Tree Farm Licence 54

PROPOSED MANAGEMENT PLAN #5

Version 1.1

October 2, 2018

Project 1414-1

Prepared for:

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Forest Management Specialists

Submission Page

Tree Farm Licence 54
Management Plan #5

Licensee: Ma-Mook Natural Resources Limited

This Management Plan #5 was prepared by:

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Forsite Consultants Ltd.

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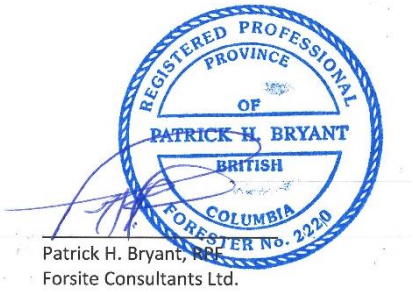

Patrick H. Bryant, RPF
Forsite Consultants Ltd.

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This Management Plan #5 was submitted on behalf of Ma-Mook Natural Resources Limited

Zoltan Schafer, RPF
Forestry Manager, Ma-Mook Natural Resources Limited

Management Plan #5 Approval Letter

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Executive Summary

This is the fifth Management Plan prepared for Tree Farm Licence (TFL) 54 held by Ma-Mook Natural Resources Limited (Ma-Mook). The completed plan meets the requirements of the *Tree Farm Licence Management Plan Regulation* (B.C. Reg. 280/2009) and is comprised of three main components:

- Management Plan that includes a general description of TFL land base, a brief history of the TFL, the title and a description of each of the publicly available planning documents used to guide forest management and operations in the TFL area, and a summary of the public review and First Nations referral process;
- Timber Supply Analysis of the short term and long term availability of timber for harvesting in the TFL area, including the impact of management practices on the availability of timber;
- Information Package includes supporting documentation for the Timber Supply Analysis.

The Management Plan must be approved by the Deputy Chief Forester who also considers the Timber Supply Analysis produced to determine the allowable annual cut (AAC) for this license. In this case, the harvest rate was recommended as area-based (rather than volume-based) to reflect, in part, the recommendations of the Clayoquot Sound Scientific Panel. With an area-based AAC, the actual volume harvested in any given year can vary significantly depending on the stand types and sensitivity of non-timber values located across the landscape.

Set on April 19, 2011, the current AAC for TFL 54 is 315.8 hectares per year. The Timber Supply Analysis for this Management Plan #5 examined the current harvest practices and incorporated new information on inoperable areas, inventory, growth and yield, and other constraints across the landscape, and recommended a single, total harvest planning area – including in-block reserves – of 185.3 hectares per year.

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List of Acronyms

AAC	Allowable Annual Cut
BEC	Biogeoclimatic Ecosystem Classification
CSLUP	Clayoquot Sound Landscape Unit Plan
CWH	Coastal Western Hemlock BEC zone
FLNRORD	BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development
FMA	Forest Management Area
FSP	Forest Stewardship Plan
IHA	Important Harvest Area
MH	Mountain Hemlock BEC zone
RPF	Registered Professional Forester
TFL	Tree Farm Licence
VILUP	Vancouver Island Landscape Unit Plan

Document Revision History

Version	Date	Description
0.1	April 19, 2018	First version distributed to project team for review and comment.
1.0	May 8, 2018	Draft version made available for review with First Nations and the public.
1.1	October 1, 2018	• Executive Summary – changed harvest planning area from 190.4 ha/year to 185.3 ha/year to account for Non-Recoverable Losses. • Figure 1 Location of TFL 54 and Land Base Classification, updated to include the CSLUP protected areas established between 1993 and 1995 (TFL54 Protected Areas). • Section 3.2 (Consolidations and Subdivisions) – included CSLUP protected areas established between 1993-1995 within TFL54. • Sections 6.2.3 (Summary of Comments Received) and 6.2.4 (Summary of Revisions) – included the received public review comments for draft MP. • Appendix 2 (Accepted Information Package) – added the updated netdown table to include the established CSLUP protected areas between 1993-1995 • Appendix 3 - (Timber Supply Analysis) – final timber supply analysis (v1.1) with updated harvest planning area to account for non-recoverable losses.

1 Introduction

This Management Plan, the fifth for the for Tree Farm Licence (TFL) 54 held by Ma-Mook Natural Resources Limited (Ma-Mook), meets the requirements of the *Tree Farm Licence Management Plan Regulation* (B.C. Reg. 280/2009). This regulation, enacted by the provincial government in November 2009 (with associated amendments to the Forest Act), includes content requirements, submission timing and public review requirements for TFL Management Plans. These content requirements replace the Management Plan content requirements listed in the TFL document and reduce the duplication of Forest Stewardship Plan matters (objectives and strategies).

This document provides a general description and history of the TFL, lists the primary planning documents that guide the management of the TFL and summarizes outcomes from the public review and First Nations referral process. The Management Plan also includes, as appendices, the accepted Information Package and a draft Timber Supply Analysis.

2 Description of TFL 54

The TFL 54 is located on the west side of Vancouver Island in proximity to communities such as Tofino and Ucluelet (Figure 1). Sections of this TFL overlap with the Clayoquot Sound region where forest management is guided by the Clayoquot Sound Landscape Unit Plan (CSLUP). Outside of the CSLUP boundary, forest management is guided by the Vancouver Island Land Use Plan (VILUP).

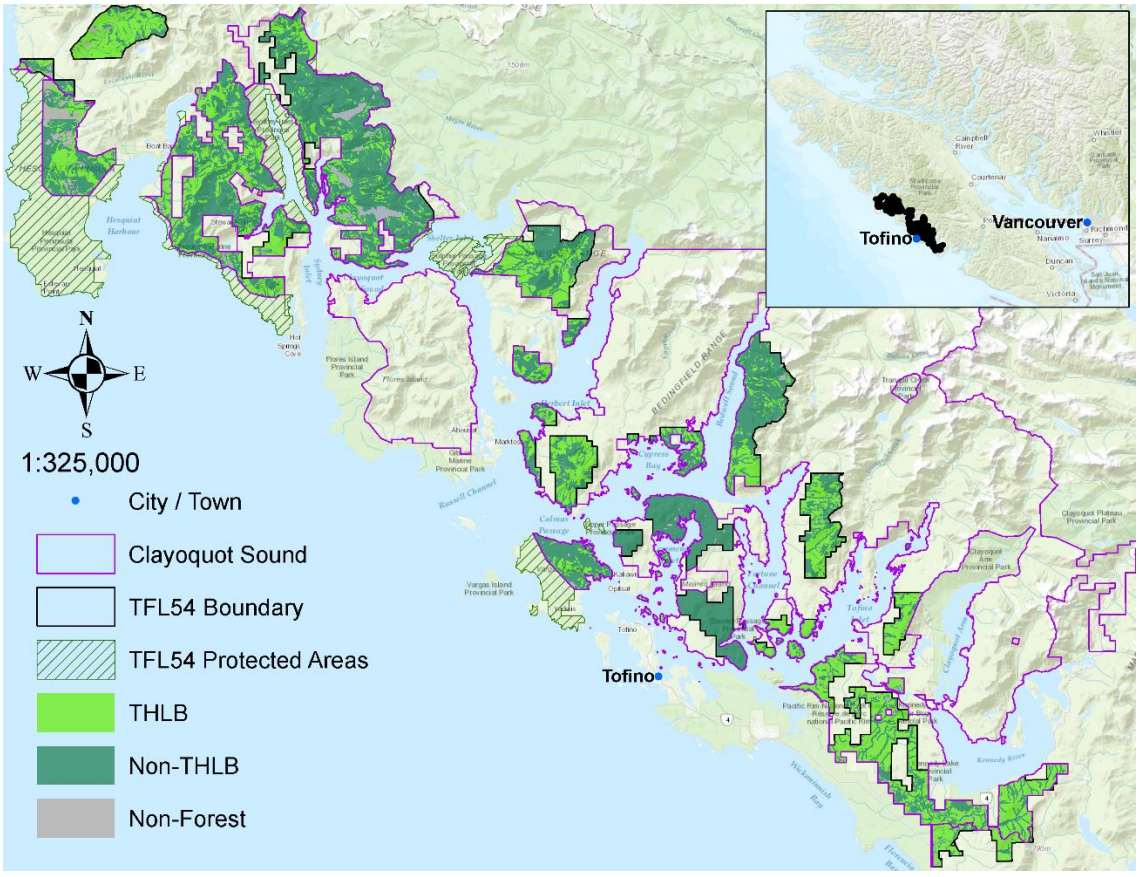

Figure 1 Location of TFL 54 and Land Base Classification

The gross area associated with TFL 54 is approximately 61,500 hectares and comprises approximately 19% of the Clayoquot Sound land base. The remaining area of the Clayoquot Sound includes TFL 57 (32%), Provincial and National Parks and Protected areas (31%), the Arrowsmith Timber Supply Area (22%), and a variety of smaller tenures, private land and Indian Reserves. The TFL 54 area consists of 315 separate geographical blocks (26 over 100 ha in size) interspersed with the Parks, Protected Areas, and TFL 57. The TFL 54 does not include private land or timber licences.

The license area is located within the traditional territory of the Central Region Board of Nuu-Chah-Nulth First Nations (Ahousaht, Hesquiaht, Tla-o-qui-aht, Toquaht, and Ucluelet Bands) and the Mowachaht-Muchalaht First Nation. First Nation villages of Ahousaht, Hot Springs Cove, Opitsat, Esowista, and Port Albion are located nearby.

The southwestern part of the TFL is accessible by the Provincial highway system. Other developed areas are accessible by logging road systems that end at various log dumps located throughout TFL 54 and TFL 57, including Hecate Bay (Cypre), Bedingfield Bay, and Rankin Cove (Tranquil).

The landscape is a complex of mountains, valleys, ocean inlets, lakes, rivers, islands, and forests. It includes two distinct physiographic regions that comprise Clayoquot Sound: the Estevan Coastal Plain and the Vancouver Island Mountains. The Estevan Coastal Plain is made up of gently undulating or nearly flat land that is subdivided into numerous islands and peninsulas by inlets, channels and Kennedy Lake. The Vancouver Island Mountains are steep and highly dissected with ridge-tops rising to over 1,000 metres and peaks attaining heights of over 1,300 metres.

The forest area defined within TFL 54 totals 48,922 hectares, where 46,649 hectares (95.4%) is considered productive land for forest management. The land base currently considered available for timber harvesting is 17,912 hectares (36.6%). As individual harvest openings are planned, further reductions to address non-timber values are implemented for an effective harvest area of 13,316 hectares (27.2%).

These forest lands cover portions of the Coastal Western Hemlock (CWH) and Mountain Hemlock (MH) biogeoclimatic ecosystem classification (BEC) zones and are comprised of western redcedar, western hemlock, and amabilis fir tree species.

3 History of TFL 54

3.1 LICENCE HOLDER AND ADMINISTRATION

In May 1955, the Maquinna Forest Management Licence No. 22 was awarded to British Columbia Forest Products Limited. In July 1981, FML22 was replaced by TFL 22, which was amalgamated in July 1983 with TFL 27 to form TFL 46. The TFL 46 was then transferred to Fletcher Challenge Canada Limited in September 1988 and was then subdivided in December 19, 1991. Blocks 4 and 5 (the west coast portion) of the TFL 46 was transferred to International Forest Products Ltd. (Interfor) on December 30, 1991, and became TFL 54. On March 28, 2007, the TFL 54 was transferred to Ma-Mook.

3.2 CONSOLIDATIONS AND SUBDIVISIONS

No consolidations or subdivisions occurred to TFL 54 since its inception on December 30, 1991.

3.3 MAJOR BOUNDARY CHANGES

On August 27, 1992, Schedule B of TFL54 was amended via legal instrument #1 to include an area of 1,807 ha north of Section 29, Township 2 in the Clayoquot Land District, and currently within Escalante Landscape Unit.

Between 1993 and 1995, approximately 12,169 ha were designated as protected areas under the CSLUP and

recognized under the Protected Areas Forests Compensation Act[1] (section 2) which established the following parks: Clayoquot Arm Park, Clayoquot Plateau Park, Flores Island Park, Hesquiat Peninsula Park, Vargas Island Park, and Sydney Inlet Park. The CSLUP protected areas continued to be recognized as part of the TFL54 in the latest AAC determination (September 04, 2008) for Management Plan #4. Therefore, the CSLUP protected areas continue to be associated with TFL54 for this Management Plan #5.

On October 4, 2006, 123 ha of private land was removed from the TFL 54 via legal instrument #4.

On April 19, 2011 (during the term of Management Plan #4), the TFL boundary was adjusted via legal instrument #6 and removed an area of 364 ha that covered the Maa-nulth First Nations Lands labelled "extinguishment area" under section 2 of the Maa-nulth Forest Compensation Interim Regulation.

On December 04, 2017, an area of 1.37ha of Crown land from Schedule B Lands was removed via legal instrument #7.

The latest GIS data indicated that the total area (not including the CSLUP protected areas) was reduced by 376 ha, from 49,298 ha in Management Plan #4 to 48,922 ha in this Management Plan #5.

3.4 ALLOWABLE ANNUAL CUT HISTORY

The first AAC for TFL 54 was determined in 1991 at 138,000 m³/year, under the management of Interfor. In May 1994, the Chief Forester ordered a temporary AAC reduction of 42,000 m³/year under Part 15 (now Part 13) of the Forest Act. This temporary reduction was needed to account for the newly protected areas and anticipated changes to management resulting from the Clayoquot Sound Land Use Decision and was maintained until 1996. In recognition of Scientific Panel recommendations on watershed rate-of-cut limits and old growth retention, a simplified version of an area-based analysis was used to determine a short-term AAC of 125 ha/year (or 75,750 m³/year based on old-growth average volume per hectare). This represented a 45% decrease from the 1991 AAC of 138,000 m³/year and was maintained until 2008, when the watershed plans were completed. From here on, an area-based harvest regulation is utilized for TFL 54, made possible by the *Tree Farm Licence Area-based Allowable Annual Cut Trial (AAC) Program Regulation*. With an area-based AAC, the area of land that can be harvested annually is defined, rather than the amount of volume.

With the transfer of the TFL54, Ma-Mook committed to implement the management approach described in the TFL 54 Management Plan #4, and its accompanying Timber Supply Analysis, submitted by the previous licensee (i.e., Interfor). Ma-Mook also aimed to harvest and mill timber from TFL 54 according to the Forest Stewardship Council standards with the goal of achieving certification. This approach was implemented in Management Plan #4 from which the Deputy Chief Forester determined an AAC of 320 ha/year in 2008.

On April 19, 2011 the TFL boundary adjustment described in section 3.3 resulted in an AAC reduction by 4.2 ha/year to the current AAC of 315.8 ha/year.

4 Publicly Available Planning Documents

4.1 REGIONAL AND LANDSCAPE LEVEL PLANS

In the 1980s and 1990s, growing public concern regarding the sustainability of forest management in the Clayoquot Sound area, where most of TFL 54 lies, attracted international attention. Following many years of public participation and consultation, the provincial government announced in 1993 its **Clayoquot Sound Land Use Decision** which designated protected areas, special management areas (for recreation, wildlife, or scenic

[1] Url: http://www.bclaws.ca/civix/document/id/consol28/consol28/02051_01

corridors), and general integrated resource management areas[2]. Under the Clayoquot Sound Land Use Decision, timber harvesting is a major activity within the general integrated management areas.

Following the Clayoquot Sound Land Use Decision, on October 22, 1993, the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound was formed with the objective to define world-class, sustainable forest practices for the area, including reviewing the forest practices standards in effect in Clayoquot Sound at that time and recommending changes to ensure that the practices would be sustainable. The 124 specific and 91 general recommendations submitted by the Scientific Panel to the provincial government in 1995, were fully accepted and planned for implementation within Clayoquot Sound area. Areas outside of the Clayoquot Sound area that fall within TFL 54 are managed in accordance with the Forest and Range Practices Act and its regulations related to Crown forest lands in BC.

To ensure the recommendations are implemented, the Clayoquot Sound Technical Planning Committee was formed of representatives from First Nations and government. The Technical Planning Committee's responsibilities are to prepare **watershed-level plans** for each of the 15 watershed planning units within the Clayoquot Sound area. From these 15 units, TFL 54 intersects 8 watershed-level plans. The 8 watershed-level plans were completed by 2006 and were all approved in 2008[3].

While the Clayoquot Sound Scientific Panel recommendations and the Clayoquot Sound watershed plans were endorsed by the Central Region Chiefs and the provincial government, they were not formally 'objectives set by government' under the Forest and Range Practices Act. In June 26, 2008, a Ministerial Order under section 93.4(1) of the Land Act was established for all areas within Clayoquot Sound (as defined in the 1993 Clayoquot Land Use Decision and Schedule 1 of the Order). This order established land use objectives to satisfy the need for a legally-enforceable linkage with the watershed plans discussed above, while providing some allowance for future adaptive management applications.

4.2 OPERATIONAL PLANS

The Forest Stewardship Plan (FSP) specifies results and strategies consistent with government objectives that apply to the land base. On June 24, 2009, the FSP #399 for the Clayoquot Sound (including TFL57, but not including TFL 54) was submitted. This FSP was amended on January 29, 2013 to include the TFL 54 and it was effective until October 7, 2014. The last major amendment (#3) was approved on May 20, 2016. This is the main planning document guiding forest operations.

4.3 PLANS REQUIRED BY INDEPENDENT FORESTRY CERTIFICATION PROGRAMS

Ma-Mook's TFL 54 is not currently managed under any forest certification program.

5 Timber Supply Analysis

The *Tree Farm Licence Management Plan Regulation* requires that management plans contain a Timber Supply Analysis that examines the short- and long-term availability of timber for harvesting in the TFL and considers how management practices influence on the availability of timber. The regulation also requires supporting information for the Timber Supply Analysis including resource inventories, a description of the model and analytical methods used to formulate the timber supply, and any other information relevant to timber supply on the TFL.

5.1 SUPPORTING DOCUMENTATION FOR TIMBER SUPPLY ANALYSIS

The Timber Supply Analysis for TFL 54 (see Appendix 3) was prepared by Forsite Consultants Ltd. using the

[2] Url: https://www.for.gov.bc.ca/dsi/Clayoquot/clayoquot_sound.htm

[3]Url: ftp://ftp.geobc.gov.bc.ca/publish/Regional/Nanaimo/Clayoquot/

modelling software Patchworks™ (version 1.3, 2018-02-27).

Area-based harvest forecasts were prepared using the licensee's assessment of the best available information on current forest management and the land base available for timber harvesting. Details for these assumptions are described in an Information Package made available for public review and First Nations referral, and later accepted by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD)'s Forest Analysis and Inventory Branch on January 26, 2018 (see Appendix 2).

6 Public Review and First Nations Referral

Section 6 of the *TFL Management Plan Regulation* outlines the requirements for public review and comment. In accordance with this requirement, a proposed public review strategy was submitted to the FLNRORD on April 24, 2017 and was subsequently approved by the Regional Executive Director on April 28, 2017.

As outlined in the strategy, two products from this management plan process were made available for public review and First Nations referral:

- A draft information package and
- A draft management plan – including the final Information Package and draft Timber Supply Analysis

In both cases, similar approaches were applied to invite the public and First Nations to review and comment on the draft material presented:

- Access to a printed copy at various locations,
- Access to an electronic document and maps through a website link,
- Email distribution to Agencies,
- Email distribution to First Nations, and
- Newspaper advertisements.

All distributions and responses received were shared with the FLNRORD.

6.1 PUBLIC AND FIRST NATIONS REVIEW OF THE DRAFT INFORMATION PACKAGE

The draft Information Package was the first product made available for review. It described the information used to support the Timber Supply Analysis; including data inputs and assumptions. The review period for this draft document was scheduled from October 04 to December 04, 2017. The draft Information Package consisted of a 42-page document, maps, and a temporary web map service for online viewing of various spatial data.

6.1.1 DISTRIBUTION

On October 02, 2017, Ma-Mook distributed the draft Information Package material to the agencies, First Nations and local governments specified in the tables below. Each distribution included an email with hyperlinks to access and download the 42-page document and a temporary web map service for online viewing of various spatial data to be used in the analysis. These emails were distributed to contacts listed in Table 1, Table 2, and Table 3, and included:

- request for confirmation that the email was received,
- offer to print the documents and/or maps and to meet with First Nations' representatives,

- details on the timing of the review period (60 days) and locations to view the products locations listed below,
- brief summary highlighting changes (where applicable) proposed from the existing TFL 54 Management Plan #4, and
- contact for submitting questions and comments.

Table 1 Agency Contacts Reviewing the Draft Information Package

Agency	Contact	Email
FLNRORD – Timber Supply Forester	Qiong Su	Qiong.Su@gov.bc.ca
FLNRORD – Senior Analyst	Jim Brown	Wjim.Brown@gov.bc.ca
FLNRORD – South Island Natural Resources District - Senior Licenced Authorizations Officer	Tracy Andrews	Tracy.Andrews@gov.bc.ca
FLNRORD – South Island Natural Resources District – District Manager	Rhonda Morris	Rhonda.Morris@gov.bc.ca
FLNRORD – Land and Resource Specialist	Ron Cotton	Ron.Cotton@gov.bc.ca
FLNRORD – Forest Tenures Specialist	Sheldon Martell	Sheldon.Martell@gov.bc.ca

Table 2 First Nations Contacts Reviewing the Draft Information Package

First Nation	Group or Association	Contact	Email
Ahousaht	Nuu-chah-nulth	Greg Louie (Chief Councillor)	
		Anne Atleo (Administrator)	info@ahousaht.ca
Hesquiaht	Nuu-chah-nulth	Richard Lucas (Chief Councillor)	hesquiahtchiefcouncillor@gmail.com
Maa-nulth Treaty Society	Maa-nulth Treaty	Anna Horel	anna.e.horel@gmail.com
	Mowachaht/Muchalaht	Allen Tweedie (Lands Manager)	lands@yuquot.ca
Tla-o-qui-aht	Nuu-chah-nulth	Elmer Frank (Chief Councillor)	elmerfrank@telus.net
		Saya Masso	saya@tla-o-qui-aht.org
Toquaht	Nuu-chah-nulth and Maa-nulth Treaty	Anne Mack (Chief Councillor)	Annem@toqhaht.ca
		Juliet Van Vliet	julietv@toquaht.ca
Ucluelet	Nuu-chah-nulth and Maa-nulth Treaty	Les Doiron (President)	les.doiron@ufn.ca
		Anna Drabosenig	anna.drabosenig@ufn.ca

Table 3 Local Governments Reviewing the Draft Information Package

Group / Association	Representative	Email
District of Tofino	Mayor and Council	info@tofino.ca
District of Ucluelet	Mayor and Council	info@ucluelet.ca

Throughout the 60-day review period, copies of the draft Information Package document were also made available for review during regular working hours at the following locations:

- Ma-Mook Natural Resources Ltd. office 2777, Pacific Rim Highway Ucluelet, BC V0R 3A0, 250-726-7037
- Ministry of Forests, Lands, and Natural Resource Operations, South Island District, 4885 Cherry Creek Road, Port Alberni, B.C., V9Y 8E9, 250-731-3000
- FTP folder (digital) hosted by Forsite Consultants Ltd.

6.1.2 NEWSPAPER ADVERTISEMENTS

Ma-Mook ran newspaper advertisements regarding the draft Information Package, on two separate occasions, in consecutive weeks, in the publications listed in Table 4. The advertisement indicated the public viewing locations, the length of time for review, web addresses to access or download each product, and contact information (phone, fax, email) for submitting comments.

Table 4 Newspaper Advertisements for the Draft Information Package

Newspaper	Distribution	Advertisement Dates
Alberni Valley Times	Weekly	October 04 and 11, 2017
The Westerly News	Weekly	October 04 and 11, 2017
Ha-Shilth-Sa	Monthly	October 19, 2017 (online from October 11)

6.1.3 SUMMARY OF COMMENTS RECEIVED

Most of the comments received involved operational concerns in complying with the CSLUP management objectives (Table 5).

Table 5 Comments Received on the Draft Information Package

Provided By	Summary of Comments or Questions
Juliet Van Vliet (Toquaht Nation)	October 04, 2017 – operational concerns regarding impacts on riparian management habitat, blowdown and wind throw, and improving continuity of ungulate habitat areas.
Francis Gillette (Ma-nulth Co-chair)	October 6 and 19, 2017 – operational concerns regarding impacts on riparian management habitat, blowdown and wind throw, and improving continuity of ungulate habitat areas within Maa-nulth First Nations important harvest areas (IHA).
Qiong Su (FLNRORD)	October 16, 2017 – sources for visual objectives.
Maryjka Mychajlowycz (Friends of Clayoquot Sound)	November 07, 2017 – terminology used for area-based AAC and the example provided in the Information Package.
Dave Johnsen (Toquaht Nation)	November 22, 2017 – Acknowledgement of the Ucluelet' First Nation being the guardians of the Haahuuli and agreement with the response to Maa-nulth.
Louis George (Maaqutusiis Hahoulthee Stewardship Society)	December 01, 2017 – concerns regarding Ahousaht First Nation land use vision within Ahousaht Forest Management Areas (FMA).
Dana Hawkins (District of Tofino)	December 04, 2017 – operational concerns on visual impacts, recreational values, and protection of District's water values on Meares Island.
Lee-Ann Unger (Clayoquot Sound Conservation Alliance)	December 04, 2017 – request to remove all old growth from the timber harvesting land base area until each First Nation community in Clayoquot Sound develops a land use vision, similarly to Ahousaht First Nation.
Richard Lucas (Hesquiaht First Nations)	December 04, 2017 – confirmation and support for the Information Package.
Saya Masso (Tla-o-qui-aht First Nations)	December 07, 2017 – operational concerns regarding implementation of the Tla-o-qui-aht land use plan, which includes Haa'uukmin Tribal Park and other areas within Clayoquot Valley.

6.1.4 SUMMARY OF REVISIONS

While the comments and questions received did not result in any significant changes to the Information Package, the following adjustments were made before proceeding with the Timber Supply Analysis:

- Section 2.2, Table 2. Developed a new resultant file to accurately portray Maa-nulth IHA and Ahousaht FMAs. This resulted in trivial differences in area (<1ha) compared to the draft Information Package.
- Future road reductions (5%) were applied to area of existing natural stands (age current to year 2017 >22yrs).
- Section 4.1. Clarified that the area-based harvest term used is not the recommended area-based AAC and emphasized that Table 10 was included as an example.
- Section 4.5. Prepared existing managed yields using the latest stand projection model, as recommended by FLNRORD.
- Section 4.6. Slight changes to minimum harvest age criteria for poor stands.
- Section 4.8. Confirmed usage of Seed Class A for regeneration of 2017+ stands.
- Added section 4.13. Included map and description of Ahousaht FMAs.
- Sections 4.15.3 and 4.16.3. Included source of maximum disturbance levels visual objectives and described how they were derived. Included assumption comparison to Arrowsmith Timber Supply Review and TFL 57 Management Plan #2.

The FLNRORD accepted the Information Package on January 25, 2018 (Appendix 2).

6.2 PUBLIC AND FIRST NATIONS REVIEW OF THE DRAFT MANAGEMENT PLAN #5

The draft Management Plan #5 was the second, and final, product made available for review. This document provides a general description and history of the TFL, listed the primary planning documents that guide the management of the TFL and summarized outcomes from the public review and First Nations referral process. The review period for the draft Management Plan #5 was scheduled from May 16, 2018 to July 16, 2018.The draft Management Plan #5 also included, as appendices, the accepted Information Package and a draft Timber Supply Analysis.

6.2.1 DISTRIBUTION

On May 14, 2018, Ma-Mook distributed the draft Management Plan #5 document to the agencies, First Nations and local governments specified in the tables below. Each distribution included an email with hyperlinks to access and download the Management Plan #5 document and to view spatially all datasets to be used in the analysis. These emails were distributed to contacts listed in Table 6, Table 7, and Table 8, and included:

- request confirmation that the email was received,
- offer to print the documents and/or maps and to meet with First Nations' representatives,
- details on the timing of the review period (60 days) and locations to view the products locations listed below,
- brief summary highlighting changes (where applicable) proposed from the existing TFL 54 Management Plan #4, and
- contact for submitting questions and comments.

Table 6 Agency Contacts Reviewing the Draft Management Plan #5

Agency	Contact	Email
FLNRORD – Timber Supply Forester	Qiong Su	Qiong.Su@gov.bc.ca
FLNRORD – Senior Analyst	Jim Brown	Wjim.Brown@gov.bc.ca
FLNRORD – South Island Natural Resources District - Senior Licenced Authorizations Officer	David Cruickshank	David.Cruickshank@gov.bc.ca
FLNRORD – South Island Natural Resources District – District Manager	Rhonda Morris	Rhonda.Morris@gov.bc.ca
FLNRORD – Land and Resource Specialist	Ron Cotton	Ron.Cotton@gov.bc.ca
FLNRORD – Forest Tenures Specialist	Sheldon Martell	Sheldon.Martell@gov.bc.ca

Table 7 First Nations Contacts Reviewing the Draft Management Plan #5

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Ahousaht	Nuu-chah-nulth	Greg Louie (Chief Councillor)	
		Anne Atleo (Administrator)	info@ahousaht.ca
Hesquiaht	Nuu-chah-nulth	Richard Lucas (Chief Councillor)	hesquiahtchiefcouncillor@gmail.com
Maa-nulth Treaty Society	Maa-nulth Treaty	Anna Horel	anna.e.horel@gmail.com
	Mowachaht/Muchalaht	Allen Tweedie (Lands Manager)	lands@yuquot.ca
Tla-o-qui-aht	Nuu-chah-nulth	Elmer Frank (Chief Councillor)	elmerfrank@telus.net
		Saya Masso	saya@tla-o-qui-aht.org
Toquaht	Nuu-chah-nulth and Maa-nulth Treaty	Anne Mack (Chief Councillor)	Annem@toqhaht.ca
Ucluelet	Nuu-chah-nulth and Maa-nulth Treaty	Les Doiron (President)	les.doiron@ufn.ca
Mowachaht/Muchalaht		Allen Tweedie, Lands Manager	lands@yuquot.ca

Table 8 Local Governments Reviewing the Draft Management Plan #5

Group / Association	Representative	Email
District of Tofino	Mayor and Council	info@tofino.ca
District of Ucluelet	Mayor and Council	info@ucluelet.ca
Group / Association	Representative	Email

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- Ma-Mook Natural Resources Ltd. office 2777, Pacific Rim Highway Ucluelet, BC V0R 3A0, 250-726-7037
- Ministry of Forests, Lands, and Natural Resource Operations, South Island District, 4885 Cherry Creek Road, Port Alberni, B.C., V9Y 8E9, 250-731-3000
- FTP folder (digital) hosted by Forsite Consultants Ltd.

6.2.2 NEWSPAPER ADVERTISEMENTS

Ma-Mook ran newspaper advertisements regarding the draft Management Plan #5, on two separate occasions, in consecutive weeks, in the publications listed in Table 9. The advertisement indicated the

public viewing locations, the length of time for review, hyperlinks to access or download each product, and contact information (phone, fax, email) for submitting comments.

Table 9 Newspaper Advertisements for the Draft Management Plan #5

Newspaper	Distribution	Advertisement Dates
Alberni Valley Times	Weekly	May 16 and May 23, 2018
The Westerly News	Weekly	May 16 and May 23, 2018
Ha-Shilth-Sa	Bi-Weekly	May 17, 2018 and May 31, 2018

6.2.3 SUMMARY OF COMMENTS RECEIVED

The public comments received are summarized in Table 10.

Table 10 Comments Received on the Draft Information Package

Provided By	Summary of Comments or Questions
Ma-Mook (Zoltan Schafer)	June 12, 2018 –the CSLUP protected area is missing from the netdown table.
Laura Loucks (Clayoquot Biosphere Trust)	July 10, 2018 – concerns regarding the Marbled Murrelet and red-legged frog management within TFL54 as part of the Clayoquot Sound UNESCO Biosphere Region. The concerns include any wildlife habitat areas within the TFL 54 and the BC Implementation Plan for the Recovery of Marbled Murrelet dated March 7, 2018.
Qiong Su (FLNRORD)	July 23, 2018 – Non-recoverable losses were not included in the draft Timber Supply Analysis and not accounted for in the estimated harvest planning area of 190.4 ha/year.

6.2.4 SUMMARY OF REVISIONS

In response to the comments received, the netdown table was updated to include the CSLUP protected areas without changing the analysis (Appendix 2). The draft timber supply analysis was then updated to include an estimate for non-recoverable losses over the THLB, which reduced the estimated harvest planning area from 190.4 ha/year to 185.3 ha/year.

The management of the Marbled Murrelet within and around TFL 54 was addressed through three mechanisms:

1) Within Clayoquot Sound there are 10 specific reserves established in the CSLUP, and then refined by the Clayoquot Sound Technical Planning Committee (i.e., a committee of representatives from First Nations and government), who developed the watershed-level plans for each of the 15 watershed planning units within the Clayoquot Sound area. Here, specifically designated areas for Marbled Murrelet were spatially identified and 100% protected from harvesting.

2) Outside of Clayoquot Sound, there are various wildlife habitat areas (WHA) designated to protect the Marbled Murrelet. The WHAs 1-430 and 1-431 overlap with TFL54 and were 100% protected from harvesting.

3) The area eligible for harvesting represents approximately 36.6% (32.2% within Clayoquot Sound) of the forested land-base. Within the Clayoquot Sound, only partial cutting silvicultural systems are allowed which retain 15-70% of the net cutblock area. Consequently, within Clayoquot Sound, more than 80% of the forested area remains in state favourable to Marbled Murrelet which is in line with the BC Implementation Plan for the Recovery of Marbled Murrelet dated March 7, 2018.

The management of the red-legged frog within and around TFL 54 was addressed through WHAs 1-393 and 1-493, the latter located completely within TFL54, which are 100% protected from harvesting.

Appendix 1 Approved Public Review Strategy

BRITISH COLUMBIA

File: 19710-30/TFL 54
CLIFF 228585

APR 2 8 2017

Zoltan Schafer, RPF
Forestry Manager
Ma-Mook Natural Resources Ltd.
P.O. Box 639
Ucluelet, British Columbia
V0R 3A0

Dear Zoltan Schafer:

Thank you for your submission on April 24, 2017, of a First Nation and Public Review Strategy for Tree Farm Licence 54, Management Plan No. 5.

As required by Section 6(2) of the Tree Farm Licence Management Plan Regulation, I hereby approve your Public Review Strategy for Management Plan No. 5 for Tree Farm Licence 54.

Please be advised that the public review process, including information sharing with First Nations, is subject to the terms and conditions outlined in Part 3 of the *Personal Information Protection Act.*

Yours truly,

Sharon Hadway

Sharon Hadway
Regional Executive Director
West Coast Natural Resource Region

pc: Rhonda Morris, District Manager, South Island Natural Resource District
Jim Brown, Senior Analyst – Tree Farm Licences, Forest Analysis and Inventory Branch
Tracy Andrews, Sr. Licenced Authorizations Officer, South Island Natural Resource District
Qiong Su, Timber Supply Forester, Forest Analysis and Inventory Branch

Ministry of Forests, Lands and Natural Resource Operations
West Coast Natural Resource Region
Mailing Address:
Suite 103, 2100 Labieux Road
Nanaimo BC V9T 6E9
Tel: (250) 751-7001
Fax: (250) 751-7196
Website: www.gov.bc.ca/for/

MA-MOOK
Natural Resources Ltd.

