harvest unless combined into economically viable blocks (Section 10.4.2.3).
- The Operational Adjustment Factor 1 (OAF1; designed to capture non-productive areas within a stand) is 15%; Operational Adjustment Factor 2 (OAF2; designed to reflect decay/waste/breakage and some forest health issues within a stand) is 5%. Both values are the provincial default.
- A relatively small area of deciduous leading stands excluded from the THLB and volume in these stands does not contribute to timber supply (Section 6.14).

3.2 Sensitivity Analyses

The Base Case harvest flow will be tested through a series of sensitivity analyses to investigate the potential impact of uncertainties in the assumptions applied. By exploring various sensitivity scenarios, it helps pinpoint the factors that exert the most significant influence on outcomes, facilitating decision-making amid different levels of uncertainty. Patchworks, serving as the simulation and optimization tool for the Base Case, is expected to project changes in outcomes when inputs are altered. To ensure meaningful comparisons, sensitivity analyses only modify the assumption(s) under evaluation in comparison to the Base Case.

Downward pressures in sensitivity analyses aim to maintain short-term harvest levels close to those in the Base Case, while upward pressures involve adjustments that could potentially increase both short-term and mid-term yields, and possibly raise long-term harvesting levels. A summary of sensitivity scenarios, along with corresponding section numbers for further details, is provided in Table 5. Additional scenarios not covered in the table may be explored and reviewed as they emerge during the modelling, engagement with Indigenous communities, and public review process.

Table 5 Proposed Sensitivity Analyses

Scenarios To Be Tested	Proposed Sensitivity Analysis	Scenario Details
Growth and Yield	Increase natural stand yields by 10%	Section 8.1
	Decrease natural stand yields by 10%	Section 8.1
	Increase managed stand yields by 10%	Section 8.2
	Decrease managed stand yields by 10%	Section 8.2
Forest Inventory	Use LiDAR-based individual tree inventory (ITI) volumes for Natural Stands[2]	Section 5.2.4
	Use LiDAR-derived Individual Tree Inventory attributes on Natural Stands; Use LiDAR-derived height and Site Index value for Early Managed Stands [1]	Section 5.2.4
Forest Management / Silviculture	Exclude genetic gain adjustments	Section 8.2.7.2
Biodiversity	Retain old seral forests to full targets in NSOG Order	Section 10.3.3
Minimum Harvest Criteria	Add 10 years to the minimum harvest ages	Section 10.4.1
	Subtract 10 years from the minimum harvest ages	Section 10.4.1
Operability	Exclude helicopter operable landbase	Section 10.4.2.2
THLB	Increase THLB within all polygons by 10%	Section 6.2
	Decrease THLB within all polygons by 10%	Section 6.2

3.3 Alternative Harvest Flows

The harvest level in the Base Case will be periodically adjusted throughout each decade in the short and mid-term to align with the estimated long-term harvest level (LTHL). These adjustments are aimed at minimizing the duration during which harvest levels dip below the

[2] Definitions of Early Managed Stands and Natural Stands are consistent with Sec. 8 Growth and Yield.

LTHL, potentially resulting in alternative harvest flow scenarios based on the outcomes of the Base Case. One potential approach involves maintaining the current AAC for as long as possible while ensuring that harvest levels remain close to or above the LTHL. Another option is to implement a non-declining (even-flow) harvest level.

As the timber supply analysis is being prepared, the need for additional sensitivity analyses or adjustments in harvest flows may become evident. If deemed necessary, these additional analyses will be incorporated into the final timber supply analysis report for the Chief Forester's consideration.

3.4 Climate Change

Climate change represents a notable source of uncertainty. There is substantial consensus within the scientific community that changes in climate will impact forest ecosystems, necessitating adjustments in forest management approaches. Nevertheless, the extent and pace of these changes remain uncertain. Although there is not a precise way to forecast climate change and its outcomes, Western has incorporated various discussion topics to proactively deal with the potential consequences.

3.4.1 Future Projected Biogeoclimatic Zones

The BEC system categorizes the land base in British Columbia based on regional, local, and site conditions, considering climate, vegetation, soils, and topography (Province of British Columbia, 1994). BEC variants are useful indicators of local climate. In the early stages of TFL 6 MP #11, a raster dataset depicting the projected boundaries of 2071-2100 BEC variants was obtained from ClimateBC, developed by Dr. Tongli Wang from the Faculty of Forestry at the University of British Columbia (Wang, Hamann, Spittlehouse, & Carroll, 2016). This BEC projection reflects a climatic scenario of plausible future pathways in the Intergovernmental Panel on Climate Change's sixth assessment report (IPCC AR6) (Intergovernmental Panel on Climate Change, 2021).

While the 2071-2100 BEC projections indicate significant portions of TFL 6 transitioning into a "novel climate" – conditions outside the range currently observed in British Columbia – this information presents challenges for forest modelling. Since BEC zones are a crucial input for these models, directly applying projected BEC shifts may not be suitable for forecasting future forest conditions. Nevertheless, during the Quatsino (TFL 6) IRMP development (background refers to Section 1.2), a separate working group is engaging with staff from the Future Forest Ecosystems Centre and the Forest Carbon and Climate Services Branch within the Office of the Chief Forester. There is good agreement that climate shifts upwards in elevation bands, aligning the climate of certain variants, like CWHvm2 for today, more closely with others, such as CWHvm1 in the future (C. Mahony, personal communication, January 10, 2023). However, the exact timing of this shift remains uncertain.

The Province offers a robust climate change projection tool accessible through a Shiny App. The model leverages historical climate data (1961-1990) and recent data (2001-2020) to forecast future temperature and precipitation patterns. It also predicts potential ranges for various tree species under different climate change scenarios extending to 2100. However, using this model for customized runs requires collaboration with provincial government staff. Unfortunately, at the time of preparing this IP, localized projections specific to TFL 6 are not yet available. This limits the ability to conduct in-depth modelling until the provincial models are completed.

3.4.2 Operational Practices

Beyond the timber supply review process, Western is actively addressing climate change through various forest management practices, including but not limited to:

- Participating in the provincial forest fertilization program, which includes a carbon sequestration initiative. Specific stands designated for treatment within the THLB are generally targeted for harvested at least 10 years after application to maximize the benefits and carbon absorption potential.
- Adopting the Climate-Based Seed Transfer (CBST) led by the Forest Improvement and Research Management Branch of the Ministry of Forests (Province of British Columbia, 2017). CBST selects seeds based on the current and predicted future climates of regeneration sites. This helps forests adapt to climate change by planting trees that are more likely to thrive in future conditions. While changes in seed transfer limits have been minimal so far, they are anticipated to expand as climate patterns continue to evolve.
- For reforestation species options, the Climate Change Informed Species Selection tool (Province of British Columbia, 2025) is used to provide guidance on suitable species based on climate trajectories.
- Actively managing forest fuels to mitigate wildfire risks. Handling harvesting residues can reduce fire hazards by burning piles along roadsides and creating planting sites. However, as more environmentally friendly methods like prescribed burns or mechanical fuel removal become available, they will be prioritized considering the carbon footprint of pile burning.
- Employing qualified forestry professionals who consider the impacts of climate change when developing planting prescriptions. Species selection is based on their ecological suitability in both the current and projected future climates, as determined by qualified forestry professionals in collaboration with provincial ecologists. Forestry practices will continually evolve to ensure optimal outcomes. These suitable species are taken into account in future forest regeneration assumptions (Section 8.2.7).

Timber supply analyses are performed at least every 10 years. The forest inventory is regularly updated to incorporate the latest disturbances and silviculture practices. Furthermore, the analysis methodology continues to evolve with the integration of new information. Updated modelling is conducted periodically to use new information to inform decision-making in the next update cycle for the TFL.

3.5 Implementation Instructions from Previous AAC Determination Rationale Documents

In the 2012 TFL 6 AAC Determination Rationale, the Chief Forester identified four implementation items of note: 1) fertilization carried out on TFL 6, 2) genetic gain on stocks planted on TFL 6, 3) implementation of retention silviculture system, and 4) actual harvest performance on ground, cable and helicopter harvest systems (Province of British Columbia, 2012).

In the 2021 TFL 6 AAC Postponement Order, the Chief Forester identified two implementation items of note: 1) usage of LiDAR to update forest inventory, and 2) improvement on the information about cultural heritage values by working collaboratively with First Nations (Province of British Columbia, 2021).

In the 2016 TFL 39 AAC Determination Rationale, the Chief Forester identified the need for improved terrain stability mapping for Environmentally Sensitive Areas (ESAs) on unstable terrain, as the existing ESA mapping was outdated (Province of British Columbia, 2016). This requirement applies to TFL 39 Block 4, which was subsequently merged into TFL 6. Actions to address these implementation instructions are detailed below.

3.5.1 Implementation Instructions from 2012 Determination Rationale

3.5.1.1 Fertilization

To account for volume gains from fertilization in yield tables for existing and future managed stands, the Chief Forester requested Western to monitor fertilizer application on TFL 6. Since the last allowable harvest level was set in 2012, over 6,510 hectares within TFL 6 have been fertilized. This includes over 5,860 hectares receiving an initial treatment, with some areas receiving additional applications (350 hectares for a second treatment and 295 hectares for a third treatment). Figure 2[3] illustrates the yearly distribution of the fertilized areas. The enhanced yields from fertilized stands will be accounted for in the growth and yield projection (Section 7.3.4).

[3] No spatial record for Year 2022 and 2023

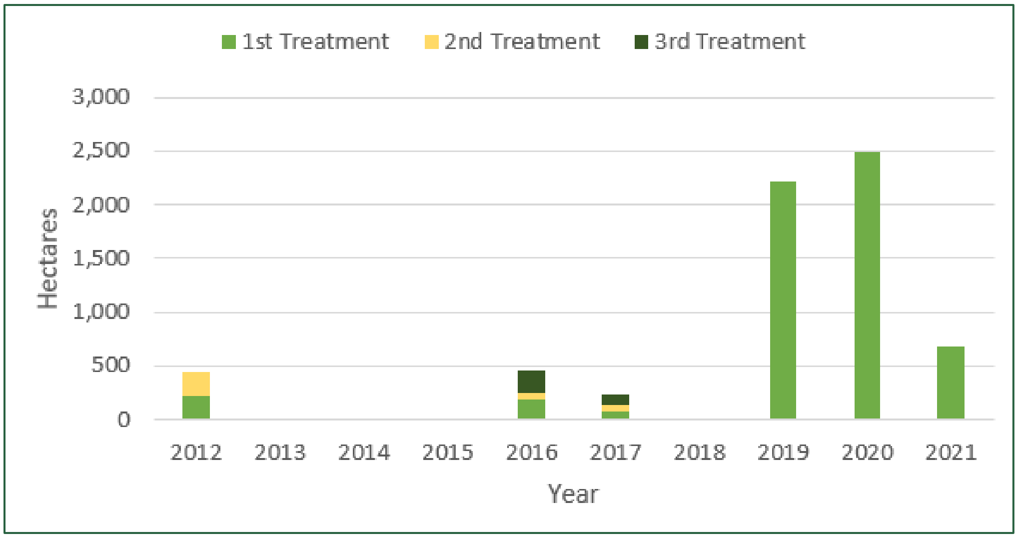

Figure 2 Area Fertilized in TFL 6 by Year Since 2012

3.5.1.2 Genetic Gain

The Chief Forester has instructed Western to monitor the implementation of planting genetically improved stock on the TFL. This request arises from the integration of volume gains resulting from genetic improvements into the yield tables for future managed stands, and concerns raised about the assumed hemlock planting quantity relative to naturally regenerated hemlock. Between 2012 and 2023, Western planted a total of 18,547,094 seedlings within TFL 6. The number of seedlings planted by species and the corresponding weighted average genetic gain is detailed in Table 6. The genetic gain values are derived from seedlot numbers and Western's Saanich Forestry Centre. The average genetic gain values of deployed stock meet or surpass the genetic gain values assumed in the last timber supply analysis for TFL 6, particularly for western redcedar (Cw) and yellow cedar (Yc).

Table 6 TFL 6 Average Genetic Gain by Species (2012-2023)

Species	Number of Seedlings Planted	% of Seedlings Planted	Weighted Average Genetic Gain (%)	Genetic Gain (%) used in TFL 6 MP #10
Amabilis Fir	687,166	3.7%	-	-
Douglas Fir – Coastal	1,668,977	9.0%	10.6	10.0
Lodgepole Pine – Coastal	18,996	0.1%	-	
Mountain Hemlock	50,710	0.3%	-	
Noble Fir	2,920	0.0%	-	
Red Alder	167,374	0.9%	11.2	

Species	Number of Seedlings Planted	% of Seedlings Planted	Weighted Average Genetic Gain (%)	Genetic Gain (%) used in TFL 6 MP #10
Sitka Spruce	1,087,148	5.9%	-	
Western Hemlock	3,324,803	17.9%	12.8	6 in high elevation sites or 10 in low elevation sites
Western Redcedar	10,381,702	56.0%	17.0	8.0
Western White Pine	86,525	0.5%	-	
Yellow Cedar	1,070,773	5.8%	14.3	7.0
Total	18,547,094	100.0%	13.7	

3.5.1.3 Silvicultural Systems

While implementing Variable Retention through the retention silvicultural system in its early stages during the timber supply analysis of MP #10, the Chief Forester directed Western to monitor its application in TFL 6. Between 2012 and 2023, 17,000 hectares were harvested in TFL 6. Of these, about 48% used the retention silvicultural system, while rest of 52% employed clearcutting with reserves. The MP #10 TSR assumed a 40% application of the retention silvicultural system, but the past performance on stand-level retention varied between 7% and 30% (averaging 17%), exceeding the TSR's 10.4% assumption. In other words, the variable retention assumptions in MP #10 were conservative. Western has applied the retention silvicultural system more extensively than assumed in the MP #10 since the last TSR. However, this higher retention may not necessarily reduce the AAC, as it could be designated for other resource values like riparian areas. Figure 3 illustrates the yearly application of the retention silvicultural system.

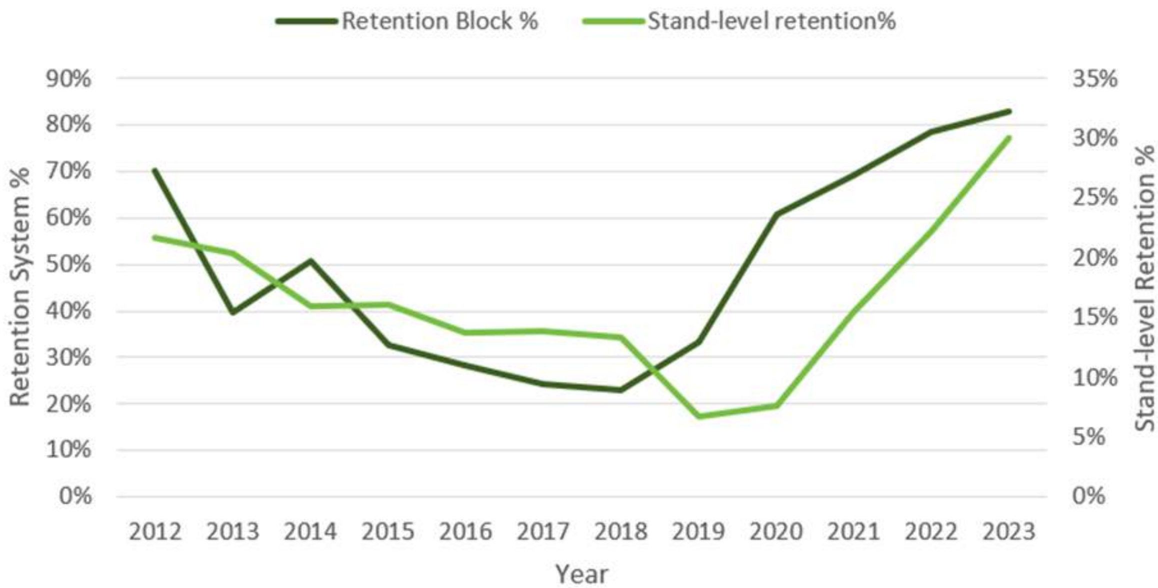

Figure 3 Application of Retention Silvicultural System in TFL 6

3.5.1.4 Harvest Performance

The Chief Forester has requested Western to monitor the harvesting activities categorized by operability class, namely cable, ground, and helicopter harvest systems. This directive is driven by the overarching goal of ensuring the economic sustainability of the TFL, with a primary focus on avoiding prolonged operations in challenging terrains requiring cable or helicopter systems.

Since the acquisition of LiDAR data for TFL 6 in 2012, the ability to access highly detailed information across the entire land base has significantly improved. Various LiDAR-derived datasets, such as Canopy Height Model (CHM), bare earth hillshade, slope, and streams, empowers Western foresters to identify productive forests, plan future road locations, and classify potential areas for future harvesting. Professional assessments have been conducted to spatially delineate future blocks and roads, associating them with suitable harvest systems. The post-harvest update of cutblock boundaries and the actual harvest method is also employed. This process is called Land Base Blocking (LBB).

Between 2012 and 2023, the harvested area of 17,000 hectares was distributed across operability classes identified in the LBB (details in Table 7). For comparison, Table 6 also includes harvest area percentages from the first decade of MP #10 timber supply analysis, acknowledging the larger land base in this management plan due to the inclusion of TFL 39 Block 4. Figure 4 further details the yearly harvest area by operability class since 2012. Notably, the actual harvest area proportions align well with MP #10's projections, despite the increased land base.

Table 7 TFL 6 Harvested Area (2012-2023) by Operability Class

Operability Class	Harvest Area (Ha)	Harvest Area (%)	Harvest Area (%) for the First Decade in MP #10 TSR (%)
Cable	6,867	40.3%	45%
Ground	9,827	57.6%	51%
Helicopter	203	1.2%	4%
Unknown/Unidentified/Inoperable[4]	161	0.9%	N/A
Total	*17,058*	*100%*	*100%*

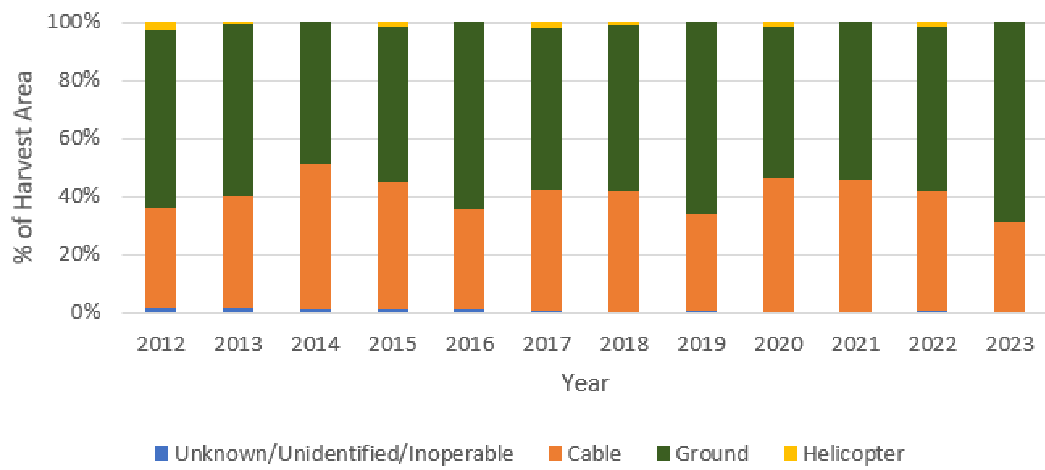

Figure 4 TFL 6 Harvested Area (2012-2023) by Operability Class

3.5.2 Implementation Instructions from 2021 TFL 6 AAC Postponement Order

3.5.2.1 LiDAR Forest Inventory

Since 2012, Western acquired LiDAR data to cover the entire TFL 6. The latest acquisition occurred in 2021 to 2022. The Chief Forester asked Western to update the forest inventory for the timber supply analysis.

In addition to employing the typical bare earth hillshade dataset and CHM for operational-level planning and mapping, Western has dedicated resources to leverage LiDAR data for improving inventory datasets related to TFL 6. This investment encompasses various phases, including a thorough LBB process aimed at delineating low productive areas within a

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[4] These areas were not identified in any harvest system in LBB but were harvested due to road Right-of-Way clearing, and operability inventory data issues or "slivers."

stand and identifying opportunities for timber harvesting and road development. LBB forms a basis of a physical operability inventory for TFL 6. Furthermore, Western also began the creation of an inventory known as the individual tree inventory (ITI) and the creation of additional resource inventory datasets using LiDAR technology.

3.5.2.2 Operability Inventory

Briefly mentioned in Section 3.5.1.4, LBB utilizes detailed LiDAR data on ground surfaces and canopy heights across TFL 6, enabling forest professionals to thoroughly assess opportunities for timber harvesting and road development. Specifically, non-productive and low-productive forests, as well as potential areas for future harvesting and road construction, are spatially delineated. Subsequently, appropriate harvesting methods (ground/cable/helicopter) are assigned to these designated areas. The LBB process unveils physically harvestable areas, with LBB polygons and associated roads forming the foundational draft for operational planning. Following the completion of LBB for TFL 6, post-harvest updates are made to the block boundaries, road locations, and the specific harvest systems employed. These adjustments ensure that the LBB dataset accurately reflects the activities and changes that have taken place on the land base. These datasets play a crucial role in determining operability (Section 6.8) in this TSR.

3.5.2.3 Individual Tree Inventory

Western's research and development initiatives in LiDAR technology have also expanded to include the creation of ITI. The ITI dataset provides detailed information on individual tree locations with estimates of species, diameter at breast height (DBH), tree height, gross and net merchantable volume/piece size, basal area, and other forest stand attributes. However, there are acknowledged limitations in directly utilizing ITI attributes in the TSR, particularly in existing natural stands in old seral stages. This limitation arises from the airborne acquisition method of LiDAR, where laser signals encounter challenges penetrating dominant tree crowns into co-dominant and understory layers, resulting in underestimations of understory basal area, total stems per hectare, and total stand volume per hectare in stands with understory trees (Sparks & Smith, 2022). Western has made multiple attempts to address these issues. In a study conducted in TFL 44 MP #6 in the South Island District, Western tested and compared the difference in relative accuracy among three different forest inventories: TFL 44 Forest Cover, the provincial VRI, and Individual Tree Inventory (ITI) based on LiDAR data acquired in 2016 (Western Forest Products Inc., 2021). Subsequently, Western developed a correction factor for the ITI-derived volume based on blocks harvested since the LiDAR acquisition, using linear regressions fit to the ITI volume estimates. This correction factor was then tested in an independent set of blocks. An internal analysis using the same methodology was also carried out in TFL 6, yielding similar results. However, the absence of ground sampling and the utilization of a training and testing dataset from the more biased (productive) part of the land base presented challenges for the Deputy Chief Forester in accepting this adjustment methodology in TFL

44 (Province of British Columbia, 2023). Since then, Western has been collaborating closely with FAIB staff to address these concerns. A pilot ground sampling and volume verification program has been completed for TFL 37 (North Island), TFL 44 (South Island), and TFL 64 (Mid Island) on Vancouver Island. This project aims to compare the ITI volume with the volume measured in the field, in both THLB and the Non-Contributing Land Base (NCLB) forests. The insights gained from these programs, along with the finalized adjustment methodology, will facilitate the validated use of ITI in strategic planning projects, such as TSR work, at a future date for TFL 6.

As this version of the IP was prepared, the ITI validation studies for TFL 6 (Mortyn, 2024a) and for other TFLs held wholly or partially by Western (Mortyn, 2024b) (Mortyn, 2024c) (Mortyn, 2024d)have been submitted to FAIB. These studies consistently demonstrate that adjusted ITI provides more accurate and precise stand volume estimates compared to forest cover data. On December 4, 2024, the Deputy Chief Forester directed that a dedicated field validation program be completed for TFL 6 prior to acceptance. A field sampling program for TFL 6 was subsequently completed during the 2025 field season. The analysis demonstrated that adjusted ITI volumes produce stand-level volume estimates that are both more accurate and more precise than estimates based on forest cover for TFL 6 (Mortyn, 2025). On November 3, 2025, FAIB has reviewed the results of the TFL 6 ITI validation and concluded that the adjusted ITI volumes provide an improvement in volume estimation over the forest inventory for TFL 6. The Deputy Chief Forester’s December 2024 correspondence, TFL 6 ITI validation report, and FAIB’s review on the TFL 6 ITI validation report can be found in the appendix section of the associated timber supply analysis report.

3.5.2.4 Riparian Inventory

Since the introduction of LiDAR in TFL 6, the prediction of stream locations has advanced through processes using LiDAR bare earth ground conditions, topology, and flow accumulation information. However, the detailed classification of streams traditionally relies on fieldwork. In a dedicated project for TFL 6, riparian classes were assigned to the LiDAR-derived stream network using machine learning techniques. To accomplish this, a training dataset was created from a subset of LiDAR-derived streams that were spatially matched to the field-verified equivalent. These field-verified streams, with classification and stream channel width information, were then compared to the flow values from the LiDAR flow accumulation raster. This became the basis for stream width classification across the land base. Each stream segment was subsequently categorized as either fish-bearing or non-fish, employing various parameters such as field-verified stream classes (S4 and above), community watersheds, elevation, known fish-bearing lakes, and fish observation points from BC Data Catalogue. Additionally, predicted fish breaks generated from LiDAR slope data were considered in this classification. To ensure the accuracy and integrity of the data, a thorough operational review and calibration were conducted by Western's forestry professionals, with a specific focus on streams within blocks where the most accurate field-verified streams are located. The resulting LiDAR-classified stream dataset, complete with its assigned classes, serves as the foundational data for land base classification (refer to Section 6.9 for more details).

The LiDAR projects exemplify Western's strong dedication to utilizing LiDAR data across various aspects of forestry planning. It is recognized that certain LiDAR-related initiatives are still in progress and achieving full-scale implementation in TFL 6 MP #11 may not be feasible within the current timeline. However, Western is committed to integrating the latest available LiDAR advancements into the Base Case, such as incorporating LiDAR-derived streams for riparian areas and LBB for operability. Alternatively, these advancements may be included as part of a sensitivity analysis, as seen in the case of adjusted ITI attributes in other TFLs.

3.5.2.5 Cultural Heritage Value

The Chief Forester has provided a new communication model for the development of MP #11. This model is intended to provide increased opportunities for early engagement with the First Nations identified in Section 1.2 within the TFL 6 area, supported by extended timelines to incorporate input at the initial stages of the IP preparation.

Consistent with this approach, a letter communicating the commencement of the TSR and inviting early engagement was shared to all First Nations in the TFL 6 area in April 2023. Subsequently, in December 2023, a summary of key assumptions and data for this IP document was shared, providing an overview of the data sources and forest management assumptions across all aspects of this IP document. Western intends to also adhere to this early engagement model during the development of the draft timber supply analysis report and MP in the subsequent stages of the TFL 6 TSR process.

In parallel with the formal TSR process, Western and Quatsino are collaboratively developing an IRMP guided by Quatsino's Land Use Plan as described in Section 1.2. This work is integral to the stewardship of cultural heritage values and Western and Quatsino have maintained regular communications with the Office of the Chief Forester. The Chief Forester has acknowledged the progress and importance of this planning and associated IRMP and TSR linkages on March 13, 2023, April 12, 2023, and September 22, 2023. In recognition that the IRMP is still in progress at the time of the current TSR, the latest guidance provided by the Chief Forester is for the analysis results to be reviewed in coordination with FAIB once the IRMP is complete, enabling this information to be integrated at that time.

The current version of the IP has integrated some of the early feedback from First Nations. Details on how this work is reflected can be found in cultural heritage value (Section 6.16) and karst (Section 6.22) sections.

3.5.3 Implementation Instructions from 2016 TFL 39 AAC Determination Rationale

applicable to old TFL 39-4 Block

On January 1, 2015, TFL 39 Block 4 (Benson River area) was merged into TFL 6. Given the current TFL 6 AAC determination of February 2012 (Province of British Columbia, 2012), and the current TFL 39 AAC determination of August 2016 (Province of British Columbia, 2016), some implementation of note in the TFL 39 AAC determination is relevant to the old TFL 39 Block 4 portion of the TFL 6.

3.5.3.1 Unstable Terrain

The Chief Forester has instructed Western to enhance the information on terrain stability mapping in areas where only Environmentally Sensitive Areas (ESA)-based mapping is currently available. This pertains specifically to the former TFL 39 Block 4 section within TFL 6 (about 21% of TFL 6). The rest of the TFL 6 has Detailed Terrain Stability Mapping (DTSM) or Landslide Hazard Mapping (LSHM).

Given LiDAR's ability to reveal detailed terrain information, particularly slope which strongly correlates with stability, LiDAR-derived slope is a logical tool to quantify unstable terrain within TFL 6. An operational review of LiDAR slope data for blocks harvested since 2012 (following Management Plan #10 approval) revealed that only 4.8% fall within the 90+% slope zone (Table 8). This translates to over 95% of harvested areas since the last AAC determination having slopes below 90%. Consequently, LiDAR-derived slope data will replace the outdated ESA-based terrain mapping for TFL 6. Areas exceeding 90% slope will be excluded from the THLB (refer to Section 6.19 for more details).

Table 8 Distribution of Slope for 2012-2023 TFL 6 Harvested Area

LiDAR-Derived Slope Ranges (%)	Proportion of TFL 6 2012-2023 Harvested Blocks
0 – 10	11.6%
10.1 – 20	17.8%
20.1 – 30	16.2%
30.1 – 40	13.8%
40.1 – 50	11.5%
50.1 – 60	9.3%
60.1 – 70	7.0%
70.1 – 80	4.9%
80.1 – 90	3.1%
90+	4.8%
Total	100.0%

3.6 Major Changes Since the Previous MP

This section outlines key changes in forest management considerations and data source since MP #10. The Base Case incorporates current management practices, including new practices and improved data. These changes, discussed in detail in subsequent sections, affect the timber supply analysis and harvest forecast. Uncertainties arising from management considerations are explored through sensitivity analyses detailed in Section 3.2.

3.6.1 Land Base/Land Use Changes

- The boundary of TFL 6 has expanded since MP #10 with the former TFL 39 Block 4 now included in TFL 6. The current THLB and AAC level come from a mathematical summation of the former TFL 39 Block 4, utilizing resource feature datasets and assumptions from TFL 39 MP #9. The lack of interaction and dynamics with the rest of TFL 6 making direct comparisons to previous TSRs challenging.
- Additional UWRs, OGMAs (both legally established and proposed), and WHAs (both legally established and proposed) have been established since MP #10 (Section 6.10 to 6.12). Many additional OGMAs and WHAs are designed to comply with the Marbled Murrelet Order. Further Marbled Murrelet suitable areas will be reserved to meet the landscape unit Aggregate/ landscape unit targets prescribed by the Order (Section 6.12.3).
- Additional areas to protect research sites (Section 6.18), permanent sampling plots (Section 6.20), big trees (Section 6.21), and karst features (Section 6.22) are excluded from THLB in MP #11.

3.6.2 Better Data

- The forest inventory of TFL 6 underwent a Phase II adjustments compatible with VDYP 7 standards as part of the Pacific Timber Supply Area (TSA) TSR project, differing from the VDYP 6 standards used in MP #10. Nevertheless, this change is anticipated to have minimal impact. Forest inventory sourced from the former TFL 39 Block 4 is now part of TFL 6. Additionally, the forest inventory has been further updated based on harvesting, silviculture activities, and survey results up to December 31, 2023 (Section 5.1).
- MP#11 leverages LiDAR for a more precise assessment of productivity (Section 6.7) and physical operability (Section 6.8). Economic operability in MP#11 focuses on helicopter harvest systems, considering factors such as species mix, timber volume, and flight distance (Section 6.13).
- LiDAR-derived classified streams replace the field-verified & TIRM-based streams used in MP #10. The proportions of THLB netdown on riparian management zones are updated based on harvest performance since MP #10 (Section 6.9).

- MP #11 incorporates spatial data on registered government archaeological sites for exclusion from the THLB. In addition, a more informed THLB netdown methodology is employed to account for unknown cultural heritage resources in MP #11, thanks to early engagement with Quatsino First Nations (Section 6.16).
- MP#11 utilizes LiDAR-derived slopes and existing Detailed Terrain Stability Mapping (DTSM) for THLB netdown, replacing the rate-of-harvest restrictions and outdated ESA terrain mapping used in former TFL 39 Block 4. (Section 6.19).

3.6.3 Revised Information and Assumptions

- Site index and ecosystem classification data used in MP #10 were sourced from a local study conducted by Terry Lewis, Ph.D. between 1982 and 1985. For MP #11, the data sources align with provincial sources of Site Index Estimates by BEC Site Series (SIBEC) and Terrestrial Ecosystem Mapping (TEM) based on BEC zone & site series classification system (Section 8.2.1 and Section 7.3.2).
- Road widths for existing roads have been slightly reduced in MP #11 based on measurements conducted using recent orthophotos and reviews of road width assumptions in nearby North Island TSA data packages (Province of British Columbia, 2020) with resource roads directly connected to TFL 6 (Section 6.5).
- MP#11 utilizes Patchworks for timber supply modelling, replacing Remsoft's Spatial Planning System (Woodstock) used in MP#10 (Section 4).
- With the spatial capabilities of the Patchworks model, cutblock green-up and adjacency can be spatially modeled (Section 10.3.2).
- MP#11 utilizes the latest versions of stand-level growth and yield modelling software (VDYP 7.33b and TIPSY 4.6) with updated yield projections compared to MP#10 (VDYP 6.6d and TIPSY 4.1).
- With the detailed LiDAR-derived slope data, Visual Quality Objectives (VQO) are modelled considering slope, plan-to-perspective ratio, and visual absorption capability at the polygon level in MP #11, as opposed to a broader disturbance rate by each VQO class in MP #10 (section 10.3.1).
- Analysis unit definitions in MP#11 align with provincial BEC zone (Version 12) and site series system, resulting in more analysis units with varying species composition, site indices, and densities (Section 7.3).
- Genetic gains used in MP #11 are based on the latest genetic worth data from the seedlots planted since MP #10 for recently managed AUs (Section 7.3.1.2.2), and current projections for future AUs (Section 8.2.7.2), resulting in higher genetic gain values than MP #10.
- A higher proportion of non-recoverable losses due to biotic and abiotic disturbances is implemented in MP #11 compared to MP #10. Additionally, natural disturbances outside of THLB are modeled in MP #11 (Section 9).

- Watershed high sensitivity zones and Equivalent Clearcut Area (ECA) limits are prescribed to more specific high sensitivity zones for watersheds in MP #11, compared to rate-of-harvest restrictions in four watersheds in MP #10 (Section 10.3.6).

3.6.4 Management Practices

- The practice of variable retention has evolved into a more detailed zonal system, considering VILUP resources management zones and wind exposure in MP #11 (Section 10.4.3). This improved variable retention strategies employed by Western have resulted in more existing WTRAs created (Section 6.17) and modified future WTRAs (Section 6.23) THLB netdown assumptions.
- With the implementation of updated variable retention silvicultural system zones in MP #11, TIPSY-based volume reduction for managed AUs due to shading effects is now implemented. (Section 8.2.8.2).
- Minimum Harvest Age has evolved from diameter by site productive class to the utilization of 95% culmination Mean Annual Increment Age and a minimum harvest volume of 350 m^3/hectare (Section 10.4.2).

4 Harvest Model

The TFL 6 timber supply analysis will utilize Patchworks™ software, created by Spatial Planning Systems Inc. based in Deep River, Ontario. Patchworks has been used in various Management Units across British Columbia and is an approved software for TSR by the Province of British Columbia.

Patchworks functions as a spatial model for timber supply, projecting harvesting activities in line with existing forest management practices over time. Employing goal programming, Patchworks schedules activities to effectively balance multiple specified objectives within the planning process. The spatially explicit nature of the model allows the inclusion of locational information in the strategic planning process, accommodating various management objectives measured in different units. These objectives encompass harvest volume (m3/year), cutblock size (hectare), distributions adjacency (metre), green-up requirements (metre), and patch size targets (% area/size class/period).

In this analysis, optimization within Patchworks will be employed to formulate the Base Case harvest schedule, taking into account all the non-timber objectives such as visual quality, cultural heritage resources, recreation, biodiversity, and wildlife habitat, alongside the primary objective of timber harvest. The aim is to maximize the flow of harvest for long-term timber supply while ensuring the preservation of other values. The timber supply forecast seeks to achieve long-term harvest potential and minimize abrupt changes during the transition from the current harvest level to mid- and long-term sustainable levels. Additionally, the model will project forest growth beyond the timber harvesting land base while accounting for natural disturbances (refer to Section 9.4).

5 Forest Cover Inventory

5.1 Vegetation Resources Inventory

A Vegetation Resource Inventory (VRI) project for TFL 6 was initiated in 1999. The VRI project received funding from Forest Renewal BC (FRBC) and the Forest Investment Account (FIA). Phase I, which involved the delineation of forest cover polygon boundaries and the estimation of attributes using aerial photography, was completed in 2000. This phase utilized 1:15,000 scale color imagery captured in 1995. Phase II, which included ground sampling and the Net Volume Adjustment Factor (NVAF) sampling, was conducted in 2001. The final component, the statistical adjustment for VDYP 6, was completed and reported on by the Timberline Natural Resource Group in 2009 (refer to Appendix A: TFL 6 Vegetation Resources Inventory Statistical Adjustment 2009 for more details). The results, approved by FAIB, were utilized in the TFL 6 MP #10 timber supply analysis.

The Phase II adjustments were updated the current VDYP 7 standard by Forest Ecosystem Solutions Ltd. in 2016 as part of a nearby Pacific Timber Supply Area project (details in Appendix B: TFL 6 Vegetation Resources Inventory Statistical Adjustment 2016). This Management Plan incorporates these updated adjustments, and the forest inventory has been further updated based on harvesting, silviculture activities, and survey results up to December 31, 2023.

The forest inventory for the portion originating from TFL 39 Block 4 is based on forest inventory data completed in the 1960s and audited in the late 1990s. For mature inventories (stands exceeding 100 years old in the 1960s inventory cruises or stands that are now over 160 years old), the land base was categorized as either accessible timber (MCI) or inaccessible timber (MCIII). The inventory of mature stands was not designed to employ provincial growth and yield models for volume generation. Instead, cruise-based field samples were used to determine volumes for MCI stands. For MCIII stands, volumes were estimated by comparing them to similar MCI stands using aerial photographs. The audit of the TFL 39 Block 4 inventory conducted in the 1990s revealed adjustment ratios to account for potential inaccuracies in the original estimates. The ratio for MCI was 0.95, indicating a slight underestimation, while MCIII required an adjustment of 1.26. The current TFL 39 MP #9 (Western Forest Products Inc., 2014) incorporates this adjustment for MCIII stands, but not for MCI due to a lack of statistical significance. All immature forests were cruised and mapped during the 1960s inventory. Each stand was characterized by age, species, site index class, and stocking. For young stands, the standard practice involved re-inventorying these stands once they reached "pole size," typically between 30 and 40 years old. At this stage, the site index was measured based on the growth of the new stand, and volume or basal area were obtained as measures of stocking conditions. Approximately

35,000 hectares of this original inventory data (16% of the total area), or about 14,300 hectares of THLB (12% of the total THLB) is still included in the current TFL 6 inventory. Similar to mature stands, sample plots for immature stands were randomly distributed to avoid bias. The results, however, only apply to the specific sampled stands and are not extrapolated to unsampled areas. The provincial Chief Forester approved the forest inventory, as documented in the TFL 39 AAC determination rationale (Province of British Columbia, 2016).

In 2016, a project was undertaken to transition the inventory updates for the portion of TFL 6 that is based on the TFL 39 forest inventory to a stand-based system as is done for the legacy TFL 6 inventory. This new system aligns more closely with how the provincial VRI is updated. Stand are updated at the polygon level using provincial growth and yield models. For the former TFL 39 Block 4, cruise-based stand attributes directly feed into the provincial growth and yield model, eliminating the need for separate adjustments. The forest inventory undergoes consistent updates to reflect changes due to harvesting, silviculture activities, and new survey results. This process leverages Western’s forest information management system, Trimble’s Trimble Land Resource Manager (LRM). The forest inventory is current as of December 31, 2023.

5.2 LiDAR

As previously illustrated in Section 3.5.2.1, Western acquired LiDAR data for TFL 6 in multiple phases: initially for a pilot project in early 2012, and subsequently in 2016 and 2021/2022.

In its initial application within the forestry sector, LiDAR primarily served to generate precise Digital Elevation Models (DEMs) of the ground surface and CHMs for forest road engineering and cutblock development. However, advancements in technology and data analysis have transformed LiDAR into a powerful tool for assessing a wide range of forest inventory attributes. These include, but are not limited to, tree height, density, and volume, for both stand level and individual tree level. This transformation highlights the increasing role of technology in enhancing the understanding and management of forest resources within TFL 6.

5.2.1 Land Base Blocking

The LBB process, as referenced in Section 3.5.2.1, was implemented across TFL 6. The purpose of this process was to conduct a comprehensive review of the entire land base, assessing its potential for timber harvesting and road development. Western’s team of forest professionals spatially assign attributes to various aspects of the land base. These included non-forested areas, low productivity forest areas, harvestable areas, harvest systems, and potential road locations. This meticulous process ensures that every hectare of the land base is considered in the planning and management of forestry operations.

The implementation of the LBB process informs the development of the updated operability mapping (Section 6.8), which is then reflected in the Base Case scenario of TFL 6 MP #11.

5.2.2 Stand Heights

LiDAR heights at the stand level were generated by following a simplified version of the FOR's LiDAR Enhanced Forest Inventory (LEFI) methodology implementation. The LEFI methodology, originally developed by the FAIB, was designed to update VRI attributes by leveraging available LiDAR datasets (Province of British Columbia, 2019).

For stands in TFL 6, heights were generated using LiDAR CHM data. Tree location points were derived from the LiDAR CHM dataset. A 20m x 20m grid was superimposed over the CHM dataset, and the average height of the top four trees (Ht_top4) was computed. This value was then summarized to the forest cover inventory polygon for the timber supply model. Ht_top4 is the default LiDAR height.

Further verification was conducted by calculating the following indicators: coefficient of variation (CV), roundness index (an index indicating the length to area ratio to identify long, skinny polygons), and the number of grid cells used to calculate the Ht_top4 mean. For stands that are highly variable (CV > 40%), highly irregular (roundness index < 0.05), or too small (number of cells < 20), the tree height value for the 50th percentile of the tree list (sorted in descending order, denoted as PolyHt50) for the polygon becomes the LiDAR tree height.

While it is acknowledged that LEFI has further processes to assign the 5th, 10th, 20th, and 30th percentile of the tree height based on different crown closures, the proportion of these options applied to forest stands is relatively small. In the original analysis that formed the LEFI methodology, 89% of the LiDAR tree heights was determined using Ht_top4 and 10% was using PolyHt50 (C. Robinson personal communication, June 8, 2020). In TFL 44, located within the South Island District, approximately 65% of the THLB area is determined using Ht_top4 (Tsawak-qin Forestry Limited Partnership, 2023). Table 9 provides a breakdown of the LiDAR tree height source for TFL 6.

Table 9 LiDAR Height Source for TFL 6

LiDAR Height Source	Gross Area (Ha)	Percentage of Gross Area (%)	THLB Area (Ha)	Percentage of THLB Area (%)
Ht_Top4	141,779	65.3%	82,393	68.6%
Poly_Ht50	74,161	34.1%	37,384	31.2%
Unclassified	1,257	0.6%	322	0.3%
Total	*217,197*	*100%*	*120,099*	*100%*

5.2.3 Site Index

The Site Index (SI) serves as an indicator of stand productivity. For the SI in the forest cover inventory (used in the Base Case), the sources are described in Section 8.2.1.

With the integration of LiDAR-derived stand heights, the predicted growth trajectories for forest stands will deviate from those based on the original forest cover attributes.

For managed stands established after 1961 (as defined in Section 7.3.1.2), the SI has been recalculated using LEFI height and stand age. This recalculation was performed using Site Tools version 4.3. While the SI for stands established before 1961 remains unchanged, the LEFI heights will influence the projection of stand growth within the VDYP growth and yield model software.

5.2.4 Individual Tree Inventory Attributes

The Individual Tree Inventory (ITI) data, as detailed in Section 3.5.2.1, was generated for TFL 6 using the Timber Species Identifier software, developed by Object Raku, now part of Forsite Consultants Ltd.. The software segmented and delineated individual tree crowns based on LiDAR point cloud data. This data was then calibrated using field-identified tree data, with trees from the same species grouped by different ecosystems and forest types.

The ITI dataset includes the locations of individual trees, along with estimates of species, DBH, volume/piece size, basal area, and other forest stand attributes. The trees identified by LiDAR can be summarized up to the forest cover polygon level to generate a set of LiDAR-based forest stand attributes.

Species composition, from Species 1 to Species 6, at the stand level can be computed using a basal area-weighted method. Stand basal area, DBH, and density can be summarized by adding values from all the individual trees within the forest cover polygon. Stand volume can also be summed, but an adjustment must be made to account for missing understory trees (discussed in Section 3.5.2.1.2).

Western is actively collaborating with FAIB to obtain full approval for the use of LiDAR-derived ITI in forest inventory and strategic analysis. In November 2025, FAIB indicated that the adjusted Integrated Timber Inventory (ITI) volumes represent an improvement in volume estimation over the existing forest inventory for TFL 6. LiDAR-derived attributes are proposed for use in sensitivity analyses for TFL 6 MP #11. This approach ensures that the potential impacts and benefits of incorporating LiDAR data can be thoroughly evaluated and understood. Two sensitivity analyses are planned:

1. Application of adjusted ITI volumes to natural stands: For Natural Stands (established since 1961; see Section 7.3.1.17.3.1.1), forest cover stand volumes will be replaced with adjusted ITI volumes aggregated to the corresponding forest cover

polygons. To account for understory trees not captured in the ITI data, an adjustment factor derived and verified from field samples within TFL 6 (Mortyn, 2025) will be applied to the yield curves. VDYP growth and yield curves will then be modified to pass through the known adjusted ITI volume and corresponding stand age using the methodology described by Pienaar & Rheney (Pienaar & Rheney, 1995).

2. LEFI Height Adjustment for Early Managed stands: Building on the application of adjusted ITI volumes to natural stands, LEFI stand heights will be calculated for each forest cover polygon. Site Index values for Early Managed Stands (established between 1961 and 2000; see Section 7.3.1.2.1) will be re-generated with the LEFI height using SiteTools version 4.3. Area-weighted average attributes will then be recalculated at the analysis unit level to support the redevelopment of yield curves.

5.3 Current Age Class Distribution

Table 10 presents the current age class distribution of the productive forest land base (refer to Section 6.6 for the definition) and the THLB for TFL 6 as of December 31, 2023. It is important to note that areas and volumes listed as zero years old may appear overstated. This is because they include areas that were planted in 2023, for which the species information was not yet available, and areas that were harvested in 2023 but are scheduled to be planted in 2024.

Table 10 Forest Age Class Distribution for TFL 6

Age Range (years)	Area		
	Productive Forest	THLB	NCLB
0-20	31,795	29,199	2,596
21-40	38,228	30,988	7,240
41-60	38,199	28,059	10,140
61-80	15,883	10,261	5,622
81-100	6,372	2,867	3,505
101-120	3,521	1,601	1,920
121-140	2,930	1,446	1,484
141-250	20,755	6,712	14,043
>250	29,742	8,964	20,777
Total	***187,425***	***120,099***	***67,326***

Figure 5 and Figure 6 provide a visual representation of the age class distribution by area for both the productive forest land base and the THLB. Similarly, Figure 7 and Figure 8 display the age class distribution by volume for the productive forest land base and the THLB. These figures offer a clear and comprehensive view of the age class distribution for the current state of the forests across TFL 6.

