

Kingcome Timber Supply Area Timber Supply Review

Data Package

June 2000



District Manager
Port McNeill Forest District



Director
Timber Supply Branch

Table of Contents

1. INTRODUCTION	1
2. CURRENT FOREST MANAGEMENT CONSIDERATIONS AND ISSUES.....	2
2.1 BASE CASE MANAGEMENT ASSUMPTIONS	2
2.2 STATEMENT OF MAJOR FOREST MANAGEMENT CONSIDERATIONS AND ISSUES	2
3. INVENTORIES.....	6
4. DIVISION OF THE AREA INTO MANAGEMENT ZONES.....	10
4.1 MANAGEMENT ZONES, GROUPS AND MULTIPLE OBJECTIVES	10
4.2 ANALYSIS UNITS.....	11
5. TIMBER HARVESTING LAND BASE DEFINITION	12
5.1 IDENTIFICATION OF THE TIMBER HARVESTING LAND BASE	12
5.2 DETAILS ON LAND BASE CLASSIFICATION	12
5.2.1 Land not administered by the British Columbia Forest Service for timber supply.....	12
5.2.2 Land classified as non-forest.....	12
5.2.3 Non-commercial cover	12
5.2.4 Environmentally sensitive areas.....	13
5.2.5 Inoperable areas	16
5.2.6 Sites with low timber growing potential.....	17
5.2.7 Unmerchantable forest types	17
5.2.8 Roads, trails and landings	18
5.2.9 Wildlife habitat reductions	19
5.2.10 Cultural heritage resource reductions	19
5.2.11 Riparian management	20
5.2.12 Exclusion of specific, geographically defined areas	20
5.2.13 Timber licence reversions	21
6. CURRENT FOREST MANAGEMENT ASSUMPTIONS	22
6.1 HARVESTING.....	22
6.1.1 Utilization levels.....	22
6.1.2 Volume exclusions for mixed species stands.....	22
6.1.3 Minimum harvestable age derivation.....	22
6.1.4 Silvicultural systems	23
6.2 UNSALVAGED LOSSES	24
6.3 SILVICULTURE.....	25
6.3.1 Regeneration activities in managed stands.....	25
6.3.2 Immature plantation history	26
6.3.3 Not satisfactorily restocked (NSR) areas	27
6.3.4 Rehabilitation areas.....	27
6.4 INTEGRATED RESOURCE MANAGEMENT	28
6.4.1 Forest cover requirements	28
7. SENSITIVITY ANALYSES	31

Table of Contents

Tables

TABLE 1.	MAJOR FOREST MANAGEMENT CONSIDERATIONS	2
TABLE 2.	INVENTORY INFORMATION.....	6
TABLE 3.	OBJECTIVES TO BE TRACKED	10
TABLE 4.	DEFINITION OF ANALYSIS UNITS	11
TABLE 5.	DESCRIPTION OF ENVIRONMENTALLY SENSITIVE AREAS	13
TABLE 6.	DESCRIPTION OF INOPERABLE AREAS	16
TABLE 7.	DESCRIPTION OF SITES WITH LOW TIMBER GROWING POTENTIAL	17
TABLE 8.	UNMERCHANTABLE FOREST TYPES CRITERIA	17
TABLE 9.	ESTIMATES FOR EXISTING AND FUTURE ROADS, TRAILS AND LANDINGS	18
TABLE 10.	ESTIMATES FOR WILDLIFE HABITAT REDUCTIONS TO THE TIMBER HARVESTING LAND BASE	19
TABLE 11.	EXCLUSION OF SPECIFIC, GEOGRAPHICALLY DEFINED AREAS	20
TABLE 12.	TIMBER LICENCE HARVEST SCHEDULE.....	21
TABLE 13.	UTILIZATION LEVELS.....	22
TABLE 14.	VOLUME EXCLUSIONS FOR MIXED SPECIES TYPES.....	22
TABLE 15.	MINIMUM STAND VOLUMES AND MINIMUM MEAN ANNUAL INCREMENT FOR DETERMINING MINIMUM HARVESTABLE AGE.....	23
TABLE 16.	SILVICULTURAL SYSTEMS	23
TABLE 17.	UNSALVAGED LOSSES	24
TABLE 18.	REGENERATION ASSUMPTIONS BY ANALYSIS UNIT	25
TABLE 19.	IMMATURE PLANTATION HISTORY	26
TABLE 20.	NOT SATISFACTORILY RESTOCKED (NSR) AREAS	27
TABLE 21.	REHABILITATION AREAS.....	27
TABLE 22A.	FOREST COVER REQUIREMENTS FOR CUTBLOCK ADJACENCY AND VISUAL VALUES.....	28
TABLE 22B.	FOREST COVER REQUIREMENTS — COMMUNITY WATERSHEDS	29
TABLE 22C.	FOREST COVER REQUIREMENTS — BIOGEOCLIMATIC UNITS AND NATURAL DISTURBANCE TYPES (NDTs) WITHIN THE KINGCOME TSA (APPLIED TO GROSS PRODUCTIVE FOREST BY LANDSCAPE UNIT).....	29
TABLE 23.	SENSITIVITY ISSUES	31

1. Introduction

The data package for the Timber Supply Review program is an organised and consistent format for supplying the basic inputs required for a timber supply analysis. It describes the data and assumptions used to define current management for the timber supply area. For the purpose of the timber supply review, "current management" is determined by:

- the current forest management regime;
- the productive forest land available for timber harvesting, the physical and economic constraints to harvesting, the harvesting systems, the silviculture treatments, and the integrated resource management guidelines used in the area;
- the standards used to approve or reject forest development plans;
- fully implemented land-use plans;
- land-use decisions approved by Cabinet;
- approved higher level plans under the *Forest Practices Code*; and,
- other approved B.C. Forest Service and joint agency forest management practices and policies.

Each section of this data package includes:

- a) a short explanation of the data required;
- b) a data table or list of assumptions; and,
- c) a description of the source of the data and other comments.

2. Current Forest Management Considerations and Issues

2.1 Base case management assumptions

The assumptions described in this section reflect current performance with respect to the status of forest land, forest management practices and knowledge of timber growth and yield. The harvest forecast developed from these assumptions is termed the base case harvest forecast and is used as a reference when examining the outcome of alternative scenarios and analysing the sensitivity to changes in key assumptions.

Varying degrees of uncertainty surround the many assumptions used in the base case. Uncertainties can be examined through sensitivity analysis, in which analysis assumptions are varied in order to identify inputs that significantly affect the timber supply forecasts. For example, if we were confident that yield estimates are within $\pm 10\%$ of actual values, sensitivity analyses would examine the timber supply impact of varying yield estimates up or down by 10%. Section 7, "Sensitivity Analyses," lists the uncertainties to be examined.

2.2 Statement of major forest management considerations and issues

The following table lists major forest management issues and considerations. Where possible, the issues will be assessed directly in the timber supply analysis. If the issue does not fall within the definition of current management as described in Section 1, the related timber supply impacts will be assessed in a sensitivity analysis. There may be significant uncertainties in defining some current management issues. In such cases, sensitivity analysis can assist in assessing the potential timber supply implications and assigning degrees of risk to timber supply during allowable annual cut determination.

Table 1. Major forest management considerations

Consideration/issues	Description
Economic and physical operability	<p>Operability mapping, completed in 1993, will be refined for use in the current Timber Supply Review (TSR). Based upon a preliminary assessment, there is some concern that the area that is operable under current and foreseeable economic conditions has diminished somewhat since the last TSR, particularly in areas with lower volumes/value and on steeper terrain. Geographic Information System (GIS) analysis of the harvest profile over the last five-year period will be used to examine this issue, and if needed, to derive operability adjustments.</p> <p>The increasing use of helicopter logging in the Kingcome TSA is a concern for the Port McNeill Forest District staff. Helicopter logging is an effective and appropriate logging method, however if used inappropriately, it may have some negative implications on timber supply by isolating stands of marginal quality.</p> <p>Additional GIS analysis and assessment of terrain and economic conditions will be used to define operability lines for low productivity cedar/cypress stands and alder stands (both currently available for harvesting under separate partitions to the annual allowable cut) within the TSA. Both forest types were not assessed as part of the 1993 operability mapping exercise.</p>

(continued)

2. Current Forest Management Considerations and Issues

Table 1. Major forest management considerations (continued)