Ma-Mook Natural Resources Ltd.
P.O. Box 639
Ucluelet, BC V0R 3A0
Telephone: (250) 726-6373

April 24, 2017

First Nation and Public Review Strategy

TFL 54 - Management Plan 5

Ma-Mook Natural Resources Limited (Ma-Mook) is commencing the process for preparing the next Management Plan #5 for Tree Farm Licence (TFL) 54 - due for approval by August 25, 2018. Requirements for reviewing this plan with the public are outlined in section 6 of the Forest Act - TFL Management Plan Regulation.

The sections below describe the strategy for reviewing the proposed Management Plan #5 with First Nations and the public. This strategy is submitted for approval to the West Coast Regional Executive Director of the Ministry of Forests, Lands, and Natural Resource Operations (FLNRO).

1 Summary of the Management Plan Approval Process

The management plan approval process involves the preparation, review, submission, and approval of four key documents:

1) First Nation and Public Review Strategy
2) Information Package
3) Timber Supply Analysis
4) Management Plan

The steps involved in this process area summarized in Table 1 and details for reviewing these documents with various groups are described in the sections below.

Table 1 Approval Process for Management Plan 5

Step #	Description	Target Date(s)
1	Ma-Mook submits a Review Strategy to the Regional Executive Director	Apr 14, 2017
2	Regional Executive Director approves the Review Strategy	Apr 21, 2017
3	Ma-Mook submits, refers, and advertises review of the proposed Information Package	Jul 2017
4	60-day review period; Ma-Mook considers comments received	Aug – Sep 2017
5	Ma-Mook submits a final Information Package to the FLNRO Timber Supply Forester	Oct 2017 (early)
6	FLNRO Timber Supply Forester accepts the Information Package	Oct 2017 (late)
7	Ma-Mook submits, refers, and advertises review of the proposed Management Plan 5 - including the Timber Supply Analysis	Dec 2017
8	60-day review period; Ma-Mook considers comments received	Jan – Feb 2018
9	Ma-Mook submits the final Management Plan 5 to the Chief Forester	Mar 25, 2018
10	Chief Forester approves Management Plan 5 and determines Allowable Annual Cut	Aug 25, 2018

2 Agencies

Ma-Mook will provide copies of the proposed and final Information Package and Management Plan documents to each of the agency representatives listed in Table 2. Only the final Management Plan will be sent to the Chief Forester. These documents will be sent via emails with hyperlinks to access or download each product.

Table 2 Agency Contacts

Agency	Contact	Email
FLNRO – Timber Supply Forester	Qiong Su	Qiong.Su@gov.bc.ca
FLNRO – Senior Analyst	Jim Brown	Wjim.Brown@gov.bc.ca
FLNRO – South Island Natural Resources District - Senior Licenced Authorizations Officer	Tracy Andrews	Tracy.Andrews@gov.bc.ca
FLNRO – South Island Natural Resources District – District Manager	Rhonda Morris	Rhonda.Morris@gov.bc.ca
FLNRO – Land and Resource Specialist	Ron Cotton	Ron.Cotton@gov.bc.ca
FLNRO – Forest Tenures Specialist	Sheldon Martell	Sheldon.Martell@gov.bc.ca

At any time during the process, Ma-Mook will provide the same copies to other interested provincial and federal agencies, as directed by the FLNRO – Timber Supply Forester.

3 First Nations

Ma-Mook will provide copies of the proposed Information Package and Management Plan documents to each of the First Nations' contacts listed in Table 3. These documents will be sent via emails with hyperlinks to access or download each product. These emails will also:

- request confirmation that the email was received,
- extend an offer to print the documents and/or maps and to meet with First Nations' representatives,
- provide details on the timing of the review period (60 days) and locations to view the products locations listed below,
- briefly highlight changes (where applicable) proposed from the existing TFL 54 MP 4, and
- identify who to contact for questions and submitting comments.

If no response has been received within approximately 3 weeks, Ma-Mook will send a follow-up email as a reminder.

Table 3 First Nations Contacts

First Nation	Group or Association	Contact	Email
Ahousaht	Nuu-chah-nulth	Greg Louie (Chief Councillor)	
		Anne Atleo (Administrator)	info@ahousaht.ca
Hesquiaht	Nuu-chah-nulth	Richard Lucas (Chief Councillor)	hesquiahtchiefcouncillor@gmail.com
Maa-nulth Treaty Society	Maa-nulth Treaty	Anna Horel	anna.e.horel@gmail.com
	Mowachaht/Muchalaht	Allen Tweedie (Lands Manager)	lands@yuquot.ca
Tla-o-qui-aht	Nuu-chah-nulth	Elmer Frank (Chief Councillor)	elmerfrank@telus.net
		Saya Masso	saya@tla-o-qui-aht.org
Toquaht	Nuu-chah-nulth and Maa-nulth Treaty	Anne Mack (Chief Councillor)	Annem@toqhaht.ca
		Juliet Van Vliet	julietv@toquaht.ca
Ucluelet	Nuu-chah-nulth and Maa-nulth Treaty	Les Doiron (President)	les.doiron@ufn.ca
		Anna Drabosenig	anna.drabosenig@ufn.ca

4 Other Stakeholders and General Public

Ma-Mook will run newspaper advertisements regarding the proposed Information Package and Management Plan, on two separate occasions, in consecutive weeks, in the publications listed in Table 4. The advertisement (Appendix 1) will indicate the public viewing locations, the length of time for review, hyperlinks to access or download each product, and contact information (phone, fax, email) for submitting comments.

Table 4 Newspaper Advertisements Inviting Public Review of the Draft Management Plan

Newspaper	Distribution	Advertisement Dates
Alberni Valley Times	Weekly	TBD
The Westerly News	Weekly	TBD
Ha-Shilth-Sa	Monthly	TBD

Copies of the proposed Information Package and Management Plan documents will be available for review during regular working hours throughout the 60-day review periods (see Table 1) at the following locations:

- Ma-Mook Natural Resources Ltd. office 2777, Pacific Rim Highway Ucluelet, BC V0R 3A0, 250-726-7037
- Ministry of Forests, Lands, and Natural Resource Operations, South Island District, 4885 Cherry Creek Road, Port Alberni, B.C., V9Y 8E9, 250-731-3000
- FTP folder (digital) hosted by Forsite Consultants Ltd.

Ma-Mook will also provide copies of the proposed Information Package and Management Plan documents to the local governments listed in Table 5. Other interested parties will be directed to the newspaper advertisements described above that describe review locations and download links.

Table 5 Local Governments Invited to Review the Draft Management Plan

Group / Association	Representative	Email
District of Tofino	Mayor and Council	info@tofino.ca
District of Ucluelet	Mayor and Council	info@ucluelet.ca

5 Responding to Comments Received

The final Management Plan submission will include this First Nation and Public Review Strategy along with a summary of the comments received. It will also include a description of responses and changes made to the Management Plan resulting from the comments.

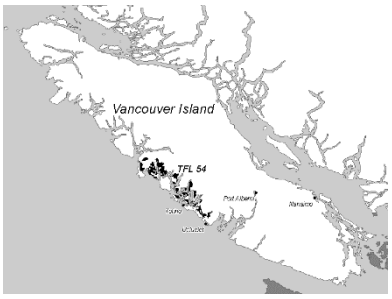
Upon submission of the final Management Plan, Ma-Mook will provide a separate but related package to the District Manager (South Island Natural Resource District) that will include a copy of all correspondence sent or received by Ma-Mook regarding this strategy. This is intended to support the Province's duty to consult on the Management Plan and, where required, accommodate First Nations, whenever it proposes a decision or activity that could impact treaty rights or aboriginal rights.

Appendix 1 Proposed Newspaper Advertisements

Proposed Information Package

Tree Farm Licence (TFL) 54 Information Package for Management Plan #5 available for review and comment.

TFL 54, held by Ma-Mook Forest Resources Limited (Ma-Mook), is located on the west side of Vancouver Island in the Clayoquot Sound region and in the vicinity of Tofino and Ucluelet. It covers roughly 61,464 hectares, including 12,169 hectares of protected areas within the TFL established by the Clayoquot Sound Land Use Decision.



The Management Plan (MP) provides a general description of the TFL, a brief history of the TFL, a list of publicly available planning documents that guide Ma-Mook's forest operations on the TFL, and a timber supply analysis that provides information to assist the Chief Forester of BC in determining a new timber harvest rate, or allowable annual cut, for TFL 54.

The Information Package and reference maps are available for public review from Day 1 until Day 60 during normal business hours at the following locations (please call ahead to arrange an appointment to view):

Ma-Mook Natural Resources Ltd. office
2777, Pacific Rim Highway Ucluelet, BC V0R 3A0, 250-726-7037

Ministry of Forests, Lands, and Natural Resource Operations, South Island District, 4885 Cherry Creek Road, Port Alberni, B.C., V9Y 8E9, 250-731-3000

You can also download the material from:
http://webftp.forsite.ca/outgoing/...

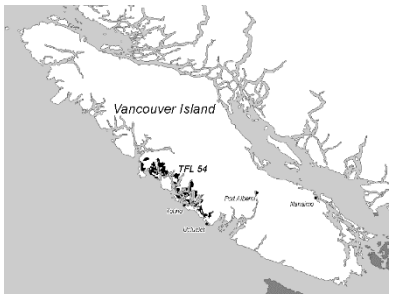
Please write or email comments by Day 60 to:

Zolie Schafer, RPF, Forestry Manager
Ma-Mook Natural Resources Ltd.
P.O. Box 639, Ucluelet, BC V0R 3A0
zolie_schafer@telus.net

Proposed Management Plan

Tree Farm Licence (TFL) 54 proposed Management Plan #5 available for review and comment.

TFL 54, held by Ma-Mook Forest Resources Limited (Ma-Mook), is located on the west side of Vancouver Island in the Clayoquot Sound region and in the vicinity of Tofino and Ucluelet. It covers roughly 61,464 hectares, including 12,169 hectares of protected areas within the TFL established by the Clayoquot Sound Land Use Decision.



The Management Plan (MP) provides a general description of the TFL, a brief history of the TFL, a list of publicly available planning documents that guide Ma-Mook's forest operations on the TFL, and a timber supply analysis that provides information to assist the Chief Forester of BC in determining a new timber harvest rate, or allowable annual cut, for TFL 54.

The proposed Management Plan #5 and reference maps are available for public review from Day 1 until Day 60 during normal business hours at the following locations (please call ahead to arrange an appointment to view):

Ma-Mook Natural Resources Ltd. office
2777, Pacific Rim Highway Ucluelet, BC V0R 3A0, 250-726-7037

Ministry of Forests, Lands, and Natural Resource Operations, South Island District, 4885 Cherry Creek Road, Port Alberni, B.C., V9Y 8E9, 250-731-3000

You can also download the material from:
http://webftp.forsite.ca/outgoing/...

Please write or email comments by Day 60 to:

Zolie Schafer, RPF, Forestry Manager
Ma-Mook Natural Resources Ltd.
P.O. Box 639, Ucluelet, BC V0R 3A0
zolie_schafer@telus.net

Appendix 2 Accepted Information Package

Updated Netdown Table

Factor			Total Area (ha)	Effective Area (ha)	% of Total Area	% of CFLB
Gross TFL54 Area (MP#4)			**61,467**			
Less:						
	Clayoquot Sound Landscape Unit Plan (CSLUP) Protected Areas (MP#4)		12,169			
	Boundary Changes since MP#4		376			
Total TFL54 Area			**48,922**		**100.0%**	
	CSLUP		45,685			
	Outside CSLUP		3,237			
Less:						
	Non Forest		2,698	1,799	3.7%	
	Existing Roads		484	474	1.0%	
Total Productive Forested Land Base (PFLB)				**46,649**	**95.4%**	**100.0%**
	Within CSLUP			43,687	89.3%	93.7%
	Outside CSLUP			2,962	6.1%	6.3%
Less:			in PFLB			
	Within CSLUP			27,872	57.0%	59.7%
		Non Vegetated	69	69	0.1%	0.1%
		Inoperable	19,125	19,087	39.0%	40.9%
		Terrain Stability	3,074	1,358	2.8%	2.9%
		Sensitive Soils	1,501	220	0.5%	0.5%
		Flood Plains	327	11	0.0%	0.0%
		Marbled Murrelet	2,635	1,365	2.8%	2.9%
		Blue Listed	2,070	760	1.6%	1.6%
		Red Listed	205	36	0.1%	0.1%
		Protected Areas	107	55	0.1%	0.1%
		Recreation and Tourism	1,883	892	1.8%	1.9%
		Interior Old Growth	130	64	0.1%	0.1%
		Hydro Buffers	6,605	2,420	4.9%	5.2%
		Meares Island*	3,662	1,536	3.1%	3.3%
	Outside CSLUP			864	1.8%	1.9%
		Inoperable	522	522	1.1%	1.1%
		ESA	228	147	0.3%	0.3%
		Terrain Stability	19	10	0.0%	0.0%
		Wildlife Habitat Area	85	63	0.1%	0.1%
		Riparian Buffers	193	122	0.2%	0.3%
Timber Harvesting Land Base (THLB)				**17,912**	**36.6%**	**38.4%**
	CSLUP			15,815	32.3%	33.9%
	Outside CSLUP			2,098	4.3%	4.5%
Less:						
	Future Roads (5%)			829	1.7%	1.8%
Long Term THLB				**17,084**	**34.9%**	**36.6%**

** Meares Island area covered by TFL54 falls entirely under the CSLUP.*

BRITISH COLUMBIA

Reference: 235919

January 26, 2018

Zoltan Schafer, RPF
Forestry Manager
Ma-Mook Natural Resources Ltd.
P.O. Box 639
Ucluelet, British Columbia
V0R 3A0

Dear Zoltan Schafer:

Thank you for your revised Timber Supply Analysis Information Package (IP) for Tree Farm License (TFL) 54 Management Plan 5 dated September 28, 2017. The earlier draft dated August 9, 2017, was extensively reviewed by me and by staff at the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD) South Island Natural Resource District and the West Coast Region. Our comments were submitted to you on August 28, 2017.

I have reviewed the revised IP and received feedback from district and region staff. As the Timber Supply / Geomatics Forester responsible for reviewing this IP, I accept the IP for use in the timber supply analysis.

I wish to point out that this letter does not mean that the FLNRORD endorses every aspect of this IP. During the allowable annual cut (AAC) determination information session, FLNRORD staff will advise the 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 and the comments received from First Nations and the public, when she determines the AAC for TFL 54.

Sincerely,

Qiong Su, RPF
Timber Supply/Geomatics Forester
Forest Analysis and Inventory Branch

pc: Jim Brown, Senior Analyst - TFLs, Forest Analysis and Inventory Branch

Ministry of Forests, Lands, Natural Resource Operations and Rural Development
Forest Analysis and Inventory Branch
Mailing Address:
PO Box 9512 Stn Prov Govt
Victoria BC V8W 9C2
Telephone: 250-356-5947
Fax: 250-387-5999

Tree Farm Licence 54 – Management Plan #5

INFORMATION PACKAGE

Version 1.2

September 19, 2018

Project 1414-1

Prepared for:

Ma-Mook Natural Resources Ltd.
P.O. Box 639
Ucluelet, BC V0R 3A0
Telephone: (250) 726-6373

MA-MOOK
Natural Resources Ltd.

Prepared by:

Cosmin Man, Phd, RPF
Forsite Consultants Ltd.
330 – 42nd Street SW
PO Box 2079
Salmon Arm, BC V1E 4R1
cman@forsite.ca
250-832-3366

FORSITE
Forest Management Specialists

Acknowledgements

Forsite thanks Zoltan Schafer, RPF (Ma-Mook forestry manager) for contributing valuable operational experience in designing the silvicultural treatments, Brynna Check (International Forest Products Ltd.) for providing the resultant file used in MP4, and Jim Brown, Qiong Su, and Tracy Andrews (BC Ministry of Forests, Lands, and Natural Resource Operations) for providing useful data and suggestions in completing the analysis. Wenli Xu (BC Ministry of Forests, Lands, and Natural Resource Operations) provided guidance to correctly estimate VDY7 yields.

The Forsite team included Cosmin Man (conducted the analysis) and Patrick Bryant (reviewed the analysis).

Contents

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List of Acronyms

AAC	Allowable Annual Cut
AU	Analysis Unit
BCLCS	BC Land Classification System
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Option
CMAI	Culmination of MAI
CSLUP	Clayoquot Sound Landscape Unit Plan
CWH	Coastal Western Hemlock BEC zone
DBH	Diameter at Breast Height
DBHq	Quadratic mean DBH
DIB	Diameter Inside Bark
ECA	Equivalent Clearcut Area
FSW	Fisheries Sensitive Watershed
GIS	Geographic Information System
LRMP	Land and Resource Management Plan
LU	Landscape Units
M	Modification VQO
MAI	Mean Annual Increment
MH	Mountain Hemlock BEC zone
MHA	Minimum Harvest Age
MP	Management Plan
NDT	Natural Disturbance Type
NHLB	Non-Harvesting Land Base
OAF	Operational Adjustment Factor
OGMA	Old Growth Management Area
PFLB	Productive Forest Land Base
PR	Partial Retention VQO
SI	Site Index
TFL	Tree Farm Licence
THLB	Timber Harvesting Land Base
TIPSY	Table Interpolation for Stand Yields
TSA	Timber Supply Area
TSR	Timber Supply Review
VDYP	Variable Density Yield Projection
VILUP	Vancouver Island Landscape Unit Plan
VLI	Visual Landscape Inventory
VQO	Visual Quality Objective
VRI	Vegetation Resource Inventory

Document Revision History

Version	Date	Description
1.1	February 18, 2018	Section 2.2, Table 2. A new resultant file was developed to accurately portray Maa-nulth IHA and Ahousaht FMAs. Thus, trivial area differences occurred (<1ha). Future road reductions (5%) applied correctly to area of existing natural stands (age current to year 2017 >22yrs).
1.1	February 18, 2018	Section 4.1. Addressed the public comment from Maryjka Mychajlowycz with Friends of Clayoquot Sound on November 7, 2017. Clarified that the term area-based harvest is not the recommended area-based AAC and that Table 10 is just an example.
1.1	February 18, 2018	Section 4.5. The existing managed yields are developed in TIPSY 4.4., as recommended by Mario DiLuca (FLNRO).
1.1	February 18, 2018	Section 4.6. Slight changes to MHA criteria for poor stands.
1.1	February 18, 2018	Section 4.8. Confirmed Seed Class A usage for regeneration of 2017+ stands.
1.1	February 18, 2018	Added section 4.13. Included map and description of Ahousaht FMAs.
1.1	February 18, 2018	Sections 4.15.3 and 4.16.3 addressing the comment from Su Qiong in regards to sources for visual objectives received on October 16, 2017. Included source of maximum disturbance levels and how they were derived. Included assumption comparison to Arrowsmith TSR and TFL 57 MP2.
1.2	September 19, 2018	Appendix 2 TIPSY Regeneration Assumptions, removed genetic gains for natural components of the stands.

1 Introduction

Ma-Mook Natural Resources Limited (Ma-Mook), the holder of Tree Farm Licence (TFL) 54 is undertaking a Management Plan (MP) #5 process - due for approval by August 25, 2018. As part of the management plan process, a timber supply analysis will be conducted to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting. An area-based harvest regulation is utilized for TFL 54, made possible by the *Tree Farm Licence Area-based Allowable Annual Cut Trial (AAC) Program Regulation*. With an area-based AAC, the area of land that can be harvested annually is defined, rather than the amount of volume. This information package has been prepared to support the timber supply analysis and describe the information that is material to the analysis, including data inputs and assumptions.

The results of the timber supply analysis will inform the AAC determination process by documenting potential future harvest flows. **Results presented here do not define a new AAC, rather they are intended to provide insight into the likely future timber supply of the TFL.** The final harvest level decision will be made by the Deputy Chief Forester.

1.1 HISTORY

In May 1955 the Maquinna Forest Management Licence No. 22 was awarded to British Columbia Forest Products Limited. In July 1981, FML22 was replaced by TFL 22, which was amalgamated in July 1983 with TFL 27 to form TFL 46. TFL 46 was then transferred to Fletcher Challenge Canada Limited in September 1988 and in December 1991, subdivided. Blocks 4 and 5 (the west coast portion) of the subdivided TFL 46 was transferred to International Forest Products Ltd. (Interfor) on December 30, 1991, and became TFL 54. On March 28, 2007, the TFL 54 was transferred to Ma-Mook.

In the 1980s and 1990s, growing public concern regarding the sustainability of forest management in the Clayoquot Sound area, where most of TFL 54 lies, attracted international attention. Following many years of public participation and consultation, the provincial government announced in 1993 its Clayoquot Sound Land Use Decision which designated protected areas, special management areas (for recreation, wildlife, or scenic corridors), and general integrated resource management areas. Under the Clayoquot Sound Land Use Decision, timber harvesting is a major activity within the general integrated management areas.

Following the Clayoquot Sound Land Use Decision, on October 22, 1993, the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound was formed with the objective to define world-class, sustainable forest practices for the area, including reviewing the forest practices standards in effect in Clayoquot Sound at that time and recommending changes to ensure that the practices would be sustainable. The 124 specific and 91 general recommendations submitted by the Scientific Panel to the provincial government in 1995, were fully accepted and planned for implementation within Clayoquot Sound area. Areas outside of the Clayoquot Sound area that fall within TFL 54 are managed in accordance with the Forest and Range Practices Act (FRPA) and its regulations related to Crown forest lands in BC.

To ensure the recommendations are implemented, the Clayoquot Sound Technical Planning Committee was formed of representatives from First Nations and government. The Technical Planning Committee's responsibilities are to prepare watershed-level plans for each of the 15 watershed planning units within the Clayoquot Sound area. From these 15 units, TFL 54 intersects 8 watershed-level plans. The 8 watershed-level plans were completed by 2006 and were all approved in 2008.

1.2 AAC HISTORY

The first AAC was determined in 1991, when the TFL 54 was managed by Interfor, at 138,000 m³/year. In May 1994, the Chief Forester ordered a temporary AAC reduction of 42,000 m³/year under Part 15 (now Part 13) of the Forest Act. This temporary reduction was needed to account for the newly protected areas and anticipated changes to management resulting from the Clayoquot Sound Land Use Decision and was maintained until 1996. In recognition of Scientific Panel recommendations on watershed rate-of-cut limits and old growth retention, a simplified version of an area-based analysis was used to determine a short-term AAC of 125 ha/year (or 75,750 m³/year based on old-growth average volume/ha). This represented a 45% decrease from the 1991 AAC of 138,000 m³/year and was maintained until 2008 when the watershed plans were completed.

Ma-Mook announced in March 2007 that it intended to implement the management approach described in the TFL 54 Management Plan and accompanying Timber Supply Analysis submitted by the previous licensee (i.e., Interfor). Ma-Mook also aimed to harvest and mill timber from TFL 54 according to the Forest Stewardship Council standards with the goal of achieving certification. This approach was implemented in MP 4 (Timberline Forest Inventory Consultants, 2005), from which the Deputy Chief Forester determined an AAC of 320 ha/year in 2008.

1.3 LOCATION OF TFL 54

TFL 54 is located within the Clayoquot Sound region on the west side of Vancouver Island and covers an area of approximately 49,000 ha (Figure 1). The landscape is a complex of mountains, valleys, ocean inlets, lakes, rivers, islands and forests. The forests cover portions of the Coastal Western Hemlock (CWH) and Mountain Hemlock (MH) biogeoclimatic ecosystem classification (BEC) zones and comprise of old growth western redcedar, western hemlock, and amabilis fir.

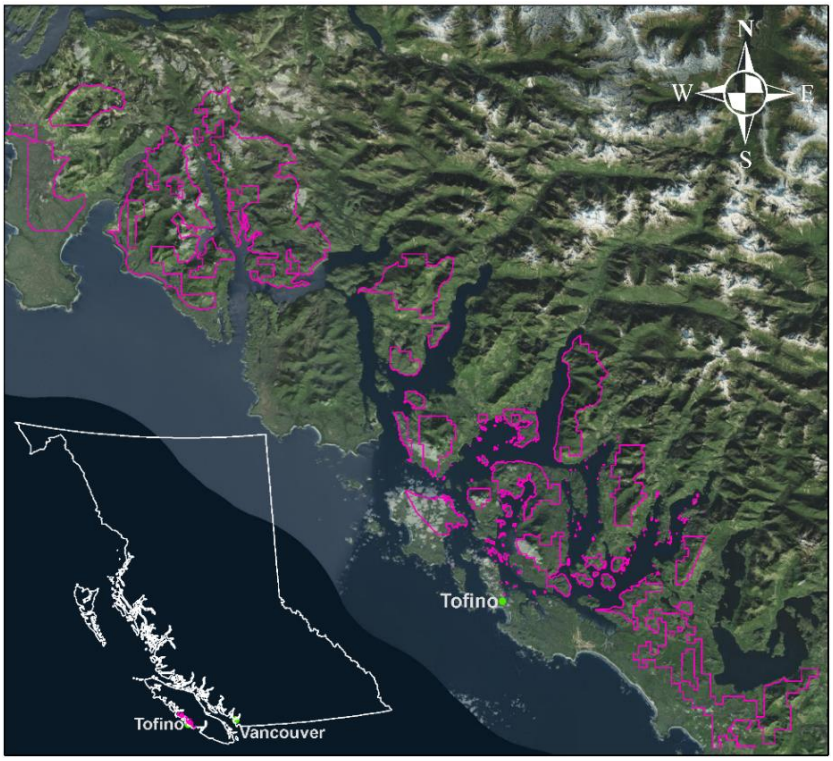


Figure 1 Location of TFL 54

1.4 FOREST MANAGEMENT CONSIDERATIONS

An area-based harvest regulation is utilized for this TFL, where the area of land that can be harvested annually is defined, rather than the amount of volume. The harvest sustainability is achieved by maintaining a constant harvest area over time.

The management TFL 54 that covers the Clayoquot Sound area is guided by the Clayoquot Sound Landscape Unit Plan (CSLUP). The CSLUP includes watershed-level plans that guide the forest management practices for areas within Clayoquot Sound. The watershed plans were developed by a scientific panel as described in section 1.1. Here, reserves are set in order to protect a range of values (wildlife, recreation, old growth forests, riparian areas, sensitive soils, unstable terrain etc.). On non-reserved areas, partial cuts with retention levels up to 70% are implemented such that non-timber objectives set by the watershed plans are achieved (landscape- and stand-level biodiversity, visual quality within scenic corridors, and reduced rate of cut within watersheds).

Areas outside of the Clayoquot Sound that fall within TFL 54 are managed in accordance to the Forest and Range Practices Act (FRPA) and its regulations related to Crown forest lands in BC. Here, reserved areas are set aside to protect wildlife habitat, riparian areas, sensitive soils, and unstable terrain. On non-reserved areas, clearcuts with reserves are implemented such that non-timber objectives set by the Vancouver Island Land Use Plan (VILUP) are achieved (landscape- and stand-level biodiversity, visual quality objectives, green-up adjacency, and reduced rate of cut for fisheries sensitive watersheds.

2 Land Base Definition

2.1 DATA SOURCES

For this timber supply analysis, the datasets and their sources are shown in Table 1. These datasets were collected with the aim to appropriately consider all management objectives with this TFL. The datasets were combined into a resultant file that was used to support the forest estate modelling.

Table 1 Source Data

Data	Source*	Feature Name	Effective
Administrative Information			
TFL 54 Boundary	WHSE_ADMIN_BOUNDARIES	FADM_TFL	2017
Ownership	WHSE_FOREST_VEGETATION	F_OWN	2017
Parks and Protected Areas	WHSE_TANTALIS	TA_PARK_ECORES_PA_SVW	2017
Landscape Units	WHSE_LAND_USE_PLANNING	RMP_LANDSCAPE_UNIT_SVW	2015
Resource Management Plans (LEGAL)	WHSE_LAND_USE_PLANNING	RMP_PLAN_LEGAL_POLY_SVW	2017
Strategic Land Resource Plan	WHSE_LAND_USE_PLANNING	RMP_STRGC_LAND_RSRCE_PLAN_SVW	2017
Maa-nulth Important Harvest Areas	WHSE_LEGAL_ADMIN_BOUNDARIES	FNT_TREATY_SIDE_AGREEMENTS_SP	2017
Ahousaht First Nation FMAs	Maaqutusiis Hahoulthee Stewardship Society	Ahousaht_FMAs	2017
Management Guidance			
Community Watersheds	WHSE_WATER_MANAGEMENT	WLS_COMMUNITY_WS_PUB_SVW	2016
Fish Sensitive Watersheds	WHSE_WILDLIFE_MANAGEMENT	WCP_FISH_SENSITIVE_WS_POLY	2017
Watershed sub-basin (rate of cut)	ftp://ftp.geobc.gov.bc.ca/publish/Regional/Nanaimo/Clayoquot/	watersheds/ws	2002
Visual Landscape Inventory	WHSE_FOREST_VEGETATION	REC_VISUAL_LANDSCAPE_INVENTORY	2015
CSLUP Scenic Areas	ftp://ftp.geobc.gov.bc.ca/publish/Regional/Nanaimo/Clayoquot/	scenic/sceneclass	2002

Data	Source*	Feature Name	Effective
CSLUP Reserves	ftp://ftp.geobc.gov.bc.ca/publish/Regional/Nanaimo/Clayoquot/	reserves/*-res	2006
Environmentally Sensitive Areas	Interfor	INT_ESA	2006
Terrain Stability	Interfor	INT_TERRAIN	2006
Operability	Interfor	INT_OPERABILITY	2006
Operability	ftp.for.gov.bc.ca\DSI\external\!publish\Arrowsmith TSR\Operability Report	Arrowsmith_EO_res11_dissolved	2014
Variable Retention Zones	Interfor	INT_VRZONE	2006
Slope >60%	Interfor	INT_SLOPE60	2006
Wildlife Habitat Area Approved	WHSE_WILDLIFE_MANAGEMENT	WCP_WILDLIFE_HABITAT_AREA_POLY	2015
Wildlife Habitat Area Proposed	WHSE_WILDLIFE_MANAGEMENT	WCP_WHA_PROPOSED_SP_polygon	2017
Wildlife Management Areas	WHSE_TANTALIS	TA_WILDLIFE_MGMT_AREAS_SVW	2015
Inventories			
Vegetation Resource Inventory	WHSE_FOREST_VEGETATION	VEG_COMP_LYR_R1_POLY	2017
Forest Cover	Interfor	TFL 54_res050_polygon	2006
Forest Inventory Consolidated	Forsite	VRI_consolidated	2017
FTA cutblocks 4.0	WHSE_FOREST_TENURE	FTEN_CUT_BLOCK_POLY_SVW	2017
RESULTS Openings	WHSE_FOREST_VEGETATION	RSLT_OPENING_SVW	2017
RESULTS Cover Reserves	WHSE_FOREST_VEGETATION	RSLT_FOREST_COVER_RESERVE_SVW	2017
RESULTS Forest Cover Inventory	WHSE_FOREST_VEGETATION	RSLT_FOREST_COVER_INV_SVW	2017
Forsite consolidated cutblocks and reserves	Forsite	Cutblocks_consolidated	2017
FWA inventories for lakes, rivers, wetlands, and streams	WHSE_BASEMAPPING	FWA_LAKES_POLY, FWA_RIVERS_POLY, FWA_WETLANDS_POLY, FWA_STREAM_NETWORKS_SP	2015
Road Buffers	Forsite consolidated from ATLAS, FTEN segments, and FTEN sections	Roads_Buffer	2017
VDYP7 input table	VEG_COMP_VDYP7_INPUT_LAYER		2017

**Sources include the BC Geographic Data Warehouse (WHSE, FTEN, VEG_COMP), BC FTP (Geo and For), Interfor (International Forest Products Ltd.), and consolidated by Forsite.*

2.2 LAND BASE SUMMARY

The total area within the boundaries of this TFL is 48,922 ha (Table 2, Figure 2). Reductions for non-forest and roads results in a productive forest land base (PFLB) of 46,649 ha (95.4%). Further reductions of areas unsuitable for harvesting, or protected from harvesting, here called non-harvesting land base (NHLB), total to 28,736 ha or 61.6% of the PFLB. The remaining area suitable for harvesting, here called the timber harvesting land base (THLB) is 17,913 ha (36.6% of total area). However, in order to properly account for the future THLB, areas that will be permanently converted to future roads need to be accounted for. Future roads reduction (5%) was applied to the THLB area that is modelled as existing natural stands (i.e., age >22 years). Thus, the future THLB was estimated to be 17,084 ha (34.9% of total TFL54 area).

In Table 2, the Total Area refers to the gross area for each factor. Once the non-forest and roads are removed, the gross area within PFLB is reported under the Total Area column. The Effective Area refers to the net area that is covered by each factor. Because there are overlaps between various factors in the net-down hierarchy, the gross and net area are not always equal. For example, a factor accounted for at an earlier stage in the net-down process can overlap with a factor accounted for at a later stage. Thus, the factor accounted earlier includes the overlaps with the factors accounted later.

