

Iisaak Forest Resources Ltd.

Tree Farm License 57

**Timber Supply Analysis
Information Package
Management Plan 1**

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(Revision #2)

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Table of Contents

<u>1.0 Introduction</u>	4
<u>2.0 Process</u>	4
<u>2.1 Growth and Yield</u>	4
<u>3.0 Timber Supply Forecast/Options/Sensitivity Analyses</u>	5
<u>3.1 Base Case</u>	5
<u>3.2 Sensitivity analysis</u>	6
<u>Table 1 Sensitivity analysis</u>	6
<u>3.3 Alternative harvest flows over time</u>	6
<u>3.4 Other options</u>	7
<u>Table 2 Options</u>	7
<u>4.0 Model description</u>	8
<u>5.0- Current forest cover inventory</u>	8
<u>5.1 Overview</u>	8
<u>5.2 Description of the current timber inventory</u>	8
<u>5.3 History and updates</u>	Error! Bookmark not defined.
<u>6.0 Description of the land base</u>	9
<u>6.1 Timber harvesting land base</u>	9
<u>6.1.1 Timber harvesting land base determination</u>	9
<u>6.1.2 Age class distribution</u>	11
<u>6.2 Total area</u>	11
<u>6.3 Non-forest</u>	11
<u>6.4 Non-productive forest</u>	11
<u>6.5 Non commercial cover</u>	12
<u>6.6 Low site</u>	Error! Bookmark not defined.
<u>6.7 Inoperable area</u>	12
<u>6.8 Hydoriparian reserves (streams, lakes, and marine shore)</u>	13
<u>6.9 Environmentally sensitive areas</u>	15
<u>Table 9 Area reductions for ESA's</u>	16
<u>6.10 Wildlife habitat reductions</u>	18
<u>6.11 Cultural heritage resource reductions</u>	18
<u>6.12 Problem forest types</u>	19
<u>6.13 Roads, trails, and landings</u>	19
<u>6.13.1 Existing roads, trails, and landings</u>	19
<u>6.13.2 Future roads, trails, and landings</u>	Error! Bookmark not defined.
<u>7 Inventory Aggregation</u>	20
<u>7.1 Management zones and multi level objectives</u>	20
<u>7.2 Analysis Units</u>	25
<u>8.0 Growth and Yield</u>	25
<u>8.1 Site index</u>	25
<u>8.2 Utilization level</u>	25
<u>8.3 Decay, waste, and breakage for unmanaged stands</u>	26

8.4 Operational Adjustment Factors (OAF's) for managed stands.....	26
8.5 Volume reductions	26
8.6 Yield table development	27
8.7 Yield tables for unmanaged stands	27
8.7.1 Existing mature timber volumes	27
8.7.2 Yield tables for unmanaged immature stands (40 years+).....	27
8.7.3 Existing timber volume check	28
8.8 Yield table for managed stands.....	28
8.8.1 Existing managed stand volumes.....	28
8.8.2 Future managed stand volumes.....	28
8.9 Existing managed immature	30
8.9.1 Existing managed immature	30
8.9.2 Backlog and current non-stocked areas (NSR).....	30
9.0 Protection	30
9.1 Unsalvaged losses	30
10.0 Integrated Resource Management.....	30
10.1 Forest Resource Inventories.....	30
10.2 Non-timber forest resource management.....	32
10.2.1 Forest cover requirements.....	32
10.2.3 Recreation resources	33
10.2.4 Wildlife	34
10.2.5 Adjacent cutblock green-up	34
10.2.6 Biodiversity.....	34
10.2.7 Watersheds.....	35
10.3 Timber harvesting	36
10.3.1 Minimum harvest age/ merchantability standards	36
10.3.2 Initial harvest rate	36
10.3.4 Harvest rules	36
10.3.5 Harvest profile	37
10.3.6 Silvicultural systems	37
11.0 Option assumptions	

1.0 Introduction

This information package provides a summary of data, assumptions, and modeling procedures to be used in the Timber Supply Analysis for Iisaak Forest Resources' (Iisaak) Tree Farm License (TFL 57) Management Plan (MP) 1. The information provided is intended to be used for timber supply purposes only. It is an approximation of current management and it is not intended to be prescriptive with respect to future management of the TFL land base.

The forest estate model FSSIM will be used to complete the timber supply analysis. The area based harvest recommendations of the Clayoquot Sound Scientific Panel (CSSP), as documented in Report 5 (Sustainable Ecosystem Management in Clayoquot Sound) will be incorporated into the timber supply analysis as forest cover requirements. These will include area based rate of cut by watershed unit, old growth retention by watershed planning unit, and recommended standards for visual management.

Iisaak will complete the timber supply analysis to estimate a timber harvest forecast over a 200 year planning horizon as a function of land base, timber volumes, and growth rates after including constraints to protect and enhance non-timber resource values. The harvest forecast will project the impacts of current management practices as defined by the Forest Practices Code (FPC), CSSP recommendations, and other current legislation, regulations, and guidelines. Sensitivity analysis will be used to examine the relative importance of variations in assumptions and to investigate the expected impacts of different management scenarios.

2.0 Process

This information package was developed in accordance with the following documents:

- Guide for Tree Farm License Management Plans (20-month) and Calendar Year Reports (MOF - March 2001)
- Provincial Guide for the Submission of Timber Supply Analysis Information Packages for Tree Farm Licenses (version 4) (MOF – March 2001)

This draft information package will be submitted for review and approval to the MOF Timber Supply Forester at Timber Supply Branch. The final information package will be used to guide the timber supply analysis and will be included as an appendix in MP 1.

2.1 Growth and Yield

Yield tables for existing stands greater than 40 years of age were developed using VDYP. Volumes for existing stands 40 years of age and less were estimated using TIPSYS. Future managed stand volumes were estimated using TIPSYS.

3.0 Timber Supply Forecast/Options/Sensitivity Analyses

This section provides a summary of the harvest forecasts that will be included in the timber supply analysis. The set of assumptions pertaining to each option and sensitivity analysis will be covered in detail in later sections.

3.1 Base Case

The base case provides a benchmark against which other timber supply options or sensitivity analyses can be compared. The base case is based on current performance and as such is guided by existing land use designations, current legislation regulations, and guidelines including the Forest Practices Code and the CSSP recommendations.

Key elements of current performance on TFL 57 includes:

- The operable land base includes forested areas accessible using conventional and non-conventional harvesting methods.
- Watershed Plan reserves are used as deductions for environmentally sensitive areas for the watershed planning units (Flores, Bedingfield, Cypre, Tofino-Tranquil) where plans are substantially complete and for units where the relevant inventory data exists (all of the rest of the watershed planning units except for parts of Kennedy Lake, Clayoquot River, and Upper Kennedy). In the areas without data a percentage area deduction is used.
- Basic silviculture to meet free growing and FPC requirements is carried out on all regenerated stands.
- CSSP recommendations regarding rate of cut by watershed are modeled for each watershed (as defined in “A Strategic Assessment of Developed Watersheds in Clayoquot Sound”, Chapman Geoscience Ltd., 1998).
- Visual objectives are modeled based on the Clayoquot Sound Scenic Resource Inventory.
- Landscape level biodiversity – The CSSP recommendation of 40% old growth (age class 8 and 9) by watershed planning unit is applied. It is anticipated that the CSSP recommendation that 20% of these age class 8 and 9 forests are in forest interior conditions will be met by the spatial pattern of the existing reserve network.
- Stand level biodiversity/variable retention harvesting – This is applied as an area net-down based on CSSP recommendations and available inventory information in the database.

- The general silviculture system, in accordance with CSSP recommendations is variable retention. There are varieties of this (dispersed and aggregated retention, single and multiple entries) applied to different parts of the TFL land base.
- Minimum harvest ages are based on the greater of 90% of culmination of mean annual increment or attainment of stand volumes of 300 cubic meters per hectare.
- Adjacency – this is not modeled directly since it is effectively replaced by the CSSP rate of cut recommendations.