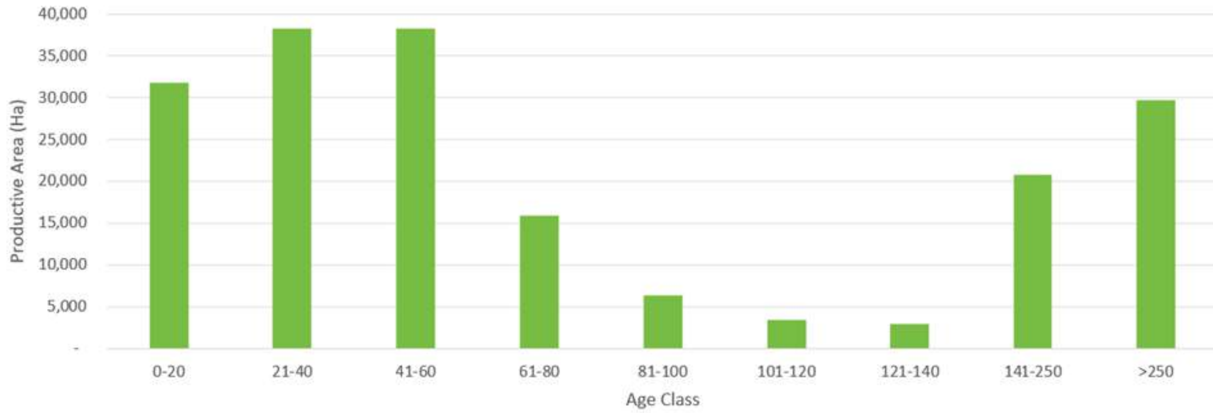

Figure 5 Productive Forest Age Class Distribution – Area

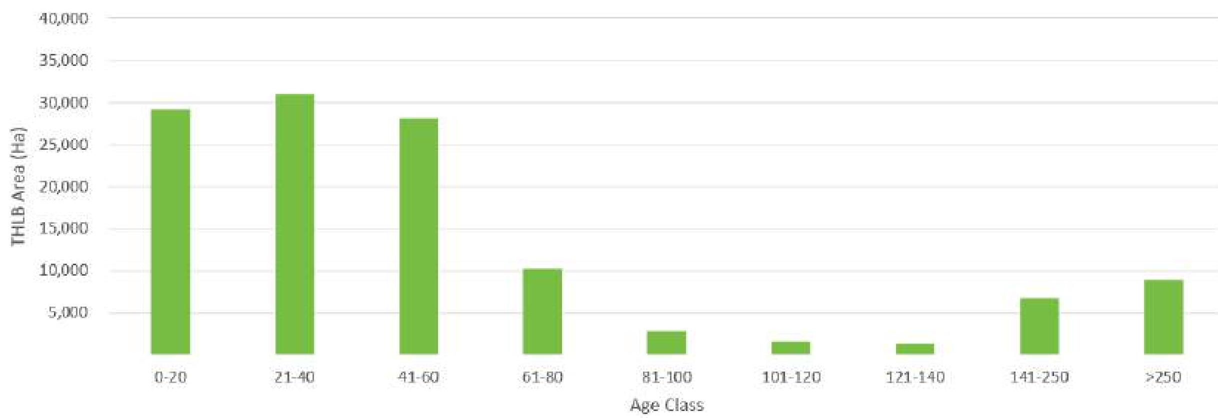

Figure 6 THLB Age Class Distribution - Area

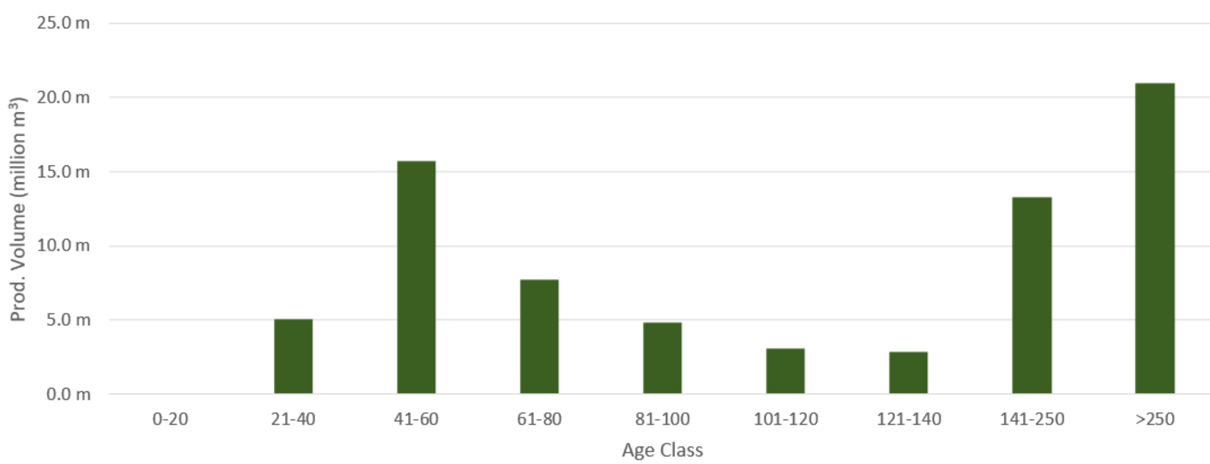

Figure 7 Productive Forest Age Class Distribution - Inventory Volume

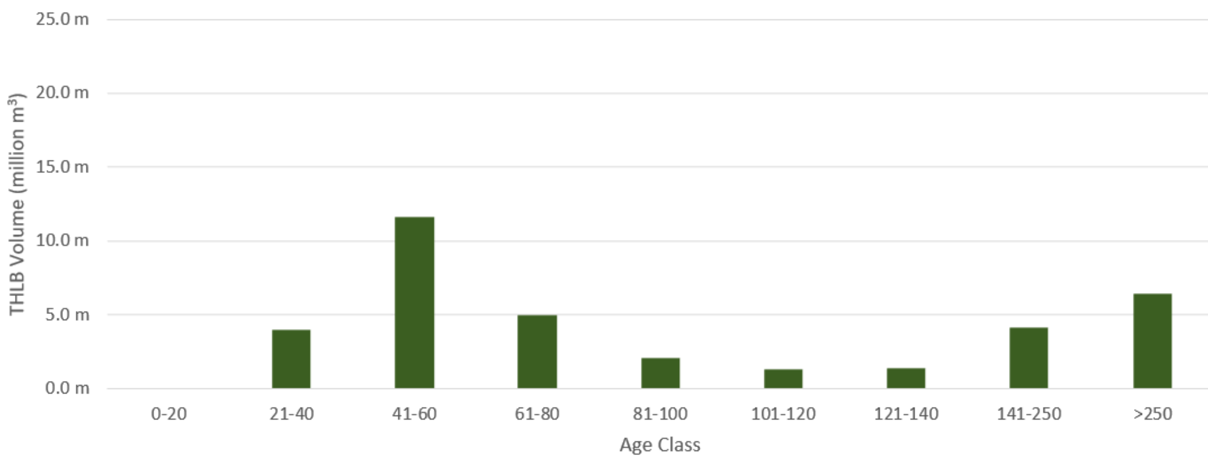

Figure 8 THLB Age Class Distribution - Inventory Volume

5.4 Age and Volume Projections

The Patchworks model will be constructed into five-year planning periods for 300 years. The initial age and volume data in Patchworks are projected to the year 2023, For areas recently harvested and awaiting reforestation, it is assumed that the new stand is established one year after the completion of harvest. For instance, areas harvested in 2023 are expected to be reforested in 2024 with 1-year-old seedlings, following the reforestation assumptions outlined in Section 8.2.7.

6 Description of Land Base

This section provides a detailed description of the TFL 6 land base and outlines the methodologies employed to identify the portion of the land base that contributes to timber harvesting, referred to as the THLB. Despite certain portions of the productive land base not contributing directly to the harvest, they play a vital role in ensuring the sustainability of non-timber resources. These specific areas are categorized as NCLB. It is noted that the areas and volumes presented in all tables within this section may not sum up perfectly due to the rounding of figures to the nearest hectare (area) or 1,000 m3 (volume).

6.1 AAC Allocation and Land Base Changes

Table 11 shows the history of the TFL 6 AAC since the creation in the 1950s. The reductions are mainly due to land base additions and removals, and the additional conservation of forests to protect other forest values.

Table 11 TFL 6 AAC History

Date From	Date To	MP No.	Total TFL 6 AAC (m3/year)
01-Jan-51	31-Dec-60	1	509,703
01-Jan-61	31-Dec-65	2	730,574
01-Jan-66	31-Dec-68	3	1,200,641
01-Jan-69	31-Dec-70	3	1,050,561
01-Jan-71	31-Dec-71	4	1,367,711
01-Jan-72	31-Dec-74	4	1,328,548
01-Jan-75	31-Dec-75	4	1,357,594
01-Jan-76	31-Dec-78	5	1,209,129
01-Jan-79	31-Dec-81	5, 6	1,180,811
01-Jan-82	31-Dec-86	6	1,320,000
01-Jan-87	30-Nov-95	7	1,300,000
01-Dec-95	30-Sep-98	8	1,288,000
01-Oct-98	31-Aug-01	8	1,490,000
01-Sep-01	30-Jan-07	9	1,460,000
31-Jan-07	14-Jul-09	9	1,343,200
15-Jul-09	09-Feb-12	9	1,260,536
10-Feb-12	31-Dec-14	10	1,160,000
01-Jan-15	Present	10	1,362,000

The AAC determined based on TFL 6 MP #10 in February 2012 was 1,160,000 m³. Following the transfer of TFL 39 Block 4 to TFL 6 as per Instrument #101 in January 2015, the AAC was revised to 1,362,000 m³. In April 2021, the determination of the AAC was deferred for a period of two years.

Of the current AAC of 1,362,000 m³, a substantial portion, 1,350,422 m³ or 99.1%, is allocated to Western. The remaining 11,578 m³, which constitutes 0.9% of the AAC, is allocated to the Kwakiutl Forestry GP Corporation, owned by the Kwakiutl First Nation, under forest licence A98197.

When the timber supply analysis dataset was compiled, the total area of TFL 6 was 217,200 hectares. This represents a net increase from the total area of 171,441 hectares at the time of the last AAC determination in February 2012. The increase in area is attributed to the addition of areas as documented in Instrument #101 in January 2015 due to addition of TFL 39 Block 4.

6.2 Timber Harvesting Land Base Determination

The Productive Forest Land Base (PFLB) refers to the area of productive forest within the TFL that contributes to landscape-level objectives such as biodiversity and the management of non-timber resources. This excludes non-forested areas, non-productive forest areas, and existing roads and powerlines.

The THLB is the portion of the TFL where timber harvesting is anticipated to occur. It is a subset of the PFLB, excluding areas that are inoperable, uneconomical for harvesting, or expected to be set aside for the management of non-timber resources. In practice, harvesting may occur outside the modelled THLB, as the THLB used in the analysis is a GIS-based estimate of an operational reality. The inclusion or exclusion of a specific site in the THLB does not necessarily dictate its management approach. As such, the estimate of the THLB has limited applicability outside of the timber supply analysis.

The THLB and the total long-term land base in TFL 6 are presented in Table 12, which includes the split between Schedule A (Timber Licence) and Schedule B (Crown land). Merchantable volume estimates are indicated in Table 13. These areas and volumes have been compiled from GIS databases constructed for the preparation of this Information Package. A visual representation of the THLB can be found in Figure 9.

Subsequent sections provide a comprehensive breakdown of the total area/volume categorized in each specific category listed in Table 12 and Table 13. These sections aim to summarize the area/volume that is subtracted from the land base, following the order of categories as depicted in the tables (i.e., addressing overlaps in a hierarchy). Please note that the areas and volumes displayed in the tables may not always add up precisely. This discrepancy is due to the rounding of figures to the nearest hectare for areas and to the nearest 1,000 m³ for volumes.

Table 12 Timber Harvesting Land Base Netdown (ha) for TFL 6

Classification	Total Area (Ha)	Net Area (Ha)			% Total	% PFLB
		Schedule A	Schedule B	Grand Total		
		Timber Licence	Crown			
Total Land Base	**217,197**	**23,578**	**193,619**	**217,197**	**100.0%**	**-**
Less Non-forest	15,943	231	15,712	15,943	7.3%	-
Less Existing Roads & Powerlines	5,261	705	4,316	5,021	2.4%	-
Total Forested	**-**	**22,643**	**173,590**	**196,233**	**90.3%**	**-**
Less Non-productive	14,939	519	8,289	8,808	6.9%	-
Total Productive	**-**	**22,123**	**165,301**	**187,425**	**83.5%**	**100.0%**
Low Sites	20,484	913	9,013	9,927	4.6%	5.3%
Less Inoperable	52,405	1,974	19,218	21,193	9.8%	11.3%
Total Operable	**-**	**19,236**	**137,069**	**156,305**	**72.0%**	**83.4%**
Reductions:						
Riparian Management	57,033	535	4,945	5,479	2.5%	2.9%
Ungulate Winter Ranges	2,366	1	1,618	1,619	0.7%	0.9%
Old Growth Management Areas	16,146	7	5,485	5,491	2.5%	2.9%
Old Growth Management Areas - Proposed	17,609	447	4,870	5,317	2.4%	2.8%
Wildlife Habitat Areas - Legal	2,760	1	413	414	0.2%	0.2%
Wildlife Habitat Areas - Proposed	676	1	16	17	0.0%	0.0%
Uneconomic	86	0	20	20	0.0%	0.0%
Deciduous-leading	4,294	41	1,536	1,576	0.7%	0.8%
Recreation	20	0	6	6	0.0%	0.0%
Known Archaeological Sites	893	186	341	527	0.2%	0.3%
Existing Stand-level Reserves	7,747	598	2,491	3,089	1.4%	1.6%
Research Site	112	-	13	13	0.0%	0.0%

Classification	Total Area (Ha)	Net Area (Ha)			% Total	% PFLB
		Schedule A	Schedule B	Grand Total		
		Timber Licence	Crown			
Terrain Stability - Class 5	9,257	300	1,693	1,993	0.9%	1.1%
Terrain Stability - LiDAR 90% + Slope	10,020	273	1,547	1,820	0.8%	1.0%
Permanent Sample Plots	180	-	134	134	0.1%	0.1%
Big Tree Reserves	85	18	24	42	0.0%	0.0%
Karst	26,673	577	3,144	3,721	1.7%	2.0%
Unknown Cultural Features within Quatsino TUS Zone	57,909	67	385	453	0.2%	0.2%
Future Stand-level Reserves	-	470	4,013	4,483	2.1%	2.4%
Total Operable Reductions	**-**	**3,521**	**32,695**	**36,216**	**16.7%**	**19.3%**
Current THLB	**-**	**15,717**	**104,382**	**120,099**	**55.3%**	**64.1%**
Less future roads	2,136	158	1,269	1,427	0.7%	0.8%
Long-term Land Base	**-**	**15,559**	**103,113**	**118,672**	**54.6%**	**63.3%**

Table 13 Timber Volume Netdown ('000m³) for TFL 6[5]

Classification	Total Volume ('000 m³)	Net Volume ('000 m³) Schedule A Timber Licence	Schedule B Crown	Grand Total	% Total	% PFLB
Total Land Base	**76,139**	**6,909**	**69,230**	**76,139**	**100.0%**	**-**
Less Non-forest	160	3	157	160	0.2%	-
Less Existing Roads & Powerlines	1,124	86	1,028	1,113	1.5%	-
Total Forested	**-**	**6,820**	**68,045**	**74,865**	**98.3%**	**-**
Less Non-productive	1,368	94	1,221	1,316	1.8%	-
Total Productive	**-**	**6,726**	**66,824**	**73,550**	**96.5%**	**100.0%**
Low Sites	4,428	324	3,483	3,807	5.0%	5.2%
Less Inoperable	18,932	1,352	12,526	13,879	18.2%	18.9%
Total Operable	**-**	**5,049**	**50,815**	**55,864**	**73.4%**	**76.0%**
Reductions:						
Riparian Management	22,652	181	2,090	2,271	3.0%	3.1%
Ungulate Winter Ranges	1,679	0	1,258	1,258	1.7%	1.7%
Old Growth Management Areas - Legal	8,456	6	3,941	3,947	5.2%	5.4%
Old Growth Management Areas - Proposed	9,069	322	3,403	3,725	4.9%	5.1%
Wildlife Habitat Areas - Legal	2,233	1	234	234	0.3%	0.3%
Wildlife Habitat Areas - Proposed	557	0	15	15	0.0%	0.0%
Uneconomic	21	0	5	5	0.0%	0.0%
Deciduous-leading	1,608	12	547	560	0.7%	0.8%
Recreation	10	0	3	3	0.0%	0.0%
Known Archaeological Sites	463	81	121	202	0.3%	0.3%
Existing Stand-level Reserves	5,683	445	1,850	2,296	3.0%	3.1%
Research Site	128	0	7	7	0.0%	0.0%
Terrain Stability - Class 5	5,085	182	903	1,085	1.4%	1.5%

[5] Data updated to the December 31, 2023 for harvest history and ages; therefore, volumes listed represent estimates at the end of 2023.

Classification	Total Volume ('000 m^3)	Net Volume ('000 m^3)			% Total	% PFLB
		Schedule A	Schedule B	Grand Total		
		Timber Licence	Crown			
Terrain Stability - LiDAR 90% + Slope	4,882	119	741	861	1.1%	1.2%
Permanent Sample Plots	81	0	48	48	0.1%	0.1%
Big Tree Reserves	56	10	12	22	0.0%	0.0%
Karst	10,851	149	1,171	1,320	1.7%	1.8%
Unknown Cultural Features within Quatsino TUS Zone	22,864	29	184	213	0.3%	0.3%
Future Stand-level Reserves	0	168	1,625	1,793	2.4%	2.4%
Total Operable Reductions	**-**	**1,706**	**18,159**	**19,866**	**26.1%**	**27.0%**
Current THLB	**-**	**3,344**	**32,659**	**36,003**	**47.3%**	**49.0%**

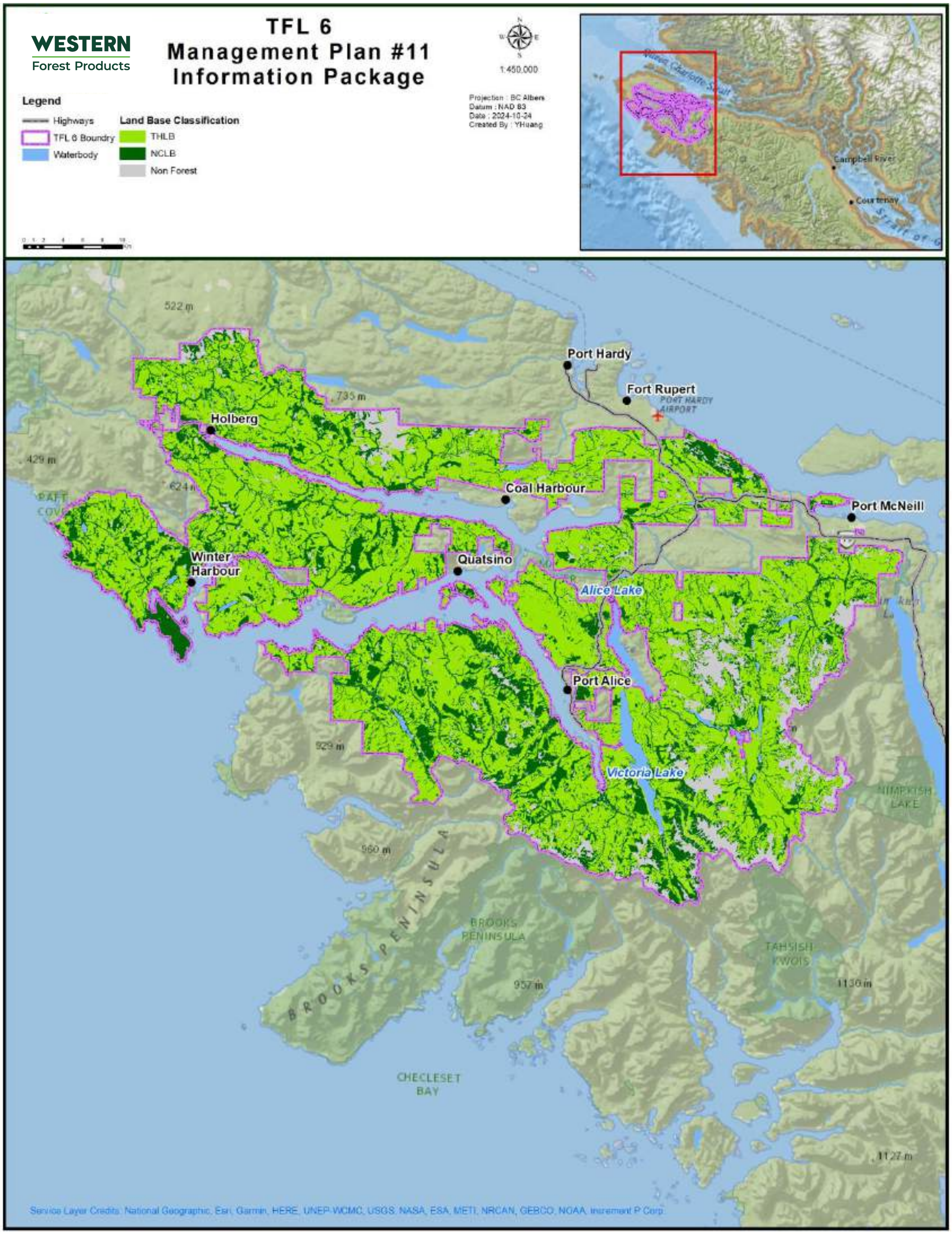

Figure 9 TFL 6 Land Base Classification

For TFL 6 MP #10 in 2011, land base reductions amounted to 37.1% of the total area of the TFL. However, forest cover constraints and aspatial netdowns were applied, further reducing the effective THLB. For MP #11, the reductions are 97,098 hectares or 44.7% of the total area, resulting in a THLB area of 120,099 hectares. Apart from increased forestry and land regulations since MP #10, the most significant changes are due to the utilization of LiDAR to identify non-productive patches, low productivity patches, inoperable areas, and a full riparian network. Additionally, old growth management areas (rather than being an aspatial forest cover constraint as was done in MP #10), and more draft wildlife habitat areas have been spatially defined.

In order to assess the sensitivity regarding potential over or under-estimation of THLB for timber supply impact, sensitivity analyses will be performed by increasing and decreasing THLB values in all polygons by 10%.

6.3 Recently Harvested Cutblocks

For cutblocks that were harvested or planned between 2001 and 2023, and for which Site Plan Standard Unit (SU) spatial data is available, the productive forest area, also known as the net area-to-reforest (NAR), will be designated as 100% THLB. The roads and reserves associated with these cutblocks, including Wildlife Tree Patches (WTPs), Wildlife Tree Retention Areas (WTRAs), retention patches, and others, will be designated as 0% THLB. The year 2001 was chosen as the starting point to align with recently managed stand era (see Section 7.3.1.2.2 for more details)

For the remaining land base, specific deductions will be applied in a sequential order to establish the THLB. These deductions account for the cumulative impact of each factor, ensuring that the final THLB value reflects the combined effect of all exclusions. Detailed tables outlining each THLB deduction factor are provided in later sections. This sequential approach ensures a comprehensive and systematic determination of the THLB. While some factors may encompass large areas within TFL 6 individually, the actual reduction in THLB area may be less significant due to overlapping exclusions being considered.

6.4 Non-Forest Areas

The areas within TFL 6 that are not forested primarily consist of the land base where commercially viable tree species are largely absent. These non-forested areas do not contribute to the timber supply objectives outlined in the timber supply analysis and are therefore excluded from the THLB. A detailed breakdown of the area reduction due to non-forested areas can be found in Table 14. Additionally, Figure 10 offers a visual representation of these areas within TFL 6.

Table 14 Non-Forest Area in TFL 6

Description	Gross Area (ha)	Area Reduction (ha)
Non-Forest	15,263	15,263
Waterbody	680	680
Total	*15,943*	*15,943*

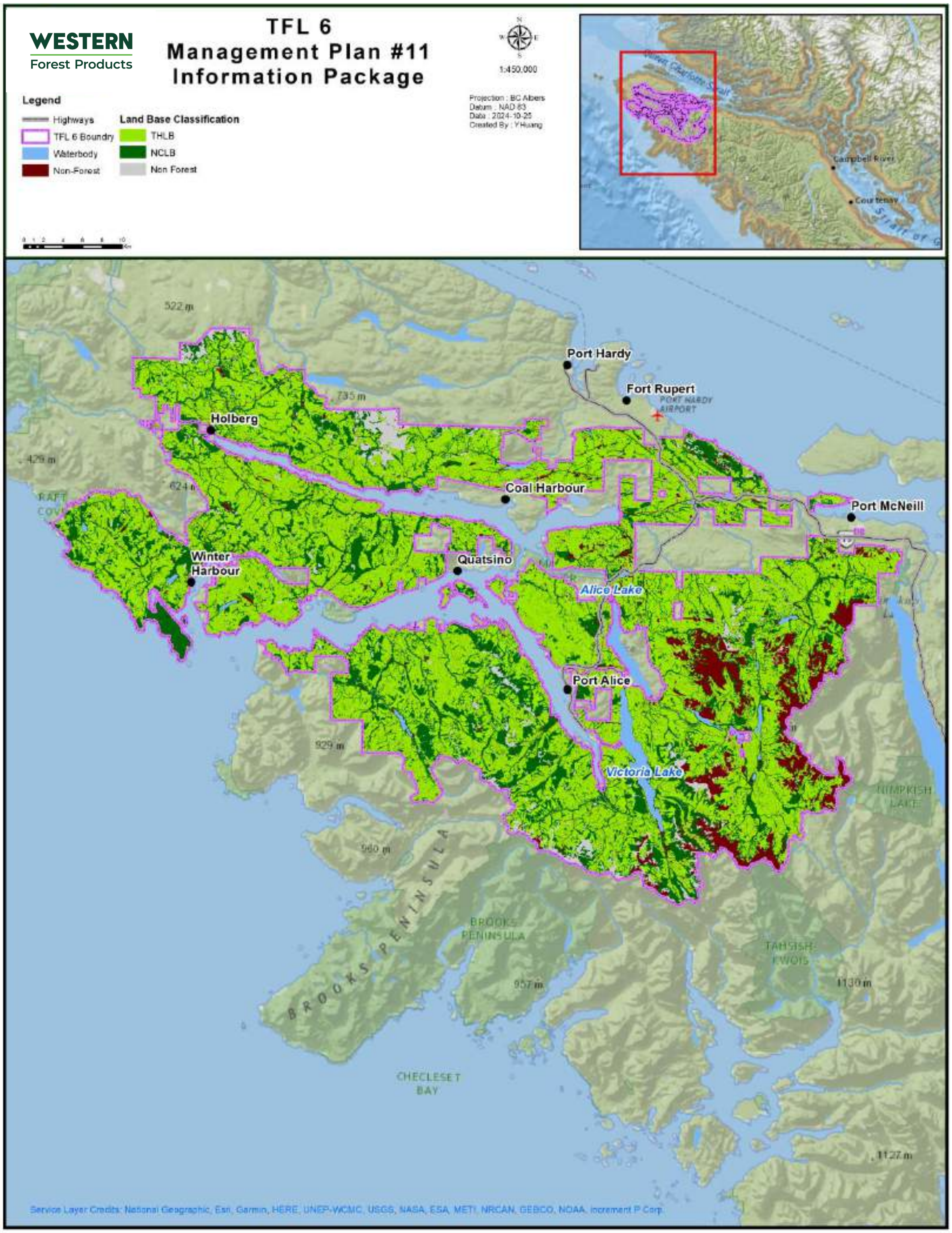

Figure 10 Non-Forest Area in TFL 6

6.5 Existing Roads and Powerlines

Existing roads and powerlines are not included as part of the THLB. This exclusion encompasses both classified and unclassified roads. Classified roads are those that are distinctly delineated as forest cover areas, separate from adjacent polygons. Notably, sections of Highway 19, Highway 30, and Coal Harbour Road are incorporated within the TFL. In contrast, unclassified roads are represented as polyline features in the GIS database. For the purposes of determining the area of features represented by a line, varying total widths are applied depending on the class.

- Highway – 16m
- Mainlines – 10m
- Spurs and Unclassified – 8m
- Powerlines – 15m

The buffer widths for various road classes were established through a review of past MPs for TFL 6 (Western Forest Products Inc., 2011) and the TSR Data Package (Province of British Columbia, 2020)for the surrounding North Island TSA which encompasses roads linked to TFL 6.

As for trails and the majority of landings, they are typically replanted following harvesting. Consequently, the reduction in area associated with these features is considered negligible in the modelling process. Table 15 provides a summary of the areas covered by existing roads and powerlines within the TFL. It is noted that this table also defines the hierarchy for attributing overlapping roaded areas in the land base. For example, a mainline takes precedence over powerlines for attribution in buffered areas.

Table 15 Existing Roads and Powerlines in TFL 6

Feature Class	Total Buffer Width (m)	Gross Area (ha)	Area Reduction (ha)
Highway	16	66	47
Mainline	10	998	936
Branch/Spurs/Unclassified	8	3,935	3,894
Powerlines	15	262	144
Total		*5,261*	*5,021*

6.6 Non-Productive Forests

TFL 6 includes 14,939 hectares of non-productive forest, as detailed in Table 16. Figure 11 provides a graphical illustration of the areas within TFL 6. These areas are primarily composed of forests situated on sites of inferior quality. The categorization of these non-productive areas originates from two primary sources:

- Forest Cover Inventory: Stands are classified as non-productive if they are over 140 years old with a volume less than 200 m³/hectare or if they are under 140 years old with a site index below 5 meters.
- LiDAR-Based LBB Process: This process involves the use of various LiDAR-derived data to assess the productivity of stands.

As outlined in Section 5.2.1, the LBB utilizes high-resolution LiDAR data on ground surfaces and canopy heights. This data empowers forest professionals to evaluate potential areas suitable for timber harvesting and road development. More specifically, non-productive forests, low productive forests, and potential areas for future harvesting and road construction were spatially delineated. Subsequently, appropriate harvesting methods are assigned to the designated areas. Non-productive forest areas are identified as part of the LBB process. Examples include small, low-height tree crowns within old-growth forest stands.

While non-productive forests are not directly included in formal biodiversity calculations, they contribute to the overall landscape biodiversity by providing a buffer zone around areas with critical biodiversity requirements.

Table 16 Non-Productive Area in TFL 6

Description	Gross Area (ha)	Area Reduction (ha)
Non-productive / Scrub Forest - Inventory	7,699	7,370
Non-productive / Scrub Forest - LBB	7,241	1,438
Total	*14,939*	*8,808*

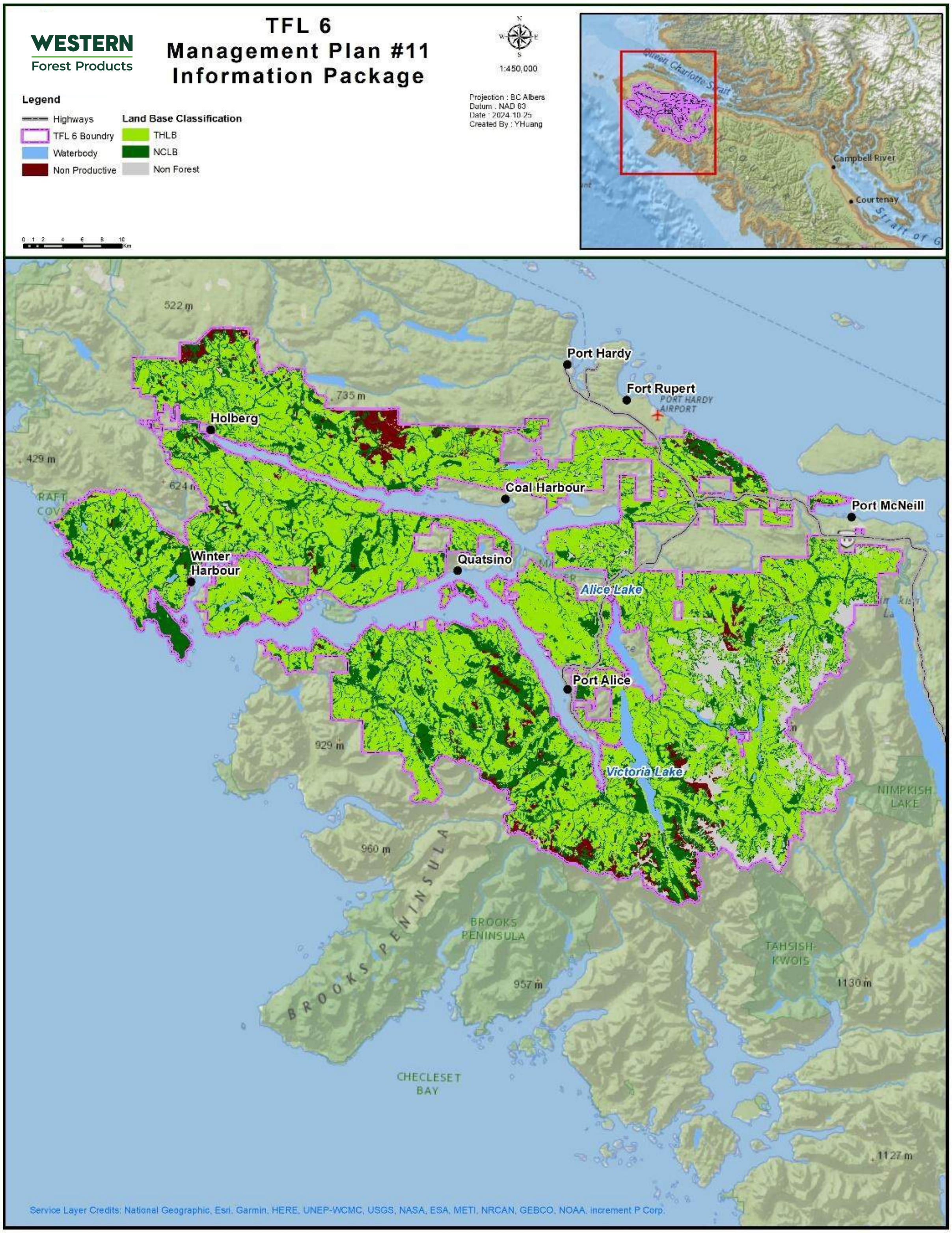

Figure 11 Non-Productive Forest Area in TFL 6

6.7 Low Productivity Sites

Low-productivity sites are currently deemed inoperable due to their limited timber volume, making harvesting economically or practically infeasible. They can be identified through either:

- Forest cover inventory: old seral forests (250+ years old) with a standing timber volume of less than 300 m³/hectare.
- LiDAR-Based LBB Process: This process involves the use of various LiDAR-derived data to enable efficient identification of low-volume stands.

Table 17 provides details regarding the total area and the impact on the THLB of these low-productivity sites within the TFL. Figure 12 visually represents the areas within TFL 6

Table 17 Low Productivity Sites in TFL 6

Description	Gross Area (ha)	Area Reduction (ha)
Low Sites - Inventory	4,332	1,758
Low Sites - LBB	16,151	8,169
Total	*20,484*	*9,927*

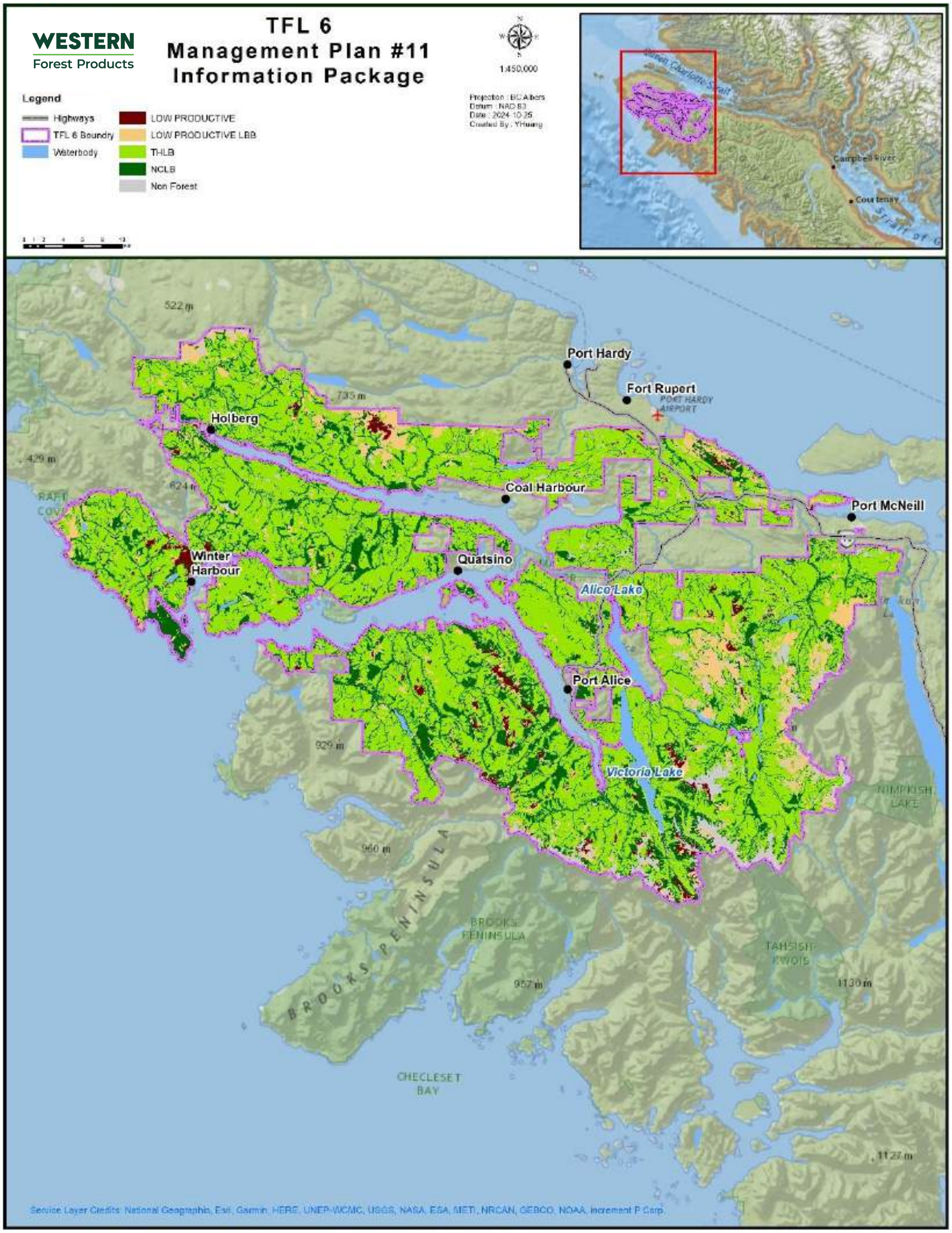

Figure 12 Low Productivity Sites in TFL 6

6.8 Physical Operability

Physical operability mapping categorizes areas based on their suitability for timber harvesting using different methods:

- Conventional: These areas are accessible for ground-based harvesting systems like skidders, feller bunchers, and cable systems.
- Non-conventional: These areas have access limitations that necessitate aerial harvesting systems like helicopters.
- Inoperable: These areas are deemed unsuitable for harvesting due to various factors.

The most recent update to the physical operability map for MP #11 utilized LiDAR data obtained through the LBB process (described in Section 5.2.1). Areas were designated as inoperable based on a comprehensive evaluation, considering safety factors, operational efficiency, environmental sensitivity, and local knowledge. Harvesting in these areas is unfeasible due to issues related to accessibility, soil sensitivity, or risks to worker safety.

Table 18 summarizes the productive area and productive timber volume within each physical operability class. Figure 13 provides a visual representation of the physical operability in TFL 6.

Table 18 Area and Volume by Physical Operability Types in TFL 6

Harvest System	Gross Area (ha)	Gross Volume ('000 m3)	Productive Area (ha)	Productive Volume (000 m^3)	% of Productive Area	% of Productive Volume
Conventional	155,079	51,020	147,920	49,902	79%	68%
Non-conventional	9,713	6,187	9,204	6,170	5%	8%
Operable (subtotal)	164,792	57,207	157,124	56,073	84%	76%
Inoperable + Low Sites[6]	52,405	18,932	30,300	17,477	16%	24%
Total	217,197	76,139	187,425	73,550	100%	100%

Only inoperable areas are removed from the THLB (see Table 19).

Table 19 Inoperability Areas in TFL 6

Description	Gross Area (ha)	Area Reduction (ha)
Inoperable	52,405	21,193

[6] The gross area for 'Inoperable + Low Sites' encompasses THLB netdown categories that were previously excluded, including non-forest areas, existing roads and powerlines, non-productive forests, and low-productivity forests.

A comparison between the harvested area from 2012 to 2023 by different harvest systems and the overall TFL 6 THLB area is shown in Table 20.

Table 20 2012-2023 Harvest Area by MP #11 Operability Type

Harvest System	% of Harvest Area	% of THLB Area
Ground	57.6%	57.3%
Cable	40.3%	39.6%
Conventional (subtotal)	97.9%	96.9%
Non-conventional	1.2%	3.1%
Inoperable + Low Sites	0.9%	N/A
Total	*100.0%*	*100.0%*

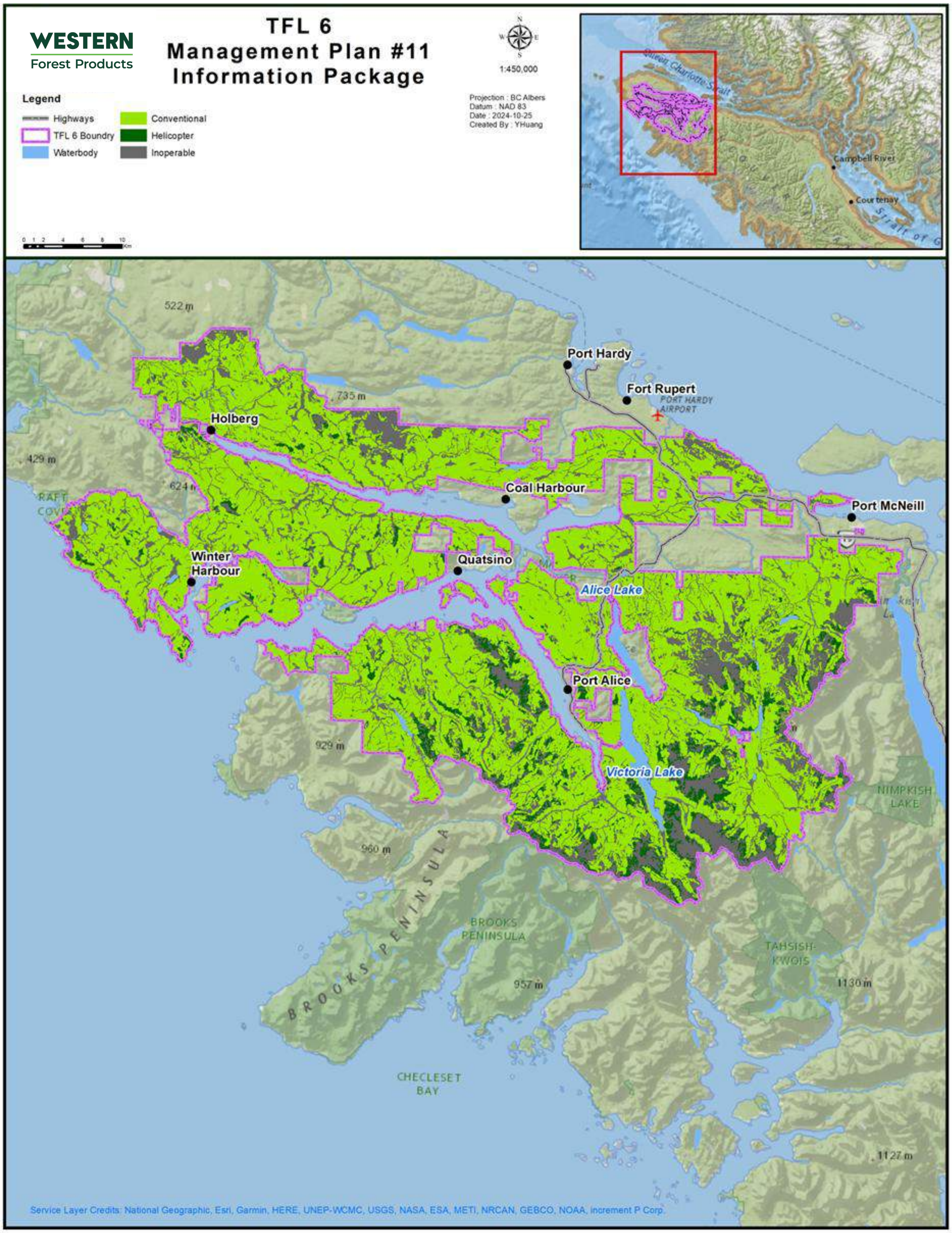

Figure 13 Physical Operability Classes in TFL 6

6.9 Riparian Management Areas

Western continuously maps and classifies detailed riparian features through forestry operations and cutblock development in TFL 6. Operational stream inventories associated with development planning have been conducted since 1988 (with the introduction of the Coastal Fisheries Forestry Guidelines) and various reconnaissance (1:20,000) fish and fish habitat inventory projects have been completed. This combination of 1:5,000 scale (operational) and 1:20,000 scale (strategic) stream data provide the basis for estimating riparian classes and reserve areas for waterbodies.

Since LiDAR became available in the TFL 6, stream locations can be predicted based on LiDAR bare earth ground conditions, topology, and flow accumulation information. But traditionally, the detailed stream classification still relies on fieldwork. For MP #11, a separate project was completed to assign stream riparian classes to the LiDAR derived stream network via supervised classification. This involved:

1. Building a training dataset: Using verified streams with known classifications, a subset of LiDAR-derived streams was chosen to train the model and obtain the parameter values.
2. Developing stream channel width classes: using LiDAR data and GIS geo-processing tools. stream flow was predicted and then each stream segment was categorized based on predicted width.
3. Classifying streams as fish-bearing or non-fish-bearing: combining various data sources, including verified stream classes, community watersheds, elevation, slope, and known fish presence information, fish presence in each stream segment was predicted.
4. Data verification: GIS and forestry professionals conducted a thorough review, comparing field-verified streams to LiDAR-classified streams in cutblocks areas with detailed field data. Whenever discrepancies arose, adjustments to parameters or riparian classes were implemented. This review ensured data accuracy and integrity.

The resulting LiDAR-classified stream dataset, with assigned classes, serves as the foundation for land-use classification. The MP #11 utilizes this LiDAR classified dataset to Riparian Management Areas (RMAs) to streams, lakes, and wetlands. These RMAs are based on the widths outlined in the FRPA Riparian Reserve Zone (RRZ) regulations and assumed levels of tree retention within the Riparian Management Zones (RMZs). Details on these assumed retention levels and effective RMA widths are listed in Table 21. Retention levels were estimated based on a review of 871 cutblocks harvested between 2012 and 2023. Additionally, as most S2-S6 streams are represented by lines on maps, the effective management area width accounts for the actual stream waterbody width.

LiDAR technology has revolutionized our understanding of the riparian network in TFL 6. It has revealed a significant number of previously undetected smaller S4 and S6 streams, traditionally identified through fieldwork. It is crucial to acknowledge, however, that LiDAR can struggle with accurately predicting smaller channels and may potentially overestimate the true extent of S4 and S6 RMAs as documented in peer-reviewed studies (James, Watson, & Hansen, 2007; Solomons, Mikhailova, Post, & Sharp, 2015). Therefore, to ensure consistency with observed conditions, the retention level within S4 RMZs has been adjusted to match that of field-verified S4 RMZs. For S6 streams, due to the limitations of LiDAR, management currently occurs at the stand level during operations, and no buffer is applied in the timber supply modelling. Further details regarding the enhanced stand-level retention strategy for S6 streams can be found in Section 6.23 and Section 10.4.3.

Finally, a 40-meter reserve zone will be applied along the entire TFL 6 ocean shoreline. This zone accounts for managing visual quality, operational considerations, and the presence of wildlife and cultural features within this important coastal shoreline area.

Riparian management areas are defined by slope distance in the field. However, modelling these zones in GIS typically uses horizontal distance. This discrepancy leads to a slight over-estimation of the actual area removed from the THLB for riparian management in the timber supply analysis.

Compared to MP #10, the net reduction in THLB area due to RMAs in this section is about half. This is because a detailed operability review using LiDAR data (referred to as the LBB process in Section 5.2.1) has already identified and excluded non-productive, low productivity, and inoperable areas from the land base. Consequently, the remaining area specifically impacted by riparian buffers is smaller. A similar situation also applies in TFL 44, where LBB is also used for operability mapping (Tsawak-qin Forestry Limited Partnership, 2023).

Table 21 Riparian Management Areas in TFL 6

Riparian Feature Class	Size Class	Riparian Reserve Zone (m)	Riparian Management Zone		Effective Management Area (m)[7]	Gross Area (ha) RRZ + RMZ	Area Reduction (ha)
			Width (m)	Netdown (%)			
Ocean	*N/A*	40	0	100	40	1,156	439
Streams	*Width (m) / Fish Source*						
S1	>20.0	50	20	85	67	1,350	198
S2	>=5.0 - 20.0	30	20	65	43	4,400	783
S3	>=1.5 - 5.0	20	20	50	30	8,568	2,596
S4	<1.5 - fish bearing	0	30	25	7.5	2,152	297
S5	>3.0 - non-fish bearing	0	30	60	18	4,207	901

[7] Effective Management Area = RRZ + (RMZ *(netdown %/100)).

Riparian Feature Class	Size Class	Riparian Reserve Zone (m)	Riparian Management Zone		Effective Management Area (m)[7]	Gross Area (ha) RRZ + RMZ	Area Reduction (ha)
			Width (m)	Netdown (%)			
S6	<3.0 - non-fish bearing	0	20	Captured at Stand Level	No Buffer	29,848	-
Lakes	*Area (ha)*						
L1-A	>=1000	0	40	100	40	1,818	72
L1-B	>5.0 - 1000	10	0	100	10	1,488	24
L2	1.0 - 5.0 When located in CDF or CWH xm, dm, ds, or mm	10	20	25	15	-	-
L3	1.0 - 5.0	0	30	65	20	320	17
L4	0.5 - 1.0 When located in CDF or CWH xm, dm, ds, or mm	10	20	25	15	-	-
Wetlands	*Area (ha)*						
W1	>=5.0	10	40	50	30	535	56
W2	>=1.0 - 5.0 When located in CDF or CWH xm, dm, ds, or mm	10	20	50	20	-	-
W3	>=1.0 - 5.0	0	30	50	15	981	85
W4	>=0.5 - 1.0 When located in CDF or CWH xm, dm, ds, or mm	10	20	25	15	-	-
W5	Wetland complex	10	40	50	30	211	12
Total						*57,033*	*5,479*

6.10 Ungulate Winter Ranges

An Ungulate Winter Range (UWR) is a designated habitat area critical for the winter survival of ungulate species, such as Columbian black-tailed deer and Roosevelt elk in TFL 6 (U-1-006 and U-1-010).

These UWRs, like most landscape-level reserves, were initially designed based on broad-scale data. Consequently, as more detailed field data becomes available, discrepancies in UWR boundaries may arise at the operational level, requiring potential adjustments. Such adjustments necessitate government approval, as exemplified by the amendment made and approved for U-1-006 in 2021.

Due to inconsistencies in tenure information, a small portion of UWRs KLA-02 and NAH-08 from the North Island TSA (U-1-011) falls within the boundaries of TFL 6. These areas are included in the analysis dataset, and they will be excluded from the THLB.

Table 22 and Figure 14 provide details regarding the current UWR area designations and their associated reductions to the THLB.

Table 22 Ungulate Winter Ranges in TFL 6

UWR ID	Species	Gross UWR Area (ha)	Productive UWR Area (ha)	Area Reduction (ha)
u-1-006	Black-tailed Deer / Roosevelt Elk	489	417	259
u-1-010	Black-tailed Deer	1,876	1,817	1,359
u-1-011	Black-tailed Deer / Roosevelt Elk / Mountain Goat / Moose	1	1	1
Total		*2,366*	*2,235*	*1,619*

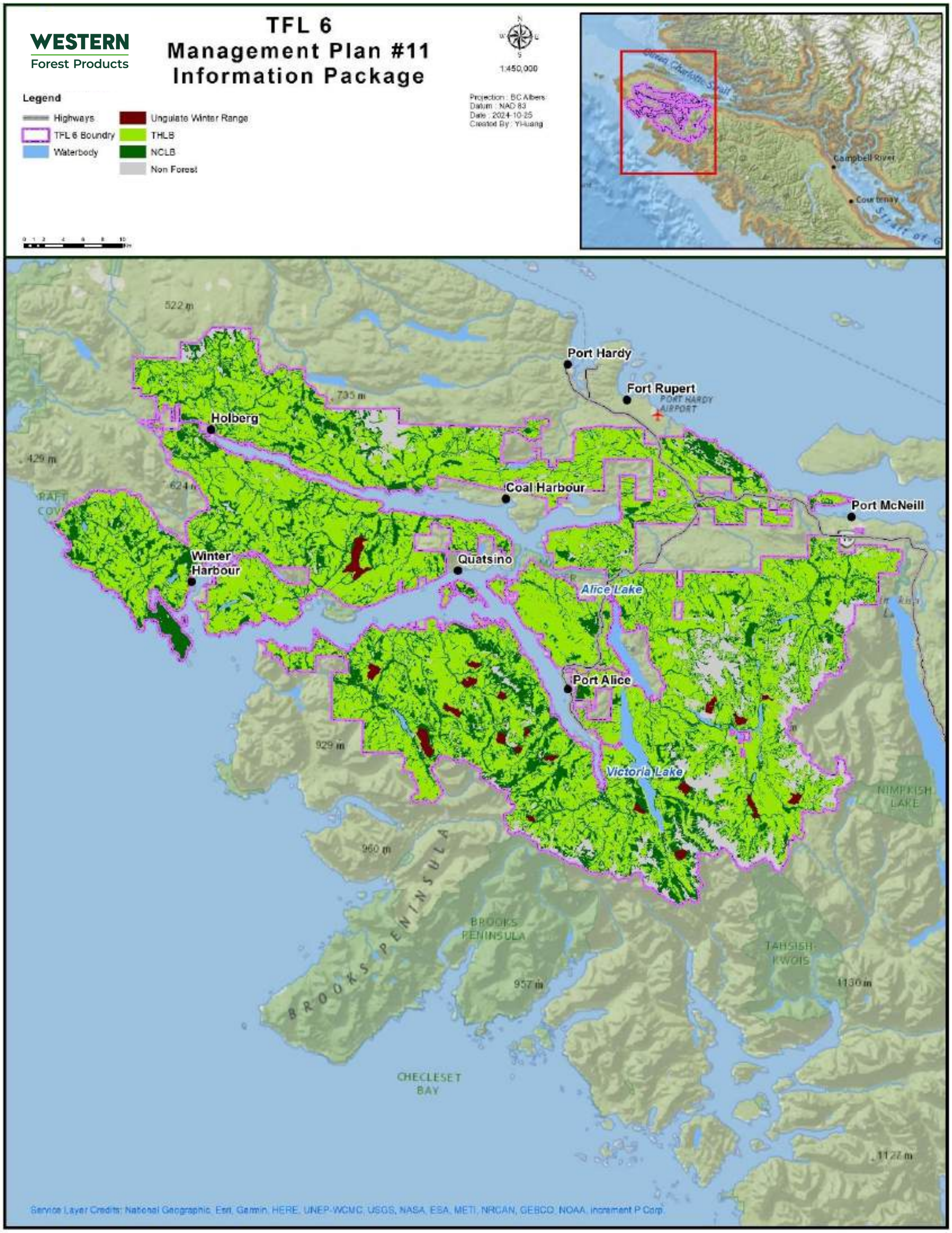

Figure 14 Ungulate Winter Ranges in TFL 6

6.11 Old Growth Management Areas

Landscape Units (LUs) are designated land areas used for long-term resource management planning in British Columbia. These units typically encompass 50,000 to 100,000 hectares in size.