Table 2 Land Base Definition

Factor			Total Area (ha)	Effective Area (ha)	% of Total Area	% of CFLB
Total Area			**48,922**		**100.0%**	
	Clayoquot Sound Landscape Unit Plan (CSLUP)		45,685		93.4%	
	Outside CSLUP		3,237		6.6%	
Less:						
	Non Forest		2,698	1,799	3.7%	
	Existing Roads		484	474	1.0%	
Total Productive Forested Land Base (PFLB)				**46,649**	**95.4%**	**100.0%**
	Within CSLUP			43,687	89.3%	93.7%
	Outside CSLUP			2,962	6.1%	6.3%
Less:			*in PFLB*			
	Within CSLUP			***27,872***	***57.0%***	***59.7%***
		Non Vegetated	69	69	0.1%	0.1%
		Inoperable	19,125	19,087	39.0%	40.9%
		Terrain Stability	3,074	1,358	2.8%	2.9%
		Sensitive Soils	1,501	220	0.5%	0.5%
		Flood Plains	327	11	0.0%	0.0%
		Marbled Murrelet	2,635	1,365	2.8%	2.9%
		Blue Listed	2,070	760	1.6%	1.6%
		Red Listed	205	36	0.1%	0.1%
		Protected Areas	107	55	0.1%	0.1%
		Recreation and Tourism	1,883	892	1.8%	1.9%
		Interior Old Growth	130	64	0.1%	0.1%
		Hydro Buffers	6,605	2,420	4.9%	5.2%
		Meares Island*	3,662	1,536	3.1%	3.3%
	Outside CSLUP			***864***	***1.8%***	***1.9%***
		Inoperable	522	522	1.1%	1.1%
		ESA	228	147	0.3%	0.3%
		Terrain Stability	19	10	0.0%	0.0%
		Wildlife Habitat Area	109	63	0.1%	0.1%
		Riparian Buffers	193	122	0.2%	0.3%
Timber Harvesting Land Base (THLB)				**17,912**	**36.6%**	**38.4%**
	CSLUP			15,815	32.3%	33.9%
	Outside CSLUP			2,098	4.3%	4.5%
Less:						
	Future Roads (5%)			829	1.7%	1.8%
Future THLB				**17,084**	**34.9%**	**36.6%**

** Meares Island area covered by TFL54 falls entirely under the CSLUP.*

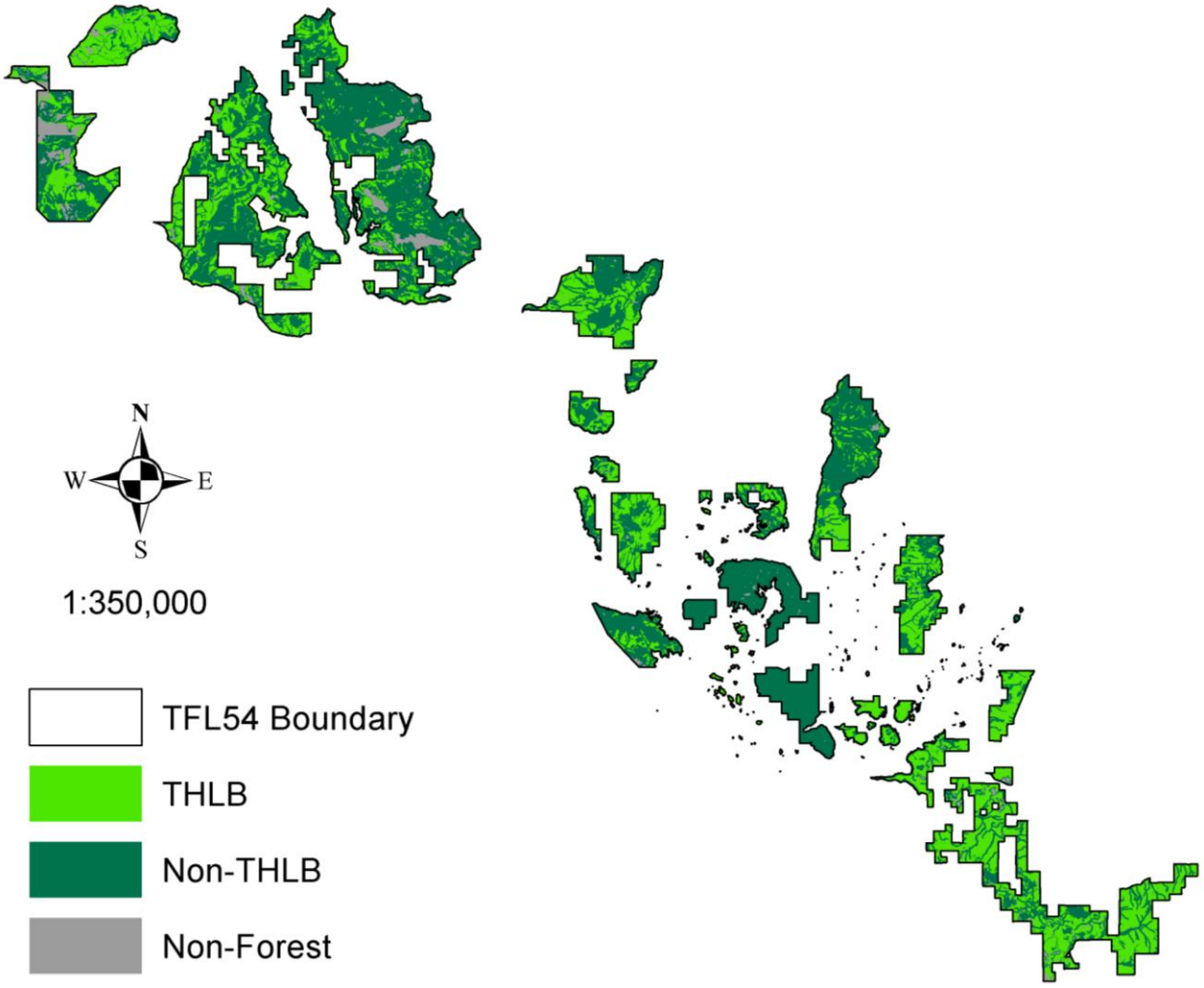


Figure 2 TFL 54 Land Base Definition

Differences from Management Plan 4

Two datasets were significantly different than those in MP4: Vegetation Resource Inventory (VRI) and operability. The VRI updates are described in section 3.1 while operability is discussed in sections 2.5 and 2.6. These differences resulted in approximately 25.6% lower THLB than MP4 (MP4 THLB = 24,086 ha).

The gross area covering TFL 54 is 364 ha smaller than MP4. This difference is believed to have been caused by minor boundary changes since MP4 and geoprocessing tools used to compile the data sources.

2.3 OWNERSHIP

TFL 54 falls almost entirely (99.9%) under Ownership code 72 and schedule B (i.e., Crown – Schedule B land, TFL) (Table 3). The small areas outside schedule B are assumed to be sliver polygons due to current ownership dataset.

Table 3 Ownership Description

Ownership Code	Ownership Schedule	Description	THLB (ha)	NHLB (ha)	Non Forest (ha)	Total (ha)
62	C	Crown – Forest Management Unit (TSA)	2		3	5
72	A	Private – Schedule A land, TFL	1	8		10
72	B	Crown – Schedule B land, TFL	17,901	28,704	2,265	48,870
No data	No data		9	24	5	37
Total			**17,912**	**28,736**	**2,273**	**48,922**

2.4 NON-FOREST LAND BASE

The non-forest land base includes areas that are not typed in the VRI, covered by water bodies, non-vegetated, wetlands, and existing roads and landings (Table 4). The latest VRI, freshwater atlas, digital road atlas, and forest tenure road segments and sections were used to compile the non-forest information. Similar to MP 4, roads were buffered 5 metres on each side. The buffered road area in MP4 was 180 ha more than in current analysis (MP4 existing roads gross area = 664 ha). Forsite conducted an investigation and overlayed the buffered roads in the MP4 with latest imagery available for the TFL54. It was observed that some roads extended outside the current TFL54 boundary and some roads do not seem to exist – these were either reforested or were in the planning stage when MP4 was developed, yet they were never built.

The allowance for future roads was adopted from the Arrowsmith TSR (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016) as 5%. This was implemented in the model by reducing the harvest area of future stands, regenerated from existing natural stands, by 5%.

Table 4 Non-Forest Areas

Non Forest Class	Criteria	Gross Area (ha)	Net Area (ha)
Not Typed	BCLCS Level 1 = U, or null	203	183
Water	BCLCS Level 1 = N, BCLCS Level 2 = W, BCLCS Level 5 = LA, RE, RI, OC; FWA water polygons (lakes, rivers)	1,826	1,062
Non Vegetated Land	BCLCS Level 1 = N, BCLCS Level 2 = L, BCLCS Level 3 = U or null (no logging history)	10	10
FMLB Vegetated Not Treed	FMLB = Y, BCLCS Level 1 = V, BCLCS Level 2 = N, BCLCS Level 3 = U or null (no logging history)	52	51
Vegetated Not Treed	BCLCS Level 1 = V, BCLCS Level 2 = N, BCLCS Level 3 = U or null (no logging history)	41	33
Wetlands	BCLCS Level 1 = V or N, BCLCS Level 2 = T or N or L or W, BCLCS Level 3 = W, BCLCS Level 5 <> LA, RE, RI, OC; FWA wetlands polygons	565	460
Road Buffers	ROAD_ID >0	484	474
Total		**3,182**	**2,273**

Note: BCLCS = BC Land Classification System, FMLB = VRI Forest Management Land Base

Difference from Management Plan 4

The gross non-forest area in MP4 was 1,841 ha (including roads), 1,341 ha (42%) less than this analysis. It is believed the differences are generated from using the newer inventory.

2.5 AREA REDUCTIONS FROM THE CLAYOQUOT SOUND LANDSCAPE UNIT PLAN

In the CSLUP, there are 10 specific reductions to the THLB, as detailed in Table 2 and Table 5. These 10 specific reductions are all 100% reserves, initially designated by the provincial government in 1993 via the Clayoquot Sound Land Use Decision, and then refined by the Clayoquot Sound Technical Planning Committee (i.e., a committee of representatives from First Nations and government) which developed the watershed-level plans for each of the 15 watershed planning units within the Clayoquot Sound area. The watershed-level plans for the 8 watersheds overlapping withTFL54 (Table 17) were completed in 2006 and approved in 2008. The datasets location of the watershed reserves network is indicated in Table 1.

Table 5 Description of Specific THLB Reductions within CSLUP

CSLUP specific THLB reduction	Source	Reserve Criteria Applied
Non Vegetated	Vegetation Resource Inventory 1996-1999, 1:20,000, ARC Alpine Consultants	100% protection of wetlands that are non-vegetated and shrub/herb dominated polygons and that are part of the littoral zone or adjacent marine shore and beside some lakes.
Terrain Stability	Terrain and Terrain Stability Mapping, 1:20,000, 1996-1999, Madrone Consultants Ltd.	100% protection of Class V Terrain
Sensitive Soils	Landslide Inventory, 1997, EBA Engineering Consultants Ltd.	100% protection of sensitive soils (bedrock terrain, shallow organic matter, organic soils, blocky and boulder-colluvial material, active colluvial cones or fans and alluvial fans, and poor growing sites). Sensitive soils associated with wetlands are captured by hydroriparian reserves.
Flood Plains	Mapped as part of the terrain and terrain stability mapping. Contemporary floodplain is defined by the Scientific Panel as "valley floor adjacent to stream channel subject to inundation by current hydrological regime." Report 5[1], p. 274.	100% protection
Marbled Murrelet	Habitat suitability model (2001) using 1:20,000 Vegetation Resource Inventory to classify nesting potential based on its vegetation characteristics (in descending order of importance): • height of leading or second leading tree species,	100% protection

[1] _____. 1995. Report 5: Sustainable Ecosystem Management in Clayoquot Sound: Planning and Practices. Victoria, B.C.

CSLUP specific THLB reduction	Source	Reserve Criteria Applied
	• age of the leading or second leading tree species, • basal area, • vertical complexity of the forest canopy, • canopy closure, • average distance of the polygon from the ocean, and • average elevation of the polygon	
Red and Blue Listed	• Terrestrial Ecosystem Mapping, 1:20,000, 1996-1999, Madrone Consultants Ltd. • Conservation Data Center's species list.	100% protection
Protected Areas	• Archaeology Inventory, 1;20,000, 1996-1999, Golder Associates Ltd. & Shoreline Archaeological Services. • Consultation with First Nations. • Scenic Inventory, 1:20,000, various projects, 1993-1999. • Vegetation Resource Inventory 1996-1999, 1:20,000, ARC Alpine Consultants. • All other inventories listed in this table.	• 100% protection of archaeology sites. • CMTs and traditional areas are protected as directed by First Nations. • Logical linkages for wildlife migration, plant and animal connectivity, and recreation and tourism opportunities. • At least 30% of each site series. • At least 50% of rare site series[2]. • At least 20% of each site series - dominant tree species -group for groupings of 201-400 years and 401 - 600 years larger than 2 hectares in size.
Recreation and Tourism	• Recreation and tourism use Information (1996-1999). • Recreation Inventory, Tourism Inventory and Capability Modelling, 1997-1998, Catherine Berris Associates, Juan de Fuca Environmental Consultants, and Wilcon Wildlife Consulting Ltd.	Recreation features that have a significance rating of very high and high.
Interior Old Growth	Vegetation Resource Inventory	At least 40% protection of old growth (i.e., age class 8 and 9) of which 20% must be forest-interior conditions.
Hydro Buffers	Hydroriparian Inventory, 1:20,000, 1996-1999, Madrone Consultants Ltd.	Scientific Panel recommendations relating to Hydroriparian Reserves in Report 5, section 7.4. It includes a range of reserve buffer widths.

Further reductions for economically and physically inoperable areas were applied using the 2014 economic operability assessment completed for Arrowsmith TSA (Forest Ecosystem Solutions Ltd., 2014), which includes the Clayoquot area. This assessment was based on species composition, slope, distance from road, and minimum harvest volumes. In addition, the following assumptions were made to the 2014 operability assessment:

- previously logged areas are considered operable,

[2] Rare site series are described as those present in less than 2 percent of area or 6 or fewer occurrences. Rare site series may or may not include red- and blue-listed plant communities.

- partially economic areas are considered inoperable, and
- inoperable areas (Economic code = N or P) are considered operable if slope is less than 60%, terrain stability class is not 5, and VRI live volume (at 17.5 dbh) is greater than 400 m³/ha. This assumption was adopted from MP 4. Given that economic operability data has a significant impact on lowering the THLB, and that a newer VRI is available compared to the VRI that was available for the economic operability dataset, it is reasonable to consider operable, areas with high volume that are otherwise physically operable.

A summary of the operability areas within CSLUP is shown in Table 6.

Table 6 Operability Areas within CSLUP

Operability 2014	THLB (ha)	NHLB (ha)	PFLB (ha)
Inoperable	2,151	20,427	22,579
Partial	450	1,307	1,757
Operable	12,508	6,053	18,561
Not Reported	706	85	791
Total	**15,815**	**27,872**	**43,687**

All area reductions from the CSLUP were completely excluded from the THLB.

Difference from Management Plan 4

MP4 used an operability layer developed in 1992 with some adjustments based on volume, age, slope, and terrain stability; similar to the current analysis. Some areas considered inoperable in the 1992 assessment were changed to operable in the 2014 operability assessment, and vice-versa.

Overall, the total inoperable area in this analysis (Table 2) was 19,125 ha + 522 ha = 19,647 ha; 1.9 times the inoperable area used in MP4 (MP4 inoperable = 10,277 ha). Forsite conducted a visual check of existing cutblocks and concluded that they follow the 2014 economic operability assessment rather well.

Except for the differences with inoperable areas discussed above, the CSLUP reductions match those used in MP4 quite closely.

2.6 REMOVALS OUTSIDE OF CLAYOQUOT SOUND LANDSCAPE UNIT PLAN

The Vancouver Island Landscape Unit Plan (VILUP) applies outside of the CSLUP. Here, the following factors were considered and completely excluded from THLB:

- Inoperable areas were based on the 1992 operability mapping provided by Interfor (Table 7), except:
    - Previously logged areas were considered operable (46 ha in Table 7),
    - Inoperable areas were considered operable if the volume was greater than 400m³/ha, slopes less than 60%, and terrain stability class not 5 (65 ha in Table 7). The volume information was compiled from current VRI (where available) and MP4 resultant data file (see section 3.1).
    - Operable areas were considered inoperable if the volume was less than 400 m³/ha and current age greater than 120 years (included in 95 ha in Table 7).

- Environmentally sensitive areas (ESA) denoting sensitive soils were excluded where terrain data was not available. ESAs are areas that have special environmental attributes which require special management (e.g., avalanche, soil sensitivity, recreation, regeneration problems, wildlife) etc.). The ESAs were initially developed in early 1990's and many of their attributes are superseded by other more recent datasets (e.g., terrain stability, designated wildlife habitat area etc.). In cases where more recent datasets are unavailable, ESAs are still used for forest estate modelling purposes.
- Unstable terrain was excluded where terrain stability mapping identified class 5. Terrain class 4 (covering approximately 197 ha THLB) was not excluded because harvest occurred in the past in these areas and Ma-Mook will most likely continue same practice in the future. The terrain dataset used outside CSLUP was provided by Interfor, and it is identical to the dataset used in MP 4.
- Wildlife management areas were excluded for the Tofino Mudflats Wildlife Management Area, established in 1997 by regulation under section 4(2) of the Wildlife Act for the purpose of conservation of an important wetland complex for waterfowl and shorebirds. Note that previous factors in the land base definition process completely excluded these areas as they cover only 24 ha (Table 8).
- Wildlife habitat areas (WHA), established to meet the wildlife habitat requirements, were excluded from the THLB (Table 8). The WHA covering areas of TFL 54 outside CSLUP shown in Table 8 do not allow harvesting activities (i.e., no harvest zone).
- Riparian buffers were removed from the THLB according to the Forest Planning and Practices Regulation, sections 47 to 49 (Table 9). In MP4 there was no specification of the buffer widths used to determine the riparian buffers. The effective buffer distance is determined as the riparian reserve zone buffer distance plus 50% of the riparian management distance. Thus, it was assumed that in the riparian management areas, 50% of the trees were being removed during logging. In the case of streams, the available dataset did not include classified streams. The 15m buffer width for streams was adopted from an older timber supply review for the Arrowsmith TSA (Timberline Natural Resource Group, 2008), yet no background information was provided. Possibly, the 15m buffer width was determined from a combination of field surveys and professional judgement. In comparison, within CSLUP, the hydroriparian buffers range from 10 to 75m.

Table 7 Operability Areas outside CSLUP

	THLB (ha)			NHLB (ha)			PFLB (ha)
	Operable 1992	Inoperable 1992	Total	Operable 1992	Inoperable 1992	Total	
Inoperable 2017	0	46	46	95	428	523	570
Operable 2017	1,986	65	2,051	328	13	341	2,392
Total	**1,986**	**112**	**2,098**	**423**	**441**	**864**	**2,962**

Table 8 Wildlife Habitat and Management Areas outside CSLUP

WHA Tag #	Species	Effective Date	Total Area (ha)	Net Area (ha)
1-393	Red-legged frog	27-May-10	5	5
1-430	Marbled Murrelet	26-Nov-15	48	43
1-431	Marbled Murrelet	26-Nov-15	25	13
1-493	Red-legged frog	proposed	7	2

WHA Tag #	Species	Effective Date	Total Area (ha)	Net Area (ha)
Tofino Mudflats Wildlife Management Area		8-Apr-97	24	
Total			**109**	**63**

Table 9 Riparian Buffers outside CSLUP

Riparian Class	Effective Buffer (m)	Size (ha)	BEC
Lake L1A	0	>=1,000	All
Lake L1B	10	<1,000	All
Lake L2	20	>=1 and <=5	PP, BG, CDF, IDFxh, IDFdw, IDFxm, CWHxm, CWHdm, CWHds
Lake L3	15	>=1 and <=5	All different than L2
Lake L4	15	>=0.5 and <1	CDF, CWHxm, CWHdm, CWHds
		>=0.25 and <1	PP, BG, IDFxh, IDFdw, IDFxm
Wetland W1	30	>5	All
Wetland W2	20	>=1 and <=5	PP, BG, CDF, IDFxh, IDFdw, IDFxm, CWHxm, CWHdm, CWHds
Wetland W3	15	>=1 and <=5	All different than W2
Wetland W4	15	>=0.5 and <1	CDF, CWHxm, CWHdm, CWHds
		>=0.25 and <1	PP, BG, IDFxh, IDFdw, IDFxm
Rivers	60	N/A	N/A (treated like S1-B)
Streams	15	N/A	N/A (Timberline Natural Resource Group, 2008)

Difference from Management Plan 4

Outside of the CSLUP, there were no significant differences in THLB reductions from MP4. However, it was unclear how riparian buffers outside CSLUP were created in MP4.

2.7 MEARES ISLAND

While there is no legal instrument removing Meares Island from the land base, it was excluded from THLB due to an existing court injunction in place since 1985. This may be reintroduced at a later time once the issue is settled. The same approach was applied in MP4. Note that Meares Island overlap with TFL54 is entirely within CSLUP.

3 Current Forest Conditions

3.1 FOREST INVENTORY CONSOLIDATION

The latest VRI accessed from Data BC represents TFL 54 relatively well. Most of the area covered by CSLUP was last updated in 2014-2015. However, the forest inventory outside of CSLUP (3,236 ha) is relatively old - as early as the 1960s. Outside of CSLUP, wherever the current VRI had null values for species composition or BCLCS_LEVEL_2 (or BCLCS_LEVEL_1 = 'U'), the adjusted inventory information from MP4 (not null) was used to consolidate an inventory dataset for this analysis. Species composition, age (updated to 2016), site index, and adjusted volume were taken from the inventory used in MP4.

The inventory was also updated for recent harvested cutblocks by utilizing the following data in the following order: VRI, RESULTS Forest Openings, RESULTS Forest Cover Inventory, and RESULTS Forest Cover Reserves. Where information was available, cutblocks identified with partial harvesting were identified.

3.2 CURRENT CONDITIONS

Most of the forest within TFL 54 is relatively old (31,085 ha or 66.6% of PFLB, older than 240 years) indicating that little recent disturbance has occurred (Figure 3). It was also observed that logging began within the area approximately 60 years ago; indicated by the 13.4% of THLB area younger than 60 years.

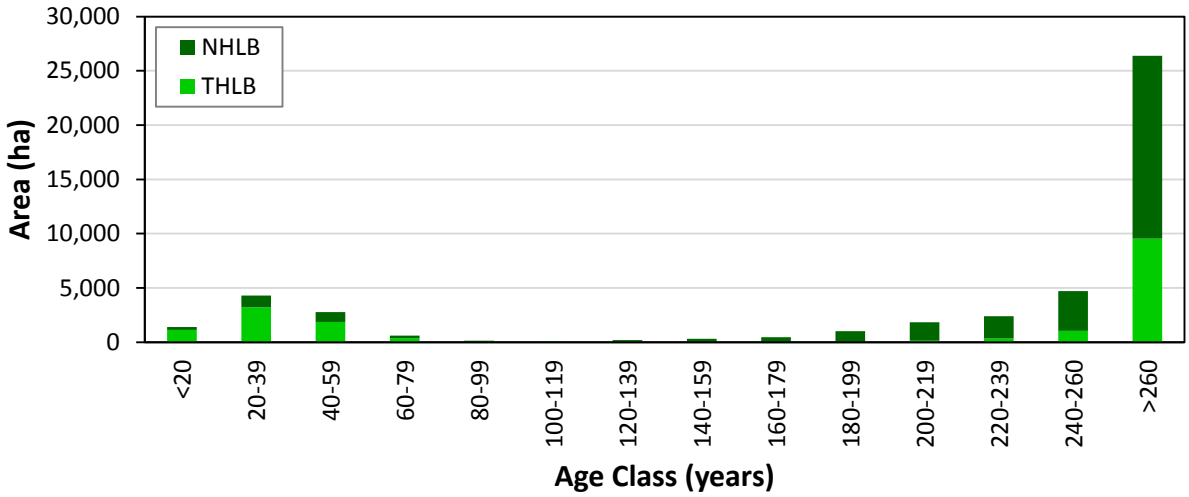


Figure 3 Current Age Class Distribution by PFLB Area

The forested land base is covered almost exclusively by the CWH BEC zone (Figure 4). Approximately 38% of the forested area within the CWH is THLB. The MH BEC zone covers just 1.6% of the forested land base, and most of this is NHLB.

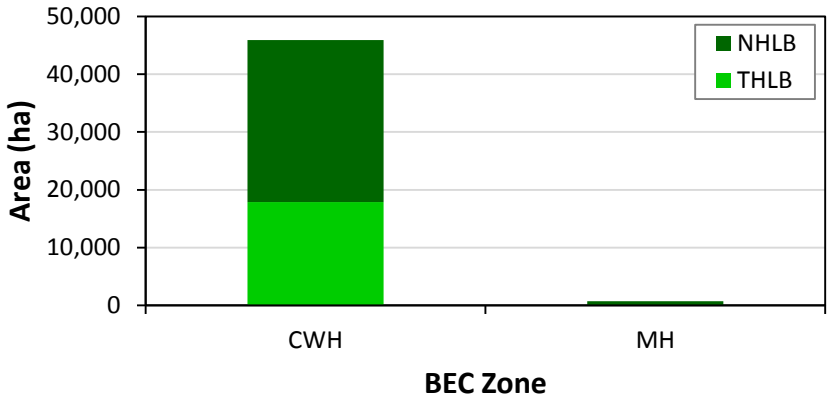
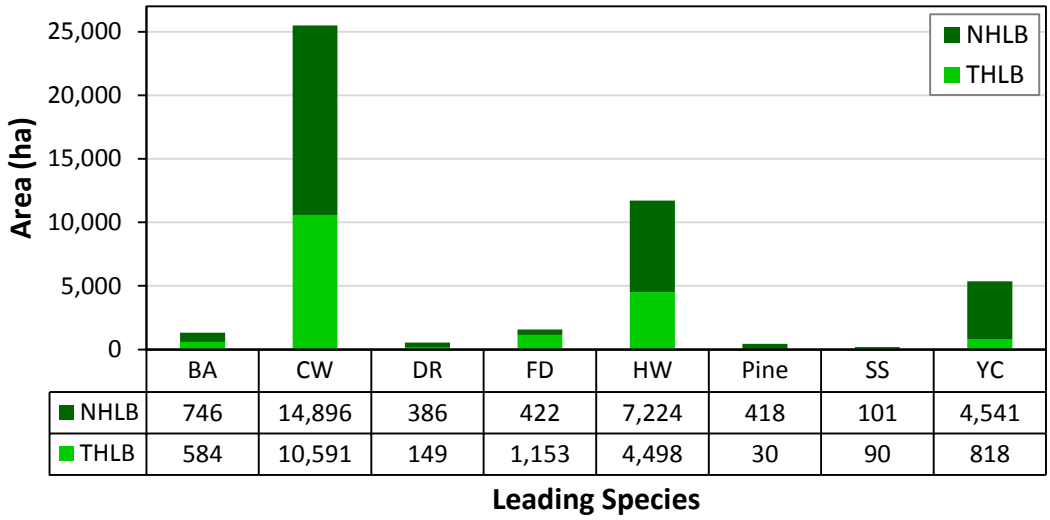


Figure 4 Current Forested Land Base Distribution over BEC zones

TFL 54 is dominated by leading stands of western redcedar and western hemlock that cover approximately 80% of

the forested land base (Figure 5). Stands with leading species of yellow cypress, Douglas-fir, and grand fir cover approximately 18%, while pine, red alder, and sitka spruce cover the remaining 2%.



	BA	CW	DR	FD	HW	Pine	SS	YC
NHLB	746	14,896	386	422	7,224	418	101	4,541
THLB	584	10,591	149	1,153	4,498	30	90	818

Figure 5 Forested Land Base Distribution by Leading Species

The forest productivity of existing natural stands within the THLB is estimated to a VRI area-weighted average site index of 14.5 m (i.e., top height in m at age 50) (Figure 6). Using the provincial site productivity layer for managed stands, the area-weighted average increased to 21.3m (+6.8 m compared to the VRI). This relatively high difference indicates that the forest has the capacity to produce higher volumes in a managed state.

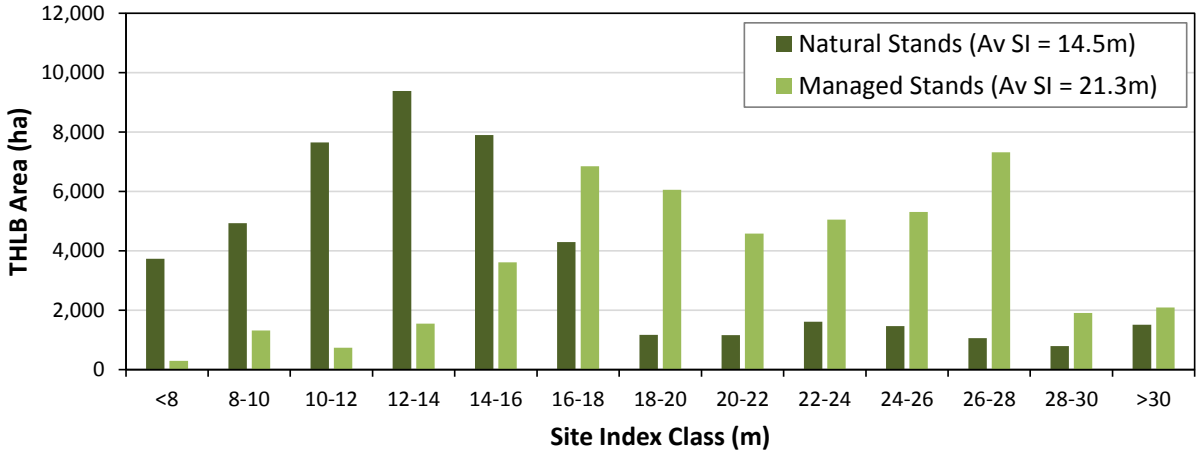


Figure 6 Comparing Natural and Managed Stands Site Index

Constraints for non-timber objectives were applied to scenic values, community watersheds, controlled rate of cuts defined for each watershed within the CSLUP, fisheries sensitive watersheds (FSW), and visual quality objectives (VQO). The current status of these objectives suggest that much of the THLB covers CSLUP scenic and watersheds (with controlled rates of cut), and will likely constrain harvest levels from these areas (Figure 7). Outside CSLUP, harvest levels will likely be constrained within FSW. These statistics offer a summarized view of the non-timber objectives and provide a basis for discussing modelling results. Note that VQO area is 54 ha, relatively

small compared to other values shown in Figure 7.

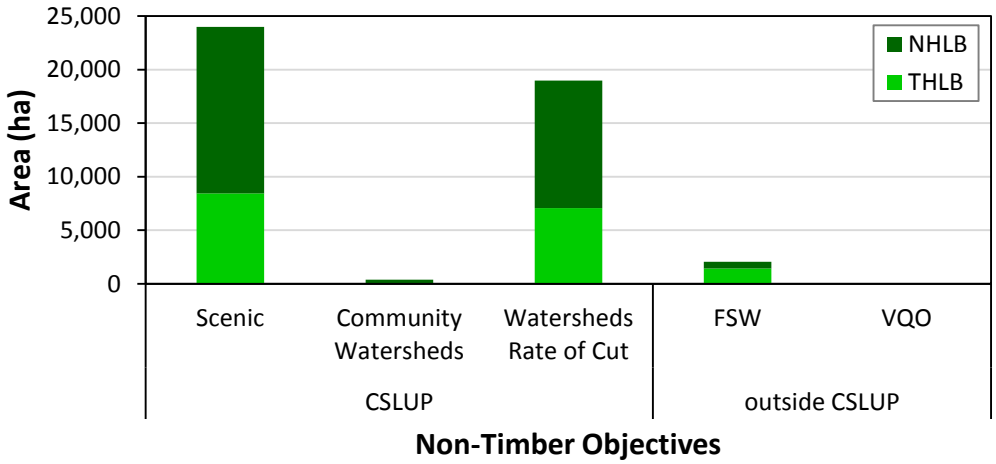


Figure 7 Forested Land Base Distribution by Non-Timber Objectives

4 Modelling Approach

4.1 MODELLING METHOD

In simplest terms, the harvest flow of an area-based harvest is the THLB area divided by average rotation age, where rotation age is the average stand age expected at harvest – as opposed to minimum harvest age (MHA) typically referenced in volume-based approaches. For this analysis, rotation age is calculated for each analysis unit (AU). The modelling exercise is configured to deliver a non-declining - area-based - harvest flow (ha/yr) given the current constraints and age class distribution. The long-term average harvest age reported for each AU is then applied to calculate the area-based harvest rate, given the future THLB area for each AU.

The following outlines the high-level approach for deriving the recommended area-based harvest rate:

1) Determine the future THLB using spatially explicit information where possible. In Table 2, the future THLB was determined to be 17,084 ha.
2) Determine the silvicultural systems – section 4.3.
3) Stratify the stands within the THLB into AUs (i.e., stands with similar growth characteristics) by treatment zone (outside CSLUP, CSLUP not scenic, CSLUP scenic low, and CSLUP scenic high), management eras (prior to 1995, 1995-2017, 2017+), species mix (leading and secondary species), and productivity (based on VRI and managed site index classes) – section 4.4.
4) Develop total merchantable yields for each AU using VDYP (management era prior to 1995) and TIPSY (management eras 1995-2017 and 2017+) – section 4.5.
5) Determine MHAs for each AU based on minimum volume, DBHq, and culmination of mean annual increment (CMAI) – section 4.6.

6) Build and run a timber supply model to establish the maximum even-flow area-harvest (ha/yr) while meeting all non-timber objectives. Here, the area-harvest refers to the actual area that is harvested in each block, it does not include the in-block retention due to partial cut harvesting systems, and it is not the recommended area-based harvest rate.

7) Report for each AU the average harvest age over the long-term and future THLB area (i.e., in-block retention area and area eligible for harvesting).

8) Divide the future THLB area of each AU by the long-term average harvest age (i.e., rotation age) to obtain a maximum rate of harvest for each AU (ha/yr). The recommended area-based harvest rate is the sum of all harvest rates for each AU. A hypothetical example is provided in Table 10, where all rotation ages are 80 years and a hypothetical recommended area-based harvest rate is 213.5 ha/yr.

9) Run sensitivities and report the findings. The recommended area-based AAC will be described in the draft timber supply analysis developed after the public review period is complete and comments received are considered.

Table 10 Example of Area-Based AAC Calculation

AU	Species Composition	Managed Site Index (m)	Future THLB Area (ha)	Rotation Age (yrs)	AAC (Future THLB Area/Rotation Age) (ha/yr)
Outside CSLUP		**21.32**	**2,006**	**80**	**25.1**
121	Cw70 Hw30	18.51	411	80	5.1
122	Cw70 Hw30	18.63	210	80	2.6
123	Cw70 Hw30	18.71	227	80	2.8
124	Hw70 Cw30	21.84	28	80	0.3
127	Fd50 Hw30 Cw20	33.29	204	80	2.5
128	Hw80 Cw20	23.13	135	80	1.7
129	Hw80 Cw20	17.86	82	80	1.0
130	Hw80 Cw20	22.35	574	80	7.2
131	Hw80 Cw20	22.51	63	80	0.8
132	Hw80 Cw20	22.53	1	80	0.0
133	Hw80 Cw20	22.52	66	80	0.8
134	Cw50 Pl40 Hw10	13.93	5	80	0.1
CSLUP not scenic		**24.49**	**7,022**	**80**	**87.8**
1121	Cw70 Hw30	16.11	488	80	6.1
1122	Cw70 Hw30	19.14	3,530	80	44.1
1123	Cw70 Hw30	18.9	1,112	80	13.9
1124	Hw70 Cw30	27.34	40	80	0.5
1127	Fd50 Hw30 Cw20	36.27	426	80	5.3
1128	Hw80 Cw20	24.16	19	80	0.2
1129	Hw80 Cw20	26.31	352	80	4.4
1130	Hw80 Cw20	27.02	735	80	9.2
1131	Hw80 Cw20	24.21	8	80	0.1
1132	Hw80 Cw20	26.32	123	80	1.5
1133	Hw80 Cw20	27.86	83	80	1.0
1134	Cw50 Pl40 Hw10	15.06	23	80	0.3
1136	Hw70 Cw30	27.3	5	80	0.1
1137	Hw70 Cw30	26.8	78	80	1.0

AU	Species Composition	Managed Site Index (m)	Future THLB Area (ha)	Rotation Age (yrs)	AAC (Future THLB Area/Rotation Age) (ha/yr)
CSLUP scenic		**24.54**	**8,055**	**80**	**100.7**
2121	Cw70 Hw30	16.05	365	80	4.6
2122	Cw70 Hw30	18.74	3,435	80	42.9
2123	Cw70 Hw30	20.08	1,106	80	13.8
2124	Hw70 Cw30	26.92	76	80	1.0
2127	Fd50 Hw30 Cw20	34.48	466	80	5.8
2128	Hw80 Cw20	24.44	33	80	0.4
2129	Hw80 Cw20	25.38	829	80	10.4
2130	Hw80 Cw20	26.41	1,422	80	17.8
2131	Hw80 Cw20	25.04	22	80	0.3
2132	Hw80 Cw20	25.63	208	80	2.6
2133	Hw80 Cw20	24.01	91	80	1.1
2136	Hw70 Cw30	27.25	3	80	0.0
Total			**17,083**	**80**	**213.5**

4.2 FOREST ESTATE MODEL

The PATCHWORKS ™ modeling software was used for forecasting and analysis. This suite of tools is sold and maintained by Spatial Planning Systems Inc. of Deep River, Ontario (Tom Moore - www.spatial.ca).