3.2 Sensitivity analysis

Sensitivity analyses will be conducted for the base case scenario in order to examine the potential impact of uncertainty in several key attributes.

Sensitivities for the base case will include:

Table 1 Sensitivity analysis

Sensitivity analysis	Magnitude or details of change
Timber harvesting land base	+/- 10%
Site productivity	Apply OGSi adjustments. Stands presently >140 years will have site index adjustments calculated in from the equations produced in the veteran tree sampling project. These site index adjustments will be used to create TIPSy curves for regenerated stands on these sites.
Minimum harvest age	+/- 10%
Visual management	+/- 10% of maximum allowable disturbance
Watershed rate of cut	Applied to the THLB instead of the total area.
Existing stand volumes	+/- 10%
Growth and yield on regenerated stands	+/- 10%
Economic operability	Exclude marginally economic areas.

No sensitivity analysis is to be done with respect to the impact of the non conventional harvesting portion of the THLB. As a result of implementing the recommendations of the Clayoquot Sound Scientific Panel helicopter yarding is very common in Clayoquot Sound.

3.3 Alternative harvest flows over time

The timber supply analysis attempts a minimum of two approaches to harvest flows:

- 1) Non declining flow from the present to the long-term level.
- 2) Transition from current harvest level to the long-term harvest level in increments of change not to exceed 10% per decade. (this may be modified depending on the outcome of the base case).
- 3) A third variation on harvest flow may be formulated once the base case has been completed.

3.4 Other options

The options listed below are intended to quantify the impacts on timber supply of pursuing management directions that are different than current management. At the present time Iisaak informally considers part of the TFL to be eehmiis area (areas that are very precious). Iisaak has not proposed any harvesting in these areas in its Forest Development Plan. The eehmiis areas do not have any official status (they are not protected areas) and are included with the integrated or special management zones of the Clayoquot Sound Land Use Decision.

Table 2 Options

Option title	Issue to be tested	Details of changes from the base case
No harvest in eehmiis areas	Iisaak is presently not operating in the eehmiis areas	Remove the eehmiis areas from the THLB.
Wildlife reserve option	No harvest in proposed wildlife (marbled murrelet) reserves	Remove the proposed wildlife reserves from the THLB.
Eehmiis and wildlife reserves	No harvest in either eehmiis or wildlife reserves	Remove the eehmiis areas and the proposed wildlife reserves from the THLB.
20 year plan starting point	Area potentially available harvest for first 20 years by 5 year period	Show potential available areas by watershed by 5 year period as a starting point for the 20 year plan.

All other assumptions remain the same as the base case.

At the present time, Iisaak has informally designated the TFL 57 land base into two categories, draft eehmiis (area that are very precious) and active forest management areas. The draft eehmiis are within the Integrated Resource Management Area or Special Resource Management Area as defined by the Clayoquot Sound Land Use Decision (e.g. they are not Protected Areas). The draft eehmiis are generally areas where completed Watershed Plans are required before any forest development is permitted. They have been defined by Iisaak considering a number of information sources including the following:

- Discussions with First Nations.
- The Memorandum of Understanding (MOU) with environmental groups.
- Undeveloped watersheds from the Chapman Report (Chapman, 1998)

At present Iisaak is focusing its forest management efforts on the active forest management areas and is emphasizing non-timber resource values in the eehmiis areas.

The marbled murrelet reserves are included in the base case because their status was uncertain when the initial land base net down assumptions were formulated. At present there is still a 3 year review provision for the status of these areas as reserves.

4.0 Model description

Model name – FSSIM (version 3.0) – B.C. Ministry of Forests timber supply model

Type – simulation (aspatial)

Description – The forest estate model FSSIM allows a number of area-based controls to be applied simultaneously to different land units to govern the rate at which the forest is harvested. This feature is used to ensure that the harvest forecast reflects the CSSP recommendations with respect to rate of cut, old growth retention, visual management, etc. Rate of cut is therefore modeled for each of the approximately 125 watershed units in the TFL. The lack of true spatial capability in the FSSIM model is not a significant drawback since adjacency is not an issue in the current management on TFL 57. It is replaced by the rate of cut recommendations and the variable retention harvest system.

5.0- Current forest cover inventory

5.1 Overview

The purpose of this section is to:

- Describe the current forest cover inventory.
- To document all the changes to the inventory that have taken place since the last timber supply analysis.
- To describe the process that was followed to obtain review and acceptance by the Forest Service.

5.2 Description of the current timber inventory –

TFL 57 is covered by two separate forest cover inventories:

- The Clayoquot Sound Resource Inventory Initiative Vegetation Resource Inventory (VRI). This was carried out between 1995 and 1998 for most of Clayoquot Sound (including most but not all of TFL 57).

- The MacMillan Bloedel (Weyerhaeuser) forest cover inventory from TFL 44.

The VRI data is used for this timber supply analysis. It was completed to the appropriate government standards in 1998. The inventory has not been updated since it was completed but there has been very little harvesting during that period.

5.3 Description of the current timber inventory

There have been no updates since this is a new inventory.

6.0 Description of the land base

6.1 Timber harvesting land base

6.1.1 Timber harvesting land base determination

Table 3 summarizes the area reductions made to the total area of the TFL to arrive at the land base that is available for timber harvesting.

Table 3 – Timber harvesting land base determination

	Area (hectares)			Volume (m3)		
	Schedule A	Schedule B	Total	Schedule A	Schedule B	Total
Total area (incl. fresh water)	18,161	69232	87393	5785327	24068495	29853822
Meares Island exclusion	3555	0	3555	1835433	0	1835433
Non-forest	615	2791	3406	0	0	0
Non-productive	621	5385	6006	8106	194509	202615
Total productive forest	13396	61057	74426	3941788	23873986	27815774
Less:						
Low site and non commercial	210	5351	5561	9648	691454	701102
Inoperable	211	6860	7070	99997	2850886	2950883
Uneconomic	227	3682	3910	89384	1408001	1497384
Hydroriparian	2823	7336	10159	852352	3182375	4034727
Terrain and soils	435	5232	5667	169144	2152350	2321494
Watershed plan ecosystem reserves	1349	3415	4764	470896	1489453	1960349
Other ESA's (Ep)	0	112	112	0	62159	62159
Non-merchantable	191	314	505	51123	93001	144124
Wildlife tree permanent retention	1320	6886	8206	382115	2844820	3226935
Existing roads	492	1095	1587	97441	374754	472196
Total current reductions	12049	48459	60508	4065639	15343762	19409401
Initial timber harvesting land base	6112	20773	26885	1719688	8724733	10444421
Less:						
Future roads, trails, and landings	127	866	993	66592	427797	494389
Long-term land base	5984	19907	25891	1653096	8296937	9950032

6.1.2 Age class distribution

Table 4 Age class distribution

Age range	Productive area (hectares)			Timber harvesting land base (hectares)
	Productive	Inoperable	Operable	
0	423	5	418	0
1-20	4889	34	4856	2327
21-40	8671	96	8476	4006
41-60	1717	84	1632	692
61-80	604	72	532	42
81-100	556	128	428	40
101-120	204	34	171	47
121-140	236	67	169	40
141-250	8213	1243	6970	2249
251+	48913	6312	42601	17441
Total	74426	8074	66352	26884

6.2 Total area

The total area of the TFL is 87,394 ha.

6.3 Non-forest

The non-forest portion of TFL 57 includes area where merchantable tree species are largely absent. Most of this area is in alpine, rocks, slides, and wet areas. Non forest was defined using the B.C. Land Classification part of the V.R.I. to exclude areas not classed as treed coniferous, treed broad leaf, and not logged.