Consideration/issues	Description
Forest inventory	<p>An audit of the Kingcome TSA forest inventory was conducted in 1995. The results of this assessment indicated the inventory overestimates current standing volume in mature stands by 18% in the operable land base, and 11% for all forested crown land. As a result, a new Vegetation Resource Inventory (VRI) was initiated for the TSA in 1996.</p> <p>Unfortunately the VRI has yet to be completed for the entire TSA. Consequently, the current analysis will use the new VRI for the southern portion (approximately 70%) of the TSA and the old inventory for the remaining portion.</p> <p>The usefulness of the 1995 audit sampling for assessing the accuracy of the old inventory of the northern portion is limited by a very small number of samples. However, a comparison of the new VRI and old inventory for the southern part of the TSA will provide additional information on the accuracy of the old inventory data for the northern portion.</p>
Stand and landscape biodiversity	<p>Biodiversity management at the stand level (wildlife tree patches) has been ongoing in the TSA since the last timber supply analysis. Licensees are currently making the transition from interim wildlife tree patch (WTP) targets to those recommended in the <i>Landscape Unit Planning Guide</i>. Some uncertainty exists regarding the actual timber supply impact of WTP management due to the transitional nature of WTP implementation over the past several years. This uncertainty is further increased by the growing use of retention systems (i.e., non-clearcut) by TSA licensees.</p> <p>Draft biodiversity emphasis options (BEOs) and landscape unit (LU) boundaries have been developed, but landscape-level management has yet to be formally implemented on the TSA. Current plans include legal establishment of targets for old-growth retention in all landscape units by 2002. Since LUs and BEOs are still draft, landscape-level biodiversity management will be modelled using weighted average old-seral forest cover requirements. Timber supply impacts of specific draft BEOs and LUs will be tested in a sensitivity analysis.</p>
Terrain stability	<p>Terrain stability remains a major issue in the TSA. A review conducted for the last TSR suggested that areas of unstable terrain are significantly underestimated in the forest inventory. Additional study of this issue was requested by the chief forester in the annual allowable cut (AAC) rationale document and is being conducted by forest district staff in preparation for this TSR. Actual terrain stability overview mapping for the TSA could not be conducted due to lack of inventory funds.</p>

(continued)

2. Current Forest Management Considerations and Issues

Table 1. Major forest management considerations (continued)

Consideration/issues	Description
Visual quality	<p>Management for visual quality is a major issue in the TSA, given the large amount of coastline and ever increasing recreation and tourism in the area. The district has recently made its scenic area 'known' under the <i>Forest Practices Code</i>. Some of the more remote, and less frequently visited portions of the TSA have not been included in this known scenic area, in attempt to mitigate the impact of visual management on timber supply. The district is seeking feedback on the current known scenic area through the <i>Central Coast Land and Coastal Resource Management Plan</i> process. Visual Quality Objectives (VQOs) have yet to be formally established; however, licensees currently meet Recommended Visual Quality Classes (RVQCs) voluntarily.</p>
Wildlife habitat	<p>In the last TSR, 2308 hectares were netted out of the land base for wildlife management, primarily for ungulates. A review of these areas by the Ministry of Forests (MoF), the Ministry of Environment, Lands and Parks (MELP) and forest licensees is currently ongoing under Section 69 of the <i>Operational Planning Regulation</i> with the intent of designating ungulate winter ranges (UWR), where deemed necessary. Since this review is incomplete, existing environmentally sensitive area information will be used for the analysis (see Section 5.2.4).</p> <p>Since the last TSR, government has announced the <i>Identified Wildlife Management Strategy</i> (IWMS). Implementation is underway, however no wildlife habitat areas (WHA) have been established to date in the TSA. Therefore, potential management under the IWMS will not be included, unless WHAs are established prior to initiation of the analysis. As part of the IWMS, timber supply impacts of its implementation are capped at 1% within each forest district.</p> <p>Grizzly bear management is a major issue in the mainland portion of the TSA. The CCLCRMP may provide some additional direction on management constraints for grizzly bears. If so, this will be incorporated into future timber supply analyses.</p>
Community watersheds	<p>Two community watersheds are located within the Kingcome TSA: the Tsulquate River (4500 hectares — District of Port Hardy), and Quaae/N.Quaae Creeks (410 hectares — Tsawataineuk First Nation). The total area of operable mature timber in these drainages is approximately 1000 hectares. Community watershed management requirements of the <i>Forest Practices Code</i> will be modelled for these areas.</p>

(continued)

2. Current Forest Management Considerations and Issues

Table 1. Major forest management considerations (concluded)

Consideration/issues	Description
Central Coast Land and Coastal Resource Management Plan (CCLCRMP)	<p>The CCLCRMP is presently under development. This planning process is considering additional protected areas for the mainland portion of the TSA. Several areas are currently deferred from development as cabinet declared "Study Areas". Due to a delay in the completion of the CCLCRMP process, these deferrals are causing additional pressures on short-term timber supply as licensees try to harvest the full AAC from a smaller land base.</p> <p>Timber supply impacts of the Study Areas will be tested in a sensitivity analysis. Timber supply impacts of other land use zones created by the CCLCRMP will be incorporated into future timber supply analyses.</p>
Vancouver Island Land Use Plan (VILUP)	<p>The VILUP created several new protected areas on Vancouver Island, however only one of these is located within the Kingcome TSA. An extension to Cape Scott Park removed approximately 900 hectares of timber harvesting land base (THLB) from the TSA. This area has been removed from the provincial forest and will not be included in the timber harvesting land base for this timber supply analysis.</p> <p>In addition to the new parks outlined above, proposed resource management zones including, Special Management Zones (SMZs) were created under the VILUP in the Kingcome TSA. Forest management practices in SMZs are more constrained than in other areas. In the case of SMZs in the Kingcome TSA, these constraints are related primarily to visual management (linked to recreation and tourism activities) and biodiversity values.</p>
Low site forest harvest opportunity	<p>The apportionment for the Kingcome TSA currently includes 130 000 m³ of AAC partitioned for harvest of "low productivity sites". Of this volume, 86 383 m³ has been allocated to a non-replaceable forest licence, with the remaining volume allocated proportionately among replaceable licence holders. As part of the review of operability mapping by district staff, the amount of low site area reasonably believed to be physically and economically suitable for harvesting will be quantified.</p>
Green-up age	<p>The timber supply in the Kingcome TSA projected in the last TSR was extremely sensitive to changes in green-up age. Green-up age is influenced by several factors, including regeneration delay and the rate that regenerating forests grow. Regeneration delay can be reduced through prompt reforestation and reduced reliance on natural regeneration (in favour of tree planting). Availability of better site index estimates should assist with more accurate predictions of growth rates in this timber supply analysis.</p>
Riparian management	<p>The Kingcome TSA, like other coastal management units, contains a substantial network of freshwater streams, lakes and rivers, many of which provide valuable habitat for freshwater and anadromous fish species. The analysis will reflect the specific measures required by the <i>Forest Practices Code</i> to maintain water quality and fisheries values.</p>

3. Inventories

The inventories to be used in determining the timber harvesting land base and representing forest management activities are listed in Table 2.

Table 2. *Inventory information*

Data	Source	Vintage	Update/re-inventory	Scale
Forest cover	MoF	VRI — 1996-97 FC1 — 1969, 71, 74	South re-inventoried 1996-97 North updated to Nov. 1993	1:20 000
Operability mapping	MoF	1993	2000	1:20 000
Biogeoclimatic classification	MoF	1987	1994	1:250 000
Draft landscape units	MoF	1997	South (VILUP area) — 1999	1:50 000
Visual landscape inventory	MoF	1994-95	1999-2000	1:50 000
ESA mapping	MoF	1978	None	1:20 000
Community watersheds	BCE	1995	None	1:50 000

Data source and comments:

Forest cover

The forest cover inventory was completed for the entire TSA between 1966 and 1974. This inventory was digitally updated in 1994 in preparation for the last TSR to account for timber harvesting and natural disturbances that occurred prior to November 1993. In 1996 a new Vegetation Resources Inventory (VRI) was initiated for the TSA. The VRI has been completed for the southern half of the TSA (mapsheets 102I, 92L, 92N and 92K except the Klinaklini supply block). Digital forest cover and data files for this area are presently being prepared. This timber supply analysis will use the old (FC1) forest cover inventory for the remainder of the TSA (northern portion). Work is ongoing on the VRI; it is hoped that it will be completed for the entire TSA (excluding the Klinaklini supply block) within the next two years. For this timber supply analysis, all files (VRI and FC1) will be updated to reflect recent harvesting. Given time constraints, these updates will be done using cutblock maps produced from satellite imagery and information summarised from the Integrated Silviculture Information System (ISIS) and Major Licensee Silviculture Information System (MLSIS) records.