PATCHWORKS is a fully spatial forest estate model that can incorporate real world operational considerations into a strategic planning framework. It utilizes a goal seeking approach and an optimization heuristic to schedule activities across time and space in order to find a solution that best balances the targets and/or goals defined by the user. Targets can be applied to any aspect of the problem formulation. For example, the solution can be influenced by issues such as mature/ old forest retention levels, young seral disturbance levels, patch size distributions, conifer harvest volume, growing stock levels, snag densities, CWD levels, ECAs, specific mill volumes by species, road building/ hauling costs, delivered wood costs, net present values, etc. The PATCHWORKS model continually generates alternative solutions until the user decides a stable solution has been found. Solutions with attributes that fall outside of specified ranges (targets) are penalized and the goal seeking algorithm works to minimize these penalties, resulting in a solution that reflects the user objectives and priorities. PATCHWORKS' flexible interactive approach is unique in several respects:

- PATCHWORKS' interface allows for highly interactive analysis of trade-offs between competing sustainability goals.
- PATCHWORKS software integrates operational-scale decision-making within a strategic-analysis environment: realistic spatial harvest allocations can be optimized over long-term planning horizons. PATCHWORKS can simultaneously evaluate forest operations and log transportation problems using a multiple-product to multiple-destination formulation. The model can identify in precise detail how wood flows to mills over a complex set of road construction and transportation alternatives.
- Allocation decisions can be made considering one or many objectives simultaneously and objectives can be weighted for importance relative to each other (softer vs. harder constraints).
- Allocation decisions can include choices between stand treatment types (clearcut vs. partial cut, fertilization, rehabilitation, etc.).

- Unlimited capacity to represent a problem – only solution times limit model size.
- Fully customizable reporting on economic, social and environmental conditions over time.
- Reports are built web-ready to share analysis results easily – even comparisons of multiple indicators across multiple scenarios.

4.3 SILVICULTURAL SYSTEMS

For areas outside CSLUP, the modelled silvicultural system was clearcut with reserves (7% to meet stand-level biodiversity objectives), similar to Arrowsmith TSR (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016). The 7% reserve is in line with past and planned future practice.

For areas within CSLUP, the Scientific Panel prescribed the variable retention silviculture system in recommendations 3.6, 3.7, and 3.8. These recommendations prescribe broad retention levels (15% to 70%) based on the presence of non-timber values, in particular scenic values. To simplify the analysis and to be in line with the principles for establishing an area-based harvest rate, three, single-pass partial cut silvicultural systems were applied within CSLUP (Table 11). The retention percentages were provided as averages from operational experience of site plans[3].

Table 11 Silvicultural Systems

Treatment Zone	Scenic Corridor	Treatment	Retention (%)
Outside CSLUP	None	Clearcut with reserves	7
CSLUP not scenic	None	Partial Cut	15
CSLUP scenic low	Small Scale Alteration	Partial Cut	30
	Minimal Alteration		
	Naturally Appealing (Not Terrain Class 4)		
CSLUP scenic high	Naturally Appealing (Terrain Class 4)	Partial Cut	70

4.4 ANALYSIS UNITS

Stands were grouped into AUs to reduce the complexity and volume of information in the model and to assign potential treatments and transitions on yield curves following harvest. In this analysis, the criteria to group stands included:

- Treatment Zone (outside CSLUP, CSLUP not scenic, CSLUP scenic low, and CSLUP scenic high),
- Management eras (prior to 1995, 1995-2017, 2017+),
- Species mix (leading and secondary species), and
- Productivity (based on VRI and managed site index classes) (Appendix 1).

BEC was not used since only 49ha of THLB was covered by MH Zone while the rest of stands in the THLB were within the CWH Zone.

For management era prior to 1995, the VRI site index was used while for the other 2 management eras (1995-2017

[3] Zoltan Schafer, RPF, Ma-Mook forestry manager, personal communication

and 2017+), the managed site index attributed to VRI leading species.

4.5 GROWTH AND YIELD MODELS

Natural yields for stands >22 years in age (management era prior to 1995), were developed for each VRI polygon using VDYP7 console (v. 7.30a, Build 299). Then, area-weighted yields were compiled for each AU.

Managed yields for stands <=22 years in age and future stands were developed for each AU using batch TIPSY (v. 4.4, Ministry Standard Database, September 2017) and the input assumptions provided in Appendix 2. The regeneration assumptions were grouped by treatment zone, management era, silvicultural system, scenic corridors, sources of regeneration assumptions (Updated MP4 or Arrowsmith TSR), and application of TIPSY variable retention factors (Table 12).

Table 12 TIPSY Regeneration Assumptions Sources

Treatment Zone	Management Era	Scenic Corridors	Treatment	Regen Assumptions	Genetic Gains	TIPSY VR Factors
Outside CSLUP	1995-2017		Clearcut	MP4	MP4	
	2017+		Clearcut of prior to 1995 stands	MP4	TSR	
	2017+		Clearcut of 1995-2017 stands	MP4	TSR	
CSLUP not scenic	1995-2017		Partial cut	MP4	MP4	
	2017+		Partial cut of prior to 1995 stands	MP4	TSR	
	2017+		Partial cut of 1995-2017 stands	MP4	TSR	
CSLUP scenic (low and high)	1995-2017	Yes	Partial cut	MP4	MP4	Yes
	2017+	Yes	Partial cut of prior to 1995 stands	MP4	TSR	Yes
	2017+	Yes	Partial cut of 1995-2017 stands	MP4	TSR	Yes

TIPSY's built-in variable retention functionality (Table 13) was used to reflect how retention is implemented operationally. Based on an examination of cutblock information harvested over the last 10-years within CSLUP scenic corridors, 75% of the retained area is within and 25% is adjacent to the harvest opening. In addition, approximately 75% of the retained area was in aggregated and 25% in dispersed retention[4]. Detailed regeneration assumptions are included in Appendix 2.

Table 13 TIPSY Inputs for Variable Retention Functionality

Input Variable	Description
Residual Stand top height at entry	Residual stand height was entered as the THLB area weighted average height of stands >60 years old from forest cover inventory for each AU.
Crown Cover retained	30% crown cover retention as this represents the type of retention that increases the overall edge length and reduces the light transmission to regenerating trees.

[4] Zoltan Schafer, RPF, Ma-Mook forestry manager, personal communication

Input Variable	Description
Relative proportion of aggregate and dispersed	75% aggregate retention, 25% dispersed.
Average aggregate Group Size	0.75 ha
Average crown area (for dispersed retention portion)	The default TISPY value of 40 m².

4.6 MINIMUM HARVEST AGES

The MHAs define when a stand is eligible for harvesting (i.e., the start of operability window) for each AU. In contrast, the rotation age defines the average age when a stand is planned for harvest which, in most cases, is older than MHA. The MHA criteria from Arrowsmith TSR (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016) was used for TFL 54:

- Minimum volume of 350 m³/ha,
- Mean annual increment (MAI) within 90% of CMAI.

Exceptions from the criteria above were made for poor site conditions for western redcedar, red alder, hemlock-balsam, and other species (AUs 1, 1001, 2001, 4, 1004, 2004, 8, 1008, 2008, 14, 1014, and 2014 (THLB = 1,345 ha) see Appendix 1). These stands do not meet the above criteria. In order to allow the forest estate model to schedule these stands for harvesting, the above MHA criteria had to be changed as follows:

- AU 1, 1001, 2001 (poor cedar) – Volume >=150 m³/ha and MAI within 90% of CMAI,
- 8, 1008, and 2008 (poor hemlock-balsam) – MAI within 90% of CMAI,
- AU 4, 1004, and 2004 (red alder) – Volume >=350m³/ha, and
- AU 14, 1014, and 2014 (other species (e.g., pine)) – Volume >=233m³/ha.

A sensitivity analysis is planned to be conducted to determine the impact on harvest area when these low site AUs that do not meet MHA criteria are removed from the THLB.

4.7 REGENERATION DELAY

Regeneration delays of 3 and 6 years[5] were respectively applied for planted and natural methods to develop yields in TIPSY.

4.8 GENETIC GAINS

For development of the MP4, Interfor conducted a review of their planting program to determine the volume increases due to planting genetically improved stock. In the case of stands regenerated prior to 1995, no genetic gains were modelled. In the case of stands regenerated after 1995, a 2% genetic gain was modelled for western redcedar, and no other genetic gains for the rest of the planted species. This assumption is carried on in the current analysis for stands regenerated between 1995 and 2017 (i.e., management era 1995-2017).

In the case of management era 2017+, the genetic gain assumptions were adopted from Arrowsmith TSA (BC

[5] Average of 2007-2016 cutblcok information from RESULTS data provided by Ma-Mook

Ministry of Forests, Lands and Natural Resource Operations, November 2016) because seedlings will be delivered by orchards that use class A seed only. The genetic worth by species and the seed availability for future plantations were provided by the Ministry of Forests, Lands and Natural Resource Operations, Tree Improvement Branch (Table 28 in Arrowsmith TSA, reproduced in Table 14 for the species planted in TFL 54). The genetic gain is then calculated by multiplying the seed availablity and genetic worth (e.g., for western redcedar, genetic gain = 0.95 x 10% = 9.5%).

Table 14 Genetic Gains by Management Era

Species	Management Era			
	1995-2017	2017+		
	Genetic Gain	Seed Availability	Genetic Worth	Genetic Gain
Western Hemlock		100%	14%	14%
Western redcedar	2%	95%	10%	9.5%
Douglas-fir		100%	11%	11%
Yellow cypress		48%	21%	10.1%

4.9 UTILIZATION LEVELS

The Arrowsmith TSR (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016) assumptions were used in this analysis (Table 15).

Table 15 Utilization Levels

Species/Management Era	Minimum DBH (cm)	Maximum Stump Height (cm)	Minimum Top DIB (cm)
Conifers prior to 1995	17.5	30	15
Conifers 1995+	12.5	30	10
Red Alder	17.5	30	15

4.10 OPERATIONAL ADJUSTMENT FACTORS

Managed stand yield projections produce potential yields that do not reflect an operational environment, so operational adjustment factors (OAF) were applied. There are two OAFs, OAF 1 affects the magnitude of the yield curve and is constant across all ages, whereas the impact of OAF 2 accelerates with age. The OAF 1 represents uneven stocking or gaps and OAF2 represents the impact of decay, waste and breakage in second-growth stands. In this analysis, OAF1=0.85 and OAF2= 0.95 similarly to Arrowsmith TSR for Clayoquot Sound area (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016).

4.11 UNSALVAGED LOSSES

The Arrowsmith TSR (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016) applied 8,038 m^3/ year unsalvaged losses from a THLB area of 59,721 ha. Without available data for the TFL 54, this analysis used these figures to prorate – based on THLB – unsalvaged losses of 2,410 m^3/yr. The unsalvaged area will be determined by dividing the unsalvaged volume by the modelled long-term average harvest volume. The determined unsalvaged area is then used to adjust the forecasted area AAC.

4.12 MAA-NULTH IMPORTANT HARVEST AREAS

On June 14, 2014, a Reasonable Opportunity Agreement (ROA) (Province of British Columbia, 2014) commenced between the Province of British Columbia and the Maa-nulth First Nations (the Huu-ay-aht First Nations, Ka:'yu:'k't'h'/Che:k'tles7et'h' First Nations, Toquaht Nation, Uchucklesaht Tribe, and Yuułuʔiłʔatḥ). The ROA is intended to ensure that a denial of a Maa-nulth First Nation's reasonable opportunity to exercise their treaty harvesting rights does not occur. The ROA outlines an Important Harvest Area (IHA) Engagement process, which took effect on March 5, 2015. The IHA refer to that portion of the Maa-nulth First Nations Harvest Area identified on a map initialized at an Annual Meeting by the Management Working Group. Current IHA covers approximately 3,557 ha THLB within the TFL54 (Figure 8). Future changes to IHA will be communicated by the Maa-nulth First Nations to the TFL 54 forest manager.

The IHA engagement process between Ma-Mook and Maa-nulth First Nations includes the delegation of specific engagement obligations outlined in Part 3.8 of the ROA after an application is submitted to the Province of British Columbia. Ma-Mook will undertake the following procedural aspects of engagement under the ROA:

- Identifying Applications that require engagement, as per 3.6.1:
    - those that are wholly or partially within an IHA; and
    - for a Significant Use or Disposition listed in Table 4 of Appendix 3-B.
- Preparing and delivering Engagement Packages, as per section 3.8.7 and 3.8.8.
- Addressing requests from the Maa-nulth First Nations for additional readily available information, as per section 3.8.9.
- Engaging with, and receiving responses from the Maa-nulth Co-Chair, as per sections 3.8.13 and 3.8.14.
- Preparing a record of all aspects of delegated engagement and providing that directly to the South Island District Manager, as per section 3.8.26.
- All resulting records of engagement will be shared by the South Island District Manager with the Maa-nulth Co-Chair to confirm their accuracy and completeness, as per section 3.8.27.

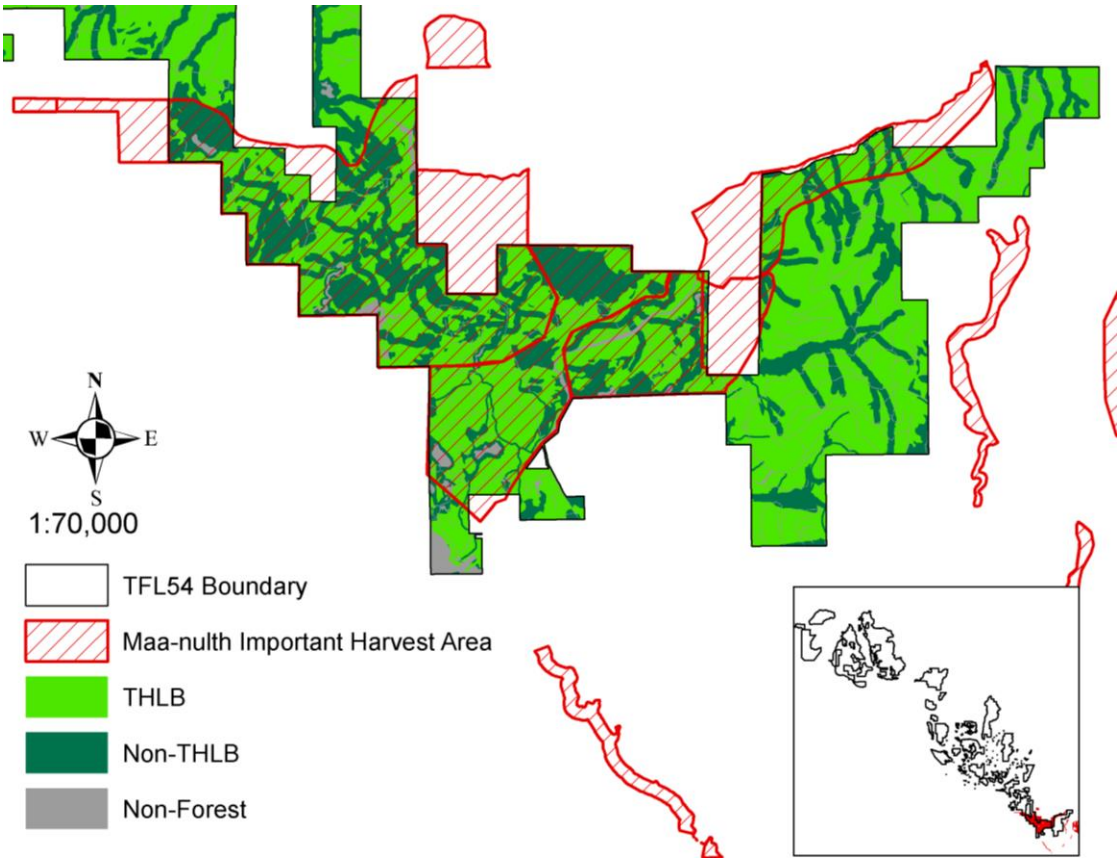


Figure 8 Maa-nulth Important Harvest Area

4.13 AHOUSAHT FOREST MANAGEMENT AREAS

The Ahousaht First Nation publicly released the Ahousaht Land Use Vision Plan on January 25, 2017, to prioritize their sustainable economic development. This plan includes three Forest Management Areas (FMA) which cover approximately 4,929 ha within TFL54 (2,169 ha within THLB) (Figure 9). The FMA areas that overlap with TFL54 will be included in the AAC determination for the TFL54 because to date, there was no legal process to remove them from the TFL54. However, Ma-Mook and its directors are aware of the Ahousaht Land Use Vision Plan which might include areas set aside for cultural use and community-based logging. In addition, Ma-Mook and its directors believe that the guidelines of the CSLUP described in this document are some of the strictest in BC and in the world. Therefore, Ma-Mook will work with Ahousaht Chief and Council and with Maaqutusiis Hahoulthee Stewardship Society and its elders in all planning stages in order to address potential concerns overlapping the three Ahousaht FMAs.

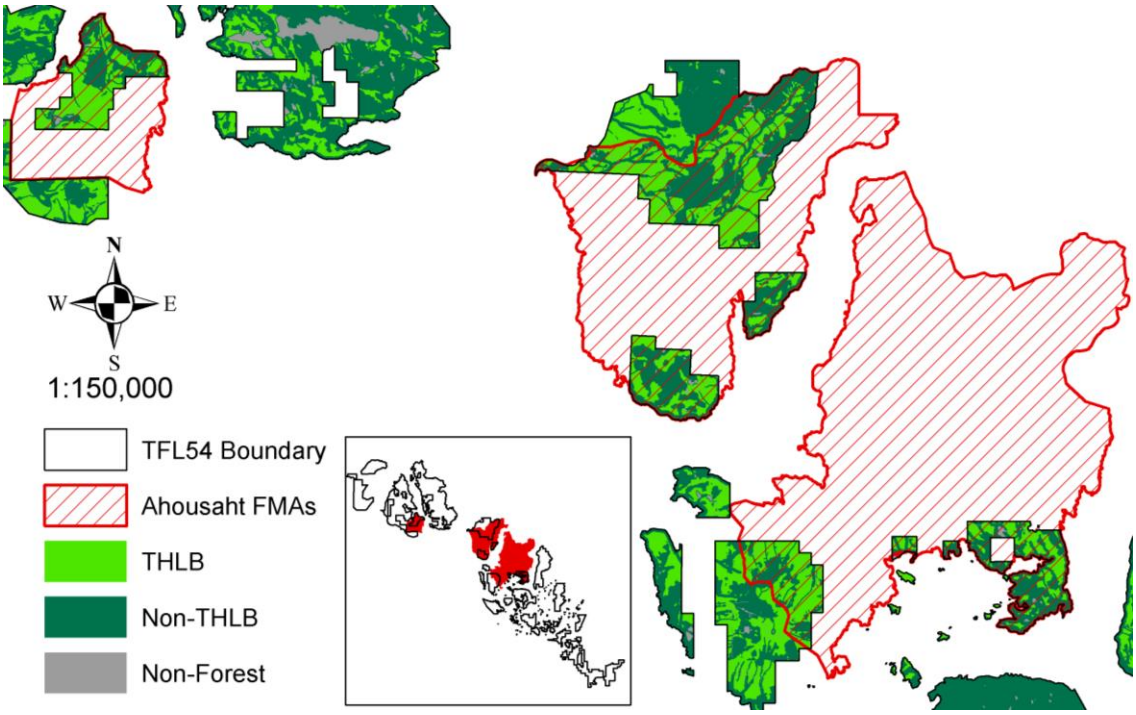


Figure 9 Ahousaht Forest Management Areas

4.14 NATURAL DISTURBANCES

Disturbances initiated by natural factors (e.g., wildfires, insects) are an intrinsic part of any forest ecosystem dynamic. In this analysis, a randomly determined constant area was disturbed annually within the NHLB. The area to be disturbed was determined based on the BEC variants present, their associated natural disturbance intervals, and old seral definitions, as outlined in the Biodiversity Guidebook (BC Ministry of Forests and BC Ministry of Environment, Lands and Parks, 1995).

The proportion of forest expected as old seral forest was calculated based on the disturbance interval:

$$\%\ \text{area in old} = \exp\left(-\frac{\text{old age}}{\text{disturb interval}}\right)$$

The % area in old is then used to calculate the effective rotation age associated with this seral distribution:

$$\text{effective rotation age} = \frac{\text{disturb interval}}{1 - \text{proportion old}}$$

The effective rotation age can then be used to define an annual area of disturbance. For example, CWH variants in Natural Disturbance Type (NDT) 1 have a disturbance interval of 250 years and an old definition of 250 years. This translates into a typical age class distribution where 37% of the area is "old" (>250 years) and the oldest stands are around 395 years. Thus, 1/395th of the area needs to be disturbed each year to maintain this age class distribution.

Table 16 shows the process used to determine the annual disturbance limits applied to the forested NHLB. The effective rotation age denotes when a stand's age is reset to zero following a stand-replacing natural disturbance. Overall, approximately 0.25% of the NHLB is disturbed annually.

Table 16 Annual Disturbance Limits in the Forecasted NHLB

BEC	NDT	Disturbance interval (yrs)	Old definition (yrs)	%Area >OLD	Effective Rotation Age (yrs)	NHLB (ha)	Annual Area Disturbed (ha)
Outside CSLUP							
CWH	1	250	250	37%	395	862	2
MH	1	350	250	49%	686	2	0
Within CSLUP							
CWH	1	250	250	37%	395	27,180	69
MH	1	350	250	49%	686	692	1
Total						**28,736**	**72**

** % area old = exp (-[old age / disturbance interval]), Effective rotation age = old age / (1 – % area old)*

4.15 NON-TIMBER OBJECTIVES WITHIN CSLUP

Starting in early 1990's, the non-timber objectives for the CSLUP were developed by a Scientific Panel. The Clayoquot Sound area was then organized into watershed planning units and a management plan was developed for each unit. By 2006, all watershed unit plans were completed and by 2008 all were accepted. There are 8 watershed units overlapping with TFL54 (Table 17). For each of the watershed unit, the Scientific Panel developed a range of management objectives for biodiversity (landscape- and stand-level), visual quality within scenic corridors, and harvest restrictions in sensitive areas of the watersheds (i.e., watershed rate-of-cut). In addition, harvest is constrained in any community watershed that overlap TFL54.

Table 17 Watershed Units within CSLUP

Row Labels	THLB (ha)	NHLB (ha)	Non-Forest (ha)	Total (ha)
Bedingfield	1,540	2,171	70	3,781
Bedwell-Ursus-Bulson	8	64	2	74
Cypre	1,997	3,786	104	5,887
Fortune Channel	1,976	1,342	68	3,385
Hesquiaht	3,540	5,182	716	9,438
Kennedy Lake	3,606	1,735	273	5,614
Sydney-Pretty Girl	2,378	8,562	665	11,605
Tofino-Tranquil (Onadsilth-Eekseuklis)		1	7	8
None	770	5,029	93	5,892
Total	**15,815**	**27,872**	**1,998**	**45,685**

4.15.1 LANDSCAPE LEVEL BIODIVERSITY

Within CSLUP, the Scientific Panel determined that the landscape-level objectives are met by maintaining at all times, a minimum 40% of the PFLB area older than 140 years, in each watershed and in each order (1st, 2nd, 3rd order). The model is set-up to achieve this objective. Detailed statistics for each watershed are included in Appendix 3.

4.15.2 STAND LEVEL BIODIVERSITY

At a stand level, the Scientific Panel recommended a range of retention levels between 15-70%. These retention levels are built into the silvicultural systems designed for this analysis (section 4.3). Thus, no additional in-block retention were applied.

4.15.3 SCENIC CORRIDORS

The scenic corridors were developed by the Scientific Panel with the aim to restrict disturbance in visually sensitive areas. There were three scenic corridors developed (Natural Appearing, Minimal Alteration, and Small Scale Alteration), and within each of the corridor, spatially-explicit polygons were developed and assigned a landscape number. For each scenic corridor, a maximum disturbance level was then determined and the tree height at which a disturbed area is not negatively impacting the visual quality of scenic corridor (i.e., green-up height) (Table 18).

The visual quality objectives are modelled as maximum disturbance levels for each unique combination of landscape number and scenic corridor (Table 18). The ages where green-up heights are achieved were determined for each analysis unit (AU) in the development of yield curves. The maximum disturbance levels and green-up heights were inherited from the previous MP where:

- Scenic corridors were translated to the corresponding VQOs,
- Disturbance levels determined using Table 4 from the Visual Impact Assessment Guidebook (assuming area removals and an average residual height of 30m), and
- Green-up heights determined via discussions between Interfor, Ministry of Forests, and consultation of Berris' Draft Recommendations.

Table 18 Scenic Corridors Objectives

Scenic Corridor	Max Area of PFLB (%)	Green-up Heights (m)	THLB (ha)	NHLB (ha)
Natural Appearing	20	8	1,469	6,614
Minimal Alteration	30	7	4,613	5,456
Small Scale Alteration	40	6	2,369	3,457
Total			**8,452**	**15,527**

In comparison, the Arrowsmith TSR (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016) used a 5m green-up height, much more restrictive maximum disturbance levels for each VQO/VAC combination (0.5-15%), and 40% retention silvicultural system within CSLUP. It is not clear though if the scenic corridor disturbance levels assumed the retention within the silvicultural system. The TFL57 MP2 (Forsite Consultants Ltd., 2014) used the CSLUP scenic corridors with similar maximum disturbance levels and identical green-up heights. The ages to achieve the green-up heights were determined for each visual polygon using SiteTools Batch v3.3.

4.15.4 WATERSHED RATE OF CUT

Watershed rates-of-cut are applied within each watershed planning unit at the watershed level for each classified watershed (1st, 2nd, or 3rd order), relative to the PFLB (Table 19). The aim of the Scientific Panel was to protect the water resources by restricting the harvesting at watershed level, as opposed to a larger management unit. Thus,

the Scientific Panel specifically restricted harvesting in large watersheds to ensure the health of the forest ecosystems. Detailed statistics for each watershed are included in Appendix 3.

Table 19 Watershed Rate of Cut

Watershed Type	Limit applied relative to PFLB area in each watershed	THLB (ha)	NHLB (ha)
Any Watershed > 500 ha (1st, 2nd, 3rd Order)	No more than 5% per 5 year period	5,567	8,622
Primary >=200 and<500	No more than 10% per 10 year period	1,496	3,300
Any Watershed > 500 ha (1st, 2nd, 3rd Order) and >=200 and <500 where cut has exceeded 20% in last ten years	No harvest until watershed conforms to specified rate-of-cut		
Any Watershed that has < 30% THLB to total area ratio **or** is <200 ha in size	No constraint applied (flagged as RULE_APPLY='n' in Watershed sub-basin (rate of cut) layer)	8,338	15,805
Total		**15,401**	**27,727**

4.15.5 COMMUNITY WATERSHEDS

There are 6 community watersheds located within TFL 54. All of these are within CSLUP where the Scientific Panel defined rates of cut that were similarly applied. Since the 6 community watersheds do not cover any THLB, no other modelling assumptions are applied.

Table 20 Community Watersheds

Community Watershed	THLB (ha)	NHLB (ha)
Brother	0	43
Close	0	21
Ginnard	0	156
Meares	0	128
Number One	0	33
Sharp	0	8
Total	**0**	**389**

4.16 NON-TIMBER OBJECTIVES OUTSIDE CSLUP

Outside of CSLUP, the area covered by TFL54 falls under VILUP which set non-timber management objectives for biodiversity (landscape- and stand-level), visual quality objectives, and integrated resource management. In addition, harvesting within any fisheries sensitive watersheds that overlap TFL 54 will be restricted, similarly to Arrowsmith TSA (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016).

4.16.1 LANDSCAPE LEVEL BIODIVERSITY

The landscape level biodiversity objectives outside of the CSLUP fall under VILUP and are described in Table 21 as per Biodiversity Guidebook (BC Ministry of Forests and BC Ministry of Environment, Lands and Parks, 1995) . Within TFL 54, there are 2 landscape units (LU), both with lower biodiversity emphasis option (BEO), and both covering the CWH BEC zone.

Table 21 Landscape Level Biodiversity Objectives outside CSLUP

LU	BEC	BEO	Mature + Old (>80 yrs)	Old (>250 yrs)	THLB (ha)	NHLB (ha)	THLB>80 yrs (%)	NHLB>80 yrs (%)	THLB>250 yrs (%)	NHLB>250 yrs (%)
Escalante	CWH	Low	>18%	>13%	1,445	627	30%	26%	28%	26%
Maggie	CWH	Low	>18%	>13%	646	206	7%	13%	6%	8%
Total					**2,090***	**833**				

**the 8 ha difference from THLB area outside CSLUP is sliver overlaps with CSLUP. There are small inconsistencies in data sources (LU and the CSLUP boundaries).*

4.16.2 STAND LEVEL BIODIVERSITY

Outside CSLUP, the silvicultural systems are clearcut with reserves. For these areas an in-block retention assumption of 7%, as required in the Forest Planning and Practices Regulation, was used in this analysis.

4.16.3 VISUAL QUALITY OBJECTIVES

Outside the CSLUP, the visual landscape inventory (VLI) applies, where targets are included for each VLI polygon ID and VQO combination as per TSR (BC Ministry of Forests, Lands and Natural Resource Operations, November 2016) (Table 18). The ages where green-up heights are achieved were determined in the development of yield curves.

Table 22 Visual Quality Objectives

VQO	Max Area of PFLB (%)	Green-up Heights (m)	THLB (ha)	NHLB (ha)
Partial Retention	15	5	19	17
Modification	25	5	13	5
Total			**32**	**22**

4.16.4 INTEGRATED RESOURCE MANAGEMENT

Outside of the CSLUP, the area within TFL 54 falls under the VILUP as Enhanced Forestry Management Zone. The VILUP objective in such cases requires a green-up adjacency target for each landscape unit as a maximum 25% of the THLB with heights <1.3m. Ages where green-up heights are achieved were determined for each AU in the development of yield curves.

4.16.5 FISHERIES SENSITIVE WATERSHEDS

There is one fisheries sensitive watershed (f-1-003 Escalante) that overlaps the northern section of TFL 54 and it is completely outside of the CSLUP (Table 23). In this case, the harvest constraint was managed using an Equivalent Clearcut Area (ECA) index capped at 20% (Table 24). Ages where heights are achieved were determined for each existing and future managed AU in the development of yield curves.

Table 23 Fisheries Sensitive Watersheds

Fisheries Sensitive Watershed	THLB (ha)	NHLB (ha)
f-1-003 Escalante	1,446	629

Table 24 Equivalent Clearcut Area

Average height of the main canopy	% Recovery	ECA (%)
0-<3 m	0	100
3-<5 m	25	75
5-<7 m	50	50
7-<9 m	75	25
>=9 m	100	0

4.17 MODELLING ASSUMPTIONS

General assumptions were incorporated into the model to improve its efficiency or to produce results that are spatially more realistic. Table 25 summarizes the modelling assumptions employed in this analysis.

Table 25 Modelling Assumptions

Criteria	Assumption
Minimum Polygon Size	Minimum size of the polygon within the resultant was set depending on the data source: • 10 m² for road/riparian buffers • 100 m² for larger area features (VRI, VLI etc.) • 1,000 m² for very large administrative boundaries (e.g. ownership, LU etc.)
Blocking	To improve modeling performance, resultant polygons within 20 m were blocked (or grouped) where possible by maintaining the same AUs and 5-year age classes. The model was configured for a target harvest opening size of 25 ha.
Planning Horizon	A 300 year planning horizon was applied and reported in 10-year increments (i.e., 30 periods). 2017 was used as the initial modelling year.
Harvest Flow Objectives	Determine the maximum even harvest (ha/yr) throughout the planning horizon.

5 Sensitivity Analyses

Sensitivity analyses are a key component of any timber supply analysis; commonly performed to examine impacts to timber supply and other values when changing data or assumptions that are uncertain. Sensitivity analyses help to frame the potential impacts of uncertainty by analyzing scenarios that are more pessimistic and more optimistic than the base case. The sensitivities planned for TFL 54 are described in Table 26.

Table 26 Sensitivity Analyses

Sensitivity	Description
Rotation age +/- (007,008)	Adjust the rotation age by -10 years and +10 years
AUs on Low Sites (003)	AUs that do not meet strict MHA criteria are removed from the THLB
Economic Operability @ 300 m³/ha (005)	Set the minimum volume threshold at 300 m³/ha
Economic Operability @ 225 m³/ha (006)	Set the minimum volume threshold at 225 m³/ha
Regeneration Delay (004)	Set regeneration delay to 2 years for stands in management era 2017+
Volume/Growing Stock (002)	Maintain a non-declining harvest (m³/year) throughout the planning horizon and a non-declining THLB growing stock in the last 100 years of the planning horizon (i.e., typical volume-based AAC).

