# TFL 39, MP #7

# Timber Supply Analysis

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# 1.0 INTRODUCTION

The TFL 39 Timber Supply Analysis (TSA) is presented as four complementary documents. This document, the TSA Report, provides a summary of the analysis and presents and discusses the main results. The Information Package documents the assumptions and describes the modelling procedures used in the analysis. The Results Report presents results of the analysis by option. The Economic Evaluation Report provides a basis for comparing the economic impacts of management choices.

The TSA Report begins with a description of issues and of the options used to analyze these issues.

The basis for the analysis is briefly described. This includes separation of TFL 39 into six working circles, derivation of the net landbase, yield projection, harvesting assumptions and integrated resource management considerations. Please refer to the Information Package for detail on these aspects.

The focus of this report is on presenting and discussing the main results of the analysis. This is organized by issue. For additional detail, refer to the Economics and Results Reports. Conclusions are provided at the end of the report.

# 2.0 ISSUES

There are several major issues, interpretations of which have significant impacts on either the estimate of long-run sustainable yield (LRSY) from the TFL, or on the schedule alternatives that project harvest from today to the attainment of that LRSY condition:

- Integrated resource management.
  - Visual landscape.
  - Biodiversity.
- Constraints relating to harvesting the forest "profile".
- Operable landbase:
  - Current harvesting economics.
  - Sensitivity to changes in the operable landbase.
  - Major reservations from the landbase.

- Silvicultural practices.
- Estimates of future yields from the second and third forests.
- Estimates of site productivity.

The options described in Table 2.1 permit analysis of these issues. Differences between options are highlighted by shading of the assumptions that differ.

## *TABLE 2.1.* Summary of Options

| Option No. | | Landbase Variation | Harvest Method and Economic Operability | | | ESAs(3) | Cover Class(2) | Silviculture | Yield Tables(4) | Site Index(5) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Uneconomic | Marginal | Nonconventional Economic | | | | | |
| 1 | Sensitive soils | -- | I | I | I | S | None | Current | ADJ | INV |
| 2 | Current procedures | -- | E | I | I | E | A | Current | ADJ | INV |
| 3 | Visual (1) | -- | E | I | I | E | B | Current | ADJ | INV |
| 4 | Visual (2) | -- | E | I | I | E | C | Current | ADJ | INV |
| 5 | Biodiversity | less 4% old growth | E | I | I | E | A | Current | ADJ | INV |
| 6 | Working landbase | -- | I | I | I | E | A | Current | ADJ | INV |
| 7 | Economic | -- | E | E | I | E | A | Current | ADJ | INV |
| 8 | Conventional | -- | E | E | E | E | A | Current | ADJ | INV |
| 9 | Basic silviculture | -- | E | I | I | E | A | Basic | ADJ | INV |
| 10 | Enhanced silviculture | -- | E | I | I | E | A | Enhanced | ADJ | INV |
| 11 | Y-XENO yields | -- | E | I | I | E | A | Current | Y-XENO | INV |
| 12 | Revised site indexes | -- | E | I | I | E | A | Current | ADJ | REV |
| 13 | Block 6 | less Yakoun Basin | E | I | I | E | A | Current | ADJ | INV |

(1) E means that the landbase component is excluded from the option. I is for inclusion.

(2) VQO Cover Class Constraint
- A. Base situation.
- B. Practical interpretation.
- C. Less stringent visual landscape constraints.

(3) ESAs
- S. Landbase reductions for sensitive soils.

(4) Yield Tables
- Y-X. Unadjusted. Y-XENO Yields.
- ADJ. Yields with MoF adjustments.

(5) Site Index
- INV. As described in inventory.
- REV. Revised site indexes.

# 3.0 GENERAL BASIS FOR THE ANALYSIS

The detailed basis for the analysis is shown in the Information Package. Some key points are summarized below.

## 3.1 Working Circles

TFL 39 consists of seven blocks dispersed over a wide geographic area of the coast. Blocks 2, 4 and 6 are important locally for community stability.

The TFL is divided into six working circles. Each is analyzed separately. The working circles are:

| Block No. | Operating Division (1994) |
|---|---|
| Block 1 | Stillwater |
| Block 2 | Menzies Bay, Kelsey Bay and Eve River |
| Blocks 3 and 4 | Port McNeill |
| Block 5 | Stillwater |
| Block 6 | Queen Charlotte Islands |
| Block 7 | Port McNeill |

## 3.2 Determination of the Working Landbase

The analysis excludes those areas within the TFL on which timber harvesting is not expected to occur. This includes:

- Non-forest. Includes areas of alpine, rock, water, swamp and roads.
- Nonproductive forest. These are mainly areas of scrub having an inventory volume of less than 212 $m^3$/ha.
- Physically inoperable areas. These are areas on which timber harvesting is not physically or safely possible.
- Sensitive soils (unstable soils). Mapping of environmentally sensitive areas (ESAs) has occurred.

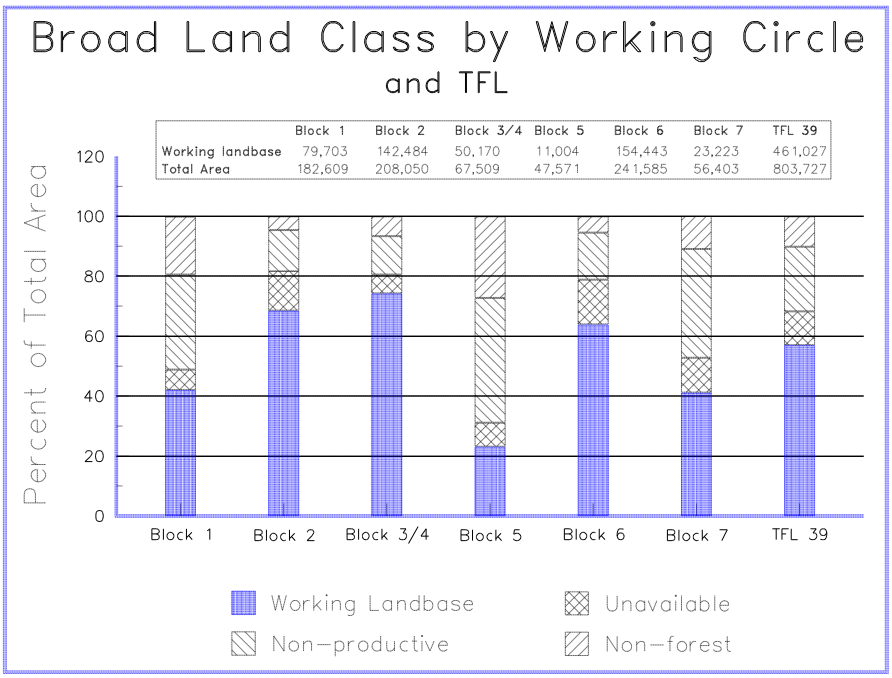
Other areas have been identified as important for non-timber resources. These are mapped as environmentally sensitive areas (ESAs) for:

- Avalanche areas.
- Buffers around streams, lakes and estuaries.
- Wildlife areas for deer, elk, grizzly bear and goat.
- Difficult regeneration areas.

- ❑ Community watersheds.
- ❑ Recreation.
- ❑ Heritage areas and other special reserves.

Figure 3.2.1 shows, by working circle, the TFL area categorized by non forest, nonproductive forest, unavailable forest (includes physically inoperable areas and reserves for sensitive sites and non-timber values) and forest available for timber management. For the TFL, 57% of the total area or 74% of the forested area is available for some form of management for timber. The percentages vary considerably across the working circles from a high of 74% of the total area in Blocks 3 and 4 combined to a low of 23% for the mountainous Block 5. For most of the options in this analysis, the available area is reduced by a further 16 600 ha (across the TFL) for areas classified as "currently uneconomic". Some options include variations of this available landbase. These are described in Section 4.0.

***FIGURE 3.2.1***




## 3.3 Silvicultural Assumptions and Yield Projection

The "current" silviculture scenario is used in most options. It portrays recent practices, including stocking densities at establishment, levels of spacing and conversion of deciduous areas to conifer. Additional scenarios titled "basic" silviculture and "enhanced" silviculture have been run to examine the impacts of less intensive or more intensive silviculture investment.

Timber volumes in mature (greater than 150 years of age) forest areas are based on measurement (timber cruise). Regeneration models and yield tables are used to estimate

future volumes of timber in younger stands and in future forest stands. Regeneration models, based on the knowledge and experience of local foresters, describe the likely conditions after harvest, the natural stocking condition, and the presence of slash and/or brush conditions. This defines the framework for examining forest management scenarios and for defining yield tables to be used in the analysis.