An audit of the Kingcome TSA forest inventory (FC1) was conducted by Resources Inventory Branch in 1995. The results of this audit indicated that the inventory overestimated overall standing mature volume (over 60 years) by 18% in the operable land base and 11% for all mature forested crown land. This information was presented to the chief forester in the last TSR and was considered as a significant downward pressure on the AAC. It was hoped that the new VRI would be available for the current TSR, thereby reducing or eliminating the inaccuracy problems of the old inventory. Unfortunately, the VRI could not be completed for the entire TSA area. Also, the usefulness of the 1995 audit sampling for adjusting estimates in the remaining FC1 inventory is limited due to the very small number of samples in that area. Therefore, to provide additional information on the accuracy of the old inventory, volume estimates from the new VRI will be compared to volume estimates from the old FC1 over the same areas. The results of this comparison, together with the audit data will be used to estimate the degree to which volumes may be overstated in the old FC1 inventory for the northern part of the TSA.

3. Inventories

Site productivity

In the last TSR, the chief forester also considered uncertainty arising from a potential underestimation of site productivity calculations. While no specific research had been conducted on the Kingcome TSA, data collected within a local Tree Farm Licence (TFL) was used to estimate that the inventory underestimated site index in the Kingcome TSA by as much as 4 metres. Additional research has since been conducted as part of the Old Growth Site Index (OGSI) project to further verify the degree of underestimation and appropriate level of adjustments. These adjustments can have a significant positive influence on timber supply. This timber supply analysis will test the implications of the OGSI research through a sensitivity analysis.

Operability mapping

Areas inside the TSA, which are feasible to harvest from an economic or physical standpoint based on current management practices are considered operable. The current operability mapping was completed in 1993 by the Port McNeill Forest District staff in consultation with forest licensees operating in the TSA. Operability classes were assigned to delineate areas that are considered operable (A) and inoperable (I). Some remote or isolated areas were not classified (N). Factors considered in the classification are as follows:

- tree species' economic operability (excluding deciduous and non-merchantable conifers);
- tree height (generally excluding mature stands < height class 3);
- stand volume (generally excluding mature stands < 350 cubic metres per hectare); and,
- potential for helicopter harvesting.

Work is currently underway at the district and regional office to compare the 1993 operability mapping against harvested areas, forest cover information, and TRIM elevation and slope information to determine trends in the types of forest and terrain that has been harvested over the past five-year period. This current harvest profile will then be compared to the profile of remaining unharvested areas within the TSA. If this comparison indicates no harvesting has occurred in areas with certain forest cover or terrain characteristics that are inside current operability lines, adjustments may be made to exclude these areas from the land base. Similarly, if significant harvesting has been occurring within areas currently considered inoperable, these areas will be added to the operable land base.

The Port McNeill Forest District staff anticipate that the harvest profile analysis will reveal trends that may result in the exclusion of some stands on steeper slope and/or at higher elevations and potentially some stands of lower quality or volume, particularly in hemlock/balsam types. A recent random sample of cruise information on 44 cutblocks within the TSA identified only one harvested stand with a net merchantable volume less than 400 cubic metres per hectare and four harvested stands with volumes between 401-450 cubic metres per hectare. A minimum operable volume of 350 cubic metres per hectare was assumed in the last TSR. The full review of harvest blocks will indicate whether or not the minimum harvest volumes should be adjusted—see Section 6.1.3, "Minimum harvestable age derivation."

3. Inventories

A substantial increase in the use of helicopter logging in the TSA is becoming a concern for forest district staff. While helicopter logging is an appropriate and highly effective means of harvesting timber in certain circumstances, district staff believe that its inappropriate use may have the side effect of economically isolating adjacent areas of marginal quality timber. Given the high cost of helicopter logging, currently it tends to be used to remove higher value and/or volume stands. If the area in question was able to be harvested by conventional logging systems, this higher value timber could have helped to offset the cost of road construction as well as the cost of harvesting the poorer quality timber. The end result of accessing an area for using conventional harvesting systems may be that a larger economic harvest unit is available, compared to what might be economic to helicopter logging. An audit by district staff of 50 TSA cutblocks approved since 1995 showed that 27% of the harvested area had been logged using helicopters. The increase in use of helicopters is due in part to the fact that logging is increasing on steeper terrain. Implementation of retention silviculture systems and managing for visual quality will also contribute to more helicopter use. Potential impact of the increased use of helicopter logging will be tested in a sensitivity analysis.

The operability profile analysis will also specifically examine recent harvesting by Shushartie Log Sales, whose operations are restricted to low productivity cedar/cypress stands in the TSA. These types of stands have historically been considered as inoperable in the TSA. Other licensees are also harvesting these types of areas, however, this constitutes a very small proportion of their total harvest volume (generally less than 5%). The profile analysis will attempt to characterise the nature of these low productivity stands, using forest inventory attributes (species, site index, and volume), so that this profile of stands can be added to the operable land base for this analysis. Historically, mapping of these marginal areas has been difficult, because the forest inventory does not stratify small 'microtypes' of better quality timber located within extensive areas of poor quality. Examination of low site operability is discussed further in Section 5.2.5, "Inoperable areas."

As with low site coniferous areas, the 1993 operability mapping for the TSA did not consider and incorporate potential alder harvest areas. Additional analysis will be conducted by forest district staff prior to the timber supply analysis to identify the areas of potentially operable alder.

Draft landscape unit boundaries

Draft landscape unit (LU) boundaries were delineated through the October 31, 1997 *Regional Landscape Unit Planning Strategy* (RLUPS), and are based on 1:50,000 TRIM mapping. The LUs on Vancouver Island were subsequently revised as a part of the July 15, 1999 RLUPS review. While the Vancouver Island LU boundaries have not been formally approved, they are unlikely to change. However, the draft LUs on the mainland portion of the TSA will be revisited in conjunction with or after the completion of the CCLCRMP process and could change as a result.

Visual landscape inventory

The visual landscape inventory was initially captured on hard copy paper maps during 1994-95. In 1997 the inventory was then transferred into digital format and updated to meet revised Recreation Branch standards. A new visual landscape inventory was initiated in 1998 and has recently been completed. This new visual landscape inventory will be used in the timber supply analysis.

3. Inventories

Environmentally sensitive areas mapping

Some forest lands are environmentally sensitive and/or significantly valuable for other resources. Environmentally Sensitive Area (ESA) mapping was completed in 1978 for the Kingcome TSA and incorporated into the forest cover inventory file. The forest cover inventory uses a specific labelling system containing the following categories of ESA: fragile or unstable soils (Es), forest regeneration problems (Ep), snow avalanche (Ea), recreation (Er), wildlife (Ew) and water (Eh). In most cases, two ESA categories are recognised: highly sensitive (1) and moderately sensitive (2). Other inventory methods, such as detailed terrain survey mapping are also utilised to identify areas which require management that may exclude or reduce their contribution to the timber harvesting land base. A combination of forest cover inventory ESAs and ESAs identified through other inventory methods has been used to identify environmentally sensitive areas for the current TSR.

Work is ongoing by forest district staff, in conjunction with forest licensees to improve upon mapping of soils related ESAs. Additional details on this work, and how it may be used in analysis are discussed in Section 5.2.4, "Environmentally sensitive areas." The management of water related ESAs (Eh) will be represented in the current TSR using the community watersheds, as described below.

Community watersheds

Two community watersheds are located within the Kingcome TSA: the Tsulquate River (4500 hectares — District of Port Hardy), and Quaae/N.Quaae Creeks (410 hectares — Tsawataineuk First Nation). The total area of operable mature timber in these drainages is approximately 1000 hectares.

4. Division of the Area into Management Zones

4.1 Management zones, groups and multiple objectives

Management zones represent areas with distinct management emphasis. For example, a zone may be based on a harvesting system, silviculture system, visual quality objective, or wildlife consideration. Sometimes one area of forest is subject to more than one management objective. For simulation modelling, a "group" function enables application of overlapping constraints. The timber supply analyst will decide whether to put an objective into a group or a mutually exclusive management zone after data assessment. In addition, the non-contributing forest (land considered unavailable for timber harvesting) may be included for consideration in attaining forest cover objectives.

Table 3. Objectives to be tracked

Group	Objectives	Comment
1	"Known" Scenic Areas Known scenic areas with RVQC ^a = Retention Known scenic areas with RVQC = Partial retention Known scenic areas with RVQC = Modification All other areas	Application of recommended visual quality classes to scenic areas that have been made known by the forest district manager. Basic constraints for cutblock adjacency will be applied to areas outside of known scenic areas.
2	Visual areas Visual areas with RVQC = Retention Visual areas with RVQC = Partial retention Visual areas with RVQC = Modification All other areas	Application of recommended visual quality classes to all visual areas identified in the visual landscape inventory.
3	Draft landscape units and biogeoclimatic variant	Draft landscape unit number as indicated on mapping.
4	Community watersheds	Limit rate of harvesting in community watershed areas.
5	<i>Vancouver Island Land Use Plan</i>	<i>Vancouver Island Land Use Plan</i> , including enhanced forest zones and special management zones.
6	Protected areas strategy	CCLCRMP protected areas strategy study areas.
7	Operable — low site land base	Operable low site areas (conifer) defined through the review of operability mapping.