6 References

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Appendix 1 Summary of Analysis Units

AU	Zone	Management era	Lead Species	Secondary Species	Site Index	MHA	Regen AU	THLB (ha)	NHLB (ha)
1	not CSLUP	< 1995	CW	ALL	<10	160	121	370	468
2	not CSLUP	< 1995	CW	ALL	>=10-<16	160	122	116	101
3	not CSLUP	< 1995	CW	ALL	>=16	70	123	239	28
4	not CSLUP	< 1995	DR	ALL	ALL	60	124	21	25
7	not CSLUP	< 1995	FD	ALL	>=16	60	127	214	28
8	not CSLUP	< 1995	HW	not YC	<10	170	128	142	67
9	not CSLUP	< 1995	HW	not YC	>=10-<16	110	129	7	2
10	not CSLUP	< 1995	HW	not YC	>=16	70	130	586	78
11	not CSLUP	< 1995	HW, BA, YC	YC, ALL, ALL	<10	160	131	66	26
13	not CSLUP	< 1995	HW, BA, YC	YC, ALL, ALL	>=16	80	133	62	7
14	not CSLUP	< 1995	OT	ALL	ALL	160	134	5	17
21	not CSLUP	1995-2017	CW	ALL	<16	90	121	60	0
22	not CSLUP	1995-2017	CW	ALL	>=16-<24	90	122	100	6
24	not CSLUP	1995-2017	DR	ALL	ALL	70	124	8	5
29	not CSLUP	1995-2017	HW	not YC	>=16-<24	100	129	75	2
30	not CSLUP	1995-2017	HW	not YC	>=24	90	130	17	2
32	not CSLUP	1995-2017	HW, BA, YC	YC, ALL, ALL	>=16-<24	90	132	1	
33	not CSLUP	1995-2017	HW, BA, YC	YC, ALL, ALL	>=24	90	133	7	1
121	not CSLUP	2017+	CW	ALL	<16	90	121		
122	not CSLUP	2017+	CW	ALL	>=16-<24	90	122		
123	not CSLUP	2017+	CW	ALL	>=24	90	123		
124	not CSLUP	2017+	DR	ALL	ALL	70	124		
127	not CSLUP	2017+	FD	ALL	>=24	60	127		
128	not CSLUP	2017+	HW	not YC	<16	70	128		
129	not CSLUP	2017+	HW	not YC	>=16-<24	80	129		
130	not CSLUP	2017+	HW	not YC	>=24	70	130		
131	not CSLUP	2017+	HW, BA, YC	YC, ALL, ALL	<16	70	131		
132	not CSLUP	2017+	HW, BA, YC	YC, ALL, ALL	>=16-<24	90	132		
133	not CSLUP	2017+	HW, BA, YC	YC, ALL, ALL	>=24	90	133		
134	not CSLUP	2017+	OT	ALL	ALL	150	134		
1001	CSLUP not scenic	< 1995	CW	ALL	<10	160	1121	293	2,449
1002	CSLUP not scenic	< 1995	CW	ALL	>=10-<16	160	1122	3,408	5,238
1003	CSLUP not scenic	< 1995	CW	ALL	>=16	70	1123	1,170	876
1004	CSLUP not scenic	< 1995	DR	ALL	ALL	60	1124	30	106
1007	CSLUP not scenic	< 1995	FD	ALL	>=16	60	1127	448	178
1008	CSLUP not scenic	< 1995	HW	not YC	<10	170	1128	20	292
1009	CSLUP not scenic	< 1995	HW	not YC	>=10-<16	110	1129	360	1,167
1010	CSLUP not scenic	< 1995	HW	not YC	>=16	70	1130	751	531
1011	CSLUP not scenic	< 1995	HW, BA, YC	YC, ALL, ALL	<10	160	1131	8	510
1012	CSLUP not scenic	< 1995	HW, BA, YC	YC, ALL, ALL	>=10-<16	100	1132	130	399
1013	CSLUP not scenic	< 1995	HW, BA, YC	YC, ALL, ALL	>=16	80	1133	88	90
1014	CSLUP not scenic	< 1995	OT	ALL	ALL	160	1134	24	274
1016	CSLUP not scenic	< 1995	SS	ALL	>=10-<16	90	1136	6	12
1017	CSLUP not scenic	< 1995	SS	ALL	>=16	80	1137	82	76
1021	CSLUP not scenic	1995-2017	CW	ALL	<16	90	1121	210	52
1022	CSLUP not scenic	1995-2017	CW	ALL	>=16-<24	90	1122	292	53
1024	CSLUP not scenic	1995-2017	DR	ALL	ALL	60	1124	12	29
1028	CSLUP not scenic	1995-2017	HW	not YC	<16	80	1128		1
1029	CSLUP not scenic	1995-2017	HW	not YC	>=16-<24	80	1129	9	
1030	CSLUP not scenic	1995-2017	HW	not YC	>=24	80	1130	22	11
1121	CSLUP not scenic	2017+	CW	ALL	<16	90	1121		
1122	CSLUP not scenic	2017+	CW	ALL	>=16-<24	80	1122		
1123	CSLUP not scenic	2017+	CW	ALL	>=24	80	1123		

AU	Zone	Management era	Lead Species	Secondary Species	Site Index	MHA	Regen AU	THLB (ha)	NHLB (ha)
1124	CSLUP not scenic	2017+	DR	ALL	ALL	60	1124		
1127	CSLUP not scenic	2017+	FD	ALL	>=24	60	1127		
1128	CSLUP not scenic	2017+	HW	not YC	<16	70	1128		
1129	CSLUP not scenic	2017+	HW	not YC	>=16-<24	70	1129		
1130	CSLUP not scenic	2017+	HW	not YC	>=24	60	1130		
1131	CSLUP not scenic	2017+	HW, BA, YC	YC, ALL, ALL	<16	70	1131		
1132	CSLUP not scenic	2017+	HW, BA, YC	YC, ALL, ALL	>=16-<24	80	1132		
1133	CSLUP not scenic	2017+	HW, BA, YC	YC, ALL, ALL	>=24	80	1133		
1134	CSLUP not scenic	2017+	OT	ALL	ALL	130	1134		
1136	CSLUP not scenic	2017+	SS	ALL	>=16-<24	60	1136		
1137	CSLUP not scenic	2017+	SS	ALL	>=24	70	1137		
2001	CSLUP scenic	< 1995	CW	ALL	<10	160	2121	357	2,279
2002	CSLUP scenic	< 1995	CW	ALL	>=10-<16	160	2122	3,346	6,206
2003	CSLUP scenic	< 1995	CW	ALL	>=16	70	2123	1,163	1,617
2004	CSLUP scenic	< 1995	DR	ALL	ALL	60	2124	42	206
2006	CSLUP scenic	< 1995	FD	ALL	>=10-<16		2126		21
2007	CSLUP scenic	< 1995	FD	ALL	>=16	60	2127	490	194
2008	CSLUP scenic	< 1995	HW	not YC	<10	170	2128	35	375
2009	CSLUP scenic	< 1995	HW	not YC	>=10-<16	110	2129	861	2,320
2010	CSLUP scenic	< 1995	HW	not YC	>=16	70	2130	1,297	970
2011	CSLUP scenic	< 1995	HW, BA, YC	YC, ALL, ALL	<10	160	2131	23	540
2012	CSLUP scenic	< 1995	HW, BA, YC	YC, ALL, ALL	>=10-<16	100	2132	218	461
2013	CSLUP scenic	< 1995	HW, BA, YC	YC, ALL, ALL	>=16	80	2133	83	72
2014	CSLUP scenic	< 1995	OT	ALL	ALL	160	2134	1	127
2016	CSLUP scenic	< 1995	SS	ALL	>=10-<16	90	2136	3	11
2017	CSLUP scenic	< 1995	SS	ALL	>=16	80	2137		2
2021	CSLUP scenic	1995-2017	CW	ALL	<16	180	2121	26	5
2022	CSLUP scenic	1995-2017	CW	ALL	>=16-<24	120	2122	256	58
2023	CSLUP scenic	1995-2017	CW	ALL	>=24	100	2123	1	
2024	CSLUP scenic	1995-2017	DR	ALL	ALL	80	2124	37	16
2028	CSLUP scenic	1995-2017	HW	not YC	<16	90	2128		0
2029	CSLUP scenic	1995-2017	HW	not YC	>=16-<24	90	2129	11	0
2030	CSLUP scenic	1995-2017	HW	not YC	>=24	80	2130	189	39
2032	CSLUP scenic	1995-2017	HW, BA, YC	YC, ALL, ALL	>=16-<24	80	2132	1	1
2033	CSLUP scenic	1995-2017	HW, BA, YC	YC, ALL, ALL	>=24	90	2133	12	5
2121	CSLUP scenic	2017+	CW	ALL	<16	180	2121		
2122	CSLUP scenic	2017+	CW	ALL	>=16-<24	110	2122		
2123	CSLUP scenic	2017+	CW	ALL	>=24	100	2123		
2124	CSLUP scenic	2017+	DR	ALL	ALL	70	2124		
2127	CSLUP scenic	2017+	FD	ALL	>=24	70	2127		
2128	CSLUP scenic	2017+	HW	not YC	<16	80	2128		
2129	CSLUP scenic	2017+	HW	not YC	>=16-<24	80	2129		
2130	CSLUP scenic	2017+	HW	not YC	>=24	70	2130		
2131	CSLUP scenic	2017+	HW, BA, YC	YC, ALL, ALL	<16	80	2131		
2132	CSLUP scenic	2017+	HW, BA, YC	YC, ALL, ALL	>=16-<24	90	2132		
2133	CSLUP scenic	2017+	HW, BA, YC	YC, ALL, ALL	>=24	100	2133		
2134	CSLUP scenic	2017+	OT	ALL	ALL	220	2134		
2136	CSLUP scenic	2017+	SS	ALL	>=16-<24	70	2136		
Total								**17,913**	**28,736**

Appendix 2 TIPSY Regeneration Assumptions

AU	BEC	Reg	Prop	Density	Delay	Spp Comp	SI Spp1	GW Spp1	SI Spp2	GW Spp2	SI Spp3	GW Spp3	Resid Height
21	CWH	P	0.6	1,000	3	Cw70 Hw30	18.51	2	21.57				
21	CWH	N	0.4	800	6	Cw70 Hw30	18.51		21.57				
22	CWH	P	0.6	1,000	3	Cw70 Hw30	18.63	2	22.2				
22	CWH	N	0.4	800	6	Cw70 Hw30	18.63		22.2				
23	CWH	P	0.6	1,000	3	Cw70 Hw30	18.71	2	22.3				
23	CWH	N	0.4	800	6	Cw70 Hw30	18.71		22.3				
24	CWH	P	1	1,600	3	Hw70 Cw30	21.84		18.57	2			
28	CWH	P	0.2	1,000	3	Hw80 Cw20	23.13		19.6	2			
28	CWH	N	0.8	4,000	6	Hw80 Cw20	23.13		19.6				
29	CWH	P	0.2	1,000	3	Hw80 Cw20	17.86		15.94	2			
29	CWH	N	0.8	4,000	6	Hw80 Cw20	17.86		15.94				
30	CWH	P	0.2	1,000	3	Hw80 Cw20	22.35		18.83	2			
30	CWH	N	0.8	4,000	6	Hw80 Cw20	22.35		18.83				
31	CWH	P	0.28	1,000	3	Hw80 Cw20	22.51		19.25	2			
31	CWH	N	0.72	2,500	6	Hw80 Cw20	22.51		19.25				
32	CWH	P	0.28	1,000	3	Hw80 Cw20	22.53		19.26	2			
32	CWH	N	0.72	2,500	6	Hw80 Cw20	22.53		19.26				
33	CWH	P	0.28	1,000	3	Hw80 Cw20	22.52		19.25	2			
33	CWH	N	0.72	2,500	6	Hw80 Cw20	22.52		19.25				
121	CWH	P	0.6	1,000	3	Cw70 Hw30	18.51	9.5	21.57	14			
121	CWH	N	0.4	800	6	Cw70 Hw30	18.51		21.57				
122	CWH	P	0.6	1,000	3	Cw70 Hw30	18.63	9.5	22.2	14			
122	CWH	N	0.4	800	6	Cw70 Hw30	18.63		22.2				
123	CWH	P	0.6	1,000	3	Cw70 Hw30	18.71	9.5	22.3	14			
123	CWH	N	0.4	800	6	Cw70 Hw30	18.71		22.3				
124	CWH	P	1	1,600	3	Hw70 Cw30	21.84	14	18.57	9.5			
127	CWH	P	0.9	1,000	3	Fd50 Hw30 Cw20	33.29	11	21.98	14	18.8	9.5	
127	CWH	N	0.1	100	6	Fd50 Hw30 Cw20	33.29		21.98		18.8		
128	CWH	P	0.2	1,000	3	Hw80 Cw20	23.13	14	19.6	9.5			
128	CWH	P	0.8	1,000	3	Hw80 Cw20	23.13	14	19.6	9.5			
129	CWH	P	0.2	1,000	3	Hw80 Cw20	17.86	14	15.94	9.5			
129	CWH	P	0.8	1,000	3	Hw80 Cw20	17.86	14	15.94	9.5			
130	CWH	P	0.2	1,400	3	Hw80 Cw20	22.35	14	18.83	9.5			
130	CWH	P	0.8	1,000	3	Hw80 Cw20	22.35	14	18.83	9.5			
131	CWH	P	0.28	1,000	3	Hw80 Cw20	22.51	14	19.25	9.5			
131	CWH	P	0.72	1,000	3	Hw80 Cw20	22.51	14	19.25	9.5			
132	CWH	P	0.28	1,000	3	Hw80 Cw20	22.53	14	19.26	9.5			
132	CWH	N	0.72	800	6	Hw80 Cw20	22.53		19.26				
133	CWH	P	0.28	1,000	3	Hw80 Cw20	22.52	14	19.25	9.5			
133	CWH	N	0.72	800	6	Hw80 Cw20	22.52		19.25				
134	CWH	P	1	1,000	3	Cw50 Pl40 Hw10	13.93	9.5	10.87		17.96	14	
1021	CWH	P	0.6	1,000	3	Cw70 Hw30	16.11	2	23.33				
1021	CWH	N	0.4	800	6	Cw70 Hw30	16.11		23.33				
1022	CWH	P	0.6	1,000	3	Cw70 Hw30	19.14	2	25.27				
1022	CWH	N	0.4	800	6	Cw70 Hw30	19.14		25.27				
1023	CWH	P	0.6	1,000	3	Cw70 Hw30	18.9	2	26.56				
1023	CWH	N	0.4	800	6	Cw70 Hw30	18.9		26.56				
1024	CWH	P	1	1,600	3	Hw70 Cw30	27.34		18.97	2			
1028	CWH	P	0.2	1,000	3	Hw80 Cw20	24.16		17.73	2			
1028	CWH	N	0.8	4,000	6	Hw80 Cw20	24.16		17.73				
1029	CWH	P	0.2	1,000	3	Hw80 Cw20	26.31		21.31	2			
1029	CWH	N	0.8	4,000	6	Hw80 Cw20	26.31		21.31				
1030	CWH	P	0.2	1,000	3	Hw80 Cw20	27.02		18.46	2			

AU	BEC	Reg	Prop	Density	Delay	Spp Comp	SI Spp1	GW Spp1	SI Spp2	GW Spp2	SI Spp3	GW Spp3	Resid Height
1030	CWH	N	0.8	4,000	6	Hw80 Cw20	27.02		18.46				
1031	CWH	P	0.28	1,000	3	Hw80 Cw20	24.21		20.76	2			
1031	CWH	N	0.72	2,500	6	Hw80 Cw20	24.21		20.76				
1032	CWH	P	0.28	1,000	3	Hw80 Cw20	26.32		22.11	2			
1032	CWH	N	0.72	2,500	6	Hw80 Cw20	26.32		22.11				
1033	CWH	P	0.28	1,000	3	Hw80 Cw20	27.86		22.51	2			
1033	CWH	N	0.72	2,500	6	Hw80 Cw20	27.86		22.51				
1121	CWH	P	0.6	1,000	3	Cw70 Hw30	16.11	9.5	23.33	14			
1121	CWH	N	0.4	800	6	Cw70 Hw30	16.11		23.33				
1122	CWH	P	0.6	1,000	3	Cw70 Hw30	19.14	9.5	25.27	14			
1122	CWH	N	0.4	800	6	Cw70 Hw30	19.14		25.27				
1123	CWH	P	0.6	1,000	3	Cw70 Hw30	18.9	9.5	26.56	14			
1123	CWH	N	0.4	800	6	Cw70 Hw30	18.9		26.56				
1124	CWH	P	1	1,600	3	Hw70 Cw30	27.34	14	18.97	9.5			
1127	CWH	P	0.9	1,000	3	Fd50 Hw30 Cw20	36.27	11	26.59	14	16.58	9.5	
1127	CWH	N	0.1	100	6	Fd50 Hw30 Cw20	36.27		26.59		16.58		
1128	CWH	P	0.2	1,000	3	Hw80 Cw20	24.16	14	17.73	9.5			
1128	CWH	P	0.8	1,000	3	Hw80 Cw20	24.16	14	17.73	9.5			
1129	CWH	P	0.2	1,000	3	Hw80 Cw20	26.31	14	21.31	9.5			
1129	CWH	P	0.8	1,000	3	Hw80 Cw20	26.31	14	21.31	9.5			
1130	CWH	P	0.2	1,400	3	Hw80 Cw20	27.02	14	18.46	9.5			
1130	CWH	P	0.8	1,000	3	Hw80 Cw20	27.02	14	18.46	9.5			
1131	CWH	P	0.28	1,000	3	Hw80 Cw20	24.21	14	20.76	9.5			
1131	CWH	P	0.72	1,000	3	Hw80 Cw20	24.21	14	20.76	9.5			
1132	CWH	P	0.28	1,000	3	Hw80 Cw20	26.32	14	22.11	9.5			
1132	CWH	N	0.72	800	6	Hw80 Cw20	26.32		22.11				
1133	CWH	P	0.28	1,000	3	Hw80 Cw20	27.86	14	22.51	9.5			
1133	CWH	N	0.72	800	6	Hw80 Cw20	27.86		22.51				
1134	CWH	P	1	1,000	3	Cw50 Pl40 Hw10	15.06	9.5	10.87		21.25	14	
1136	CWH	P	1	1,000	3	Hw70 Cw30	27.3	14	18.86	9.5			
1137	CWH	P	1	1,000	3	Hw70 Cw30	26.8	14	16.08	9.5			
2021	CWH	P	0.6	1,000	3	Cw70 Hw30	16.05	2	19.43				19
2021	CWH	N	0.4	800	6	Cw70 Hw30	16.05		19.43				19
2022	CWH	P	0.6	1,000	3	Cw70 Hw30	18.74	2	24.03				30
2022	CWH	N	0.4	800	6	Cw70 Hw30	18.74		24.03				30
2023	CWH	P	0.6	1,000	3	Cw70 Hw30	20.08	2	26.01				39
2023	CWH	N	0.4	800	6	Cw70 Hw30	20.08		26.01				39
2024	CWH	P	1	1,600	3	Hw70 Cw30	26.92		19.97	2			29
2028	CWH	P	0.2	1,000	3	Hw80 Cw20	24.44		19.38	2			30
2028	CWH	N	0.8	4,000	6	Hw80 Cw20	24.44		19.38				30
2029	CWH	P	0.2	1,000	3	Hw80 Cw20	25.38		20.39	2			35
2029	CWH	N	0.8	4,000	6	Hw80 Cw20	25.38		20.39				35
2030	CWH	P	0.2	1,000	3	Hw80 Cw20	26.41		20.2	2			39
2030	CWH	N	0.8	4,000	6	Hw80 Cw20	26.41		20.2				39
2031	CWH	P	0.28	1,000	3	Hw80 Cw20	25.04		21.05	2			27
2031	CWH	N	0.72	2,500	6	Hw80 Cw20	25.04		21.05				27
2032	CWH	P	0.28	1,000	3	Hw80 Cw20	25.63		21.17	2			36
2032	CWH	N	0.72	2,500	6	Hw80 Cw20	25.63		21.17				36
2033	CWH	P	0.28	1,000	3	Hw80 Cw20	24.01		20.17	2			43
2033	CWH	N	0.72	2,500	6	Hw80 Cw20	24.01		20.17				43
2121	CWH	P	0.6	1,000	3	Cw70 Hw30	16.05	9.5	19.43	14			19
2121	CWH	N	0.4	800	6	Cw70 Hw30	16.05		19.43				19
2122	CWH	P	0.6	1,000	3	Cw70 Hw30	18.74	9.5	24.03	14			30
2122	CWH	N	0.4	800	6	Cw70 Hw30	18.74		24.03				30
2123	CWH	P	0.6	1,000	3	Cw70 Hw30	20.08	9.5	26.01	14			39
2123	CWH	N	0.4	800	6	Cw70 Hw30	20.08		26.01				39

AU	BEC	Reg	Prop	Density	Delay	Spp Comp	SI Spp1	GW Spp1	SI Spp2	GW Spp2	SI Spp3	GW Spp3	Resid Height
2124	CWH	P	1	1,600	3	Hw70 Cw30	26.92	14	19.97	9.5			29
2127	CWH	P	0.9	1,000	3	Fd50 Hw30 Cw20	34.48	11	26.52	14	19.79	9.5	34
2127	CWH	N	0.1	100	6	Fd50 Hw30 Cw20	34.48		26.52		19.79		34
2128	CWH	P	0.2	1,000	3	Hw80 Cw20	24.44	14	19.38	9.5			30
2128	CWH	P	0.8	1,000	3	Hw80 Cw20	24.44	14	19.38	9.5			30
2129	CWH	P	0.2	1,000	3	Hw80 Cw20	25.38	14	20.39	9.5			35
2129	CWH	P	0.8	1,000	3	Hw80 Cw20	25.38	14	20.39	9.5			35
2130	CWH	P	0.2	1,400	3	Hw80 Cw20	26.41	14	20.2	9.5			39
2130	CWH	P	0.8	1,000	3	Hw80 Cw20	26.41	14	20.2	9.5			39
2131	CWH	P	0.28	1,000	3	Hw80 Cw20	25.04	14	21.05	9.5			27
2131	CWH	P	0.72	1,000	3	Hw80 Cw20	25.04	14	21.05	9.5			27
2132	CWH	P	0.28	1,000	3	Hw80 Cw20	25.63	14	21.17	9.5			36
2132	CWH	N	0.72	800	6	Hw80 Cw20	25.63		21.17				36
2133	CWH	P	0.28	1,000	3	Hw80 Cw20	24.01	14	20.17	9.5			43
2133	CWH	N	0.72	800	6	Hw80 Cw20	24.01		20.17				43
2134	CWH	P	1	1,000	3	Cw50 Pl40 Hw10	16.86	9.5	15.52		23.57	14	17
2136	CWH	P	1	1,000	3	Hw70 Cw30	27.25	14	18.63	9.5			43

Appendix 3 Landscape Level Biodiversity Objectives by Watersheds (CSLUP)

RULE APPLY	ws5 ID	WS_TYPE	THLB (ha)	NHLB (ha)	THLB >140 yrs (ha)	NHLB >140 yrs (ha)	THLB>140 yrs (%)	NHLB>140 yrs (%)	PFLB>140 yrs (%)
y	2	p>=200-<500	57.2	155.2	54.2	145.0	26%	68%	94%
y	5	p>=200-<500	96.3	222.0	90.1	204.5	28%	64%	93%
y	7	p>=200-<500	76.8	88.7	75.3	77.8	45%	47%	92%
y	8	p>=500	142.5	30.7	106.9	24.3	62%	14%	76%
y	9	p>=200-<500	76.5	81.2	61.4	61.8	39%	39%	78%
y	18	p>=500	263.6	128.3	152.9	59.8	39%	15%	54%
y	22	t>=500	212.9	244.4	212.9	237.9	47%	52%	99%
y	23	t>=500	318.5	321.4	318.5	321.4	50%	50%	100%
y	24	p>=200-<500	5.0	0.0	5.0	0.0	100%	0%	100%
y	25	p>=200-<500	69.2	35.2	69.2	33.4	66%	32%	98%
y	26	p>=200-<500	50.8	81.5	50.8	81.5	38%	62%	100%
y	27	p>=500	82.8	182.5	75.3	180.0	28%	68%	96%
y	28	p>=200-<500	75.1	152.8	67.4	152.6	30%	67%	97%
y	29	p>=500	59.9	78.2	58.1	78.2	42%	57%	99%
y	32	p>=500	144.4	174.9	142.5	174.9	45%	55%	99%
y	33	p>=200-<500	100.2	115.2	93.6	115.2	43%	53%	97%
y	34	p>=200-<500	3.6	104.2	3.6	104.2	3%	97%	100%
y	35	p>=500	103.9	245.4	102.4	245.3	29%	70%	100%
y	38	p>=500	239.9	229.2	171.6	211.7	37%	45%	82%
y	40	s>=500	14.5	8.3	7.6	8.3	33%	36%	70%
y	151	s>=500	230.5	101.8	84.8	40.7	26%	12%	38%
y	153	s>=500	0.0	1.6	0.0	1.6	0%	100%	100%
y	154	p>=500	319.6	147.3	281.0	139.8	60%	30%	90%
y	176	t>=500	332.1	146.5	28.2	52.7	6%	11%	17%
y	177	t>=500	157.5	115.5	32.5	66.7	12%	24%	36%
y	192	p>=200-<500	0.0	176.6	0.0	176.6	0%	100%	100%
y	193	p>=200-<500	0.0	37.6	0.0	37.1	0%	99%	99%
y	194	p>=200-<500	0.0	153.8	0.0	153.3	0%	100%	100%
y	203	p>=200-<500	1.0	129.8	1.0	129.8	1%	99%	100%
y	204	p>=200-<500	62.6	54.9	45.5	48.9	39%	42%	80%
y	205	p>=500	172.7	69.1	160.8	61.6	67%	25%	92%
y	212	p>=200-<500	0.0	0.6	0.0	0.6	0%	100%	100%
y	213	p>=200-<500	17.7	11.7	17.7	11.7	60%	40%	100%
y	214	p>=200-<500	232.7	100.7	222.4	86.5	67%	26%	93%
y	243	p>=500	55.9	36.6	31.8	26.4	34%	29%	63%
y	246	t>=500	206.2	787.9	205.2	775.3	21%	78%	99%
y	256	p>=200-<500	133.2	79.6	121.0	71.6	57%	34%	90%
y	259	t>=500	240.2	485.6	240.2	481.3	33%	66%	99%
y	260	s>=500	105.3	208.3	105.3	205.2	34%	65%	99%
y	262	p>=200-<500	42.7	31.5	36.4	30.0	49%	40%	89%
y	264	p>=500	135.2	212.7	111.9	197.4	32%	57%	89%
y	265	p>=500	51.0	59.3	41.4	56.9	38%	52%	89%
y	266	p>=200-<500	80.6	95.1	50.1	89.7	29%	51%	80%
y	267	p>=200-<500	75.6	64.1	43.3	55.8	31%	40%	71%
y	269	p>=500	0.0	6.1	0.0	5.4	0%	89%	89%
y	301	p>=500	10.2	12.3	9.6	12.3	43%	55%	98%
y	302	p>=500	98.4	461.5	98.4	452.7	18%	81%	98%
y	303	p>=200-<500	61.8	316.3	61.8	314.2	16%	83%	99%
y	305	p>=200-<500	15.1	278.3	15.1	266.5	5%	91%	96%
y	331	s>=500	116.8	19.7	14.0	7.7	10%	6%	16%
y	358	s>=500	519.5	218.9	37.0	65.3	5%	9%	14%

RULE APPLY	ws5 ID	WS_TYPE	THLB (ha)	NHLB (ha)	THLB >140 yrs (ha)	NHLB >140 yrs (ha)	THLB>140 yrs (%)	NHLB>140 yrs (%)	PFLB>140 yrs (%)
y	361	p>=200-<500	0.0	127.5	0.0	126.0	0%	99%	99%
y	362	p>=200-<500	0.0	7.7	0.0	7.7	0%	100%	100%
y	365	p>=500	104.8	254.0	104.8	254.0	29%	71%	100%
y	366	p>=500	195.2	186.2	110.4	105.4	29%	28%	57%
y	382	p>=200-<500	36.3	43.5	23.0	33.1	29%	42%	70%
y	384	s>=500	60.7	44.7	34.4	38.9	33%	37%	70%
y	386	p>=500	318.8	189.5	158.9	162.1	31%	32%	63%
y	387	s>=500	3.4	122.6	3.4	121.6	3%	97%	99%
y	388	s>=500	0.0	0.5	0.0	0.5	0%	100%	100%
y	392	s>=500	0.6	7.5	0.6	7.5	7%	93%	100%
y	393	s>=500	0.3	17.1	0.3	17.1	2%	98%	100%
y	401	q>=500	0.0	1.5	0.0	1.5	0%	100%	100%
y	413	p>=200-<500	41.7	228.4	41.7	228.4	15%	85%	100%
y	414	p>=200-<500	46.7	241.6	46.7	236.4	16%	82%	98%
y	432	p>=200-<500	37.9	84.5	37.9	84.5	31%	69%	100%
y	433	p>=500	240.4	1,081.2	240.4	1,080.4	18%	82%	100%
y	434	p>=500	103.0	426.3	103.0	424.5	19%	80%	100%
y	436	q>=500	16.3	659.1	16.3	631.7	2%	94%	96%
y	437	s>=500	189.7	897.3	189.7	890.1	17%	82%	99%
n	3	p<200	0.0	1.0	0.0	1.0	0%	100%	100%
n	4	s-residual	3.4	27.0	3.4	20.6	11%	68%	79%
n	6	p<200	38.5	42.6	28.3	34.0	35%	42%	77%
n	10	p<200	26.6	12.5	19.5	5.1	50%	13%	63%
n	11	p<200	35.1	42.1	24.8	41.1	32%	53%	85%
n	12	s<500	21.6	7.7	15.4	3.7	53%	13%	65%
n	13	p<200	16.7	42.5	15.4	40.1	26%	68%	94%
n	14	p-residual	129.8	751.1	95.7	693.8	11%	79%	90%
n	15	s<500	37.2	85.9	33.6	75.8	27%	62%	89%
n	16	s<500	147.0	128.5	141.0	125.7	51%	46%	97%
n	17	p<200	78.0	80.0	52.5	55.7	33%	35%	68%
n	19	p-residual	87.6	134.2	85.4	124.9	38%	56%	95%
n	20	p-residual	18.2	4.0	18.2	4.0	82%	18%	100%
n	21	p-residual	4.6	1.0	4.6	1.0	82%	18%	100%
n	36	p<200	47.2	15.2	42.6	14.2	68%	23%	91%
n	37	p<200	8.7	45.5	8.7	43.5	16%	80%	96%
n	39	p<200	8.0	57.0	8.0	53.2	12%	82%	94%
n	42	p-not a watershed	61.7	75.9	25.4	61.3	18%	45%	63%
n	46	p-not a watershed	0.0	694.5	0.0	624.3	0%	90%	90%
n	48	p-not a watershed	0.0	7.5	0.0	7.5	0%	100%	100%
n	49	p-not a watershed	0.0	19.7	0.0	19.7	0%	100%	100%
n	51	p-not a watershed	0.0	13.6	0.0	13.6	0%	100%	100%
n	53	p-not a watershed	0.0	189.7	0.0	186.4	0%	98%	98%
n	55	p-not a watershed	29.0	37.0	29.0	37.0	44%	56%	100%
n	56	p-not a watershed	0.0	365.8	0.0	360.9	0%	99%	99%
n	57	p-not a watershed	0.3	6.1	0.3	6.1	4%	96%	100%
n	58	p-not a watershed	4.7	24.5	0.4	18.7	1%	64%	66%
n	62	p-not a watershed	78.3	88.2	69.6	82.7	42%	50%	91%
n	65	p-not a watershed	156.7	101.9	122.8	81.0	47%	31%	79%
n	66	p-not a watershed	20.9	12.9	20.9	12.9	62%	38%	100%
n	67	p-not a watershed	21.3	105.0	20.6	66.5	16%	53%	69%
n	69	p-not a watershed	8.1	373.7	8.0	350.3	2%	92%	94%
n	70	p-not a watershed	38.9	264.0	38.9	264.0	13%	87%	100%
n	71	p-not a watershed	10.6	89.5	10.6	89.5	11%	89%	100%
n	74	p-not a watershed	31.5	36.9	20.2	35.7	29%	52%	82%
n	75	p-not a watershed	55.3	115.8	47.9	107.3	28%	63%	91%
n	76	p-not a watershed	47.9	28.6	46.6	27.6	61%	36%	97%

RULE APPLY	ws5 ID	WS_TYPE	THLB (ha)	NHLB (ha)	THLB >140 yrs (ha)	NHLB >140 yrs (ha)	THLB>140 yrs (%)	NHLB>140 yrs (%)	PFLB>140 yrs (%)
n	83	p-not a watershed	39.8	163.0	30.2	126.6	15%	62%	77%
n	89	p-not a watershed	9.6	27.1	9.6	25.9	26%	71%	97%
n	92	p-not a watershed	6.0	40.7	6.0	40.7	13%	87%	100%
n	107	p-not a watershed	318.6	448.7	220.3	390.5	29%	51%	80%
n	109	p-not a watershed	6.6	1.9	4.9	0.3	58%	3%	62%
n	110	p-not a watershed	0.0	19.1	0.0	19.1	0%	100%	100%
n	111	p-not a watershed	0.0	7.7	0.0	7.7	0%	100%	100%
n	112	p-not a watershed	12.6	10.9	12.6	10.9	54%	46%	100%
n	114	p-not a watershed	51.4	215.3	46.8	206.1	18%	77%	95%
n	115	p-not a watershed	15.9	61.5	15.3	59.0	20%	76%	96%
n	116	p-not a watershed	0.1	0.9	0.1	0.9	11%	89%	100%
n	119	p-not a watershed	48.7	15.9	25.2	13.7	39%	21%	60%
n	121	p-not a watershed	23.8	52.2	23.8	50.8	31%	67%	98%
n	122	p-not a watershed	56.2	104.9	45.6	102.2	28%	63%	92%
n	123	p-not a watershed	29.4	32.9	15.5	30.0	25%	48%	73%
n	124	p-not a watershed	35.5	28.3	28.0	24.8	44%	39%	83%
n	128	p-not a watershed	52.7	52.3	43.9	52.1	42%	50%	91%
n	129	p-not a watershed	0.3	0.6	0.3	0.6	36%	64%	100%
n	130	p-not a watershed	62.4	4.5	48.8	4.5	73%	7%	80%
n	134	p-not a watershed	21.4	113.9	21.4	112.2	16%	83%	99%
n	142	p-not a watershed	0.0	66.7	0.0	66.7	0%	100%	100%
n	144	p-not a watershed	225.7	348.4	135.8	301.5	24%	53%	76%
n	145	p<200	16.6	0.3	15.8	0.0	94%	0%	94%
n	146	p<200	115.1	19.2	111.1	19.2	83%	14%	97%
n	147	p<200	89.8	48.9	89.8	48.9	65%	35%	100%
n	148	p<200	53.3	79.5	52.2	78.8	39%	59%	99%
n	149	p<200	1.8	109.5	0.6	99.9	1%	90%	90%
n	150	s<500	198.9	47.2	56.6	8.6	23%	3%	26%
n	160	p<200	49.3	41.0	35.1	33.0	39%	37%	75%
n	161	p<200	60.6	58.9	36.0	49.0	30%	41%	71%
n	162	p<200	0.0	20.4	0.0	20.4	0%	100%	100%
n	163	p-residual	174.6	134.0	96.9	107.9	31%	35%	66%
n	164	p-residual	162.4	86.0	4.1	7.6	2%	3%	5%
n	165	p-residual	34.3	6.8	0.0	0.9	0%	2%	2%
n	166	p-residual	236.5	234.4	90.8	148.6	19%	32%	51%
n	185	t<500	0.0	0.3	0.0	0.0	0%	0%	0%
n	190	s<500	108.9	38.2	1.7	6.3	1%	4%	5%
n	191	s<500	127.3	55.6	0.8	0.0	0%	0%	0%
n	196	p<200	0.0	42.7	0.0	42.7	0%	100%	100%
n	197	p<200	0.0	129.5	0.0	118.1	0%	91%	91%
n	198	p<200	0.0	88.2	0.0	88.0	0%	100%	100%
n	199	p<200	10.2	5.0	0.1	0.0	1%	0%	1%
n	200	p<200	0.0	43.4	0.0	41.1	0%	95%	95%
n	201	p<200	21.0	91.6	21.0	91.6	19%	81%	100%
n	215	p<200	74.8	44.4	74.8	42.1	63%	35%	98%
n	217	s<500	19.9	305.1	19.9	303.6	6%	93%	100%
n	220	t-residual	0.0	1.0	0.0	1.0	0%	100%	100%
n	238	p-residual	6.3	1.5	6.3	1.5	81%	19%	100%
n	239	s-residual	74.8	376.4	74.8	375.1	17%	83%	100%
n	244	p-residual	32.4	191.0	32.4	181.9	15%	81%	96%
n	245	t<500	47.4	239.5	47.4	239.5	17%	83%	100%
n	247	s<500	104.2	143.1	104.2	142.7	42%	58%	100%
n	251	p-residual	0.0	0.3	0.0	0.3	0%	100%	100%
n	254	p-residual	122.7	141.6	106.5	131.4	40%	50%	90%
n	255	s<500	17.1	219.7	15.3	212.9	6%	90%	96%
n	257	s<500	45.1	62.9	41.2	54.3	38%	50%	88%

RULE APPLY	ws5 ID	WS_TYPE	THLB (ha)	NHLB (ha)	THLB >140 yrs (ha)	NHLB >140 yrs (ha)	THLB>140 yrs (%)	NHLB>140 yrs (%)	PFLB>140 yrs (%)
n	258	s-residual	130.1	150.8	130.1	150.3	46%	54%	100%
n	268	p-residual	78.9	87.0	43.0	73.6	26%	44%	70%
n	270	p-not a watershed	290.5	213.8	222.7	178.2	44%	35%	80%
n	271	p-not a watershed	314.6	111.0	67.1	37.7	16%	9%	25%
n	272	p-not a watershed	372.8	184.5	286.6	153.9	51%	28%	79%
n	275	p-not a watershed	0.0	1,245.5	0.0	1,195.2	0%	96%	96%
n	276	p-not a watershed	27.9	5.0	18.8	4.4	57%	13%	70%
n	277	p-not a watershed	8.0	12.9	8.0	12.5	38%	60%	98%
n	278	p-not a watershed	120.4	328.4	115.1	317.2	26%	71%	96%
n	279	p-not a watershed	15.7	4.4	11.5	3.4	57%	17%	74%
n	280	p-not a watershed	182.6	173.9	139.1	155.2	39%	44%	83%
n	281	p-not a watershed	168.7	286.2	116.1	271.5	26%	60%	85%
n	282	p-residual	0.0	0.6	0.0	0.6	0%	100%	100%
n	283	s<500	0.0	0.2	0.0	0.2	0%	100%	100%
n	289	p-not a watershed	19.0	147.5	19.0	147.5	11%	89%	100%
n	294	p-not a watershed	141.8	315.1	94.9	230.6	21%	50%	71%
n	295	p-not a watershed	116.1	360.2	116.1	359.0	24%	75%	100%
n	296	p-not a watershed	4.6	0.0	3.8	0.0	84%	0%	84%
n	297	p-not a watershed	0.0	0.6	0.0	0.6	0%	100%	100%
n	298	p-not a watershed	77.3	25.2	63.8	21.2	62%	21%	83%
n	299	p-not a watershed	75.3	423.2	75.3	423.2	15%	85%	100%
n	304	p-residual	572.9	221.6	125.3	45.5	16%	6%	21%
n	324	p-residual	6.2	2.9	5.7	2.9	63%	32%	95%
n	328	p-residual	6.4	0.0	0.0	0.0	0%	0%	0%
n	330	p-residual	266.2	54.3	21.7	20.9	7%	7%	13%
n	347	s-residual	188.5	93.0	36.4	27.9	13%	10%	23%
n	348	s-residual	7.3	15.7	0.2	7.7	1%	33%	34%
n	357	s<500	165.3	145.5	90.0	80.2	29%	26%	55%
n	363	p<200	0.0	153.7	0.0	152.8	0%	99%	99%
n	364	p<200	0.0	144.4	0.0	144.4	0%	100%	100%
n	383	p-residual	558.0	832.0	197.7	625.1	14%	45%	59%
n	394	s-residual	0.0	8.4	0.0	8.4	0%	100%	100%
n	431	p<200	22.9	24.1	22.9	24.1	49%	51%	100%
n	435	t-residual	103.8	980.2	103.8	979.3	10%	90%	100%
	0		413.7	145.4	333.3	134.1	60%	24%	84%
Total			**15,815.0**	**27,872.0**	**10,523.0**	**25,213.9**			

Appendix 3 Timber Supply Analysis

Tree Farm Licence 54 – Draft Management Plan #5

TIMBER SUPPLY ANALYSIS REPORT

Version 1.1

August 27, 2018

Project 1414-1

Prepared for:

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Executive Summary

The Tree Farm Licence (TFL) 54 is located on the west side of Vancouver Island and covers an area of approximately 49,000 ha, out of which 46,649 ha (95.4%) is productive forested land base and 17,913 ha (36.6% of total area) is timber harvesting land base (THLB). Approximately 93% of the TFL54 overlaps with the Clayoquot Sound region. The THLB in current analysis was 25.6% lower than previous analysis because of the economic operability assessment differences.