Within this framework the yield model Y-XENO, developed by MB, is used to predict the future volumes of timber in different areas. These volumes are adjusted to reflect operational factors including small unproductive areas, pest and disease losses and impacts of brush competition. For most of the options, a further adjustment is made to ensure yields similar to those used by the MoF. As Section 4.5 shows the impact of this last adjustment is small, particularly in the short term.

## 3.4 Harvesting Assumptions

Initial harvest levels for this TSA assume continuation of the strategy outlined in MP #6; that is, to gradually adjust harvest levels towards our best estimate of the long-run sustainable yield (LRSY) of the forest. Such gradual change in harvest levels over time encourages stability in communities dependent on forest management in TFL 39.

The initial harvest level is 3 733 000 $m^3$/year or 85 000 $m^3$/year less than the AAC of 3 818 000 $m^3$/year for MP #6. This decrease includes 22 000 $m^3$/year reduction during the moratorium on the Lower Tsitika River.

There is some reallocation of harvest between blocks (compared to MP #6), partly based on the increasing availability of merchantable second growth particularly in Blocks 1 and 3.

***TABLE 3.4.1.*** **Harvest Levels (000 $m^3$/year)**

| Block | MP #6 | Initial Harvest Levels MP #7 TSA |
|---|---|---|
| 1 | 424 | 450 |
| 2 | 1 404 | 1 348 * |
| 3 & 4 | 410 | 420 |
| 5 | 150 | 100 |
| 6 | 1 250 | 1 220 |
| 7 | 180 | 195 |
| Total | 3 818 | 3 733 |

* Includes 22 000 $m^3$/year reduction for moratorium in Lower Tsitika.

In the TSA, second growth (new forest) is not considered for harvest until it has attained minimum merchantability standards. The intent is to approximate minimum practical harvest ages. Most of the minimum harvest ages are a little younger than the age at which maximum average annual volume growth occurs. This is consistent with objectives of achieving near maximum volume production while providing some additional flexibility for harvesting some areas (e.g., areas of high visual landscape values) over an extended period.

The minimum harvest ages for some low-site areas are extended to ensure achievement of a minimum average tree size and volume/hectare. In the analysis, areas are often "harvested" well beyond these minimum harvest ages depending on the availability of "merchantable" timber and the occurrence of constraints for reducing the rate-of-harvest in areas managed for non-timber values.

There are many possible harvest schedules for any forest. The general procedure used in this analysis is to gradually change the harvest level from the initial harvest rate (period 1993 to 1997) until LRSY is reached by the period 2103 to 2107 at the latest. LRSY is the rate-of-harvest that is equivalent to forest growth (measured in stands of 14 m height and greater) over the 100-year period from 2103 to 2202.

Further, for the TFL as a whole and for the community-based working circles, harvest schedules are constrained to ensure that harvest reductions of more than 10%/decade are avoided (unless such reductions are necessitated by timberland allocation to higher land use). In Blocks 5 and 7 (which do not directly support communities), the transition to LRSY is allowed to occur with greater than 10% adjustment in harvest/decade.

## 3.5 Integrated Resource Management

This TSA explicitly recognizes a wide range of sensitive sites and non-timber resource concerns. Many of them are listed in Section 3.2 above. Visual Quality Objectives (VQOs) classes have been identified and mapped on more than a third of the TFL forested area of 722 000 ha. Areas occupying over 130 000 ha have been identified as having sensitive soil concern. Recreation, fisheries and wildlife values affecting forest management have been mapped on 27 000 ha, 15 000 ha and 11 000 ha of forest area respectively.

Management implications of these concerns are modelled in the analysis as either a reduction in the landbase available for timber management or as a forest cover requirement.

Reductions to the timber management landbase area are applied to sensitive soil, recreation, fisheries, wildlife, avalanche, community watershed, difficult regeneration, heritage and other special reserve areas. They total more than 59 000 ha of productive forest land that is physically operable for timber management.

The major application of forest cover requirement constraints is for visual landscape management. Areas in the TFL have been mapped for visual sensitivity by VQO classes from "retention" as the most sensitive (and, hence more restrictive on timber management) class through "partial retention" to the less sensitive "modification" class. They occupy 1%, 21% and 13%, respectively, of the net-timber management landbase. The rate-of-harvest (cover class constraint) is restricted on these areas to a maximum percentage that may be below "greenup" (defined at 5 m in height for most options) at any given time. The percentage is least for the most restrictive retention areas and is higher for the less sensitive modification area. The impact of these forest cover constraints on timber harvest over time is shown by options with variations in the constraints.

Smaller areas in avalanche run-out zones and in community watersheds are also subject to forest cover requirements.

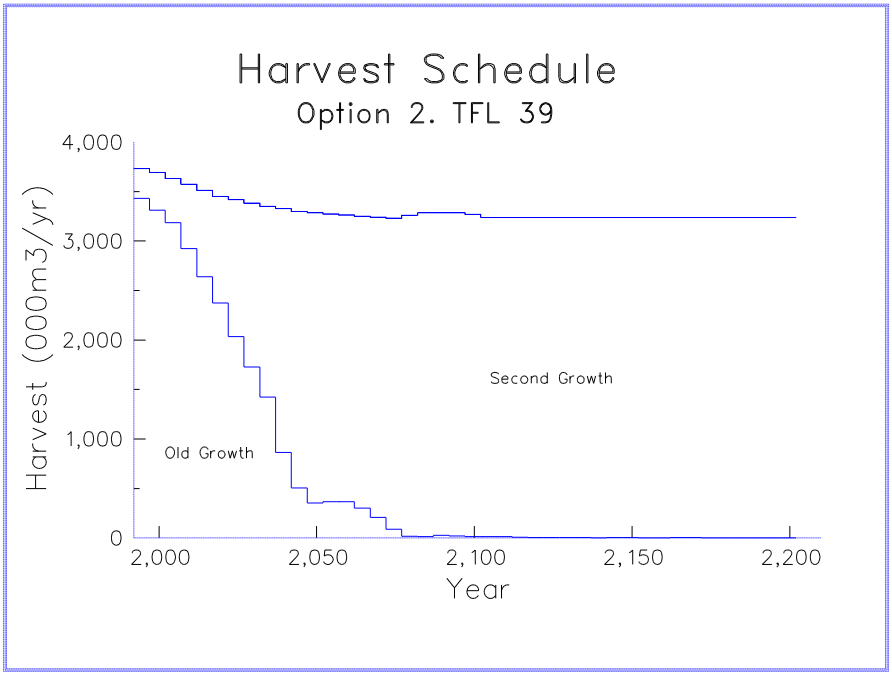
A cover class constraint of no more than 25% of the available area to be less than 10 years of age at any time is imposed for cutblock adjacency in areas not covered by more restrictive VQO classes.

## 4.0 DISCUSSION OF ISSUES

Option 2 is used as a base for comparing options for the various issues discussed in the remaining sections.

The Option 2 harvest schedule for TFL 39, showing the transition from predominately old-growth harvest to second-growth harvest is displayed in Figure 4.0.1.

***FIGURE 4.0.1***



The TFL 39 harvest schedule starts at 3 733 000 $m^3$ and declines gradually (at no time more than 3.5% in a 10-year period) reaching a level close to LRSY (3 236 000 $m^3$/year) in 75 years. The total change in harvest rate is less than 14%. This forest wide result includes a wide range of forest age class distributions and, hence, harvest schedules within the six working circles. At one extreme is Block 1 with a long history of harvest activity, relatively little remaining old growth and a harvest schedule that increases from an initial harvest rate to a level higher than LRSY before decreasing again to LRSY by 2103. At the other extreme is Block 7 in which harvest operations commenced only during the last decade. The Block 7 harvest schedule declines smoothly from its initial harvest rate, reaching LRSY in 50 years. Old growth provides most of the harvest for the next 75 years. Refer to Section 2.0 of the Results Report for more detail.

Timber harvest from TFL 39 is important to the economic well-being of a number of communities on the coast. They include, Port Hardy, Port McNeill, Sayward, Campbell River, Powell River, Chemainus, Nanaimo, Port Clements, Sandspit, Masset, Skidegate and Queen Charlotte City. The lower Mainland also benefits significantly from the forest sector and therefore from TFL 39.