On June 30, 2004, the Order Establishing Provincial Non-Spatial Old Growth Objectives (NSOG order) assigned Biodiversity Emphasis Options (BEOs) and old forest conservation targets to LUs. This order remains in effect until Old Growth Management Areas (OGMAs) are established through individual Landscape Unit planning processes. The NSOG order allows reducing old forest retention targets by up to two-thirds in LUs with a Low BEO, aiming to balance conservation with timber supply needs.

TFL 6 has legally established OGMAs within the San Josef (2005) and Marble (2010) landscape units. In the Marble Enhanced Forestry Zone (EFZ), VILUP Objective #10 was applied to reduce the total old growth retention target by one-third within the Marble LU. However, this was conditional upon identifying suitable younger second-growth forests for future recruitment. Lower Nimpkish LU also has legally established OGMAs, but due to minimal overlap, none fall within TFL 6 boundaries. A small portion of Nahwitti LU's legally established OGMAs is, however, included within TFL 6.

Proposed OGMAs have been identified in the Holberg, Keogh, Mahatta, and Neroutsos LUs (only covering TFL 6 that Western hold; not for the nearby North Island TSA). These proposed OGMAs aim to meet the NSOG order requirements and are currently included in the timber supply analysis. However, these proposed OGMAs are subject to a public and First Nations' review process before they become legally binding.

The proposed OGMAs in LUs with a Low BEO are of sufficient size to meet old forest seral targets for the first rotation (80 years) across all BEC variants. In some cases, enough area has been identified to meet the full target. Goals for the second (160 years) and third (240 years) rotations are addressed based on landscape level biodiversity old seral targets (see details in Section 10.3.3).

The legal and proposed OGMA are excluded from contributing to THLB in the model. Table 23 illustrates the total, productive areas, and the corresponding reductions in THLB area per LU. A spatial overview is provided in Figure 15.

Table 23 Old Growth Management Areas in TFL 6

Landscape Unit	BEO	OGMA Status	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Marble	Intermediate	Legal	9,703	5,724	2,386

Landscape Unit	BEO	OGMA Status	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Nahwitti	Intermediate	Legal	2	2	2
San Josef	Intermediate	Legal	6,441	6,048	3,104
Established OGMAs (subtotal)			*16,146*	*11,774*	*5,491*
Holberg	Low	Proposed	4,707	2,874	1,179
Keogh	Low	Proposed	4,456	2,939	1,390
Mahatta	Low	Proposed	3,490	3,087	930
Neroutsos	Low	Proposed	4,956	3,984	1,818
Proposed OGMAs (subtotal)			*17,609*	*12,884*	*5,317*
OGMAs Total			*33,755*	*24,658*	*10,809*

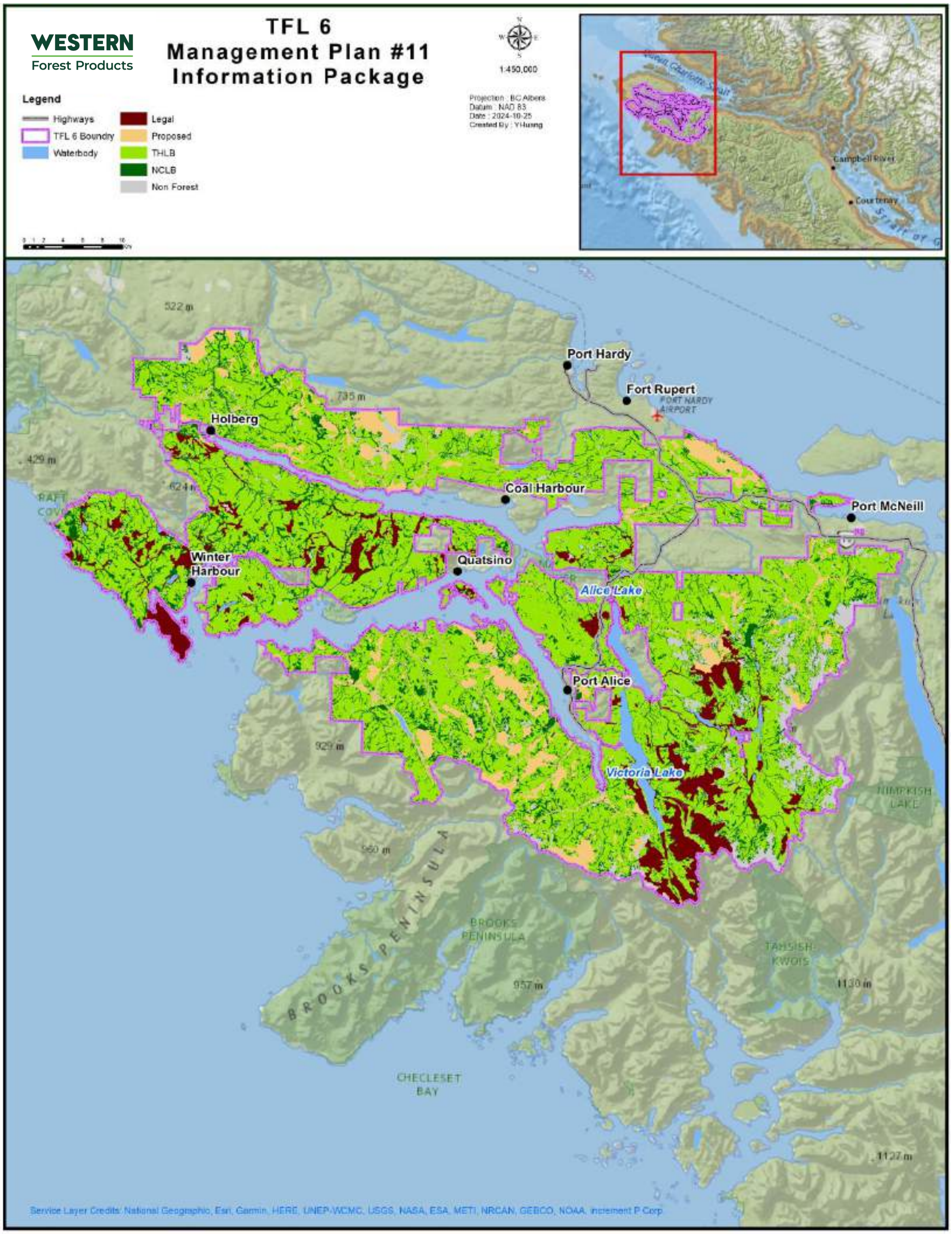

Figure 15 Legally Established and Proposed Old Growth Management Areas in TFL 6

6.12 Wildlife Habitat Areas

Wildlife Habitat Areas (WHAs) are designated areas established to protect the habitat of species at risk. When no WHAs are present, the Forest Planning and Practices Regulation (FPPR) Section 7 requires Forest Stewardship Plan (FSP) holders to address species at risk habitat through specific results and strategies.

6.12.1 Legally Established WHAs

At the time of the timber supply analysis dataset compilation, 40 approved WHAs encompassed 2,759 hectares within TFL 6 (Figure 16). These WHAs comprise 2,679 hectares of productive forest (Table 24). Four WHAs (1-089, 1-721, 1-722, and 1-723) are established for Northern Goshawk and the rest of the WHAs are established for Marbled Murrelets. Notably, most WHAs are also OGMAs, minimizing the amount of incremental change to the THLB.

Table 24 Legally Established Wildlife Habitat Areas in TFL 6

Description	WHA Status	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Wildlife Habitat Area - Marbled Murrelet	Legal	2,054	1,978	15
Wildlife Habitat Area - Northern Goshawk	Legal	706	676	399
Legal WHAs Total		*2,760*	*2,654*	*414*

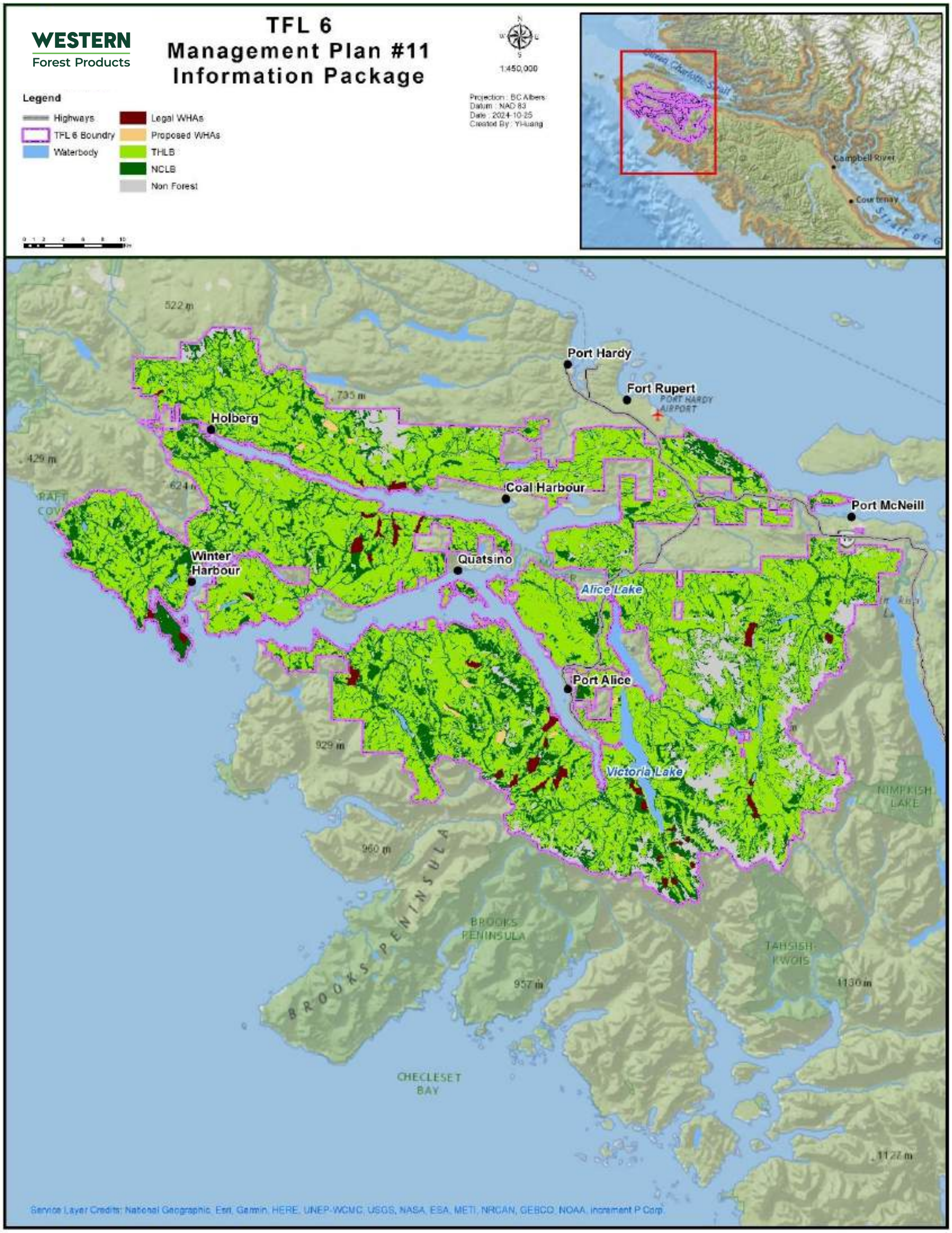

Figure 16 Legally Established and Proposed Wildlife Habitat Areas in TFL 6

6.12.2 Proposed WHAs

The TFL 6 modelling dataset included over 676 hectares of proposed WHAs primarily dedicated to Marbled Murrelet conservation within the TFL (Table 25 and Figure 16).

Table 25 Proposed Wildlife Habitat Areas in TFL 6

Description	WHA Status	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Wildlife Habitat Area - Marbled Murrelet	Proposed	676	654	17
Proposed WHAs Total		*676*	*654*	*17*

The BC Northern Goshawk Implementation Plan (February 2018) emphasizes expanding Vancouver Island's WHAs by 30% as a short-term goal. Similarly, the *Marbled Murrelet Order* (December 2, 2021) identifies suitable habitat and mandates specific conservation targets within WHAs.

These proposed WHAs are undergoing the approval process and are expected to be formally established in the future. Like existing WHAs, most have already been factored into previous netdown assessments, resulting in limited new additional impact on the THLB.

Although the FPPR Section 7 notice for North Island – Central Coast Natural Resources District (NICCNRD or District) identifies other species at risk such as coastal tailed frogs, grizzly bears, and great blue herons, no immediate reductions to the THLB are planned. While WHAs may be established within TFL 6 in the future to address their habitat conservation needs, or for the previously mentioned species, the uncertain allotment of additional areas to Identified Wildlife Management Strategies (IWMS) necessitates no further reductions to be made at this time.

6.12.3 Marbled Murrelet Order

The BC Marbled Murrelet Implementation Plan was released in February 2018. One of the key actions is issuing an Order under the Land Use Objectives Regulation for suitable Marbled Murrelet habitat protection. The BC *Marbled Murrelet Order* was effective on December 2, 2021 (Province of British Columbia, 2021). This order aims to protect suitable habitat for the Marbled Murrelet, a species primarily found within old seral forests.

Table 2 of Schedule 7 in the Marbled Murrelet Order outlines specific habitat targets for each LU and LU aggregates. The Order also identifies suitable Marbled Murrelet areas protected within WHAs and in both WHAs and OGMAs. Table 26 summarizes these targets based on information from the NICCNRD, Ministry of Forests. Existing proposed OGMA and WHA designs have already addressed a significant portion of these habitat targets. Importantly, the suitable habitat targets by LU will be maintained in the timber supply model to account for any potential gaps and ensure long-term conservation planning to achievement of the targets.

Table 26 Suitable Marbled Murrelet Habitat Areas for TFL 6 (From North Island - Central Coast Natural Resources District)

LU Aggregate	LU	Suitable Habitat Target	WHA and OGMA Suitable Habitat Target	WHA Suitable Habitat Target
Cape Scott	Holberg	1,091	521	308
	Nahwitti	3	2	0
	San Josef	1,734	1,210	546
McNeill	Keogh	159	62	38
	Marble	977	763	276
	Neroutsos	1,055	679	545
Quatsino	Klaskish	3	2	1
	Mahatta	968	386	244
Total		*5,991*	*3,625*	*1,960*

6.13 Economic Operability

The physical operability mapping of TFL 6 was refined in 2023/2024, building upon the LBB process outlined earlier (see Section 5.2.1). The resulting map classifies areas into two categories:

- Economic: These areas are commercially viable for harvesting based on their stand value exceeding harvesting costs.
- Uneconomic: These stands are not expected to generate sufficient value to cover harvest expenses.

Leveraging LiDAR-derived physical operability data (refer to Section 6.8), this analysis assumes all conventionally operable areas become economically viable for harvest at some point in the market cycle, provided they meet minimum harvest criteria.

Table 27 summarizes the minimum forest inventory attributes and flight distances required for areas harvested using helicopters. These figures represent the lowest-value merchantable stands (70+ years old) that may be harvested with non-conventional systems under different market conditions.

Table 27 Inventory Thresholds for Non-Conventional Economic Operability

Flight Distance (m)	Economic Definition (Age > 80 years)	
	Minimum Volume (m^3/ha)	Minimum Cw+Fd+Yc component
0 – 499	350	15%
500 – 999	370	25%

Flight Distance (m)	Economic Definition (Age > 80 years)	
	Minimum Volume (m^3/ha)	Minimum Cw+Fd+Yc component
1000 +	400	30%

Stands failing to meet these minimum requirements are classified as uneconomic and excluded from the THLB. A comprehensive breakdown of physical and economic operability for TFL 6 is presented in Table 28 and their locations visually represented in Figure 17. Since most uneconomic areas have already been accounted for in previously discussed netdown categories, this category results in a minimal net reduction to the THLB as outlined in Table 29.

Table 28 Area and Volume by Economic Operability Type

Harvest System & Operability	Gross Area (ha)	Gross Volume ('000 m^3)	Productive Area (ha)	Productive Volume ('000 m3)	Area Reduction (ha)	Volume Reduction ('000 m^3)
Conventional Economic	155,079	51,020	147,920	49,902		
Non-conventional Economic	9,627	6,165	9,136	6,151		
Economic (Subtotal)	*164,706*	*57,185*	*157,056*	*56,053*		
Non-conventional Uneconomic	86	21	68	19	20	5
Inoperable	52,405	18,932	30,300	17,477		
Total	*217,197*	76,139	*187,425*	73,550	*20*	*5*

Table 29 Non-Conventional Uneconomic Areas in TFL 6

Description	Gross Area (ha)	Area Reduction (ha)
Uneconomic	86	20

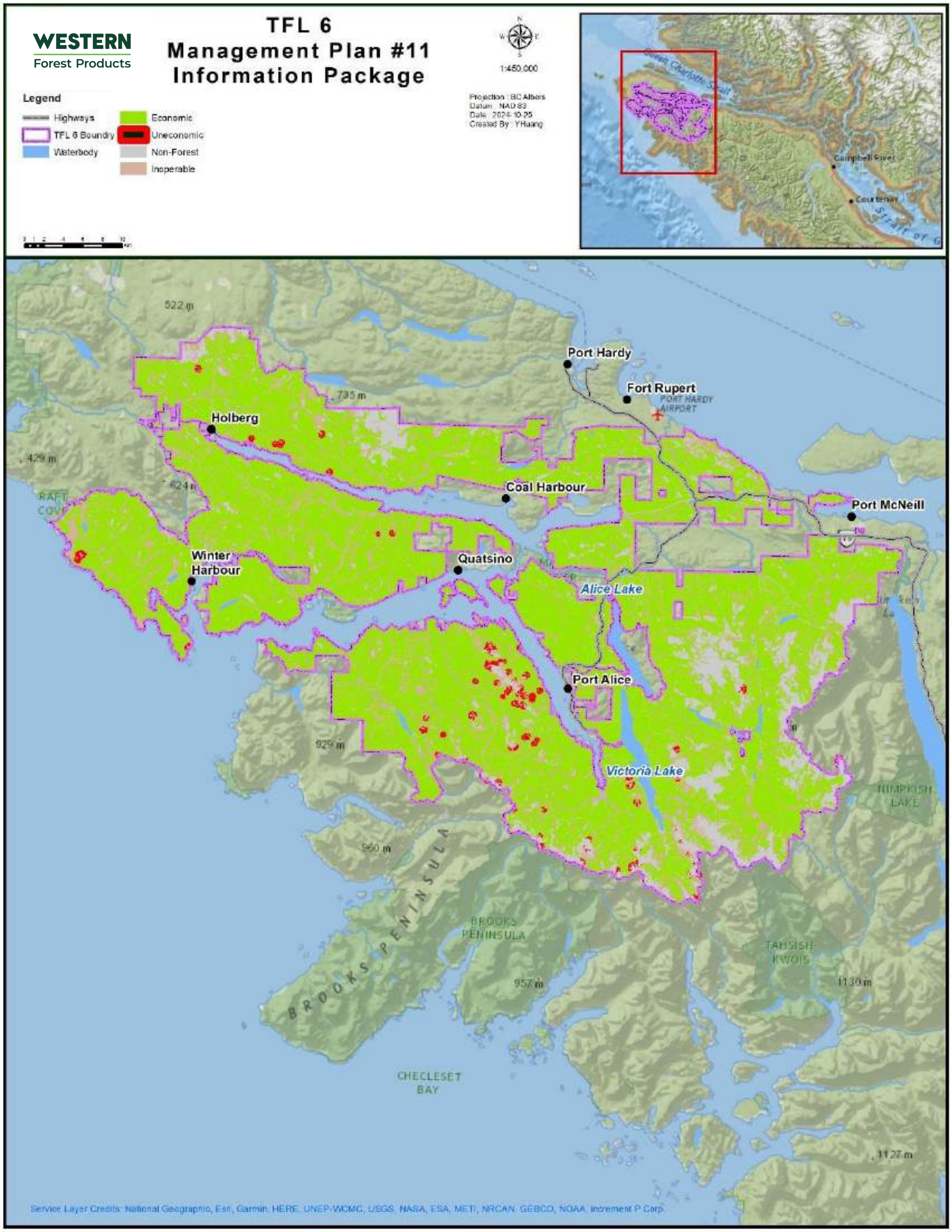

Figure 17 Economic Operability in TFL 6

6.14 Deciduous-leading Stands

Table 30 and Figure 18 identify areas within the forest inventory dominated by deciduous tree species. These stands comprise roughly 2.1% of the productive forest. A review from Harvest Billing System (HBS) from 2002 to 2023 revealed that the deciduous harvested volume in TFL 6 accounts for less than 0.2% of the total harvested volume. Given the minimal historical harvest activity targeting deciduous species in TFL 6, these areas are currently excluded from the THLB. However, a small portion of TFL 6 has been reforested with genetically improved red alder seedlings following established deciduous stocking standards since the last AAC determination. These young deciduous stands are included in the THLB, and their growth and yield are factored into the relevant analysis units detailed in Section 7.3.

Table 30 Area of Deciduous Forest Types in TFL 6

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Deciduous-leading stands	4,294	3,988	1,576

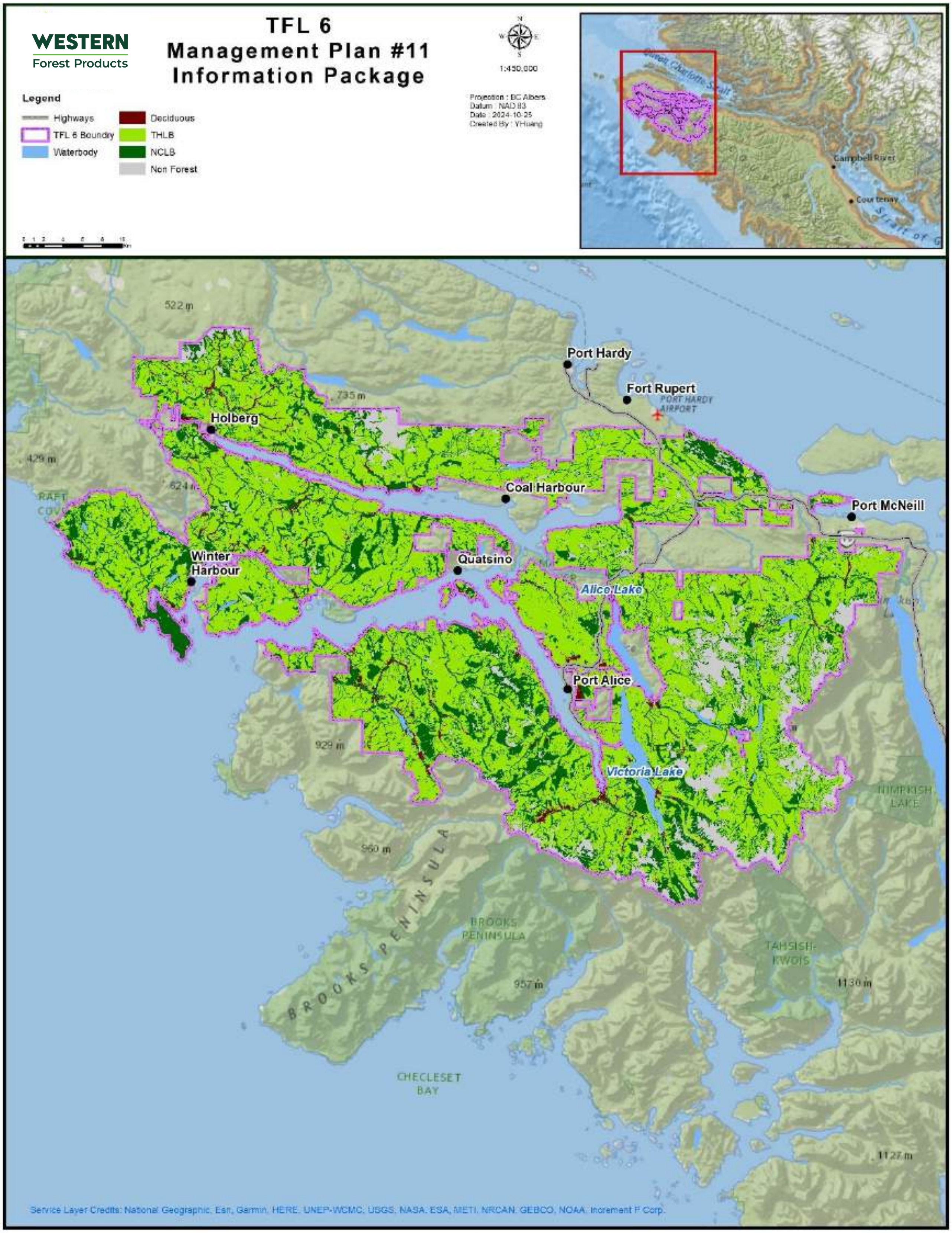

Figure 18 Deciduous-leading Stands in TFL 6

6.15 Recreation Features

Unlike other Vancouver Island Districts where Government Actions Regulation (GAR) Orders formally identify recreation resource features, the TFL 6 recreation inventory identifies extensive areas of moderately significant recreation resource features. These features are primarily associated with non-forested areas (Section 6.4), non-productive forests (Section 6.6), riparian features (Section 6.9) and visual resources (Section 10.3.1). Existing management practices are assumed to address these features.

More significant features requiring special forest management are identified as Recreation Sites, and Trails. These features are removed from the THLB by applying a 10 m buffer zone to the features.

Table 31 lists the recreation sites and trails identified during the process for TFL 6.

Table 31 Recreation Sites and Trails in TFL 6

Recreation Sites	Recreation Trails
Clint Beek Rec Site	Hecht Area
Devils Bath	Grant Bay Trail (REC16102)
Eternal Fountain	Lady Ellen Point (REC6250)
Kathleen Lake	Marble River Trail
Lac truite (trout lake)	Hecht Trail
Marble River Campsite	Lac Truite (REC3243)
Marble River Hatchery	Topknot Trail
Marble River Rec Site	Beaver Lake (REC3202)
Maynard Lake	Clint Beek Park
Merry Widow Mountain Trail	Merry Widow Mountain (REC260693)
O'Connell Lake Recreation Area	Old Wagon Road
Spruce Bay	Hecht Cabin Access
Three Isle Lake	Quatsino Story Trail (REC262804)
	Cluxewe Beach Trail (REC16078)
	Hecht Beach (REC16079)
	Spruce Bay Old Growth Trail (REC16082)

Table 32 and Figure 19 show the areas and spatial locations for the above-mentioned recreation features.

Table 32 Recreation Features in TFL 6

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Recreation Features	20	14	6

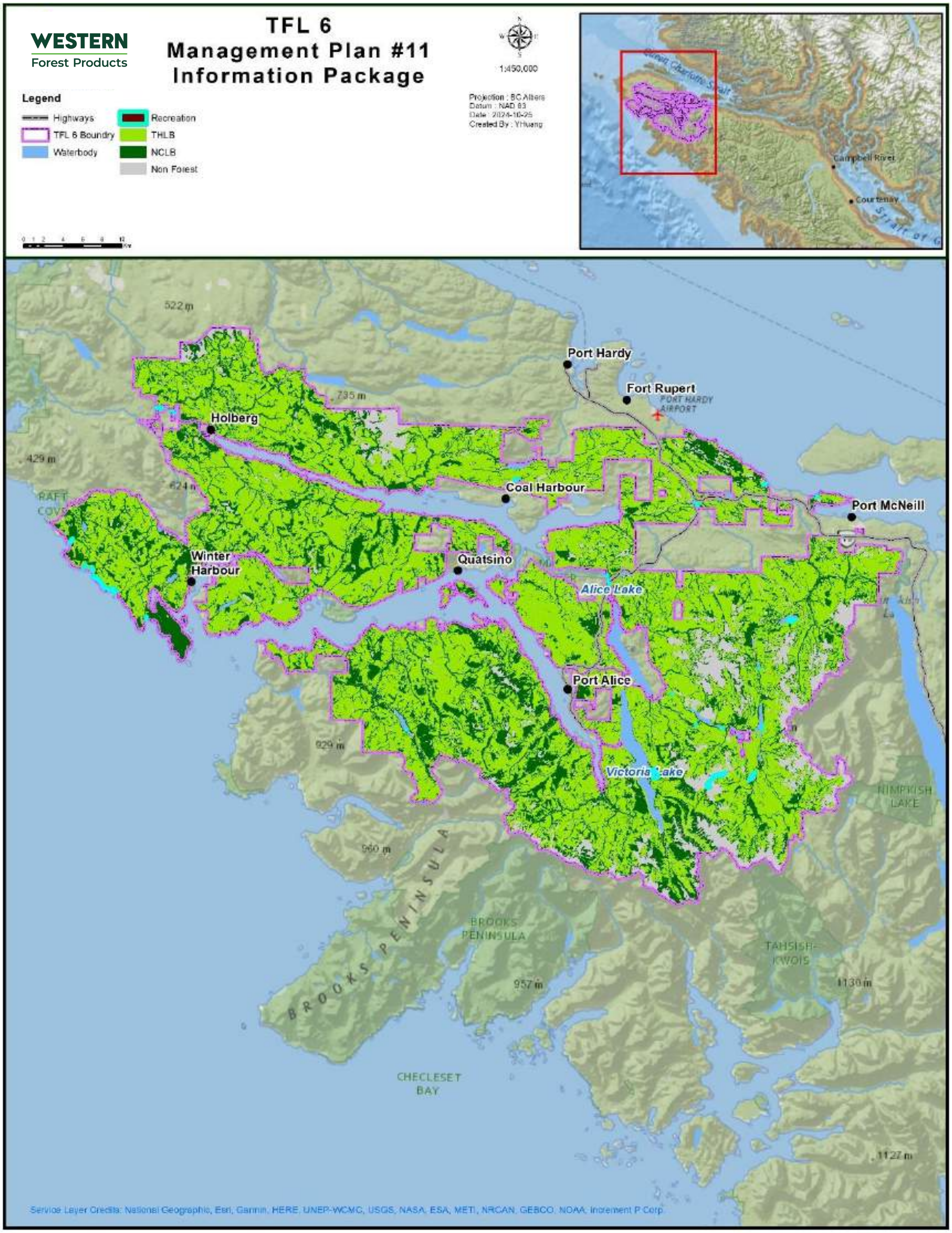

Figure 19 Recreation Features in TFL 6

6.16 Cultural Heritage Resources

First Nations possess diverse cultures, histories, and traditions. The Heritage Conservation Act safeguards archaeological sites containing evidence of human activity before 1846. Under this Act, damaging, excavating, or altering these sites requires a permit from the responsible minister or designate. Data on archaeological sites, provided by the Archaeology Branch of the FOR, is excluded from THLB.

The broader term "cultural heritage resources" encompasses various elements defined by the Forest Act as "objects, sites, or locations of traditional societal practices significant to British Columbia, a community, or an Aboriginal people." FRPA outlines government objectives for conserving or protecting these resources, focusing on:

a) Locations of ongoing traditional use by Aboriginal peoples, and
b) Sites not regulated by the Heritage Conservation Act.

An archaeological overview assessment (AOA) for the former Port McNeill Forest District, completed in 1995 by I.R. Wilson Consultants Ltd., helps identify and assess archaeological resource potential. The AOA predicts archaeological site characteristics and distribution, providing a framework for evaluating site significance.

Quatsino First Nation (Quatsino) conducted a Traditional Use Study (TUS) for their territory in 1996, which has been maintained. Additionally, the Galgalis Traditional Use Study, compiled in 1998 for the Kwakiutl Territorial Fisheries Commission, gathered input from various Kwakwaka'wakw Nations on northern Vancouver Island, the central coast, and intervening islands. First Nations with TUS information hold detailed records on traditional use sites and values within their asserted territories. While TUS information is not typically shared with forest licensees, decision-makers consider it when making statutory decisions.

The Quatsino (TFL 6) IRMP process (discussed in Section 3.5.2.2) is very helpful in informing the TSR with the best available cultural heritage information within TFL 6. Through this collaboration, Western gained valuable geographical insights into a Quatsino TUS zone, a confidential area with high concentration of cultural significance encompassing approximately 58,000 hectares (27%) of the total TFL area. This knowledge facilitated a deeper understanding of the Quatsino's interests in land and resources within their traditional territory. Consequently, Western is better positioned to integrate these interests into its resource management and planning processes.

Culturally modified trees (CMTs) are the most prevalent cultural heritage resource found within TFL 6. These trees bear modifications made by Indigenous peoples during traditional forest use practices. Examples include bark removal, stumps and felled logs, trees tested for soundness, and scars from plank extraction. Western redcedar is the most commonly used and culturally significant species for CMT.

Surveys for CMTs are completed where required in coordination with First Nations as part of operational planning. This detailed stand-level information is recorded in Western's GIS database and informs forest management planning (see Sections 6.17 and 6.23 for details on existing and future stand-level retention netdowns, respectively). Additionally, landscape-level netdowns, such as those outlined in the riparian management plan (Section 6.9), also contribute to overall cultural heritage protection. Archaeological sites registered with the provincial government will be entirely removed from the THLB (see Table 33), even if permits allow for limited alterations. Due to the sensitive nature of the data, a spatial illustration of these sites within the TFL will not be shown in the IP. Location inquiries can be made directly to the Archaeology Branch, Province of BC.

To address the potential for unidentified cultural heritage resources as part of the TSR, Western collaborated with the IRMP technical team. This collaboration involved a joint review of recently harvested areas within the Quatsino TUS zone. The review specifically focused on areas where adjustments were made to boundaries or retention levels due to confirmed archaeological or cultural findings. Notably, existing retention levels within cutblocks in the Quatsino TUS zone were demonstrably higher than the average across the entire TFL 6. This suggests that increased retention can be an effective way to account for the potential presence of unidentified cultural features for the timber supply modelling projections.

Based on this finding, an updated netdown to account for an average of 28% stand level retention has been established for all of Western 's variable retention management zones within the Quatsino TUS zone (see Section 6.23 and Section 10.4.3 for details). This level of retention is accounted for through an aspatial netdown approach, to reflect the potential presence of unknown cultural features. This updated netdown represents a significant increase from the current area-weighted average target of 12.5% retention in the Quatsino TUS zone.

It is important to emphasize that the measures outlined above do not supplant the on-ground practice of the retention silvicultural system as described in Section 10.4.3, nor do they serve as a substitute for archaeological surveys in targeted areas during the operational planning phase.

Table 33 summarizes the combined area reduction for the government-registered archaeological sites and Quatsino TUS zone within the TFL.

Table 33 Cultural Heritage Resources in TFL 6

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Government Archaeological Sites	893	849	527
Unknown Cultural Features within	57,909[8]	53,018	453

[8] This is the gross area of the confidential Quatsino TUS zone.

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Quatsino TUS Zone			
Total	*58,802*	*53,868*	*979*

6.17 Existing Stand-Level Reserves

Stand-level reserves play an important role in maintaining biodiversity and providing wildlife habitat. Policy direction for wildlife tree management began in 1985 with the release of Protection of Wildlife Trees policy. This was further developed in 1995 with the introduction of the Forest Practices Code of British Columbia and the associated Biodiversity Guidebook. Under these guidelines, wildlife tree patches (WTPs) were designated for nearly every harvested cutblock. The FRPA continued this requirement, replacing WTPs with wildlife tree retention areas (WTRAs). Landscape Unit Plans typically establish WTRA objectives based on biogeoclimatic variants.

Forestry licensees may implement additional stand-level retention measures beyond those mandated by legislation, based on their own management policies and strategies. For further details on this, refer to Sections 6.23 and 10.4.3.

For MP #11, existing long-term stand-level retention areas will be excluded from the THLB as shown in Table 34 and Figure 20. This reflects the assumption that these areas will be retained again during future harvesting operations.

Table 34 Existing Stand-Level Retention in TFL 6

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Existing stand-level retention	7,747	7,287	3,089

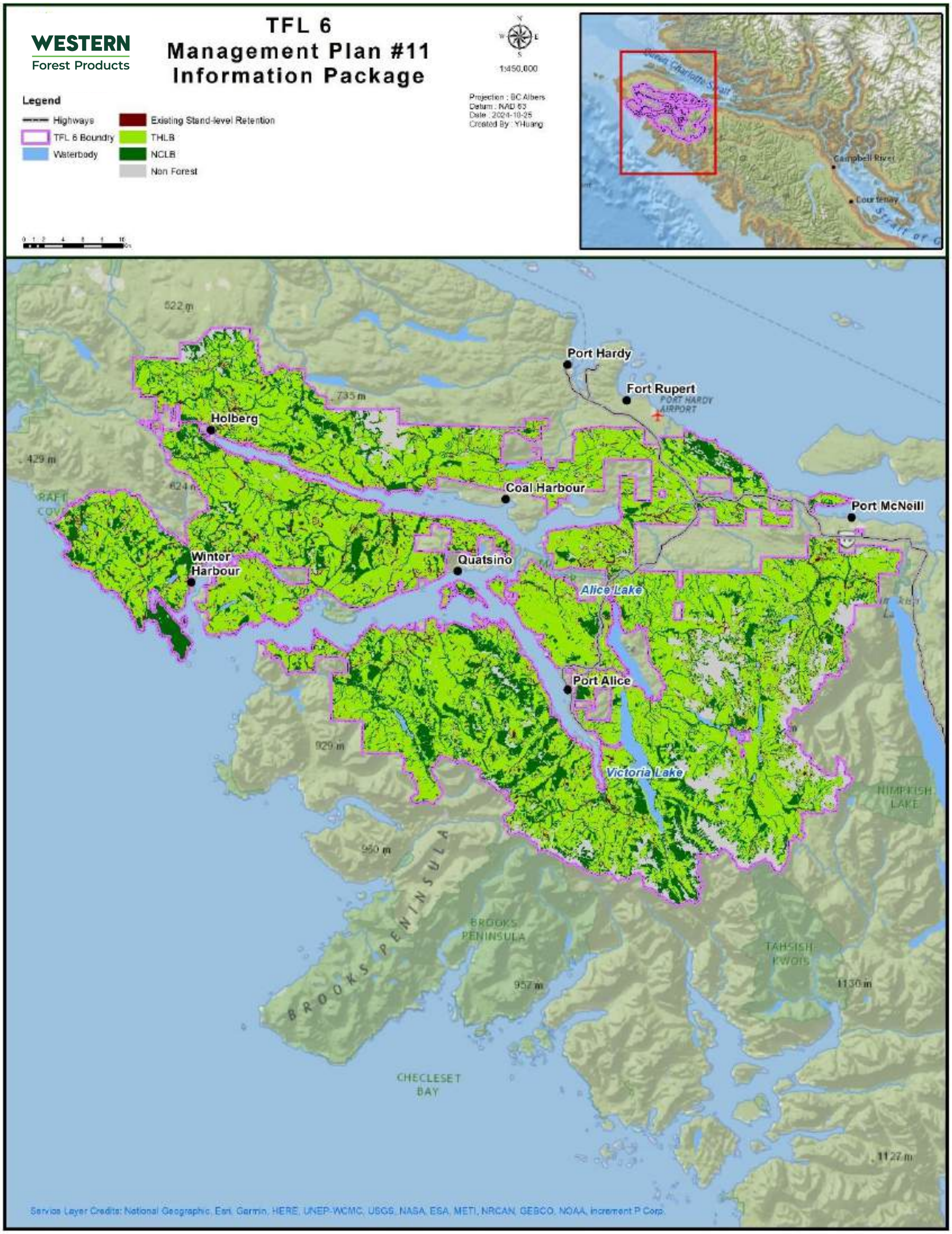

Figure 20 Existing Stand-Level Reserves in TFL 6

6.18 Research Sites

TFL 6 includes 51 active research installations with diverse objectives, such as testing experimental silvicultural treatments, genetics, and genecology. The Forest Improvement and Research Management Branch and the Forest Science Planning & Practices Branch establishes variable-width buffers (5 to 100 metres) around these sites in the spatial data obtained from the BC Data Catalogue.

To prioritize research integrity, most installations will be deferred from harvesting in the timber supply model for 70 years after establishment. This timeframe reflects the researchers' intent to potentially produce merchantable timber within these trials. Additionally, a portion of EP703-56, due to its long-term research focus, will be excluded from the THLB. This approach has been endorsed by staff from both Forest Improvement and Research Management Branch and the Forest Science Planning & Practices Branch. Table 35 and Figure 21 summarize the area and spatial location of the research installation excluded from THLB within TFL 6. It is noted that most area of this particular research site has already been excluded from the THLB, as per the proposed OGMA discussed in Section 6.11.

Table 35 Research Site Excluded from THLB

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Research Sites	112	112	13

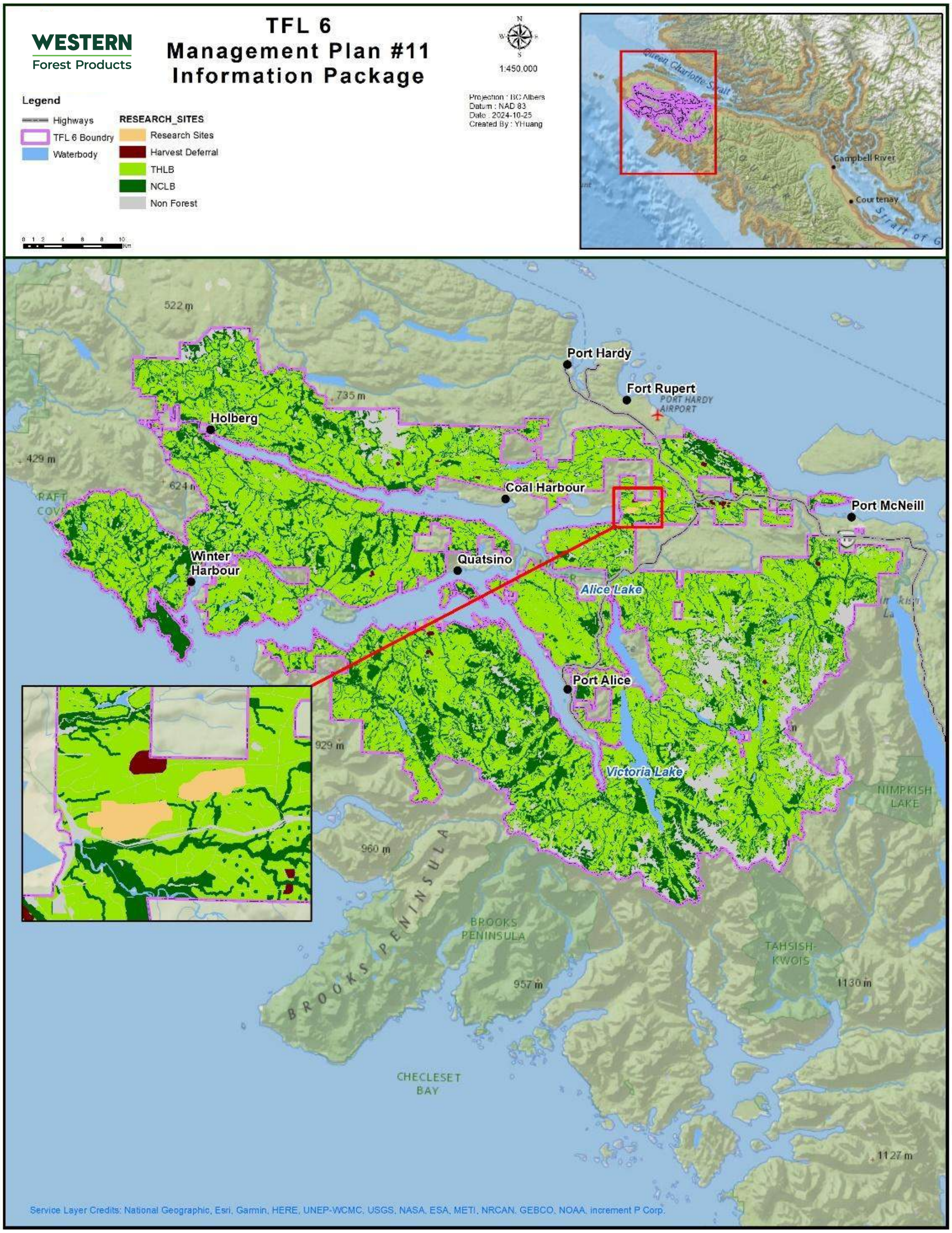

Figure 21 Research Sites within TFL 6

6.19 Terrain Stability

There are two primary terrain stability mapping methods within TFL 6:

- Detailed terrain stability mapping (DTSM or 5-class): originally conducted by T. Lewis in 1992 and 1995, with subsequent updates to meet Ministry standards in 1998 across the majority of TFL 6 at a 1:20,000 scale. This mapping categorizes areas into five classes, indicating the probability of post-harvest instability.
- Environmentally Sensitive Area (ESA) Mapping (Es1/Es2): mapped for the eastern portion of TFL 6, originally part of TFL 39 Block 4. This mapping standard was applied during a project in the 1970s. ESA mapping has known limitations and was deemed outdated by the Chief Forester in the TFL 39 AAC determination (Province of British Columbia, 2016). Consequently, ESA-based terrain stability mapping is no longer considered valid for MP #11.

Given the availability of a LiDAR-derived slope dataset and its strong correlation with landslide risk, an operational review was conducted. This review assessed harvest performance and opportunities based on different LiDAR slope gradients. For areas harvested between 2012 and 2023, analysis showed that 95% of the net harvested areas occurred in < 90% LiDAR-derived slope data (Section 3.5.3.1). Therefore, areas with LiDAR-derived slopes exceeding 90% are deemed too risky for the environment and excluded from the THLB for the entire TFL.

The same operational review revealed that only 1.8% of the area harvested between 2012 and 2023 was DTSM Class 5 terrain (highest instability risk) in where DTSM terrain mapping is available (Table 36). Consequently, Class 5 terrain, other than in recently harvested cutblocks, will also be excluded from the THLB, in addition to the LiDAR slope exclusion.

Table 36 2012-2023 Harvested Areas by Terrain Stability Class

Terrain Class	% of Harvested Area[9]
1	6.8%
2	8.9%
3	77.4%
4	5.1%
5	1.8%
Total	*100%*

Table 37 and Figure 22 indicate the unstable terrain area indicates the areas removed from the THLB based on the above netdown methodology.

[9] Proportionality is calculated based on the areas where DTSM terrain mapping is available.

Table 37 Terrain Stability Netdowns

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
DTSM Class 5 (high)	9,257	7,992	1,993
LiDAR 90+% Slope	10,020	7,768	1,820
Total	*19,278*	*15,760*	*3,812*

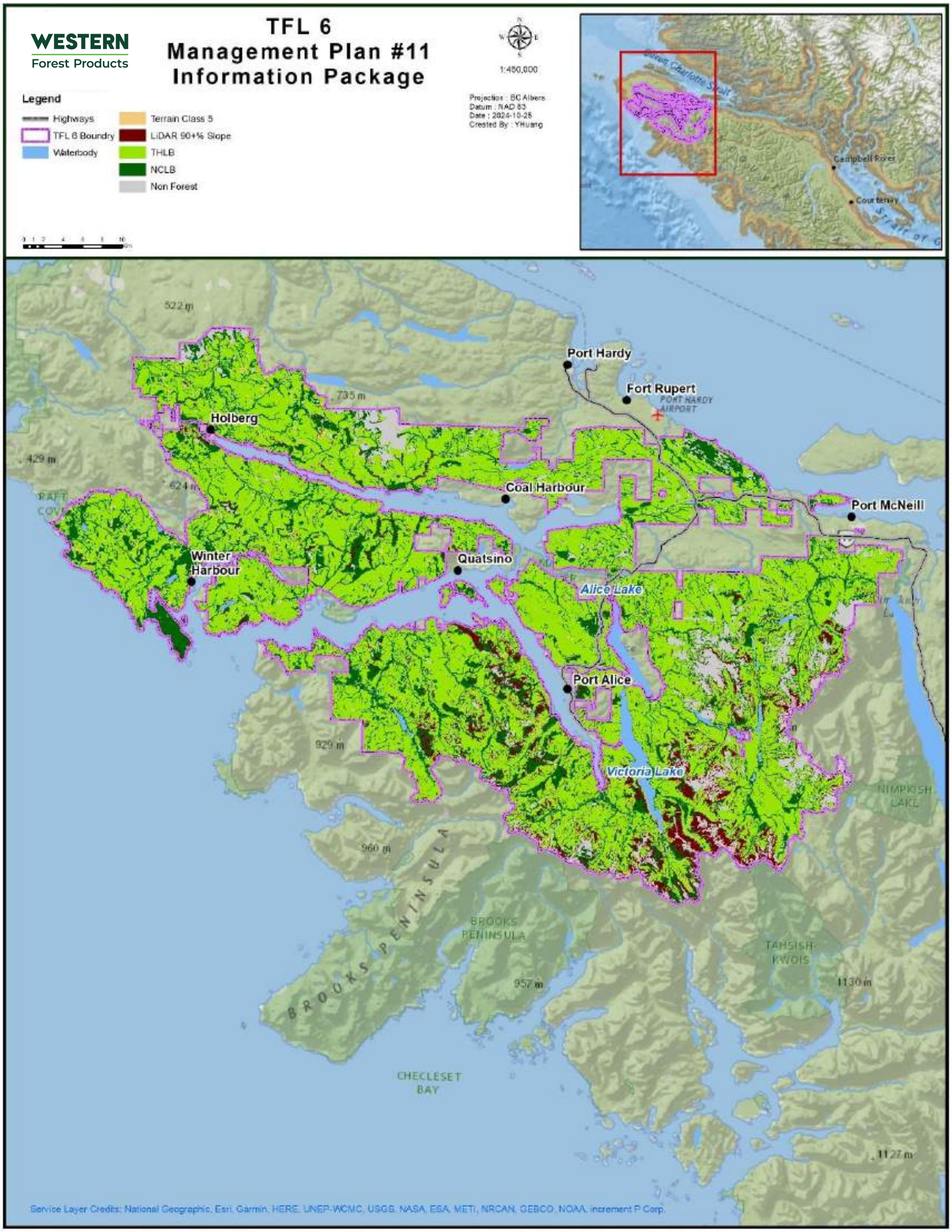

Figure 22 Terrain Stability Classes and 90+% Slope in TFL 6

6.20 Permanent Sample Plots

The FOR's Forest Improvement and Research Management Branch maintains a province-wide network of Permanent Sample Plots (PSPs) to monitor forest growth and calibrate growth and yield models. While the objectives for these plots have not been formally established through legislation, an operational review of harvest practices reveals that active plots (including their buffers) are currently avoided during harvesting activities.