This document summarizes the timber supply analysis results for the TFL 54 held by Ma-Mook Natural Resources Limited, recommends a harvest rate, provides a focus for public review and First Nations referrals, and it is ultimately submitted to the provincial Deputy Chief Forester for consideration in determining an appropriate Allowable Annual Cut (AAC) for the next management plan period. The TFL 54 harvest rate is regulated through the *Tree Farm Licence Area-based Allowable Annual Cut Trial Program Regulation*. An area-based AAC defines the area of land that can be harvested annually rather than the amount of volume. The last timber supply analysis was conducted in 2005, which resulted in the current AAC of 315.8 ha/year established on April 19, 2011.

The harvest rate was calculated for each analysis unit as the division between the THLB area (gross and net) and the area weighted average rotation age (i.e., the age at harvest). The gross harvest rate was calculated as 185.3 ha/year (39.7% lower than the current AAC) and a net harvest rate of 137.2 ha/year. A modelled harvest forecast was also developed with a net harvest rate of 137 ha/year (4 ha lower than the calculated net harvest forecast without the NRLs). All non-timber objectives established through the Clayoquot Sound Land Use Order (CSLUP) and Vancouver Island Land Use Plan were met during current analysis. The most constraining non-timber objectives on the harvest rate were the landscape-level biodiversity (within CSLUP), and fisheries sensitive watershed maximum disturbance rate (outside CSLUP).

Sensitivity analyses focused on THLB area and yield estimates; the two key variables used to determine the area-based harvest rate. The results showed an amplitude of 23.4% (44.6 ha/year, without NRLs) relative to the Base Case, up to 13.1 % harvest rate increase (215.4 ha/year) and down to 10.3% harvest rate decrease (170.7 ha/year). Compared to the area-based approach, the non-declining, volume-based analysis resulted in lower net and gross area rates harvested in the long-term (by 10.3%), similar volume harvest rates, and less efficient use of the growing stock over time. Given these results, it is recommended to maintain an area-based harvest rate for the TFL54 and continue to improve the land base definition and growth and yield estimates for determining rotation ages.

Scenario	Harvest Gross (ha/year)	Difference from Base Case (ha/year)	Difference from Base Case (%)
Base Case (001)	**190.4**	0.0	0.0%
Non-declining harvest volume rate (002)	170.7	-19.7	-10.3%
Low sites exclusions (003)	176.6	-13.8	-7.2%
Regeneration Delay (004)	189.1	-1.3	-0.7%
Economic Operability @ 300 m³/ha (005)	202.7	12.3	6.4%
Economic Operability @ 225 m³/ha (006)	215.4	24.9	13.1%
Rotation age +10 yrs (007)	171.6	-18.8	-9.9%
Rotation age -10 yrs (008)	214.1	23.6	12.4%

Ma-Mook Natural Resources Limited recommends the area-based harvest rate resulting from the Base Case scenario as the allowable annual cut over the next management plan period: 185.3 ha/year of gross harvest area.

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List of Acronyms

AAC	Allowable Annual Cut
AU	Analysis Unit
Ba	Balsam Fir
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Option
CSLUP	Clayoquot Sound Landscape Unit Plan
Cw	Western Redcedar
CWH	Coastal Western Hemlock BEC zone
Dr	Red Alder
ECA	Equivalent Clearcut Area
Fd	Douglas-fir
FMA	Forest Management Area
FSW	Fisheries Sensitive Watershed
GIS	Geographic Information System
Hw	Western Hemlock
IHA	Important Harvest Area
LU	Landscape Units
MH	Mountain Hemlock BEC zone
MHA	Minimum Harvest Age
MP	Management Plan
NHLB	Non-Harvesting Land Base
NRL	Non-Recoverable Losses
PFLB	Productive Forest Land Base
Pl	Lodgepole Pine
SI	Site Index
Ss	Sitka Spruce
TFL	Tree Farm Licence
THLB	Timber Harvesting Land Base
TIPSY	Table Interpolation for Stand Yields
VDYP	Variable Density Yield Projection
VILUP	Vancouver Island Landscape Unit Plan
VQO	Visual Quality Objective
VRI	Vegetation Resource Inventory
Yc	Yellow Cypress

Document Revision History

Version	Date	Description
0.1	April 13, 2018	First version distributed to project team for review and comment.
1.0	May 8, 2018	Draft version made available for review with First Nations and the public.
1.1	August 27, 2018	Final version Executive Summary – changed harvest planning area from 190.4 ha/year to 185.3 ha/year to account for Non-Recoverable Losses (NRL). Section 2.1 (Calculated Harvest Forecast) – updated text to include the non-recoverable losses in the calculation of the harvest forecast. Added an extra row in Table 2 to include the non-recoverable losses in the harvest forecast. Added reference to the Arrowsmith TSR data package for prorating the non-recoverable losses.

Acknowledgements

Forsite thanks Zoltan Schafer, RPF (forestry manager, Ma-Mook Natural Resources Limited) for contributing valuable operational experience in designing the silvicultural treatments, Brynna Check (International Forest Products Ltd.) for providing the resultant file used in MP4, and Jim Brown, Qiong Su, and Tracy Andrews (BC Ministry of Forests, Lands, and Natural Resource Operations) for providing useful data and suggestions in completing the analysis. Wenli Xu (BC Ministry of Forests, Lands, and Natural Resource Operations) provided guidance to correctly estimate VDY7 yields.

The Forsite team included Cosmin Man (conducted the analysis) and Patrick Bryant (reviewed the analysis).

1 Introduction

Ma-Mook Natural Resources Limited (Ma-Mook), the holder of Tree Farm Licence (TFL) 54 is undertaking a Management Plan (MP) #5 process - due for approval by August 25, 2018. As part of the management plan process, a timber supply analysis will be conducted to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting. An area-based harvest regulation is utilized for TFL 54, made possible by the *Tree Farm Licence Area-based Allowable Annual Cut Trial (AAC) Program Regulation*. With an area-based AAC, the area of land that can be harvested annually is defined, rather than the amount of volume. The results of the timber supply analysis will inform the AAC determination process by documenting potential future harvest flows. **Results presented here do not define a new AAC, rather they are intended to provide insight into the likely future timber supply of the TFL.** The final harvest level decision will be made by the Deputy Chief Forester.

Timber supply is defined as the amount of timber available for harvest over time. Assessing timber supply involves consideration of a wide range of physical, biological, social, and economic factors that can influence the acceptable rate of timber harvesting within a management unit. Such factors include timber and non-timber values, such as wildlife, biodiversity, watershed health, recreational opportunities etc. The previous analysis was completed in 2005 (Timberline Forest Inventory Consultants, 2005) and the current Allowable Annual Cut (AAC) was determined by the Deputy Chief Forester in 2008 (Ministry of Forests and Range, 2008) at a rate of 320 ha/year. This was later amended to 315.8 ha/year on April 19, 2011 to account for boundary adjustments.

This document describes the timber supply analysis for TFL 54. The general objective of the analysis process is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting within the TFL. This analysis applied the detailed technical information and assumptions on current forest management practices under existing policy and legislation as provided in the Information Package made available for public review and comment in October 2017, and revised in March 2018 (Forsite Consultants Ltd., 2018). Both, the Information Package and Timber Supply Analysis Report documents, are required components to the TFL Management Plan (MP) process.

This analysis focuses on a forest management scenario that reflects current management practices (i.e., Base Case), which becomes the basis for comparing sensitivity analyses used to assess the impact of uncertainties in data or assumptions. Together, these analyses form a solid foundation for discussions with the government and stake holders in determining an appropriate harvest level.

1.1 TFL DESCRIPTION

The TFL 54 is located on the west side of Vancouver Island and covers an area of approximately 49,000 ha (Table 1 and Figure 1). Sections of this TFL overlap with the Clayoquot Sound region where the forest management is guided by the Clayoquot Sound Landscape Unit Plan (CSLUP). Outside of the CSLUP, the forest management is guided by the Vancouver Island Land Use Plan (VILUP).

Reductions for non-forest and roads resulted in a productive forest land base (PFLB) of 46,649 ha (95.4% of the total area). Further reductions of areas unsuitable for or protected from harvesting, the non-harvesting land base (NHLB), totalled to 28,736 ha or 61.6% of the forested land base. The remaining area suitable for harvesting, the timber harvesting land base (THLB), was 17,912 ha (36.6% of total area). In Table 1, the Total Area refers to the gross area for each factor. Once the non-forest and roads are removed, the area within PFLB is reported under the Total Area column. The Effective Area refers to the net area that is covered by each factor. Because there are overlaps between various factors in the net-down hierarchy, the gross and net area are not always equal. For example, a factor considered at an earlier stage in the net-down process can overlap with a factor considered at a later stage. Thus, the factor accounted earlier includes the overlaps with the factors accounted later.

Table 1 Land Base Definition

Factor			Total Area (ha)	Effective Area (ha)	% of Total Area	% of CFLB
Total Area			**48,922**		**100.0%**	
	Clayoquot Sound Landscape Unit Plan (CSLUP)		45,685		93.4%	
	Outside CSLUP		3,237		6.6%	
Less:						
	Non Forest		2,698	1,799	3.7%	
	Existing Roads		484	474	1.0%	
Total Productive Forested Land Base (PFLB)				**46,649**	**95.4%**	**100.0%**
	Within CSLUP			43,687	89.3%	93.7%
	Outside CSLUP			2,962	6.1%	6.3%
Less:			*in PFLB*			
	Within CSLUP			***27,872***	***57.0%***	***59.7%***
		Non Vegetated	69	69	0.1%	0.1%
		Inoperable	19,125	19,087	39.0%	40.9%
		Terrain Stability	3,074	1,358	2.8%	2.9%
		Sensitive Soils	1,501	220	0.5%	0.5%
		Flood Plains	327	11	0.0%	0.0%
		Marbled Murrelet	2,635	1,365	2.8%	2.9%
		Blue Listed	2,070	760	1.6%	1.6%
		Red Listed	205	36	0.1%	0.1%
		Protected Areas	107	55	0.1%	0.1%
		Recreation and Tourism	1,883	892	1.8%	1.9%
		Interior Old Growth	130	64	0.1%	0.1%
		Hydro Buffers	6,605	2,420	4.9%	5.2%
		Meares Island	3,662	1,536	3.1%	3.3%
	Outside CSLUP			***864***	***1.8%***	***1.9%***
		Inoperable	522	522	1.1%	1.1%
		ESA	228	147	0.3%	0.3%
		Terrain Stability	19	10	0.0%	0.0%
		Wildlife Habitat Area	109	63	0.1%	0.1%
		Riparian Buffers	193	122	0.2%	0.3%
Timber Harvesting Land Base (THLB)				**17,912**	**36.6%**	**38.4%**
	CSLUP			15,815	32.3%	33.9%
	Outside CSLUP			2,098	4.3%	4.5%
Less:						
	Future Roads (5%)			829	1.7%	1.8%
Future THLB				**17,084**	**34.9%**	**36.6%**

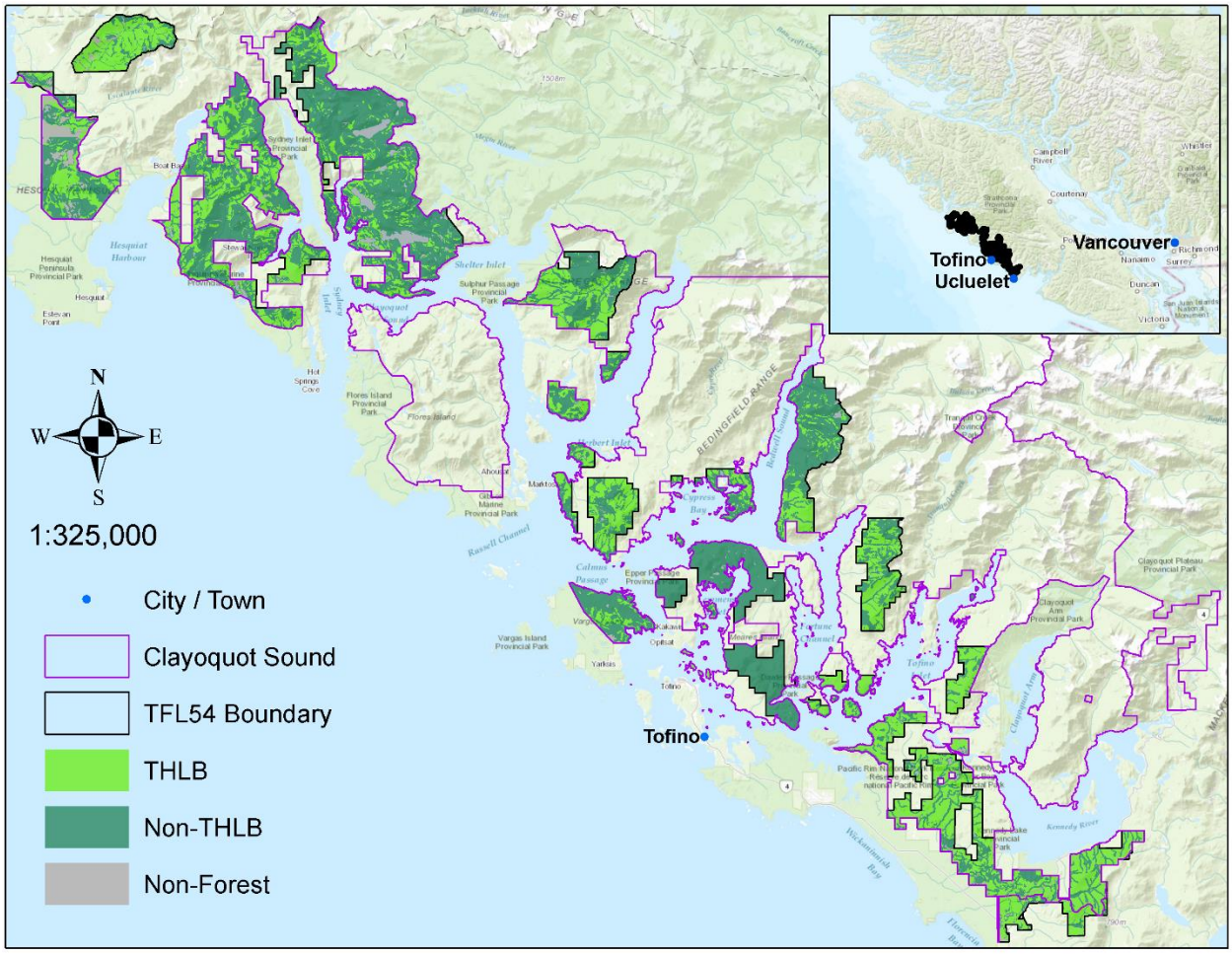


Figure 1 Location of TFL 54 and Land Base Classification

Most of the forest within TFL 54 is relatively old (i.e., 31,085 ha or 66.6% of the forested land base, older than 240 years) indicating that few large-scale disturbances have occurred over the last couple of centuries (Figure 2).

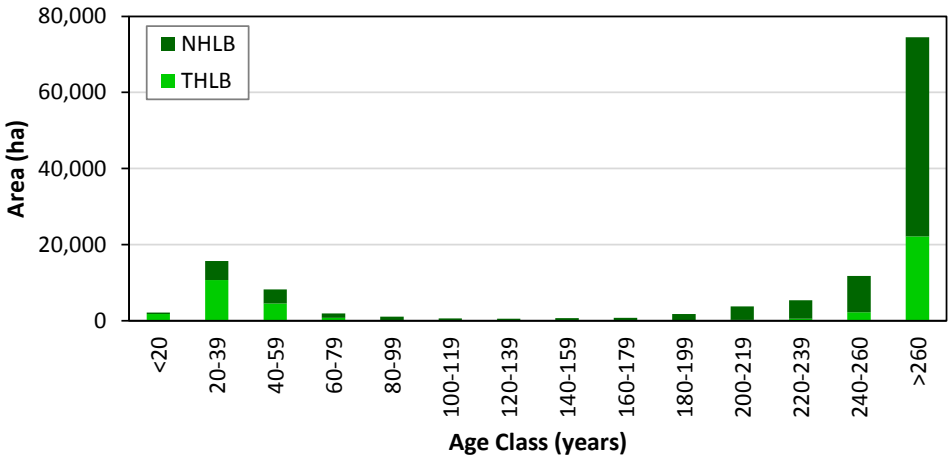


Figure 2 Current Age Class Distribution

The forested land base is almost exclusively within the CWH BEC zone (Figure 3), where approximately 38% of the forested area is THLB. Only 1.6% of the forested land base is within the MH BEC zone and nearly all of this is NHLB.

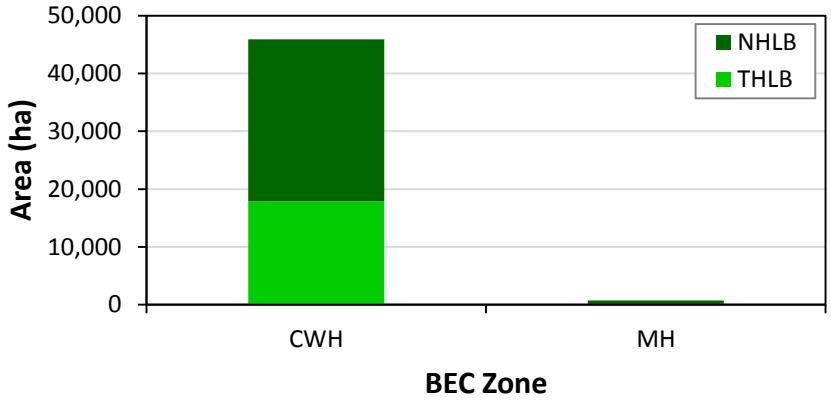
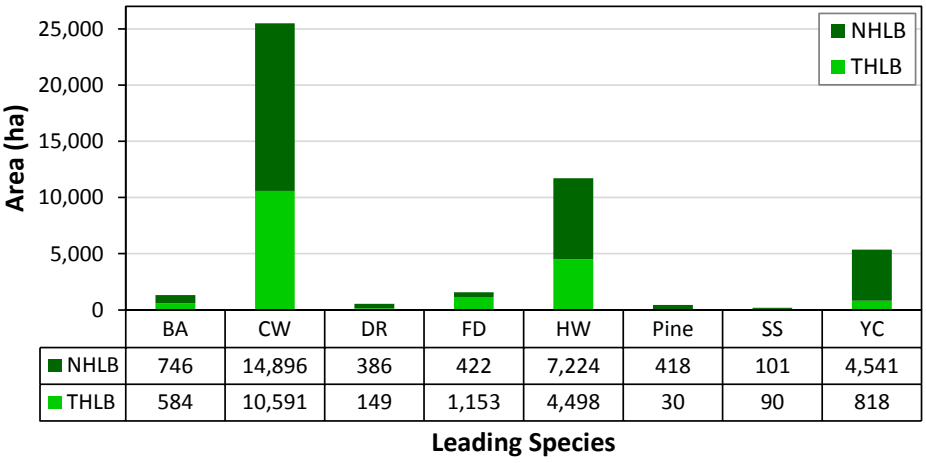


Figure 3 Current Forested Land Base Distribution over BEC zones

Approximately 80% of the forested land base is dominated by stands with leading tree species of western redcedar (Cw) and western hemlock (Hw) (Figure 4). Stands with leading species of yellow cypress (Yc), Douglas-fir (Fd), and grand fir (Ba) cover approximately 18%, while pine, red alder (Dr), and sitka spruce (Ss) cover the remaining 2%.



	BA	CW	DR	FD	HW	Pine	SS	YC
NHLB	746	14,896	386	422	7,224	418	101	4,541
THLB	584	10,591	149	1,153	4,498	30	90	818

Figure 4 Forested Land Base Distribution by Leading Species

The forest productivity estimates of existing natural stands within the THLB have an area-weighted average site index of 14.5 m (i.e., top height in m at age 50) (Figure 5). Using the provincial site productivity layer, the area-weighted average site index for managed stands increased to 21.3m (+6.8 m compared to the VRI). This relatively high difference indicates that the forest has the capacity to produce higher volumes under a managed forest regime.

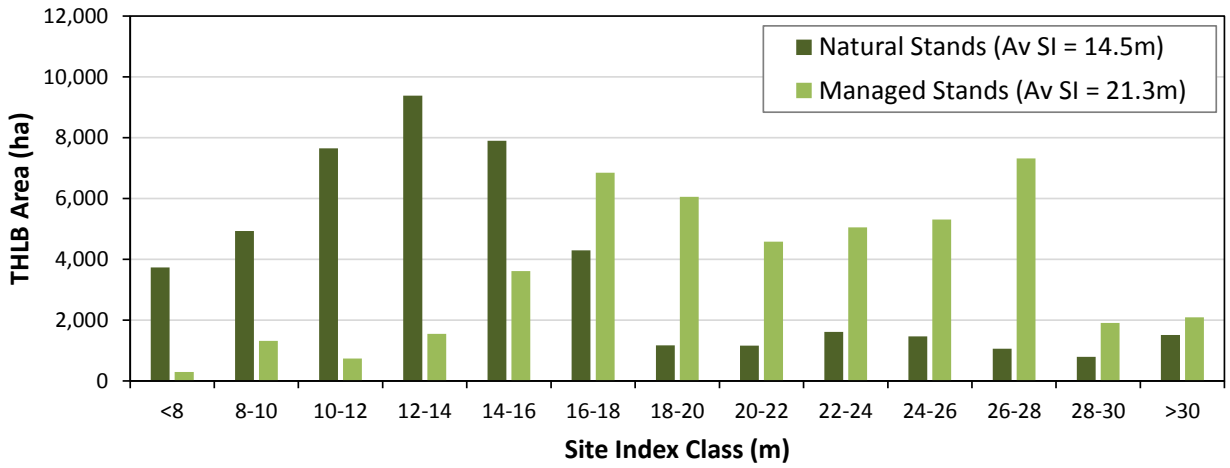


Figure 5 Comparing Natural and Managed Stands Site Index

Constraints for non-timber objectives were applied to the entire forested land base for biodiversity objectives, and to subsets of the forested land base for scenic values, community watersheds, watersheds within the CSLUP (i.e., controlled rate of cuts defined for each), fisheries sensitive watersheds (FSW), and visual quality objectives (VQO). A current area summary for these objectives (Figure 6) shows that most of the THLB exists within CSLUP scenic and watershed areas. In addition to landscape-level biodiversity objectives, these objectives will likely constrain harvest levels, while outside CSLUP, harvest levels will likely be constrained within FSW. These statistics reflects the non-timber objectives and provides a basis for discussing modelling results. Note that VQO area is 54 ha; relatively small compared to other values shown in Figure 6.

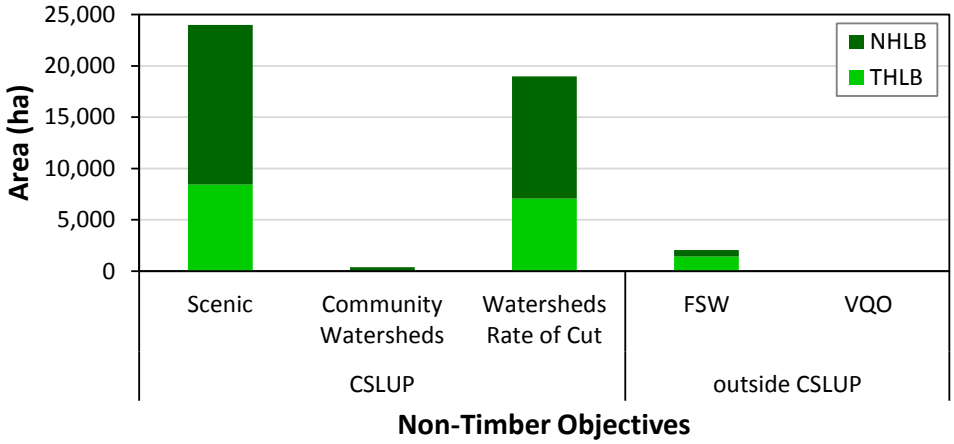


Figure 6 Forested Land Base Distribution by Non-Timber Objectives

1.2 DIFFERENCES FROM MP4

The gross area of TFL 54 was 364 ha smaller than in MP#4. This difference is believed to have resulted from minor boundary changes since MP#4 and geoprocessing techniques used to compile the data sources.

The THLB area in this analysis was approximately 25% less than the THLB area in MP#4 (THLB = 24,086 ha). This is primarily the result of differences in the economic operability assessment. The economic operability assessment in MP#4 was developed by the International Forest Products Ltd. in 1992 and was based on volume, age, slope, and terrain stability. The current economic operability assessment was conducted in 2014 (Forest Ecosystem Solutions Ltd., 2014) which considered, in addition to the 1992 operability factors, the distance to existing roads. The 2014 economic operability assessment identified 1.9 times more area as inoperable compared to the 1992 data (2014 inoperable = 19,467 ha, 1992 inoperable = 10,277 ha).

The current CSLUP reserves are approximately 1% less than the same areas in MP#4. This was likely due to geoprocessing techniques used to compile the data.

It is also important to consider improvements in growth and yield estimates since the last MP. In MP#4, average volumes for existing natural stands (management era prior to 1995, or current age <22 years) were assumed to remain constant over time so yield tables/curves were not generated. Managed stand yields (existing and post-harvest regenerated) were prepared using an older version of TIPSY. In this analysis, yields for existing natural stands were prepared using inventory attributes and Variable Density Yield Projection (VDYP) version 7 console (v. 7.30a, Build 299), while yields for managed stands were developed in batch TIPSY (v. 4.4, Ministry Standard Database, September 2017).

2 Base Case Analysis

2.1 CALCULATED HARVEST FORECAST

There are two classical forest management methods to regulate a forest estate: volume and area control (Davis, et al., 2001). This TFL uses the area control method, where the area to be harvested each year is determined as the division between the THLB and the rotation age. The B.C. Reg. 482/2004[1] is detailing the TFL area-based AAC trial program regulation, where the gross THLB (retention + harvested) should be used for AAC determination (section 5, subsection 8). The rotation age for the purpose of the AAC determination is not the minimum harvesting age, but an outcome of an analysis process where conflicting timber and non-timber objectives are investigated (i.e., forest estate modelling exercise). In the case of the TFL 54, the THLB was determined in the Information Package document (and briefly summarized in section 1.1) and the rotation age was determined for each stand type (i.e., analysis unit) following an area control timber supply analysis. The approach used here was also in line with the approach used in TFL 57 (Forsite Consultants Ltd., 2014), also part of the area-based AAC trial program regulation.

The harvest forecast was calculated for each analysis unit (AU) as the division between the THLB area and the area-weighted average rotation age. Harvest rates for each AU were then summed to determine the final harvest rate. A gross and net harvest forecast of 185.3 ha/year and 137.2 ha/year (non-recoverable losses (NRL) accounted for), respectively, was calculated over the gross THLB of 17,911 ha and net THLB of 13,319 ha, respectively (Table 2). The gross THLB (retention + harvested areas) includes stand-level retention areas – 7% outside of CSLUP and 15 to 70% within CSLUP – while the net THLB did not (i.e., harvested area only). The NRLs were prorated from the Arrowsmith TSR (BC Ministry of Forest, Lands, and Natural Resource Operations, 2016) to 5.1 ha/year for the gross THLB and 3.8 ha/year for the net THLB.

Rotation ages for each AU were developed from a forest estate model as the area-weighted average age at harvest over the last 100 years of the 300-year planning horizon (i.e., year 200 to year 300). The gross THLB area was used to determine the area-weighted average age for the gross harvest rate, while, the net THLB area was used to

[1] http://www.bclaws.ca/Recon/document/ID/freeside/482_2004

determine the area-weighted average age for the net harvest rate.

Table 2 Harvest Forecast Calculation

PHR[1] AU	Species Composition	Managed SI (m_{50})	Gross THLB Area (ha)	Rotation Age Gross[2] (yrs)	Harvest Gross (ha/yr)	Net THLB (ha)	Rotation Age Net (yrs)	Harvest Net (ha/yr)
Outside CSLUP		**21.32**	**2,098**	**97**	**22.0**	**1,951**	**97**	**20.4**
121	Cw70 Hw30	18.51	434	109	4.0	403	109	3.7
122	Cw70 Hw30	18.63	310	123	2.5	289	125	2.3
123	Cw70 Hw30	18.71	140	100	1.4	130	101	1.3
124	Hw70 Cw30	21.84	29	79	0.4	27	79	0.3
127	Fd50 Hw30 Cw20	33.29	214	72	3.0	199	72	2.8
128	Hw80 Cw20	23.13	142	78	1.8	133	78	1.7
129	Hw80 Cw20	17.86	69	87	0.8	64	87	0.7
130	Hw80 Cw20	22.35	617	95	6.5	573	95	6.0
131	Hw80 Cw20	22.51	66	75	0.9	61	75	0.8
132	Hw80 Cw20	22.53	2	94	0.0	2	94	0.0
133	Hw80 Cw20	22.52	69	99	0.7	64	99	0.6
134	Cw50 Pl40 Hw10	13.93	5	147	0.0	5	147	0.0
CSLUP not scenic		**24.49**	**7,363**	**86**	**82.0**	**6,258**	**86**	**69.3**
1121	Cw70 Hw30	16.11	458	95	4.8	389	95	4.1
1122	Cw70 Hw30	19.14	3,739	97	38.4	3,178	98	32.4
1123	Cw70 Hw30	18.9	1,176	96	12.3	1,000	96	10.4
1124	Hw70 Cw30	27.34	42	65	0.6	36	65	0.5
1127	Fd50 Hw30 Cw20	36.27	448	73	6.2	381	73	5.2
1128	Hw80 Cw20	24.16	20	74	0.3	17	74	0.2
1129	Hw80 Cw20	26.31	370	77	4.8	314	77	4.1
1130	Hw80 Cw20	27.02	772	70	11.0	656	71	9.3
1131	Hw80 Cw20	24.21	8	75	0.1	7	75	0.1
1132	Hw80 Cw20	26.32	130	91	1.4	110	91	1.2
1133	Hw80 Cw20	27.86	88	108	0.8	75	108	0.7
1134	Cw50 Pl40 Hw10	15.06	24	136	0.2	20	136	0.2
1136	Hw70 Cw30	27.3	6	63	0.1	5	63	0.1
1137	Hw70 Cw30	26.8	82	80	1.0	69	80	0.9
CSLUP scenic		**24.54**	**8,451**	**95**	**86.4**	**5,110**	**96**	**51.3**
2121	Cw70 Hw30	16.05	364	181	2.0	249	181	1.4
2122	Cw70 Hw30	18.74	3,620	117	30.9	2,256	118	19.1
2123	Cw70 Hw30	20.08	1,165	102	11.4	695	103	6.8
2124	Hw70 Cw30	26.92	79	73	1.1	40	73	0.5
2127	Fd50 Hw30 Cw20	34.48	490	75	6.5	262	75	3.5
2128	Hw80 Cw20	24.44	35	82	0.4	22	82	0.3
2129	Hw80 Cw20	25.38	872	79	11.1	528	79	6.6
2130	Hw80 Cw20	26.41	1,486	76	19.6	848	77	11.0
2131	Hw80 Cw20	25.04	23	81	0.3	15	81	0.2
2132	Hw80 Cw20	25.63	218	102	2.1	136	104	1.3
2133	Hw80 Cw20	24.01	95	102	0.9	57	103	0.6
2136	Hw70 Cw30	27.25	3	72	0.0	2	72	0.0
Total			**17,911**	**92**	**190.4**	**13,319**	**92**	**141.0**
Total less NRLs					**185.3**			**137.2**

[1] PHR = post-harvest regenerated

[2] Rotation Age Gross was determined as an area-weighted average in the last 100 years of the planning horizon using the gross THLB (harvested + retention). Rotation Age Net was determined using the net THLB (harvested only).