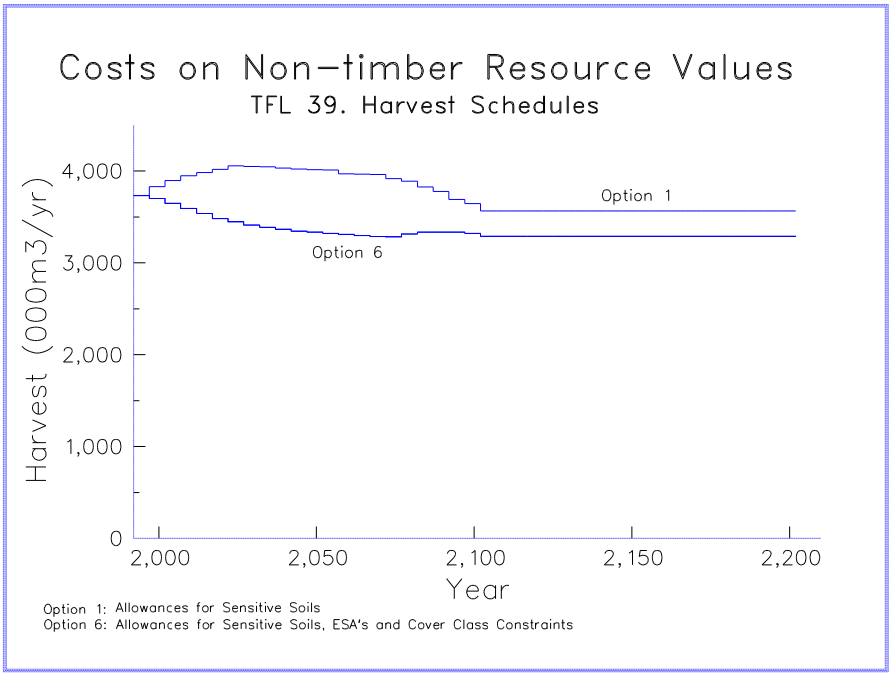
## 4.1 Integrated Resource Management

MB recognizes that non-timber values are important. Mapping of environmentally sensitive sites and areas with non-timber values has occurred throughout TFL 39 (see the Information Package for details). Option 2, used as a base for comparing options in this analysis, includes allowances for these values through explicit reductions to the landbase and through imposing cover class constraints.

First, we estimate total costs of reservations and constraints for non-timber resources in terms of foregone timber values. Inspection of Options 1 and 6 permits this comparison.

Option 1 portrays a view of timber as the dominant forest use. Area netdowns are made to safeguard sensitive soils. Unlike Option 6, netdowns are not made for other non-timber values (ESAs) and cover class constraints are not imposed for visual landscape or other reasons. Figure 4.1.1 shows the difference in harvest schedules between these two scenarios reflecting the costs of reductions to the working landbase and cover class constraints for non-timber values.

***FIGURE 4.1.1***




Differences in harvest levels are an average of 428 000 m³/year over the first 50 years and 275 000 m³/year in LRSY.

The economic activity forgone because of these regulations is estimated in the Economics Report. Economic impact analysis is used to assess the impact of alternative harvest schedules on macro level economic and social indicators such as employment, wages, government revenues and sales (Table 4.1.1). Harvesting activity in TFL 39 could support an additional 682 direct jobs if these regulations, aside from those to safeguard sensitive soils, were not imposed. In addition, these regulations cost all levels of government at least $33 million each year.

***TABLE 4.1.1.*** **50-Year Economic Impact of IRM Constraints, Option 6 Compared to Option 1**

| | **Average Annual Impacts during 1993 to 2042** |
|---|---|
| Harvest Reduction (m³/year) | 428 000 |
| Direct Jobs | 682 |
| Indirect Jobs | 1,363 |
| **Total** | **2,045** |
| Direct Wages & Salaries | 38,021 |
| Indirect Wages & Salaries | 43,624 |
| **Total** ($000/year) | **81,645** |
| Direct Government Revenues | 25,255 |
| Indirect Government Revenues | 8,392 |
| **Total** ($000/year) | 33,648 |
| **Sales Value** ($000/year) | **90,620** |

The economic costs reported in Table 4.1.2 are forgone timber values, determined in a benefit-cost analysis framework.

The total discounted cost of these regulations is $0.76 billion. On an annualized basis, using a 4% discount rate, the costs equate to $31 million/year (see Table 4.1.2).

***TABLE 4.1.2.*** **Economic Costs of Integrated Resource Management Regulations, Option 6 Compared to Option 1**

| | Costs/year ($000/year) | NPV ($000) |
|---|---|---|
| Forgone Rents | 14,117 | 352,921 |
| Fixed Costs | 483 | 12,084 |
| Harvesting Costs | 16,054 | 401,347 |
| **Total** | 30,654 | 766,351 |

Forest management for non-timber resource production entails considerable costs. MB accepts that much of this cost may be justified. However, we are concerned that management for the various forest values is done objectively and that both costs and benefits are considered.

These concerns are illustrated in the following discussion. First, estimates of benefits (from the literature) for recreation and passive benefits are compared with estimated costs. In the next two sections, the harvest and economic impacts of options for visual landscape and biodiversity are discussed.

Using recent information on participation in outdoor recreation and assuming the TFL 39 share of this is proportional to it's area, results in a rough estimate of 2.2 million recreation days/year in TFL 39.

Recent studies indicate that the average value of use (e.g., forestry-based recreation and tourism activities) and non-use (e.g., preservation) benefits are in the range of $20/day to $30/day (refer to the Economics Report for details) which is in addition to the cost borne by the participant.

Relating to Table 4.1.2 above, this suggests that in TFL 39, an additional 1.0 million to 1.5 million days (an increase of 45% to 68%) of outdoor activity will be required each year to offset the economic costs of integrated resource management regulations. This is an increase above that which would occur without the additional constraints.

## *4.11 Costs of Visual Landscape Constraints*

Mapping of visual landscapes by Visual Quality Objective (VQO) class has occurred in visually sensitive areas (e.g., main travel corridors) in TFL 39.

Options 2, 3 and 4 impose different cover class constraints (reduced rates-of-harvest) on these areas. In Option 2, the constraints are based on procedures currently recommended by the Vancouver Forest Region, MoF. MB believes that VQOs can be met by less constraining conditions than those incorporated in Option 2.

The Option 2 approach does not recognize the broad level of visual landscape mapping used in parts of TFL 39 nor does it account for the differences between the TSA carried out on a planimetric basis compared to operational planning on a perspective basis (areas hidden from view in the latter are assumed visible in the former).

In Option 3, the cover class constraints are relaxed to allow for these factors. Option 4 is further relaxed by defining visually effective greenup (VEG) at 3 m in height compared to 5 m for the other two options.

Differences in cover class constraints between Options 3, 4, and 2 are summarized in Table 4.11.1.

***TABLE 4.11.1.*** **Description of Visual Landscape Cover Class Constraints**

| | Option 2 | Option 3 | Option 4 |
|---|---|---|---|
| VEG (m) | 5 | 5 | 3 |
| Corresponding average age (years) | 13 to 19 | 13 to 19 | 10 to 14 |
| | | | |
| Regen. delay for retention and partial retention areas | 2 | 2 | 1 |
| | | | |
| Percent visual alteration(1) | | | |
| Retention | 3 | 4 | 4 |
| Partial retention | 10 | 12.5 | 12.5 |
| Modification | 20.5 | 22.75 | 22.75 |

(1) In all options, the percent visual alteration relates to an area halfway between the net available area and the total green area (i.e., semi dispersed available and unavailable areas. Refer to Section 8.3 in the Information Package).

Visual landscape cover class constraints can have a significant impact on timber harvest schedules, particularly when they are imposed as new additional management constraints without a transition period. Two indicators of relative impact of these cover class constraints are the "harvest cycle" for a VQO class within a forest unit and the proportion of land available for timber harvest that is within the more restrictive VQO classes.

The harvest cycle is the minimum period of time that it would take to complete one harvest of the available land within a VQO class. The longer the harvest cycle the more restrictive is the cover class constraint. Consider Block 6 of TFL 39 as an example. Table 4.11.2 compares the three options for the partial retention VQO class.

