PRIVATE MANAGED FOREST LAND COUNCIL

Report on Audit

of

Private Managed Forest Properties

2006

Acknowledgements

The audit and this report were completed by Bob Kopp, RPF, Shawn Hamilton, RPBio, and Gordon Butt, P.Geo, PAg, who were retained by the Private Managed Forest Land Council for the 2006 audit program. We thank the participating landowners and their representatives for their cooperation in the field audit site visits and for providing audit information.

Executive Summary

The *Private Managed Forest Land Act* (the Act) establishes management objectives for key public environmental values, which are fish habitat, water quality, critical wildlife habitat, soil conservation, and reforestation. The requirements for the protection of these key values are set out in related regulations.

In the summer of 2006, the Private Managed Forest Land Council commissioned a limited scope audit of the private managed forest land program. The purpose of the audit was to evaluate compliance with the regulation applicable to fish habitat and water quality. Twelve private managed forest properties were selected, representing a combination of large, mid-size and small properties on Vancouver Island. The audit was conducted between September 19 and November 6, 2006. This audit report presents the findings of the auditors and a description of the objectives, scope and methodology used.

The audit examined operational activities and obligations in the areas of harvesting, road construction, maintenance and deactivation for the period August 3, 2005 up to the day of each field audit. The audit process involved on-site meetings with each owner. The owners were interviewed during the audit on matters specific to each field site and the management activity on their lands.

For each managed forest property, audit findings were developed from an evaluation of information collected through interviews, map and document reviews and site-specific field observations and measurements. The overall audit findings were derived by aggregating the findings from each managed forest property sampled.

The auditors found that the forest management practices evaluated in the managed forests audited comply with the practice requirements of the Private Managed Forest Land Council Regulation for water quality and fish habitat. With few exceptions, operational practices on all properties were consistent with the intent of the legislation, and operations are protecting water quality and fish habitat.

The auditors did find certain bridge and culvert crossings where small amounts of sediment had entered streams. Although the amount of sediment might have been minimized at these sites with use of Best Management Practices, auditors concluded that the small amounts of sediment had no material effect on water quality or fish habitat. Although this finding identifies an area of practice requiring improvement, it is not a finding of non-compliance. Nevertheless it is important that owners pay particular attention to sediment control practices on their road systems in order to reduce the potential for sediment delivery to streams

The auditors found the forest management practices evaluated in the sample of MFs audited complied with the requirements of the council regulation for water quality and fish habitat for the period of August 3, 2005 to November 6, 2006.

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1.0 Introduction

Mandate and Legislation

The Private Managed Forest Land Council (council) was established by the provincial government in 2004 as the agency responsible for administration of the private managed forest land program. Applicable legislation includes the *Private Managed Forest Land Act* (the *Act*); the Private Managed Forest Land Council Regulation (council regulation); the Private Managed Forest Land Regulation; and the Private Managed Forest Land Council Matters Regulation. The object of the council is to encourage forest management on private managed forest land, taking into account the social, environmental and economic benefits of those practices.

The *Act* establishes management objectives for the key public environmental values. These are fish habitat, water quality, critical wildlife habitat, soil conservation, and reforestation. The council regulation sets requirements for the protection of water quality, fish habitat, soil conservation and reforestation. Additionally, provision is made in the Private Managed Forest Land Regulation for the wildlife minister to designate land as critical for the survival of one or more species at risk.

The legislation provides the council with powers to set, monitor, investigate and enforce forest practice standards for land assessed as managed forest (MF). The council conducts forest practices audits with respect to the legislated standards and requirements as part of their administrative role. The legislation objectives and practice requirements are summarized in Appendix III of this report.

Background

In July 2006 the council engaged three independent consultants to form the audit team to conduct an audit of MF properties. The selection of MF properties was made by the council from coastal MF lands only, as coastal MFs have the highest concentration of fish streams and water supply areas. The audit was based on a sample of harvesting operations and road drainage structures within or adjacent to fish streams, community watersheds and /or water supply intakes downstream. The properties chosen included large, medium and small MFs that reported harvesting of more than 1000 cubic meters in their 2005 annual declarations.

All the MF properties audited are located on Vancouver Island and were field assessed between September 18 and November 6, 2006.

This report presents the findings of the audit and a description of the objectives, scope and methodology used.

Audit Team

Bob Kopp – lead auditor. Mr. Kopp is a registered professional forester with over 33 years of experience in forest management planning and operations. He has undertaken forestry audits since 1998, and he has completed numerous environmental audits with the BC Forest Practices Board. His training and audit experience has encompassed environmental management systems, forestry certification standards and regulatory compliance. In addition to his experience in planning and conducting forestry audits, Mr. Kopp is able to provide expertise in the areas of silviculture, harvesting and forest engineering.