2.2 MODELLED HARVEST FORECAST

Over the 300-year planning horizon, the net THLB was controlled in the model to produce an even-flow harvest area (Figure 7) which formed the basis for determining the area-weighted rotation ages. The THLB area maintained as retention area averaged to 54 ha (39.4%) over the 300-year planning horizon, and it was not controlled in the model. Both the harvested and retention areas, contributed to the operational cutblocks and were included in the gross harvest forecast. The modelled net harvest forecast of 137 ha/year was 4.0 ha/year (2.8%) lower than the calculated net harvest rate in Table 2 without the NRLs. The 4 ha/year difference occurred because the age at harvest was different for each stand within the corresponding AU and from one period, or year, to the next. When such differences were averaged over the last 100 years of the planning horizon – the period that the rotation age is determined for harvest forecast calculation – there is expected to see a difference between modelled and calculated values.

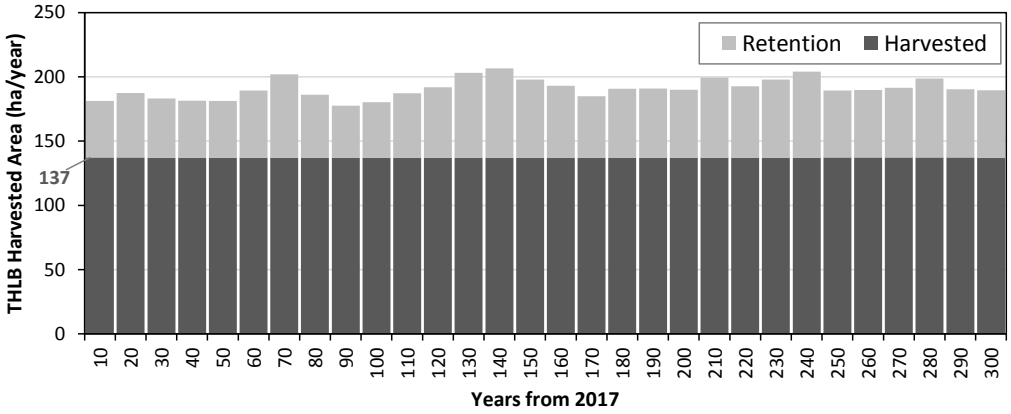


Figure 7 Harvest Area Forecast

2.3 HARVEST FORECAST DIFFERENCES FROM MP#4

MP#4 presented an average gross harvest rate of 336 ha/year over the 250-year planning horizon (Figure 8). This harvest rate was modelled, not calculated, and it was composed of the net harvest area (red line, at approximately 175 ha/year over the MP period of 2004 to 2014), in-block retention area (green line, approximately 140 ha/year), while deferred areas (i.e., orange line, at approximately 21 ha/year), will be harvested in the future but not at current entry. The sum of all 3 area components was controlled to produce an even flow but none of the individual components were controlled. It is important to note that in MP#4, the modelled harvest rate was recommended for AAC.

As discussed in section 2.2, the modelled harvest forecast was determined to be 137 ha/year, which was approximately 22% less than the net modelled harvest forecast presented in MP#4 (175 ha/year). This difference could be explained solely by the difference in net THLB area (approximately 25%) resulting mainly from changes in operability (section 1.2). Because the rotation ages from MP#4 were not available, it was not possible to compare the calculated harvest forecasts to the current analysis.

The in-block retention area at harvest was approximately 161 ha/year (47.8%) in MP#4, compared to approximately 54 ha/year (28.2%) in current analysis. The in-block retention in both, MP#4 and current analysis, varied between 7% and 70%, yet in MP#4 there was more in-block retention set aside in visually sensitive areas. This approach probably worked well at the time of MP#4 given the relatively coarse estimates of the operable areas. In current analysis, the in-block retention values were refined to be more in line with current practice[2].

[2] Retention percentage were provided as averages from operational experience of site plans by Zoltan Schafer, RPF, Ma-Mook forestry manager.

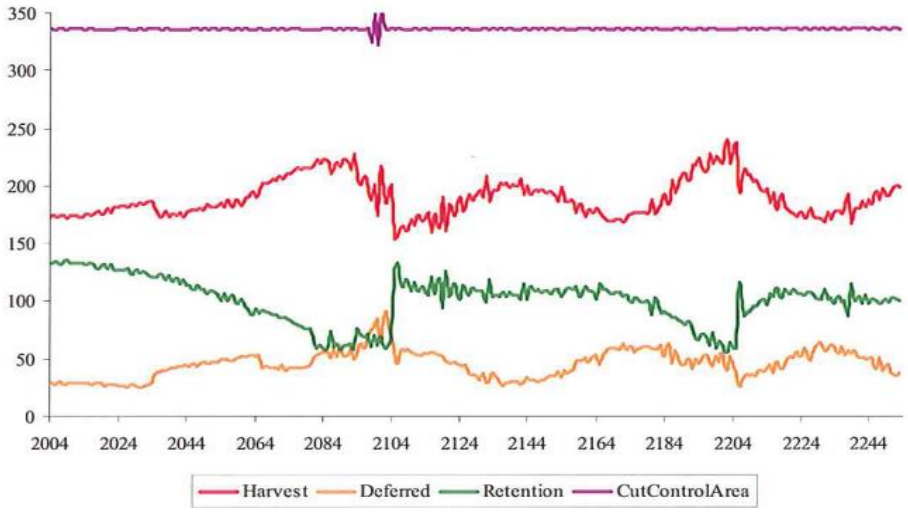


Figure 8 MP#4 Harvest Area (ha/year), Figure 6-3 from MP#4 Analysis Report

2.4 KEY HARVEST METRICS

To generate the even flow request, the model harvested existing stands (i.e., old and mature stands regenerated well before 1995) over the first 70 years of the 300-year planning horizon (Figure 9). Here, the NRLs were not accounted for. A gradual transition from the existing to post-harvest regenerated stands occurred between 80 and 160 years; over the last 100 years, post-harvest regenerated stands almost exclusively. In the long-term, only a few hectares of harvest was sourced from existing natural stands regenerated before year 2017; these stands were either poor stands with relatively old minimum harvest ages or were held by the model to meet certain non-timber objectives.

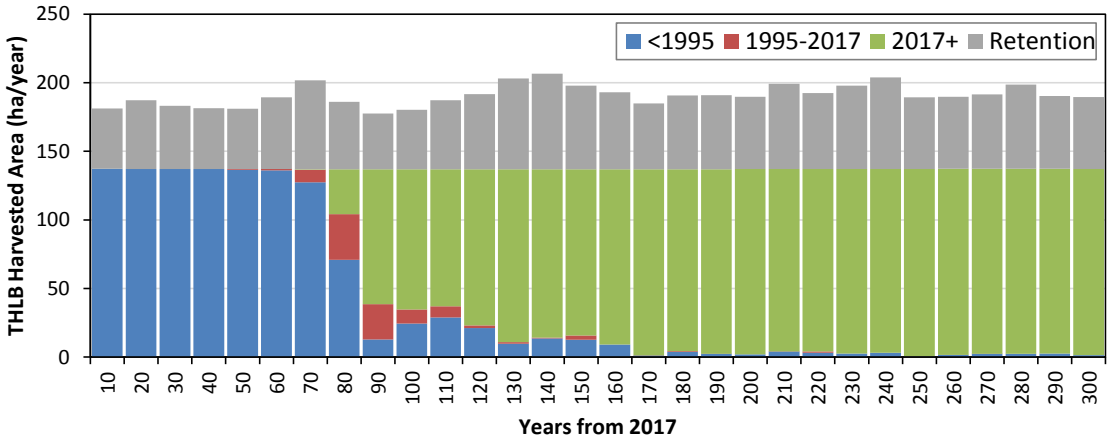


Figure 9 Harvested Area by Management Era

The harvested area was sourced exclusively from the net THLB area. The harvested volume from the net THLB varied between 58,000 and 74,000 m³/year over the planning horizon, for an average of 67,000 m³/year (Figure 10). The total standing volume on the net THLB started at 4.2million m³ and steadily declined to a relatively stable level of 2.8 million m³ over the last 100 years of the planning horizon (Figure 11). The same trend existed for merchantable volume that started at 3.6 million m³ and leveled-off at 1.3 million m³.

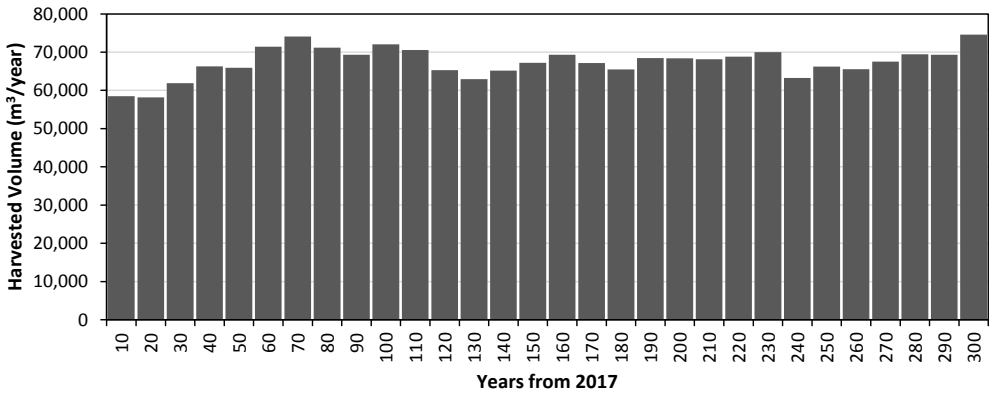


Figure 10 Harvested Volume over Net THLB

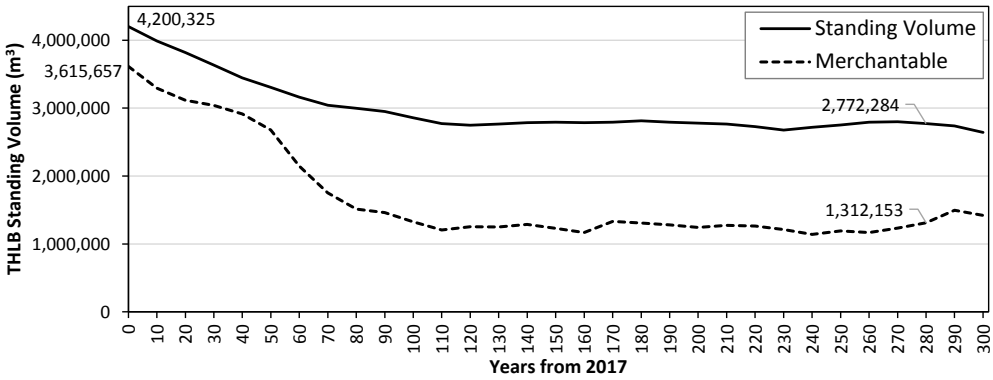


Figure 11 Growing Stock over Net THLB

The average volume at harvest increased from 426 m³/ha in the beginning of the planning horizon to 540m³/ha by year 70, then it stabilized around 475 m³/ha by year 120 (right axis of Figure 12). The average volume at harvest over the last 100 years of the planning horizon was 473 m³/ha. Meanwhile, the average age at harvest started at 309 years and declined to 100 years after 90 years, as the harvest transitioned from the existing to the post-harvest regenerated stands. As discussed above, the area-weighted average age at harvest over the last 100 years of the planning horizon was 92 years.

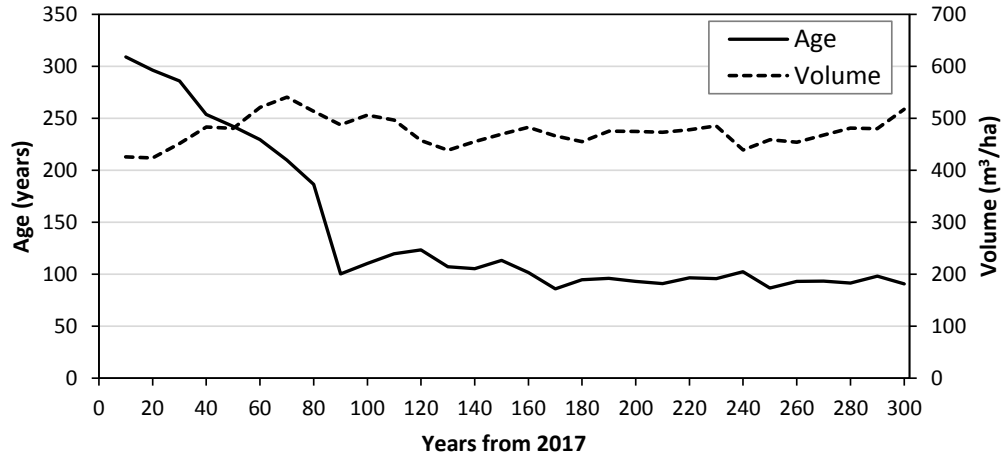


Figure 12 Average Age and Volume at Harvest

The net harvest area and volume were sourced mostly from stands with *leading* species of Cw and Hw, and smaller areas of Fd and Ba (Figure 13). Meanwhile, the volume harvested by *individual* species (Figure 14) shows that in addition to the Cw, Hw, Fd, and Ba, small amounts of other species (Dr, Pl, Ss, and Yc) were harvested throughout the entire 300-year planning horizon. These findings were in line with the current TFL description (section 1.1) and regeneration assumptions detailed in the Information Package, where existing stands regenerated to Cw, Hw, and Fd leading stands, some of them with a small pine component. The volume of other species (Ba, Dr, Ss, and Yc) harvested towards the end of the 300-year planning horizon was sourced from existing stands that were either poor with relatively old minimum harvest ages or were held by the model to meet certain non-timber objectives. This is in line with the trends observed in Figure 9.

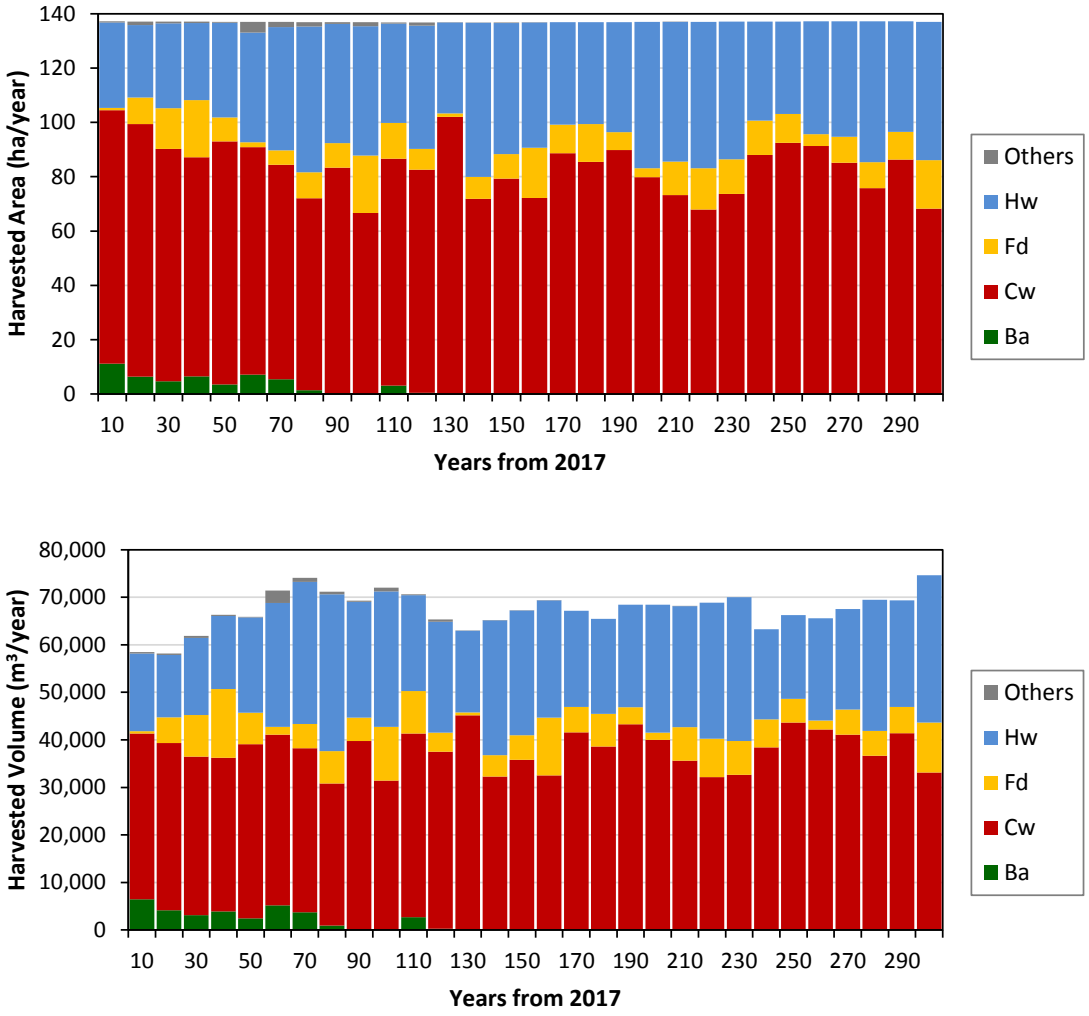


Figure 13 Net harvest Area (top) and Volume (bottom) by Leading Species

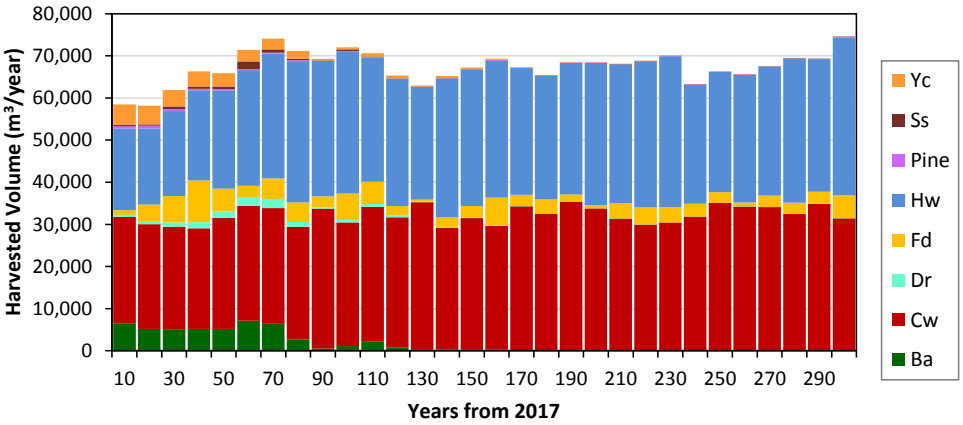


Figure 14 Harvested Volume by Individual Species

The net harvest area and volume were sourced from stands older than 200 years for the first 70 years of the 300-year planning horizon (Figure 15). Starting from year 80, the net harvest area and volume were sourced from stands aged 60-120 years. These findings corroborate the observations of rotation ages from harvest forecast calculation (Table 2), the net harvest area by management era result (Figure 9), and the average volume and age at harvest (Figure 12). A trivial amount of harvest area and volume were sourced from stands younger than 60 years; these were either the most productive Fd leading stands, or Dr leading stands with minimum harvest ages between 53 and 58 years.

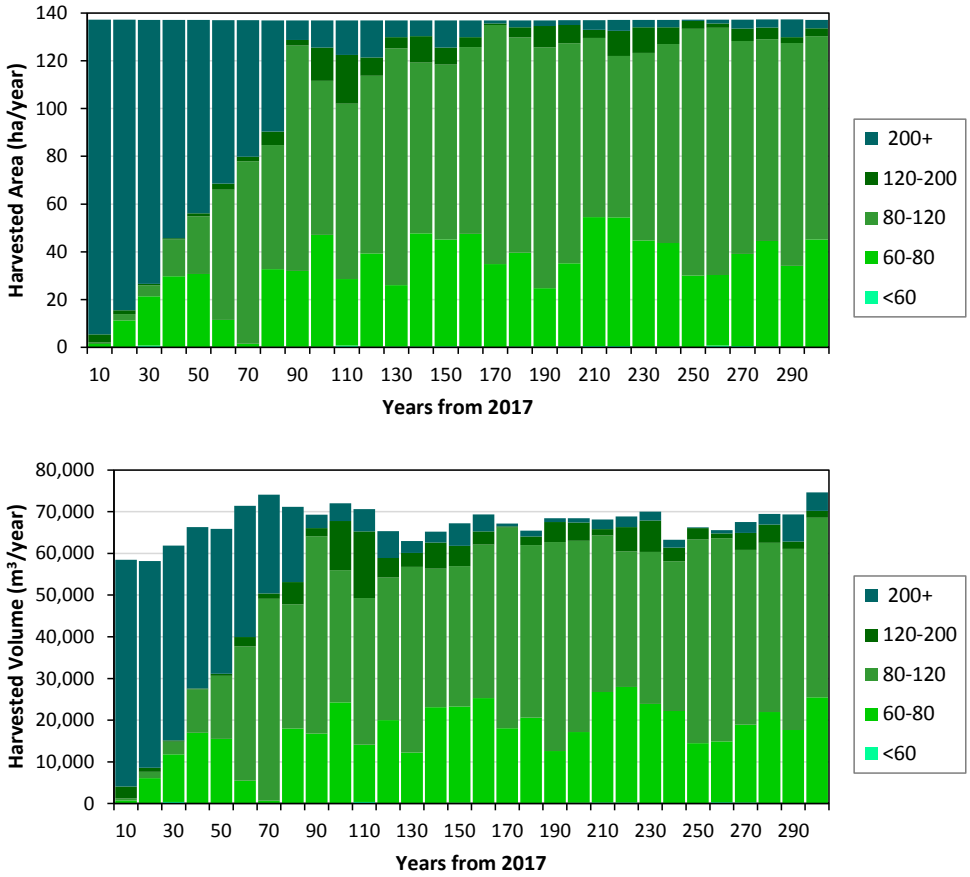


Figure 15 Harvested Area (top) and Volume (bottom) by Age Class

2.5 AGE CLASSES

Age class distributions at years 0, 50, 100, 150, 200, and 300 indicated a transition of the THLB from relatively old ages to a more even distribution in age classes under 100 years (Figure 16). The THLB area in retention continues to age throughout the 300-year planning horizon because no disturbance was modelled for it. In comparison, approximately 73 ha/year were randomly disturbed within the NHLB area to mimic natural disturbance patterns. By year 300, the NHLB area was evenly distributed in each age class. An exception was observed with the NHLB area where stands were either: (1) never disturbed because of the disturbance rate compared to the total NHLB area (73 ha/year x 300 years = 21,900 ha disturbed vs. 28,736 ha total NHLB) and the longer disturbance intervals for the Mountain Hemlock BEC zone, or (2) disturbed once and then grew older than 240 years by the end of the 300-year planning horizon.

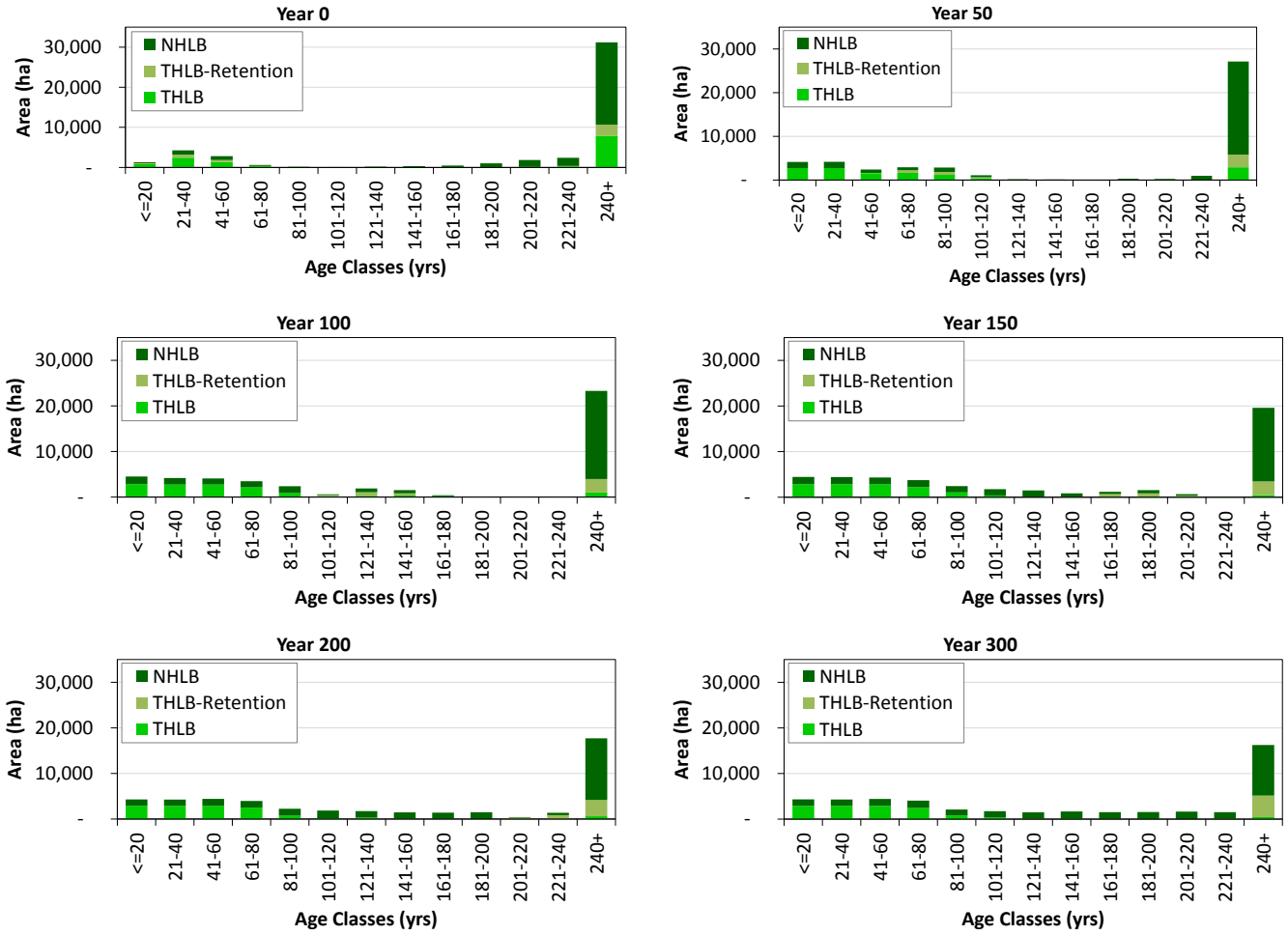


Figure 16 Area by Age Class and land Base Classification

2.6 HARVEST RATES FOR OVERLAPPING AREAS OF INTEREST

The TFL54 overlaps with three Ahousaht First Nation Forest Management Areas (FMA), as well as, Important Harvest Areas (IHA) identified by the Maa-nulth First Nation (Figure 17). The net THLB projected for harvest within these areas was summarized as follows:

- IHA averaged 9 ha/year; ranging between 2 and 17 ha/year,

- Atleo River FMA averaged 9 ha/year; ranging between 3 and 17 ha/year
- Cypre River FMA averaged 4 ha/year; ranging between 2 and 8 ha/year, and
- Stewardson Inlet FMA averaged 2 ha/year; ranging between 0 and 4 ha/year.

The average for all 3 Ahousaht FMAs combined was summarized at 16 ha/year; ranging between 9 and 24 ha/year.

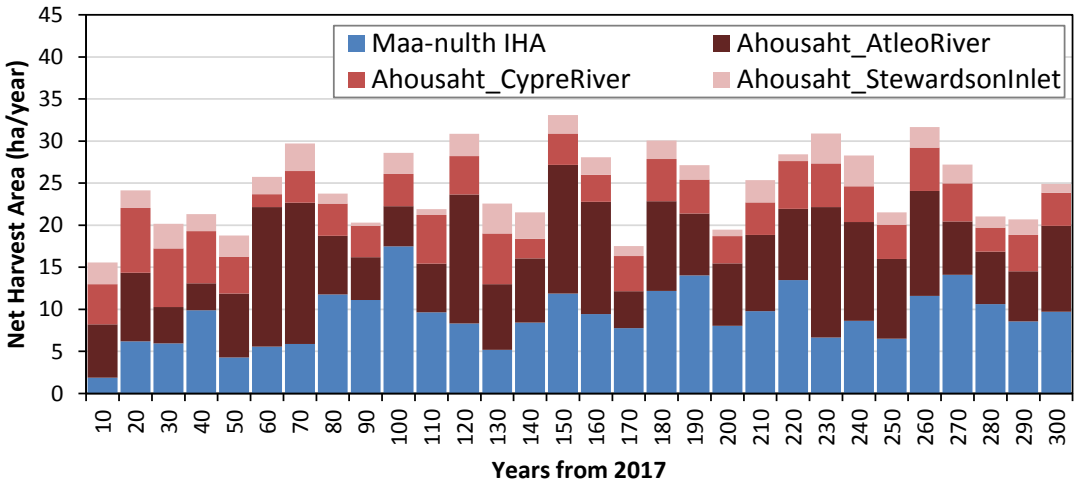


Figure 17 Effective Long-term Harvested Area by First Nation

2.7 NON-TIMBER OBJECTIVES WITHIN CSLUP AREA

The non-timber objectives modelled within the CSLUP area included:

- Landscape-level biodiversity – minimum 40% of the forested land base area older than 140 years within each watershed and each order (1st, 2nd, and 3rd order).
- Stand-level biodiversity – stand retention level 15-70% built-in the un-even aged silvicultural systems.
- Scenic corridors – maximum disturbance within PFLB area:
    - 20% in each landscape number within Natural Appearing scenic corridors with height <8m.
    - 30% in each landscape number within Minimal Alteration scenic corridors with height <7m.
    - 40% in each landscape number within Small Scale Alteration scenic corridors with height <6m.
- Watershed rate-of-cut – maximum 5% of the PFLB area disturbed per 5-year period in any watershed >500 ha and maximum 10% of the PFLB per 10-year period in primary watersheds 200-500 ha.

There were also six community watersheds overlapping this TFL, but their entire area occurs within the NHLB land base classification and no other objectives were modelled in this analysis.

Within the CSLUP area, landscape-level biodiversity objectives were the only targets set in the model that reflected a constraint to the harvest rate. The other non-timber objectives did not appear to be constraining. A few examples are included below for watersheds with the largest THLB area (Figure 18). Here, the red-shaded area indicates the minimum target that must be achieved over time and the black line indicates the actual value of the percentage PFLB area in each period that is older than 140 years within the watershed. The target is not achieved wherever the black line is within the red-shaded zone.

For example, in the case of the old seral requirement for watershed ID 243 (THLB = 591 ha), stands older than 140 years within PFLB area declined slightly due to the natural disturbances simulated for the NHLB then recovered to

above the target after 80 years. In comparison, stands within watershed ID 304 (THLB = 572 ha) were not randomly selected for natural disturbance within the NHLB at the beginning of the planning horizon so actual percentage of area older than 140 years did not decline. As the stands within the watershed continued to age, the landscape-level biodiversity target was achieved and harvest could then occur, in combination with the natural disturbances for the NHLB, such that the landscape-level biodiversity target was maintained for the rest of the planning horizon. A different stand dynamic occurred in the case of watersheds 272 (THLB = 373 ha) and 386 (THLB = 319 ha), where a surplus of PFLB area over 140 years exists at year 0. As harvest and natural disturbances were simulated, the PFLB area older than 140 years declined to the level required by the landscape-level biodiversity target and were then maintained over the rest of planning horizon.

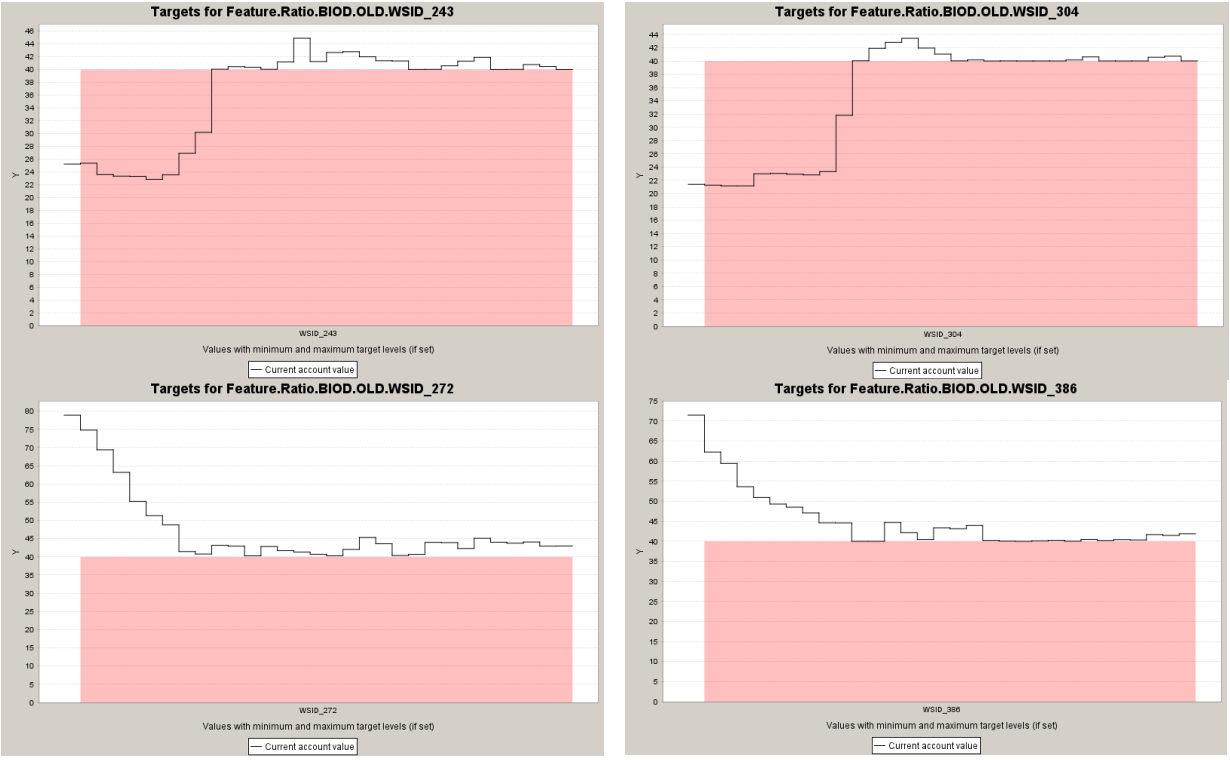


Figure 18 Examples of Landscape-level Biodiversity Objectives within CSLUP

Generally, the forecasted harvest did not appear to infringe upon the scenic corridor objectives. Examples of the scenic corridor and landscape number combination that were closest to be constraining and with relatively high THLB area are included in Figure 19. Here, the blue-shaded zone indicates the maximum target and the black line shows the actual percentage of PFLB area disturbed within the reporting unit; the aim is to remain below the blue-shaded (target) zone. Reporting units where the THLB area represents a relatively small portion of the scenic corridor and landscape number combination relative to the PFLB, tend to quickly violate the scenic corridor targets when natural disturbances are simulated for the NHLB. This is the case with the Natural Appearing scenic corridor and landscape number 128 (THLB = 31ha, NHLB = 127 ha) example.