To ensure the long-term viability of the PSP program, all active plots within TFL 6 (total of 65 plots) will be excluded from the THLB. A standardized buffer distance of 100 metres will be applied to all plots. To protect the integrity of research programs, the precise locations of these PSPs within TFL 6 are not disclosed. However, the approximate locations can be viewed on BC Data Catalogue website. Table 38 summarized the area excluded from THLB.

Table 38 Permanent Sample Plots in TFL 6

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Permanent Sample Plots	180	167	134

6.21 Big Tree Reserves

British Columbia recognizes the importance of big trees through the Special Tree Protection Regulation implemented on September 11, 2020 (Province of British Columbia, 2020). Under this regulation, big trees on the BC Big Tree Registry, generally defined by height and diameter-at-breast-height (DBH), are considered protected under Part 13 of the Forest Act. Additionally, specified trees, a standing live or dead tree meeting the criteria of the Special Tree Protection Regulation, require additional reserves and protections.

Western 's Big Tree Retention Policy goes beyond provincial requirements, retaining standing live trees exceeding 80 metres in height or meeting minimum DBH standards outlined in the Western big tree standard. For example, under this policy, a western redcedar with a DBH of 300 centimetres and a yellow cedar with a DBH of 210 centimetres in TFL 6 would qualify as big trees.

LiDAR data and field verification work together to locate and retain big trees. LiDAR-generated treetop points identify potential candidates (over 80 metres tall). Measurements of these potential big trees initially utilize LiDAR point cloud data, followed by on-site verifications and evaluations. This two-step approach broadens the definition of significant trees by including height, which is difficult to assess using traditional ground-based methods. However, ground-truthing of all potential big tree candidates is ongoing.

As of this timber supply analysis, 406 big trees have been identified using both the provincial regulation and Western's big tree retention policy. Specified trees receive a one-hectare retention area, while other big trees receive a 0.25-hectare retention area. The impact on the THLB for these big trees in TFL 6 is detailed in Table 39.

Table 39 Big Tree Reserve Area in TFL 6

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Specified Big Tree	47	46	26
Western Big Tree	38	36	16
Total	85	83	42

6.22 Karst

Karst landscapes, characterized by fluted rock surfaces, sinkholes, caves, and underground drainage systems, are sensitive to logging impacts due to safety concerns, the intrinsic value of cave systems, and the presence of unique flora and fauna. These landscapes are formed by the dissolving action of water on limestone bedrock (Quatsino formation) underlying portions of TFL 6.

In 2007, the District Manager of the NICCNRD established a GAR order identifying karst caves, important features and elements within very high and high vulnerability karst and significant surface karst features as resource features requiring management under FRPA.

During early engagement for this IP in spring 2024, Quatsino First Nation highlighted the traditional significance of karst features on the land base.

To assist with quantifying an appropriate netdown to the THLB for the management of karst features within TFL 6, the area reserved as WTRAs since the GAR order within primary and secondary karst likelihood zones, identified by the provincial inventory data, was analyzed. WTRAs are designated areas identified for harvest blocks where trees are left standing for a variety of reasons including wildlife habitat, biodiversity, and to mange for other values at the site-level including karst features. The analysis revealed that on average, 17% of the area of each cutblock in these karst likelihood zones is currently reserved as WTRA. To ensure adequate accounting for karst features, a netdown to account for 20% WTRA is used. (see Section 6.23 and Section 10.4.3 for details). If the overall THLB netdown percentage is below 20% in these karst zones (e.g., Enhanced Windy zone with 15% retention target), additional areas will be excluded aspatially from the THLB to achieve the 20% level. Conversely, if the overall THLB netdown percentage exceeds 20%, it is considered that karst features have been adequately accounted for in the WTRAs established by the stand-level retention allowances.

Figure 23 shows the primary and secondary karst likelihood area within TFL 6. Table 40 presents the productive forest area by karst likelihood class and the resulting area removed from the THLB.

Table 40 Karst Inventory Likelihood Classes and THLB Netdowns in TFL 6

Karst Likelihood	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Primary	15,653	14,636	2,227
Secondary	11,019	10,209	1,494
Total	26,673	24,845	3,721

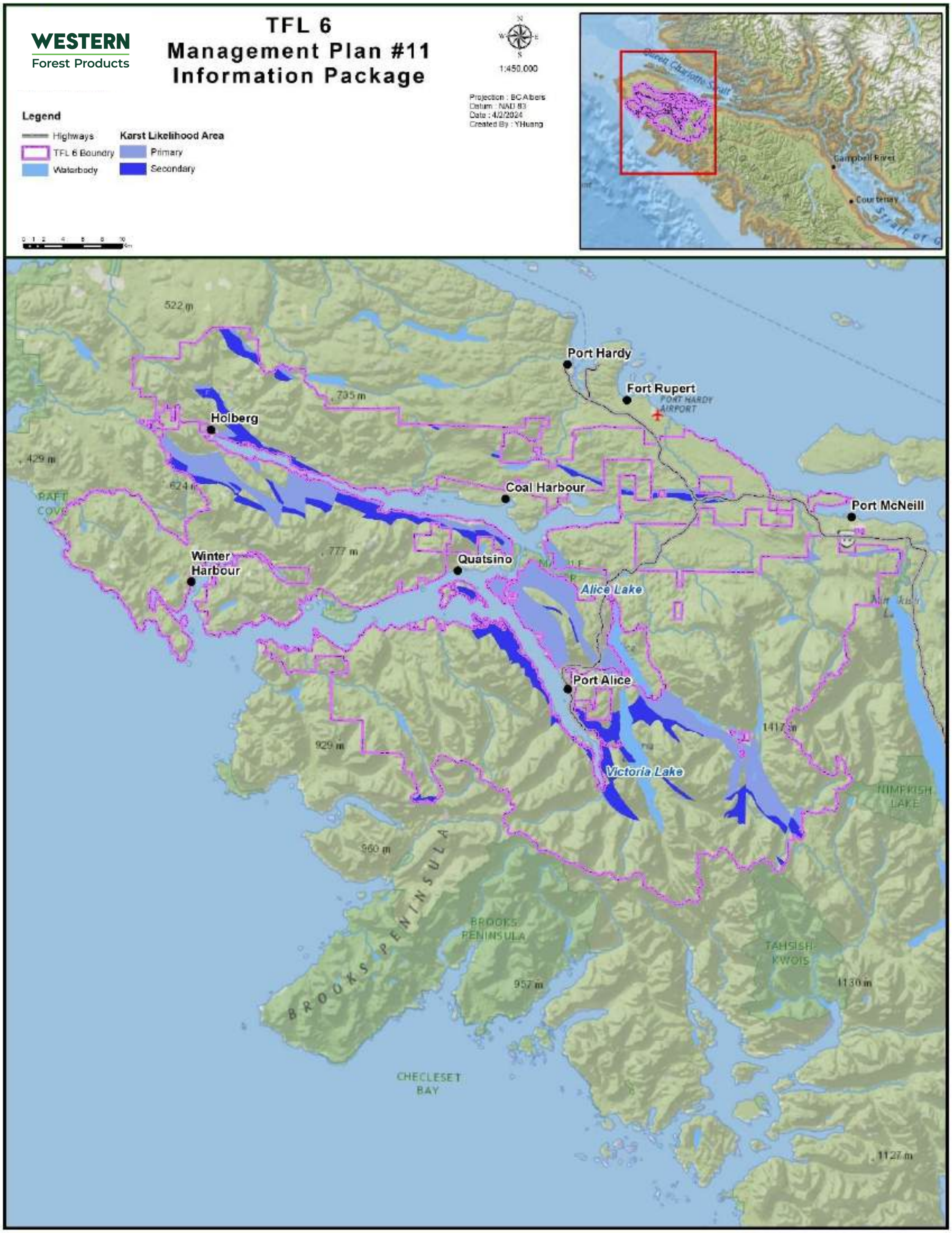

Figure 23 Karst Likelihood Area in TFL 6

6.23 Future Stand-Level Retention

6.23.1 Wildlife Tree Retention Areas

When possible and compatible with wildlife objectives, WTRAs are prioritized in areas with limited harvesting options, such as riparian zones, inoperable stands, or steep and unstable terrain (Class 5 or 90+% slope). In the absence of specific WTRA objectives set by land-use orders or landscape unit plans, the FPPR Section 66 applies, requiring a minimum of 7% WTRA retention for TFL 6.

To account for WTRAs located in harvestable areas, an aspatial THLB area reduction is applied. A review of harvested areas from 2018 to 2023 revealed that 46.8% of the WTRA placements occurred within harvestable areas. This means that 53.2% of the WTRAs were situated in areas already excluded from harvest, such as riparian zones, cultural heritage sites, or areas with terrain stability concerns.

Since the proportion of WTRA placement in harvestable areas can vary based on the specific retention zones defined in Western's Stewardship and Conservation Plan (WSCP) (see Section 6.23.2 and Section 10.4.3), a zone-specific adjustment factor has been applied to the provincial 7% minimum WTRA target to account for future WTRA requirements within the THLB (details in Table 41).

Table 41 Zone-Specific Provincial WTRA Netdown Adjustment Factors for TFL 6

Western Stewardship & Conservation Zones	Provincial WTRA Target (%)	Retention Factor Excluding Other Netdown Categories (%)	Retention Factor% x Provincial WTRA Target (%)
Enhanced Basic	7	42.9	3.0
Enhanced Windy	7	46.9	3.3
General Basic	7	47.5	3.3
General Windy	7	40.8	2.9
Special	7	49.2	3.4

6.23.2 Additional Stand-Level Retention

Section 10.4.3 details how applying the retention silvicultural system under WSCP results in at least 41.3% of the harvest area within TFL 6 falling under retention silvicultural system cutblocks (the remaining area being clearcut-with-reserves). WSCP retention requirements vary by WSCP zones created to account for VILUP resource management zone management goals and windthrow risk levels. Consequently, different netdown factors are applied to ensure the total THLB reduction aligns with the findings of the review discussed in Section 6.23.1.

Table 42 outlines the collective stand-level retention targets, combining provincial WTRA and retention silvicultural system targets for each LU.

Table 42 Stand-Level Retention Targets by LU in TFL 6

Landscape Unit	Western Stewardship & Conservation Zones	Provincial WTRA (%)	Weighted Average Retention Target with WSCP (%)
Holberg	Enhanced Windy	7	9.4
Keogh	Enhanced Basic	7	11
	Enhanced Windy	7	9.4
	General Basic	7	14.8
	General Windy	7	12.2
Klaskish	Enhanced Windy	7	9.4
Lower Nimpkish[10]	Enhanced Basic	7	11
	Enhanced Windy	7	9.4
Mahatta	Enhanced Windy	7	9.4
Marble	Enhanced Basic	7	11
	Enhanced Windy	7	9.4
	General Basic	7	14.8
	General Windy	7	12.2
Nahwitti	Enhanced Windy	7	9.4
Neroutsos	Enhanced Windy	7	9.4
	General Basic	7	14.8
	General Windy	7	12.2
San Josef	Enhanced Windy	7	9.4
	Special	7	23.2
Tsulquate	Enhanced Windy	7	9.4

Table 42 illustrates the resulting THLB area reduction due to these targets for future retentions.

Table 43 Total THLB % Netdowns for Future Stand-Level Retention

Western Stewardship & Conservation Zones	Area Subject to this netdown (ha)[11]	Provincial WTRA Target (%)	Provincial WTRA Target Implementation (%)	WSCP Long-Term Variable Retention Target (%)	WSCP Long-Term Variable Retention Target Implementation (%)	Total Retention Target (%)	Retention Factor x Total WTRA Target (%)	THLB reduction for WTRA (%)	THLB reduction for WSCP (%)	Area reduction (ha)
Enhanced Basic	6,297	7%	50%	15%	50%	11.0 %	4.7%	3.0%	1.7%	296

[10] As noted in Section 1.2, the two SMZs established under the January 2026 Gwa'ni Land Use Objectives Order were not included, as the legal order had not yet been issued at the time the accepted version of the Information Package and timber supply model were prepared. Accordingly, the Enhanced Forestry Zone identified under VILUP was applied for Lower Nimpkish LU.

[11] Existing WTRAs established for stands harvested after the WSCP implementation (stands 21 years old or younger) are presumed to be maintained, thus satisfying future WTRA requirements.

Western Stewardship & Conservation Zones	Area Subject to this netdown (ha)[11]	Provincial WTRA Target (%)	Provincial WTRA Target Implementation (%)	WSCP Long-Term Variable Retention Target (%)	WSCP Long-Term Variable Retention Target Implementation (%)	Total Retention Target (%)	Retention Factor x Total WTRA Target (%)	THLB reduction for WTRA (%)	THLB reduction for WSCP (%)	Area reduction (ha)
Enhanced Windy	52,603	7%	70%	15%	30%	9.4%	4.4%	3.3%	1.1%	2,315
General Basic	15,914	7%	40%	20%	60%	14.8%	7.0%	3.3%	3.7%	1,114
General Windy	1,618	7%	60%	20%	40%	12.2%	5.0%	2.9%	2.1%	81
Special	5,944	7%	10%	25%	90%	23.2%	11.4%	3.4%	8.0%	678
Total	*82,376*	-	-	-	-	-	-	-	-	*4,483*

6.24 Future Roads

LiDAR data was used to refine the physical operability inventory within TFL 6 through the LBB process (detailed in Section 5.2.1). A key element of this update involved projecting future roads to support conventional harvesting activities. The goal is to minimize road construction for future harvests; therefore, these projected roads represent the most practical and anticipated network. These projections are then integrated into the modelling dataset. When harvest areas overlap with these future roads, the THLB within the designated road right-of-way will be reduced in the next rotation.

Table 44 details the projected road network required for accessing conventionally harvested blocks within TFL 6.

Table 44 Future Roads Projected for TFL 6

Description	Gross Area (ha)	Productive Area (ha)	Area Reduction (ha)
Future Roads	2,136	2,048	1,427

7 Inventory Aggregation

This section outlines the process for delineating the TFL land base for this analysis. It covers two key aspects:

1. Landbase Delineation: Dividing the TFL area into distinct management zones. These zones accommodate diverse forest management strategies and consider various forest cover constraints, such as those related to landscape-level biodiversity.
2. Stand Type Definition: Grouping forest stands with similar characteristics into Analysis Units (AUs). Stand similarities are based on leading species composition, historical context, and productivity.

Please note that due to rounding to the nearest hectare, totals within tables in this section may not add up precisely.

7.1 Resource Management Zones

Unique forest cover objectives will be modelled across VILUP Resource Management Zones (RMZs):

- Special Management Zones (SMZs),
- General Management Zones (GMZs),
- Enhanced Forestry Zones (EFZs)

Table 45 and Figure 24 identify the VILUP RMZs within the TFL. These zones define specific forest cover requirements, detailed in Section 10.3. As noted in Section 1.2, the two SMZs resulting from the January 2026 Gwa'ni Land Use Objectives Order are not included, as the formal legal order had not yet been issued at the time the accepted version of the IP and timber supply model were prepared.

To streamline the dataset and reduce the number of unique resource management zones, minor revisions were made:

- 300 hectares of productive forest (148 hectares of THLB) that is marked as Settlement in the RMZ within Neroutsos LU around the village of Port Alice was assigned to the Mahatta-Neroutsos EFZ. 132 hectares of productive forest (95 hectares of THLB) that is marked as Settlement in the RMZ within Keogh and Lower Nimpkish LU around the Town of Port McNeill was assigned to the Keogh-Cluxewe EFZ.

- 11 hectares of productive forest (six hectares of THLB) originally identified within the Brooks Bay SMZ were assigned to the Mahatta-Neuroutsos EFZ due to GIS data discrepancies between Mahatta LU and the RMZ data.
- Eight hectares of productive forest (four hectares of THLB) originally identified within the Kashutl GMZ but within Marble LU were assigned to the Marble GMZ; Five hectares of productive forest (two hectares of THLB) originally identified within the Kashutl GMZ but within Neroutsos LU were assigned to the Mahatta-Neuroutsos EFZ. This is due to discrepancies between the TFL 6 boundary and the RMZ data.
- 106 hectares of productive forest (71 hectares of THLB) originally identified within the Klaskish GMZ were assigned to the Mahatta-Neroutsos EFZ due to a different height-of-land interpretation.
- 137 hectares of productive forest (99 hectares of THLB) originally identified within the Nahwitti-Tsulquate GMZ were assigned to the Holberg EFZ. The boundary between these two RMZs is intended to be the TFL 6 boundary.
- 41 hectares of productive forest (13 hectares of THLB) originally identified within the Marble River Protected Area but within Marble LU were assigned to the Marble GMZ; 31 hectares of productive forest (17 hectares of THLB) originally identified within the Marble River Protected Area but within Neroutsos LU were assigned to the Mahatta-Neuroutsos EFZ; Two hectares of productive forest (one hectare of THLB) originally identified within the Marble River Protected Area but within San Josef LU were assigned to the San Josef-Koprino EFZ. This revision is the result of different boundaries for the Marble River Park between the provincial park data and the RMZ data.
- 24 hectares of productive forest (22 hectares of THLB) originally identified within the Nimpkish EFZ but within the Lower Nimpkish LU were assigned to the Keogh-Cluxewe EFZ. The Nimpkish EFZ boundary is intended to be the TFL 6 boundary. 14 hectares of productive forest (five hectares of THLB) originally identified within the Nimpkish EFZ but within the Marble LU were assigned to the Marble GMZ due to a different height-of-land interpretation.
- Three hectares of productive forest (Three hectares of THLB) originally identified within the Quatsino Protected Area were assigned to San Josef-Koprino EFZ. This is due to discrepancies between the TFL 6 boundary and the RMZ data.
- 12 hectares of productive forest (seven hectares of THLB) originally identified within the Raft Cove Protected Area were assigned to West Coast Nahwitti Lowlands SMZ. This is due to discrepancies between the TFL 6 boundary and the RMZ data.
- 11 hectares of productive forest (eight hectares of THLB) originally identified within the Tahsish EFZ were assigned to the Marble GMZ due to a different height-of-land interpretation.

- 178 hectares of productive forest (32 hectares of THLB) that is marked as Ocean in the RMZ within Holberg LU were assigned to the Holberg EFZ due to a different land mass interpretation.
- 17 hectares of productive forest (six hectares of THLB) that is marked as Ocean in the RMZ within San Josef LU were assigned to the San Josef-Koprino EFZ due to a different land mass interpretation.
- Four hectares of productive forest (0.02 hectare of THLB) within Keogh LU, 101 hectares of productive forest (12 hectares of THLB) within Mahatta and Neroutsos LUs, and 161 hectares of productive forest (49 hectares of THLB) within San Josef LU, are not covered by a SMZ, GMZ or EFZ. They are assigned to their corresponding RMZs: Keogh – Cluxewe EFZ, Mahatta – Neroutsos EFZ, and San Josef – Koprino EFZ, respectively.

Table 45 Area by VILUP Resource Management Zone

Mgmt Zone	Mgmt Unit	Seral Stage[12]	Productive Forest (ha)	THLB Area (ha)	Management Considerations (from Vancouver Island Summary Land Use Plan)
EFZ 5	Holberg	Early	12,407	10,904	***Enhanced Forestry Zone*** *suited for enhanced timber harvesting and production, while maintaining fish values and watershed integrity.*
		Mid	9,557	6,854	
		Mature	7,237	2,601	
		Old	939	374	
		Total	30,141	20,753	
EFZ 6	Keogh-Cluxewe	Early	9,255	8,093	***Enhanced Forestry Zone*** *suited for enhanced silviculture, with limited opportunity for enhanced timber harvesting; integration of visual values along coastline and highway corridor, as well as recreational opportunities along Keogh River.*
		Mid	10,224	7,598	
		Mature	3,206	1,113	
		Old	3,309	958	
		Total	25,994	17,762	
SMZ 4	Koprino	Early	2,446	2,174	***Special Management Zone*** *should be focal area (within the landscape unit) for the retention of old forest and associated wildlife habitat, as well as for mature and old forest connectivity.*
		Mid	605	419	
		Mature	1,785	460	
		Old	712	135	
		Total	5,549	3,188	
EFZ 8	Mahatta-Neuroutsos	Early	15,860	13,641	***Enhanced Forestry Zone*** *suited for enhanced timber harvesting and silviculture;*
		Mid	11,300	7,699	
		Mature	8,536	3,708	

[12] Early seral is <40 years old; Mid seral is 40-80 years old in CWH zone and 40-120 years old in MH zone; Mature seral is 81-250 years old in CWH zone and 121-250 years old in MH zone; Old seral is >250 years old.

Mgmt Zone	Mgmt Unit	Seral Stage[12]	Productive Forest (ha)	THLB Area (ha)	Management Considerations (from Vancouver Island Summary Land Use Plan)
		Old	10,327	3,268	*wildlife values in Mahatta system and marbled Murrelet values in noted drainages require specific integration through maintenance of old seral forest; objectives for other resources are to be integrated at the basic stewardship level.*
		Total	46,022	28,317	
GMZ 7	Marble	Early	12,899	10,494	***General Management Zone** particularly suited for enhanced silviculture in second growth stands; high fisheries values, wildlife values/capability, as well as ecosystem representation and connectivity functions result in intermediate biodiversity significance; integration of recreational values associated with lakes.*
		Mid	16,154	11,472	
		Mature	2,831	753	
		Old	8,844	2,357	
		Total	40,728	25,077	
EFZ 4	San Josef-Koprino	Early	13,954	12,148	***Enhanced Forestry Zone** suited for enhanced timber harvesting and production, while maintaining fish values and watershed integrity.*
		Mid	5,738	4,068	
		Mature	6,605	2,692	
		Old	2,984	1,035	
		Total	29,280	19,943	
SMZ 2	West Coast Nahwitti Lowlands	Early	3,202	2,734	***Special Management Zone** with main focus on special management for significant scenic and recreational values which are concentrated along narrow coastal strip; additional consideration should be on maintenance of the high riparian fish and coastal wildlife values.*
		Mid	523	208	
		Mature	3,359	1,280	
		Old	2,627	837	
		Total	9,711	5,059	
Grand Total			187,425	120,099	

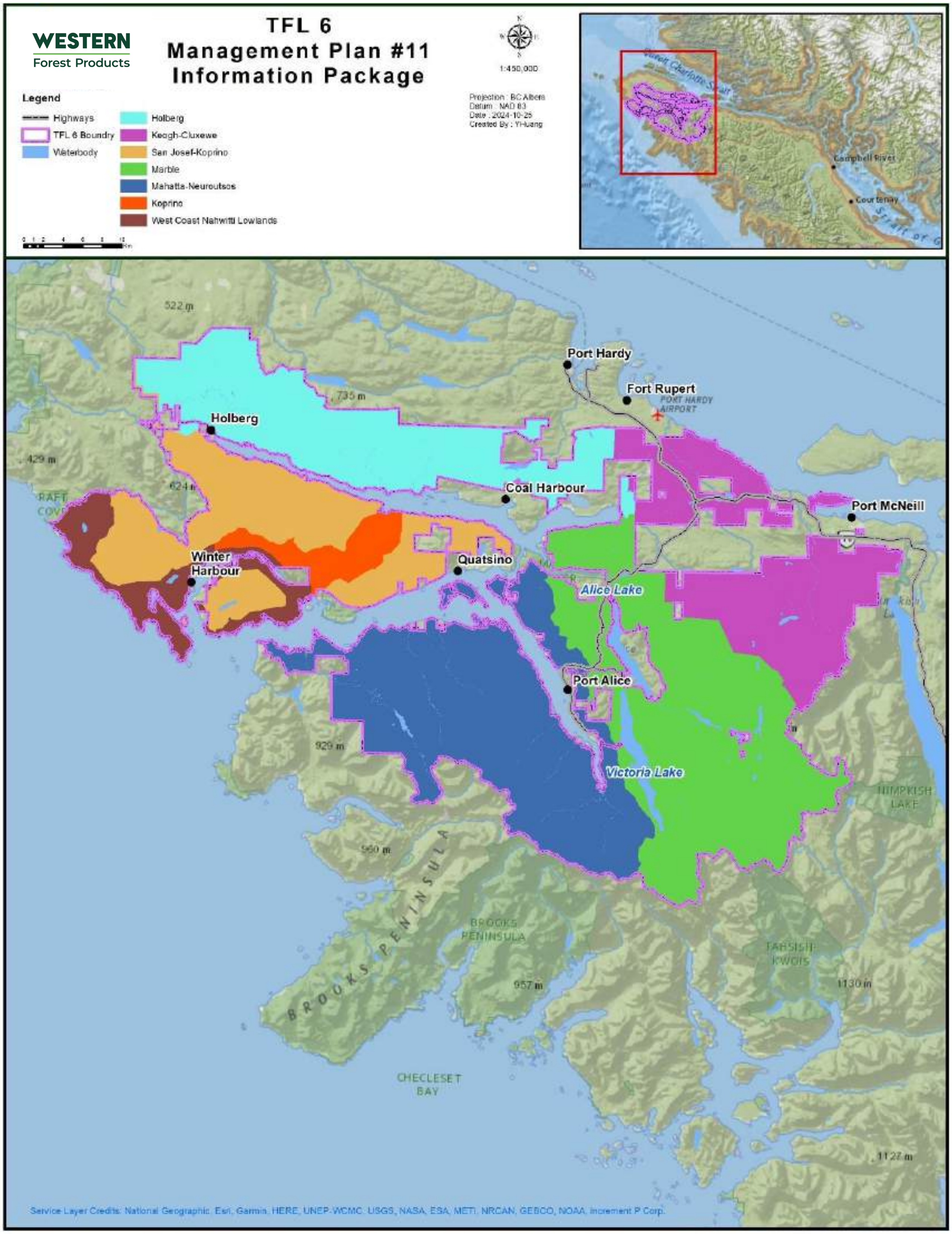

Figure 24 Resource Management Zones in TFL 6

It is important to note that some areas designated as LUs or RMZs only partially overlap with the TFL 6 boundaries. Additionally, while boundaries might differ slightly between the GIS data used for the modelling database and other sources, they ultimately represent the same geographical features. This discrepancy can make it difficult to enforce certain management restrictions associated with RMZs on small and isolated areas ("slivers"). Note that the list of RMZs in this section excludes those with a relatively small portion within the TFL. This is because activities and management efforts on the non-TFL portion of these RMZs will have a more significant impact than any constraints applied solely to the TFL portion.

7.2 Landscape Units

As discussed in Section 1.3, 10 landscape units are found within TFL 6:

- Holberg
- Keogh
- Klaskish
- Lower Nimpkish
- Mahatta
- Marble
- Nahwitti
- Neroutsos
- San Josef
- Tsulquate

To improve the clarity of the dataset, some minor consolidations were made, resulting in a reduction of total number of LUs. Specifically, 16 hectares of productive forest (including 10 hectares of THLB) originally classified within the Nahwitti LU, and 19 hectares of productive forest (including 13 hectares of THLB) originally classified within the Tsulquate LU, were reclassified as belonging to the Holberg LU.

The specific targets for old seral forests and designated old-growth management areas depend on two factors: LU and BEC variant, as per description in Section 10.3.3.

Table 45 details the distribution of forest seral stages within each landscape unit, categorized by BEC variant (Version 12). For a visual reference, Figure 25 illustrates the boundaries of these landscape units.

Table 46 Seral Stage Area by Landscape Unit and BEC Variant for TFL 6

Landscape Unit	BEC	Seral Stage [13]	Productive Forest (ha)	Non Contributing Area		THLB Area	
				ha	%	ha	%
Holberg	CWHvh1	Early	2,429	234	10%	2,195	90%
		Mid	1,565	538	34%	1,027	66%
		Mature	3,497	1,898	54%	1,599	46%
		Old	250	178	71%	72	29%
	CWHvh1 Total		7,742	2,848	37%	4,893	63%
	CWHvm 1	Early	9,475	1,247	13%	8,228	87%
		Mid	7,645	2,143	28%	5,502	72%
		Mature	3,250	2,349	72%	901	28%
		Old	565	355	63%	210	37%
	CWHvm1 Total		20,935	6,094	29%	14,841	71%
	CWHvm 2	Early	645	47	7%	598	93%
		Mid	377	45	12%	332	88%
		Mature	576	372	65%	204	35%
		Old	110	51	46%	59	54%
	CWHvm2 Total		1,708	515	30%	1,194	70%
	MHmm1	Early	15	2	13%	13	87%
		Mid	0	0	59%	0	41%
		Mature	71	68	95%	3	5%
		Old	6	4	61%	2	39%
	MHmm1 Total		92	73	79%	19	21%
Holberg Total			30,478	9,531	31%	20,947	69%
Keogh	CWHvm 1	Early	7,644	989	13%	6,655	87%
		Mid	9,885	2,636	27%	7,249	73%
		Mature	2,776	1,867	67%	910	33%
		Old	1,898	1,416	75%	482	25%
	CWHvm1 Total		22,204	6,908	31%	15,296	69%
	CWHvm 2	Early	1,346	150	11%	1,196	89%
		Mid	1,566	259	17%	1,308	83%
		Mature	42	19	45%	23	55%
		Old	1,236	862	70%	373	30%
	CWHvm2 Total		4,190	1,290	31%	2,900	69%
	MHmm1	Early	183	22	12%	161	88%
		Mid	36	4	10%	32	90%

[13] Early seral is <40 years old; Mid seral is 40-80 years old in CWH zone and 40-120 years old in MH zone; Mature seral is 81-250 years old in CWH zone and 121-250 years old in MH zone; Old seral is >250 years old.

Landscape Unit	BEC	Seral Stage [13]	Productive Forest (ha)	Non Contributing Area		THLB Area	
				ha	%	ha	%
		Mature	5	5	83%	1	17%
		Old	335	235	70%	101	30%
	MHmm1 Total		560	265	47%	295	53%
	MHmmp	Early	8	1	14%	7	86%
		Mid	13	2	18%	11	82%
		Mature	5	5	97%	0	3%
		Old	37	34	93%	3	7%
	MHmmp Total		63	42	67%	21	33%
Keogh Total			27,017	8,505	31%	18,511	69%
Klaskish	CWHvm 1	Early	1	0	35%	0	65%
		Mid	-	-	N/A	-	N/A
		Mature	-	-	N/A	-	N/A
		Old	1	0	84%	0	16%
	CWHvh1 Total		1	1	57%	0	43%
	CWHvm 2	Early	44	6	13%	39	87%
		Mid	-	-	N/A	-	N/A
		Mature	31	15	48%	16	52%
		Old	19	7	38%	12	62%
	CWHvm2 Total		94	28	29%	67	71%
	MHmm1	Early	2	1	51%	1	49%
		Mid	-	-	N/A	-	N/A
		Mature	0	0	84%	0	16%
		Old	7	3	39%	4	61%
	MHmm1 Total		9	4	43%	5	57%
Klaskish Total			105	32	31%	72	69%
Lower Nimpkish	CWHvm 1	Early	305	48	16%	257	84%
		Mid	290	43	15%	248	85%
		Mature	315	146	46%	169	54%
		Old	158	75	48%	83	52%
	CWHvm1 Total		1,068	312	29%	756	71%
	CWHvm 2	Early	50	11	23%	39	77%
		Mid	-	-	N/A	-	N/A
		Mature	2	1	41%	1	59%
		Old	73	56	76%	18	24%
	CWHvm2 Total		125	68	54%	58	46%
	MHmm1	Early	0	0	15%	0	85%

Landscape Unit	BEC	Seral Stage [13]	Productive Forest (ha)	Non Contributing Area		THLB Area	
				ha	%	ha	%
		Mid	-	-	N/A	-	N/A
		Mature	-	-	N/A	-	N/A
		Old	0	0	91%	0	9%
	MHmm1 Total		0	0	50%	0	50%
Lower Nimpkish Total			1,194	380	32%	814	68%
Mahatta	CWHvh1	Early	7	3	47%	4	53%
		Mid	-	-	N/A	-	N/A
		Mature	3	1	37%	2	63%
		Old	1	0	44%	1	56%
	CWHvh1 Total		10	5	44%	6	56%
	CWHvm 1	Early	6,408	896	14%	5,513	86%
		Mid	7,794	2,415	31%	5,379	69%
		Mature	1,822	1,152	63%	670	37%
		Old	2,718	1,940	71%	779	29%
	CWHvm1 Total		18,743	6,403	34%	12,340	66%
	CWHvm 2	Early	1,471	116	8%	1,355	92%
		Mid	394	49	13%	344	87%
		Mature	439	275	63%	164	37%
		Old	1,355	853	63%	502	37%
	CWHvm2 Total		3,658	1,293	35%	2,365	65%
	MHmm1	Early	32	6	20%	26	80%
		Mid	0	0	100 %	-	0%
		Mature	118	84	71%	34	29%
		Old	255	209	82%	46	18%
	MHmm1 Total		405	300	74%	105	26%
	MHmmp	Early	1	-	0%	1	100 %
		Mid	-	-	N/A	-	N/A
		Mature	-	-	N/A	-	N/A
		Old	3	1	40%	2	60%
	MHmmp Total		3	1	34%	2	66%
Mahatta Total			22,820	8,001	35%	14,818	65%
Marble	CMA 0	Early	-	-	N/A	-	N/A
		Mid	-	-	N/A	-	N/A
		Mature	0	0	100 %	-	0%
		Old	1	1	100	-	0%

Landscape Unit	BEC	Seral Stage [13]	Productive Forest (ha)	Non Contributing Area		THLB Area	
				ha	%	ha	%
					%		
	CMA 0 Total		1	1	100 %	-	0%
	CWHvm 1	Early	9,511	1,932	20%	7,578	80%
		Mid	13,270	4,090	31%	9,180	69%
		Mature	1,891	1,339	71%	553	29%
		Old	3,865	3,128	81%	737	19%
	CWHvm1 Total		28,537	10,489	37%	18,049	63%
	CWHvm 2	Early	2,789	370	13%	2,419	87%
		Mid	1,298	246	19%	1,052	81%
		Mature	769	584	76%	186	24%
		Old	3,788	2,472	65%	1,316	35%
	CWHvm2 Total		8,644	3,671	42%	4,973	58%
	MHmm1	Early	269	31	11%	239	89%
		Mid	20	11	54%	9	46%
		Mature	141	130	92%	11	8%
		Old	800	548	69%	251	31%
	MHmm1 Total		1,230	720	59%	510	41%
	MHmmp	Early	13	2	12%	12	88%
		Mid	10	9	84%	2	16%
		Mature	108	95	88%	13	12%
		Old	108	81	75%	27	25%
	MHmmp Total		240	186	78%	54	22%
Marble Total			38,653	15,067	39%	23,585	61%
Neroutsos	CMA 0	Early	-	-	N/A	-	N/A
		Mid	-	-	N/A	-	N/A
		Mature	-	-	N/A	-	N/A
		Old	0	0	100 %	-	0%
	CMA 0 Total		0	0	100 %	-	0%
	CWHvm 1	Early	6,376	1,074	17%	5,303	83%
		Mid	2,411	940	39%	1,471	61%
		Mature	4,227	2,254	53%	1,973	47%
		Old	3,785	2,632	70%	1,154	30%
	CWHvm1 Total		16,800	6,899	41%	9,901	59%

Landscape Unit	BEC	Seral Stage [13]	Productive Forest (ha)	Non Contributing Area		THLB Area	
				ha	%	ha	%
	CWHvm 2	Early	1,438	104	7%	1,334	93%
		Mid	639	144	23%	495	77%
		Mature	1,268	691	54%	577	46%
		Old	1,871	1,163	62%	708	38%
	CWHvm2 Total		5,217	2,102	40%	3,115	60%
	MHmm1	Early	29	6	21%	23	79%
		Mid	14	13	91%	1	9%
		Mature	138	108	78%	30	22%
		Old	224	179	80%	45	20%
	MHmm1 Total		406	307	76%	99	24%
	MHmmp	Early	1	0	26%	1	74%
		Mid	3	3	93%	0	7%
		Mature	81	54	67%	27	33%
		Old	22	13	61%	9	39%
	MHmmp Total		107	71	66%	37	34%
Neroutsos Total			22,530	9,379	42%	13,151	58%
San Josef	CWHvh1	Early	3,028	379	13%	2,648	87%
		Mid	729	280	38%	448	62%
		Mature	2,981	1,921	64%	1,060	36%
		Old	2,374	1,565	66%	809	34%
	CWHvh1 Total		9,111	4,145	45%	4,966	55%
	CWHvm 1	Early	15,809	2,126	13%	13,683	87%
		Mid	6,028	1,893	31%	4,134	69%
		Mature	8,377	5,154	62%	3,223	38%
		Old	3,629	2,553	70%	1,076	30%
	CWHvm1 Total		33,843	11,726	35%	22,117	65%
	CWHvm 2	Early	687	31	5%	655	95%
		Mid	112	17	15%	95	85%
		Mature	583	308	53%	275	47%
		Old	204	123	60%	82	40%
	CWHvm2 Total		1,587	479	30%	1,107	70%
	MHmm1	Early	6	0	7%	6	93%
		Mid	-	-	N/A	-	N/A
		Mature	42	40	96%	2	4%
		Old	41	39	97%	1	3%
	MHmm1 Total		89	80	90%	9	10%

Landscape Unit	BEC	Seral Stage [13]	Productive Forest (ha)	Non Contributing Area		THLB Area	
				ha	%	ha	%
San Josef Total			44,629	16,430	37%	28,199	63%
TOTAL			187,425	67,326	36%	120,099	64%

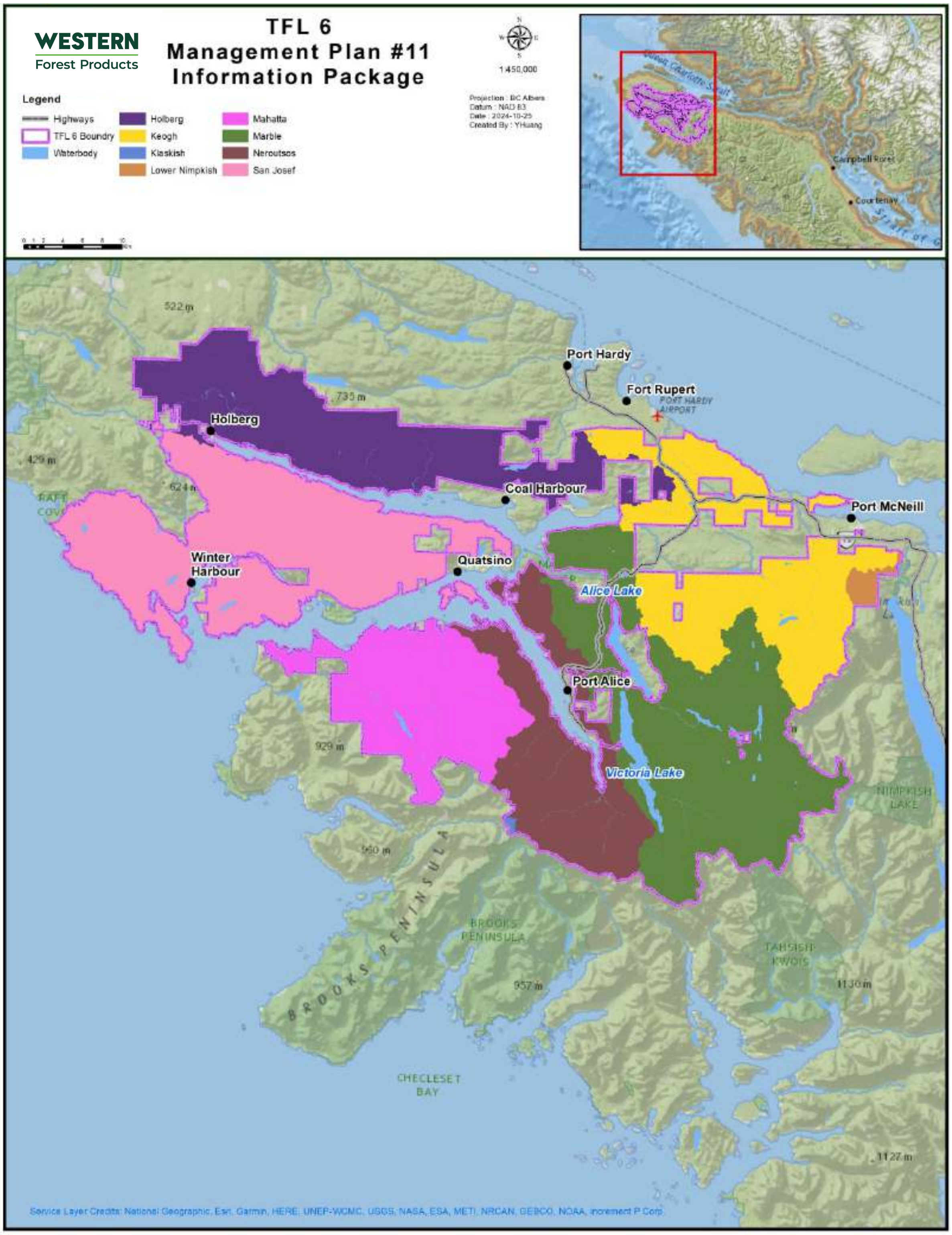

Figure 25 Landscape Units in TFL 6

7.3 Analysis Units

The timber supply modelling dataset uses forest cover stand polygons as its fundamental building block. Stands older than 62 years (established before 1961) are considered natural and will have individual growth and yield information developed for each polygon for projection and growth simulation. For managed stands, the area is grouped into units with similar characteristics called Analysis Units (AUs). These AUs are assigned growth and yield information suitable for modelling landscape-level forest growth and harvests. The specific characteristics used to define AUs are:

1. AU era
2. BEC zone/subzone/variant
3. Site series
4. Leading species
5. Silvicultural treatments

These grouping are described in more detail in the following sections.

7.3.1 AU Era

Stand age is a key factor in assigning stands to AUs. AU eras are based on the management practices prevalent during the stand's establishment period. Stand ages are determined using either known or estimated establishment dates, with all ages reported as of December 31, 2023. The AU era classifies forest cover into two main categories: natural stands and managed stands. Each category uses a different volume estimation approach.

7.3.1.1 Natural Stands (> 62 years old, established before 1961)

These stands are assumed to have resulted from natural regeneration following disturbances or harvesting. Their volume is estimated using the FOR's Variable Density Yield Projection (VDYP) version 7.33b for each individual forest cover polygon.

7.3.1.2 Managed Stands (established since 1961)

Managed stands encompass those established after detailed silviculture records began in 1961. While most originated from planting, some natural regeneration exists, particularly in older stands within this category. FOR's Table Interpolation Program for Stand Yields (TIPSY) v4.6 (sindex33.dll version 1.54) is used to estimate volume in these stands.

7.3.1.2.1 Early Managed (EM) Stands (1961-2000, Age 23-62 years)

Established during the initial phase of active forest management, these stands have minimal genetic gain and predate the implementation of the retention silvicultural system. Post-harvest planting was dominant, although natural regeneration becomes more frequent with increasing age within this category.

7.3.1.2.2 Recent Managed (RM) Stands (2001-2023, Age 1-22 years)

These recently established stands exhibit slightly higher planting density, incorporate genetic improvements, and reflect the influence of the retention silvicultural system with increased stand-level retention (refer to Sections 8.2.8.2 and 10.4.3 for details on yield modelling considerations).

7.3.1.2.3 Future Stands

This category includes stands yet to be established, including areas classified as "not satisfactorily restocked" (NSR). They are expected to have higher genetic gain compared to the 1-22 year old stands and benefit from the continued application of the improved retention silvicultural system, leading to higher levels of stand-level retention following harvest. Eventually, after one rotation, the entire forests in the THLB will transition into future AUs. Table 47 shows all the three AU Eras in TFL 6.

Table 47 Analysis Units AU Era

AU Era
E – early managed (23 to 62 years old)
R – recent managed (1 to 22 years old)
F – future stands

7.3.2 BEC Variant and Site Series Assignment

Terrestrial Ecosystem Mapping (TEM) projects were completed in 2001 for the former TFL39 Block 4 and in 2007 for TFL 6. TEM was used to assign BEC variants and site series for the majority of TFL 6, utilizing BEC version 12, based on LMH No. 28. However, there are small data gaps primarily located along the edges of private land parcels and watershed height-of-land slivers. To fill these gaps, the provincial BEC mapping along with soil moisture and nutrient regime data from the provincial VRI were utilized. This process ensured that each stand within the TFL was assigned to a unique combination of BEC variant and site series at the AU level. A summary of the BEC variant and site series assignments can be found in Table 48, while the spatial distribution of BEC variants across the TFL is depicted in Figure 26. For analysis purposes, BEC variants smaller than 30 hectares are merged with the larger neighboring variant within the edatopic grids.

Table 48 Analysis Units BEC Variant and Site Series

BEC Variant	Site Series[14]
1 - CWHvh1	00
	01
	03
	04
	04s
	06
	08
	10
	13
2 - CWHvm1	00
	01
	01s
	03
	04
	05
	06
	06s
	07
	09
	10
	11
	14
	31
	33
3 - CWHvm2	00
	01
	03
	05
	07
	08
	11
4 - MHmm1/MHmmp/MHmmp1	01
	22

[14] Smaller BEC variants are consolidated to the most similar BEC variants: CWHvh1 15/31/32/33/OW/PO/RI/SC/SM; CWHvm1 02/13/32/LA/PO/RI/RC/ZZ; CWHvm2 02/04/06/09/10/20/32/33/51/AC/PO/RM/RO/SA/SC/ZZ; MHmm1 00/02/03/05/06/07/08/09/21/22/27/32/51/AC/OW/PO/RO/SA/SC/TS/YB/YR/ZZ; MHmmp 21/23/51/RO/SC/ZZ/MHmmp1 AC/KC/LM/MH/RO/SS

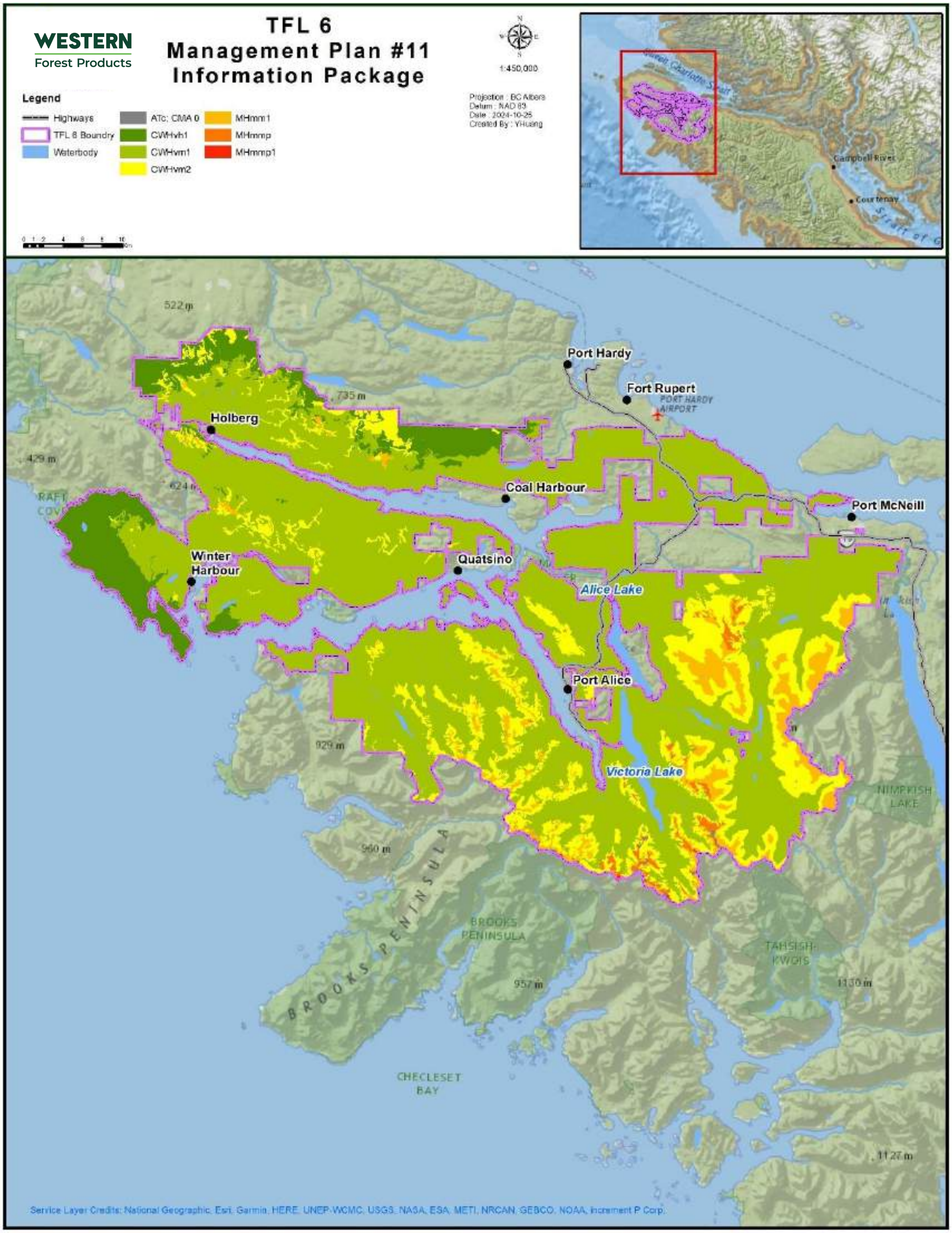

Figure 26 BEC Variants in TFL 6

7.3.3 Leading Species

Existing forest cover data is used to group stands into AUs. Since BEC variant and site series represent microsite conditions, many AUs can be defined solely based on era, BEC variant, and site series.