(a) RVQC = Recommended visual quality classes.

4. Division of the Area into Management Zones

4.2 Analysis units

An analysis unit represents areas dominated by stands of specific tree species with a specific timber growing capability, as indicated by the inventory type group and site index in the forest inventory file, or stand types subject to a particular silvicultural regime. Each analysis unit is assigned its own timber volume projections (yield tables) for existing and future stands. In the Kingcome TSA, cedar (*Thuja plicata* + *Chamaecyparis nootkatensis*), sitka spruce (*Picea sitchensis*) and hemlock (*Tsuga heterophylla* + *Tsuga mertensiana*) stands are grouped into analysis units on the basis of leading species and site index class. The criteria for dividing stands into analysis units are shown in Table 4.

Table 4. Definition of analysis units

No.	Analysis unit	Species	Inventory type groups	Site index range ^a
1	Cedar – good	Cw / Cy	9 – 11	SI ≥ 20
2	Cedar – medium	Cw / Cy	9 – 11	20 > SI ≥ 15
3	Cedar – poor	Cw / Cy	9 – 11	SI < 15
4	Hemlock/balsam – good	Hw	12 – 20	SI ≥ 25
5	Hemlock/balsam – medium	Hw	12 – 20	25 > SI ≥ 20
6	Hemlock/balsam – poor	Hw	12 – 20	SI < 20
7	Spruce/fir – all	S / Fd	1 – 8, 21 – 26	—
8	Alder	Dr	37 – 38	—

(a) Sites index reference age is 50 years at breast height.

Data source and comments:

Site index was used to classify cedar and hemlock stands into productivity groups as indicated in Table 4. These ranges were set to divide the operable area of the inventory types into relatively equal sized units. The small amount of spruce and Douglas-fir in the timber harvesting land base will be combined into a single analysis unit. Pine, cottonwood and other species are excluded from the timber harvesting land base (see Section 5.2.7, "Unmerchantable forest types"). The site index ranges used in Table 4 to classify the relative capability of each analysis unit may be revised once the timber harvesting land base has been finalised.

5. Timber Harvesting Land Base Definition

5.1 Identification of the timber harvesting land base

The timber harvesting land base for the Kingcome TSA will be determined by separating out various categories of land that do not contribute to the timber supply of the TSA. This section outlines the steps used to identify the timber harvesting land base within the TSA.

Land may be unavailable for timber harvesting for three principle reasons:

- it is not administered by the British Columbia Forest Service for timber supply (e.g., private land, parks);
- it is not suitable for timber production (e.g., non-forest, non-productive forest); and,
- it is required for other forest values (e.g., recreation areas, riparian management areas).

Land may also be added to the timber harvesting land base:

- by management activities which improve productivity or operability (e.g., the stocking of land currently classified as non-commercial brush);
- by the addition of productive forest land into the TSA (e.g., timber licence reversions).

The classification of "unavailable for timber harvesting" will apply only to land where no harvesting is anticipated to occur. Any area in which some timber harvesting will occur will remain in the timber harvesting land base, even if the area is subject to stringent constraints. Any such constraints will be reflected in the analysis.

Once all lands that do not contribute to the timber harvesting land base have been identified, additional lands will be added to the land base (e.g., areas classified as not satisfactorily restocked that have been reforested). The resulting productive forest land base will define the "current timber harvesting land base" for the TSA.

5.2 Details on land base classification

5.2.1 Land not administered by the British Columbia Forest Service for timber supply

Ownership codes included in the forest inventory file are used to identify whether or not land contributes to the timber supply for the TSA. Ownership codes 61C, 62C and 69C denote Crown land in a UREP reserve, forest management unit and miscellaneous reserve, respectively. These are generally the only ownership codes that are considered to contribute to the TSA timber supply. Timber licence area — ownership code 70N — is not administered by the crown until it has been harvested and reverted to the crown. The reversion rate for timber licences in the Kingcome TSA is described further under Section 5.2.13, "Timber licence reversions." Areas with other ownership codes will be removed from the timber harvesting land base.

5.2.2 Land classified as non-forest

Lands labelled as inventory type identity 6 (non-forest, alpine forest, lakes, rocks, etc.) and inventory type identity 8 (untyped) will be excluded from the timber harvesting land base.

5.2.3 Non-commercial cover

Lands labelled with inventory type identity 5 are areas occupied by non-commercial brush species. These areas are considered unlikely to support timber production and will be excluded from the timber harvesting land base.

5. Timber Harvesting Land Base Definition

5.2.4 Environmentally sensitive areas

As described in Section 3, ESA mapping is a component of the forest cover inventory for the Kingcome TSA. This ESA mapping was completed in 1978 for a variety of non-timber values. In some cases, this ESA mapping remains the best available information on a particular resource value or feature and will be used in this timber supply analysis. In other cases, as outlined below, additional information has been acquired and will be used in place of the original ESA mapping.

For the timber supply analysis, there are two strategies for accounting for ESAs — per cent area reductions, and specific evaluation of individual ESA polygons for harvesting opportunity. In this case, per cent area reductions will be used. The percentage reductions to be applied to particular ESAs are outlined in Table 5. Generally speaking, the higher the value or sensitivity of the ESA, the higher per cent reduction that is applied.

Table 5. Description of environmentally sensitive areas

ESA category	ESA description	Reduction per cent (%)
Terrain stability class V	High likelihood of landslide initiation following timber harvesting or road construction.	80
Terrain stability class IV	Moderate likelihood of landslide initiation following timber harvesting or road construction.	20
R1	Recreation — high sensitivity	100
R2	Recreation — moderate sensitivity	50
W1	Wildlife habitat — high value	100
W2	Wildlife habitat — moderate value	50
P1 or P2	Difficult regeneration	100
A1	Avalanche buffer	100
H1 or H2	Watershed values	N/A

Data source and comments:

Terrain class IV and V

During the last TSR, the 1978 ESA mapping for areas of sensitive terrain was found to have some limitations. In particular, no areas of moderately sensitive terrain (Es2) had been mapped. District staff conducted a study of detailed terrain stability mapping to attempt to quantify the potential problem. That study indicated that while there appeared to be only a slight underestimation of Class V areas (Es1), a large area (up to 20 000 hectares of operable forest) of potential Class IV (Es2) area had not been identified. This information was accepted by the chief forester as representing a significant downward pressure on timber supply. The chief forester subsequently requested that terrain stability mapping for the TSA be re-visited and improved prior to the next TSR.

5. Timber Harvesting Land Base Definition

Due to funding constraints, the forest district has been unable to conduct a terrain overview assessment of the TSA in order to improve the sensitive soils mapping. Therefore, in order to fulfil the chief forester's request for better information, an alternate approach was required. A GIS analysis is being conducted to overlay terrain stability overview assessments (where available) and mapped of slope classes. Analysis will then be conducted to determine if there are any correlations between areas of unstable terrain and specific slope classes. If so, these findings will be extrapolated to other parts of the TSA where conditions are similar. The findings of this terrain analysis will then be incorporated into the timber supply analysis, and used with or in place of the original ESA mapping.

Terrain assessment overview mapping occurs over large geographic areas such as watersheds and is done at smaller map scales, primarily through photo interpretation and aerial reconnaissance. Highly unstable areas are more easily detected and reliably mapped than moderately unstable areas. Prior to the harvest of a cutblock, detailed terrain assessments must be completed if harvesting is proposed in areas that are potentially unstable. These assessments involve considerable ground reconnaissance and are more precise as a result. A limited amount of harvesting opportunity (i.e., stable ground) is generally found within the Terrain Class V areas identified on the overview mapping. Forest district staff believe that an 80% netdown is appropriate for these areas. For Terrain Class IV areas, a 20% netdown is believed to appropriately reflect the land base constraint at the operational level. Generally, these areas represent significant obstacles to road construction, but constraints to harvesting are limited.

Er (recreation)

The Er category identifies areas having significant value for recreational activities. Initially, Er mapping also identified areas of outstanding landscape (visual) features, however this component of the Er mapping has since been captured within the visual landscape inventory.

Recreational features are defined as a physical, biological, cultural or historic aspect of an area making it attractive for actual or potential recreational use. Only features of exceptional quality, uniqueness and availability having recreational, educational, scientific or heritage value were considered for Er designation.