***TABLE 4.11.2.*** **Block 6: Partial Retention Cover Class Constraints by Option**

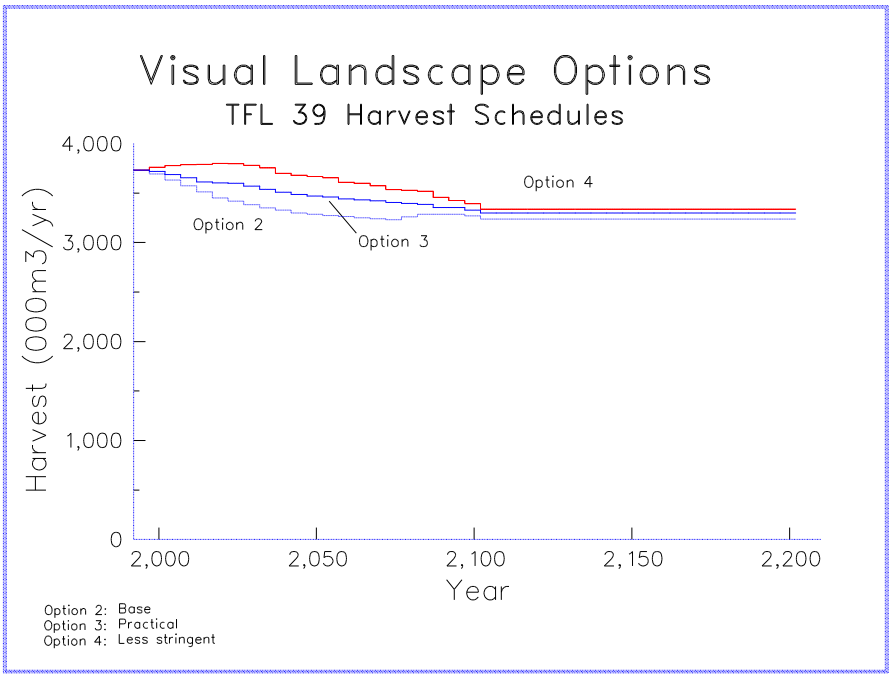
| | Option 2 | Option 3 | Option 4 |
|---|---|---|---|
| Harvest cycle (years) | 151 | 121 | 83 |
| | | | |
| Maximum percentage of forested viewscape harvested during a 10-year period | 4.4 | 5.5 | 8.0 |
| | | | |
| Increase in maximum harvest rate relative to Option 2 | 0 | 25 | 82 |

The partial retention VQO class covers 30.6% of the available area (for these options) in Block 6. With Option 4 constraints, compared to Option 2, the harvest rate for this 30% of the timber management area is increased by 82% while the proportion of forested viewscape that has not reached VEG does not go above 8% in 10 years.

Of interest are the benefits and costs of such incremental changes in cover class constraints.

The potential costs are illustrated here by examining differences between harvest schedules for the three sets of constraints. TFL harvest schedules for Options 2, 3 and 4 are shown in Figure 4.11.1.

***FIGURE 4.11.1***




For TFL 39, the average economic impacts for the first 50 years and the average economic costs of more stringent visual quality constraints are shown in Table 4.11.3.

***TABLE 4.11.3.* 50-Year Economic Impact of Visual Quality Constraints, Options 3 and 2 Compared to Option 4**

| | **Average Annual Impacts (Reductions) 1993 to 2042** | |
|---|---|---|
| | *Option 3* | *Option 2* |
| Harvest (000 m³/year) | 146 | 261 |
| Jobs(1) | 701 | 1 246 |
| Wages and Salaries(1) ($000/year) | 27,975 | 49,733 |
| Government Revenue(1) ($000/year) | 11,529 | 20,496 |
| Sales Value ($000/year) | 31,050 | 55,200 |

| **Average Economic Cost ($000/year)** | |
|---|---|
| *Option 3* | *Option 2* |
| 9,363 | 17,891 |

(1) These include both direct and indirect impacts.

In the longer term, the differences in LRSYs are 37 000 $m^3$/year between Options 4 and 3 and a further 64 000 $m^3$/year between Options 3 and 2 totaling 101 000 $m^3$/year or 3% of the LRSY for Option 4.

The Queen Charlotte Islands (QCI) incurs approximately two thirds of the harvest impacts of the more stringent visual landscape constraints. Block 1 (Powell River) also experiences above average impacts. No logging community associated with TFL 39 will go unaffected. Of the 701 to 1,246 jobs, these communities can expect to lose anywhere from 122 to 215 jobs, with over half of these losses likely to occur in the QCI.

The results show that:

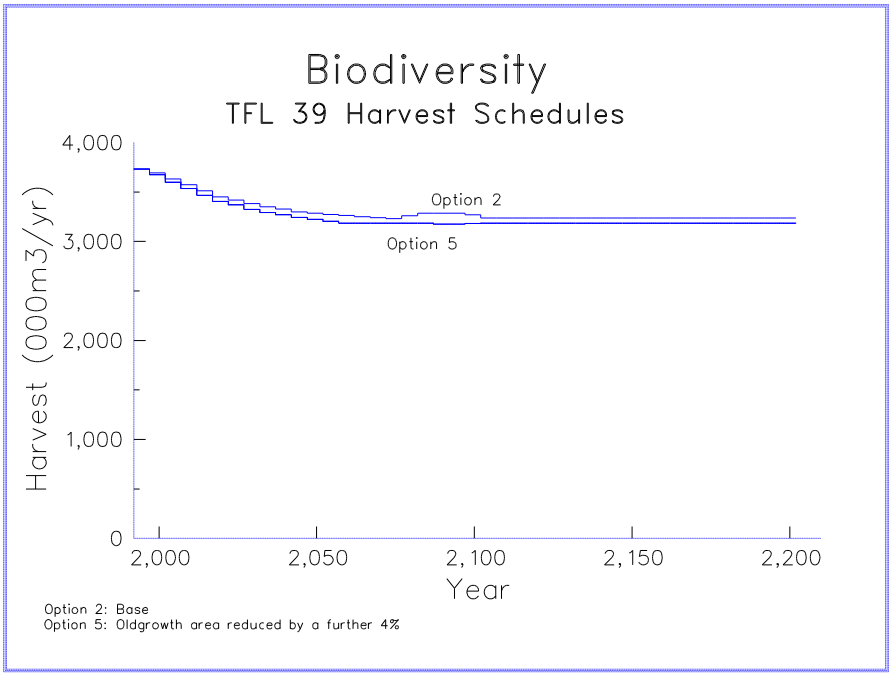
- The impacts and costs of visual landscape constraints can be high. MB encourages efforts to provide better information on the value of offsetting benefits.
- The costs can be particularly high in the medium term. These may be reduced substantially if a period of transition is allowed between the present forest structure (created without the recently implemented visual landscape constraints) and the desirable forest viewscapes.
- Relatively small differences in interpretation of operational guidelines for application in timber supply analysis can have a significant impact on harvest levels and, hence, on local communities. This is illustrated by a comparison of Options 2 and 3.

### *4.12 Reduction in Net Old-Growth Area and Volume for Biodiversity*

The net old-growth area and volume was reduced by a further 4% in Option 5 compared to Option 2. This option was requested by the Chief Forester as an additional allowance for biodiversity concerns.

The potential costs of the 4% reduction in old growth are illustrated here by examining differences between harvest schedules for Options 2 and 5. TFL harvest schedules are shown in Figure 4.12.1.

***FIGURE 4.12.1***




- For TFL 39 the 4% reduction in old growth results in a 51 000 $m^3$/year (1.6%) reduction in LRSY.

- Average economic impacts for the first 50 years and average economic costs are shown in Table 4.12.1.

***TABLE 4.12.1.*** **50-Year Economic Impact of Biodiversity Constraints, Option 5 Compared to Option 2**

| | **Average Annual Impacts (reductions) 1993 to 2042** |
|---|---|
| Harvest (000 $m^3$/year) | 41 |
| Jobs(1) | 197 |
| Wages and Salaries(1) ($000/year) | 7,874 |
| Government Revenues(1) ($000/year) | 3,245 |
| Sales Value ($000/year) | 8,740 |

| **Average Economic Costs ($000/year)** |
|---|
| 2,929 |

(1) These include both direct and indirect impacts.

- Because of their size, most of the harvest impacts occur in Block 2 in the Sayward and Campbell River area and in Block 6 (QCI). The greatest relative impact is in Block 7 as it is largely old-growth forest. At least 34 jobs and $1.5 million in labour income will be lost to the TFL 39 logging communities. The milling communities, such as Chemainus, Nanaimo and the lower mainland will also feel an impact. The annual economic cost is $335/ha reserved for biodiversity.

The annual benefits to biodiversity values of such additional reservations are estimated(1) to be $20/ha to $85/ha.

Furthermore, management for other resource values will ensure that additional areas of mature seral stages will be maintained and management activity will be dispersed throughout the forest:

- More than a third of the forest, almost all old growth, will not be harvested for various reasons.
- A substantial portion of the remaining working forest will be managed for visual landscape and other concerns on rotations of at least 90 years. This is approximately 14% of the total TFL 39 forest area in this analysis.
- Coast-harvest guidelines, particularly the greenup and rate-of-cut requirements will disperse harvest operations.

Finally, MB is committed to propose reserve status to any small areas of unique ecological significance as they are located.

## 4.2 Constraints Related to Harvesting the "Profile"

The order in which forest stands are harvested has a significant impact on the magnitude of the conversion return(2) . This is the amount available to pay the owner (mainly the Crown) for it's timber and the operator for his investment in logging equipment.