Shawn Hamilton – auditor. Mr. Hamilton is a registered professional biologist with over 30 years experience working in the field of fisheries/forestry interactions. From 1974 to 1992 Mr. Hamilton was employed by the Department of Fisheries and Oceans (DFO), and he was Senior Fisheries/Forestry Interaction Biologist for the Pacific and Yukon Region in 1992. He has provided consulting services for government and private sector clients on fisheries/forestry issues. He has conducted numerous watershed assessment studies. His experience includes

compliance auditing, investigations of contraventions and development of forest harvesting guidelines.

Gordon Butt – auditor. Mr. Butt is a professional geoscientist and professional agrologist as well as a certified arborist. Mr. Butt has over 26 years work experience in the areas of terrain stability assessment, windthrow hazard assessment, soil science and water management. He worked for the BC Ministry of Forests, MacMillan Bloedel Ltd and overseas (Malaysia, Thailand, UK) before establishing an environmental consulting firm, Madrone Environmental Services Ltd. He has conducted numerous investigations of landslides, floods, sedimentation events and windthrow primarily on the BC coast.

Observers

The landowners and/or their representatives for each MF accompanied the auditors and participated in the audit process. Rod Bealing, forestry manager for the Private Forest Landowners Association (PFLA) attended as an observer on two of the MFs audited. Mr. Bealing's responsibility as the PFLA forestry manager is to provide landowners with technical and policy support concerning regulatory issues, Best Management Practices (BMP), forestry education and training for their members.

For the purpose of the audit, Best Management Practices (BMPs) are not rules, but are practices designed to help meet the objectives set for key environmental values. They should be considered as recommended practices tailored to site specific conditions intended to help minimize environmental harm.

2.0 Audit Objectives

The purpose of the audit was to evaluate forest practices in meeting the legislated management objectives for water quality and protection of fish habitat, both during and after harvesting.The audit objective was to determine the degree to which forest practices on the selected MFs comply with the *Act* and the associated council regulation for the protection of water quality, fish habitat and streams.

3.0 Scope

The 2006 audit terms of reference was set by council as a "limited scope" audit. A limited scope audit involves the examination of selected forest activities and practices undertaken during a defined period, while a full scope audit examines all forest activities and practices.

For this audit the scope covered activities for the period August 3, 2005 up to the day of each field audit visit. Those activities that may affect water quality, fish habitat and streams, namely harvesting, road construction, maintenance and deactivation, were evaluated by the audit team.

Properties

The 12 MF properties included in this audit are:

MF #	Owner	Location	MF Area (hectares)	Harvest in Audit Period
7, 8, 65, 68 & 76	TimberWest	North & South Vancouver Island	334,000	Yes
19	Island Timberlands	Buckley Bay, Northwest Bay, Cowichan	258,000	Yes
5 & 39	Hancock Forest Management/ Comox Timber	Cowichan Lake & Campbell River	23646	Yes

MF #	Owner	Location	MF Area (hectares)	Harvest in Audit Period
61	Western Forest Products	Holberg	2531	Yes
78	Kapoor Lumber	Victoria	2037	Yes
363	510968 BC Ltd.	Malahat	30	Yes
177	Totangi Forestry	Victoria	174	Yes

Both TimberWest and Hancock Forest Management are responsible for operations on more than one MF property. However for the audit, their operations were assessed as single units. Due to the amount of harvesting and the large area covered by the TimberWest and Island Timberlands properties, audit samples for these MFs were selected based on proximity to streams while maintaining geographic coverage of the ownerships.

Each MF audited has unique conditions that include access issues, physical features, local climate and other issues specific to the ownership.

All MFs are located on the eastern side of Vancouver Island extending south from Campbell River to the Sooke district north of Victoria. Warm dry summers and mild wet winters are common at the low elevations in the region. The TimberWest, Island Timberlands and Hancock properties extend over a large section of eastern Vancouver Island that includes high elevation sites with colder and longer winters.

The majority of the properties have a history of harvesting and extensive road networks that have been developed over many years. The amount of second growth timber being harvested has been increasing in recent years. In spite of this trend, only a few new major crossings of rivers and large streams have been required to access second growth timber.

Fish streams and water supply intakes are most abundant at lower elevations on Vancouver Island. The varied terrain and climates are favorable for tree growth and support a range of commercial tree species including Douglas fir, western hemlock, western red cedar, true firs and western white pine.

Audit Process

The council selected the sample of MFs to be audited and notified each owner. Following this notification, the lead auditor contacted the owners to schedule the field assessment, assemble information and request that they complete an audit questionnaire. These questionnaires, copies of owners' management commitments, and the most recent annual declarations, provided the basis for preparing the audit plan.