Table 5 Non-forest areas

Description	Non-forest area (ha)
Total	3406

6.4 Non-productive and non commercial forest

Non productive sites were defined as areas meeting any of the following criteria:

- Typid=6
- Typid=8
- Typid>0 and S.I<5
- No logging history and species = “ “
- Typid=2 and crown closure <10%

- Typid=2 and crown closure <30 and leading species = hemlock.

6.5 Non commercial cover

Non- commercial cover is defined as areas meeting either of the following criteria:

- Typid=5
- Land classification = “shrub low” or “shrub tall”

6.6 Low site

Low productivity sites are defined as those sites with a site index $\leq 8m$.

6.7 Inoperable areas

Both physical and economic operability mapping was provided to Iisaak by MacMillan Bloedel when TFL 57 was subdivided from TFL 44. This information was produced in 1993 and was used in the last (MP 3) timber supply analysis for TFL 44. The definitions used in these inventories may change over time with changing product markets and with changes in management approaches and harvest systems brought about by the implementation of the CSSP recommendations. At present Iisaak does not have enough experience implementing the new approaches to consider changes to either the physical or economic operability and therefore the MB information was used in its present form.

Three classes of physical operability (*OPER_TYPE*) have been mapped:

- Conventional harvest systems (operable) – Timber on productive, physically operable land that is loggable by conventional methods (conventional cable or hoe-chuck) (*OPER_TYPE=0* or “ “)
- Non-conventional harvest systems (operable) – Timber on productive, physically operable land that is loggable only by non-conventional methods. These include helicopter, balloon or long-line cable systems. (*OPER_TYPE=1*)
- Physically inoperable timber – Timber on productive land that is so steep and/or rocky, that it cannot be safely felled or yarded or a significant proportion of the volume could not be recovered. (*OPER_TYPE=2*)

Conventional and non-conventional harvest systems are included in the THLB.

Three classes of economic operability (*ECON_TYPE*) have also been mapped:

- Marginally economic (*ECON_TYPE=1*)
- Uneconomic (*ECON_TYPE=2*)
- Economic (*ECON_TYPE=3* or “ “)

Economic and marginally economic areas are included in the THLB.

These three classes are defined as follows:

Table 6 – Economic operability criteria

Stand type	Conventional		Non-conventional	
	Uneconomic	Marginal	Uneconomic	Marginal
Fir, Fir-Hem Fir-Cedar	<250	250-350	<400	400-500
Hemlock Hem-Bal	<300	300-400	<450	450-550
Hem-Bal-Cypress <40% X, Y, Z Grades >40% X, Y, Z Grades	<300 <400	300-400 400-500	<400 >500	400-500 500-600
Cedar <40% X, Y, Z Grades >40% X, Y, Z Grades	<250 <350	250-350 350-450	<350 <500	350-450 500-600

Table 7 Inoperable land base

Criteria	Total area (hectares)	Reduction area (hectares)
Physically inoperable	8906	7070
Uneconomic	4711	3910

Table 8 Operability classification of the THLB

	Conventionally operable area (ha)	Non conventional Area (ha)	Net area (ha)
Economic	21361	3322	24683
Marginally economic	650	558	1208
Total	22011	3880	25891

6.8 Hydroriparian reserves (streams, lakes, and marine shore)

The CSSP recommended that a system of hydroriparian reserves be implemented in Clayoquot Sound. The reserves are based on a classification system for streams, lakes, wetlands, and marine shores that is different than that used under the FPC. The stream system is based on channel morphology, channel gradient, and stream width. Presence or absence of fish is not considered in classifying the streams.

The hydroriparian inventory was completed for most of Clayoquot Sound as part of the Clayoquot Sound Resource Inventory Initiative (CSRII – see section 10.1 – Forest Resource Inventories for a general description). It classifies all streams, lakes, wetlands, and marine shores that appear on 1:20,000 TRIM maps. There are small areas of TFL 57

where the inventory has not been completed (primarily in the Kennedy Lake, Upper Kennedy, Clayoquot River, and Bedwell/Ursus/Bulson).

All hydroriparian reserves were assigned to the hydroriparian features identified in hydroriparian inventory on the basis of the reserve recommendations described on pages 175-185 of the Clayoquot Sound Scientific Panel report "Sustainable Ecosystem Management in Clayoquot Sound". The GIS approach used to generate these reserves is the same one developed by government agencies for the work completed to date on the draft watershed plans for the Flores, Bedingfield, Cypre, and Tofino/Tranquil watershed planning units. There are no riparian management zones, only reserve zones. In all cases the CSSP reserves are equal to or greater than the FPC riparian reserve zones. In most cases the CSSP reserves are equal to or greater than the FPC riparian management area (the total of the riparian reserve zone and the riparian management zone).

In TFL 57 the hydroriparian reserves are implemented (for the 1:20,000 TRIM streams) at the watershed planning level.

Watershed Plans are substantially complete for the Flores, Bedingfield, Cypre, Tofino-Tranquil watershed planning units. Hydroriparian reserves have been generated from the hydroriparian inventory where the inventory data exists (all of the rest of the watershed planning units except for Kennedy Lake, Clayoquot River, Upper Kennedy, and a small part of the Bedwell/Ursus/Bulson). In the areas without data a percentage area deduction is used. The percentage is calculated from the completed watershed planning units (Flores, Bedingfield, Cypre, Tofino/Tranquil, Fortune for hydroriparian). This resulted in areas where the hydroriparian inventory was missing having an adjustment factor of 13% applied. This was based on the average percent deduction for stream hydroriparian reserves. Deduction for other hydroriparian categories (lakes, wetlands, marine) were not included in the adjustment factor since they were either not applicable (e.g. marine reserves in planning units with no marine shore) or were not missing in the inventory. The adjustment percentage applies only to the particular point in the netdown process where this item was removed from the THLB, it is not related to final area summaries.

Additional streams (in addition to those shown on 1:20,000 maps) are often found during field engineering work. These are generally smaller streams but some of them still require reserves under the CSSP recommendations. The areas of these reserves are expected to be accounted for in the area deductions for permanent retention (wildlife tree patches).

Table 9 Hydroriparian reserve zones

Watershed planning unit	Hydroriparian reserve area (hectares)				
	Streams	Lakes and Wetlands	Marine	Adjustment*	Total
Beach	0	0	0	0	0
Bedingfield	229	7	101	0	338
Bedwell/Ursus Bulson	1232	35	1	220	1487
Clayoquot River	0	20	0	467	487
Cypre	1863	39	571	0	2473
Flores Island	877	93	415	0	1384
Fortune Channel	443	8	600	0	1051
Hesquiat	12	1	0	0	13
Kennedy Lake	0	429	0	947	1377
Meares Island	NA	NA	NA	NA	NA
Megin	0	0	0	2	2
Moyeha	0	0	4	1	5
Sydney/Pretty Girl	246	10	49	0	306
Tofino/Tranquil	1011	29	0	0	1040
Upper Kennedy	82	3	0	112	198
Total	5995	674	1741	1748	10159

*Areas where the hydroriparian inventory was missing had an adjustment factor of 13% applied. The areas in this column are the area deduction calculated as a result of applying this factor.

6.9 Environmentally sensitive areas and other (non hydroriparian) watershed plan reserves

Some forestlands are environmentally sensitive and/or significantly valuable for other resource uses. In the past these areas were identified and delineated during a forest inventory and called environmentally sensitive areas (ESA's). The CSSP recommended that many of these items be identified and protected in reserves at the watershed planning level. This recommendation resulted in the Clayoquot Sound Resource Inventory (CSRI) initiative to acquire the resource information necessary to identify these values and designate the appropriate reserves through the watershed planning process. This has resulted in many of the original ESA's being superceded by newer and more detailed information for much of TFL 57. See section 10.1 (Forest Resource Inventories) for additional information.