Historically, the best timber currently available, i.e., with the highest conversion return, has been harvested. This is economically rational behavior(3) that maximizes the return to the owner and society.

MB believes that the extensive margin of the forest will continue to expand so that all of the physically operable and administratively available timber in the TFL will become economic to harvest within the period of analysis. Furthermore, MB is confident that a 20-Year Logging Plan prepared every five years will confirm the availability of the forecast harvest schedule.

In the TSA for TFL 44 (July 1993), MB presented results of a case study of the Nahmint Watershed to estimate the potential impacts of logging the profile of the forest.

Cutting the "operability profile" in the Nahmint Watershed resulted in an average reduction of about $5/m$^3$ of harvest that would otherwise be available for stumpage and return to capital.

Extending this result to TFL 39, as a whole, leads to an estimated annual loss of $15 million.

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(1) See Economic Report, Section 5.0 for details.
(2) Conversion return = (log selling price - logging cost).
(3) For example, see Williams, D.H. 1993. *"Opportunity Costs of Ruling Defining the Timber Harvesting Landbase and Harvesting Order".*

There are very real administrative difficulties to implementation of a formal harvest profile policy. Administrative requirements and their interpretation alone could significantly impact harvest levels and, hence, benefits to society.

As a simple example, consider Options 7 and 8 (shown in Figure 4.31.1), which provide harvest schedules for landbases that exclude portions of the inventory profile for harvest methods and current economics. The results for these options portray the three classes of currently marginal, nonconventional and conventional as if they are separate forests, each managed for sustained yield, rather than as parts that contribute to a single sustained yield forest. Interpretation of these results in a harvest profile policy may inadvertently be costly to society.

Superimposing additional requirements for various cover class constraints and unexpected events (e.g., a study area moratorium, aboriginal land claims dispute, environmentalist disruptions, wildfire or windthrow) creates even more complexity.

Current practices, make it unnecessary to introduce a formal policy on harvesting the forest profile.

- MB has and continues to recognize community stability concerns in allocating the harvest between different geographic areas (different blocks).
- The guidelines and regulations already in effect are forcing dispersion of harvesting throughout the available areas within the TFL.
- MB is harvesting nonconventional and marginal timber types. The 20-Year Plan shows the distribution of harvest from the different classes.

MB recommends that no formal harvest profile policy be implemented, but undertakes to report progress in this regard in the Annual Report for the TFL.

## 4.3 Operable Landbase

### *4.31 Current Harvesting Economics*

The treatment of operability can be a significant issue in the estimation of LRSY and in the analysis that portrays the harvest pattern from today to the achievement of that LRSY.

Since the analysis is for a 200-year period, it follows that all stands available for harvesting during that period should be included in the analysis. The BC coast has a history of an ever-widening extensive forest margin. The ingenuity of the logging sector coupled with a continuing, real, long-term increase in old-growth log prices has conspired to render more and more of the forest economically accessible. There is no reason to suspect that these trends will be arrested given the demand for appearance grade logs and the lessening global supply.

MB believes that over the next 100+ years, all of the mature timber, physically safe to fell and extract without unacceptable environmental damage, will be economically available for harvest. The preparation of a 20-year operating plan at five-year intervals will confirm the continuing validity of the assumption.

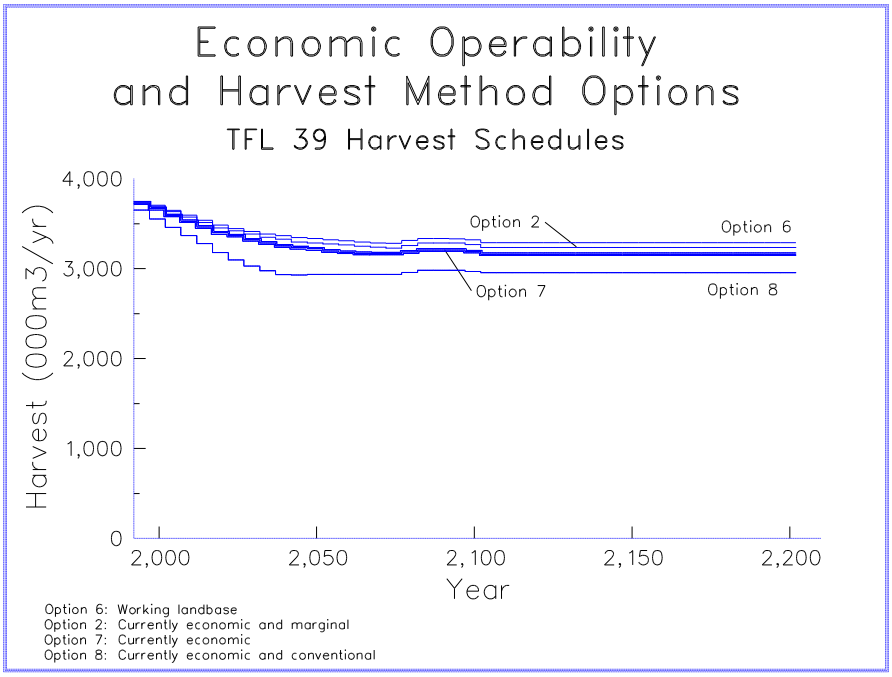
The MoF takes the position that only stands economically accessible during the last price cycle should be part of the landbase for which LRSY is calculated.

A comparison of Options 6 and 2 portrays the differences between MB and MoF views of operability for TFL 39.

In Option 6, old-growth areas classified as "currently uneconomic" are included in the net landbase. Harvest of these "currently uneconomic" stands is spread out over 100 years to simulate the long term opportunity for utilizing this timber according to market cycles and real price trends for quality old-growth timber.

In Option 2 , areas classified as "currently uneconomic" are excluded from the net landbase.

***FIGURE 4.31.1***




For the TFL, the "currently uneconomic" timber is only 3.5% of 1991 available old-growth volume and a similar percent of available area. The Option 6 harvest level gradually increases above that for Option 2 until LRSY is reached at 3 289 000 $m^3$/year, 1.6% (56 000 $m^3$/year) higher than that for Option 2.

Locally, the impact of assumptions on long-term economic operability can be more significant. For example, the relative impact is greatest in Block 7 as it has the highest proportion of old growth and the greatest proportion of old-growth volume (14.2%) that is classified as "currently uneconomic". For Block 7, adding the "currently uneconomic", increases LRSY by almost 15% . The transition to LRSY is more gradual, although the harvest rate drops slightly below LRSY (always higher than the Option 2 harvest schedule) for a period because the gradual harvest of the "currently uneconomic "areas delays the addition to available timber from the future managed forest.

As by definition a timber supply analysis examines long-term timber supply, it should incorporate assumptions that are consistent with this long term view. In this context the Option 6 (timber supply analysis) procedure for handling areas classified as "currently uneconomic" is appropriate.

### *4.32 Sensitivity to Changes in the Operable Landbase*

The results for Options 7 and 8 are useful for showing the sensitivity of harvest schedules to changes in the availability of old-growth timber. They support the TFL initial harvest levels over a substantial range of assumptions on the availability of old-growth timber. The TFL harvest schedules are shown in Figure 4.31.1

Option 7 excludes timber classified as currently marginal, reducing the TFL net available landbase and old-growth volume by 4.2% and 5.2% respectively compared to Option 2. The initial harvest level does not change, although the transition to LRSY is a little steeper in Option 7 (than Option 2) and the LRSY is lower by 3.3% or 76 000 $m^3$/year.

Option 8 excludes areas classified for nonconventional harvesting methods as well as currently marginal, reducing the TFL net available landbase and old-growth volume by 11.4% and 19.1% respectively compared to Option 2.

Note that areas classified as currently marginal or nonconventional, excluded in one or both of these optons, are being harvested and are included in the 20-Year Plan.

Lower initial harvest levels by a combined total of 80 000 $m^3$/year occur for Option 8 in Blocks 5 and 7 compared to Option 2. For both of these working circles the modeled adjacency constraint becomes limiting in the early periods of the harvest schedules. The TFL harvest schedule reduces at a maximum of 6%/decade towards LRSY indicating opportunities for reallocating harvest to the other working circles to retain the same initial harvest rate as Option 2 and not exceed a 10%/decade rate-of-change in TFL 39 harvest. The TFL LRSY is 281 000 $m^3$/year or 8.7% lower than that for Option 2. and Harvest levels close to LRSY are reached near 2038, 30 years earlier than occurs in Option 2.

Current old-growth volumes may be reduced by more than 19% and the corresponding available area by more than 11% without impacting TFL initial harvest levels. The allocation of harvest between working circles might be affected depending on the geographic location of the changes.