A recreation features inventory is nearing completion and will update and enhance the recreation (Er) mapping. A digital version of this new inventory will not be accessible in time for incorporation into this timber supply analysis however. As a result, Er mapping will be utilised to reflect the current management in the TSA. Harvesting of high value recreation areas (Er1) is likely to be severely limited, therefore a 100% netdown will be applied. A 50% netdown will be assumed for Er2 areas. Similar assumptions were used in the previous TSR.

In addition to the above netdowns, areas in the TSA that have been established as Forest Service Recreation Sites are considered to be non-contributing to timber supply and will be excluded from the timber harvesting land base.

Ew (wildlife)

The Ew category identifies areas with significant value for food, shelter, or reproduction for wildlife. When Ew mapping for the Kingcome TSA was conducted approximately 20 years ago, high value areas (Ew1) were intended to identify areas of critical importance to wildlife, where the removal of any timber would be detrimental. Some conditional harvesting was acceptable within moderate value areas (Ew2). In the Kingcome TSA, Ew areas were primarily winter range areas for ungulate species—deer and elk on Vancouver Island, and mountain goats on the mainland.

5. Timber Harvesting Land Base Definition

Clear guidelines were never established in the TSA to instruct forest licensees as to the appropriate management of Ew areas. As a result, over the years, some of the original Ew areas have been harvested. In addition, the level of understanding of behaviour and habitats of some wildlife species has increased considerably. The *Forest Practices Code* has also introduced new measures for managing for wildlife species. The combination of the above factors necessitates the revision of Ew mapping for the TSA.

In the last TSR, 1125 hectares of Ew1 and 1183 hectares of Ew2 were netted out of the land base for wildlife management, primarily for ungulates, as indicated above. These areas are currently under review by the MoF, MELP and forest industry staff. This review may result in the confirmation or revision of existing areas, or delineation of new areas. Ultimately, agreed to areas will be established as ungulate winter ranges under Section 69 of the *Operational Planning Regulation*. As the review is not yet complete, and ungulate winter ranges not established, they cannot be incorporated into this timber supply analysis. Existing Ew mapping, and the previous TSR netdown percentages (as outlined in Table 5) will be applied as the best available information.

Additional considerations for the management of wildlife in the TSA will be considered in the timber supply analysis and are discussed in Section 5.2.9, "Wildlife habitat reductions."

Ea (avalanche)

Ea's are intended to protect human-made structures and valuable natural resources from snow avalanches by preventing the removal of forest cover from steep slopes in snow belts. A 100% netdown will be applied to these areas in the timber supply analysis.

Ep (difficult regeneration)

The Ep category identifies areas with actual or potentially severe regeneration problems, as a result of geoclimatic (e.g., soil, frost, drainage, elevation, aspect) or biotic (e.g., brush, wildlife browse) factors. A 100% netdown will be applied to these areas in the timber supply analysis.

Eh (watershed)

No reductions will be applied for Eh areas since the forest cover requirements set out in the *Community Watershed Guidebook* will be modelled. This approach will be more representative of the current management regime under the *Forest Practices Code*. Modelling assumptions to be applied are outlined in Section 6.4.1, "Forest cover requirements."

5. Timber Harvesting Land Base Definition

5.2.5 Inoperable areas

Operability codes are generally used to describe the presence or absence of physical barriers or limitations to harvesting, appropriate logging methods, and the merchantability of stands.

Once the operable land base has been determined, as described in Section 3, "Inventories" it will be incorporated into the timber supply analysis as outlined in Table 6.

Table 6. Description of inoperable areas

Inventory description	Code	Reduction per cent (%)
Operable — conventional (includes helicopter areas)	A	0
Operable — low site	L	To be determined by further analysis
Operable — alder	D	To be determined by further analysis
Inoperable areas	I/N	100

Data source and comments:

Operable — conventional land base

The operable-conventional land base is the area without significant limitations or barriers to accessing and harvesting timber. This area will be further reduced to exclude low site forests. As indicated in Section 3, work is currently underway at the district and regional office to compare the 1993 operability mapping against recently harvested areas, forest cover information, and TRIM elevation and slope information to determine trends in the profile of remaining unharvested stands. This review may result in refinement to the operable-conventional land base.

Operable — low-site land base

In the last TSR, forest district staff conducted an evaluation of the potential for harvesting on certain low productivity sites in the TSA. They estimated that approximately 21 000 hectares of these sites were potentially suitable for harvesting. These areas were limited primarily to the Nahwitti Lowlands (north Vancouver Island) and Hecate Lowlands ecosection areas, and were located outside of conventional operability lines.

Precise mapping of "operable — low site" areas is very difficult, due to the broad stratification of forest cover in the current forest inventory for these particular geographic areas. A more detailed stratification will be provided in the new VRI, however, only a small portion of the area currently defined as operable — low site is covered by the VRI.

Should the low site portion of the operability assessment be inconclusive, reduction factors will be developed by the forest district staff, in consultation with licensees to approximate the proportion of the broader area to be considered as available for timber harvesting.

Operable — alder

Due to the dispersed nature of alder stands through the TSA and limited harvesting history of this species in the district, precise identification of operable stands may be difficult. Species and volume attributes from the forest inventory will be used initially to identify potential alder harvest areas. Only stands with more than 50% alder by volume are eligible for harvesting in the TSA under the partitioned deciduous AAC. Generally, only stands with a total net merchantable volume of more than 300 m³/hectare are currently being harvested in the TSA. Local knowledge and a review of current plans that include alder harvesting will be used to further refine mapping of operable alder stands.

5. Timber Harvesting Land Base Definition

5.2.6 Sites with low timber growing potential

Stands may have low productivity because of inherent site factors (nutrient availability, exposure, excessive moisture, etc.) that reduce the growth and density of commercial tree species. As these stands are not considered eligible for harvest, they need to be identified and excluded from the timber harvesting land base. This will be done as outlined on Table 7.

Table 7. Description of sites with low timber growing potential

Species group	Inventory type group	Volume criterion (m ³ /hectare)		Site index ^a (metres)	Reduction per cent (%)
Cedar	9 – 11	NMV ^b < 350	and ^c	SI < 14.8	100
Hemlock	12 – 20	NMV < 350	and	SI < 12.4	100
Spruce / fir	1 – 8, 21 – 26	NMV < 350	and	SI < 9.2 (Ss) SI < 17.0 (Fd)	100
Alder	21 – 26	NMV < 300	and	SI < 31.0	100

(a) The site index values in Table 7 are the site indices required for each stand type to achieve the NMV volume criteria at 150 years. These were calculated using the VDYP yield model (core version 6.4a).

(b) NMV — net merchantable volume.

(c) For a stand to be excluded, on the basis of low timber growing potential, it must fail to meet both the minimum volume requirement and the minimum SI requirement.

Data source and comments:

Stands with volumes above the low site threshold may be removed from the timber harvesting land base due to operability constraints defined in Section 5.2.5, "Inoperable areas". The criteria defined in Table 7 may be refined based upon the results of the low-site operability analysis as described above, to ensure that operable-low site areas are not excluded in the low-site netdown.

5.2.7 Unmerchantable forest types

Unmerchantable forest types are stands that are physically operable and exceed low-site criteria but are not currently utilised or have marginal merchantability. These types are excluded from the timber harvesting land base.

Table 8. Unmerchantable forest types criteria

Species	Inventory type groups	Reduction per cent (%)
Deciduous other than alder	35, 36, 39, 42	100
Pine	27 – 32	100

Data source and comments:

Deciduous other than alder (cottonwood)

Distribution of merchantable cottonwood stands through the TSA is limited and localised in the valley bottoms of a few of the larger river valleys. Forest inventory information for cottonwood tends to be less reliable as these areas were not intensively measured or assessed during the 1970's forest inventory process, which focussed on merchantable coniferous species.

5. Timber Harvesting Land Base Definition

Historically, cottonwood has been considered as an unmerchantable tree species; however Scott Paper was awarded a deciduous non-replaceable forest licence in 1989 for this species. Scott Paper currently operates in the Kingcome River watershed and expects to remain in that area for at least ten more years. As a result, more detailed inventory information on cottonwood has been collected for the Kingcome TSA. Some preliminary reconnaissance has also been done by Scott Paper in the Wakeman drainage.

As a result of above, the timber supply analysis will exclude cottonwood stands from the forest inventory, however a separate timber supply assessment for cottonwood will be completed using more accurate localised inventory information from Scott Paper.

Pine

Coastal lodgepole pine dominated stands are generally indicative of poor productivity and are not harvested. These stands will be excluded from the timber harvesting land base.