The Watershed Plan reserves are used as the starting point for deductions for environmentally sensitive areas for the watershed planning units (Flores, Bedingfield, Cypre, Tofino-Tranquil) where plans are substantially complete and for units where the relevant inventory data exists (all of the rest of the watershed planning units except for Kennedy Lake, Clayoquot River, and Upper Kennedy). The GIS approach used to generate these reserves is the same one developed by government agencies for the work completed to date on the draft watershed plans for the Flores, Bedingfield, Cypre, and Tofino/Tranquil watershed planning units. In the areas without data, units where reserves haven't been designated, or values that were not addressed by the new inventories other approaches are used as described below.

Table 10 Area reductions for ESA's

ESA category ESA description	Approach used	Total Area (ha)	Percent reduction*	Total area reduction (ha)
Class V terrain and sensitive soils	Watershed Plan (WP) reserve criteria applied to entire TFL	15234	100	5667
Red listed ecosystems ¹ (designated)	WP reserves for area covered by TEM	258	100	89
Red listed ecosystems ² (not designated)	Percent reduction for area lacking TEM	NA		31
Blue listed ecosystems ³ (designated)	WP reserves for 4 units	Total area (ha)	100	488
Blue listed ecosystems ⁴ (not designated)	Percent reduction for remaining units	NA		332
Ecosystem representation ⁵ (designated)	WP reserves for 4 units	18061	100	1835
Ecosystem representation ⁶ (not designated)	Percent reduction for remaining units	NA		1988
Ep (regeneration problems)	MB ESA inventory	278	100	112
Recreation reserves around large lakes**	Watershed plan recommendations			

*The percent reduction applies to the areas previously identified as reserves through the watershed planning process and therefore the reductions are listed as 100%. It does not for instance, apply to all of the area in blue listed ecosystems, of which 50% were designated as reserves.

**These were unintentionally included in the hydriparian reserves at the GIS stage of data preparation so there is no further deduction.

ESA description:

Class V terrain and sensitive soils – The following inventories from the Clayoquot Sound Resource Inventory project are used to produce these reserves:

- Terrain stability class mapping – to identify Class V terrain reserves.
- Terrain mapping – to identify sensitive soils (bedrock, organic, colluvial).
- Terrestrial ecosystem mapping – to identify additional areas of sensitive soils (by site series).

The older MacMillan Bloedel terrain stability mapping is used for the areas not covered by the CSRI data (part of the Tofino/Tranquil, Kennedy Lake, and Upper Kennedy Watershed Planning Units). In these areas there is only a deduction for Class V terrain, not for sensitive soils.

Red listed ecosystems¹ – These are identified from the terrestrial ecosystem mapping (TEM) according to the list provided by the B.C. Conservation Data Center. All of the mature areas in these ecosystems are reserved. These reserves exist for all areas covered by the TEM mapping (the entire TFL except for Clayoquot River, Kennedy Lake and smaller portions of other units in the southern part of the TFL). The percentage reduction (0.24% for red listed ecosystems²) for the missing areas is an average taken from the Bedingfield, Cypre, Flores, and Tofino/Tranquil units. The adjustment percentage applies only to the particular point in the netdown process where this item was removed from the THLB, it is not related to final area summaries.

Blue listed ecosystems³ – These are also identified from the terrestrial ecosystem mapping according to the list provided by the B.C. Conservation Data Center. 50% of the mature areas in these ecosystems are reserved. These reserves are designated only for the four watershed planning units with substantially complete watershed plans (Flores, Bedingfield, Cypre, and Tofino/Tranquil). The GIS approach used to generate these reserves is the same one developed by government agencies for these units. The percentage reduction (1.5% for blue listed ecosystems⁴) for the missing areas is an average taken for the four watershed planning units. The adjustment percentage was calculated at the point in the netdown process where this item was removed from the THLB, it is not related to final area summaries.

Ecosystem representation⁵ – Thirty percent of the total area in each site series is to be reserved. These reserves are designated only for the four watershed planning units with substantially complete watershed plans (Flores, Bedingfield, Cypre, and Tofino/Tranquil). The percentage reduction (3.4 % for representative ecosystems⁶) for the missing areas is an average taken for the four watershed planning units. As was noted above for other categories the reserves for the four units were generated using the GIS approach developed by government agencies, and the percentage is only relevant at the point in the netdown where this area is removed from the THLB.

Ep (regeneration problems) – (EP_TYPE=1) – These areas are from the MacMillan Bloedel ESA mapping.

Recreation reserves around large lakes – 100m recreation reserves (e.g. 70m beyond the 30m hydriparian reserve) have been designated through the watershed planning process around the large lakes in Clayoquot Sound (Riley, Muriel, Kennedy, Pretty Girl, Adrienne). This was inadvertently merged in with the hydriparian reserves during the GIS work done to prepare the data for timber supply analysis.

6.10 Wildlife habitat reductions

Reserves specifically for protection of wildlife habitat have not been finalized under the watershed planning process. Many habitat requirements are already protected through the existing reserve network or are accounted for through the percentage reductions in lieu of established reserves on some parts of the TFL land base. The variable retention harvest system also provides significant protection for wildlife habitat outside of the established reserve network. Some additional reserves may be designated in the future to protect habitat for red or blue listed animal species (principally Marbled Murrelet) if the existing reserve network is considered to be insufficient. These potential reserves have been included in the data base which allows this issue to be examined in the wildlife habitat option.

The marbled murrelet reserves are included as part of the THLB in the base case because their status was uncertain when the initial land base net down assumptions were formulated. They are removed from the THLB in the wildlife reserve option (see section 3.4). At present there is still a 3 year review provision for the status of these areas as reserves.

6.11 Cultural heritage resource reductions

A recent archaeological inventory in Clayoquot Sound concluded that:

- 83% of villages reported were within 100 meters of the saltwater shoreline
- 94% of middens reported were within 100 meters of saltwater shoreline
- 76% of the known culturally modified trees (CMT's) occur within 200 meters of saltwater and 66% are within 100 meters of the shoreline.

Most of these features are already within either reserves (primarily the marine shore reserve of either 100 or 150 meters) or are within visual management zones where retention levels are high. CMT surveys are done prior to the lay out of retention patches. Some CMT's are then designated for harvest (subject to the approval of the appropriate Band) and the remainder are included in retention patches. The protection of these features is therefore already accounted for either through the existing reserve network or the WTP (retention) reduction. No further reductions will be made.

6.12 Problem forest types

There is presently no utilization of leading deciduous stands on the TFL and therefore they are excluded from the THLB. Problem type concerns for coniferous stands are dealt with through the criteria for economic operability.

Table 11 – Problem forest types

Type	Total area (ha)	Percent reduction	Excluded area (ha)
Leading deciduous	1646	100	505

6.13 Roads, trails, and landings

6.13.1 Existing roads, trails, and landings

Roads in the TFL have been mapped primarily as lineal features. It is difficult to extract any reliable estimate of polygon area in roads from the VRI data. The total area of existing roads, trails, and landings (classified and unclassified) is estimated to be 4%. This is applied to the area in the THLB less than 60 years old. This estimate is consistent with past experience in this TFL for the total area of existing roads (classified and unclassified), trails, and landings and with adjacent management units.

Table 12 – Existing roads, trails, and landings

	Percent reduction	Total area reductions (ha)
Existing classified roads		1139
Existing unclassified roads	4%	448
Total existing roads		1587

6.13.3 Future roads, trails, and landings

An area reduction of 5% should be applied to conventionally operable stands over 60 years old to account for future roads, trails, and landings. This is consistent with the maximum recommended in the CSSP report. This number may be revised in the future as Iisaak gains more experience with the proportion of helicopter harvesting used.

6.14 Exclusion of specific, geographically defined areas

Meares Island was not included in the provincial government's 1995 Clayoquot Sound Land Use decision. Since 1985, Meares Island has been subject to a court injunction preventing all timber harvesting on the island. Meares Island is excluded from the THLB.