### *4.33 Major Reservations*

The MoF requested options to examine the impacts of four local landbase scenarios. All four include reductions in the net landbase available for timber management They are:

- The Yakoun Lake Basin in Block 6.
- The Yakoun River Corridor in Block 6.
- The Koeye Watershed in Block 7.
- The Lower Tsitika River in Block 2.

MB has added a fifth:

- The Lower Tsitika River plus adjacent areas (wings) draining directly to Johnstone Strait, but logically accessible through the Lower Tsitika in Block 2.

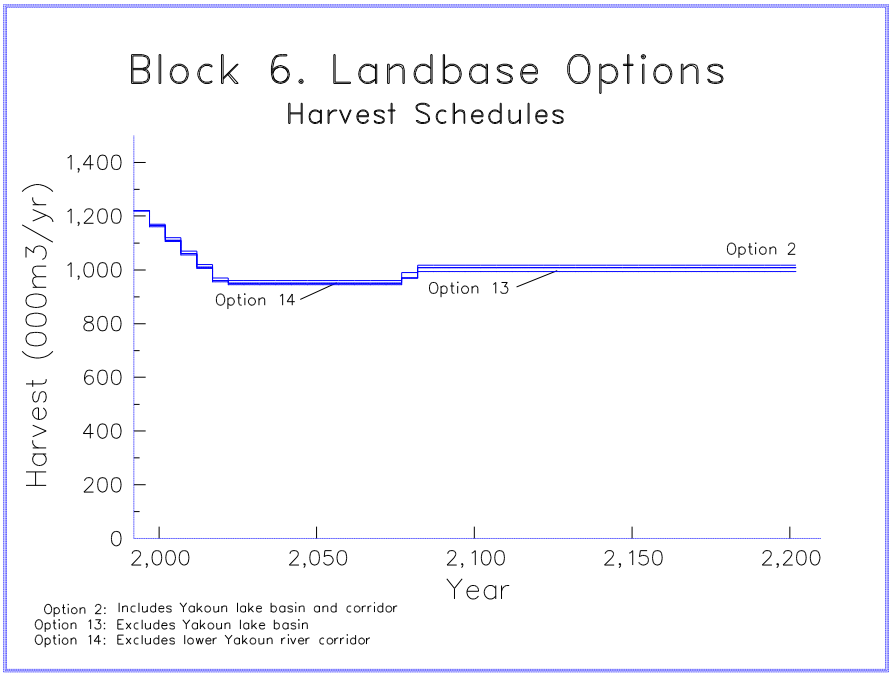
**Note that this report does not account for recent government decisions regarding protected areas on Vancouver Island. Also, we cannot forecast future decisions in this respect. As a consequence, the analysis presented below may be, or may become, redundant.**

### *4.33.1 Block 6: The Yakoun Lake Basin*

The Yakoun Lake Basin contributes 3 270 ha to the Block 6 area of land available for timber management in Option 2. It contains largely old-growth timber. However, a significant portion; 667 ha (20%) of this area is classified in the very restrictive retention VQO class for visual landscape management. This reduces the impact of this area on harvest schedules, particularly in the medium term. Harvest of this retention area is spread out over more than 350 years.

Block 6 harvest schedules for Options 2 and 13 (excludes the Yakoun Lake Basin) are shown in Figure 4.33.1.1. The Option 13 harvest schedule is generally 15 000 $m^3$/year less than Option 2 through to 2077 with the difference increasing to 24 000 $m^3$/year between LRSYs.

***FIGURE 4.33.1.1***



### *4.33.2 Block 6: The Yakoun River Corridor*

The smaller Yakoun River Corridor area has a greater impact on harvest levels relative to its size compared to the Yakoun Lake Basin. The Corridor contains land of above average site index and it is less constrained on average by visual quality cover class constraints. The net area of the corridor is 605 hectares or 18.5% of the 3270 hectares in the Lake basin. Yet the harvest impact of the corridor (difference between Options 2 and 14) is 10 000 $m^3$/year for much of the medium term compared to 15 000 $m^3$/year for the Lake basin (from the difference between Options 2 and 13) and the impact on LRSY is 9 000 $m^3$/year or 38% of the 24 000 $m^3$/year for the Lake Basin.

The Block 6 harvest schedule that excludes the Yakoun River Corridor (Option 14) is compared with Option 2 and Option 13 in Figure 4.33.1.1.

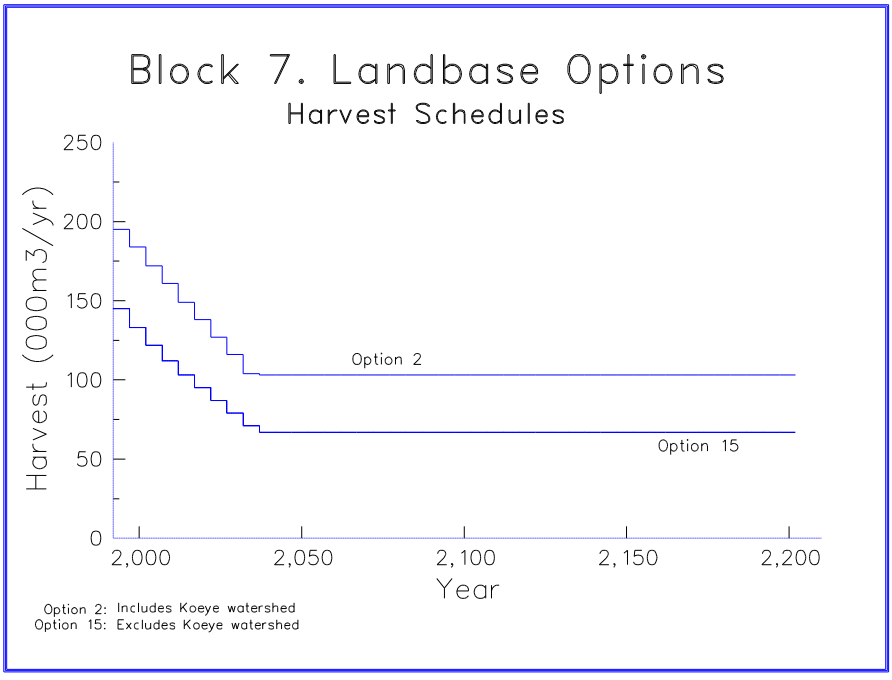
### *4.33.3 Block 7: The Koeye Watershed*

Figure 4.33.3.1 compares harvest schedules for Option 2 (includes the Koeye) and Option 15 which excludes the Koeye.

The Koeye Watershed contributes approximately one third of the net landbase and starting old-growth volume in Block 7, Option 2. Correspondingly, the LRSY for Option 15 at 67 000 $m^3$/year is 65% of that for the total Block 7 in Option 2.

The initial harvest level is reduced by 50 000 $m^3$/year to 145 000 $m^3$/year in Option 15 to meet the modeled adjacency constraint in the early years of the run and to show a regular decline in harvest level towards LRSY.

***FIGURE 4.33.3.1***

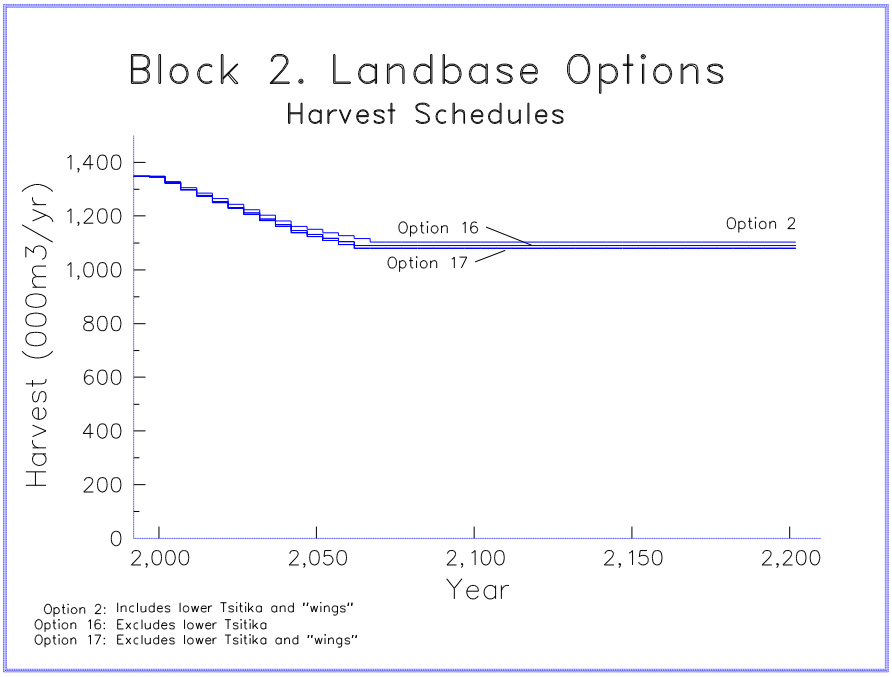


### *4.33.4 Block 2: The Lower Tsitika River*

The Lower Tsitika identified in the protected area strategy, includes this area and part of that identified as the "wings" in the following section.