For larger existing managed AUs (e.g., CWHvm1 01), a further level of differentiation is applied by leading species:

- h: Western hemlock is the leading species.
- c: Western redcedar is the leading species.
- f: Douglas-fir is the leading species.
- b: Amabilis Fir is the leading species.
- s: Sitka Spruce is the leading species.
- y: Yellow cedar is the leading species.
- d: Red Alder is the leading species.

For future stands, reforestation assumptions are based on BEC variant and site series. As a result, only one leading species group is required per BEC variant-site series combination. This leading species will be the most dominant species used in the reforestation strategies.

A summary of the leading species assignments can be found in Table 49.

Table 49 Analysis Units for Leading Species

Leading Species
h – Hw leading
c – Cw leading
f – Fd leading
b – Ba leading
s – Ss leading
y – Yc leading
d – Dr leading

7.3.4 Silvicultural Treatments

For managed stands, fertilization and juvenile spacing treatments are used to differentiate analysis units in order to better reflect the differences in expected growth rates in stands following these treatments.

Approximately 15,000 hectares within TFL 6 have undergone post-establishment nitrogen fertilization since 1986. Some areas have received multiple fertilizer applications. To account for this fertilization in TIPSY yield tables, AUs located within the treated areas will be assigned an "F" marker. The default TIPSY fertilization response, which is currently only available for Douglas-fir in TIPSY version 4.6 for BC Coast, will be applied to reflect the yield impact. Since past fertilization relied on government funding programs, it is assumed that no fertilization will be included in the modelling of future stands.

Over 9,700 hectares within TFL 6 have undergone juvenile spacing treatments. However, some early managed stands received spacing in the 1970s and have since been harvested. Consequently, only Early Managed AUs within the spatial area of these remaining juvenile spacing treatments will be assigned an "S" marker in the TIPSY yield tables. The growth and yield assumptions for these stands will reflect an initial establishment density of 1,600 stems per hectare, followed by a pre-commercial thinning to 900 stems per hectare in TIPSY to account for the juvenile spacing treatments.

Table 50 defines silvicultural treatments used in AU assignments.

Table 50 Analysis Units for Silvicultural Treatments

Silvicultural Treatments
F – Fertilized
S - Spaced

7.3.5 Analysis Unit Codes

A five-part code identifies the AU era, BEC variant, site series, species group and silvicultural treatments for each analysis unit (Table 51).

Table 51 Analysis Units Legend

First Part	Second Part	Third Part	Fourth Part	Fifth Part
AU Era	BEC Variant	Site series	Leading Species	Silvicultural Treatments
E – Early Managed (23 to 62 years old)	1 - CWHvh1	00	h – Hw leading	F – Fertilized
R – Recent Managed (1 to 22 years old)	2- CWHvm1	01	c – Cw leading	S - Spaced
F – Future	3- CWHvm2	02	f – Fd leading	
	4- MH	03	b – Ba leading	
		04	s – Ss leading	
		05	y – Yc leading	
		Etc.	d – Dr leading	

For example, code E201cF identifies the Early managed/CWHvm1/01/Cw leading/fertilized analysis unit.

8 Growth and Yield

This section outlines the approach for developing yield tables for both managed and natural stands within TFL 6. These tables will forecast growth and yield for existing and future stands, categorized as follows:

1. Existing natural stands;
2. Existing managed stands (Early managed and Recently managed); and
3. Future managed stands.

Table 52 provides a detailed breakdown of how growth and yield information will be generated for each category.

Table 52 Growth & Yield Generation for TFL 6

Stand Type	AU Label	Age Criteria	Growth & Yield Source
Existing Natural	Nat + Forest Cover Polygon ID	Age > 62	VDYP 7.33b
Existing Managed	AU Era + BEC + Site Series + Leading Spp. + Silv Treatment	Age <= 62	BatchTIPSY/TIPSY 4.6
Future Managed	F + BEC + Site Series + Leading Spp. + Silv Treatment	N/A	BatchTIPSY/TIPSY 4.6

8.1 Yield for Natural Stands

Stands older than 62 years of age (established prior to 1961) are classified as natural stands, likely regenerated following harvesting or natural disturbances. Volume estimation for these stands is conducted using VDYP version 7.33b. The process incorporates stand attributes from the forest cover inventory, accounting for adjustments based on VRI Phase II ground samples (details in Appendices A and B). Natural stand yield curves for each forest cover polygon within the productive forest land base will be generated.

The initial gross stand volumes (close utilization less decay) are adjusted to account for estimated waste and breakage using factors within VDYP 7 version 7.33b.

To gauge the sensitivity of TFL 6's timber supply to variations in natural stand volume estimates, sensitivity analyses will be performed by increasing and decreasing estimated natural stand volumes by 10%.

8.2 Yield for Managed Stands

8.2.1 Site Index

Site index (SI) is a key metric used to assess the productivity of a forest stand. It is calculated based on the average height of dominant trees at a specific age, typically 50 years. A higher SI indicates a more productive site, influencing several factors in the forests:

- Seedling establishment: Higher SI sites generally favor faster seedling growth and shorter green-up time.
- Timber yield: Higher SI sites have the potential to produce a greater volume of timber per hectare.
- Rotation age: Higher SI sites reach merchantable size faster compared to those on lower SI sites.

For SI in managed stands (≤ 62 years old), the values are derived from data reported in RESULTS (reflected in forest cover inventory attributes), and then aggregated to their respective analysis units using weighted area averaging. For future stands, SI is assigned based on biogeoclimatic site series from FOR's "Site Index Estimates by BEC Site Series (SIBEC)". SIBEC is a long-term research project providing average growth potential estimates for different tree species within specific forested site series across British Columbia. SIBEC assigns site index values to all available tree species within a stand. If a site index value is missing for a particular species, conversion equations within TIPSY software are used. The site series data for TFL 6 is obtained from the TEM project, as described in Section 7.3.2.

Table 53 summarizes the site index distribution within the productive forest area of TFL 6 for all age classes, categorized by BEC variants. The table categorizes stands into three productivity classes: poor, medium, and good. These classes are generally defined as the average SI (23.3 metres for TFL 6) plus or minus one standard deviation. As for the THLB area, the area-weighted average SI is 24.5 metres.

Table 53 Area-Weighted Average Site Index Values for TFL 6

BEC Variant	Productive Area (Ha)	Site Class		
		Poor	Medium	Good
		Weighted Average - 1 Standard Deviation	Weighted Average	Weighted Average + 1 Standard Deviation
CWHvh1	16,863	10.4	16.5	22.6
CWHvm1	142,132	18.0	24.7	31.4
CWHvm2	25,223	14.1	20.9	27.8
MH	3,207	9.5	16.4	23.3

BEC Variant	Productive Area (Ha)	Site Class		
		Poor	Medium	Good
		Weighted Average - 1 Standard Deviation	Weighted Average	Weighted Average + 1 Standard Deviation
Total	*187,425*	*16.1*	*23.3*	*30.5*

8.2.2 Stocking Density

TFL 6 has implemented a significant planting program since 1961. For the past two to three decades, most harvested areas have been replanted, typically at a density of around 1,200 stems per hectare (sph). However, many areas also contain a substantial amount of natural regeneration. TIPSY software cannot directly model planted stands with natural regeneration. Therefore, managed stand yields are simulated based on the planting success alone. However, the species composition of the modelled stands reflects the natural regeneration of western hemlock, a common natural ingress species in BC Coast.

The following density assumptions with regeneration delay of 1 year will be used in TIPSY. These densities are supported by recent practice and a review of free-growing stands.:

- Recently Managed Stands (1-22 years old): Modelled as planted at 1,000 sph.
- Early Managed Stands (23-62 years old): Modelled as planted at 900 sph.
- Future Stands: Modelled as planted at 1,200 sph for most sites, except for CWHvm1 33/33 and MHmmp22. These low-productivity sites have lower free-growing density requirements and will be modelled with a planting density of 800 sph.

8.2.3 Fertilization

Since 1986, nitrogen fertilization (post-establishment) has been applied to roughly 15,000 hectares in TFL 6. This fertilization primarily targeted Douglas-fir leading stands on high-quality sites where the TIPSY model predicted minimal volume growth. These mid- to late-rotation stands typically received urea or a combination of urea and phosphorus at free-growing. The program relied on government funding.

The impacts of this fertilization treatment, along with the potential benefits of fertilizing late-rotation Douglas-fir stands, will be factored into the TIPSY yield tables for treated areas within analysis units. The standard TIPSY fertilization response will be used for this adjustment.

In early 2021, the FOR collaborated with the Stand Management Cooperative to initiate a fertilization project on North Island. This study aims to assess the growth response of western hemlock to urea and triple superphosphate fertilization using a grouped-tree design. One of the designated project areas falls within TFL 6. The fertilization has been successfully applied, and the response is scheduled to be measured and quantified in 2026.

As described in Section 7.3.4, TIPSY version 4.6 currently does not have a default fertilization response for Western Hemlock in coastal regions. Therefore, the results from this project will be integrated into the next MP for the site. This could potentially allow for the extrapolation of the results to all Western Hemlock leading stands where the same type of fertilization has been applied.

8.2.4 Spacing

Since 1965, over 9,700 hectares within TFL 6 have undergone juvenile spacing treatments. However, some early managed stands received spacing in the 1970s and have since been harvested. Consequently, only Early Managed AUs within the spatial area of these remaining juvenile spacing treatments will be assigned an "S" marker in the TIPSY yield tables. The growth and yield assumptions for these stands will reflect an initial establishment density of 1,600 stems per hectare, followed by a pre-commercial thinning to 900 stems per hectare in TIPSY to account for the juvenile spacing treatments.

8.2.5 Volumes for Early Managed Stands (1961-2000, Age 23-62 years)

Silviculture assumptions for managed stands established between 1961 and 2000 (aged 23-62 years) includes a plantation regeneration method for all stands, species composition from the inventory database, establishment density based on inventory and free-growing stand data considering expected relative stocking success. These assumptions, along with SIBEC site index estimates by species, were used as inputs for Batch TIPSY 4.6 (see Table 54). Genetic gain was not applied to stands in this age range. Areas that received fertilization and juvenile spacing are addressed separately.

Table 54 TIPSY Inputs for Early Managed Stands Aged 23-62 Years

Existing AU	SPH	Spp%	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Prod. Area (ha)	THLB Area (ha)
E100	900	hw55 ba17 ss10 dr10 cw8	26.1					8	5
E101	900	cw46 hw33 yc14 ba6 dr1	16.0	16.0	16.0	12.0		109	85
E101F	900	cw67 hw20 yc12 ba1	16.0	16.0	16.0	12.0		132	119
E103	900	hw50 cw26 ss13 ba8 dr3	12.0	12.0	10.0	9.9		41	35
E104	900	hw63 cw17 ss9 ba8 dr3	24.0	20.0	24.0	24.0		1,343	1,067

Existing AU	SPH	Spp%	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Prod. Area (ha)	THLB Area (ha)
		fd2							
E104F	900	hw54 cw35 ba6 ss3 yc2 dr2	24.0	20.0	24.0	24.0	20.0	578	503
E104S	1,600	hw79 ss7 cw7 ba5 dr2	24.0	24.0	20.0	24.0		139	118
E104sc	900	cw69 hw19 fd4 ss4 dr4 yc3	20.0	24.0	27.1	24.0		246	176
E104scF	900	cw79 hw17 yc2 dr1 ss1	20.0	24.0	20.0		24.0	676	597
E104sh	900	hw72 cw14 ss6 dr5 ba3 fd3	24.0	20.0	24.0		24.0	179	142
E104shF	900	hw68 cw21 ss5 dr4 yc2 ba1	24.0	20.0	24.0		20.0	236	201
E106c	900	cw78 hw15 ss5 yc1 ba1	24.0	24.0	32.0	24.0	24.0	113	69
E106h	900	hw63 dr18 cw9 ba5 ss5	24.0		24.0	24.0	32.0	362	158
E106s	900	ss64 hw24 cw8 ba3 dr1	32.0	24.0	24.0	24.0		111	69
E108	900	ss30 hw28 cw20 dr20 ba2	28.0	28.0	24.0		28.0	93	20
E110	900	dr49 hw37 cw7 ss7	21.2					24	1
E113	900	cw35 hw34 ss22 dr5 ba4	16.0	16.0	20.0		13.8	147	80
E113F	900	cw63 hw25 ss9 dr2 ba1	16.0	16.0	20.0		13.8	100	70
E200	900	hw61 ba13	25.4					351	215

Existing AU	SPH	Spp%	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Prod. Area (ha)	THLB Area (ha)
		cw12 dr10 ss4 fd3							
E200F	900	hw46 ss35 cw9 fd9 ba1	28.3					14	10
E201b	900	ba60 hw20 cw10 ss6 fd4 yc2	29.1	27.7	22.6	30.8	35.8	849	735
E201c	900	cw69 hw24 fd4 ba2 yc1 dr1	22.6	27.7	35.8	29.1	22.6	1,263	991
E201cF	900	cw73 hw23 fd2 yc1 ba1	22.6	27.7	35.8	22.6	29.1	708	604
E201d	900	dr86 hw12 ss1 cw1	23.2	27.7	30.8	22.6		491	-
E201f	900	fd66 hw23 cw6 ss3 ba2 pl1	35.8	27.7	22.6	30.8	29.1	733	577
E201fF	900	fd76 hw22 cw1 ss1	35.8	27.7	22.6	30.8		926	727
E201fS	1,600	fd71 hw29	35.8	27.7				182	136
E201h	900	hw79 ba9 cw8 ss2 fd2 dr1	27.7	29.1	22.6	30.8	35.8	26,801	22,068
E201hF	900	hw75 cw15 ba6 fd3 ss1 dr1	27.7	22.6	29.1	35.8	30.8	1,915	1,683
E201hFS	1,600	hw71 cw12 fd8 ss5 ba4	27.7	22.6	35.8	30.8	29.1	119	106
E201hS	1,600	hw82 ba7 ss4 cw4 fd3 dr1	27.7	29.1	30.8	22.6	35.8	3,740	3,233
E201sc	900	cw52 hw23 ss19 dr3 ba3 fd2	22.6	27.7	30.8		29.1	2,561	1,897
E201scF	900	cw78 hw18 ss2	22.6	27.7	30.8		29.1	3,678	3,235

Existing AU	SPH	Spp%	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Prod. Area (ha)	THLB Area (ha)
		dr1 ba1 yc1							
E201scS	1,600	ss46 hw27 cw24 dr2 ba1	30.8	27.7	22.6		29.1	104	86
E201sh	900	hw72 cw16 ba5 ss5 dr2 fd2	27.7	22.6	29.1	30.8		1,418	1,104
E201shF	900	hw68 cw19 ba6 ss5 dr2 yc1	27.7	22.6	29.1	30.8		829	720
E203c	900	cw68 hw23 fd6 ba2 dr1 yc1	16.0	17.4	32.2	15.2		294	216
E203cF	900	cw77 hw19 fd3 dr1	16.0	17.4	32.2			200	167
E203f	900	fd65 hw18 cw9 ss5 pl3	32.2	17.4	16.0	16.8	16.0	84	54
E203fF	900	fd84 hw9 cw7	32.2	17.4	16.0			298	202
E203h	900	hw76 cw12 ba7 fd3 ss2 dr1	17.4	16.0	15.2	32.2	16.8	1,616	1,217
E203hF	900	hw69 fd14 cw10 ba4 ss3	17.4	32.2	16.0	15.2	16.8	113	87
E204	900	hw81 cw8 ba6 dr3 ss2 fd1	26.2	22.5	24.0		24.0	133	100
E205b	900	ba68 fd12 hw10 ss5 cw5 yc1	30.9	36.0	28.6	32.7	24.0	214	140
E205c	900	cw73 hw22 ba2 dr2 fd1 yc1	24.0	28.6	30.9		36.0	282	138
E205cF	900	cw77 hw19 fd2 ba1 yc1 ss1	24.0	28.6	36.0	30.9	24.0	300	213
E205d	900	dr85	24.5	28.6	32.7	24.0		464	-

Existing AU	SPH	Spp%	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Prod. Area (ha)	THLB Area (ha)
		hw12 ss2 cw1							
E205f	900	fd64 hw29 ss4 ba2 cw1 dr1	36.0	28.6	32.7	30.9	24.0	107	69
E205fF	900	fd62 hw28 ss4 cw3 dr3	36.0	28.6	32.7	24.0		170	117
E205h	900	hw76 ba9 cw8 ss4 dr3 fd1	28.6	30.9	24.0	32.7		4,281	2,442
E205hF	900	hw77 cw13 ba4 fd3 ss3 dr2	28.6	24.0	30.9	36.0	32.7	271	174
E205hS	1,600	hw79 ba7 cw7 ss5 dr2 fd1	28.6	30.9	24.0	32.7		348	240
E205s	900	ss70 hw22 cw5 dr2 ba1 fd1	32.7	28.6	24.0		30.9	631	415
E206	900	hw44 cw34 yc11 fd7 ss4 dr2	25.2	23.3	23.3	28.5	24.0	119	96
E206s	900	cw57 hw34 dr4 yc3 ba2 pl2	23.3	25.2		23.3	29.1	106	80
E206sF	900	cw48 hw43 ba5 yc2 pl2 ss2	23.3	25.2	29.1	23.3	23.3	211	182
E207	900	hw60 ss15 cw11 fd8 ba6 dr3	32.6	32.0	24.0	36.7	28.0	1,181	575
E207F	900	fd55 hw36 cw4 ba3 dr2 ss1	36.7	32.6	24.0	28.0		154	91
E209d	900	dr90 hw7 ss2 cw1	25.0	28.0	28.0	24.0		182	-
E209h	900	hw47 ss35 ba9 cw6 dr3	28.0	28.0	28.0	24.0		655	176

Existing AU	SPH	Spp%	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Prod. Area (ha)	THLB Area (ha)
		fd1							
E210	900	hw39 dr26 ss16 cw10 fd9 ba3	30.4		32.0	24.0	34.2	140	12
E211	900	hw66 cw14 fd8 ss7 dr5 ba5	30.4					67	22
E214c	900	cw51 hw21 ss14 dr10 pl4 fd2	19.4	21.0	26.0		19.4	809	409
E214cF	900	cw79 hw12 ss4 yc3 pl2 dr1	19.4	21.0	26.0	19.4	19.4	876	713
E214h	900	hw66 cw16 ss9 ba5 dr4 fd2	21.0	19.4	26.0	18.7		564	330
E214hF	900	hw67 cw16 ba11 ss5 dr1	21.0	19.4	18.7	26.0		374	298
E231	900	cw61 hw30 ba5 pl2 ss2 dr1	21.0					43	30
E233	900	hw44 cw36 dr13 ba4 ss3 fd2	23.6					67	18
E300	900	hw62 ba22 cw9 dr5 ss2 yc1	24.7					67	47
E301	900	hw57 ba25 yc9 cw7 fd2 dr1	28.0	25.7	20.0	20.0	31.6	6,346	5,461
E301F	900	hw51 cw39 ba7 ss2 fd1	28.0	20.0	25.7	30.0	31.6	122	113
E301S	1,600	hw75 ba22 cw3	28.0	25.7	20.0			269	233
E303	900	hw48 cw35	16.0	16.0	13.8	16.0		350	265

Existing AU	SPH	Spp%	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Prod. Area (ha)	THLB Area (ha)
		ba12 yc4 dr1 fd1							
E305	900	hw61 ba18 yc9 cw9 fd3 dr1	28.0	28.0	24.0	24.0	31.6	152	104
E307	900	hw52 yc22 ba20 cw3 ss3 dr2	28.0	24.0	28.0	24.0	28.0	85	51
E308	900	hw65 ba16 dr9 cw8 yc2	28.0	28.0		24.0	24.0	108	31
E311	900	hw64 ba20 cw9 yc7	16.0	13.8	16.0	16.0		152	121
E401	900	hw44 ba30 yc20 cw5 dr1	16.0	12.0	14.1	14.1		148	113
E422	900	hw57 ba21 cw11 yc9 dr2	23.8					38	22

8.2.6 Volumes for Recent Managed Stands (2001-2023, Age 1-22 years)

Silviculture assumptions for recently established stands (aged 1-22 years; 2001-2023) includes planting for all stands, species composition from the inventory database and stand assessments, establishment density reflecting stocking success. Genetic gain for Cw, Fd, Hw and Yc are incorporated for stands in this age range. Values are based on averages for seedlots planted in TFL 6 since 2012. The tree types were determined using forest cover data, and genetic improvements were sourced from Western's Saanich Forestry Centre that produced the seedlings. Similar to older managed stands, areas that received fertilization are grouped separately to assess growth impacts. All details for these recently managed forests are documented in Table 55 and serve as inputs for the TIPSY model.

For the timber supply model, yields for these stands will be adjusted downward to account for the growth reduction caused by trees retained during the previous harvest (see Sections 8.2.8.2 and Section 10.4.3 for details).

Table 55 TIPSY Inputs for Recently Managed Stands Aged 1-22 Years

Existing AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					Prod. Area (ha)	THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5		
R100	1,000	hw45 ba28 cw20 yc6 ss1	23.2							17.0	14.3		13	10
R101	1,000	cw52 yc24 hw22 pl1 ba1	16.0	16.0	16.0	16.0	12.0	17.0	14.3				426	405
R103	1,000	hw49 cw39 ss8 ba4	12.0	12.0	10.0	9.9			17.0				57	54
R104c	1,000	cw74 hw21 ss3 yc2	20.0	24.0	24.0	20.0		17.0			14.3		465	445
R104h	1,000	hw64 cw20 ss10 ba5 yc1	24.0	20.0	24.0	24.0	20.0		17.0			14.3	735	717
R104s	1,000	cw65 hw23 yc9 ba2 ss1	20.0	24.0	20.0	24.0	24.0	17.0		14.3			782	753
R106	1,000	hw42 cw39 ss13 yc3	24.0	24.0	32.0	24.0	24.0		17.0		14.3		179	161

Existing AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					Prod. Area (ha)	THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5		
		ba3												
R113	1,000	cw68 hw19 ss12 yc1	16.0	16.0	20.0	16.0		17.0			14.3		129	121
R200	1,000	hw53 cw33 ba7 yc5 fd2 ss2	27.1						17.0		14.3	10.6	111	106
R201c	1,000	cw72 hw20 ba3 ss3 fd2 yc1	22.6	27.7	29.1	30.8	35.8	17.0	12.8			10.6	2,656	2,472
R201h	1,000	hw75 cw11 ba7 ss4 fd3 dr1	27.7	22.6	29.1	30.8	35.8	12.8	17.0			10.6	15,834	14,530
R201sc	1,000	cw72 hw22 yc4 ba1 ss1 pl1	22.6	27.7	22.6	29.1	30.8	17.0	12.8	14.3			1,519	1,427
R201sh	1,000	hw64 cw22 ba10 ss2 yc2	27.7	22.6	29.1	30.8	22.6	12.8	17.0			14.3	899	830
R203c	1,000	cw71 hw2	16.0	17.4	16.0	15.2	32.2	17.0		14.3		10.6	244	221

Existing AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain % Spp1	Spp2	Spp3	Spp4	Spp5	Prod. Area (ha)	THLB Area (ha)
		5 yc2 ba1 fd1												
R203h	1,000	hw70 cw14 ba10 fd4 ss2 yc2	17.4	16.0	15.2	32.2	16.8		17.0		10.6		378	345
R204	1,000	hw74 cw14 fd7 ba3 ss2 dr2	26.2	22.5	32.0	24.0	24.0		17.0	10.6			112	91
R205	1,000	hw62 cw20 ba7 fd7 ss4 dr1	28.6	24.0	30.9	36.0	32.7		17.0		10.6		3,629	3,022
R206s	1,000	cw58 hw30 ss10 pl1 ba1	23.3	25.2	24.0	23.3	29.1	17.0					42	37
R207	1,000	hw68 cw15 dr7 fd7 ss3 ba2	32.6	24.0		36.7	32.0		17.0	11.2	10.6		312	267
R209	1,000	hw56 ss18 cw16	28.0	28.0	24.0	28.0				17.0			161	132

Existing AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					Prod. Area (ha)	THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5		
		ba6 dr4 fd4												
R214	1,000	cw65 hw29 ss3 pl2 ba1 yc1	19.4	21.0	26.0	19.4	18.7	17.0					675	580
R233	1,000	hw56 cw24 fd10 ss6 ba4 dr1	25.9						17.0	10.6			21	13
R300	1,000	hw59 ba25 cw8 ss5 yc3 fd2	26.8							17.0		14.3	9	8
R301b	1,000	ba51 hw33 yc13 cw3	25.7	28.0	20.0	20.0				14.3	17.0		984	933
R301c	1,000	cw65 hw19 yc9 ba6 fd1 ss1	20.0	28.0	20.0	25.7	31.6	17.0		14.3		10.6	406	390
R301h	1,000	hw62 ba23 cw7 yc7 fd1	28.0	25.7	20.0	20.0	31.6			17.0	14.3	10.6	2,289	2,156
R301	1,0	yc6	20.	28.	25.	20.	31.	14.			17.	10.6	636	595

Existing AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					Prod. Area (ha)	THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5		
y	00	0 hw19 ba13 cw7 fd1	0	0	7	0	6	3			0			
R303	1,000	hw43 cw26 ba20 yc10 fd1	16.0	16.0	13.8	16.0	24.0		17.0		14.3	10.6	236	221
R305	1,000	hw41 ba26 yc22 cw11	28.0	28.0	24.0	24.0				14.3	17.0		104	91
R308	1,000	hw51 ba29 cw10 yc10	28.0	28.0	24.0	24.0				17.0	14.3		53	47
R311	1,000	hw42 cw22 ba18 yc17 fd1	16.0	16.0	13.8	16.0	18.2		17.0		14.3	10.6	64	58
R332	1,000	hw36 cw29 yc27 ba8	16.9						17.0	14.3			20	19
R401	1,000	ba44 hw3	12.0	16.0	14.1	14.1				14.3	17.0		409	371

Existing AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					Prod. Area (ha)	THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5		
		2 yc22 cw2												
R422	1,000	hw41 ba31 yc17 cw11	22.2							14.3	17.0		42	38

8.2.7 Future Stand Volumes

Western staff has developed ecologically-based silviculture strategies for future stands, drawing from current practices and a review of surveys conducted on stands established between 2001 and 2023. The species composition predominantly reflects the natural ingress of hemlock on most sites (refer to Table 57). Species and stocking levels are portrayed at a broad average level to each unique AU combination described above.

Planting densities will vary depending on site productivity. The majority of the AU will be planted at a density of 1,200 sph to reflect the continued practice of planting most harvested areas. This excludes areas designated for permanent road construction, which will be replanted only after rehabilitation and reclamation are complete. Low-productivity sites, such as CWHvm1 33/33 and MHmmp22, will be modelled with a planting density of 800 sph due to lower free-growing density requirements.

While planting conifers is the primary strategy, specific exceptions may exist. Red alder may be established on a small portion of the land base, following the prescriptions outlined in CHWvm07 (including application of genetic gain). In addition, increased reliance on natural regeneration may be considered in some areas. For further details on alder management, please refer to Hardwood Management in the Coast Forest Region (Province of British Columbia, 2009).

8.2.7.1 Regeneration Delay

Regeneration delay pertains to the average duration between harvesting and the establishment of the subsequent rotation. In the TFL, it remains standard practice to promptly plant nearly all harvested areas. Typically, planted seedlings are one year old, and on certain sites, their early growth is aided by fertilization at the time of planting. The actual time between harvest and seed germination for the next generation of forests is generally less than one year. To account for establishment processes beyond germination, a one-year regeneration delay is incorporated into TIPSY modelling.

8.2.7.2 Genetic Gain

Projections for genetic gain are based on seed inventory and development plans from Western's Saanich Forestry Centre seed inventory and development plans. These projections indicate a modest increase in genetic gain from 2016 to 2036.

Since very little Hw is to be planted, the expected gain values for Hw in low-elevation (e.g., CHWvm1) and high-elevation (e.g., CHWvm2) stands are significantly reduced to 1.7% and 1.1%, respectively (representing a 90% decrease). This reflects the anticipated natural regeneration for Hw in harvested areas of these AUs. Consequently, genetic gains for Hw are not applied in other AUs.

For Yc, it is noted that only half of the seeds at the Saanich Forestry Centre are genetically improved. Therefore, the initial projection of 20% gain has been adjusted to a weighted average of 10.0%.

Table 56 provides average genetic gain values by species. These values will be applied to future managed stands.

Table 56 Genetic Gain % for Future AUs

Species	Genetic Gain% for Future AUs
Cw	21.0
Fd low elevation (e.g. CHWvh1 and CWHvm1)	16.0
Fd high elevation (e.g. CHWvm2 and MH)	11.0
Hw low elevation (e.g. CHWvh1 and CWHvm1)	1.7 for CHWvm1 01[15]
Hw high elevation (e.g. CHWvm2 and MH)	1.1 for CWHvm2 01
Yc	10.0[16]
Dr in CHWvm1	32.0[17]

A sensitivity analysis excluding the genetic gains will be conducted to evaluate the impact.

[15] The source genetic gains for Hw are 17% at low elevations and 11% at high elevations. Due to the limited scope of Hw planting, the implemented genetic gains have been reduced by 90% and are currently restricted to the CHWvm1 01 and CHWvm2 01 sites.

[16] The genetic gain of Yc comprises a combination of 50% genetically improved seeds, possessing a genetic worth of 21%, and 50% wild seeds. As a result, the weighted average genetic gain for Yc stands at 10.0%.
[17] Dr planting is exclusive to CWHvm1 07

8.2.7.3 Yields

Future stand yield tables for the Base Case can be found in Table 57. The area-weighted average THLB SI for future AUs is 24.5 metres.

However, within the timber supply model, these yields are adjusted downward to account for the reduced growth caused by trees retained during the previous harvest to meet stand-level retention targets (see Sections 8.2.8.2 and Section 10.4.3 for details).

Table 57 TIPSY Inputs for Future Managed Stands

Future AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5	
Fvh101	1,200	Cw75 Yc15 Hw10	16.0	16.0	16.0	-	-	21.0	10.0	-	-	-	1,604
Fvh103	1,200	Cw40 Yc30 Hw20 Ba5 Plc5	8.0	8.0	9.6	7.5	12.0	21.0	10.0	-	-	-	294
Fvh104	1,200	Cw60 Hw30 Ba5 Ss5	20.0	24.0	24.0	24.0	-	21.0	-	-	-	-	3,871
Fvh104s	1,200	Cw75 Hw15 Yc10	20.0	24.0	20.0	-	-	21.0	-	10.0	-	-	2,751
Fvh106	1,200	Cw50 Yc25 Hw15 Ss5 Ba5	24.0	24.0	24.0	32.0	24.0	21.0	10.0	-	-	-	781
Fvh108	1,200	Ss30 Hw25 Cw20 Dr20 Ba5	28.0	28.0	24.0	26.0	28.0	-	-	21.0	-	-	57

Future AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5	
Fvh113	1,200	Cw70 Yc15 Hw10 Plc5	16.0	16.0	16.0	16.0	-	21.0	10.0	-	-	-	508
Fvm101	1,200	Hw40 Cw30 Fdc20 Ba5 Ss5	27.7	22.6	35.8	29.1	30.8	1.7	21.0	16.0	-	-	62,618
Fvm101s	1,200	Cw85 Hw15	22.6	27.7	-	-	-	21.0	-	-	-	-	11,015
Fvm103	1,200	Cw50 Fdc25 Hw20 Yc5	16.0	32.2	17.4	16.0	-	21.0	16.0	-	10.0	-	3,659
Fvm104	1,200	Hw70 Cw20 Ba5 Ss5	26.2	22.5	24.0	24.0	-	-	21.0	-	-	-	298
Fvm105	1,200	Cw40 Fdc30 Hw20 Ss10	24.0	36.0	28.6	32.7	-	21.0	16.0	-	-	-	10,206
Fvm106	1,200	Cw50 Hw40 Ba5 Ss5	23.3	25.2	29.1	24.0	-	21.0	-	-	-	-	125
Fvm106s	1,200	Cw85 Hw15	23.3	25.2	-	-	-	21.0	-	-	-	-	336
Fvm107	1,200	Hw45 Cw2	32.6	24.0	36.7	32.0	26.0	-	21.0	16.0	-	32.0	1,298

Future AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5	
		5 Fdc15 Ss10 Dr5											
Fvm109	1,200	Hw45 Cw25 Ss20 Dr5 Fdc5	28.0	24.0	28.0	26.0	31.6	-	21.0	-	-	16.0	388
Fvm111	1,200	Hw45 Ss30 Cw20 Dr5	30.4	32.0	24.0	26.0	-	-	-	21.0	-	-	75
Fvm114	1,200	Cw80 Hw10 Yc5 Ss3 Plc2	19.4	21.0	19.4	26.0	19.4	21.0	-	10.0	-	-	3,158
Fvm131	800	Cw80 Hw10 Dr4 Plc3 Ss3	19.4	21.0	26.0	19.4	26.0	21.0	-	-	-	-	75
Fvm133	800	Cw70 Plc20 Hw5 Ss5	19.4	19.4	21.0	26.0	-	21.0	-	-	-	-	49
Fvm201	1,200	Hw30 Yc25 Ba20 Cw20 Fdc5	28.0	20.0	25.7	20.0	31.6	1.1	10.0	-	21.0	11.0	14,134
Fvm203	1,200	Hw30 Cw30 Ba20 Yc20	16.0	16.0	13.8	16.0	-	-	21.0	-	10.0	-	890
Fvm2	1,2	Hw4	28.	24.	28.	24.	-	-	21.	-	10.	-	247

Future AU	SPH	Spp %	Spp1 SI	Spp2 SI	Spp3 SI	Spp4 SI	Spp5 SI	Genetic Gain %					THLB Area (ha)
								Spp1	Spp2	Spp3	Spp4	Spp5	
05	00	0 Cw30 Ba15 Yc15	0	0	0	0			0		0		
Fvm207	1,200	Hw40 Cw30 Ba20 Yc10	28.0	24.0	28.0	24.0	-	-	21.0	-	10.0	-	70
Fvm208	1,200	Hw40 Cw30 Ba20 Yc10	28.0	24.0	28.0	24.0	-	-	21.0	-	10.0	-	192
Fvm211	1,200	Hw40 Cw30 Yc20 Ba10	16.0	16.0	16.0	13.8	-	-	21.0	10.0	-	-	245
FMH01	1,200	Hw40 Ba30 Yc30	16.0	12.0	14.1	-	-	-	-	10.0	-	-	939
FMH22	800	Hw40 Ba30 Yc30	16.0	12.0	14.1	-	-	-	-	10.0	-	-	216

8.2.8 Managed Stands Volume Reduction

8.2.8.1 Operational Adjustment Factors

Yield tables account for adjustments made to the volumes of managed stands. The initial TIPSY model output does not consider these adjustments because it relies on growth patterns observed in research plots. These plots typically represent evenly-aged, fully-stocked stands with uniform site conditions and minimal pest activity.

To address these limitations and reflect real-world conditions, Operational Adjustment Factors (OAFs) are incorporated. OAF 1 accounts for unproductive areas within a stand, such as voids or gaps in canopy cover. OAF 2 addresses potential volume reductions due to forest health issues. The standard provincial values for OAF 1 and OAF 2 are 15% and 5%, respectively. These default values will be used for the yield projections in this analysis.

8.2.8.2 Shading from Retained Trees

Recently established stands (1-22 years old; 2001-2023) and all future stands will have their volume estimates reduced in the TIPSY model to account for the growth impact of trees left for variable retention silvicultural systems.

TIPSY initially estimates volume assuming regeneration in clear-cut areas. However, keeping trees in harvested areas reduces the yield of the regenerating stand due to shading. To address this, a Variable Retention Adjustment Factor (VRAF) is applied. The VRAF has two components: the removal of area from future timber production and the competition influence (shading) of retained areas on the adjacent regenerating portions of the cutblock. As the area impact is addressed as a THLB netdown (Section 6.23), only the effect of shading needs to be considered for these stands.

VRAF relies on three key factors: tree crown cover percentage, length of the edge (perimeter) of retained trees, and top height of retained trees. To determine VRAF adjustments for the TFL, various TIPSY simulations were conducted Fd and Hw across different site productivities and retention levels: 0% (baseline), 15%, 20%, and 25% (relevant to Enhanced Basic/Enhanced Windy/Special Zones; see Section 10.4.3). Top height was based on approximate rotation ages (95% Cumulation Mean Annual Increment Age; see Section 10.4.1) in scenarios without VRAF applied. Retention is typically implemented in groups of varying shapes and sizes. In VRAF calculations concerning perimeter length, TIPSY simulations adopt 0.25-hectare rectangular groups (approximately 22m x 113m) to replicate retention along streams. Additionally, a "square" group of 0.25-hectare retention is simulated for reference purposes.

Table 58 details the range and average yield impacts observed in the TIPSY scenarios in a 1x5 rectangular shape. The average VRAF is applied proportionally to the expected harvest area using the retention system, considering the corresponding retention level to generate the average yield impact. This reduction is applied when individual stands are harvested within the model, without altering the overall yield curves.

Table 58 Yield Component of Variable Retention Adjustment Factor

Description	Western Stewardship and Conservation Plan Zones				
Zone	Enhanced Windy	Enhanced Basic	General Windy	General Basic	Special[18]
Retention Level	15%	15%	20%	20%	25%
Range in VRAF in TIPSY scenarios	2% - 6%	2% - 6%	3% - 7%	3% - 7%	4% - 8%
Average VRAF	3.4%	3.4%	4.8%	4.8%	6.0%
Percent of harvest area	30%	50%	40%	60%	90%

[18] As noted in Section 1.2, the two SMZs established under the January 2026 Gwa'ni Land Use Objectives Order were not included, as the legal order had not yet been issued at the time the analysis.

Description	Western Stewardship and Conservation Plan Zones				
Average yield impact to be applied	1.0%	1.7%	1.9%	2.9%	5.4%

8.2.9 Not Satisfactorily Restocked Areas

The dataset utilized for analysis consists of 1,167 hectares of productive forests categorized as not satisfactorily restocked (NSR; see Table 59). The "NSR" area encompasses a larger area compared to operational records, including areas where planting occurred in 2023, but planting data was not accessible during compilation of the modelling dataset. Additionally, it includes areas harvested in 2023, designated for planting in 2024. These NSR zones are designated for regeneration within the model and allocated to suitable future AUs during the initial planning period.

Table 59 NSR Area in TFL 6

Description	Productive Area (ha)	THLB Area (ha)
NSR Areas	1,167	1,096

To assess how variations in managed stand volume estimates might affect the timber supply of TFL 6, sensitivity analyses will be conducted by increasing and decreasing the estimated managed stand volumes by 10% to simulate potential fluctuations.

8.3 Utilization Levels

TFL 6 adheres to the timber merchantability specifications outlined in the Provincial Logging Residue and Waste Measurements Procedure Manual (Province of British Columbia, 2019). Table 60 summarizes these utilization standards.

For stands younger than 121 years and future managed stands, the minimum usable diameter is 12.5 cm. The stump height for these stands is 30 cm, and the minimum top diameter inside bark (DIB) is 10 cm. Mature stands have a higher minimum usable diameter of 17.5 cm, with the same stump height and top DIB requirements.

Table 60 Utilization Levels

Age Class	Utilization			Firmwood Standard
	Minimum DBH (cm)	Stump Height (cm)	Top DIB (cm)	
Mature (>120 years old)	17.5	30.0	10.0	50%
Immature (<=120 years old)	12.5	30.0	10.0	50%

8.4 Inventory Volume and Initial Growing Stock Check

Table 61 presents a comparison of inventory (polygon-specific) volumes against the initial growing stock estimates used in the timber supply model. The growing stock utilizes a combination of aggregated AU-level and polygon-specific volume projections. For the THLB, the total volumes derived from forest inventory and the initial growing stock model shows a difference of less than 1%. For the NCLB, the initial growing stock estimates are approximately 1.9% lower than the inventory volume. This variance is due to the forest attribute averaging process used in the AU-level projections. Overall, the volume discrepancies are within a reasonable range, particularly for the THLB, where the focus of the modelling exercise lies.

Table 61 Volume Check

Land Base	Inventory Volume (m^3)[19]	Initial Growing Stock (m^3)	Difference (m^3)	Difference (%)
THLB	35,865,607	35,535,357	- 330,250	-0.9%
NCLB	37,684,135	36,950,633	- 733,502	-1.9%
Total	73,549,742	72,485,990	- 1,063,752	-1.4%

[19] The inventory volume and initial growing stock volume values presented in this table are derived from Version 3 of the IP in January 2025. It has been assessed that the corrections implemented in Version 4 have a negligible impact and, therefore, do not necessitate a refresh of the initial growing stock in the timber supply model.

9 Non-Recoverable Losses

Natural disturbances, such as wind, insect outbreaks, diseases, fires, and other events, can cause widespread tree mortality in the TFL, leading to the loss of entire stands. The impacts of these natural causes of loss can be estimated and incorporated into forest management models. In British Columbia, some of the dead or dying timber from these disturbances may still be salvageable if it falls within merchantable stands (Province of British Columbia, 2006). These natural disturbance events are considered in the forecast of the modelling exercise.

9.1 Windthrow

Historically, windthrow in TFL 6 has primarily affected individual trees or small clusters. These losses are typically accounted for in two ways: through OAFs (see Section 8.2.8.1) applied to managed stands, and through existing timber yield estimates that consider windthrow during inventory sampling. While many windthrow areas can be salvaged, meaning the timber can be harvested and the area replanted using silvicultural techniques, some areas are unrecoverable.

MP #9 and MP #10 estimate a non-recoverable loss of around 7,000 m3/year due to windthrow. A recent internal review used 15cm high-resolution imagery acquired in 2022 to quantify the windthrow impact on TFL 6. The review focused on 2015 harvest blocks (1,957 hectares) that had been exposed to wind for six years by the time the imagery was acquired. Results showed that 7% (138 hectares) of the reviewed area exhibited signs of windthrow. However, not all windthrow events result in fallen or broken trees; the actual impact was estimated to be less than a third of the observed area. Additionally, with favorable economic conditions, roughly half of the timber within windthrow areas is considered salvageable. Consequently, the estimated non-recoverable loss due to windthrow is around one percent of the 2015 AAC, or 13,600 m^3/year.

Over the past decade, many research studies have focused on understanding factors that increase windthrow along cutblock edges after harvesting. These research studies have also evaluated the effectiveness of various edge treatments (e.g., pruning, topping, and feathering) in mitigating windthrow. Findings from these studies have significantly influenced cutblock design and silvicultural treatment prescriptions, leading to a noticeable reduction in windthrow from regular winds. Furthermore, delineating "windy zones" and reducing retention levels in these areas (as described in Section 10.4.3) should further mitigate windthrow risk in TFL 6.

9.2 Insects and Diseases

The forests of TFL 6 have been fortunate to experience minimal insect and disease outbreaks, resulting in negligible timber losses. No major infestations have caused significant unsalvageable mortality or volume reduction.

The primary insect in the TFL has been the spruce weevil (*Pissodes strobi*), which has heavily impacted second growth Sitka spruce. As a result, spruce is now a minor component in reforestation programs. Western has established a weevil-resistant seed orchard producing seedlings with an average 86% resistance. This translates to an estimated 7% of seedlings being susceptible to weevil attack in a given year. These highly resistant seedlings are prioritized for planting wherever spruce is a suitable species, and the risk of weevil infestation is high. From 2012 to 2023, spruce seedlings accounted for roughly 5.9% of all planted seedlings.

The most recent major insect outbreak in the TFL, including the surrounding North Island TSA area, occurred between 2010 and 2013. This outbreak involved the western black-headed budworm (*Acleris gloverana*) and affected roughly 28,000 hectares of forest across the entire District. It was a larger-scale recurrence of an outbreak that occurred in the late 1980s, which impacted approximately 7,000 hectares. The western black-headed budworm primarily targets western hemlock, Sitka spruce, and true firs for defoliation. To monitor this outbreak, Western and FOR staff implemented a multi-year comprehensive forest health monitoring program. This program utilized aerial surveys, field surveys, and a technique called "branch beating" to collect insect samples. The budworm population began to decline in 2013, and no further occurrences were observed since 2015. While the 2013 aerial survey identified that about 12% of the affected area in NICCNRD experienced severe defoliation, fortunately, most of the damage appeared temporary with new foliage emerging.

Hemlock dwarf mistletoe is prevalent throughout merchantable stands. While occasional sanitation treatments are needed to prevent its spread in newly regenerated western hemlock stands, established stands typically experience minimal impact.

Root diseases can cause isolated pockets of tree mortality. These losses are likely accounted for by the OAFs applied to yield curves. Notably, the impacts of Armillaria ostoyae and Phellinus weirii are less severe compared to other regions, and no additional OAF adjustments are necessary.

9.3 Fire

The TFL benefits from a relatively low risk of fire due to its predominantly wet climate with cool, wet summers. Effective fire suppression efforts further minimize the threat. However, a lightning-caused fire event in 2018 impacted approximately 940 hectares (750 hectares of productive forest, 600 hectares of THLB). An active reforestation program successfully replanted a significant portion of the burned area. To assess the impact on timber supply, forest inventories from 2017 (pre-fire) were compared with forest inventory in the timber supply model. Accounting for reforestation efforts, fire intensity (many trees still survived within the fire perimeter), and five years of subsequent growth, an estimated 59,000 m³ of THLB volume was lost. As no major fires have occurred since the last AAC determination, and the next TSR will incorporate post-fire forest conditions, the estimated annual timber loss due to fire activity is set at 5,900 m³/year.

9.4 Natural Disturbance in Non-Contributing Land Base

While the previous sections discussed specific natural disturbances, existing methods can estimate the time it takes for forests within different BEC variants to fully regenerate after a major disturbance. This information is crucial because the model schedules activities within the THLB, but natural disturbances can also occur outside these areas. Therefore, it is appropriate to simulate a reasonable rate of natural disturbance in NCLB forests.

For TFL 6 MP #11 modelling, the most recent data sourced from the Old Growth Technical Advisory Panel report on disturbances was used (Old Growth Technical Advisory Panel, 2021). This data incorporated updated age definitions and disturbance intervals provided by provincial experts. Table 61 outlines the annual area affected by disturbances for each BEC variant within the TFL. Based on the combined area of the THLB and NCLB in MP #11, an annual disturbance of approximately 30.7 hectares is projected for the NCLB.

Table 62 Natural Disturbance Rate in NCLB for TFL 6

Variant	Area (ha)			Age of Old	Stand-initiating Return Interval	% of Area Expected Old	Annual Disturbance (Ha)
	Productive Forest	THLB	NCLB				
CWHvh1	16,863	9,812	7,051	250	10,000	98%	0.7
CWHv	142,132	92,97	49,1	250	2,000	88%	24.6

Variant	Area (ha)			Age of Old	Stand-initiating Return Interval	% of Area Expected Old	Annual Disturbance (Ha)
	Productive Forest	THLB	NCLB				
m1		8	54				
CWHvm2	25,223	15,776	9,447	250	2,000	88%	4.7
MHmm1[20]	3,207	1,155	2,051	250	3,000	92%	0.7
Total	187,425	119,722	67,703				30.7

9.5 Total Non-Recoverable Losses

Natural disturbances, such as fire and insect outbreaks, can exert downward pressure on TFL 6's long-term sustainable timber supply. As outlined in this section, the total quantifiable, non-recoverable losses attributable to these disturbances amount to an estimated 19,500 m³/year. To account for these losses, a 1.5% annual deduction will be applied to the allowable harvest volume. This deduction removes the lost volume from the THLB and effectively transitions the affected stand area to age zero for modelling purposes. Timber volume deemed unrecoverable due to natural disturbances will not be included in reported harvest totals. Furthermore, to ensure accurate forecasting, natural disturbance events within the NCLB will be integrated into the model, reflecting their impact on long-term landscape-level biodiversity.

[20] Includes MHmmp, MHmmp1 and CMA 0 that do not have a prescribed disturbance rate.

10 Integrated Resource Management

This section provides an overview of resource inventories used for the timber supply review of TFL 6. It also describes other resource management information that informs planning within the TFL.

10.1 Forest Resource Inventories

Table 63 summarizes the key forest resource inventories maintained specifically for TFL 6. Additional inventories managed by the provincial government can be accessed periodically through the BC Data Catalogue.

Table 63 Forest Resource Inventory Status

Item	Status
Forest Inventory	TFL 6 VRI was completed between 2000 and 2001 (photo interpretation and field sampling) with final phase (statistical adjustment) completed in 2009 for VDYP 6, and 2016 for VDYP 7. Former TFL 39 Block 4 was initially conducted in 1970s. Augmented since with operational and second growth cruising. Inventory was audited during the late 1990s. Both inventories were updated for growth, harvesting and silviculture to December 31, 2023.
Ecosystems	TEM projects were completed in 2001 for the former TFL39 Block 4 and in 2007 for TFL 6. TEM data was distributed by the Ministry of Environment in 2016 as part of the Terrestrial Ecosystem Information (TEI) Spatial Data Non-Predictive Ecosystem Mapping (PEM) distribution package for the BC coast.
Terrain Stability	Various inventories to different standards. Completed by T. Lewis in 1992 (Block 2) and 1995 (Block 1). Block 2 inventory was updated to Ministry standards in 1998. LiDAR-based slope mapping based on 2022/2023 LiDAR acquisition for TFL 6
Recreation Inventory	Updated in January 2004 by RRL Recreation Resources Ltd. to 1998 Ministry standards.
Visual Landscape Inventory (VLI)	VLI updated between 2003 and 2005 to 1997 Ministry standards by RRL Recreation Resources Ltd. Accepted by NICCNRD in June 2010 and is being used as basis for GAR Order to establish Visual Quality Objectives for TFL 6 and Block 7 of the Pacific TSA.
UWRs	UWRs for Columbian black-tailed deer and Roosevelt elk in TFL 6 (U-1-006 and U-1-013)

Item	Status
WHAs	Legal WHAs established for Marbled Murrelets and Northern Goshawk; and proposed WHAs for Northern Goshawk and Marbled Murrelet.
OGMAs	OGMAs have been established in the San Josef and Marble LUs. Refinement of proposed OGMAs is proceeding for Holberg, Keogh, Mahatta, and Neroutsos LUs.
Stream Classification	LiDAR-derived stream inventories classified to riparian standards.
Archaeological and Cultural Resources	Registered archaeological features and sites from the Archaeology Branch (updated in 2023) were included. And Quatsino TUS layer for high frequency of culturally significant sites
Operability	LiDAR-based LBB process as described in Section 6.8.
Big Tree Reserves	BC Big Tree Registry big trees and LiDAR-derived tree top points greater than 80 metres.

10.2 Other Resource Inventories

Table 64 lists the spatial datasets used to create the resultant GIS data for the timber supply analysis. It includes their respective data sources and vintage date (date of downloading). Data sources include the Western corporate GIS database, the BC Data Catalogue (https://catalogue.data.gov.bc.ca/), or external datasets from First Nations.