Table 13 – Exclusion of specific, geographically defined areas

Description of area to be excluded	Excluded area (hectares)	Reason for exclusion
Meares Island	3555	Court injunction preventing timber harvesting.

7 Inventory Aggregation

7.1 Management zones and multi level objectives

Clayoquot Sound has been broken down into 15 watershed planning units in order to implement the watershed planning recommendations of the CSSP. TFL 57 includes all or part of 12 of the watershed planning units (one of these 12, Meares Island does not contribute any area towards the THLB). These units are further broken down into 131 individual watersheds defined in accordance with CSSP recommendations. In addition to this there are three visual zones from the Clayoquot Sound Scenic Resource Inventory and a 300m recreation management zone along the marine shore.

CSSP old growth recommendations are applied to the watershed planning units. Rate of cut rules are applied to the individual watersheds except for the face units, or small undefined drainages, draining directly into the ocean which are numbered starting at 200 and indicated with a *.

Table 14 –Watershed planning units and watersheds

Watershed Planning Unit	Watershed #	TFL 57 total area (ha)	TFL 57 THLB area (ha)
Beach	2	0.3	0.2
Bedingfield	66	365.4	89.2
	67	105.1	60.6
	69	34.5	8.2
	69.1	12.6	5.7
	72	11.3	8.5
	73.1	47.7	22.2
	73.2	833.0	122.7
	74	72.2	6.7
	209*	780.1	260.1
	210*	10.1	0.1
	Bedwell/Ursus/Bulson	19	88.9
20		836.0	208.6
21		3541.6	924.9
21.1		383.5	83.7
21.2		1210.8	212.3
21.3		428.6	66.2
21.4		479.5	104.1

	21.5	407.3	82
	21.6	690.4	116.3
	32	1530.9	535.1
	32.1	665.6	84.4
	32.2	3659.1	1065.1
	32.2.1	378.4	55.2
	32.2.2	1309.5	253.1
	32.2.3	629.3	70.8
	32.2.4	807.3	145.7
	32.2.5	524.1	55.1
	32.3	285.8	122.3
	32.6	244.4	40.7
	32.7	347.4	77.3
	32.8	50.2	0
	205*	13.8	4.8
Clayoquot River	4.3.6	974.1	399.7
	4.3.6.1	613.4	215.2
	4.3.6.4	993.4	370.4
	4.3.6.5	613.4	169.3
	4.3.6.6	438.7	217.8
	4.3.6.7	160.7	52.5
	4.3.6.8	755.4	206.3
	4.3.6.9	610.4	211.7
Cypre	22	829.3	202.9
	23	123.8	50.8
	24	43.2	19.9
	26	1.8	0.5
	27	0.3	0
	28	0.6	0
	30	5.8	0
	31	126.2	30.2
	31.1	368.4	165.6
	31.2	506.9	142.5
	33	169.9	26.7
	34	248.9	112.5
	35	279.8	105.6
	36	2974.8	1012.4
	36.1	637.5	220.2
	36.2	969.6	312.4
	36.3	1154.3	252.0
	37	73.2	26.1
	38	1.1	0
	56	230.4	33.8
	57	101.3	45.6
	58	260.0	101.1

	59	188.5	73.2
	60	784.4	238.0
	61	208.0	98.6
	62	253.1	74.6
	63	193	63.3
	64	1219.7	306.1
	64.1	373.3	51.4
	130	475.8	211.6
	205*	78.8	18.5
	207*	1068.6	234.8
	208*	945.4	318.0
	209*	1947.2	699.9
	219*	246.1	72.1
Flores	81	219.1	41.1
	82	635.1	191.6
	83	393.0	245.0
	84	406.0	202.4
	84.1	385.9	173.1
	84.2	500.7	178.4
	85	449.9	233.7
	86	323.8	108.0
	87	461.6	238.1
	88	310.6	87.7
	89	172.3	98.2
	90.1	504.4	133.5
	90.2	961.7	335.1
	91.A	0.3	0.2
	91.B	37.0	16.5
	92	13.3	5.6
	93	6.6	2.5
	93.1	876.4	173.2
	93.1.1	403.0	86.9
	93.2	1.5	0
	93.2.1	328.4	73.0
	93.3	160.9	34.5
	94	346.4	144.4
	211*	1232	568.5
	212*	1022	344.4
Fortune Channel	5	74.3	25.8
	6	182.1	57.3
	7	554.2	110.0
	12	162.5	82.3
	13	145.1	74.0
	14	69.8	22.4
	16	192.0	93.0

	17	87.7	37.6
	18	33.9	14.0
	32.1	140.0	1208.8
	200*	3508.8	151.5
	205*	438.4	53.9
Hesquiat	110	179.5	98.2
Kennedy Lake	3	521.2	314.9
	3.1	185.2	99.1
	3.2	477.8	271.2
	4	2304.2	1045.1
	4.1	323.6	123.5
	4.1.1	13.5	2.8
	4.2	352.1	199.6
	4.2.1	156.0	94.3
	4.2.2	405.1	242.1
	4.3	1138.7	418.1
	4.3.1	308.3	120.3
	4.3.2	195.6	48.4
	4.3.3	358.4	123.8
	4.3.4	1.5	0.4
	4.3.5	560.9	158.9
	4.6	3.0	1.8
	4.7	3.2	1.7
	4.8	346.9	137.2
	4.9	1646.2	645.6
Meares Island – not in THLB, watersheds not listed			
Megin	210*	9.9	5.9
	75	2.1	0
	75.1	1.1	0.1
	77	1.7	0.8
Moyeha	209*	12	4
Sydney/Pretty Girl	78	164.5	83.7
	97	103.4	42.6
	99.1.1.1	18	2.8
	100	115.5	37.9
	102	562.2	283.7
	102.1	50.5	24.5
	102.1.1	153.5	73.6
	102.1.2	160.6	64.1
	102.2	134.2	40.7
	102.4	21.3	12.9
	105	101.7	41.2
	210*	63.6	35.1
	214*	345.4	157.3
Tofino/Tranquil	8	716	201.6

	9	2104.4	347.8
	9.1	734.6	103.9
	9.2	379.5	41.4
	9.3	677.4	94.9
	9.4	588.1	71.5
	10	197.7	48.0
	11	2101.6	831.6
	11.1	1200.9	243.3
	11.2	2290.8	428.1
	200*	125.7	55.6
Upper Kennedy	4.12	1215.3	448.7
	4.12.1	8.5	2.8
	4.12.11	15.6	2.7
	4.12.11.1	0.9	0
	4.12.11.2	5.1	0
	4.12.2	6.3	2.6
	4.12.3	1.6	0.2
	4.12.3.1	329.0	95.8
	4.12.3.2	151.5	49.2
	4.12.4	63.5	19.5
	4.12.5	31.2	4.4
	4.12.7.1	0.4	0

Table 15 – Visual and recreation zones

Zone	Name	Total area (hectares)	THLB area (hectares)	Rational/comments
1	Small scale alteration	9494	3474	Clayoquot Sound Scenic Resource Inventory
2	Minimal alteration	20119	6019	As above
3	Natural appearing	12764	3655	As above
R1	Recreation management zone	3074	783	Clayoquot Sound watershed planning

7.2 Analysis Units

Table 16 – Analysis units

Analysis unit #	Analysis unit name	Net area (ha)	Species/type groups	Site index range	Age range
99*	Deciduous	266			
11	Fir/Pine-G	878	1-8, 27-31	>24	1-40
12	Fir/Pine-M	461	1-8, 27-31	>=20<=24	1-40
13	Fir/Pine-P	33	1-8, 27-31	<20	1-40
14	Fir-G	272	1-8	>24	41+
15	Fir-M	7	1-8	>=20<=24	41+
16	Fir-P	5	1-8	<20	41+
21	Cedar-Cypress-G	337	9-11	>24	1-40
22	Cedar-Cypress-M	1044	9-11	>=20<=24	1-40
23	Cedar-Cypress-P	49	9-11	<20	1-40
24	Cedar-Cypress-G	22	9-11	>24	41+
25	Cedar-Cypress-M	38	9-11	>=20<=24	41+
26	Cedar-Cypress-P	13298	9-11	<20	41+
31	Hemlock/Balsam/Spruce-G	1477	12-26	>24	1-40
32	Hemlock/Balsam/Spruce-M	1711	12-26	>=20<=24	1-40
33	Hemlock/Balsam/Spruce-P	93	12-26	<20	1-40
34	Hemlock/Balsam/Spruce-G	298	12-26	>=25	41+
35	Hemlock/Balsam/Spruce-M	192	12-26	>=20<=24	41+
36	Hemlock/Balsam/Spruce-P	6401	12-26	<=19	41+

*This includes some leading deciduous areas that was not netted out due to inconsistencies in the VRI data base. It will not be included in the timber supply analysis.