The Lower Tsitika identified here amounts to 1 787 ha of the available landbase for Block 2 in Option 2. Most of this area is covered in old growth. A large part (962 ha or 55%) is classified as the restrictive partial retention VQO class contributing to a smaller impact than might be expected for this area on the Block 2 harvest schedule. The LRSY for Option 16 (excludes the Lower Tsitika) is 13 000 $m^3$/year less than that for Option 2.

***FIGURE 4.33.4.1***




### *4.33.5 Block 2: The Lower Tsitika River and Adjacent "Wings"*

The combined Lower Tsitika and adjacent wings contribute 3 577 ha to the available landbase for Block 2 in Option 2. Most of this area is covered with old growth. However, it is amongst the most constrained areas in Block 2 for harvest scheduling. The partial retention visual landscape class occurs on 55% of the net area removed in the Lower Tsitika (962 of 1766 ha) and on 100% of that removed in the wings (1 810 ha).

Consequently, the difference in harvest schedules is smaller than might otherwise be expected. This is particularly so in the medium term as in Option 2 the harvest of predominately old-growth timber in these partial retention areas is spread out over approximately 150 years. Over the first fifty years, the difference in harvest levels between Option 17 and Option 2 is 12 000 $m^3$/year while in the long-term harvest levels (LRSYs) are decreased by 23 000 $m^3$/year through removing the Lower Tsitika and adjacent wings (Option 17).

## 4.4 Silvicultural Practices

Variations in silvicultural assumptions have been examined for two reasons:

- To show the potential harvest volume gains from changes in silvicultural investment.
- To provide a sensitivity on silvicultural assumptions.

Option 2, and most other options analyzed, portray current silviculture (recent practices).

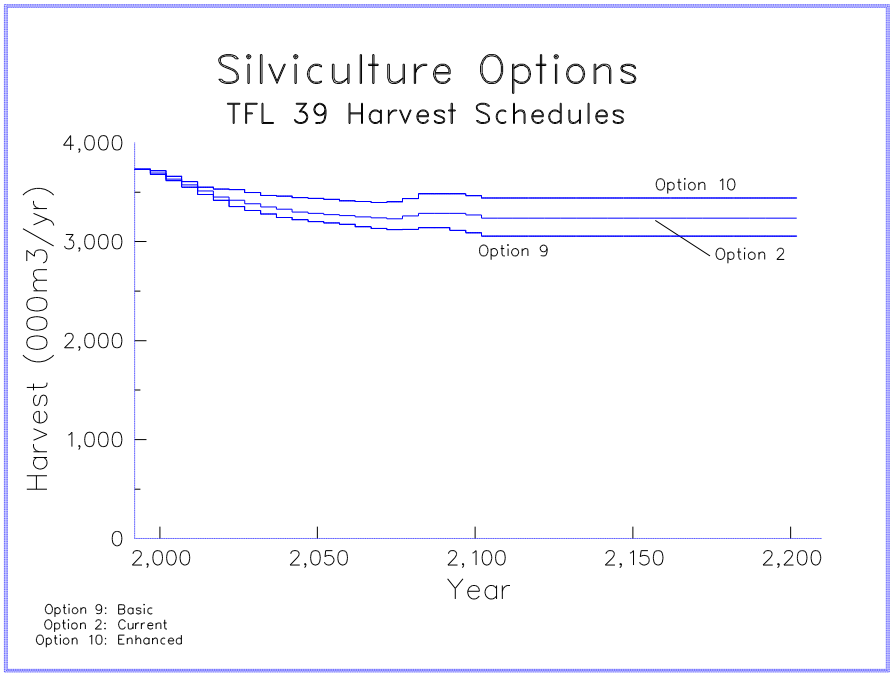
Options 9 and 10 portray less intensive and more intensive management respectively, relative to Option 2.

The main differences between the three scenarios are increasing levels of planting density and treatment for brush competition from Option 9 through Option 2 to Option 10. Option 9 excludes spacing of overstocked stands and conversion of deciduous to conifer. These occur in Option 2 and to a greater extent in Option 10.

In particular, early treatments that improve site occupancy (site preparation, planting and brush control) and reclamation of underutilized sites (e.g., deciduous areas) contribute most to increased growth of merchantable timber.

The TFL harvest schedules for the three options are shown in Figure 4.4.1.

***FIGURE 4.4.1***



Long-term impacts are more significant than short-term effects, as differences in harvests between silvicultural levels gradually increase until LRSYs are attained.

Option 9 (basic silviculture) has a TFL LRSY of 3 055 000 $m^3$/year, 181 000 $m^3$/year (5.6%) lower than that for Option 2. For Option 10 (enhanced silviculture), the TFL LRSY is 3 441 000 $m^3$/year or 205 000 $m^3$/year (6.3%) higher than for Option 2.

Results indicate that merchantable volume gains of around 5% are possible from increased reforestation activities and in better utilizing some sites. However, these harvest volume gains are not available for several decades. Also, much of the additional investment is unattractive economically. Many of the incremental activities on poorer sites yield benefits substantially below the cost outlays.

Results for the three options show that initial harvest levels are unaffected across the range of silvicultural assumptions. Again, this is largely because most of the impact is long term.

## 4.5 Yield Assumptions for Second and Third Forests

There are differences between MB yield projections and those of the MoF. On average MoF yields are higher for the hemlock species association (including hemlock, redcedar, true firs and Sitka spruce) and lower for Douglas-fir. It appears that the MoF, in the absence of local knowledge applies a greater reduction for operational factors. MB includes operational reductions at different stages in the yield projection process. For example, allowances are made for excessive brush competition (including that from salal) through the definition and allocation of regeneration models to the inventory. Further, MB has local information on unmapped non-productive areas.

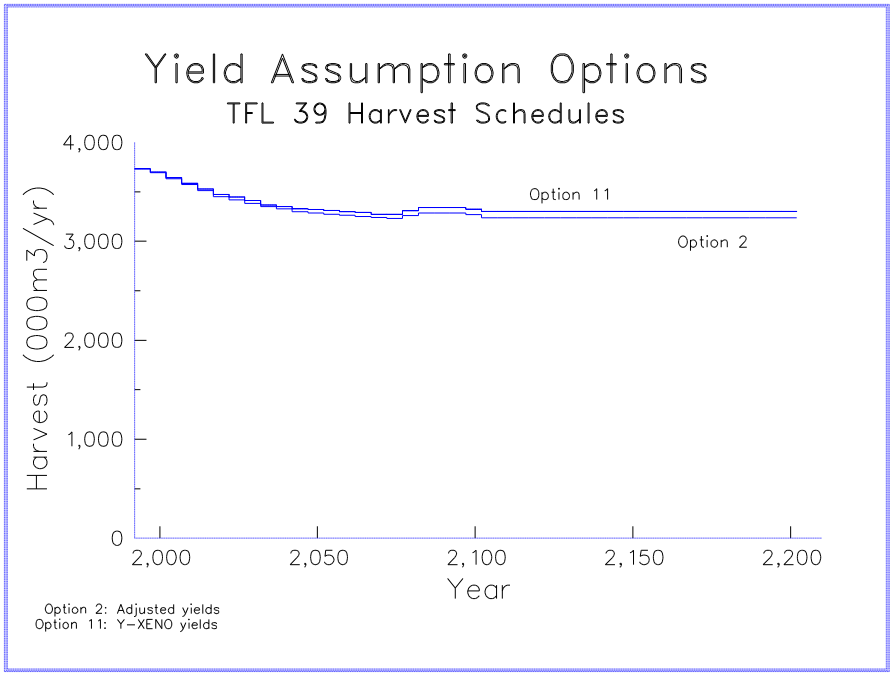
For Option 2 and most of the other options in this analysis, adjustments have been made to approximate MoF yield estimates. This includes a 10% yield reduction for forest types dominated by Douglas-fir, a 5% increase for hemlock association forest types and an additional 5% operational reduction allowance.

Option 11 yield projections were made without the Option 2 adjustments. TFL 39 harvest schedules for the two options are compared in Figure 4.5.1.

The impact of the yield changes on the TFL harvest schedule increases gradually over time, reaching a difference in LRSYs of 66 000 $m^3$/year (Option 11 is 2% higher than Option 2).