Table 64 Spatial Data Sources for TFL 6 MP#11

Data Name	Source	Vintage Date
TFL 6 Boundary and Schedules	Western	November, 2023
Big Trees	BC BigTree Registry	March, 2024
Community Watershed	BC Data Catalogue	October, 2023
DTSM Terrain Mapping	Western	February, 2024
Existing Roads	Western	November, 2023
Existing WTRAs	Western and BC Data Catalogue (RESULTS)	November, 2023
Fertilization Treatment Area	Western and BC Data Catalogue (RESULTS)	March, 2024
First Nations Traditional Territory	Western	November, 2023
Forest Cover	Western	December, 2023
Harvested Blocks	Western	November, 2023
Juvenile Spacing Treatment Area	Western and BC Data Catalogue (RESULTS)	March, 2024
Landscape Unit	BC Data Catalogue	October, 2023
LBB Harvest System	Western	February, 2024
LBB Heli Flight Distance	Western	February, 2024
LBB Low Productivity	Western	February, 2024
LBB Non-Productive	Western	February, 2024
LBB Projected Roads	Western	February, 2024

Data Name	Source	Vintage Date
LiDAR Elevation	Western	February, 2024
LiDAR Slope 90+%	Western	March, 2024
LiDAR-derived Riparian Management Zones	Western	November, 2023
LiDAR-derived Riparian Reserve Zones	Western	November, 2023
Marbled Murrelet LU Aggregate	BC Marbled Murrelet Order Attachment	November, 2023
Marbled Murrelet Suitable Habitats	BC Marbled Murrelet Order Attachment	November, 2023
OGMA (Legal)	Western	November, 2023
OGMA (Proposed)	Western	November, 2023
Old Growth Technical Advisory Panel (TAP) Priority Deferral Areas	BC Data Catalogue	November, 2023
Permanent Sampling Plots	Forest Analysis & Inventory Branch, FOR	March, 2024
Powerlines	BC Transmission Corporation and BC Hydro	November, 2023
Quatsino TUS Zone	Quatsino First Nations	February, 2024
Reconnaissance Karst Potential Mapping	BC Data Catalogue	January, 2024
Recreation Inventory	Western	November, 2023
Registered Archaeological Sites	Archaeology Branch, FOR	November, 2023
Research Sites	BC Data Catalogue and Forest Science Planning & Practices Branch, FOR	March, 2024
TEM BEC variant and Site Series	Western	October, 2023
UWR	Western	November, 2023
VILUP Resource Management Zones	BC Data Catalogue	October, 2023
Visual Landscape Inventory	BC Data Catalogue	March, 2024
Waterbodies	Western	November, 2023
Watershed	Western	February, 2024
Watershed High Sensitivity Zones	Western	March, 2024
Western Big Trees	Western	March, 2024
WHA (Legal)	BC Data Catalogue	November, 2023
WHA (Proposed)	Western	April, 2024
WSCP Variable Retention Zones	Western	March, 2024

10.3 Forest Cover Requirements

10.3.1 Visual Quality

On September 24, 2010, the District Manager signed the GAR Order to establish Visual Quality Objectives (VQO) for Tree Farm Licence 6 and Block 7 of the Pacific TSA within the North Island Central Coast Forest District. The established VQO classes, Visual Absorption Capability (VAC), and VQO polygons are used in this analysis.

There are currently 139 VQO polygons, totaling 21,884 hectares of productive forests and 12,877 hectares of THLB within TFL 6. A visual representation of these VQO polygons is depicted in Figure 27.

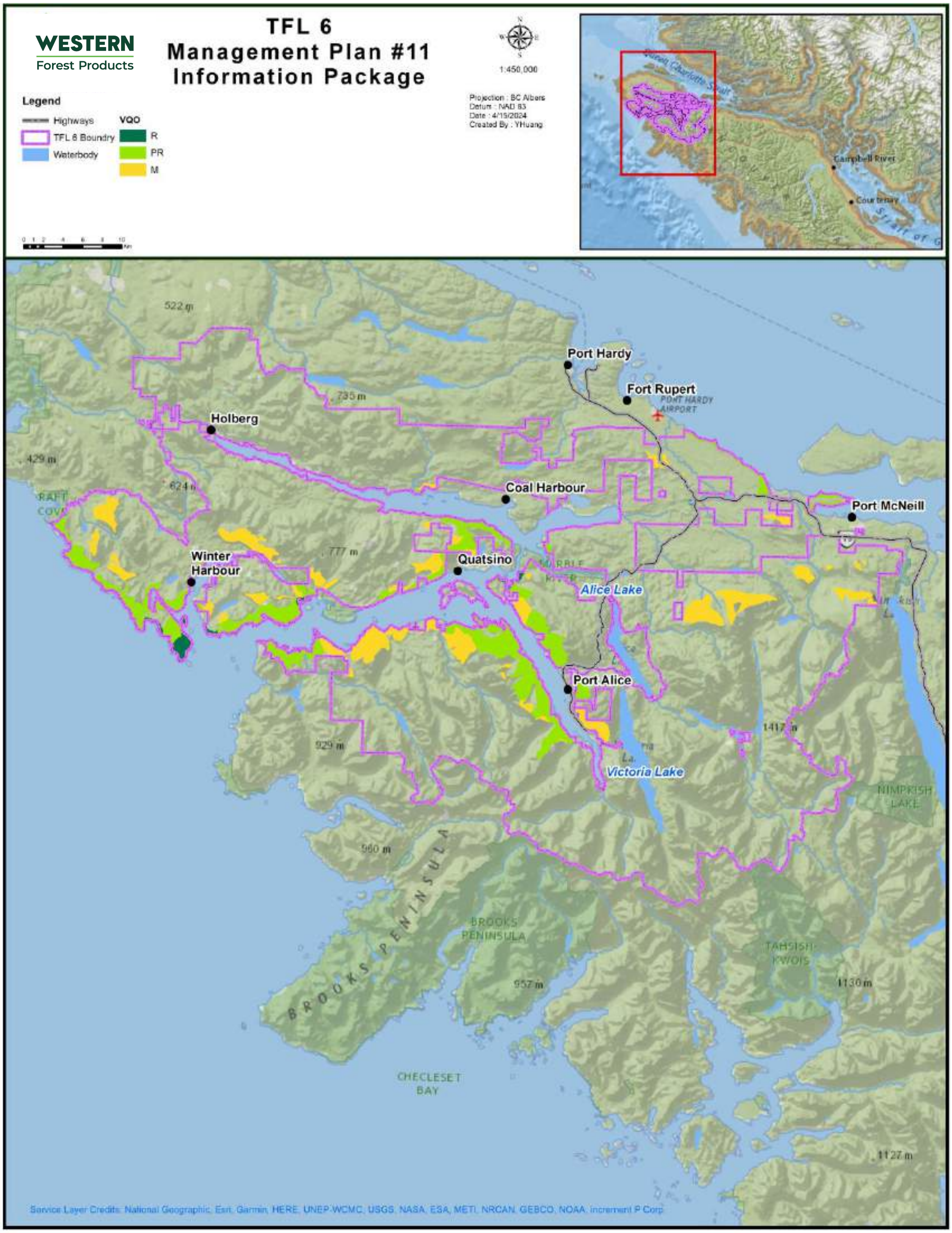

Figure 27 VQO Polygons within TFL 6

The Procedures for Factoring Visual Resources into Timber Supply Analyses (Province of British Columbia, 1998) and an updated bulletin (Province of British Columbia, 2003) guide the modelling of visual management in this analysis. The following VQO classes, defined by FPPR, present in TFL 6 are considered:

- Retention (R): *an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is difficult to see, small in scale, and natural in appearance;*
- Partial Retention (PR): *an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is easy to see, small to medium in scale, and natural and not rectilinear or geometric in shape;*
- Modification (M): *an altered forest landscape in which the alteration, when assessed from a significant public viewpoint, is very easy to see, and is large in scale and natural in its appearance, or small to medium in scale but with some angular characteristics.*

The procedures document specifies visually effective green-up (VEG) heights, ranging from 3 metres to 8.5 metres depending on slope class. A plan-to-perspective ratios (P2P) is also defined based on slope class (as shown in Table 65). Given the availability of LiDAR-based slope data for TFL 6, the VEG height, VAC value, permissible percentage alterations (Table 66) and area-weighted LiDAR-based slope will be used to manage visual quality for each VQO polygon. The permissible percentage alteration for each slope class is calculated by multiplying the P2P ratio by the maximum percentage alteration in the perspective view. For instance, the lowest maximum percentage alteration (excluding instances where it is already 0) for TFL 6 occurs for slope class ≥70%, VQO class R, and medium VAC, resulting in 1.04 x 0.75 = 0.78%. The highest percentage alteration is observed for slope class <5%, VQO class M, and high VAC, calculated as 4.68 multiplied by 18, resulting in 84.24%. TIPSY height curves by analysis unit will be used to track the total area within each VQO polygon that falls below the associated VEG height.

Table 65 VEG Heights and P2P Ratios by Slope (Province of British Columbia, 2003)

Slope (%)	0-5	5.1-10	10.1-15	15.1-20	20.1-25	25.1-30	30.1-35	35.1-40	40.1-45	45.1-50	50.1-55	55.1-60	60.1-65	65.1-70	>70
VEG (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
P2P ratio	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

Table 66 Visual Quality Management Assumptions

Visual Quality Objective (VQO)	VAC	Permissible % Alteration in Perspective View (Province of British Columbia, 2003)	VLI #	Productive Forest (ha)	THLB Area (ha)
Retention (R)	Low	0.0	2	432	32
	Medium	0.75	9	337	98
	High	1.5	1	54	36
Partial Retention (PR)	Low	1.6	11	939	387
	Medium	4.3	47	9,360	4,959
	High	7	11	1,634	868
Modification (M)	Low	7.1	1	23	18
	Medium	12.55	47	7,900	5,528
	High	18.0	10	1,051	798
Total			139	21,731	12,725

10.3.2 Adjacent Cutblock Green-Up

Legislation requires trees within regenerated cutblocks to reach specified heights before the adjacent timber can be harvested. Forest harvesting practices within the TFL adhere to both provincial forestry regulations and higher-level plans such as VILUP.

FRPA mandates specific tree heights in reforested areas before harvesting can resume in adjacent cutblocks.

FPPR sets a maximum cutblock size of 40 hectares along the BC coast. However, larger openings are permitted if they resemble natural disturbances. Additionally, the FPPR stipulates a "green-up" requirement, where at least 75% of reforested areas in adjacent cutblocks must reach a height of three metres before harvesting can occur in a new area.

VILUP establishes three management zones: General, Enhanced Forestry, and Special (refer to Section 7.1). Enhanced Forestry Zones allow for more flexibility in forestry operations. Therefore, a stricter green-up height of three metres will apply to areas without specific VQOs within General and Special Management Zones. In Enhanced Forestry Zones (outside VQO polygons), a reduced green-up requirement of 1.3 metres will be used in the modelling exercise.

The Patchworks model enforces limitations on cutblock size and adjacency. It regulates green-up height based on patch attributes, with support from stand age for green-up requirements defined above. For managing cutblocks separated by linear features like roads or riparian reserves, the MP #11 adopts a similar approach used in the Sunshine Coast TSA to handle cutblock size and adjacency (Province of British Columbia, 2021). Grouped openings harvested within a 10-year period (green-up height can be reached by Year 10) and within 20 metres of each other will be considered a single unit, with a maximum size of 40 hectares (refer to "X" in Figure 28 for the maximum distance between grouped blocks).

The model allows for flexibility in the spatial design of these grouped cutblocks over time to accommodate various management objectives, such as meeting VQOs. To better reflect operational practices, the model avoids creating cutblocks smaller than one hectare, as these can be impractical to manage. However, it allows for some openings between one and five hectares. Occasionally, the model may permit cutblocks exceeding 40 hectares. This is to avoid situations where leaving a small residual area would make future harvesting economically unviable. To comply with adjacency regulations, the model maintains a minimum distance of 100 metres between adjacent grouped cutblocks (refer to "Y" in Figure 28). The assignment of size limits within the timber supply model will be informed by analyzing historical cutblock data from the past five years.

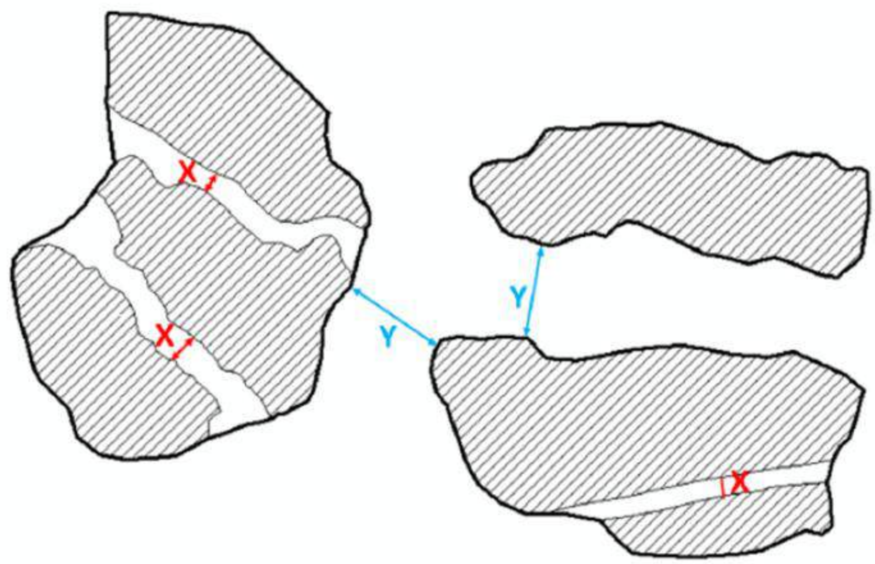

Figure 28 Example of Cutblock Adjacency and Harvest Openings (Province of British Columbia, 2021)

10.3.3 Landscape Level Biodiversity

LUs and BEOs within the TFL originated from the NSOG order, effective June 30, 2004. This order remains in place until Landscape Unit planning determines the designation of OGMAs. The specific BEO class and proposed OGMA status for each LU are detailed in Section 6.11 and Table 22. For TFL 6, old forests are defined as stands older than 250 years. OGMAs have been established within the San Josef (Intermediate BEO) LU and the Marble (Intermediate BEO) LU. These two LUs with intermediate BEO will be subject to the full approved OGMA areas throughout the analysis period in the model.

Proposed OGMAs in the Holberg (Low BEO), Keogh (Low BEO), and Neroutsos (Low BEO) LUs have been identified. For the Mahatta (Low BEO) LU, proposed OGMAs have been identified for the Western tenure portion of the LU only. These proposed OGMAs meet the old seral target within TFL 6 drawn down to 1/3 for the first rotation (80 years). The target for the end of the second rotation (160 years) will be 2/3 of the full target, with the full old seral target being achieved by the end of the third rotation (240 years). It is important to note that these proposed OGMAs will be incorporated into the MP #11 model, but they still require public and First Nations' review before becoming legally binding. Additionally, for the CWHvm1 portion of Keogh LU within General Management Zone 7, 2/3 of the full old seral target will be met during the first two rotations, with the full target achieved by the end of the third rotation. This requirement is mandated by VILUP Objective 10.

The TFL 6 boundary overlaps with a small portion of several LUs: Klaskish (High BEO), Lower Nimpkish (Low BEO), Nahwitti (Intermediate BEO), and Tsulquate (Intermediate BEO). Notably, Lower Nimpkish, Nahwitti, and Tsulquate already have legally established OGMAs.

Due to Klaskish LU's High BEO classification, the full old seral targets will be applied. As for Lower Nimpkish LU, since these legally established OGMAs are designed to meet the full targets without contribution from TFL 6, there will be no old seral requirements in this modelling exercise. Regarding Nahwitti (Intermediate BEO) and Tsulquate LUs (Intermediate BEO), applying old seral targets would not be effective given the minimal area of these LUs within TFL 6 (less than 20 hectares). Forestry activities on the portions of these LUs outside the TFL boundary would likely outweigh any targets implemented within the TFL.

In situations where a BEC variant within the TFL might not meet the full or drawn-down old seral forest target, the Patchworks model will delay harvesting activities within portions of those LUs. This ensures that the existing representation of old-seral forest is not depleted, allowing the forests to naturally mature into old seral stages over time. In addition, The NSOG Order does not specify targets for CMA 0, MHmmp, and MHmmp1 BEC variants. These variants contain insignificant productive forest and THLB areas.

Table 67 outlines the specific landscape biodiversity targets applied to old seral forests within the TFL 6 MP #11 timber supply model. For reference, Table 45 provides a breakdown of the current forest age class distribution across landscape units and BEC variants.

Table 67 Old Seral Targets in TFL 6

Landscape Unit	BEO	NDT	BEC	Area (ha)		Old Seral Targets (% of productive)		
				Productive	THLB	1st rotation	After 2nd rotation	After 3rd rotation
Holberg	Low	1	CWHvh1	7,708	4,871	OGMAs	8.7	13
			CWHvm1	20,935	14,841	OGMAs	8.7	13

Landscape Unit	BEO	NDT	BEC	Area (ha)		Old Seral Targets (% of productive)		
				Productive	THLB	1st rotation	After 2nd rotation	After 3rd rotation
			CWHvm 2	1,707	1,194	OGMAs	8.7	13
			MHmm 1	92	19	OGMAs	12.7	19
Keogh	Low	1	CWHvm 1 in GMZ 7	2,435	1,671	8.7	8.7	13
			Other CWHvm 1	19,769	13,625	OGMAs	8.7	13
			CWHvm 2	4,190	2,900	OGMAs	8.7	13
			MHmm 1	560	295	OGMAs	12.7	19
			MHmm p	63	21	Old Seral Target Not Applicable: No Targets in NSOG Order		
Klaskish	High	1	CWHvm 1	1	0	19	19	19
			CWHvm 2	94	67	19	19	19
			MHmm 1	9	5	28	28	28
			MHmm p1	0	0	Old Seral Target Not Applicable: No Targets in NSOG Order		
Mahatta	Low	1	CWHvh 1	10	6	OGMAs	8.7	13
			CWHvm 1	18,743	12,340	OGMAs	8.7	13
			CWHvm 2	3,658	2,365	OGMAs	8.7	13
			MHmm 1	405	105	OGMAs	12.7	19
			MHmm p	3	2	Old Seral Target Not Applicable: No Targets in NSOG Order		
Marble	Intermediate	1	CMA 0	1	-	Old Seral Target Not Applicable: No Targets in NSOG Order		
			CWHvm 1	28,537	18,049	OGMAs	OGMAs	OGMAs
			CWHvm 2	8,644	4,973	OGMAs	OGMAs	OGMAs

Landscape Unit	BEO	NDT	BEC	Area (ha)		Old Seral Targets (% of productive)		
				Productive	THLB	1st rotation	After 2nd rotation	After 3rd rotation
			MHmm1	1,230	510	OGMAs	OGMAs	OGMAs
			MHmmp	238	54	Old Seral Target Not Applicable: No Targets in NSOG Order		
			MHmmp1	2	0	Old Seral Target Not Applicable: No Targets in NSOG Order		
Neroutsos	Low	1	CMA 0	0	-	N/A	N/A	N/A
			CWHvm1	16,800	9,901	OGMAs	8.7	13
			CWHvm2	5,217	3,115	OGMAs	8.7	13
			MHmm1	406	99	OGMAs	12.7	19
			MHmmp	106	37	Old Seral Target Not Applicable: No Targets in NSOG Order		
			MHmmp1	1	-	Old Seral Target Not Applicable: No Targets in NSOG Order		
San Josef	Intermediate	1	CWHvh1	9,111	4,966	OGMAs	OGMAs	OGMAs
			CWHvm1	33,843	22,117	OGMAs	OGMAs	OGMAs
			CWHvm2	1,587	1,107	OGMAs	OGMAs	OGMAs
			MHmm1	89	9	OGMAs	OGMAs	OGMAs
Lower Nimpkish	Low	1	CWHvm1	1,068	756	Old Seral Target Not Applicable: Due to Existing Legal OGMAs Outside TFL 6		
			CWHvm2	125	58			
Nahwitti	Intermediate	1	CWHvh1	15	9	Old Seral Target Not Applicable: Due to Small Overlaps		
			CWHvm2	1	0			
Tsulquate	Intermediate	1	CWHvh1	19	13			
Total				*187,425*	*120,099*			

A sensitivity analysis will be conducted to assess the impact of all LU-BEC variant combinations meeting their full old seral targets throughout the entire analysis period. A second sensitivity analysis will examine the impact of not harvesting existing old seral forests in LU-BEC variant combinations that are currently below their full old seral targets until those targets are met.

10.3.4 Community Watersheds

FRPA defines a community watershed as the entire or a designated portion of an area where water drains. This uphill area is located upstream from the point where water is diverted for human consumption by an authorized waterworks system. Community watersheds are designated to protect these vital sources of drinking water.

TFL 6 includes one designated community watershed (CWS): Calbick Creek (930.003), located between Quatsino Lake and Coal Harbour (Table 68). While the watershed is no longer used for drinking water by Quatsino First Nation (water licence holder), a rate-of-harvest limit ensures no more than 10% of the productive area within the watershed is covered by stands younger than 10 years. This approach aligns with TFL 6 MP #10.

Table 68 Calbick Creek Community Watershed Area

Total Area (ha)	Forested Area (ha)	Productive Forest Area (ha)	THLB Area (ha)
64	62	62	51

10.3.5 Fisheries Sensitive Watersheds

There are no designated fisheries sensitive watersheds within TFL 6.

10.3.6 Other Watersheds

Beyond the Calbick Creek CWS, forest planning and activities within other TFL 6 watersheds follow the Watershed Management Strategies (WMS) introduced in 2007 (Horel, Tree Farm License 6, Tree Farm License 37, Tree Farm License 39 Block 4 Watershed Management Strategies, 2007). The WMS development incorporates data-driven risk control measures based on physical watershed processes. These strategies guide on-site decision-making through the Terrain Risk Management Strategy (TRMS).

The WMS undergoes periodic updates by subject matter experts. The 2019 update incorporated updated forest development data, new stream channel disturbance information, and improved understanding of risk control options. Additionally, various watersheds received sensitivity class designations (Horel, 2019). Figure 29 illustrated these high sensitivity watersheds, along with the spatially defined high sensitivity zones within these watersheds. These zones, often associated with landslide initiation and potential fish habitat impacts, require a cautious harvesting approach to minimize sediment delivery risks.

Operationally, site-level assessments conducted by qualified professionals evaluate the risk against prescribed risk tolerance levels. For timber supply modelling, a more generalized approach is developed to achieve the same WMS outcomes. To limit the amount of harvest over time and support hydrological recovery, Specific Equivalent Clearcut Area (ECA) limits were recommended for each sensitivity zone. Table 69 details the area, ECA recovery curves and corresponding ECA limits for each watershed with available sensitivity zones. These ECA limits ensure that harvesting activities in the timber supply model are aligned with the overall watershed management objectives.

As part of the Quatsino IRMP (described in Section 3.5.2.2), a focus is on revising WMS, with an emphasis on expanding spatially delineated watershed high sensitivity zones by qualified professionals. These high sensitivity zones can benefit both operational planning for more focused site-level assessments and strategic planning for setting limits on these zones in the timber supply model. The updated WMS and associated modelling approaches for the Quatsino IRMP scenario, if available, will be incorporated into the timber supply analysis report.

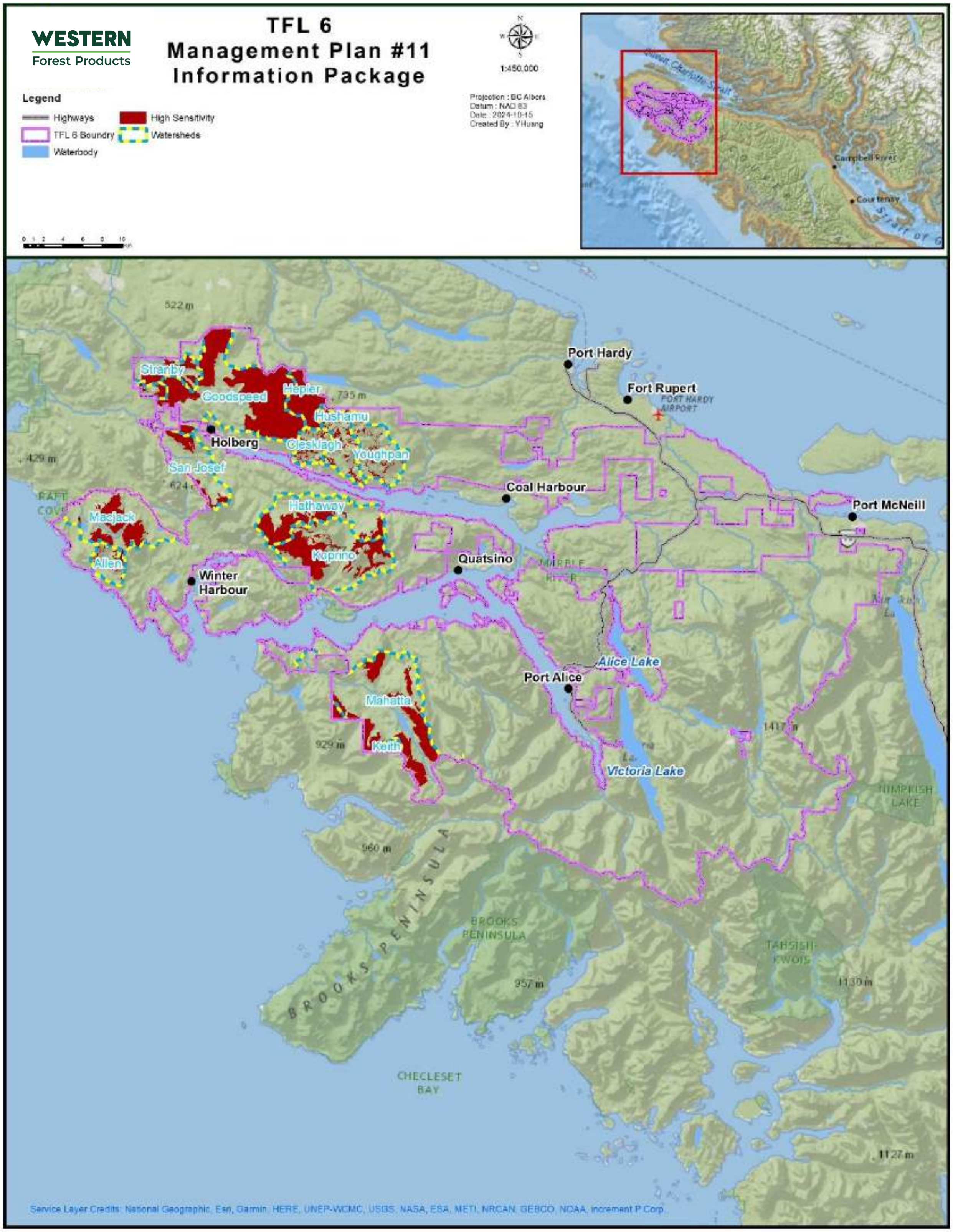

Figure 29 TFL 6 Watershed Zones of Sensitivity Overview

Table 69 ECA Limits for Zones of Sensitivity for TFL 6 Watersheds

Watershed Unit	Landslide Disturbance Level in 2019 TRMS	High Sensitivity Area		Modelling Tactic (ECA%)	R1b curve Implementation
		Productive Forest Area (ha)	THLB Area (ha)		
Allen	High	83	71	25%	T of 4 m curve
Clesklagh	Severe	230	44	25%	T of 4 m curve
Goodspeed	Severe	5,494	3,963	20%	T of 4 m curve
Hathaway	High	1,413	890	25%	T of 4 m curve
Hepler	High	1,274	759	25%	T of 4 m curve
Hushamu	High	360	45	25%	T of 4 m curve
Keith	Severe	420	330	20%	T of 4 m curve
Koprino	High	1,971	918	25%	T of 4 m curve
Macjack	High	1,450	929	25%	T of 4 m curve
Mahatta	High	2,646	1,571	25%	T of 4 m curve
San Josef	Severe	716	441	25%	T of 4 m curve
Stranby	Severe	639	455	25%	T of 4 m curve
Youghpan	High	237	23	25%	T of 4 m curve

ECA calculations utilize the ECA recovery factors outlined in Table 70 and TIPSY height projections. These recovery factors are based on the methodology detailed in FOR's Technical Report TR-032 (Hudson & Horel, 2007). Specifically, the R1b T of 4 m recovery curve is used in watersheds with a high landslide frequency. Areas that have been harvested and are regenerating will contribute to the ECA until stands reach a height of 34 metres for T of 4 m curve. At this point, it is assumed that the stands will have reached hydrological green-up. Appendix C: Hydrologic Recovery Method Review provides further details on the development of the hydrologic recovery method.

Table 70 Recovery and ECA Factors for TFL 6 Watersheds (Hudson & Horel, 2007)

Stand Height (m)	R1b T of 4 m Curve	
	Recovery Factor (RF)	ECA Factor (1 – RF)
1	-	1.00
2	-	1.00
3	-	1.00
4	-	1.00
5	0.11	0.89
6	0.24	0.76
7	0.35	0.65
8	0.45	0.55
9	0.54	0.46
10	0.62	0.38
11	0.68	0.32

Stand Height (m)	R1b T of 4 m Curve	
	Recovery Factor (RF)	ECA Factor (1 – RF)
12	0.73	0.27
13	0.78	0.22
14	0.81	0.19
15	0.85	0.15
16	0.87	0.13
17	0.89	0.11
18	0.91	0.09
19	0.93	0.07
20	0.94	0.06
21	0.95	0.05
22	0.96	0.04
23	0.97	0.03
24	0.97	0.03
25	0.98	0.02
26	0.98	0.02
27	0.98	0.02
28	0.99	0.01
29	0.99	0.01
30	0.99	0.01
31	0.99	0.01
32	0.99	0.01
33	0.99	0.01
34	1.00	-

10.3.7 Terrain Stability

Similar to the terrain stability measures implemented during the THLB netdown process (Section 6.19) using terrain stability mapping and LiDAR-derived slope data, the assessment of TFL 6 watersheds and hydrologic recovery methods (refer to Appendix C: Hydrologic Recovery Method Review) revealed a valuable co-management benefit. Managing ECA within high-sensitivity zones addresses both hydrologic and geomorphic concerns at the watershed level, further enhancing hillslope stability. Consequently, mitigating concerns regarding slopes prone to landslides or steep terrain in areas where landslides frequently occur can be achieved by avoiding terrain classified as class 5 and areas with LiDAR slopes exceeding 90%, as well as by imposing restrictions on ECA within the timber supply model.

10.3.8 Higher Level Plan

The Vancouver Island Land Use Plan (VILUP), implemented on December 1, 2000, established Resource Management Zones with specific objectives. One objective for SMZs is to maintain seral forest over one quarter to one third of the forested area (Section II 1(a)(i)). Landscape unit planning will determine the final target within this range.

As detailed in Table 45, portions of two SMZs are present within TFL 6:

- SMZ 2 – West Coast Nahwitti Lowlands;
- SMZ 4 – Koprino.

For this analysis, a restriction will be implemented to maintain at least 25% of the productive forest land base in either mature or old seral stages within these SMZs.

VILUP Objective 10 requires that no more than one-third of the total 13% landscape-level biodiversity old seral target for CHWvm1 in General Management Zone 7 Marble can be reduced. As detailed in Section 10.3.3, Marble LU has legally established OGMAs that fulfill this target. However, General Management Zone 7 also extends into Keogh LU, which does not currently have legally established OGMAs. Consequently, for CHWvm1 areas within General Management Zone 7 and Keogh LU, the timber supply model will maintain two-thirds of the full 13% old seral target for the first two rotations, achieving the full target by the third rotation, as outlined in Table 67 of Section 10.3.3.

VILUP Objective 15 and 16 require old growth forests within Resource Management Zone 8 Mahatta-Neuroutsos of TFL 6 to be retained for Marbled Murrelet habitat areas. This requirement is satisfied by preserving Marbled Murrelet habitat areas described in Section 6.12.3.

The Gwa’ni Land Use Objectives Order, established in January 2026, created two SMZs from the EFZ identified under VILUP:

- ‘mał̱ik SMZ
- dza̱'wa̱n SMZ

The Order specifies that a minimum of 33% of the forested area within these SMZs must be at least 120 years old within 50 years (by 2075), and a minimum of 50% must be at least 120 years old within 100 years (by 2125). These requirements would have been incorporated into the timber supply modelling. However, as noted in Section 1.2, the SMZs were not included because the formal legal order had not yet been issued at the time the accepted version of the IP and timber supply model were prepared.

The portion of TFL 6 within the Gwa’ni project area represents approximately 0.6% of the total TFL area and 0.7% of the total Order area. As such, the influence of the Gwa’ni Land Use Objectives Order on the overall harvest forecast for TFL 6, as well as its broader implementation implications, is expected to be limited. These requirements will be incorporated in future TSRs.

10.4 Timber Harvesting

10.4.1 Minimum Harvestable Age

Minimum harvestable ages (MHA) are key inputs in the timber supply model. Although, in practice, harvesting may occur below these minimums for specific forest-level objectives (e.g., maintaining timber flow, addressing forest health, and market conditions), many stands remain unharvested until well past the minimum age due to other resource value considerations.

Previous MPs for TFL 6 set MHAs based on tree size thresholds and harvest systems or site productivity classes. Stands were considered harvestable by the model when their average DBH reached a threshold that varied by harvest system (30cm/37cm/42cm for ground/cable/helicopter system in MP #10). This selection considered current harvesting and manufacturing systems.

However, average harvested stand DBH can be variable due to external factors such as equipment capacity, seasonality, and market conditions. Additionally, operational staff noted that ground and cable systems are often used at the same time within the same operating area. Therefore, the 7cm DBH difference between these systems in the previous criteria may not be realized in operational planning.

To ensure sustainable long-term harvesting and optimize yield, the timing of harvest generally targets stands when they are approaching their peak average growth rate, referred to as the culmination Mean Annual Increment (CMAI). This age represents the optimal biological rotation for maximizing long-term timber volume (Province of British Columbia, 2008). However, achieving this age for every area might not be feasible due to broader landscape objectives and values. As a result, reaching 95% of the culmination age is often considered a reasonable target. This approach of using 95% CMAI age and minimum volume of 350 m^3/hectare aligns with recent timber supply analyses in other BC coastal regions with similar forest profiles and topography, such as the surrounding North Island TSA (using 95% CMAI) (Province of British Columbia, 2020) and nearby TFL 47 (using 90% CMAI & 300 m^3/ hectare) (Mosaic Forest Management Corp., 2024).

TFL 6 MP #11 analysis sets the minimum harvest age at 95% of CMAI, along with a minimum volume requirement of 350 m3/ha. If the minimum volume is not met within 250 years, a minimum harvest age of 250 years applies. Existing natural stands over 62 years old have stand-level minimum ages determined for each polygon. Managed stands between 1-62 years old follow the minimum harvest ages outlined in Table 71 for their analysis units. The weighted average minimum harvest age for these early and recently managed stands is approximately 69 years old with an average volume of 630 m^3/hectare.

Table 71 Minimum Harvest Ages for Managed AUs

Analysis Unit	Current THLB Area (ha)	95% Culmination	
		MHA	Volume at MHA
Early Managed Stands Aged 23 - 62 Years (established 1961 – 2000)			
E100	5	63	508
E101	85	102	367
E101F	119	101	380
E103	35	174	351
E104	1,067	78	581
E104F	503	81	588
E104S	118	78	601
E104sc	176	82	517
E104scF	597	83	526
E104sh	142	78	573
E104shF	201	78	565
E106c	69	75	659
E106h	158	61	422
E106s	69	61	736
E108	20	59	532
E110	1	101	352
E113	80	97	409
E113F	70	99	394
E200	215	65	492
E200F	10	62	713
E201b	735	63	647
E201c	991	73	611
E201cF	604	74	612
E201d	-	N/A	N/A
E201f	577	56	601
E201fF	727	54	590
E201fS	136	55	601
E201h	22,068	67	672
E201hF	1,683	67	655
E201hFS	106	66	663
E201hS	3,233	66	672
E201sc	1,897	67	608
E201scF	3,235	74	602
E201scS	86	62	683
E201sh	1,104	66	639
E201shF	720	66	635
E203c	216	92	380
E203cF	167	95	379
E203f	54	61	441
E203fF	202	56	474
E203h	1,217	97	415
E203hF	87	87	414
E204	100	70	608

Analysis Unit	Current THLB Area (ha)	95% Culmination	
		MHA	Volume at MHA
E205b	140	58	670
E205c	138	71	638
E205cF	213	73	664
E205d	-	63	350
E205f	69	56	631
E205fF	117	55	612
E205h	2,442	62	648
E205hF	174	64	674
E205hS	240	63	670
E205s	415	58	786
E206	96	74	612
E206s	80	73	584
E206sF	182	74	618
E207	575	58	732
E207F	91	53	636
E209d	-	69	351
E209h	176	63	651
E210	12	54	563
E211	22	58	664
E214c	409	82	478
E214cF	713	86	513
E214h	330	85	523
E214hF	298	87	532
E231	30	80	542
E233	18	68	431
E300	47	74	553
E301	5,461	69	625
E301F	113	72	612
E301S	233	67	650
E303	265	103	365
E305	104	66	644
E307	51	67	653
E308	31	62	579
E311	121	107	374
E401	113	117	353
E422	22	77	574
Recently Managed Stands Aged 1 - 22 Years (established 2001 - 2023)			
R100	10	79	559
R101	405	93	384
R103	54	163	350
R104c	445	76	543
R104h	717	76	596
R104s	753	76	540
R106	161	69	656
R113	121	91	414

Analysis Unit	Current THLB Area (ha)	95% Culmination	
		MHA	Volume at MHA
R200	106	68	667
R201c	2,472	66	616
R201h	14,530	61	668
R201sc	1,427	67	616
R201sh	830	62	650
R203c	221	90	391
R203h	345	92	405
R204	91	69	630
R205	3,022	61	657
R206s	37	71	643
R207	267	53	652
R209	132	62	627
R214	580	78	501
R233	13	69	630
R300	8	69	644
R301b	933	69	608
R301c	390	72	544
R301h	2,156	67	630
R301y	595	73	558
R303	221	99	371
R305	91	65	646
R308	47	65	654
R311	58	99	372
R332	19	95	361
R401	371	117	352
R422	38	82	527

Table 72 outlines the minimum harvest ages for future stands by analysis unit. The weighted average minimum harvest age across these units is 64 years old with an average volume of 586 m3/hectare. The table also displays the CMAI, and the corresponding Long-Run Sustained Yield (LRSY) for each future analysis unit. LRSY is the maximum annual harvest that can be sustained long-term, assuming all stands are harvested at the age of optimal growth (CMAI). Considering a 1.5% reduction to account for non-recoverable losses (as discussed in Section 9.5), the total LRSY for TFL 6 is 1,182,900 m^3/year.

Table 72 Minimum Harvest Ages for Future Stands

Analysis Unit	Current THLB Area (ha)	95% Culmination		Culmination	
		MHA	Volume at MHA	CMAI	LRSY
Fvh101	1,604	87	385	4.66	7,473
Fvh103	294	250	149	1.49	438
Fvh104	3,871	73	550	7.94	30,734

Analysis Unit	Current THLB Area (ha)	95% Culmination		Culmination	
		MHA	Volume at MHA	CMAI	LRSY
Fvh104s	2,751	73	523	7.57	20,826
Fvh106	781	67	647	10.2	7,962
Fvh108	57	56	526	9.89	564
Fvh113	508	87	377	4.57	2,320
Fvm101	62,618	59	615	11.01	689,429
Fvm101s	11,015	67	613	9.64	106,181
Fvm103	3,659	64	362	6	21,956
Fvm104	298	68	625	9.69	2,892
Fvm105	10,206	55	623	11.93	121,752
Fvm106	125	68	631	9.79	1,220
Fvm106s	336	68	643	9.95	3,340
Fvm107	1,298	52	627	12.77	16,571
Fvm109	388	59	597	10.68	4,148
Fvm111	75	56	666	12.62	944
Fvm114	3,158	74	496	7.09	22,389
Fvm131	75	75	466	6.57	495
Fvm133	49	77	471	6.45	319
Fvm201	14,134	68	571	8.85	125,089
Fvm203	890	95	373	4.15	3,693
Fvm205	247	63	630	10.6	2,614
Fvm207	70	63	634	10.64	743
Fvm208	192	63	634	10.64	2,045
Fvm211	245	94	377	4.23	1,037
FMH01	939	99	350	3.32	3,119
FMH22	216	113	350	3.12	673
Total	*120,099*				*1,200,969*

The impact of minimum harvestable age will be evaluated through sensitivity analyses by simulating a 10-year increase and decrease in the minimum harvestable age for each AU.

10.4.2 Harvest Rules

The Patchworks model will be used for this analysis, leveraging its ability to consider spatial distribution of stands to optimize and forecast harvest schedules. Unlike simulation models that set harvest priority rules, optimization models like Patchworks determine the sequence of harvests to achieve specific goals. Harvest rules will be incorporated to illustrate the transition from harvesting old-growth stands to second-growth stands. Additionally, the harvest schedule will take into account performance within the non-conventional portion of the THLB.

10.4.2.1 Second-Growth Stands Contribution

Recent data on harvesting and short-term plans show a consistent trend of harvesting second growth stands (i.e., <121 years old) in TFL 6. Therefore, second-growth harvest in the Base Case option will commence at least 20% and will gradually increase over time until the transition to second-growth harvest is largely complete, though small volumes of old-growth harvest may continue to be harvested because of the scheduling impacts of forest cover class constraints.

10.4.2.2 Non-Conventional Harvesting Contribution

Recent harvest performance in the non-conventional (helicopter) portion of the THLB, as discussed in Table 7 in Section 3.5.1.4, has been approximately 1.2% of the total harvested area from 2012 to 2023. Non-conventional operable land base represents 3.1% of the THLB area and 6.2% of the THLB volume (Table 73), as determined by physical operability classes defined through the LBB process using LiDAR data (Section5.2.1). Considering the historically low harvest rate and projected limited future contribution from the non-conventional harvesting area, the Base Case will predict a harvest level within a reasonable range that considers the contribution from non-conventional harvest systems. This approach reflects the expectation of minimal contribution from the non-conventional harvesting system.

Table 73 THLB Breakdown by Harvest System

Harvest System	THLB Area (ha)	THLB Volume (m3)	% of THLB Area	% of THLB Volume
Ground	68,845	19,216,294	57.3%	53.4%
Cable	47,524	14,563,331	39.6%	40.5%
Non-conventional	3,730	2,223,221	3.1%	6.2%
Total	120,099	35,978,868	100.0%	100.0%

Western is particularly interested in understanding the economic impact of accessing this economically challenging timber source. Therefore, a sensitivity analysis will be conducted by excluding the helicopter operable land base from the timber supply analysis.

10.4.2.3 Harvest Patch Size

Isolated or spatial "silver" THLB areas, those too small to form economically viable harvest blocks, will be considered in this analysis. Historical harvest data from 2012 to 2023 reveals that only eight out of 435 blocks, representing 0.15% of the net harvested area in TFL 6, were smaller than two hectares.

To prevent the model from generating non-operational harvest blocks, a patch target of two hectares will be implemented within the Patchworks model. This ensures that isolated stands or spatial "silver" THLB areas will not be harvested unless they can be combined with adjacent stands to create a larger, economically feasible block. Consequently, the projected harvest level for TFL 6 will exclude these smaller, isolated areas.

10.4.3 Silvicultural Systems

The application of Variable Retention and the retention silvicultural system is a key component of Western's Stewardship and Conservation Plan (WSCP). This plan aims to maintain various landscape values over time, including biodiversity, timber, water resources, carbon, and climate change resilience. Stand-level retention specifically helps address biodiversity elements by:

- Maintaining ecosystem representation: Ensuring a variety of habitat types are present across the landscape.
- Preserving legacies: Protecting old-growth characteristics like large trees and snags for future generations.
- Influencing both above and below ground: Providing habitat for a range of species that depend on both the forest canopy and understory.
- Protecting rare ecosystems: Prioritizing the conservation of unique and rare habitats.
- Conserving old forests: Maintaining areas with mature and old-growth trees for their ecological value.
- Safeguarding big trees: Retaining large or tall trees that provide crucial wildlife habitat value.

The utilization of the retention silvicultural system and the extent of retention within TFL 6 are based on RMZs outlined in VILUP by ecosections (refer to Section 7.1). Ecosection is a provincial classification system that categorizes the complexity of terrestrial and marine ecosystems in British Columbia. Figure 30 provides the geographical extent of various Stewardship and Conservation Zones in within TFL 6.

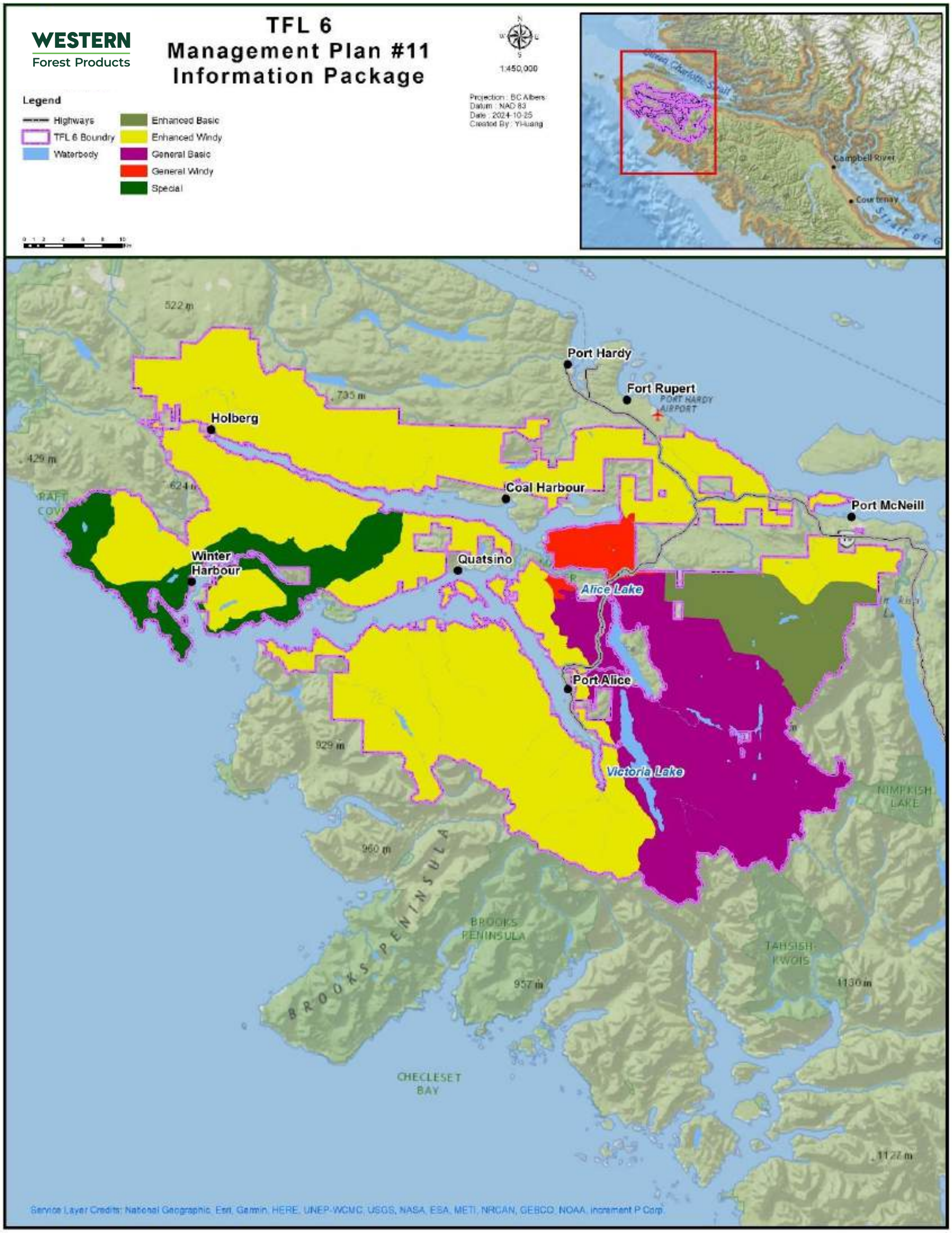

Figure 30 Stewardship and Conservation Zones within TFL 6

The specific percentage of trees retained after harvest depends on several factors:

- Ecosection: Retention levels are generally lower in windy coastal areas and higher in sheltered inland regions.
- VILUP Zone: Retention levels are higher in SMZs to prioritize resource values and more flexible in EFZs for operational planning.
- BEC Variant: Drier variants require higher minimum long-term retention targets (not applicable to TFL 6).

Here is a breakdown of the retention levels for different WSCP zones:

- Enhanced Basic: 50% of the harvested area will use the retention silvicultural system, with a minimum long-term target of 15% stand-level retention.
- Enhanced Windy: Due to increased wind exposure from the Pacific Ocean, only 30% of the harvested area will use the retention silvicultural system, while maintaining a minimum long-term target of 15% stand-level retention.
- General Basic: 60% of the harvested area will use the retention silvicultural system, with a minimum long-term target of 20% stand-level retention. The increased harvested area subject to retention silvicultural system and retention level than the EMZ reflects a more restricted operating land base.
- General Windy: 40% of the harvested area will use the retention silviculural system, with a minimum long-term target of 20% stand-level retention. The reduced retention level is reflective of larger exposure of winds from the Pacific.
- Special: Following the VILUP Higher Level Plan Order, this special management zone area will utilize various silvicultural systems (clearcut, clearcut with reserves, seed tree, shelterwood, selection, or retention) with a maximum cutblock size of 5 ha (except for shelterwood, selection, or retention which can be up to 40 ha). To achieve the long-term stand-level retention objective, the WSCP mandates a minimum of 25% retention across 90% of the harvested area.

For any remaining area harvested within each zone, the provincial requirement of a minimum 7% WTRA will still apply. Table 74 summarizes these retention targets.

Table 74 WSCP Retention Targets

Western Stewardship & Conservation Zones	Ecosection	VILUP Resource Management Zone	BEC Variants	THLB Area (ha)	Retention Strategy Use (% of harvest area)	Long Term Retention (% of harvest area)
Enhanced Basic	Northern Island Mountains	Enhanced	CWHvm1, CWHvm2, MHmm1,	8,098	50%	15.0%

Western Stewardship & Conservation Zones	Ecosection	VILUP Resource Management Zone	BEC Variants	THLB Area (ha)	Retention Strategy Use (% of harvest area)	Long Term Retention (% of harvest area)
			MHmmp			
Enhanced Windy	Nahwitti Lowland	Enhanced	All	78,672	30%	15.0%
General Basic	Northern Island Mountains	General	CWHvm1, CWHvm2, MHmm1, MHmmp	21,987	60%	20.0%
General Windy	Nahwitti Lowland	General	CWHvh1, CWHvm1, CWHvm2	3,084	40%	20.0%
Special	Nahwitti Lowland	Special	CWHvh1, CWHvm1, CWHvm2	8,257	90%	25.0%
Total				120,099	41.3%	16.7%

Variable Retention is a long-term strategy for the Ecosection/VILUP Management Zone/BEC variant combinations within TFL 6. Stand level retention must remain in place for at least one rotation. Under this strategy, 41.3% of the total harvest area will be managed using retention silvicultural systems. The remaining area will be subject to clearcutting or clearcutting with reserves. Across the TFL 6, the area-weighted average minimum stand level retention requirement is at 16.7%.