8.0 Growth and Yield

8.1 Site index

Site index estimates for all stands were calculated from forest cover attributes (stand height and age) by Ministry of Sustainable Resource Management staff.

8.2 Utilization level

Table 17 – Utilization levels

Species group	Utilization			Firmwood Standard
	Minimum DBH (cm)	Stump Height (cm)	Top DIB (cm)	
Managed conifers (0-40 years)	12.5	30.0	10.0	50%

Immature conifers (41-120 years)	17.5	30.0	15.0	50%
Mature conifers (121+ years)	17.5*	30.0	15.0	50%

*used operationally

Note: Volumes were also calculated for a second utilization level with all values the same as specified in the table above except for minimum DBH for conifers greater than 41 years is changed to 22.5 cm (consistent with the TFL license).

8.3 Decay, waste, and breakage for unmanaged stands

The default decay, waste, and breakage factors for TFL 57 within VDYP (Variable Density Yield Prediction) were used for existing natural stands.

8.4 Operational Adjustment Factors (OAF's) for managed stands

An OAF1 (stocking gaps) of 15% and an OAF2 (decay, disease and pests) of 5% were used for yield tables generated with TIPSY (Table Interpolation Program for Stand Yields).

8.5 Volume reductions

The total effect on forest yield of implementing the variable retention harvest system is two-fold:

- 1-An area/volume reduction for the leave trees.
- 2-The effects of the leave trees on the growth of the trees growing in the remaining areas.

This section deals only with the second component, the area/volume reductions are discussed in section 10.2.6.2 (Wildlife tree retention).

The yield tables described in section 8.8.2 (Future managed stand volumes) are clear cut yields. The increased edge and leave tree amount inherent in the variable retention system is thought to negatively impact growth, however the magnitude of this effect has not yet been confirmed by monitoring results. The magnitude of this effect likely varies according to the amount and spatial pattern of retention. At present Iisaak's application of the variable retention system throughout the TFL land base is still evolving (subject to adaptive management approaches). The proportions of the variable retention approaches within each zone and associated yield adjustment factors listed in the following table are an estimate at this point in time. They will likely be refined for future timber supply analyses.

The yield adjustment factors are based on work done by Weyerhaeuser on effects of alternative silviculture systems on yield in coastal BC Forests (see "Effects of Alternative silviculture on Yield: Coastal BC Forests", N. J. Smith, Weyerhaeuser, BC Coastal Group Nanaimo Woodlands, April 27, 1999). The Weyerhaeuser figures were applied in

a very generalized fashion because the relative proportions of the different variable retention techniques within each zone are difficult to estimate at this time, given Iisaak's limited operational experience. The degree of shading will be much different in a 2 ha patch than in a small group selection opening. The factors listed below proportional yield reductions and are applied to the TIPSY curves for regenerated stands.

Table 18 – Variable retention yield adjustment factors

Zone	THLB		Variable retention description	Yield adjustment factor (%)
	Area (ha)	Percent		
Class IV terrain	4045	15	-narrow strips (<20m) -group selection (<0.5 ha)	20%
Natural appearing	3656	14	-patches (<2.0 ha) -narrow strips (<20m) -group selection (<0.5 ha)	15%
Minimal alteration	6019	22	-patches -narrow strips -group selection	10%
Remaining area	13165	49	-15% aggregated retention	5%
Total /weighted average	26885	100		9.8%

The yield adjustment factor is lower for the minimal alteration zone than for the natural appearing zone due to an expected higher proportion of larger patches in the minimal alteration zone.

8.6 Yield table development

Yield tables are developed as described in the sections below.

8.7 Yield tables for unmanaged stands

8.7.1 Existing mature timber volumes

The timber volume in existing mature stands was determined for each analysis unit by using VDYP and the area weighted site index for these stands.

8.7.2 Yield tables for unmanaged immature stands (40 years+)

The timber volume in existing immature stands was determined for each analysis unit by using VDYP and the area weighted site index for these stands.

8.7.3 Existing timber volume check

Table 19 – Existing timber volume check (to be completed when yield curves are generated for analysis)

	Inventory volume	Yield table (AU) volume	Percent difference
Total volume (m3)			

8.8 Yield table for managed stands

8.8.1 Existing managed stand volumes

For existing managed stands, all stands were assumed to be plantations, species composition was taken from the inventory database, establishment density was assumed to be 10% higher than free-to-grow density, and the inventory site indices were used. Yield tables were calculated for individual polygons using TIPSYS.

8.8.2 Future managed stand volumes

These tables are also calculated using TIPSYS. Input information is provided in Table 20. OAF1 was 15% and OAF2 was 5%.

The schedule of volume gains from tree improvement was incorporated as follows:

Iisaak Forest Resources Ltd. does not have a secure supply of second generation seed. Gains from tree improvement were incorporated where estimated orchard production exceeded estimated seedling need (according to forecasts from the Tree Improvement Branch of the Ministry of Forests). This was the case from low elevation red cedar Cw (CWH-vh1 and vm1 which comprise about 85% of the THLB) and hemlock for all elevations. A gain of 7% (from Tree Improvement Branch figures reduced to allow for the area of higher elevation in the THLB) was applied to cedar and a gain of 13% for hemlock. These are applied to all stands planted from 2002 onwards.

Table 20 Silviculture management assumptions

Analysis Unit	Area (ha)	Leading species	Second species	Weighting	SI*	Establishment Density (stems/hectare)	Regeneration delay		Management
							Natural	Planted	Spacing
11-Fd-G	878	Fd	Hw	70/30	31.7	1000	3	2	NA
12-Fd-M	461	Fd	Hw	60/40	23.5	1000	3	2	NA
13-Fd-P	33	Fd	Hw	60/40	18.0	1000	3	2	NA
14-Fd-G	272	Fd	Hw	70/30	33.7	1000	3	2	NA
15-Fd-M	7	Fd	Hw	60/40	21.4	1000	3	2	NA
16-Fd-P	6	Fd	Hw	60/40	10.8	1000	3	2	NA
21-Cw-G	337	Cw	Hw	60/40	27.5	1000	3	2	NA
22-Cw-M	1044	Cw	Hw	60/40	23.0	1000	3	2	NA
23-Cw-P	49	Cw	Hw	60/40	17.7	1000	3	2	NA
24-Cw-G	22	Cw	Hw	60/40	31.4	1000	3	2	NA
25-Cw-M	38	Cw	Hw	60/40	21.7	1000	3	2	NA
26-Cw-P	12634	Cw	Hw	60/40	13.2	1000	3	2	NA
31-Hw-G	1477	Hw	Cw	60/40	28.0	1000	3	2	NA
32-Hw-M	1711	Hw	Cw	70/30	23.4	1000	3	2	NA
33-Hw-P	93	Hw	Cw	70/30	17.6	1000	3	2	NA
34-Hw-G	295	Hw	Cw	60/40	30.5	1000	3	2	NA
35-Hw-M	186	Hw	Cw	70/30	22.2	1000	3	2	NA
36-Hw-P	6084	Hw	Cw	70/30	12.7	1000	3	2	NA

Table 21 Planting and natural regeneration

Existing analysis unit	Regeneration method	
	Planting %	Natural %
11-Fir-G	100	0
12-Fir-M	100	0
13-Fir-P	100	0
14-Fir-G	100	0
15-Fir-M	100	0
16-Fir-P	100	0
21-Cedar-G	100	0
22-Cedar-M	100	0
23-Cedar-P	100	0
24-Cedar-G	100	0
25-Cedar-M	100	0
26-Cedar-P	100	0
31-Hem/Bal-G	0	100
32-Hem/Bal-M	0	100
33-Hem/Bal-G	0	100
34-Hem/Bal-M	0	100
35-Hem/Bal-G	0	100
36-Hem/Bal-M	0	100

All analysis units will be regenerated to the same analysis unit (there will be no species conversion).