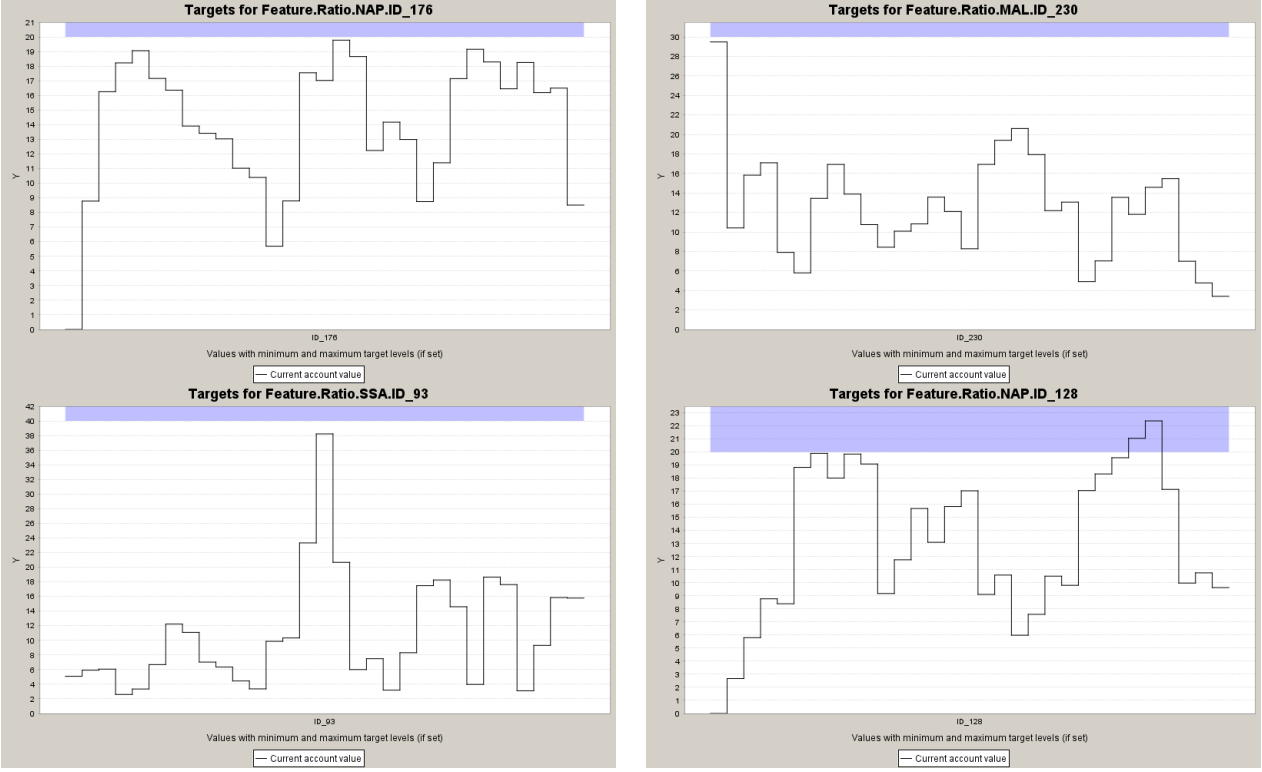


Figure 19 Examples of Scenic Corridor Objectives

The forecasted harvest did not appear to infringe upon the watershed rate-of-cut. Examples of rate-of-cuts that were closest to be constraining and with relatively high THLB area are included in Figure 20.

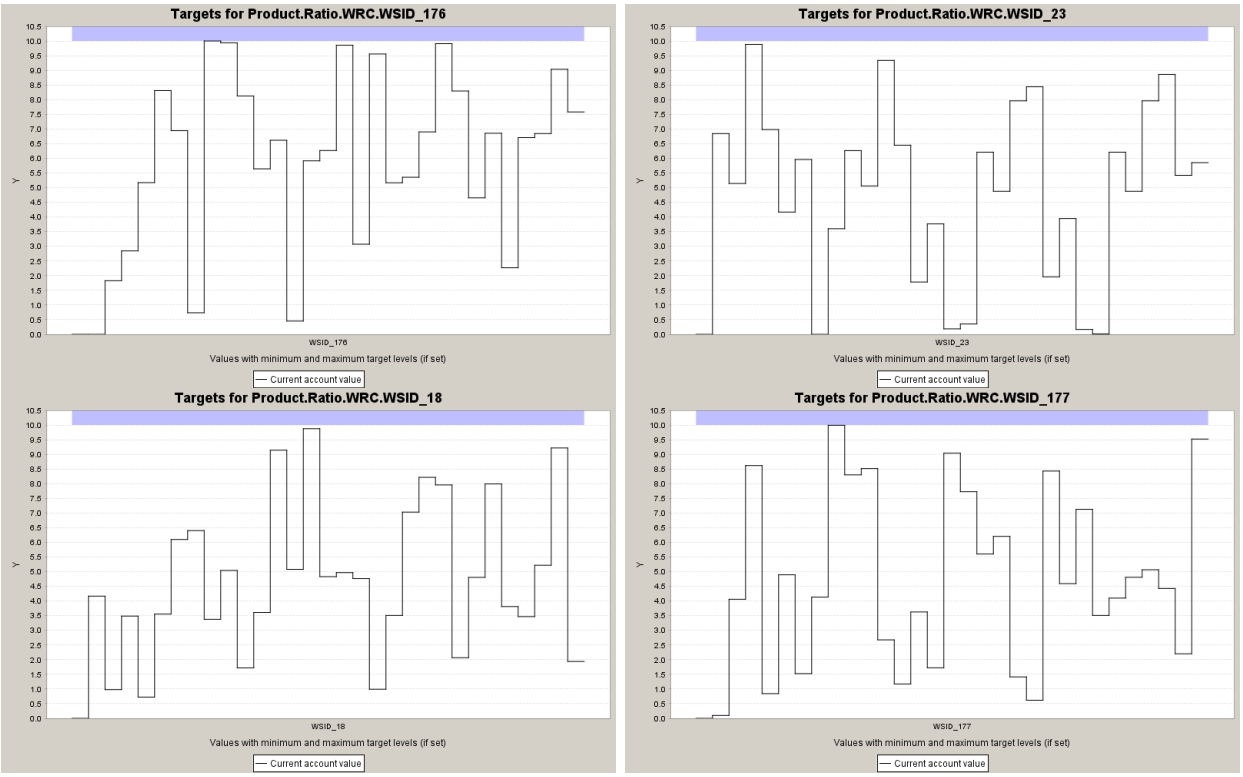


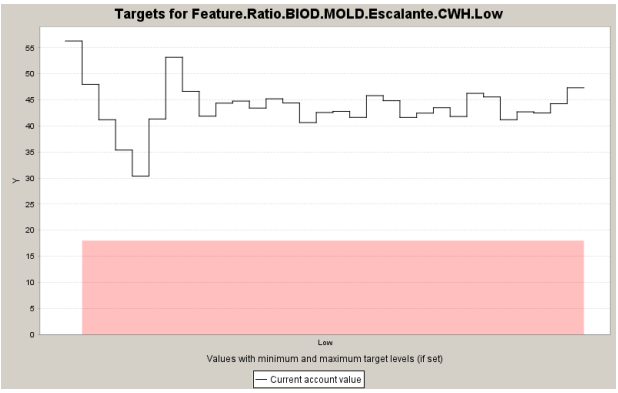
Figure 20 Examples of Watershed Rate-of-Cut Objectives

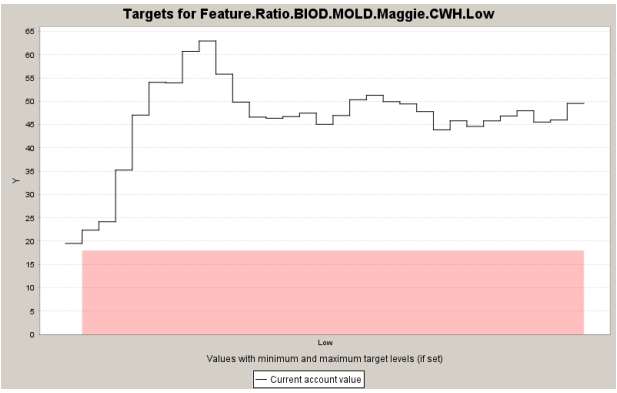
2.8 NON-TIMBER OBJECTIVES OUTSIDE CSLUP

The non-timber objectives modelled outside the CSLUP, and under the VILUP, included:

- Landscape-level biodiversity – minimum 18% of the PFLB area older than 80 years and minimum 13% of the PFLB area older than 250 years in each landscape unit (LU), BEC zone, and biodiversity emphasis option (BEO) combination.
- Stand-level biodiversity – stand retention level 7% built-in the clearcut silvicultural system.
- VQOs – maximum PFLB area disturbed (i.e., 5 m green-up heights) of:
    - 15% in each visual landscape polygon ID within partial retention VQO.
    - 25% in each visual landscape polygon ID within modification VQO.
- Integrated resources management – green-up adjacency target for each LU as a maximum 25% of the THLB with heights <1.3m. The TFL 54 outside CSLUP falls entirely under the Enhanced Forestry Management Zone as defined under VILUP.
- Fisheries sensitive watersheds (FSW) – one FSW (f-1-003 Escalante), maximum 20% Equivalent Clearcut Area (ECA).

The landscape-level biodiversity objectives did not significantly constrain the harvest rate (Figure 21). A minor violation of the minimum target was observed in year 140-170 of the planning horizon in the case of old seral requirement for the Maggie LU, CWH BEC zone, and Low BEO combination. Here, the PFLB area older than 250 years drops to 12.4% - below the 13% threshold – due to harvest and natural disturbances. Given the accuracy of the data used to classify the land base and the inherent rounding errors when target percentages were determined, target violations of up to 1% are typically accepted for short periods of time to give the forest estate model an appropriate time to solve. Should this minor violation be corrected, the overall impact on the harvest rate would be very small, if any. Providing more time to solve for very small solution improvements, allows the heuristic algorithm of the forest estate model to eventually resolve the issue with a slightly different solution and very similar harvest rate.





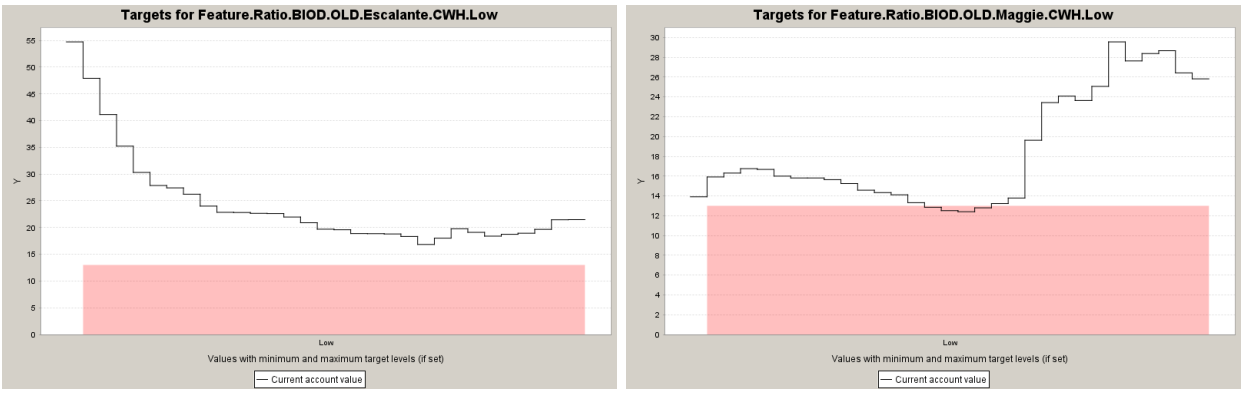


Figure 21 Landscape-level Biodiversity Objectives outside CSLUP

Very small VQO polygons exist outside the CSLUP (i.e., from <1ha to 19 ha). Here, any disturbance (harvest or natural) had a significant impact on the target. Thus, little to no harvest occurred in the VQO constrained areas. Some examples of the VQOs that covered the largest PFLB area are included in Figure 22.

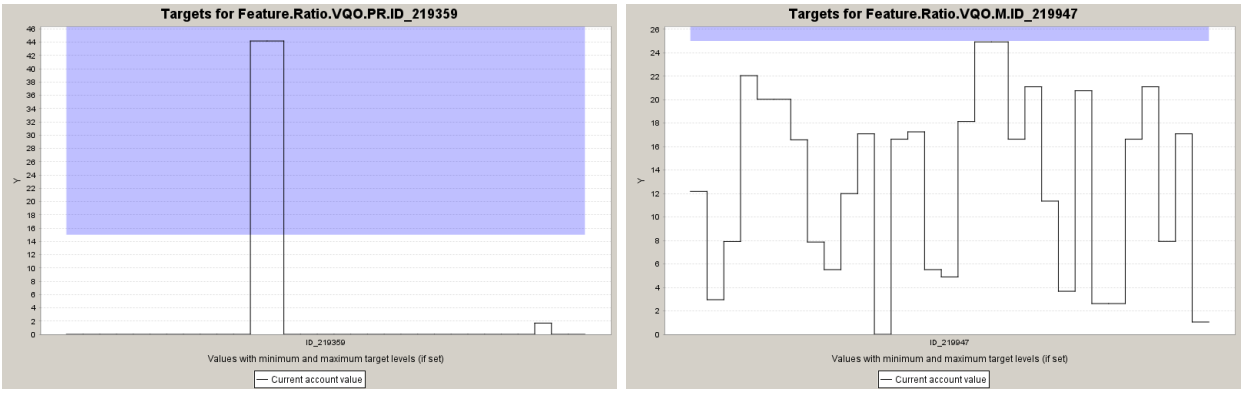


Figure 22 Examples of Visual Quality Objectives outside CSLUP

The green-up adjacency objectives did not constrain the harvest rate (Figure 23). This is explained by the relatively high growing rates of the regenerated stands that reach 1.3 m in height by age 10, that do not reach a maximum 25% over the planning period. This particular objective starts to become constraining at a maximum threshold of approximately 10%.

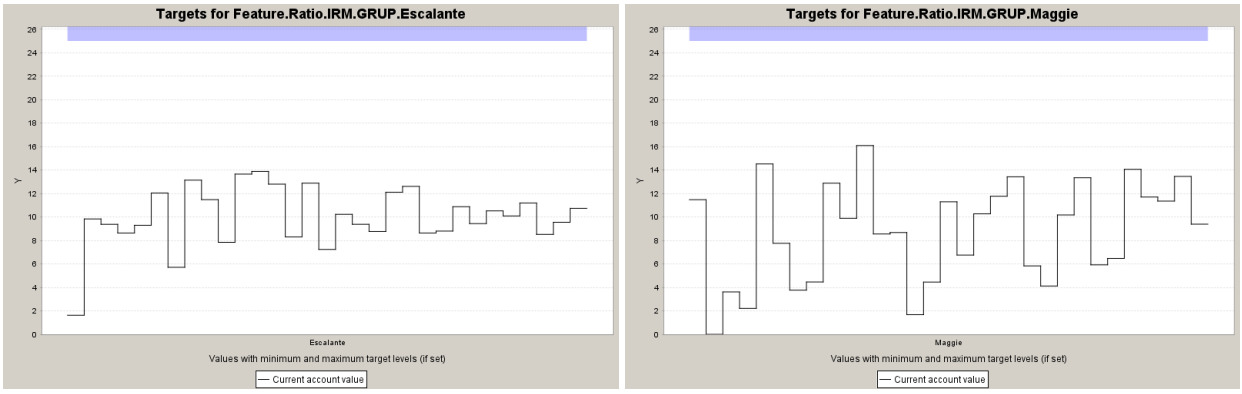


Figure 23 Integrated Resource Management Green-up Adjacency Objectives outside CSLUP

The FSW objective to limit disturbance using ECA thresholds was the only non-timber objective outside CSLUP that constrained the harvest rate (Figure 24). The initial ECA value of 13.3% gradually increased to approach the maximum threshold of 20% by year 60. Afterwards, the ECA value was maintained to just below 20%; a clear indication that this objective is constraining.

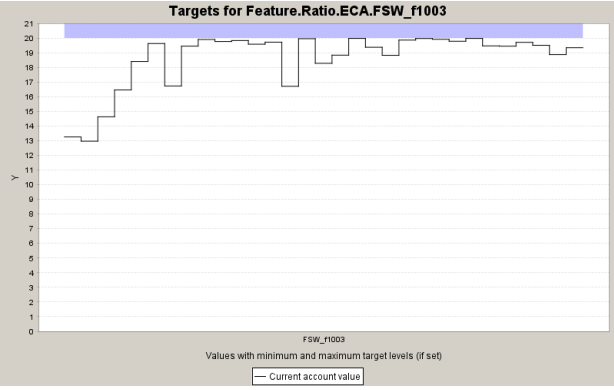


Figure 24 Fisheries Sensitive Watershed Objective (ECA)

3 Sensitivity Analyses

All timber supply analyses include some degree of uncertainty related to factors involving spatial data, growth and yield, and management assumptions. Key factors are typically analyzed further by performing sensitivity analyses, where each factor is investigated separately and specific harvest metrics are then compared to the base case results. This section describes the results of the sensitivity analyses conducted (Table 3). All sensitivities results were compared first to the modelled harvest forecast (section 2.2), and second to the calculated gross harvest forecast (section 2.1).

Table 3 Sensitivity Analyses

Run	Sensitivity	Description
002	Non-declining, volume-based harvest flow	Maintain a non-declining, volume-based harvest flow (m^3/year) throughout the planning horizon and a non-declining THLB growing stock in the last 100 years of the planning horizon.
003	Low sites exclusions	AUs that do not meet strict MHA criteria are removed from the THLB
004	Regeneration Delay	Set regeneration delay to 2 years for stands in management era 2017+
005	Minimum Volume Threshold at 300 m^3/ha	Set the operability minimum volume threshold at 300 m^3/ha
006	Minimum Volume Threshold at 225 m^3/ha	Set the operability minimum volume threshold at 225 m^3/ha
007	Rotation age +10	Adjust the rotation age by +10 years
008	Rotation age -10	Adjust the rotation age by -10 years

3.1 NON-DECLINING, VOLUME-BASED HARVEST FLOW (002)

The non-declining, volume-based harvest flow was determined to be approximately 70,000 m^3/year (Figure 25). In this case, the non-declining harvest flow was identical to the even-flow harvest forecast. Any attempt to harvest more volume in the mid- and long-term resulted in decreasing the long-term growing stock to an unsustainable level. The net harvest area was relatively high initially, approximately 203 ha/year, but then declined to 104 ha/year by year 70 before reaching a long-term, relatively stable, level of approximately 120 ha/year (Figure 25). The calculated harvest forecast described in section 2.1 developed a gross harvest rate of 171 ha/year (19.7% lower than the Base Case gross calculated harvest forecast).

These results suggest that compared to the area-based approach, the non-declining, volume-based harvest flow resulted in lower net and gross area rates harvested in the long-term, similar volume harvest rates, and a less

efficient use of the standing volume. Note that the standing volume of the area-based analysis fluctuates within a reasonable tolerance (2.6 to 2.8 million m³) from year 100 to year 300 of the planning horizon. In comparison, growing stock of the volume-based analysis was relatively flat in the last 100 years of the 300-year planning horizon.

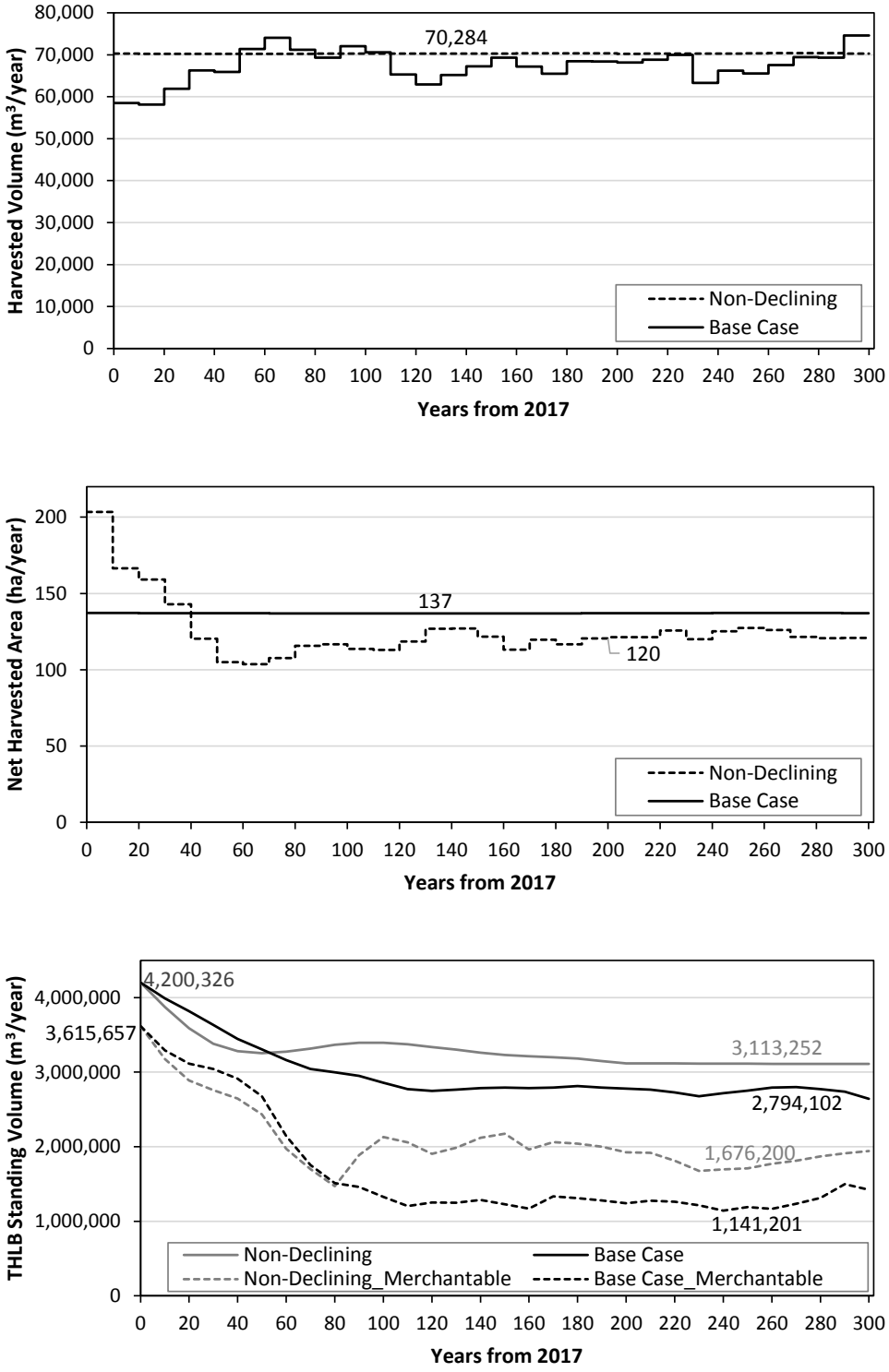


Figure 25 Non-declining Harvest Volume Rate –Volume and Area Comparison to the Base Case

3.2 LOW SITES EXCLUSION (003)

The exclusion of the low sites reduced the THLB by 1,345 ha (7.5 %; from 17,912 ha to 16,567 ha). Consequently, the net harvest area declined by 8.0%; from 137 ha/year to 126 ha/year (Figure 26). The calculated harvest forecast described in section 2.1 developed a gross harvest rate of 176.6 ha/year (7.2% lower than the Base Case gross calculated harvest forecast).

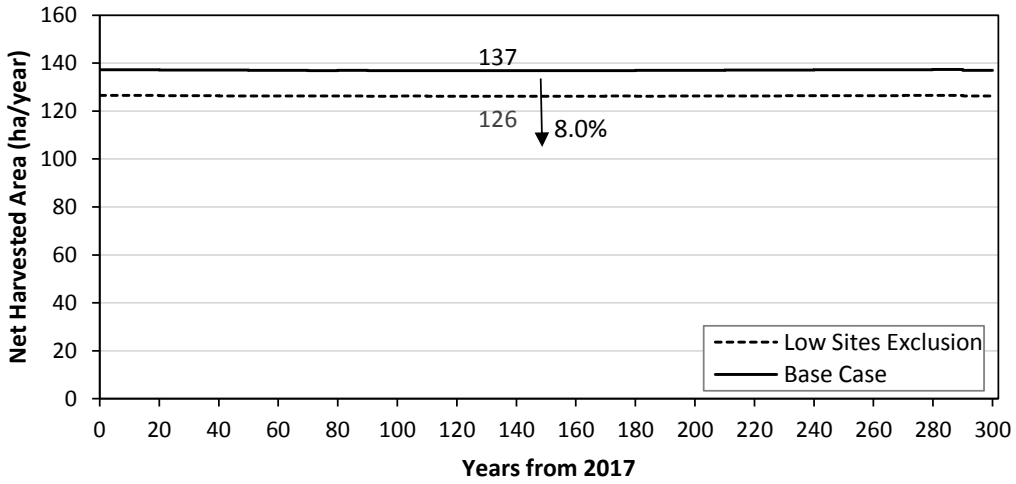


Figure 26 Low Sites Exclusion – Modelled Net Harvest Area Comparison to the Base Case

3.3 REGENERATION DELAY (004)

By reducing the regeneration delay from 3-6 years to 2 years, the yield curves of post-harvest regenerated stands increased slightly and the minimum harvest ages were lower compared to the Base Case. Consequently, it was expected that the rotation ages in the last 100 years of the 300-year planning horizon would be lower compared to the Base Case. However, the modelled results indicated no difference in the modelled net harvest area, a slightly higher long-term standing volume due to slightly higher post-harvest regenerated yields (Figure 27), and a calculated gross harvest forecast of 189.1 ha/year. The slightly lower calculated gross harvest forecast is explained by the rotation ages in the last 100 years of the 300-year planning horizon which, overall, were higher than the base case (opposite than expected). The area-weighted average rotation age for the Base Case was 97.6 years, 0.4 years less than the regeneration delay scenario. These results suggest that the harvest was constrained more by the non-timber objectives than the yield estimates.

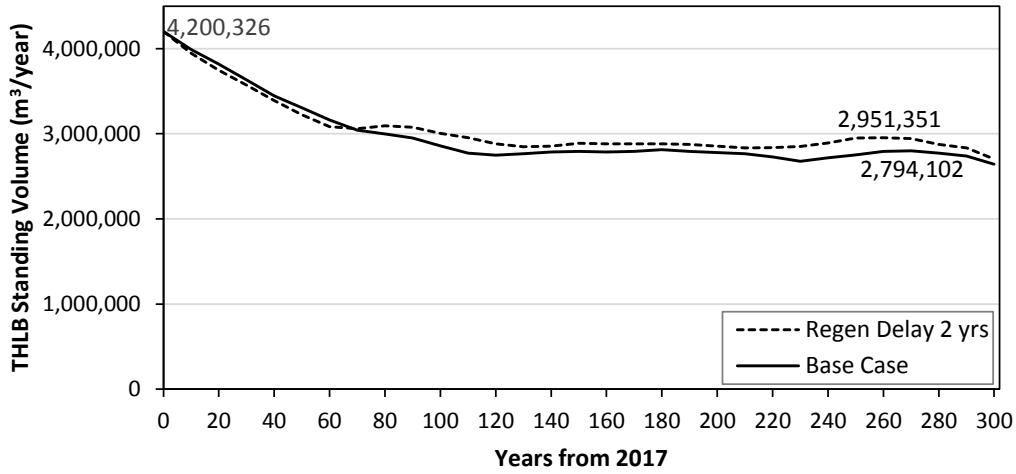


Figure 27 Regeneration delay – Standing Volume Comparison to the Base Case

3.4 MINIMUM VOLUME THRESHOLDS (005,006)

These sensitivity analyses were tailored at the economic operability assessment report (Forest Ecosystem Solutions Ltd., 2014) where a minimum volume of 400 m^3/ha was defined as operable. The minimum volume thresholds were changed from a minimum of 400 m^3/ha in the Base Case to a minimum of 300 and 225 m^3/ha, respectively. Consequently, the THLB area increased to 19,150 ha (6.9%) and to 20,746 ha (15.8%), respectively. The results showed that the net harvest rate increased by 6.6% (to 146 ha/year) and by 14.6% (to 157 ha/year), respectively (Figure 28). The calculated harvest forecast described in section 2.1 developed a gross harvest rate of 202.7 ha/year (1.064 times or 6.4% higher than the Base Case gross calculated harvest forecast) and 215.4 ha/year (1.131 times or 13.1 % higher than the Base Case gross calculated harvest forecast), respectively.

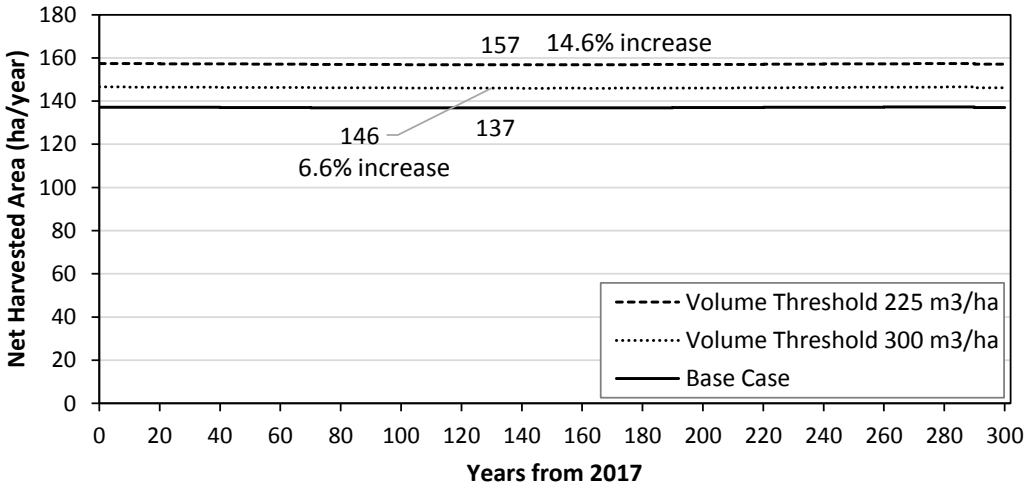


Figure 28 Minimum Volume Thresholds – Net harvest Area Comparison to the Base Case

3.5 ROTATION AGE (007,008)

The calculated harvest flow described in section 2.1 was replicated here, using the identical THLB gross and net areas from Table 2, and then adjusting the gross and net rotation ages higher and lower by 10 years. The results showed that increasing the rotation age by 10 years caused the gross calculated harvest forecast to decrease by 9.9% (171.6 ha/year gross and 127.2 ha/year net), compared to the Base Case. Decreasing the rotation age by 10 years caused the gross harvest forecast to increase by 12.4% (214.1 ha/year gross and 158.4 ha/year net), compared to the Base Case.

3.6 SUMMARY OF SENSITIVITY ANALYSES

A summary of sensitive analyses results (NRLs not accounted for) is provided in Table 4.

Table 4 Sensitivity Analysis Summary Results

Scenario	Harvest Gross (ha/year)	Difference from Base Case (ha/year)	Difference from Base Case (%)
Base Case (001)	190.4	0.0	0.0%
Non-declining harvest volume rate (002)	170.7	-19.7	-10.3%
Low sites exclusions (003)	176.6	-13.8	-7.2%
Regeneration Delay (004)	189.1	-1.3	-0.7%
Minimum Volume Thresholds @ 300 m^3/ha (005)	202.7	12.3	6.4%
Minimum Volume Thresholds @ 225 m^3/ha (006)	215.4	24.9	13.1%
Rotation age +10 yrs (007)	171.6	-18.8	-9.9%
Rotation age -10 yrs (008)	214.1	23.6	12.4%

4 Summary and Recommendations

Assumptions developed for the Base Case scenario reflect the current management and desired products and forest conditions. This analysis demonstrates that the area-based harvest rate presented in the Base Case complies with the management intent for individual watershed plans established under the Clayoquot Sound Land Use Order.

Non-timber objectives maintained throughout this analysis included landscape-level biodiversity, stand-level biodiversity, scenic corridors, watershed rate-of-cut, visual quality, green-up/adjacency, and fisheries sensitive watersheds. The most constraining non-timber objectives on the harvest rate were the landscape-level biodiversity (within CSLUP), and fisheries sensitive watershed maximum disturbance rate (outside CSLUP). Objectives for scenic corridors and visual quality were somewhat constraining in some instances in the future.

Sensitivity analyses focused on THLB area and yield estimates; the two key variables used to determine the area-based harvest rate. The results showed a variance of 23.4% (44.6 ha/year) in harvest rate relative to the Base Case, as high as 13.1% (increase of 215.4 ha/year) and as low as 13.8% (decrease to 176.6 ha/year). Compared to the area-based approach, the non-declining, volume-based analysis resulted in lower net and gross area rates harvested in the long-term (by 10.3%), similar volume harvest rates, and a less efficient use of the growing stock over time. Given these results, it is recommended to maintain an area-based harvest rate for the TFL54 and continue to improve the land base definition and growth and yield estimates for determining rotation ages.

Ma-Mook Natural Resources Limited recommends the area-based harvest rate resulting from the Base Case scenario as the allowable annual cut over the next management plan period: 185.3 ha/year of gross harvest area.

5 References

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