10.4.4 Initial Harvest Rate

The current AAC for TFL 6 is set at 1,362,600 m³ per year. This volume is divided between Western with 1,350,422 m³ and First Nations with 11,578 m³.

Prior to consolidation with the former TFL 39 Block 4, the TFL 6 MP #10 timber supply analysis indicated a potential 5% decline in AAC over the next decade. In contrast, the portion of TFL 6 that originated from TFL 39 Block 4 (reflected in TFL 39 MP #9) projected a stable timber supply for the next 40 years. Due to changes in THLB netdowns and estimates of future timber growth, the timber supply dynamics for TFL 6 may differ from the historical forecasts. Therefore, various initial harvest rates will be analyzed through modelling. This will help determine a Base Case harvest schedule that aligns with the established harvest flow objectives outlined in Section 10.4.5.

10.4.5 Harvest Flow Objectives

The harvest level forecasts are designed to optimize timber harvesting for a 300-year planning horizon while adhering to key sustainability principles:

- Gradually adjust harvest levels to approach the best estimate of the long-term sustainable yield;
- Minimize periods where the harvest level falls below the long-term sustainable yield level; and
- Maintain a consistent and sustainable long-term growing stock.

10.5 Old Growth Deferral Areas

In November 2021, the Province of British Columbia announced the deferral of harvesting on 2.6 million hectares of old-growth forest (Province of British Columbia, 2019). The deferral is temporary and uses spatial data provided by the Technical Advisory Panel (TAP). The identified categories of Priority Deferral Areas include three categories: Priority big-treed old growth, ancient forest and remnant old ecosystems. This deferral process is still ongoing with the consultation process with applicable First Nations underway across the province.

According to the updated TAP vector dataset from August 2022, 10,868 hectares (or 5.0%) of the deferred area fall within TFL 6. 3,550 hectares (or 3.0%) overlap with the THLB. Table 75 details the distribution of these deferred old-growth classes within TFL 6.

Table 75 Old Growth Deferral Areas in TFL 6

TAP Classification	Gross Area (Ha)	Productive Area (Ha)	THLB (Ha)
Priority big-treed old growth	9,951	9,734	3,221
Ancient forest	160	151	50
Remnant old ecosystems	1,326	1,274	502
Net Total[21]	10,767	10,498	3,550

A sensitivity analysis may be planned to assess the impact on timber supply if all the deferred old-growth areas are excluded from the THLB.

[21] The TAP polygons overlap across their three classifications. As a result, the net total does not equate to a mathematical sum of the three categories.

11 Subsequent Analysis Report and Management Plan

The primary goal of the TSR is to assess the current state of the forests and how they are managed for the TFL. Then information is gathered and analyzed to understand how much harvestable timber the TFL can sustainably supply. The IP outlines the data, assumptions, and modelling procedures to be used in the timber supply analysis.

Upon completion of the timber supply analysis, the findings and discussions will be summarized in a timber supply analysis report. This report and the draft MP will be released for First Nations consultation and public review.

It is important to note that the TSR is an ongoing process. The factors influencing timber supply, as outlined in the IP, may change based on feedback received during the consultation and review stages. Any updates or modifications will be incorporated into a revised IP and attached to the final timber supply analysis report and draft MP.

All feedback gathered during the First Nations consultation and public review, regardless of whether it leads to changes in timber supply inputs, will be submitted to the chief forester.

The chief forester will make a statutory decision regarding the AAC for TFL 6. The reasoning behind the AAC decision will be outlined in a publicly available AAC determination rationale document. This document will also identify any areas where improvements in information gathering, or forest management practices are needed.

12 Glossary (Province of British Columbia, 2008)

Allowable Annual Cut (AAC)	The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres per year.
Analysis Unit (AU)	A grouping of forest types – for example, by biogeoclimatic zone, site productivity, leading tree species, and age - done to simplify analysis and the generation of timber yield tables.
Base case harvest forecast (Current Management Option)	The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.
Biodiversity (biological diversity)	The diversity of plants, animal and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.
Biogeoclimatic zones and variants (BEC)	A large geographic area with broadly homogeneous climate and similar dominant tree species.
Cutblock	A specific area, with defined boundaries, authorized for harvest.
Cutblock adjacency	The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested cutblocks must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested.

Equivalent Clearcut Area (ECA)	An indicator that quantifies the percentage of the productive forest area within a watershed where the hydrologic response resulting from disturbance is equivalent to the hydrologic response of a clearcut.
Forest inventory	An assessment of timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of other forest values such as recreation and wildlife habitat.
Forest and Range Practices Act	Legislation that governs forest and range practices and planning, with a focus on ensuring management of all forest values.
Forest type	The classification or label given to a forest stand, usually based on tree species composition.
Free-growing	An established seedling of an acceptable species that is free from growth-inhibiting brush, weeds and excessive tree competition.
Geographic Information System (GIS)	A geographic information system, also known as a geographical information system or geospatial information system, is a system for capturing, storing, analyzing and managing data and associated attributes which are spatially referenced to the Earth.
Green-up	The time needed after harvesting for a stand of trees to reach a desired condition (usually expressed as a specific height) - to ensure maintenance of water quality, wildlife habitat, soil stability, or aesthetics – before harvesting is permitted in adjacent areas.
Growing stock	The volume estimate for all standing timber at a particular time.

Harvest forecast	The potential flow of timber harvest over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized over time for a specified land base and a set of management practices. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.
Inoperable areas	Areas defined as unavailable for timber harvest for terrain-related or economic reasons. Operability can change over time as a function of changing harvesting technology and economics.
Integrated resource management (IRM)	The identification and consideration of all resource values, including social, economic and environmental needs in resource planning and decision-making.
Karst features	Karst is a distinctive topography that develops as a result of the dissolving action of water on carbonate bedrock (usually limestone, dolomite or marble). Karst features include fluted rock surfaces, vertical shafts, sinkholes, sinking streams, springs, complex sub-surface drainage systems and caves.
Landscape-level biodiversity	The *Landscape Unit Planning Guide* and the *Order Establishing Provincial Non-Spatial Old Growth Objectives* provide objectives for maintaining biodiversity at the landscape level and stand level. At the landscape level, objectives are provided for the maintenance of old growth.
Landscape unit	A planning area based on topographic or geographic features, that is appropriately sized (up to 100,000ha), and designed for application of landscape-level biodiversity objectives.

Long-term harvest level	A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.
Lorey height	Basal area weighted average stand height: Sum of tree height multiplied by tree basal area for all trees, then divided by the basal area of the stand.
Management assumptions	Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specifications for minimum harvestable ages, utilization levels, and integrated resource management and silviculture and pest management programs.
Model	An abstraction and simplification of reality constructed to help understand an actual system. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help management activities.
Natural disturbance type (NDT)	An area that is characterized by a natural disturbance regime, such as wildfires and wind, which affects the natural distribution of seral stages. For example areas subject to less frequent stand-initiating disturbances usually have more old forests.
Non-recoverable losses	The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested.

Operability	Classification of an area considered available for timber harvesting. Operability is determined using the terrain characteristics of the area as well as the quality and quantity of timber on the area.
Riparian area	Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.
Riparian habitat	The stream bank and flood plain area adjacent to streams or water bodies.
Sensitivity analysis	A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed and the results are compared to a baseline or the Base Case.
Site index	A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground).
Site Index by Biogeoclimatic Ecosystem Classification site series (SIBEC)	Site index estimates for tree species according to site units of the Biogeoclimatic Ecosystem Classification system of British Columbia.
Site Series	Sites capable of producing similar late seral or climax plant communities within a biogeoclimatic subzone or variant.
Stocking	The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.

TIPSY (Table Interpolation Program for Stand Yields)	A BC Forest Service computer program used to generate yield projections for managed stands based on interpolating from yield tables of a model (TASS) that simulates the growth of individual trees based on internal growth processes, crown competition, environmental factors and silvicultural practices.
Timber harvesting land base (THLB)	Forest land within the TFL where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and harvesting technology.
Timber supply	The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.
Tree farm licence (TFL)	Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.
Ungulate	A hoofed herbivore, such as a deer.
Volume estimates (yield projections)	Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products.
Watershed	An area drained by a stream or river. A large watershed may contain several smaller watersheds (basins).
Wildlife tree	A standing live or dead tree with special characteristics that provide valuable habitat for wildlife.

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Appendices

Appendix A TFL 6 Vegetation Resources Inventory Statistical Adjustment 2009

WESTERN FOREST PRODUCTS INC.
TFL 6
VEGETATION RESOURCES INVENTORY
STATISTICAL ADJUSTMENT

Prepared for:
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Project Number: BC0108834

December 2009

EXECUTIVE SUMMARY

Western Forest Products Inc. (Western) initiated a Vegetation Resources Inventory (VRI) program in 2001 on Tree Farm License (TFL) 6 to Ministry of Forests and Range (MFR) inventory standards. The Phase II program was completed in the 2001 field season.

In May 2007, Timberline Natural Resource Group Ltd. was asked to complete the inventory adjustments in TFL 6 in preparation for Timber Supply Review (TSR). Height, age, and total live net merchantable volume (17.5+ cm) were adjusted following MFR inventory methods.

The target population, where the adjustment was applied, is the Vegetated Treed (VT) (BC Landcover Classification Scheme) portion of the TFL over 30 years of age (in 2001), excluding private lands, parks and other officially protected areas. The target population covers 137,688 ha.

Following adjustment, the TFL 6 inventory **volume increased by approximately 14%. Height and age increased by 1% and 12%,** respectively and **site index decreased by 0.4%**. The recommendations from this report are that Western apply the adjusted estimates of height, age, and volume into the upcoming TSR.

This version of the report incorporates the comments provided by MFR on July 27, 2009.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 Background

1.1.1 Vegetation Resources Inventory Overview

The Vegetation Resources Inventory (VRI) is the Ministry of Forests and Range's (MFR) forest inventory standard on public lands in BC. Where possible, forest licensees must use the VRI standard in their Data Package submission for Timber Supply Review (TSR).

The VRI is a four-step process (Figure 1):

1. Phase I (unadjusted inventory data) – Estimates of polygon attributes are derived for the target population, usually from photo-interpretation.
2. Phase II (ground sample data) – Measurements are taken from randomly located ground samples in the target population.
3. Net Volume Adjustment Factor (NVAF) sampling – Random trees are selected for stem-analysis from the Phase II samples to develop adjustment ratios that correct taper and decay estimation bias.
4. Adjustment Phase – The Phase I estimates are adjusted using the NVAF-corrected Phase II ground samples to provide an adjusted unbiased estimate of forest inventory attributes. The final product is an adjusted VRI database (Section 3.4).

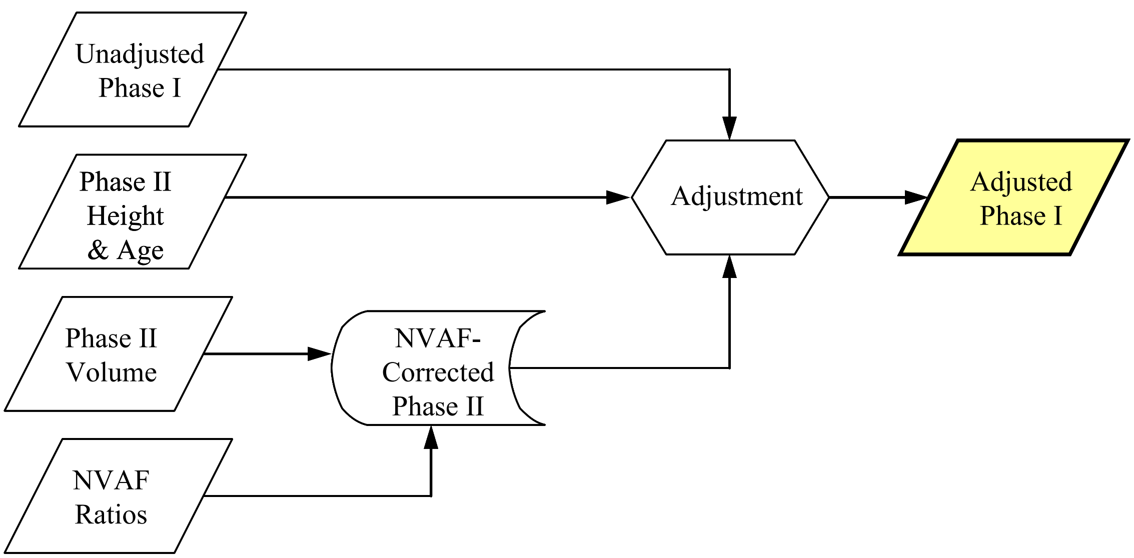

Figure 1: VRI program overview

1.1.2 VRI Program Background

Dave Byng, *RPF* led implementation of Western Forest Products Inc. (Western) Tree Farm Licence (TFL) 6 VRI Phase II program. In March 2006, Guillaume Thérien, *PhD* of Timberline Natural Resource Group Ltd. (Timberline) assisted Dave by completing statistical analysis of the data and developing preliminary adjustment factors for TFL 6.[1] Patrick Bryant, *RPF* of Western approached Timberline in March 2008 seeking to update the inventory with NVAF data, readjust the inventory according to the most current VRI statistical adjustment standards (i.e. only adjust polygons greater than 30 years), and to document the adjustment results.

1.2 Project Objectives

The objective of this project was to complete a statistical adjustment of the TFL 6 Phase I VRI to the most recent MFR standards using Phase II and NVAF data and report on the results.[2]

1.3 Terms of Reference

Timberline prepared this report for Patrick Bryant of Western. Stephanie Ewen, *RPF* was the lead analyst and prepared the report. Technical support was provided by Guillaume Thérien and the project manager was Hamish Robertson, *RPF*. This report will be provided to the MFR Forest Analysis and Inventory Branch (FAIB) for review and comment prior to its use in TSR.

[1] J.S. Thrower & Associates Ltd. 2005 Contract for Western Forest Products Ltd. (Project no. WPC-006).

[2] This analysis was completed in the spring of 2008 using VDYP (version 6.6d).

2.0 DATA

2.1 Landbase

TFL 6 covers 205,839 ha in the northern portion of Vancouver Island (Figure 2). The TFL is administered by the North Island – Central Coast Forest District, which is part of the Coast Forest Region. TFL 6 is predominantly within the Coastal Western Hemlock biogeoclimatic zone. Western hemlock (Hw)-leading forests are most common in the TFL; also present are western redcedar (Cw), balsam (Ba), Sitka spruce (Ss), Douglas-fir (Fd) and red alder (Dr).

TFL 6 is bordered by the Kingcome Timber Supply Area (TSA), Strathcona TSA, TFL 39 and Cape Scott Provincial Park. A forest management license covering the TFL area was originally issued in 1950. In 1998, a portion of TFL 25 (Block 4 near Port McNeill) was added to TFL 6.

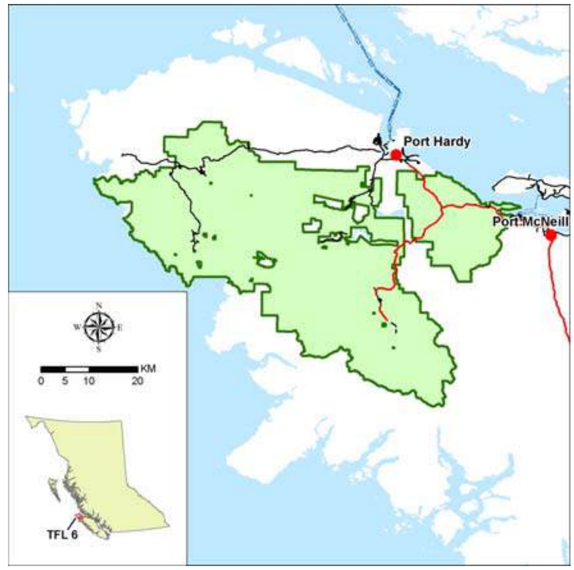

Figure 2: Location of TFL 6

2.2 Target Population

The TFL is 205,839 ha of which 137,688 ha are in the target population (Table 1).[3] The target population is the Vegetated Treed (VT) (BC Landcover Classification Scheme) portion of the TFL over 30 years of age (in 2001), excluding private lands, parks and other officially protected areas. The Phase I data provided the basis of units to be sampled. The main tree species in the target population are Hw (64%) and Cw (23%), reported by area as a leading species.

Table 1: TFL 6 netdown summary

Landclass	Area (ha)	%
Total Area	205,839	100
Leading Species Unknown	6,174	3
Productivity Group Unknown	5,477	2.7
Under 30 Years Old	56,500	27.4
Target Population	***137,688***	***66.9***

[3] The target population was identified from the 2006 Forest Cover database where records existed in the "treelayer" table, an age (at time of sampling) in the inventory ≥ 30 years, a populated leading species attribute (spp1), and a populated productivity group (prod_group) with a value ≤ 4. The assumption is made that all private lands, parks and other officially protected areas were excluded from the total area of the TFL in the initial GIS data.

2.3 Stratification

2.3.1 Area

The Phase I population was stratified based on age class (Table 2). “Young” stands were established after 1861 (< 140 years in 2001), while “Old” stands were established in or before 1861 (≥ 140 years in 2001). Each strata was sub-stratified into species groups based on Phase I leading species.[4]

Adjustment ratios were calculated at the strata level. Sub-strata were used to distribute samples.

Table 2: TFL 6 stratification summary

Stratum	Sub-Stratum	Area (ha)	% Pop.	% Stratum
Young	Hw	52,969	38.5	87.6
Young	Cw	7,472	5.4	12.4
Young	*Total*	*60,441*	*43.9*	*100*
Old	Hw	42,054	30.5	54.4
Old	Cw	35,193	25.6	45.6
Old	*Total*	*77,247*	*56.1*	*100*
Total	***Total***	***137,688***	***100***	

2.3.2 Phase I (Photo-Interpretation) Inventory Statistics

Overall average net merchantable volume (17.5 cm utilization) in the unadjusted Phase I population was 507.7 m^3/ha as projected to 2001 (Table 3). Average site index (SI) was approximately 26 m and 15 m in the “Young” and “Old” strata, respectively. Average age was approximately 59 years and 285 years for the “Young” and “Old” strata, respectively.

Table 3: Unadjusted inventory statistics for the TFL 6 target population

Stratum	Area (ha)	Mean Age (yrs)	Mean Height (m)	Mean SI (m)	Mean Vol. 17.5cm+ (m^3/ha)
Young	60,441	59	25.4	25.5	382.3
Old	77,247	285	35.0	15.2	605.8
Total	***137,688***	***186***	***30.8***	***19.7***	***507.7***

Note: Phase I (photo-interpretation) volume is net merchantable volume as predicted from VDYP version 6.6d.

[4] The “Cw” species group includes stands that are Cw, Yc (yellow cedar), Dr (red alder), Pl (shore pine), Pw (white pine) or Ac (black cottonwood) leading. The “Hw” species group includes stands that are Hw, Ss, Ba, Hm (mountain hemlock), or Fd (Douglas-fir) leading.

2.4 Phase II (Ground Sampling)

2.4.1 Actual Sample Size

One hundred (100) plots were intended to be established in TFL 6.[5] Ninety-eight (98) plots were installed after 2 were dropped because they were unsafe.[6] Of the 98 plots, 4 were established outside the initial target population and 14 were located inside the target population, but were less than 30 years of age (Phase I). The total actual sample size was 80 plots (Table 4).

Table 4: Plot distribution by land class

Land Class	n	(%)
Harvested post-2001	3	3.1
Productivity Group Unknown	1	1.0
Under 30 Years Old	14	14.3
Target Population	*80*	*81.6*

The plots covered the entire target population and their distribution is shown in Figure 3.

2.4.2 Sampling Weights

Sampling weights were calculated using the total actual number of plots sampled from within the target population. The sample plan[7] notes that samples were selected at the sub-stratum level, and therefore weights were also calculated at the sub-stratum level (Table 5).

Table 5: Sampling weights for Phase II plots

Stratum	Sub- Stratum	Area (ha)	n	Area/n
Old	Cw	35,192.5	18	1,955.1
Old	Hw	42,054.4	23	1,828.5
Young	Cw	7,472.0	5	1,494.4
Young	Hw	52,969.4	34	1,557.9

[6] Plots 69 and 93 were dropped because they were unsafe.

[7] Western Forest Products Limited. 2001. Tree Farm Licence 6 Quatsino Sound – North Vancouver Island Timber Emphasis VRI Ground Sampling Plan. Unpublished Report, February 2001. 16 pp.

2.4.3 Sample Statistics

The Phase II plot statistics showed that on average, the "Young" stands were 27 m tall, 62 years of age, had a site index of 28 m, and produced approximately 400 m^3/ha of merchantable volume. Conversely, on average, the "Old" stands were 33 m tall, 326 years of age, had a site index of 15 m, and produced approximately 740 m^3/ha (Table 6). In general, the average unadjusted Phase I heights appear similar to the average Phase II heights, and ages appear under-predicted (Table 7). In the "Young" stratum, the site index is under-predicted while volumes are slightly over-predicted. In the "Old" stratum, the site index is slightly over-predicted, while volumes are under-predicted. The Phase I and Phase II data for each sample is provided in Appendix II.

Table 6: Phase II statistics for the TFL 6 samples

Stratum	Sub-Stratum	Height (m)	Height Sample Size (n)	Age (yrs)	Age Sample Size (n)	SI (m)	SI Sample Size (n)	Vol. 17.5cm+ (m^3/ha)	Vol. Sample Size (n)
Young	Cw	29.8	4	67.3	4	28.0	4	242.5	5
Young	Hw	27	32	61.8	30	28.5	30	426.1	34
Young	*Total*	*27.3*	*36*	*62.4*	*34*	*28.4*	*34*	*403.4*	*39*
Old	Cw	23.6	14	370.2	16	10.9	14	589.6	18
Old	Hw	40.8	18	288.2	20	18.5	16	868.7	23
Old	*Total*	*33*	*32*	*326*	*36*	*14.9*	*30*	*741.6*	*41*
Total		***30.5***	***68***	***210.3***	***70***	***20.9***	***64***	***593.1***	***80***

Note: Phase II (ground sampling) volume was whole-stem volume less tops, stumps, NVAF-corrected cruiser-called decay, waste, and breakage.

Table 7: Phase I statistics for the TFL 6 samples

Stratum	Sub-Stratum	Height (m)	Age (yrs)	SI (m)	Vol. 17.5cm+ (m^3/ha)
Young	Cw	28.8	58.8	27.4	345.9
Young	Hw	23.9	55.1	24.8	421.1
Young	*Total*	*24.4*	*55.5*	*25.1*	*411.8*
Old	Cw	26.8	310.8	12.8	416.5
Old	Hw	41	276	17.7	729.1
Old	*Total*	*34.5*	*292.1*	*15.5*	*586.7*
Total		***30.1***	***188.2***	***19.7***	***509.9***

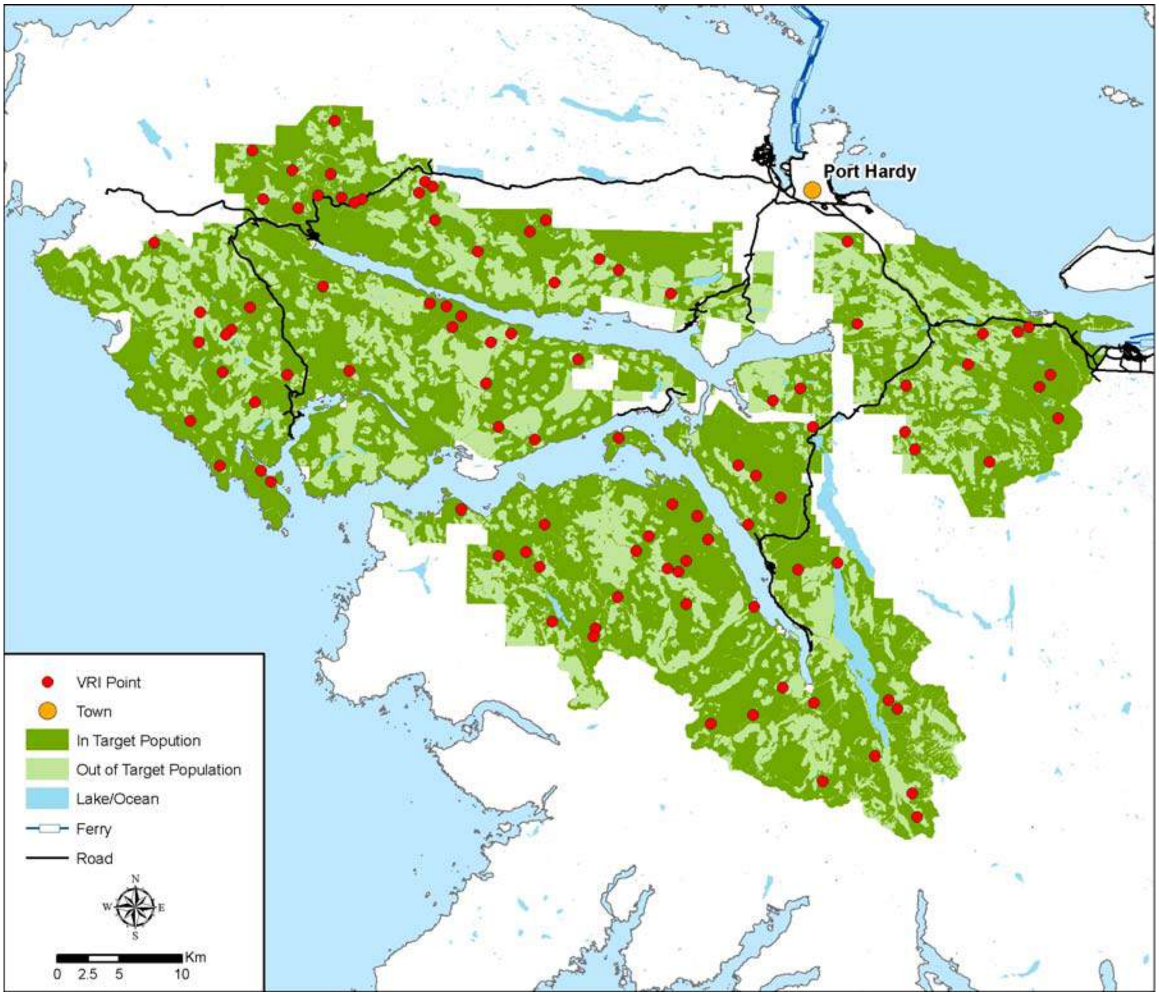

Figure 3: VRI plot locations in the target population for TFL 6

3.0 METHODS

3.1 Unadjusted Phase I Population

The last full-scale inventory completed for TFL 6 was based on photos taken in 1967 and standardized in 1970. The inventory was partially updated for second growth stands in 1998. The Phase I data used in this analysis also includes denudation and regeneration updates up to and including 2004. The photo-interpreted age was projected to 2001[8] by adding or subtracting the required number of years. The photo-interpreted height, stocking class, and corresponding net merchantable volume were projected to 2001 using VDYP *version 6.6d*. All other VDYP inputs (species composition, crown closure, forest inventory zone, and public sustained yield unit) were not modified.

3.2 NVAF

NVAF ratios were generated by Will Smith, MFR and provided to Western for the adjustment analysis (Table 8).[9]

Table 8: NVAF ratios as supplied by Western

Live / Dead	Maturity	Species Group	NVAF Ratio
Live	Immature	All	0.94064
Live	Mature	Cw	1.29029
Live	Mature	Hw	0.94511
Dead	All	All	0.92527

3.3 Phase II Compilation and Data Screening

The Phase II data was compiled using the MFR SAS VRI Phase II compiler (June 27, 2002 version). Dead trees (standing and fallen) were recorded in all auxiliary plots. The received NVAF ratios were then applied to the compiled Phase II volumes. The SAS compiler has built-in error checking and validation routines to identify potential problems in the Phase II field data. No outstanding errors were encountered in the compilation.

3.4 Statistical Adjustment

The most recent MFR VRI statistical adjustment standards[10] were used to adjust height, age, and live net merchantable volume. The MFR adjustment procedures assume that the unadjusted (Phase I) inventory volume is biased due to two sources of error:

[8] 2001 was the year of sampling.

[9] Downloaded from Western's FTP site March 17, 2008.

1. An attribute bias associated with the photo-interpreted height and age; and
2. A model bias inherent to the growth and yield model used to estimate volume (*VDYP version 6.6d*).

Three attributes needed for volume prediction are not directly adjusted in this process. A new stocking class is derived by *VDYP* using adjusted age, while there are no acceptable standards for species composition and crown closure adjustment. Leaving these attributes unadjusted is assumed to create a negligible bias.

The attribute adjustment procedure (Figure 1) is a two-step process called the Fraser method (Figure 4) and is described as follows:

Step 1: Phase I height and age bias are corrected using an adjustment ratio of means (ROM) calculated from the Phase I (height or age) and the Phase II plots. An attribute-adjusted volume is then estimated using VDYP with the adjusted height and age.

Step 2: An adjustment ROM estimated from the attribute-adjusted volume and the NVAF-corrected Phase II volume is calculated, and this ratio is used to correct the model bias in the attribute-adjusted volume.

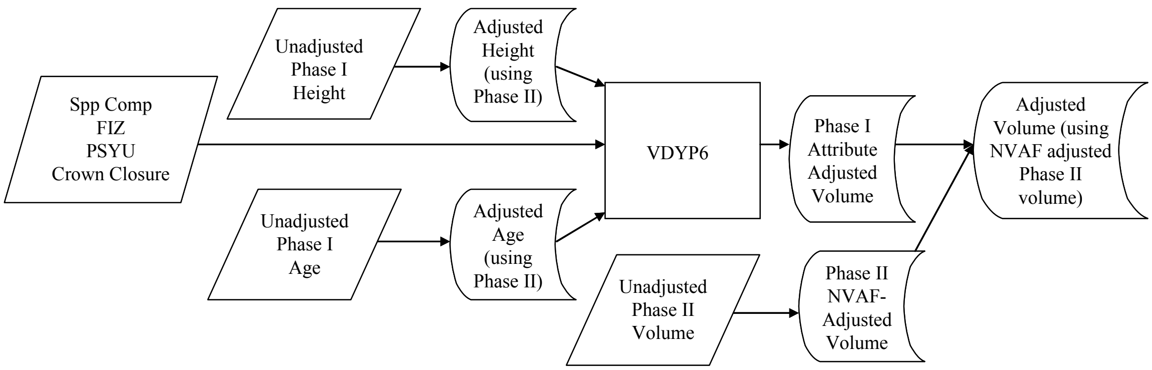

Figure 4: Fraser method

Although the ratios below are shown for each species sub-strata, the adjustment ratios were applied at the strata level that is maturity.

[10] VRI Procedures and Standards for Data Analysis Attribute Adjustment and Implementation of Adjustment in a Corporate Database, Version 2.0, March 2004. The statistical adjustment was completed in May 2008, prior to the release of VDYP7 as a MFR standard.

4.0 RESULTS

4.1 Height

Twelve (12) plots were dropped from the analysis because their top height tree measurements did not match the sample leading species in the inventory, leaving 68 plots for analysis. Of these 68 plots, 36 and 32 plots were in the "Young" and "Old" strata, respectively. On average, inventory height was slightly biased (under-estimation of 1%, Table 9). Inventory height was under-estimated in the "Young" stratum (12%) and over-estimated in the "Old" stratum (5%). The 95% sampling error was 3.9% (Figure 5).

Table 9: Height adjustment statistics for the TFL 6 target population

Stratum	Sub-Stratum	Unadj. Pop.		Sample				Adj. Population		
		Area (ha)	Avg. (m)	n	Phase I (m)	Phase II (m)	ROM	Adj. Avg. (m)	95% E (m)	95% E (%)
Young	Cw	7,472	19.1	4	28.8	29.8	1.036	19.7		
Young	Hw	52,969	26.3	32	23.9	27.0	1.130	29.7		
Young	*Total*	*60,441*	*25.4*	*36*	*24.4*	*27.3*	*1.118*	*28.4*	*1.8*	*6.2*
Old	Cw	35,193	29.6	14	26.8	23.6	0.881	26.1		
Old	Hw	42,054	39.5	18	41.0	40.8	0.994	39.3		
Old	*Total*	*77,247*	*35.0*	*32*	*34.5*	*33.0*	*0.955*	*33.4*	*1.7*	*5.2*
Total	***Total***	***137,688***	***30.8***	***68***			***1.014***	***31.2***	***1.2***	***3.9***

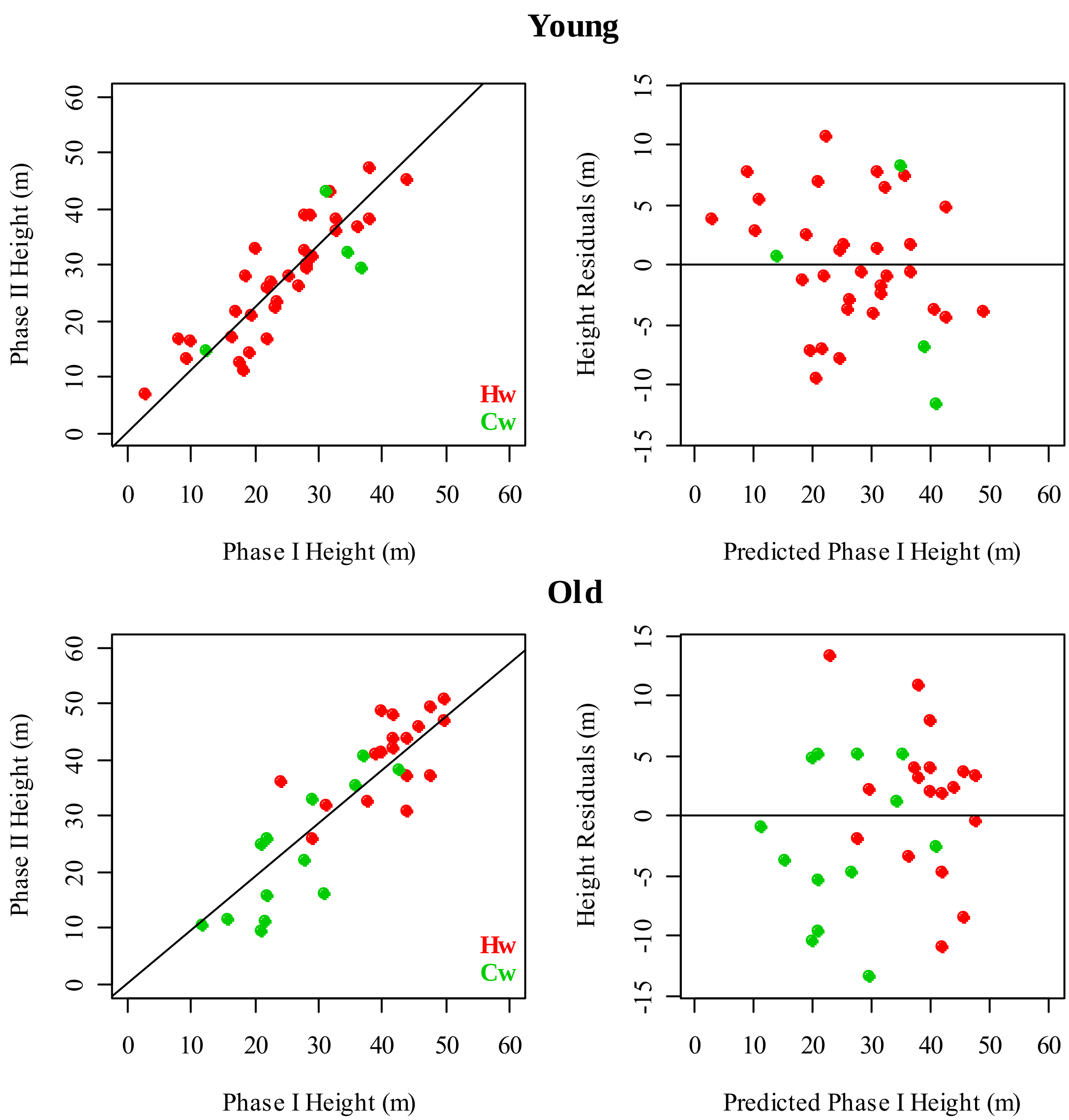

Figure 5: Height scatterplots

4.2 Age

Ten (10) plots were dropped from the analysis because their top height tree measurements did not match the sample leading species in the inventory, leaving 70 plots for analysis. Of these 70 plots, 34 and 36 plots were in the "Young" and "Old" strata, respectively. On average, inventory age was under-estimated by approximately 12% (Table 10). This under-estimation was common to both strata. There is one outlier[11] in the "Old" stratum; however, it only contributes to 1.1% of the sampling error. The 95% sampling error was higher than the sampling error for height (11.2% vs 3.9%). This may be associated with age class mid-pointing in the Phase I age estimation process. Figure 6 shows the same Phase I age estimate for a range of measured Phase II ages in the "Old" stratum.

Table 10: Age adjustment statistics for the TFL 6 target population

Stratum	Sub-Stratum	Unadj. Pop.		Sample			Adj. Population			
		Area (ha)	Avg. (yrs)	n	Phase I (yrs)	Phase II (yrs)	ROM	Adj. Avg. (yrs)	95% E (yrs)	95% E (%)
Young	Cw	7,472	44.2	4	58.8	67.3	1.146	50.7		
Young	Hw	52,969	61.6	30	55.1	61.8	1.121	69.1		
Young	*Total*	*60,441*	*59.5*	*34*	*55.5*	*62.4*	*1.124*	*66.8*	*5.0*	*7.5*
Old	Cw	35,193	310.2	16	310.8	370.2	1.191	369.4		
Old	Hw	42,054	263.8	20	276.0	288.2	1.044	275.5		
Old	*Total*	*77,247*	*284.9*	*36*	*292.1*	*326.0*	*1.116*	*318.1*	*41.9*	*13.2*
Total	***Total***	***137,688***	***186.0***	***70***			***1.117***	***207.8***	***23.2***	***11.2***

[11] Inventory age for the leading species (Yc) was recorded as 161 years old, with a field-observed age of 560 years for the ground leading species (Yc).

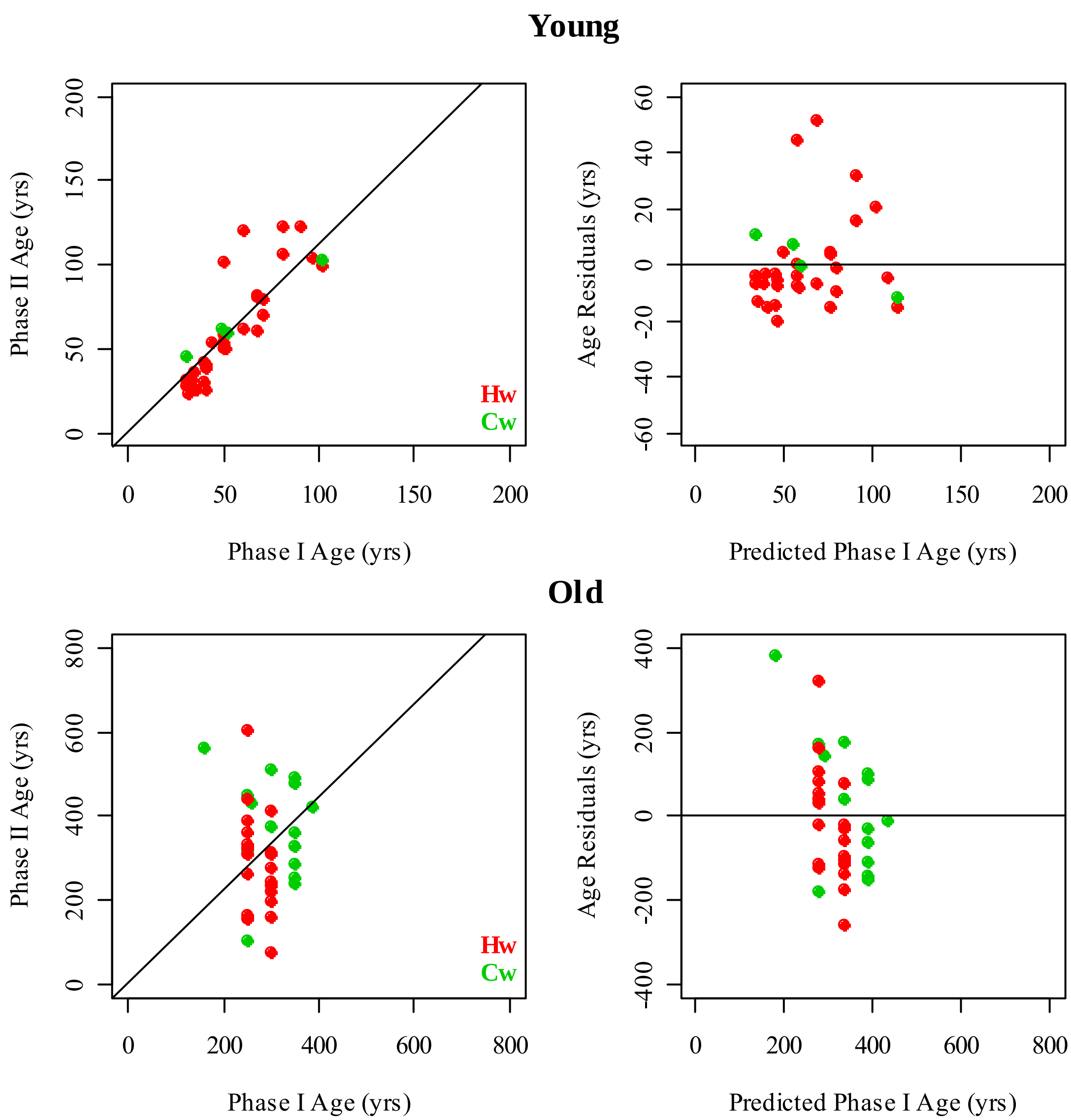

Figure 6: Age scatterplots

4.3 Attribute–Adjusted Volumes for the TFL 6 Target Population

VDYP volumes were re-estimated using the adjusted height and age inputs. Attribute-adjusted volumes increased by 15% and decreased by 9% in the "Young" and "Old" strata, respectively, when compared to the Phase I volumes (Table 11). Overall, volumes increased by 0.5% relative to the unadjusted volumes. The reduced volume in the "Old" stratum reflects a decrease in height averaging 1.6 m (the main driver of volume) and an average age increase of 33 years. The increased volume in the "Young" stratum reflects the increased heights and ages.

Table 11: Volume change in the TFL 6 target population due to attribute adjustments

Stratum	Area (ha)	Unadjusted Inventory	Attribute-Adjusted Inventory	Difference (m)	(%)
Young	60,441	382.3	451.8	69.5	15.4
Old	77,247	605.8	556.3	-49.5	-8.9
Total	***137,688***	***507.7***	***510.4***	***2.7***	***0.5***

4.4 Site Index

Site index is not directly adjusted in the VRI standard statistical adjustment. Instead, an adjusted site index is derived from the adjusted height and age. The average inventory site index decreased by approximately 0.4% after attribute-adjustment (Table 12). The minimal overall change in site index is due to the site index decreasing in the "Old" stratum, while increasing in the "Young" stratum. Site index increased in the "Young" stratum because of the proportionally higher increases in height than age. Similar to the volume changes described in Section 4.3, site index decreased in the "Old" stratum because of increased ages and decreased heights.

Table 12: Site index change due to input attribute adjustment

Stratum	Area (ha)	Site Index (m)	Adj. Site Index (m)	Difference (%)
Young	60,441	25.5	26.2	0.7
Old	77,247	15.2	13.9	-1.3
Total	***137,688***	***19.7***	***19.3***	***-0.4***

4.5 Live Net Merchantable Volume

All Phase II observations were used to compute the volume ratios. The live net merchantable volume increased by 15% after adjustment (Table 13). The target sampling error (10%) was met for the overall target population at the 17.5 cm utilization levels (Figure 7).

Table 13: Live merchantable volume (17.5+ cm) adjustment statistics for the TFL 6 target population

Stratum	Sub-Stratum	Attr.Adj. Vol. Area (ha)	Attr.Adj. Vol. Avg. (m^3/ha)	Sample n	Sample Phase I (m^3/ha)	Sample Phase II (m^3/ha)	ROM	Adj. Population Adj. Avg. (m^3/ha)	Adj. Population 95% E (m^3/ha)	Adj. Population 95% E (%)
Young	Cw	7,472	191.4	5	345.9	242.5	0.701	134.2		
Young	Hw	52,969	488.5	34	421.1	426.1	1.012	494.3		
Young	*Total*	*60,441*	*451.8*	*39*	*411.8*	*403.4*	*0.980*	*442.6*	*68.8*	*15.5*
Old	Cw	35,193	434.5	18	416.5	589.6	1.416	615.1		
Old	Hw	42,054	658.3	23	729.1	868.7	1.191	784.3		
Old	*Total*	*77,247*	*556.3*	*41*	*586.7*	*741.6*	*1.264*	*703.2*	*83.5*	*11.9*
Total	***Total***	***137,688***	***510.4***	***80***			***1.153***	***588.8***	***54.9***	***9.3***

Note: Phase I volume is the attribute-adjusted net merchantable volume as predicted from VDYP version 6.6d using adjusted heights and ages. Phase II volumes have been adjusted with the appropriate NVAF ratios to remove bias from cruiser-called decay values.

4.6 Unadjusted vs. Adjusted Volume

After adjustment, the live inventory volume increased by approximately 14% when compared to the unadjusted inventory for the TFL 6 target population (Table 14).

Table 14: Volume change due to input attribute adjustment

Stratum	Area (ha)	Unadjusted Inventory (m^3/ha)	Adjusted Inventory (m^3/ha)	Difference	(%)
Young	60,441	382.3	442.6	60.4	13.6
Old	77,247	605.8	703.2	97.4	13.9
Total	***137,688***	***507.7***	***588.8***	***81.2***	***13.8***

Note: calculated at the 17.5 cm utilization level

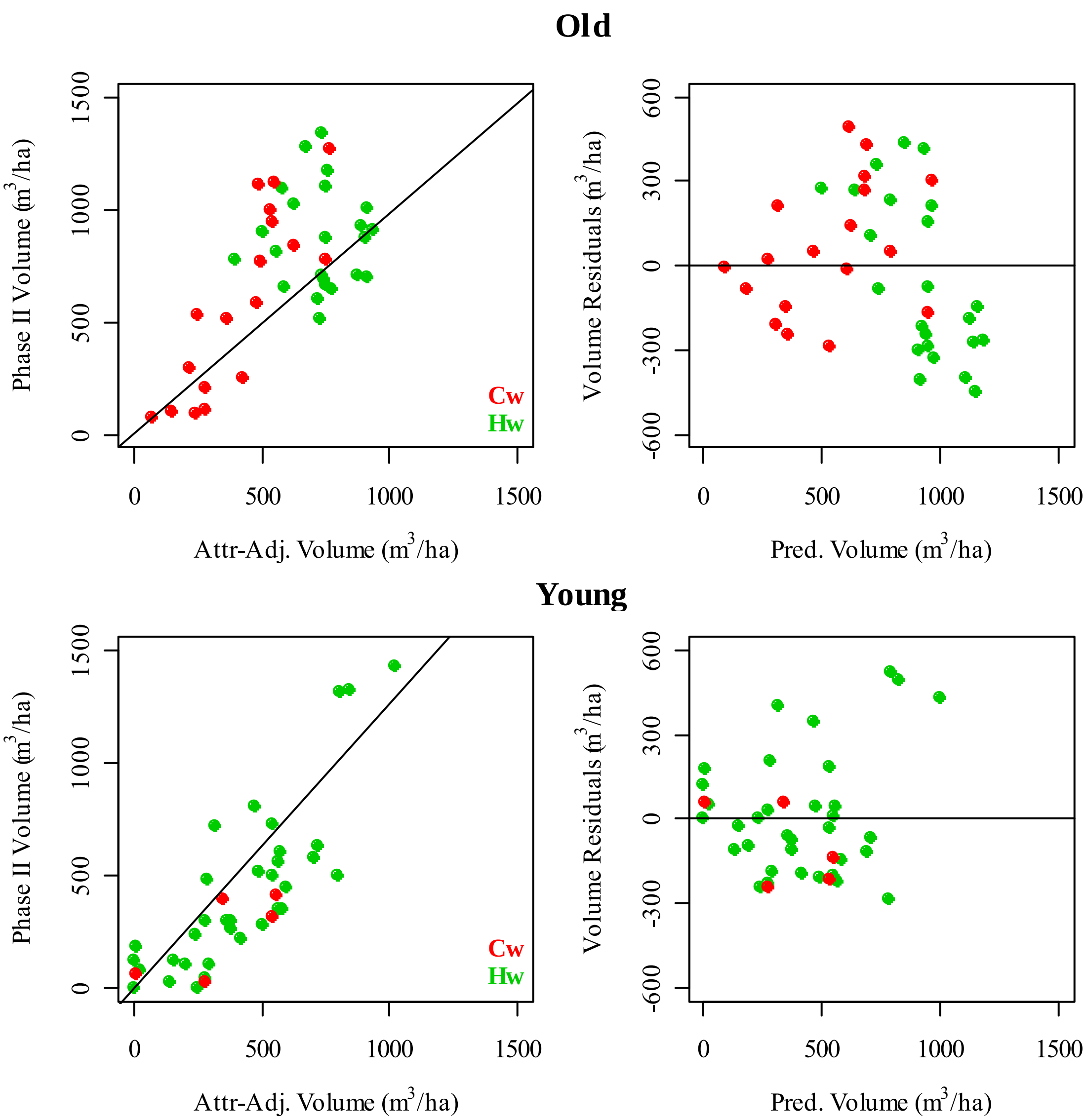

Figure 7: Volume scatterplots (Phase II vs. Attribute-Adjusted Phase I)

5.0 DISCUSSION

5.1 Accuracy and Precision

The inventory adjustment provides unbiased estimates for the TFL 6 target population. This means unbiased estimates at the stratum level. There is always a possibility that local bias exists within a stratum. It would be inappropriate to try to estimate sub-stratum bias given the small sample size provided at a smaller scale.

The MFR-recommended precision for adjusted average volume at the management unit level is a sampling error of ±10% (95% probability). The overall sampling errors achieved in this project were smaller than this target (9.3%, Table 13). This means that the inventory adjustment provides the appropriate level of confidence for timber supply analysis.

5.2 Risks and Uncertainties

5.2.1 Age Trend

The statistical adjustment removes the bias in each stratum. In other inventory programs, age-related trends have existed within the VRI data that have led to concerns in the TSR process. To determine whether this is the case for TFL 6, residual errors for each adjusted attribute were plotted against stand age to identify any age-related trends. None of the attributes of interest showed an age-related trend in the residuals. Volume, the most important attribute, did not show any age-related trend in the residuals.