5.2.8 Roads, trails and landings

Separate estimates are made for the loss of productive forest land due to existing and future roads, trails and landings (RTL). Existing RTL estimates are applied as reductions to the current productive forest considered available for harvesting, and future RTL reductions are applied after the first projected harvest of a stand in the simulation model. Estimates can be applied as the number of hectares or as percentages of area to be removed from specified age classes and zones.

Table 9. *Estimates for existing and future roads, trails and landings*

Location	Year of harvest	Reduction per cent (%)
Existing RTLs		
Roads, trails and landings	Pre-1995	7.0
Roads, trails and landings	1995-1999	6.0
Future RTLs		
Roads, trails and landings	Post-1999	6.0

Data source and comments:

Pre-1995 netdowns for roads, trails, and landings are based on estimates prepared for the last TSR, which reviewed 303 harvest blocks from 1987 to 1995. A sample updated to 1999 shows decreased site degradation, likely due in part to increased use of helicopter logging. It is anticipated that 6.0% will accurately represent the long-term area to be occupied by roads, trails and landings within the Kingcome TSA.

The existing road netdown will be applied to stands less than or equal to 55 years (or ages from 1 to 5 years for stands harvested between 1995 and 1999). No further reduction is assumed for between-block roads; the within-block reduction is believed to adequately represent total site degradation.

5. Timber Harvesting Land Base Definition

5.2.9 Wildlife habitat reductions

Beyond the exclusion of wildlife based ESAs, described in Section 5.2.4, "Environmentally sensitive areas," Table 10 outlines additional forest management requirements under the *Forest Practices Code* to maintain wildlife habitat at the stand level and how these will be incorporated into the timber supply analysis.

Table 10. Estimates for wildlife habitat reductions to the timber harvesting land base

Issue	Excluded area
Stand-level biodiversity – WTPs	25% of wildlife tree retention guidelines specified in Table A3.1 of <i>Landscape Unit Planning Guide</i>

Data source and comments:

Wildlife tree patches (WTP) will be retained according to the percentages identified in Table A3.1 of the *Landscape Unit Planning Guide* (LUPG). These percentages will be determined for, and applied to each draft landscape unit. Forest district staff are of the opinion that there will be sufficient suitable area removed from the timber harvesting land base for reasons such as riparian reserve zones, terrain stability and low site to provide up to 75% of the required WTP area; therefore 25% of the percentage listed in the LUPG will be excluded from all stands in the timber harvesting land base. This assumption is consistent with the *FPC Timber Supply Analysis* (1996).

A recent audit by the forest district staff of 50 silvicultural prescriptions indicated that designation of WTPs by TSA licensees was impacting more of the operable land base than standard *Forest Practices Code* impact assumptions. District staff attribute these larger impacts to the variable nature of WTP requirements over the past five years, and the associated learning curve for licensees. Clear implementation instructions and LU specific targets have now been issued by the district and will hopefully alleviate this issue. A sensitivity analysis will be undertaken to determine the impact of a higher percentage of WTPs coming from the timber harvesting land base.

The *Identified Wildlife Management Strategy* was announced in the spring of 1999, outlining a process to identify and establish wildlife habitat areas (WHAs) and general wildlife measures (GWMs) to protect rare and endangered species. To date, no WHAs or GWMs have identified in the Kingcome TSA. As such, the IWMS will not be represented in the analysis. Under current government policy, timber supply impacts of the IWMS are limited to 1% for each forest district.

5.2.10 Cultural heritage resource reductions

Many portions of the TSA possess significant archaeological and cultural heritage values, particularly culturally modified trees (CMTs) and shell middens. An archaeological overview assessment (AOA) completed in 1995, the *Galgalis Traditional Use Study*, and consultation with First Nations during operational planning help to identify areas of sensitivity. Archaeological impact assessments (AIA) are conducted by licensees as directed by the forest district manager. Often, the cultural resource values are not within the timber harvesting land base, or can be incorporated into a wildlife tree patch. In other instances, the recommendations of the AIA are such that there is no impact on the timber harvesting land base. As a result, no specific netdown will be applied for management of cultural resources in this timber supply analysis.

5. Timber Harvesting Land Base Definition

5.2.11 Riparian management

To account for riparian reserve zones, the timber harvesting land base will be reduced by a total of 4.7%. This figure is based on a review of the silvicultural prescriptions for 50 cutblocks approved after December 15, 1995 and reflects the actual merchantable area left unharvested in riparian reserve zones within the TSA. This figure is very close to that of work conducted by Wild Stone Resources in 1994, which determined a 4.8% land base reduction based upon an audit of 92 coastal cutblocks.

Best Management Practices recommendations from the *Forest Practices Code Riparian Management Area Guidebook* list maximum basal retention levels to be applied within the riparian management zone. Different levels of retention are recommended for each stream classes, ranging from 5 to 50%. Based upon the stream class distributions found in the Wild Stone study, application of Best Management Practices would equate to a 4.2% timber supply impact. During the review of 50 cutblocks described above, it was determined that timber retention in the riparian management zone equated to a 0.7% impact on the timber harvesting land base. However, district staff believe that recent harvesting practices in riparian management zones are becoming more consistent with the Best Management Practice recommendations. Gully management practices also result in additional timber retention on smaller streams. As a result, a 4.2% netdown is believed to be reasonable for the riparian management zone.

5.2.12 Exclusion of specific, geographically defined areas

While road construction has approached to within approximately ten kilometres of the southern boundary of the Klinaklini Supply Block, there is no indication of planned access into this area for the next five years or more. As a result, the area is not considered available at this time, and will be excluded from the timber harvesting land base. Availability of the Klinaklini Supply Block will be re-assessed again during the next Timber Supply Review.

Table 11. *Exclusion of specific, geographically defined areas*

Location	Excluded area (hectares)	Reason for exclusion
Klinaklini supply block	To be determined	Uneconomic to develop

Data source and comments:

The exact number of hectares to be excluded will be determined when the inventory file is available.

5. Timber Harvesting Land Base Definition

5.2.13 Timber licence reversions

Timber licences are old tenure arrangements that give a licensee exclusive rights to harvest merchantable timber within the licence area and do not contribute to the TSA allowable annual cut. However, once these areas have been harvested, regenerated and attain free-growing status, the timber licence area reverts to Forest Service jurisdiction. Accordingly, these areas are included in the timber harvesting land base after they have been harvested and regenerated and will contribute to the TSA harvests in the medium to long term.

Table 12. Timber licence harvest schedule

Area of timber licence harvested (hectares) by period of harvest				
1995-1999	2000-2010	2011-2020	2021-2030	2031-2040
1 316	3 754	3 754	3 754	3 754

Data source and comments:

As of 1995, there were 28 419 hectares of unreverted timber licence in the Kingcome TSA. During the last TSR, this area was determined to contain 16 332 hectares of the timber harvesting land base.

The area of harvest since 1995 was estimated to be 1316 hectares, based on ISIS records. The remaining harvestable timber licence area ($16\,332 - 1316 = 15\,016$ hectares) will be assumed to be harvested in equal proportions over the next four decades. Once an updated forest inventory file is available, the area of unreverted timber licences will be determined and the harvest schedule for timber licences will be evaluated, and revised if necessary.

6. Current Forest Management Assumptions

6.1 Harvesting

6.1.1 Utilization levels

The utilization levels define the maximum stump height, minimum top diameter inside bark (dib) and minimum diameter at breast height (dbh) by species. These are used in the analysis to calculate merchantable volume.

Table 13. Utilization levels

Analysis units	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
All – natural	17.5	30	10
All – managed	12.5	30	10

Table 13 reflects current regional standards, licence requirements and current management.

6.1.2 Volume exclusions for mixed species stands

Deciduous species in predominantly coniferous stands are not normally harvested. Therefore, the unharvested portions will not contribute to the estimated stand volume in the timber supply analyses.

Table 14. Volume exclusions for mixed species types

Species	Volume exclusion (%)
Deciduous (in coniferous-leading stands)	100

Data source and comments:

Licensees harvesting under the deciduous partition are using deciduous volume from deciduous-leading stands. Deciduous volumes in areas subject to conventional coniferous licences are not utilized.

6.1.3 Minimum harvestable age derivation

The minimum harvestable age is the time required for stands to grow to a harvestable size, and defines the lower limit for harvesting. Harvesting may occur in stands at the minimum age in order to meet forest level objectives (e.g., maintaining harvest levels for a short period of time, or avoiding large inter-decadal changes in harvest levels). However, many stands will not be harvested until past the minimum age due to management objectives for other resource values (e.g., requirements for the retention of older forest).