The main difference between the two sets of yield assumptions occurs in the Douglas-fir dominant forest types. These occur on only 12.2% of the available area within TFL 39, minimizing the impact of the different assumptions.

***FIGURE 4.5.1***




Douglas-fir dominant forest types are more prevalent in the southern working circles; Blocks 1 and 2. They occur on 35% of Block 1's available forest contributing to an Option 11 LRSY that is 33 000 $m^3$/year (6%) higher than that for Option 2. Most of the remaining difference between Options 11 and 2 occurs in Block 2 where 10% of the available forest area is in Douglas-fir dominant forest types resulting in the LRSY for Option 11 that is 24 000 $m^3$/year higher than that for Option 2.

In summary, the impacts of the differences in yield estimates are long term and they are relatively small because of the small percentage of Douglas-fir dominant forest types in TFL 39.

## 4.6 Estimates of Site Productivity

Site index curves developed for coastal species do not work in old stands (perhaps from age 120 years up). In these stands, many of the dominant trees have been suppressed for parts of their lives and ages are difficult to measure. When existing site index curves are used, the growth potential of the area is underestimated.

In young stands (generally, less than 20 years of age), the relationship between age and height is often unstable as the trees compete for light, water and nutrients. In very young stands, the trees many not have reached a sufficient height to register on the site index curve.

MB has developed a biophysical decision tree to improve site index estimates for strategic (forest level) analyses. This relates a known series of second growth site indices to biophysical site attributes, such as geographic location and elevation. Once the relationship is established, site index may be estimated for all stands in the forest, based on specific biophysical site factors.

MB has a large database of second-growth permanent sample plots and cruise plots as well as research plots established for this purpose. These have permitted the development, calibration and validation of the decision tree.

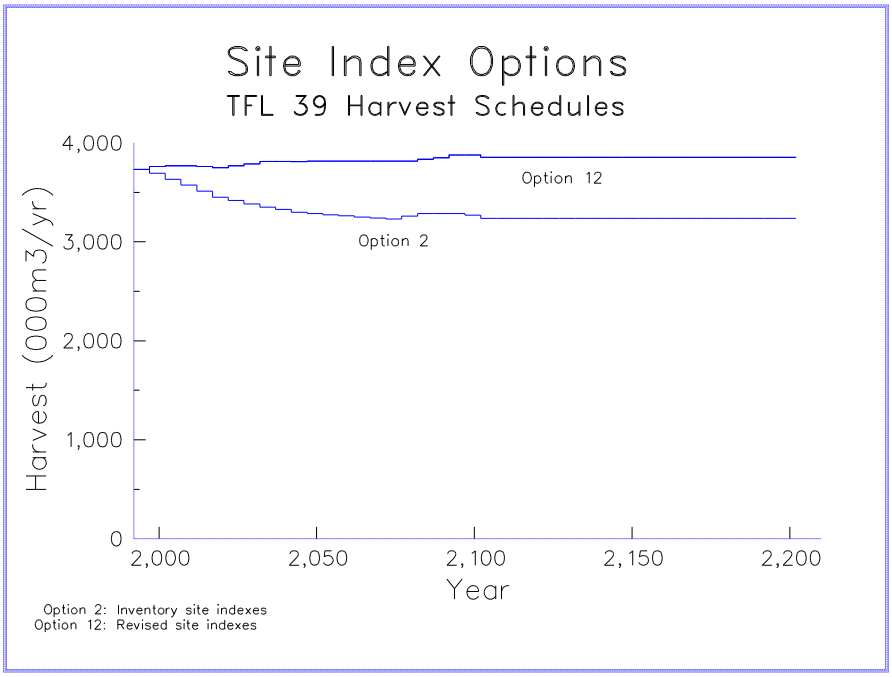
Option 12 incorporates the decision tree for estimates of site index applied to all stands except for recently measured second growth.

The resulting site indices are significantly higher on average than those in the inventory. For the TFL, the average increase in site index is 2.8 m with a range between working circles of 2.3 m to 4.4 m.

The increased site indices in Option 12 compared to Option 2 have two main impacts. The first is to increase volume estimates at a given age. The second is to reduce minimum harvest ages.

The TFL 39 harvest schedule increases gradually to a LRSY of 3 856 000 m³/year that is 3.3% higher than the initial harvest level and 19.2% higher than the LRSY for Option 2. Refer to Figure 4.6.1 compares of TFL 39 harvest schedules.

***FIGURE 4.6.1***




Within working circles, the greatest increase in LRSY occurs in Block 1 (26.1%) and in Block 5 (31.6%). For the other working circles, the increase ranges between 16% and 19%.

These results indicate that if these site productivity corrections are valid, there need be no long-term reduction in harvest as long as the landbase remains intact.

# 5.0 CONCLUSIONS

Comparison of the harvest schedule options in conjunction with their economic implications leads us to the following conclusions concerning the major issues:

- ❑ Integrated resource management constraints result in some 400 000 $m^3$/year of harvest forgone over the next 50 years. These constraints are in addition to those applied to retain the integrity and protect the productive potential of sensitive soils.

  - The annual cost of this forgone harvest is:

    ⇒ 2,000 jobs.

    ⇒ $82 million in wages.

    ⇒ $34 million in government revenue.

    ⇒ $91 million in annual sales.

  - A major portion of this cost involves constraints to maintain visual landscape quality, much of it in the Queen Charlotte Islands. The magnitude of the impact is sensitive to relatively small changes in interpretation of the visual quality standards. In comparison to the less restrictive interpretation of visual quality standards (portrayed in Option 4), the average impacts of more restrictive standards (Options 3 and 2) over the next 50 years are:

| | **Option 3** | **Option 2** |
|---|---|---|
| Annual harvest reduction | 146 000 m3 | 261 000 m3 |
| Job reduction | 701 | 1,246 |
| Wages and salaries forgone | $28 million/year | $50 million/year |
| Government revenues forgone | $12 million/year | $20 million/year |
| Sales value forgone | $31 million/year | $55 million/year |
| Economic cost | $9.4 million/year | $17.9 million/year |

  - Any further reductions in old growth availability for harvesting (e.g., to meet demands for non-timber resource outputs) cost society in proportion to the volume reserved:

    ⇒ Lost Government revenue of $85/$m^3$ not harvested.

    ⇒ Forgone economic activity of $230/$m^3$ not harvested.

    ⇒ Five jobs for every 1 000 $m^3$ not harvested.

- ❑ Because of the large proportion and quality of mature timber within the license area, the current definition of the landbase deemed "operable" is of relatively small consequence when distributing an AAC of the present magnitude. However, each hectare of productive forest removed from the landbase lowers the LRSY. MB believes that all physically and administratively available areas of old-growth

timber will be commercially accessible over 100+ years. In view of the 200-year horizon for the TSA, all areas accessible over that period should be included in the analysis.

- Revisions to silvicultural practices would have little or no impact on short-term harvest levels. Current practices already increase estimates of LRSY by 181 000 $m^3$/year over basic silvicultural requirements. An enhanced level of silviculture (as envisioned in Option 10) could result in a further LRSY increase of 205 000 $m^3$/year, but MB analysis shows that much of this would be achievable only at a cost in excess of the value of the growth gains.

- The potential impact of differences in yield model estimates of the second and third forests is long-term and only amounts to a LRSY change of 66 000 $m^3$/year (less than 2%).

- Evidence from a comparison of old-growth and second-growth plots in the same stands suggests that site productivity estimates are low. Correction could result in a gradual increase in harvest levels to a LRSY of 3 856 000 $m^3$/year (19.2% over the LRSY for Option 2). Thus, stability and even growth of economic opportunities available to communities dependent in part on TFL 39 could be expected in the future, provided other factors unconnected with the capacity to grow new forests do not prevent realization of this growth potential.

## 6.0 RECOMMENDED HARVEST

Analysis of the issues affecting harvest scheduling shows potential differences in the pattern of harvest. These schedules reach an estimated LRSY for the present landbase of between 3.2 million $m^3$/year and 3.9 million $m^3$/year with the current level of silvicultural investment. All of these harvest schedules use an initial harvest of 3.7 million $m^3$. The results are particularly robust, that is, they show little change in short-term harvest schedule consequent upon changes in the assumptions.

TFL 39 makes a significant contribution to the provincial economy as well as fuelling the economic engine of several forest-dependent communities along the BC coast.

In view of the future impact of recent, and still to be made, land use decisions on BC society and in particular, communities dependent upon TFL 39, we recommend (and the analysis supports ) an AAC(1) of 3.7 million $m^3$.

Adjustments may be necessary when the impact of land use changes has been evaluated.

(1) Coniferous area AAC only. An additional AAC for stands classified as deciduous will be developed separately.