8.9 Existing managed immature

8.9.1 Existing managed immature

The purpose of this section is to identify areas of existing immature forest where the density was controlled and therefore should be assigned to a managed stand yield curve (TIPSY). All stands less than 40 years in age are considered to be managed stands and will be assigned TIPSY curves. Assumptions are as specified in Table 20

Analysis units	Area managed (%)		
	Age class 1	Age class 2	Age class 3
All	100	100	0

8.9.2 Backlog and current non-stocked areas (NSR)

Backlog NSR is area that was denuded prior to 1987 and is not yet fully stocked. All other NSR is current NSR.

In the case of TFL 57 the new V.R.I. forest cover does not identify any areas as NSR.

9.0 Protection

9.1 Unsalvaged losses

Fire, insects, disease, wind, and other natural factors can cause losses of entire stands of trees. The purpose of this section is to provide an estimate of average annual unsalvaged volume loss due to these factors.

The risk of loss of timber due to fire is generally low within the TFL. Much of the TFL has a wet climate with cool summers. Historical losses to fire have been very small. The forests of TFL 57 have been relatively free of major insect or disease infestations and therefore no losses are indicated for these factors. Wind-throw appears to be the most significant of these factors although historically it has been isolated in relatively small areas. Iisaak has an active salvage program and therefore much of the accessible wind-throw will be recovered.

In this analysis an allowance of 1% of the harvest volume is made for non-recoverable losses. When modeling the timber supply, the unsalvaged losses are added to the desired harvest forecast and then subtracted from the forecast upon completion of the modeling exercise.

10.0 Integrated Resource Management

10.1 Forest Resource Inventories

In 1995 the Clayoquot Sound Resource Inventory Initiative began as a joint venture between the forest licensees in Clayoquot Sound, the Ministry of Forests, and the Ministry of Environment in order to acquire updated resource information of consistent quality across Clayoquot Sound. A number of inventory projects were initiated. The funding was provided by Forest Renewal B.C. (FRBC). The Clayoquot Sound Planning Committee coordinated the collection of the new inventory information relating to many of the resource values of Clayoquot Sound in order to provide the information necessary to complete the watershed plans. Iisaak presently uses these inventories in conjunction with inventories previously carried out by MacMillan Bloedel Ltd. for the TFL when it was part of TFL 44. This provides a collection of resource information that is among the most comprehensive available for any area in the Province of B.C. Since these inventories were carried out by provincial government agencies (or at least by contractors for these agencies) to the standards of the day it appears that the normal approval process for TFL inventories is inappropriate in this instance.

Table 22 Forest Resource inventory status

Forest Resource inventory	Standard	Date completed	Status
Forest cover	Vegetation Resource Inventory	Completed in 1997	Government project, directed to use it
Terrain mapping	1:20,000 scale, TSIL B	1999 by Madrone Consulting Ltd. and EBA Engineering Consultants Ltd.	Parts of several of the southern watershed planning units are incomplete, earlier MB mapping is used for those areas
Hydroriparian inventory	1:20,000 TRIM water features	1999 by Madrone Consulting Ltd.	Parts of several of the southern watershed planning units are incomplete
Terrestrial ecosystem mapping	1:20,000 scale to RIC standards	1999 by Madrone Consulting Ltd.	Parts of several of the southern watershed planning units are incomplete
Visual landscape inventory	Clayoquot Sound Scenic Resource Inventory standards	1999 by Catherine Berris and Associates.	Rationalized with FS visual landscape inventory
Recreation features inventory	1:20,000 scale, current MOF Forest Recreation Resource Inventory standards	1999	Complete

10.2 Non-timber forest resource management

The CSSP made a number of recommendations and subsequent planning activities provided additional direction for management of non-timber resources including the following:

- Designate a comprehensive reserve system at the watershed planning level to protect ecosystem integrity and other key values.
- Manage rate of cut by watershed.
- Designate management zones to protect specific resource values (visuals and recreation).
- Implement a variable retention harvest system where the amount and distribution of retained structures varies according to non-timber resource values and site sensitivity.

The above items provide a basis for a timber supply analysis that fully considers non-timber resource values. Within the THLB this is done both through temporal restrictions on rate of harvest (forest cover requirements for watersheds, visuals, recreation, and biodiversity) and through varying levels of permanent retention (expressed as an area deduction) across the land base.

10.2.1 Forest cover requirements

10.2.1.1 Green-up

Green-up age requirements within the visual and recreation zones will be modeled based on height/age relationships from Site Tools.

10.2.2 Visual resources

The major visual landscape management issues are associated with views from boats traveling in Clayoquot Sound. On Nov. 13, 1998 the District Manager of the South Island Forest District designated the Clayoquot Sound visual corridors as known scenic areas. A visual landscape inventory (VLI) has been completed for TFL 57. The Clayoquot Sound Scenic Resources Inventory was completed following the CSSP report and provides recommendations for management of scenic corridors (areas visible from the waters of Clayoquot Sound or highways). There are three management zones with associated guidelines in the scenic areas:

- Natural appearing - visual disturbance not discernible (no visible bare ground).
- Minimal alteration - visual disturbance may be discernible but not clearly evident (<4% cumulative visual disturbance in perspective).
- Small-scale alteration - visual disturbance must remain visually subordinate (<8% cumulative visual disturbance in perspective).

Table 23- Visual resources

Visual zone	Productive area (ha)	THLB area	Green-up height (metres)	Green-up age (years)	Allowable denudation (percent)	Land base constraints apply to
1-Small scale alteration	8787	3474	6		35	Productive forest by watershed planning unit
2-Minimal alteration	17389	6019	7		30	
3-Natural appearing	10775	3656	8		25	

Current practice in areas subject to the Clayoquot Sound Scenic Resource Inventory are a mixture of dispersed retention (single tree removal, narrow (<20m) strips, and small groups) and aggregated retention (small patches). The allowable denudation percentages in the above table were taken from Table 4 in the Visual Impact Assessment Guidebook (2nd edition, January, 2001). This table provides a percentage volume (or number of stems) removal that will result in a 90% probability of meeting particular VQO's. The natural appearing zone has been equated to a retention VQO, and the minimal alteration and small scale alteration zones to different degrees of a partial retention VQO. The partial cutting percentages have been directly converted to an allowable denudation percent for ease of modeling.

10.2.3 Recreation resources

Recreation resources are primarily accounted for through land base deductions for other values, in particular the marine shore reserve and other hydroriparian reserves. There are also specific recreation reserves around large lakes. In addition to this the following forest cover requirement will be applied in the recreation management zone:

Table 24 Recreation resources

Zone	Productive area (ha)	THLB area (ha)	Allowable denudation	Green up age	Land base constraints apply to
Recreation management zone	2687	783	35%	Age to reach 6m in height	Productive forest

Most of this area is already covered by one of the three visual zones. The recreation management zone forest cover requirement will apply only to the small areas that are

within the zone and not visible. The forest cover requirement is intended to reflect the smaller openings that will be used in this zone.