The minimum harvestable age for stands in each analysis unit will be set to the greater of:

a) the estimated age at which the stand is predicted to reach a required volume; and b) the age at which the stand's mean annual increment (MAI) achieves a value of 95% of the maximum (culmination). The required minimum stand volumes and minimum MAI criteria are listed in Table 15.

6. Current Forest Management Assumptions

Table 15. Minimum stand volumes and minimum mean annual increment for determining minimum harvestable age

#	Analysis unit	Volume at minimum harvestable age (m ³ /hectare)	Mean annual increment
1	Cedar — good	350	95% of MAI at culmination
2	Cedar — medium	350	95% of MAI at culmination
3	Cedar — poor	350	95% of MAI at culmination
4	Hemlock — good	350	95% of MAI at culmination
5	Hemlock — medium	350	95% of MAI at culmination
6	Hemlock — poor	350	95% of MAI at culmination
7	Spruce / fir	350	95% of MAI at culmination
8	Alder	300	95% of MAI at culmination

Data source and comments:

Estimated minimum harvestable ages based on the above criteria will be determined once the timber harvesting land base has been finalised, and the average productivity of stands in each analysis unit is determined. Minimum harvestable ages for existing stands will be based on the natural stand yield estimates from the Variable Density Yield Prediction — VDYP — model, while managed stand yield estimates will be generated from the Table Interpolation for Stand Yields — TIPS Y — model.

Based upon the results of the operability assessment, the volume per hectare limit used to derive minimum harvestable ages may be adjusted upwards, if the analysis of logging history indicates the economic cut-off to be at higher volumes per hectare. Additionally, a sensitivity analysis could be used to try to estimate the longer term implications of increased use of helicopter logging, by adjusting the minimum harvest volume upward on the portion of the land base expected to be helicopter logged.

6.1.4 Silvicultural systems

Table 16 describes the types of silvicultural systems currently used in the Kingcome TSA, and the assumptions that will be used to incorporate these systems into the timber supply analysis.

Table 16. Silvicultural systems

Silvicultural system	Eligible analysis units or locations	Per cent (%) retention	# of entries	Time between entries
Clearcut with reserve	All	LU specific	1	N/A
Retention	All (25% of harvested area)	10	1	80 – 100 years (one rotation)

Data source and comments:

The majority of the area harvested in the Kingcome TSA is currently done using a clearcut with reserves

6. Current Forest Management Assumptions

silvicultural system. The LU-specific per cent retention levels are equal to the reserve requirements for wildlife tree patches calculated for each landscape unit following Table A3.1 of the *Landscape Unit Planning Guide*. District staff anticipate that 75% of the area harvested over the next five-year period will be done by clearcut with reserves.

While historically there has been very little use of retention silvicultural systems, (e.g., shelterwood, selection or patchcut) in the timber supply area, this is rapidly changing. Recently several licensees in the TSA, including the Small Business Forest Enterprise Program (SBFEP), have made public commitments to use retention systems on some or all of their operating areas. New forest development plans received by the district office are reflecting this change in practice. As a result, district staff believe that it is reasonable to expect that 25% of the area harvested over the next five-year period will be done using retention systems. While the amount of harvesting using retention systems will likely change in coming years, for the analysis a requirement will be applied to ensure that a minimum of 25% of the projected harvest is done using retention systems. This area will be divided evenly across all analysis units within the TSA. A sensitivity analysis will be used to estimate the timber supply impact of using retention systems on 50% of the area harvested, should the 25% estimate prove to be conservative. The proportion of harvest with the various systems will continue to be re-evaluated, and any changes incorporated into future analyses.

As this transition to new silvicultural systems occurs, the exact timber supply impact is difficult to quantify. The amount of retention, its spatial distribution and the sequencing of harvesting (one *versus* multiple entries) varies significantly from cutblock to cutblock based on site specific conditions and the licensee involved. Initial indications are that on average, about 10% of cutblock area in addition to wildlife tree patch requirements is being retained within retention cutblocks for at least one rotation.

6.2 Unsalvaged losses

Table 17 shows the estimated average annual unsalvaged volumes that are lost to insect or disease epidemics, fires, wind damage, or other agents over the long term on the timber harvesting land base.

Table 17. *Unsalvaged losses*

Cause of loss	Annual unsalvaged loss (m ³ per year)
Fire	3 083
Windthrow	10 500
Total	13 583

Data source and comments:

Fire information is based on Forest Service Protection Branch information and represents the average loss over the past ten-year period. Windthrow losses are based on forest district staff visual estimates of approximately 15 hectares per year, assuming an average stand volume of 700 m³/hectare. It is the opinion of district and regional staff that epidemic insect and disease losses are minimal with no apparent volume losses in the TSA.

6. Current Forest Management Assumptions

6.3 Silviculture

6.3.1 Regeneration activities in managed stands

Recent plantations and future stands will be grown on managed stand yield tables (MSYTs) produced using the Forest Service TIPSy growth and yield model. Table 18 below contains the inputs required to produce MSYTs for this analysis. Average site indexes for each analysis unit will be determined after defining the timber harvesting land base.

Table 18. *Regeneration assumptions by analysis unit*

No.	Analysis unit	Regen delay ^a (years)	Age of stock (years)	OAFs		Method ^b Type	%	Regen AU		Density	
				1 (%)	2 (%)			AU	%	Initial sph	Thin
1	Cw good	4	1	15	5	Artificial	93	1	100	3000	—
2	Cw medium	4	1	15	5	Artificial	96	2	100	3000	—
3	Cw poor	3	1	15	5	Artificial	100	3	100	3000	—
4	Hw good	4	1	15	5	Artificial	77	4	100	5000	—
5	Hw medium	4	1	15	5	Artificial	66	5	100	5000	—
6	Hw poor	5	1	15	5	Artificial	92	6	100	5000	—
7	Ss/Fd	4	1	15	5	Artificial	100	7	100	2000	—
8	Dr	4	1	15	5	Artificial	100	5	100	5000	—
8 ^c	Dr (20 hectares/year)	3	1	15	5	Planted	100	8	100	1600	—

(a) Regeneration delay period may be revised following further assessment by Port McNeill Forest District.

(b) The method type and per cent represents the average per cent of the areas that were planted (artificially reforested).

(c) Under the Vancouver Forest Region red alder strategy, in the next four years, 20 hectares a year of red alder will be planted in the Kingcome TSA. For analysis purposes, 20 hectares of the red alder analysis unit will be reforested back to red alder.

Data source and comments:

The average actual regeneration delay was obtained from the review of all ISIS records (approximately 700 openings) from 1987 to 1999. The table provides the percentage of area assumed to be planted. The remaining stands are assumed to regenerate naturally. When generating managed stand yield estimates, yield tables will be created for both planted and naturally regenerated stands using TIPSy, and combined based on the percentages shown. Given the current maximum density policy, it is not anticipated that any opening will be spaced prior to free-growing declaration. Therefore, the estimates of initial density represent the expected densities of naturally and artificially regenerated stands (including natural in-fill in planted stands).

Note that most alder sites that are harvested in the TSA are currently regenerated to coniferous species, primarily hemlock. Generally, these sites are highly productive for conifers (SI > 25). In exceptional circumstances, regeneration to alder is deemed acceptable. Under the Vancouver Forest Region red alder strategy, 20 hectares a year of red alder will be planted in the Kingcome TSA, over the next four years.

6. Current Forest Management Assumptions

Operational adjustment factors (OAF) are used to adjust the potential yields generated from TIPSYS to reflect actual yields achieved under operational conditions. OAF 1 reduces the potential yields by a constant percentage to reflect small stocking gaps within stands, which are incapable of growing trees. OAF 2 reduces potential yields to reflect losses due to pests, disease and decay. OAF 2 increases with age and for this analysis, passes through 5% at age 100.

Tree improvement

Prior to the timber supply analysis, information on the proportion of planting stock that is Class A (selected) will be compiled to allow for the assessment of the potential timber supply implications through sensitivity analysis.

6.3.2 Immature plantation history

The purpose of this section is to identify areas of existing immature forest where the density (stems per hectare) was controlled and therefore should be assigned to a managed stand yield curve (MSYT). All NSR and future harvested stands will be managed under MSYTs. Table 19 lists the area of immature forest in each analysis unit where density has been controlled.

Table 19. Immature plantation history

Analysis unit	Area managed (hectares)			
	Age 1 – 10	Age 11 – 20	Age 21 – 30	Age 31 – 40
Cw good	6 351	430	716	
Cw medium	1 353	504	33	
Cw poor	144	34	5	
Hw good	5 685	3 810	121	21
Hw medium	3 591	621	41	
Hw poor	612	779	37	
Ss	1 294	1 751	280	21
Dr	111	144	14	

Data source and comments:

The managed area identified above represents all area that was artificially reforested within the Kingcome TSA. These were generated from detailed reports from both the ISIS as well as MLSIS.