5.2.2 Age Adjustment

The age adjustment of the "Old" stratum was done using input data where Phase I ages had been mid-pointed (i.e., all stands within a given age class were assigned the appropriate mid-point age). Ages of the "Old" stratum increased by approximately 33 years and reflect the fact that the stands sampled had a higher average age than the mid-points used to represent the age classes. The adjustment process does not allow for ranges to be computed, only for existing ages to be updated. Therefore, the resulting adjusted database will still have a single adjusted age to represent each age class.

6.0 CONCLUSIONS & RECOMMENDATIONS

A statistical adjustment was completed for TFL 6 using standard MFR methodology. Unbiased estimates of height, age, and volume were obtained due to the design of the VRI statistical adjustment methods. These estimates represent the best estimates available at present. Therefore, we recommend that

> *Western apply the adjusted estimates of height, age, and volume in the upcoming TSR.*

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Appendix B TFL 6 Vegetation Resources Inventory Statistical Adjustment 2016

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MEMO

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To: Mike Davis

From: Rueben Schulz

Date: September 9, 2016

Subject: TFL 37 and TFL 6 Inventory Adjustment

Introduction

This document describes the application of a new adjustment, using VDYP 7, for Western Forest Products (WFP) TFL 37 and TFL 6 forest inventories. Both inventories had Phase 2 adjustments completed for them in 2004 and 2009 (respectively). The original inventory adjustments were applied using VDYP 6 and an older adjustment methodology.

The original adjustments are described in the following reports:

- J.S. Thrower & Associates Ltd., Vancouver-Kamloops, BC, June 2004, Tree Farm Licence 37 Vegetation Resources Inventory Statistical Adjustment Version 3.0

- J.S. Thrower & Associates Ltd., Vancouver-Kamloops, BC, June 2004, Tree Farm Licence 37 Net Volume Adjustment Factor Analysis Version 2.0

- Ewen, Stephanie, Timberline Natural Resources Group Ltd., Kamloops, BC, Dec 2009, Western Forest Products Inc. TFL 6 Vegetation Resources Inventory Statistical Adjustment

Both TFLs had take back areas removed and added to the Pacific TSA. During the 2015 TSR for the Pacific TSA, the adjustments for Pacific Block 7 (formerly part of TFL 6) and Pacific Block 8 (formerly in TFL 37) were re-calculated for VDYP 7 and applied to the Pacific TSA inventories and growth and yield curves. Since the re-calculated adjustments used all of the ground plots in the original TFL areas, the new adjustments can also be applied to the TFL inventories.

The re-calculation of the Pacific TSA block 7 and 8 inventory adjustments are described in the following reports:

- Forest Ecosystem Solutions Ltd., April 2015, Pacific TSA Supply Block 8 Vegetation Resources Inventory Statistical Adjustment Version 1.0

- Forest Ecosystem Solutions Ltd., May 2015, Pacific TSA Supply Block 7 Vegetation Resources Inventory Statistical Adjustment Version 1.0

This memo details the application of the new adjustments calculated for the Pacific TSA to the TFL 37 and TFL 6 inventories.

Data

WFP provided original forest inventories for TFL 37 and TFL 6 to apply the adjustment to. The TFL 6 inventory was projected to 2000 and the TFL 37 inventory had a 1996 reference year. Both inventories include take back areas that are no longer part of the TFLs.

Methods

The original VDYP 6 based adjustment had two stages. In the first stage age and height ratios were computed between the inventory and plot values. The inventory stands were then adjusted with these ratios and projected with VDYP 6 to generate an attribute adjusted volume. A volume adjustment ratio (VAF) was then calculated between the attribute adjusted volume and ground volume (NVAF). The application of the linear VAF completed the adjustment.

The new adjustment methodology with VDYP 7 is similar and adds an adjustment for basal area, density and lorey height. Age, height, basal area, and tree density adjustment ratios are calculated between the inventory and plot values. The adjustment factors are applied to the stand inputs and an attribute adjusted output is calculated. Ratios for the VAF and for lorey height are calculated. The main difference with the application of the volume adjustment in VDYP 7 is that it applies the volume and lorey height adjustments internally. Rather than just a linear adjustment, the adjustment is applied at the year plots were measured and then tappers over time.

The application of the new adjustments calculated for the Pacific TSA required the adjustment population and strata for each TFL inventory to be determined. For both TFLs the adjustment was only applied to the rank 1 inventory layer.

TFL 37

The total area of TFL 37 is 190,669 ha, with 163,895 ha having a rank 1 tree species (forested). The adjustment population was the economic and marginally economic, vegetative treed area where the 1996 stand age was greater than or equal to 36 years.

The TSR economic classification was not available; however a TSR dataset with an adjusted inventory was available. The old (>= 36 years in 1996) areas that were not adjusted in the TSR dataset were cut out and rated into the TFL 37 inventory. These uneconomic older areas, and stands younger than 36 years (1996) were excluded from the adjustment population. Additionally, non-productive areas were also excluded from the adjustment, as they were found to be unadjusted in the TSR dataset.

The adjustment population was split into two strata: old and young. The old strata consisted of stands greater than or equal to 300 years (1996), while the young strata comprised stands from 36 to 299 years old. In the original inventory, all stands older than 300 years were assigned an age of 300 years. The old stratum was 71,245 ha and the young stratum was 27,270 ha.

TFL 6

The original TFL 6 adjustment was applied to a 2006 VRI and the adjustment used FOR_PID as the unique link between the adjustment table and inventory. The inventory adjusted here is a 2000 VRI, which lacked a FOR_PID identifier. The 2000 VRI also includes the take back area, which is no longer part of the TFL and was excluded from the 2009 adjustment.

The total area of the 2000 TFL 6 VRI is 287,537 ha, of which 273,407 ha is forested with a rank 1 tree species. The adjustment population was the vegetated portion of the TFL with an age greater than or equal to 30 (in 2001), excluding private lands, parks or other protected areas.

The original adjustment table and a 2006 VRI were used to restrict the adjustment population for the 2000 VRI. The 2006 VRI was rated into the older inventory to provide the FOR_PID link. This excluded the take back, private land, parks and protected areas from the population.

The adjustment population was separated into two strata: the old strata comprised stands greater than or equal to 140 years (2001) and the young strata included stands between 30 and 139 years old (2001). The old stratum was 76,541 ha and the young stratum was 60,120 ha.

Results

TFL 37

The inventory adjustment applied to TFL 37 increased the overall TFL volumes in both 2001 (the base year of the adjustment) and 2016 (Table 1). The adjustment to the old strata increased the volumes, though the increase was reduced by 2016. The slight decrease in the old unadjusted volumes from 2001 to 2016 resulted from VDYP 7 dropping the volume of mature stands as they age. The young strata has a slight downward adjustment in 2001, which is further increased in 2016. Between 2001 and 2016 the young strata gained volume, both adjusted and unadjusted. The upward adjustment to the entire forest was lessened in 2016 by the drop in the adjusted young volumes.

Table 1: TFL 37 average adjusted and un-adjusted volumes (12.5 cm untilization, net decay waste and breakage)

Population	Average 2001 Volume (m^3/ha)		Average 2016 Volume (m^3/ha)		Area (ha)
	Unadjusted	Adjusted	Unadjusted	Adjusted	
Old Strata	683	748	678	702	71,245
Young Strata	493	490	616	575	27,270
Entire Forested VRI	422	450	487	491	163,716

When running the entire forest in VDYP 7, 179 ha of stands failed to run. These stands were too young for VDYP to process and were excluded from the Entire Forested VRI summary.

TFL 6

The adjustment to the TFL 6 inventory increased the average volumes in both 2001 and 2016 (Table 1). Both the old and young strata volumes were adjusted upwards. The slight drop in the old strata volumes between 2001 and 2016 is due to VDYP 7 lowering the volume of old stands as they age. The 2001 adjustment impact is only slightly diluted by 2016.

Table 2: TFL 6 average adjusted and un-adjusted volumes (12.5 cm untilization, net decay waste and breakage)

Population	Average 2001 Volume (m^3/ha)		Average 2016 Volume (m^3/ha)		Area (ha)
	Unadjusted	Adjusted	Unadjusted	Adjusted	
Old Strata	553	660	549	629	76,541
Young Strata	406	463	535	600	60,120
Entire Forested VRI	333	375	383	420	273,407

The 2006 TFL 6 inventory that was originally adjusted included depletions that were young and therefore outside of the adjustment population. In the 2000 TFL 6 inventory, adjusted in this project, these stands were old. Since they were not part of the original adjustment population these older stands remained unadjusted in this analysis. When the 2000 inventory is updated for depletions, these unadjusted older stands will once again be young.

One 30 year old stand in the adjustment population, TL_LINK 17719 (KEYID 851_092L064), failed to run in VDYP 7 and has no adjustment output. This stand is 8.6 ha.

Pacific TSA Supply Block 7

Vegetation Resources Inventory Statistical Adjustment

Version 1.0

May 25, 2015

Prepared by:
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Table of Contents

List of Figures

List of Tables

1 Introduction

As part of the current timber supply review (TSR) for the Pacific TSA, the best available inventory and growth and yield data is being compiled. Supply Block 7 of the Pacific TSA was formerly part of Tree Farm Licence (TFL) 6. The TFL 6 phase 1 inventory that provided the basis for the Supply Block 7 Vegetation Resource Inventory (VRI) was originally completed in 1970 and then regularly updated for denudations and regeneration. The majority of the TFL 6 was re-inventoried in 2000 and further depletion updates were applied up to 2004.

As part of the 2000 re-inventory of TFL 6, an inventory adjustment to Age, Height and Volume (net volume adjustment factor) was completed in 2009. Ninety eight phase 2 ground plots were established in 2001 as part of that statistical adjustment. The original inventory adjustment and sampling was described in the following reports:

- Western Forest Products Inc. TFL 6 Vegetation Resources Inventory Statistical Adjustment, December 2009, Timberline Natural Resource Group Ltd.
- Tree Farm Licence 6: Quatsino Sound – North Vancouver Island Timber Emphasis VRI Ground Sampling Plan, February 2001

The original VRI phase 2 inventory adjustment was completed with VDYP 6. The growth and yield modeling for natural stands for the Pacific TSA TSR will use VDYP 7, the current Ministry of Forests, Lands and Natural Resource Operations (FLNRO) standard. Adjustment procedures for VDYP 7 require adjustment ratios to be calculated for age, height, density, basal area, lorey height and volume. This necessitated a re-calculation of the adjustment ratios so that they could be applied to the Supply Block 7 VRI for the Pacific TSA.

2 Methods

The methodology used for this adjustment was based on the following documents:

- Vegetation Resources Inventory, Interim Procedures and Standards for Statistical Adjustment of Baseline VRI Timber Attributes. Jan 2008
- Procedure for Adjusting VRI Attributes for VDYP7 Projection

Additional help was provided by Sam Otukol and his staff at the Forest Analysis and Inventory Branch (FAIB) of FLNRO.

2.1 Study Area

The Supply Block 7 has a total area of 11,401 ha, of which 11,239 ha is classified as forest management land base (FMLB). The adjustment population was the vegetated treed (BC Landcover Classification) portion of the Supply Block with an age greater than or equal to 30 (in 2001), excluding private lands, parks or other protected areas.

The Supply Block 7 VRI was composed of three sources: former TFL 6 inventory, some depletions and non-forest areas from BC Geospatial Warehouse (BCGW), and another inventory used to fill in some gaps between the new Block 7 boundary and old TFL 6 boundary. The adjustment was only applied to the VRI derived from the former TFL 6 inventory, which covered 10, 821 ha of Supply Block 7 (10,687 ha FMLB). The location of the Pacific TSA Block 7 is shown in Figure 1

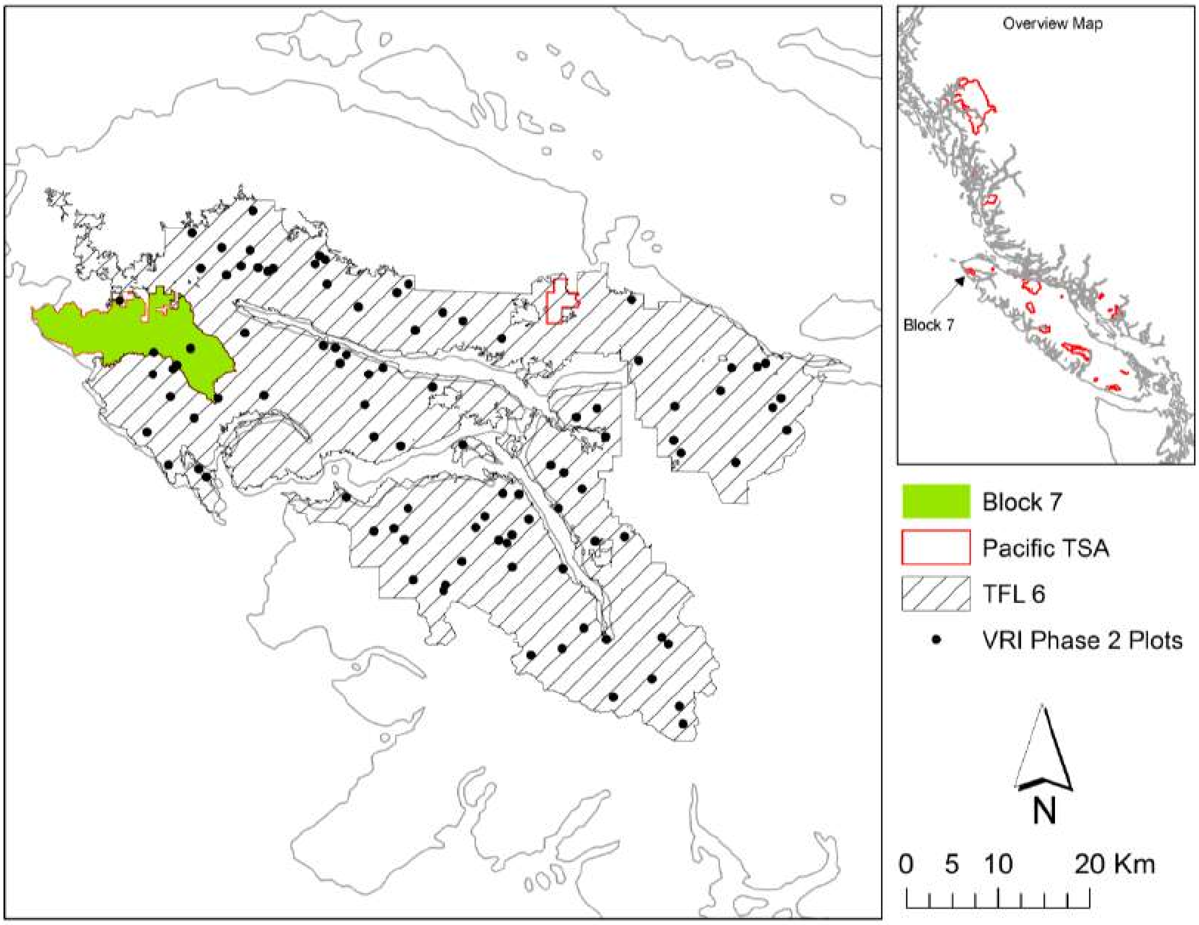

Figure 1: Location of the Pacific TSA Block 7, relative to TFL 6 and phase 2 ground plots.

The adjustment population was separated into two strata. The old strata were stands greater or equal to 140 years (2001) and the young strata included stands from 30 to 139 years old (2001).

The location of private lands and parks that was excluded from the adjustment population was not available, however a table of the previous adjustment that listed all adjusted inventory stands was available. This adjustment table was used to define the adjustment populations and their strata.

The Block7 VRI was updated with recent depletions. These areas were removed from the adjustment population as they are now young.

The Pacific TSA Block 7 VRI areas and adjustment population are described in Table 1.

Table 1: Pacific TSA Block 7 VRI Areas

Description	FMLB Area (ha)	Non-FMLB Area (ha)	Total Area (ha)
Block 7 VRI	11,239	162	11,401
Block 7 VRI Treed	10,879	42	10,922
Block 7 VRI Former TFL 6 inventory	10,687	134	10,821
Block 7 VRI former TFL 6 inventory, treed	10,340	33	10,373
Old Adjustment Strata	4,485	0	4,485
Young Adjustment Strata	1,788	0	1,788

2.2 Ground Sampling Data

Compiled data for the 98, 2001 phase 2 plots was provided by Bob Krahn of FAIB. The plot data contained 81 Timber Emphasis plus CWD plots and 17 Timber Emphasis plots. These plots consisted of a central plot and up to 4 satellite plots. The plot data was compiled to provide stand level values at 4, 7.5, 12.5, 17.5 and 22.5 cm utilization levels.

2.3 VRI Data

Only two of the phase 2 ground plots were located within Supply Block 7 and the rest fell within the current TFL 6 boundary.

Most of the Supply Block 7 VRI consisted of a TFL 6 inventory that had a projection year of 2005. Input VDYP 7 data from FAIB with a 2005 reference year provided the inventory data for these stands. This data only contained one rank 1 layer per stand with age and height data for only the leading species.

An inventory projected to 2006 was provided by Western Forest Products Limited that covered the remaining area of TFL 6. This inventory contained two layers and ages and heights for the leading and secondary species in each layer.

2.4 Plot Matching

The phase 2 plots were linked to the Supply Block 7 and TFL 6 inventories based on their UTM coordinates. A comparison to the adjustment table from the previous adjustment, which recorded the stands that linked to plots, showed that four plots linked to a different stand than in the previous adjustment. An examination of these plots showed that their UTM coordinates published in the previous adjustment were different than the UTM coordinates for plots in the new data. For these four plots, a link was made to the same inventory stand as in the previous adjustment.

Three plots where located in stands where the second layer was rank 1 and the plot was linked to layer 2.

Of the 98 plots, 14 were located in young stands (< 30 years old in 2001) and were excluded for being outside the adjustment population. A further four plots were located outside the target population and also excluded. After these exclusions, there were 80 plots left to use for the adjustment.

After the plots were linked, the match between the plot leading species and the inventory stand species was examined. Fifty nine of the plots matched the leading inventory species and were linked to the leading species age and height. Fifteen plots matched the secondary species of the inventory stands and were linked to the secondary species age and height. Finally, six plots had a leading species that did not match the leading or secondary species of the inventory stand. However, as all of these plots and the remaining inventory stands had a coniferous leading species, the plots were linked to the inventory using the plot leading conifer and the leading conifer in the inventory

2.5 Statistical Adjustment

The adjustment calculation involved the following steps:

1. Project the original 2005/2006 inventory stands with VDYP 7 to 2001 to match the ground plot date.
2. Project the inventory secondary species ages and heights with SiteTools to 2001 for the 15 inventory stands where the plot leading species matched the inventory secondary species.

3. Calculate adjustment ratios between the projected 2001 inventory values and phase 2 plot values for age, height, density and basal area
4. Apply the adjustment ratios to the 2001 age, height, density and basal area and project these values (at both 7.5cm and 12.5cm utilization levels) with VDYP 7 to produce attribute adjusted volumes (7.5cm and 12.5cm utilization levels) and lorey height (7.5cm utilization level).
5. Calculate adjustment ratios between the attribute adjusted volume and lorey height and the Net Volume Adjusted Factor (NVAF) plot volume and lorey height.
6. Project the Supply Block 7 inventory using the adjusted 2001 age, height, density and basal area. The adjustment ratios were applied to the volumes and lorey height; these adjusted values were included as inputs to VDYP 7, which applied the volume adjustment to the output.

The BEC zone used in the VDYP7 projections came from the two sources. Projections of the stands linked to plots used the BEC zone value from the plot data. The final application of the adjustment to the Supply Block 7 VRI used the BEC zone from the VRI.

Detailed adjustment procedures are provided in an Appendix at the end of this document.

3 Results

Of the 80 inventory plots established within the adjustment population for the original adjustment, 76 had ages and 74 had tree heights.

Table 2 details the statistics for the age, height, density, basal area, lorey height and volume adjustment. The phase 1 inventory underestimated the stand age slightly. The height was slightly overestimated in the old strata and underestimated in the young strata.

Table 2: Table of adjustment values

Attribute	*Stratum*	*n*	*Mean weighted Phase II value, by stratum*	*Mean weighted Phase I value, by stratum*	*Ratio of means adjustment factors*	*Sampling error %*
Age of 1st sp	Old	37	309.4	288.9	1.0708	14.1%
	Young	39	59.7	57.2	1.0450	14.1%
Height of 1st sp	Old	35	32.4	34.3	0.9465	8.0%
	Young	39	26.6	24.9	1.0662	8.2%
Trees/ha @7.5cm+ dbh	Old	41	619.8	343.0	1.8070	27.0%
	Young	35	1,101.8	847.5	1.3001	25.1%
Basal area/ha @7.5cm+ dbh	Old	41	70.6	68.2	1.0345	10.5%
	Young	35	52.7	46.9	1.1235	12.3%
Lorey height @7.5cm+ dbh	Old	41	29.6	30.3	0.9782	8.9%
	Young	38	23.5	23.3	1.0101	8.4%
Volume/ha net top, stump, decay & waste @12.5cm+ dbh	Old	41	783.2	669.6	1.1697	14.1%
	Young	38	452.4	478.6	0.9453	15.7%

Figure 2 to Figure 7 provide scatter graphs of the phase 1 inventory and phase 2 plot values for each stratum.

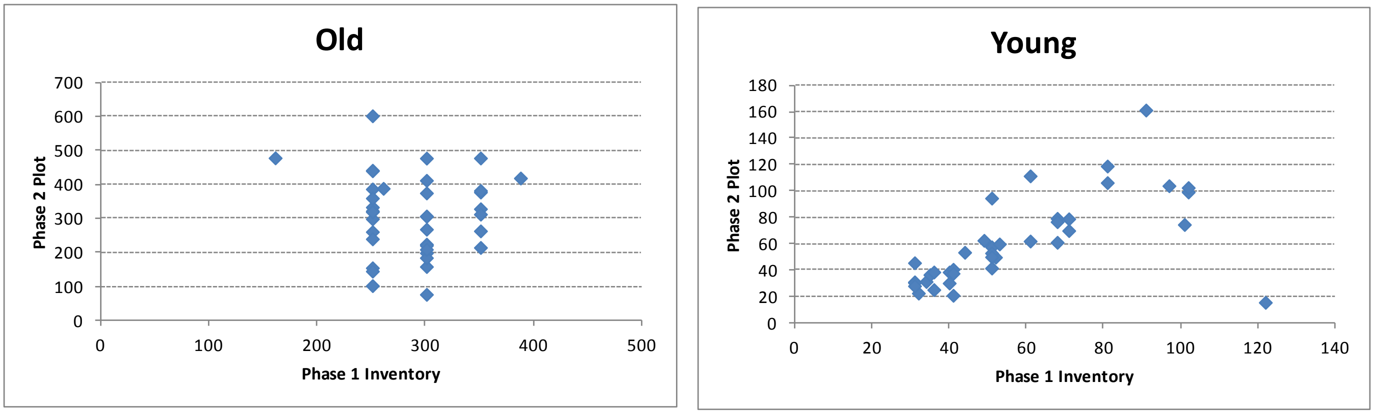

Figure 2: Phase 2 vs. Phase 1 age (yrs), by stratum.

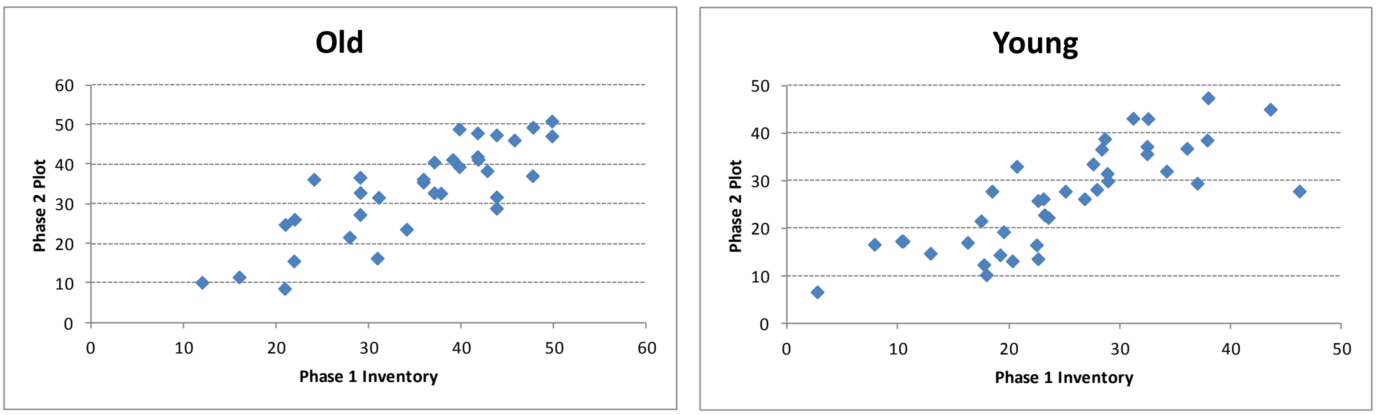

Figure 3: Phase 2 vs. Phase 1 height (m), by stratum.

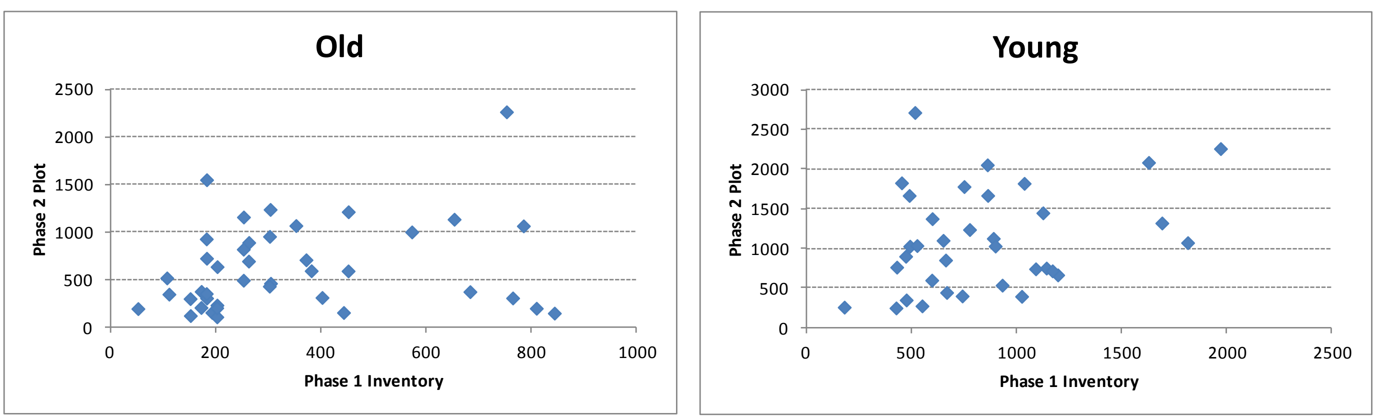

Figure 4: Phase 2 vs. Phase 1 density (stems/ha), by stratum.

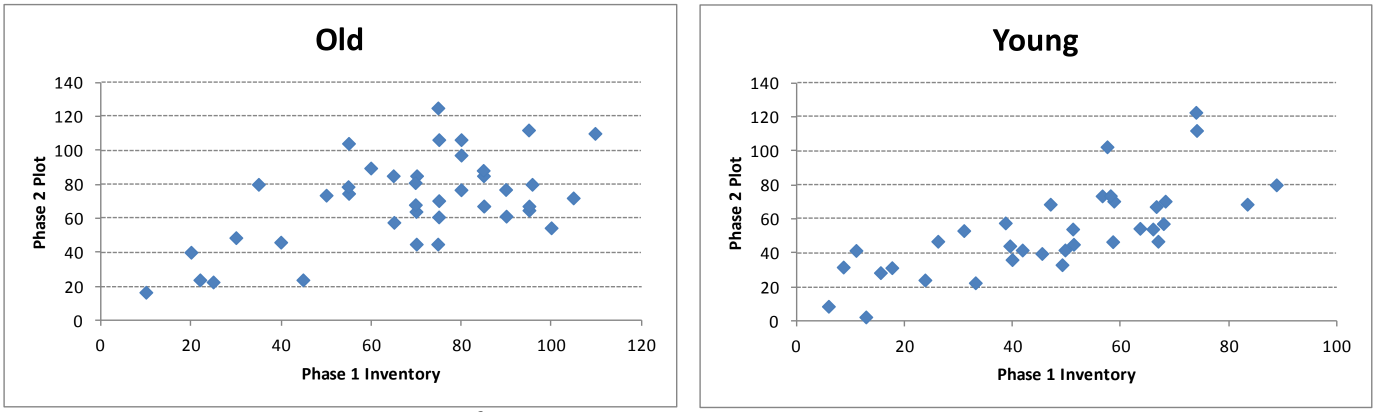

Figure 5: Phase 2 vs. Phase 1 basal area (m^2/ha), by stratum.

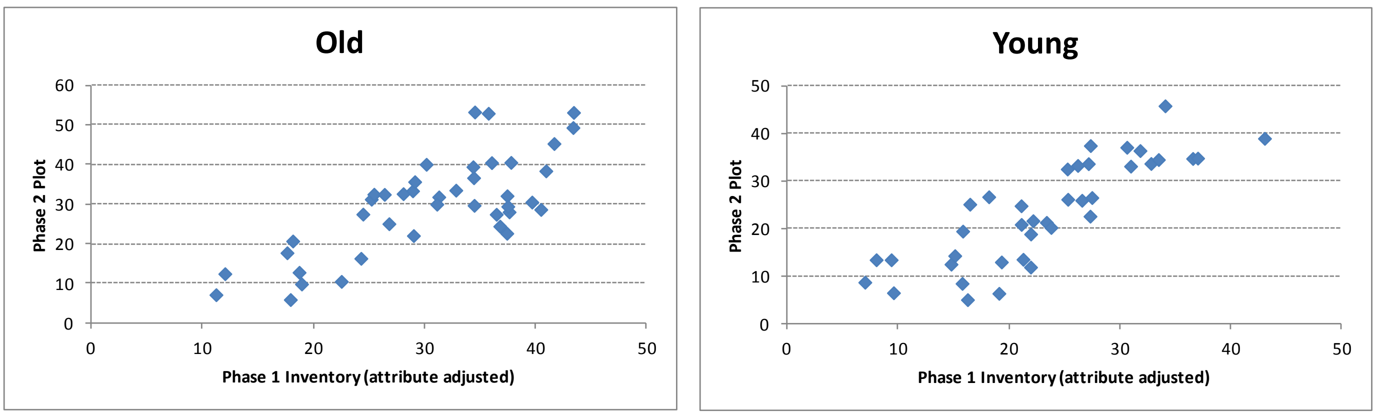

Figure 6: Phase 2 vs. Phase 1 (attribute adjusted) lorey height (m), by stratum.

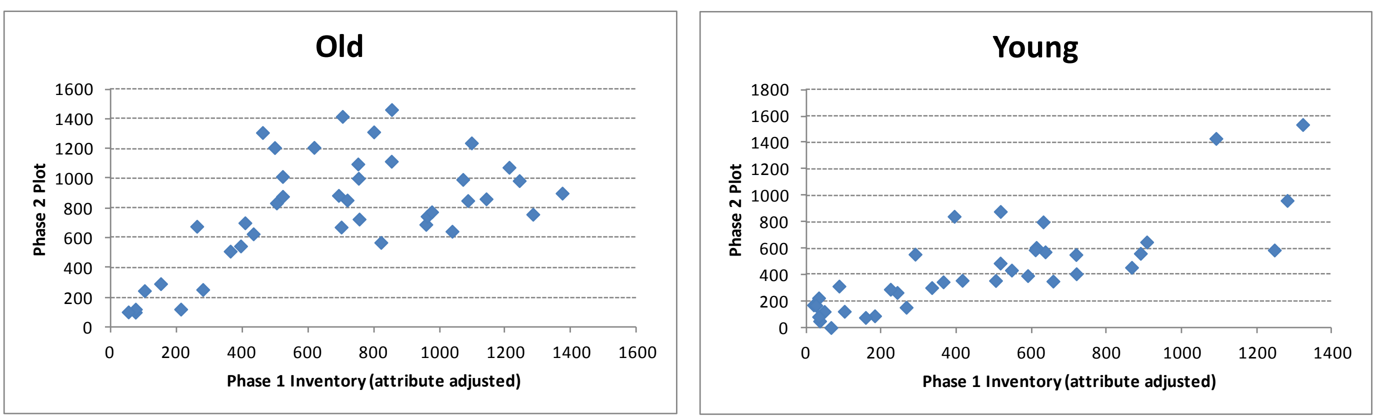

Figure 7: Phase 2 NVAF vs. Phase 1 (attribute adjusted) close utilization decay and waste volume (m^3/ha), by stratum.

The inventory adjustment increases the overall Supply Block 7 VRI volumes, as seen in Table 3 and

Population	**Average 2001 Volume (m^3/ha)**		**Average 2014 Volume (m^3/ha)**		**Area (ha)**
	Unadjusted	**Adjusted**	**Unadjusted**	**Adjusted**	
Old Strata	669	808	667	775	4,485
Young Strata	355	406	446	506	1,788
Entire VRI (updated with depletions)	405	470	436	490	10,922

Table 4. The increase comes from the upward adjustment to both the young and old strata. The slight downward volume adjustment to the young stratum was offset by an increase to stand height (and site index).

The largest impact of the adjustment is to the 2001 reference year. As the inventory is projected farther from the reference year (2014), the adjustment effect is diluted. Also, the projected volume of old stands in VDYP 7 drops slightly over time, which further leads to a slight decrease in old stratum volumes.

Table 3: Block 7 VRI average adjusted and un-adjusted volume (12.5 cm utilization, decay waste and breakage)

Population	**Average 2001 Volume (m^3/ha)**		**Average 2014 Volume (m^3/ha)**		**Area (ha)**
	Unadjusted	**Adjusted**	**Unadjusted**	**Adjusted**	
Old Strata	669	808	667	775	4,485
Young Strata	355	406	446	506	1,788
Entire VRI (updated with depletions)	405	470	436	490	10,922

Table 4: Block 7 VRI average adjusted and un-adjusted volume, FMLB only (12.5 cm utilization, decay waste and breakage)

Population	**Average 2001 Volume (m^3/ha)**		**Average 2014 Volume (m^3/ha)**		**Area (ha)**
	Unadjusted	**Adjusted**	**Unadjusted**	**Adjusted**	
Old Strata	669	808	667	775	4,485
Young Strata	355	406	446	506	1,788
Entire VRI (updated with depletions)	407	472	437	490	10,879

4 Discussion

There were a few differences between this adjustment and the previous 2009 adjustment.

The original adjustment excluded plots where the plot leading species did not match the leading or secondary species in the inventory stand (conifer/deciduous rule). This resulted in the original adjustment only using 68 plots for the height adjustment and 70 plots for the age adjustment. The six plots that only matched the inventory species at the coniferous level were included in this adjustment calculation.

A comparison of the phase 2 plot ages and heights, published in the original adjustment, showed that they are slightly different from the plot ages and heights used in this adjustment. This difference likely resulted from the plot data being compiled in a different manner than in the original adjustment.

The different number of plots used and different compilation of plots resulted in slightly different age and height adjustment ratios for this adjustment compared to the original adjustment. The basal area, trees per ha, and lorey height adjustment ratios were not part of the original adjustment done with VDYP 6 and therefore cannot be compared. The volume ratio in this adjustment was also different from the original adjustment, but they cannot be directly compared due to the change from VDYP 6 to VDYP 7.

The adjusted inventory values provide an unbiased estimate of the inventory attributes and volumes for the Supply Block 7 VRI and should be used in the preparation of growth and yield curves for the Pacific TSA TSR analysis.

Appendix: Detailed Methodology

The following procedure describes re-calculating the adjustment for TFL 6 and applying it to the inventory. The original adjustment was done for VDYP 6.

1) Obtained plot data from FLNRO. The data was in TFL6_VRIgroundData.xlsx and contained 4 worksheets:

- Samples – includes plot locations
- SMY_NCS – compiled plot data by species for 5 utilization levels (4, 7.5, 12.5, 17.5, and 22.5)
- SMY_NC - compiled plot data for 5 utilization levels (4, 7.5, 12.5, 17.5, and 22.5).
- Data_dictionary

The 98 plots include (separated by TYPE_CD): Timber Emphasis + CWD (D01) and Timber Emphasis (Q01) plots. Additionally the data contained 20 Net Volume Adjustment (N01) plots which we did not use.

Each plot included 4 satellite plots (total of 5). A call was made on the ground to determine which 4 satellite plots were within the inventory stand (some were in neighbouring stands). Outside plots were excluded.

The data has already been compiled to give per ha plot information (and the NVAF was applied). The following fields were required:

- CLSTR_ID - unique ID
- TYPE_CD - plot type (D01 was used)
- UTIL
- BGC_ZONE – BEC Zone
- SPB_CPCT – species composition – used for matching plots to inventory stands
- BA_HA - basal area live
- STEMS_HA - density live
- HT_MEAN1 - weighted mean ht (incl. broken top) - used for Lorey Ht adjustment
- HT_M_TLS - mean height of top, site, and second spp site height trees (T,L,S).
- AT_M_TLS - mean age of (T,L,S trees)
- NVL_NW2 - NVAF * Whole stem vol/ha less Top, Stump, Cruiser Decay and Waste (live)

2) Plots were linked to an original 2006 TFL 6 inventory and the supply block 7. Points were created from the UTM coordinates data and intersected with the inventories.

A list of inventory stands that linked to plots in the previous adjustment was available and showed that four plots linked to different stands than in the previous analysis. An examination of the plot coordinates showed that the plot data had slightly different UTM coordinates than those published in the 2009 adjustment. For consistency with the 2009 adjustment, the plots were linked to the same inventory stands as before.

3) Species attributes were compared to determine if inventory and plot layers match (4 cm utilization).

The result was that:

- 59 plot leading species matched to the inventory species 1
- 15 plot leading species matched to the inventory species 2

- 6 plots had a leading species that did not match inventory species 1 or 2 but the plots and inventory did match at the conif/decid level.

All plots linked to the rank 1 layer of the inventory. The block 7 VRI only had one rank 1 layer, but the TFL 6 inventory had up to two layers, and in three cases the second layer was the rank 1 layer.

Of the 98 plots, 14 were in young stands and a further 4 were in stands outside the target population. This left 80 plots for the adjustment.

Six plots were lacking height data and could not be included in the height ROM calculation, while 4 plots lacked age information and were not included in the age ROM.

The original adjustment stated that 12 plots did not have height information and 10 did not have age information. Most likely the 2009 analysis excluded the 6 plots that had a leading species that did not match the species 1 or 2 in the inventory. This adjustment is using different procedures and included these 6 plots.

4) Inventory is 2005/2006 and plots were measured in 2001. First the inventory needs to be projected to 2001 so it can be properly compared to the plots (also missing SPH and BA needs to be filled in by the VDYP7 FIP module).

The inventory values for the 80 plots were inserted into a VDYP 7 input template. Inv_Standard_Cd of "F" was used since the inventory is closer to an FC1 (with BA added) than a VRI. Reference year was 2005/2006.

BEC Zone was taken from the BEC Zone of the phase 2 plots.

This input file was run in VDYP 7 ("Step 1") at a 7.5 cm utilization. Multiple years (2001-2015) were run but only 2001 is needed.

Four plots in the young strata were too young/small for VDYP 7 to project. While they had age and dominant height generated, there was no basal area, density or volume for them.

5) 15 of the plots that linked to the second inventory species required the second species age and height in 2001 to compare the plot values to.

These stands had the site index of the second species calculated in SiteTools from the age and height of the second species at the stands reference year. The second species site index was then used to generate the height at the age in 2001.

6) Compute Age, Height, Basal Area, and SPH adjustment ratios.

There were two strata: young (30 to 139 yrs) and old (140 yrs +).

Adjustment ratio of means (ROM) were calculated for each strata between:

- 2001 inventory (VDYP 7) age and plot AT_M_TLS
- 2001 inventory (VDYP 7) PRJ_DOM_HT(7.5) and plot HT_M_TLS(7.5).
- 2001 inventory (VDYP 7) PRJ_BA(7.5) and plot BA_HA(7.5)
- 2001 inventory (VDYP 7) PRJ_TPH(7.5) and plot STEMS(7.5)

For the 15 stands linking to the inventories second species, the second species age and height was used instead of the VDYP 7 projected stand age and height.

The Ministry Excel Marco VRI Analysis1_Original.xlsm was used to calculate sampling error.

Sample weights were provided for each plot and were input into the adjustment spreadsheet.

7) Calculate attribute adjusted volumes (and Lorey Ht).

VDYP 7 was run a second time ("Step 2") with the same species composition and other fields, however the age, height, basal area and stems/ha (output from the "step 1" run) were adjusted using the calculated adjustment ratios. The Inv_Standard_Cd was set to "V" so that VDYP will use the basal area and SPH. The reference year was set to 2001.

The 4 young stands that lacked basal area and density from the “Step 1” output were run with a null basal area and density. VDYP 7 estimated BA and SPH for these stands. With the age and height adjustment, 3 of these young stands were now big enough for VDYP 7 to generate a basal area, sph, lorey height and volume.

VDYP 7 output is needed at both 7.5 and 12.5 cm utilizations (same input file is run twice with different util parameters).

8) Calculate volume and lorey height adjustment ratios.

Adjustment ratios for each strata were calculated between:

- Inventory (VDYP 7 Step 2) PRJ_LOREY_HT(7.5) and plot HT_MEAN1(7.5)
- Inventory (VDYP 7 Step 2) PRJ_VOL_DW(12.5) and plot NVL_NW2 (12.5)

The lorey height ROM is used to adjust the lorey height, while the same volume ROM gets applied to WSV7.5, WSV12.5, CUV12.5, VOL_NET_D12.5, and VOL_NET_DW12.5.

9) Calculate final adjusted volumes ("Step 3")

The same "Step 2" VDYP input file is run (which has adjusted age, ht, BA, sph), but the following fields are also filled in:

- R1_ADJ_INPUT_ID - id based on strata (must be non null)
- R1_LOREY_HEIGHT - adjusted PRJ_LOREY_HT (7.5)
- R1_BASAL_AREA_125 - **un**adjusted PRJ_BA (12.5)
- R1_VOL_PER_HA_75 - adjusted PRJ_VOL_WS (7.5)
- R1_VOL_PER_HA_125 - adjusted PRJ_VOL_WS (12.5)
- R1_CLOSE_UTIL_VOL_125 - adjusted PRJ_VOL_CU (12.5)
- R1_CLOSE_UTIL_DECAY_VOL_125 - adjusted PRJ_VOL_D (12.5)
- R1_CLOSE_UTIL_WASTE_VOL_125 - adjusted PRJ_VOL_DW (12.5)

The above values came from the "Step 2" output multiplied by the adjustment ROM.

When this input is run in VDYP 7, it will use the adjusted lorey height and volumes to apply a final volume adjustmet to the output values.

10) Apply the final adjustment to the supply block 7 inventory. Only the portions of the supply block that consisted of VRI from the TFL 6 inventory were adjusted.

The same steps need to be done:

a) project inventory to 2001 ("Step 1")

b) apply calculated age, height, BA, sph ROM to 2001 values and re-run VDYP to generate attribute adjusted values ("Step 2").

c) apply calculated lorey ht and volume ROM to attribute adjusted lorey ht and volumes. Input these as adjusted values and re-run VDYP to generate final adjusted volumes ("Step 3").

The adjustment population and strata was determined by linking the supply block 7 VRI to the adjustment table from the 2009 adjustment. This table already excluded private lands and parks which were outside of the adjustment population.

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Appendix C Hydrologic Recovery Method Review

Applying hydrologic recovery curves in coastal BC watersheds

Hydrologic recovery means the extent to which a regenerating forest stand compares to a reference stand (typically old growth) with respect to rainfall interception, snowpack development and ablation. TR032[1] presents the current method in the scientific literature for estimating hydrologic recovery in coastal watersheds. TR032 provides a suite of recovery curves for different kinds of runoff events. For most purposes in coastal BC watersheds, it is suggested to assume a rain-on-snow event for the full elevation range of a watershed for tracking hydrologic recovery and equivalent clearcut area (ECA) and applying the R1b recovery curve using a threshold T=3 m (lower elevations or drier climate zones) or T=4 m (higher elevations or wetter climate zones).

	R1b rain-on-snow	
Stand ht, m	R % T=3 m	R % T=4 m
1	0	0
2	0	0
3	0	0
4	11	0
5	24	11
6	35	24
7	45	35
8	54	45
9	62	54
10	68	62
11	73	68
12	78	73
13	81	78
14	85	81
15	87	85
16	89	87
17	91	89
18	93	91
19	94	93
20	95	94
21	96	95
22	97	96
23	97	97
24	98	97
25	98	98
26	98	98
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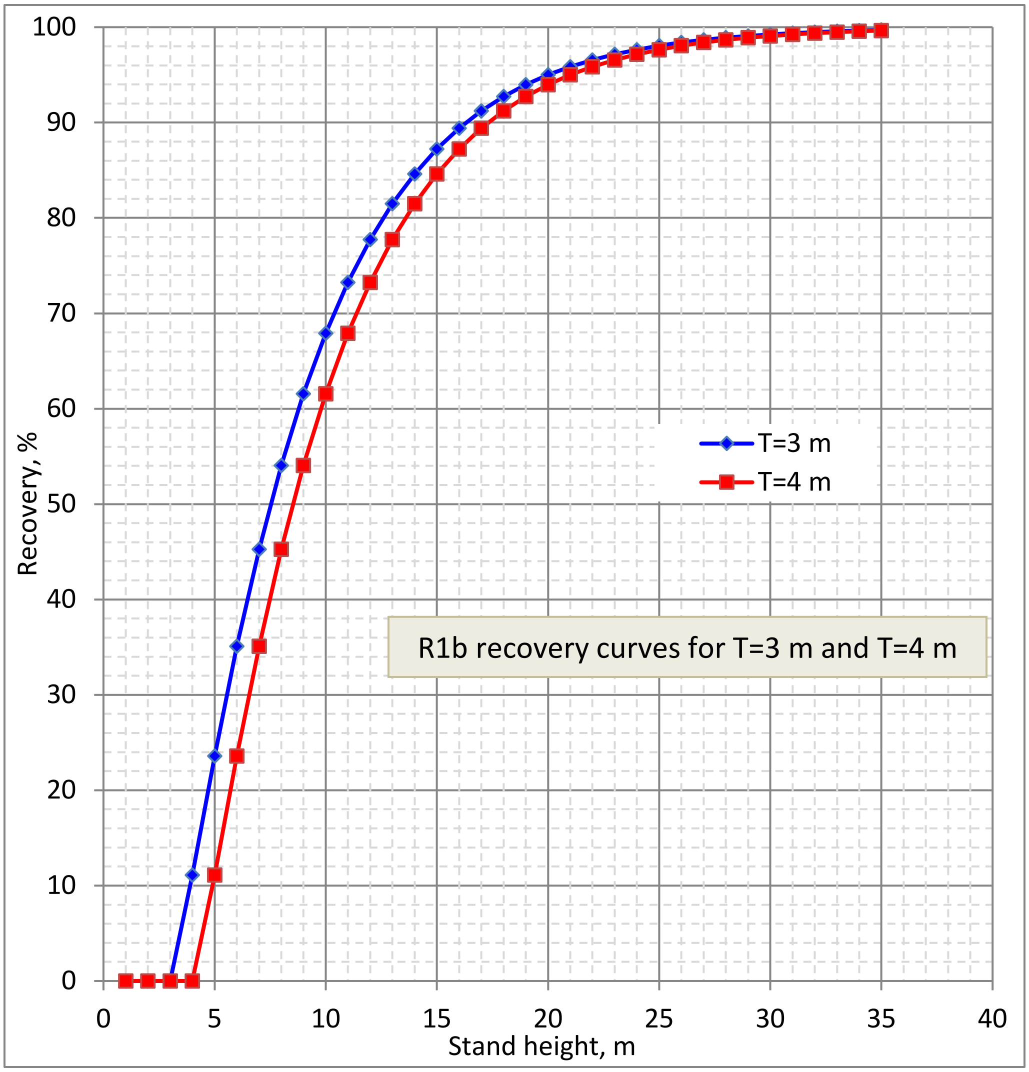
31	99	99
32	99	99
33	100	99
34	100	100



R1b recovery curve:
$R=100(1-e^{-0.189(Ht-T)})^{1.25}$

R=hydrologic recovery in percent
Ht=stand height in metres
T= tree height threshold in metres

[1]Hudson,R.,and G.Horel. 2007. An operational method of assessing hydrologic recovery for Vancouver Island and south coastal BC. Res. Sec., Coast For.Reg., BC Min. For., Nanaimo, BC. Technical Report TR-032/2007.

Regenerating stands from harvested cutblocks are represented spatially as polygons in the forest cover layer.

After hydrologic recovery R has been determined for each regenerating stand using the above recovery equations, equivalent clearcut area (ECA) is then determined for each regen stand as follows:

$$ECA = A(1-R/100)$$

Where:
ECA = equivalent cut area in ha
A = area of regen stand in ha
R = hydrologic recovery in percent

ECA for the zone of interest is then determined by summing the ECA's for the regen stands and dividing by the total area of the zone.

Explanatory notes

The zone of interest depends on the purpose for tracking ECA. Purposes can include:

- indicator of potential for stream flow change resulting from harvesting, wildfire or forest mortality (e.g., beetle kill)
- monitoring the disturbance footprint in a particular zone (e.g., upland forest in land use orders)
- constraining harvesting in zones with specific sensitivities (e.g., combined factors of terrain susceptible to landslides, steep gullied slopes with high rates of runoff, elevations that receive higher precipitation)
- a trigger for conducting a more detailed hydrologic/geomorphic assessment in a watershed unit

Examples of zones for which ECA is often tracked:

- For potential stream flow change from harvesting:
    - Total watershed area
    - Elevation bands within a watershed unit
    - Portions of watershed units more likely to have increased runoff response (e.g., high elevation areas or headwater basins)
- Portions of watershed units with legally constrained harvest (upland forest in land use orders)
- A specific area for which ECA is tracked as a management indicator (e.g., zones of sensitivity)
- Timber harvesting land base (THLB)
- Forest managed land base (FMLB)

Applying hydrologic recovery:

- Hydrologic recovery is not applied to natural stands such as scrub, or non-vegetated sites such as rock slopes or natural non-treed areas such as wetlands.

- Hydrologic recovery is applied to regenerating harvested forested stands, typically those less than 60 years old.

- For forest conditions where no recovery curves have been developed, hydrologic recovery values can be assigned from "best estimates", e.g., for:
    - Stands regenerated to deciduous (alder Dr leading species)
    - Wildfire, windthrow areas, or forest mortality such as beetle-kill with partial standing trees

- Permanent clearings such as roads or hydro rights of way, agricultural lands or other human development are assigned a hydrologic recovery value of 0%. The extent to which these can be distinguished for ECA calculations depends on the level of detail in the mapping.

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