10.2.4 Wildlife

There are no specific ungulate winter ranges identified in TFL 57. Wildlife habitat is expected to be managed through the reserve network, rate of cut provisions, and the variable retention harvest system which are all factored into the timber supply analysis.

10.2.5 Adjacent cutblock green-up

No forest cover requirements are applied for adjacent cutblock greenup since under CSSP recommendations the rate of cut recommendations replace specific provisions for cutblock adjacency (page 83, CSSP Report 5 - Sustainable Ecosystem Management in Clayoquot Sound). These are specified in section 10.2.7 of this document. FPC regulations regarding adjacency are dealt with through the variable retention harvest system.

10.2.6 Biodiversity

10.2.6.1 Landscape level biodiversity

In TFL 57 the watershed planning units area used as landscape unit boundaries. Retention of old growth is based on CSSP recommendations instead of on the Biodiversity Guidebook. The old seral requirement applies to each watershed planning unit and is not specified by BEC subzone.

Table 25 – Old seral targets

Watershed planning unit	Old seral age	Minimum percent above old seral age
All	>140	40%

(page 171 CSSP Report 5 Sustainable Ecosystem Management in Clayoquot Sound)

10.2.6.2 Wildlife tree retention

One of the central CSSP recommendations is the adoption of the variable retention harvest system. The goal of the variable retention system is to maintain ecological or ecosystem integrity. The levels of retention recommended by the CSSP vary widely according to site specific resource values and site sensitivity. Iisaak is still in the early stages of gaining experience about how various levels of retention can best be used to protect resource values. The retention levels specified below are a best estimate at this point in time, they will likely be revised in the future as more experience is acquired in applying the variable retention system. A specified level of retention is assigned to the entire THLB. In some cases the same geographic unit is used to assign both a retention

level (permanent retention) and a forest cover requirement (e.g. visuals). The minimum retention level recommended by the CSSP is 15%.

The retention percentages listed in Table 26 below have been adjusted downward from those specified in the Clayoquot Sound Scientific Panel Recommendations in order to reflect the contribution towards overall retention objectives of areas that have already been removed from the THLB for other reasons. Watershed plan reserves are considered as not contributing to the retention requirements. Areas deducted for other Environmentally Sensitive Areas (Ep and Ea), recreation features, and problem forest types are assumed to contribute fully to retention requirements. A portion (approximately 20%) of the areas deducted for non commercial, low site, and uneconomic types are assumed to contribute to retention requirements.

As noted in section 10.2 forest cover requirements also apply to the areas listed below, for example in the natural appearing visual zone the forest cover requirement limits each entry to 25% in addition to the percentage retained until the next rotation.

These reductions should be applied as a land base reduction.

Table 26 – Wildlife tree retention

Zone/area description	Productive area (ha)	THLB (ha)	Total wildlife tree retention (%)	Retention area
Class IV terrain	16160	4045	50%	4445
Visual zone of natural appearing or minimal alteration	28165	9674	16%	1707
Remaining areas	30101	12172	12%	2054

10.2.6.3 Coarse woody debris, patch size objectives, connectivity objectives

Coarse woody debris is an important part of forest management on TFL 57 but is currently managed within harvesting utilization standards and therefore does not require specific consideration in the timber supply analysis. Patch size objectives are not a major consideration under the variable retention system. Connectivity is largely dealt with through variable retention without additional timber supply impact.

10.2.7 Watersheds

The total area of the individual watersheds as listed in Table 15 should be used only to determine the watershed size for purposes of specifying the type of rate of cut to be applied. These areas are the total area of the watershed, which in some cases includes area outside of TFL 57. For the purposes of calculating rate of cut for the timber supply

analysis the total area of the watershed inside TFL 57 should be used. The current rate of cut should be calculated for year one.

Table 27 – Watershed rate of cut

Watershed size	Rate of cut limitation
>500 ha	5% of the total watershed area within a five year period
200-500 ha	10% of the watershed area within a 10 year period.
<200 ha (e.g. the units numbered 200)	No rate of cut limitation

(page 81 CSSP Report 5 Sustainable Ecosystem Management in Clayoquot Sound)
 In many cases the rate of cut in smaller watersheds, or face units (200 series) is controlled by visual management provisions.

10.3 Timber harvesting

10.3.1 Minimum harvest age/ merchantability standards

Minimum harvest ages are simply minimum criteria. Many (likely most) stands will not be harvested until well beyond the minimum harvest age.

Minimum harvest ages will be the greater of the following two criteria:

- The age at which the stand achieves 90% of maximum mean annual increment (MAI).
- The age at which the stand reaches a volume of 300 cubic meters per hectare.

The 90% of maximum MAI criteria provides a reasonable balance between achieving maximum site productivity and providing opportunities for accessing second growth stands. The minimum volume of 300 M3 per hectare provides for reasonable operational economics.

10.3.2 Initial harvest rate

The initial harvest rate for the timber supply analysis will be set at the currently approved level of 123,800 cubic meters. The initial harvest rate may be increased or decreased depending on initial results. Rates will be varied to meet the objectives stated in Section 10.3.7. Once a suitable harvest flow is established sensitivity analyses will be performed.

10.3.4 Harvest rules

Relative oldest first.

10.3.5 Harvest profile

No constraints will be imposed in the model to target certain species or product grades. It is not appropriate to do this given the focus on ecosystem management and the resulting large number of spatial and temporal constraints already in place.

10.3.6 Silvicultural systems

Table 28 Silvicultural systems

Silvicultural Systems	Eligible location	Productive area	THLB area	% perm. Retention	Allowable denudation %	# of entries	Time between entries
Variable retention	Class IV terrain	16160	4045	50%	NA	1-2	NA
	Natural appearing visual zone	10775	3656	16%	25%	4	8m VEG
	Minimal alteration visual zone	17389	6019	16%	30%	3	7m VEG
	Small scale alteration visual zone	8787	3474	12%	35%	3	6m VEG
	Remaining area	21315	8697	12%	NA	1-3	NA

A variable retention harvest system applies to the entire area of TFL 57. Permanent retention is accounted for as an area deduction (Table 26-Wildlife Tree Retention). In some of the zones (particularly the visual zones) there are also temporal requirements which regulate the rate at which harvesting can proceed. There is no “pass system” for adjacency in the “remaining area” since the rate of cut requirement effectively replaces adjacency rules. The temporal requirements are modeled as clear cut forest cover requirements in order to simplify the modeling process. Operationally these are implemented as a mixture of patch cuts (even aged management) and various forms of dispersed retention (narrow strips, group selection, and some single tree selection).

11-Option assumptions

All options are described in Table 2. Additional details pertaining to particular options are as follows:

11.1- Eehmiis areas- These are described as follows:

Table 29 Eehmiis areas

Watershed Planning Unit	Watershed #	TFL 57 total area (ha)	TFL 57 THLB area (ha)
Bedingfield	72, 73.1, 73.2, 74	964.2	160.1
Bedwell/Ursus/Bulson	All except 19, 20, 32.1, 32.2 (10%), 32.3	16270.4	3785.9
Clayoquot River	All	5159.5	1842.9
Flores	All except 94 and 212	8783.5	3226.8
Sydney Pretty Girl	All except 105 and 214	1547.3	701.6
Tofino Tranquil		2000.1	270.3
Eehmiis total		34725.0	9987.6

11.2 Wildlife (marbled murrelet) reserves

These areas are as follows:

Watershed Planning Unit	THLB area (ha)
Flores Island	542.9
Bedingfield	35.4
Tofino/Tranquil	199.6
Cypre	477.2
Total	1255.1