6. Current Forest Management Assumptions

6.3.3 Not satisfactorily restocked (NSR) areas

Land classified in the TSA FIP file as type identity 4 or 9 is generally included in the current timber harvesting land base. These type identities indicate not satisfactorily restocked land base. The purpose of this section is to identify the total area of NSR currently existing in the timber harvesting land base, and the estimated rate at which the NSR area is expected to be restocked. Table 20 summarises the restocking schedule of NSR lands in the Kingcome TSA.

Table 20. Not satisfactorily restocked (NSR) areas

Analysis unit	Current NSR (hectares)	Backlog NSR (hectares)	
	1 – 10 years	1 – 10 years	> 10 years
All (current)	5 963		—
Cw medium (backlog)		200	—
Ss (backlog)		150	—
Total	5 963	350	—

Data source and comments:

The current and backlog NSR was generated from ISIS and MLSIS records. There are 5963 hectares of current NSR which are assumed to regenerate within specified regeneration delay periods as per Table 18 (over approximately 4 years). The Ministry of Forests estimates the backlog NSR to be 350 hectares, which is anticipated to be eliminated within the next decade.

6.3.4 Rehabilitation areas

Areas that have been treated or are planned for treatment (secured funding) will be included in the timber harvesting land base. Table 21 below indicates the expected rehabilitation rate within the TSA.

Table 21. Rehabilitation areas

Current analysis unit	Post-rehabilitation analysis unit	Total area (hectares)	Rate of restocking (hectares/decade)	Rehabilitation criterion
Dr	Hw medium	650	325	≥ 50% Dr volume

Data source and comments:

The rate of conversion reflects the current harvest and conversion of alder stands to hemlock stands within the Port McNeill Forest District.

6. Current Forest Management Assumptions

6.4 Integrated resource management

6.4.1 Forest cover requirements

As noted in Section 4.1, "Management zones, groups and multiple objectives," the Kingcome TSA is divided into management zones which define areas of distinct management emphasis and similar forest cover. Since the computer simulation model used for the timber supply analysis can track multiple objectives for an area, management zones can overlap. For example, a landscape unit that is managed for biodiversity may be partly covered by a visually sensitive area. The objectives for each area may specify requirements to retain different forest characteristics across the landscape, such as a minimum percentage of old-growth forests or a maximum percentage of forest area below green-up height.

Integrated resource management and visual values

In order to limit the impact of harvesting on visual, wildlife, hydrological and other values in the TSA, the forest cover requirements outlined in Table 22a will be applied to areas that fall into each of the "Level 1" groupings¹ (cutblock adjacency and visual quality).

Table 22a. Forest cover requirements for cutblock adjacency and visual values

Grouping	Green-up height (metres)	Maximum allowable area not greened-up (%)
RVQC = Retention	5	1.1 – 5% (of total forested area)
RVQC = Partial retention	5	5.1 – 15% (of total forested area)
RVQC = Modification	5	15.1 – 25% (of total forested area)
IRM base area	3	25% (of harvestable land base)

Data source and comments:

Green-up height for the IRM base area represents the top-height (average height of the 100 largest trees per hectare) for the regenerating forest which is required to meet general integrated resource management objectives associated with hydrology, wildlife, recreation, or other similar concerns. The green-up height for RVQC areas is the visually effective green-up (VEG). When VEG is achieved, the regenerated forest cover generally blocks views of previously harvested openings. Known scenic areas in the Kingcome TSA are currently managed with a visually effective green-up height of 5 metres. This is consistent with results obtained from a test application of the *Procedures for Factoring Visual Resources into Timber Supply Analyses*². Table 22a provides the range for the maximum allowable area not greened-up for each visual quality class. A precise target will be determined for each visual quality class within "known" scenic areas once the final resultant data set has been created. These will be calculated using the Visual Absorption Capacity information provided in the visual landscape inventory and the methods described in the *Procedures for Factoring Visual Resources into Timber Supply Analyses*.

A sensitivity analysis will be conducted to determine the timber supply impacts of managing for visual quality over the entire area covered by the landscape inventory, as opposed to only within the current scenic area.

(1) Grouping levels identified in Table 3, "Objectives to be tracked".

(2) Ministry of Forests 1998. *Procedures for Factoring Visual Resources into Timber Supply Analyses*. REC-029, page 9, table 6.

6. Current Forest Management Assumptions

Community watersheds

In order to protect water quality, the forest cover requirements outlined in Table 22b will be applied to the forested area in community watersheds.

Table 22b. Forest cover requirements — community watersheds

Area applied	Green-up age (years)	Maximum allowable area below green-up (% area)
Community watersheds	5	5

Data source and comments:

Community watershed guidelines are taken from the *Forest Practices Code Community Watershed Guidebook*. The maximum allowable disturbance percentages reflect current practice in the Kingcome TSA.

Landscape-level biodiversity

To ensure that older forests are maintained reasonably evenly within the TSA, the forest cover requirements outlined in Table 22c will be applied to each draft landscape unit/biogeoclimatic variant group³. These requirements were derived from the *Landscape Unit Planning Guide*.

Table 22c. Forest cover requirements — biogeoclimatic units and natural disturbance types (NDTs) within the Kingcome TSA (applied to gross productive forest by landscape unit)

Biogeoclimatic zone ^a	NDT	Minimum old-growth retention area by decade (%)			Minimum age (years)
		1 to 7	8 to 14	15 to 21	
CWH	1	9.7	11.7	13.6	250
CWH	2	6.7	8.1	9.4	250
MH	1	14.2	17.1	19.9	250

(a) The percentages listed in the table apply to all variants within the zones shown, and reflect a 10% / 45% / 45% weighting for higher, intermediate and lower BEOs (see comments next page).

(3) Landscape unit boundaries and BEO assignments as submitted to the chief forester in the *Vancouver Regional Landscape Unit Strategy*, July 7, 1999.

6. Current Forest Management Assumptions

Data source and comments:

Interim biodiversity-emphasis options (BEOs) have been assigned to each landscape unit in the Kingcome TSA through the *Regional Landscape Unit Planning Strategy*. However, these BEOs have not yet been legally established. Therefore a single old-seral stage requirement based on the anticipated distribution of 10% high-, 45% intermediate- and 45% low-emphasis will be applied in the base case. The values shown in Table 22c reflect the weighted *Landscape Unit Planning Guide* values. They are based on the requirements to achieve one-third of the full requirement in the first 70 years, two-thirds in the second 70 years, and the full requirement by the end of three 70-year rotations, or 210 years from now, in the lower-emphasis areas.

The timber supply implications of applying the draft BEO assignment for each landscape unit set out in the *Regional Landscape Unit Planning Strategy* will be examined in a sensitivity analysis as described in Section 7, "Sensitivity Analyses".

There is some Interior Douglas-fir (IDF) and Engelmann Spruce-Subalpine Fir (ESSF) in the Kingcome TSA (e.g., Klinaklini); however none is operable. Also, the LUs where they appear are geographically isolated, so landscape-level biodiversity will not be tracked in those biogeoclimatic ecosystem classification (BEC) zones in the analysis.

7. Sensitivity Analyses

Sensitivity analysis can provide a measure of the timber supply impact of uncertainty in management assumptions and/or data. By developing a number of sensitivity analyses, it is possible to determine which variables most affect analysis results. Table 23 lists specific assumptions to be tested in sensitivity analysis.

Table 23. Sensitivity issues

Issue to be tested	Sensitivity levels
Age when forest achieves old-forest characteristics	+/- 50 years of LUPG ages
Existing stand yields	+/- 10%
Regenerated stand yields	+/- 10%
Minimum harvestable age	+/- 10 years
Old-growth site index adjustments	As per draft OGSI adjustments
Land base changes	+/- 5% and +/-10%
Visual quality objectives	High/low range % denudation; /exclude/include non-scenic area
Harvest flow alternatives	—
Green-up periods	+/- 5 years
IRM zone	Maximum area below green-up at 20% and 33%
Draft biodiversity emphasis options	Apply specific BEOs from Regional Landscape Unit Planning Strategy
Seral-stage distributions	Apply requirements for early-seral stage, mature + old-seral stage
Central Coast LCRMP	Exclude PAS Study Areas
Wildlife tree patches	40% of WTP requirement from the timber harvesting land base (25% in base case)
Retention silvicultural systems	Increase to 50% of area harvested (25% in base case)