An opening meeting involving the audit team, owners or their representatives, and observers was held prior to, or at the outset of, the field visit to each property. The purpose of these meetings was to explain the audit process, provide an opportunity for owners to ask questions, and enable them to inform the audit team of property-specific management strategies and relevant background information. The field sample was then finalized based on the level of activity at each property.

The owners were interviewed in the field on matters specific to each site and the associated activities. The audit examined the effects of forest practices on individual streams and features including streamside tree retention, free movement of fish, and the level of sediment introduced into streams at road crossings. The auditors looked at individual stream sites but did not assess cumulative effects of practices on streams beyond a site-specific level.

For each property, audit findings were developed from an evaluation of information collected through interviews, map and document reviews, field observations and measurements. Information collected for each sample includes site-specific maps, field notes, work papers, audit checklists and photographs.

An informal closing meeting was held with each owner upon completion of the field assessment phase. The auditors provided a verbal assessment and the provisional findings of the audit for each MF.

The overall findings for the audit were derived by aggregating the findings from each MF property.

Audit Sample

Ten of the 12 MFs (seven owners) audited have fish habitat and/or water supply intakes within or downstream of the properties. For properties with high levels of harvesting, the audit examined a sample of harvesting, and newly constructed, maintained, and deactivated roads in proximity to fish streams. Field assessment of the large properties focused on sites with fish streams, streams in water supply areas and access roads. For properties with low levels of activity, all the sites with harvesting activity were audited, including sites without streams requiring tree retention.

Most harvest block samples were directly adjacent to fish streams or a water supply intake was nearby, and many involved road crossings over small, low gradient fish streams. By regulation, streams within water supply areas default to fish streams, and therefore, the same tree retention requirements apply. For the harvest blocks that required streamside buffers, tree retention and overall conditions were assessed at locations with the fewest retained trees or the narrowest buffers. Bridges and culverts were assessed in the harvest areas and along roads driven or walked to access the sites. No aerial observations were undertaken.

The sites sampled at the 12 MF properties are summarized in the following table:

MF #	Owner	# of Harvest Blocks	Blocks Adjacent to Fish Streams	# of Bridges & Major Culverts	Km of New & Maintained Road
7, 8, 65, 68 & 76	TimberWest	23	23	5	110
19	Island Timberlands	28	28	7	132
5 & 39	Hancock Forest Management	12	11	3	59
61	Western Forest Products	2	2	-	10
78	Kapoor Lumber	7	3	-	23
363	510968 BC Ltd.	1	0	-	0.7
177	Totangi Forestry	1	0	-	1.0

4.0 Findings

The overall audit findings for compliance and performance are presented below. These findings are summarized for all properties sampled except where noted. The findings reflect the audit team's assessment of the MFs evaluated only, and therefore do not necessarily represent forest practices in other MFs in the Managed Forest Program. Appendix IV provides a summary of the observations noted for each MF. A selection of photographs from the audit is in Appendix V.

4.1 Water Quality and Fish Habitat

Compliance

The auditors found that forest management practices at all properties were in compliance with the regulatory requirements for water quality and fish habitat. In all instances where streamside tree retention was required by regulation, the streams were correctly classified and a sufficient number of trees were retained.

Auditors found that a range of practices was used to minimize sediment entering streams. At most sites where there was an increased potential (i.e. steep slopes, fine-textured soils, exposed mineral soil, etc.) for sediment to be transported into streams, BMPs were used to minimize erosion.

The private managed forest land legislation is results-based, so compliance is expected to achieve results that are consistent with the *Act's* forest management objectives for protecting water quality and fish habitat.

Observations on Performance

Discussion of Water Intakes

All the owners were aware of licensed water intakes on or downstream of their properties. The intakes were identified on maps and all owners understood their obligations and requirements under the *Act*. Water supply intakes were being avoided altogether where practical to do so. For example, in one situation harvesting took place within 100 meters of a water supply intake. In this particular case the harvesting was completed without damaging the intake and without any reported reduction in water quality.

Discussion of Streamside Tree and Understory Retention

In nearly all instances where trees and understory were retained as required, stream channel beds, banks and embedded organic debris were unaffected.

Auditors observed some windthrow in several streamside retention areas. In general, only individual trees or small groups of trees were blown down. However, at several sites on small streams, some bank and channel disturbance resulted from uprooted trees along the stream banks. These channel disturbances resulted in minor sediment delivery to the streams. In the opinion of the auditors, the amount of sediment delivery was small and was judged to have no material affect.

At one streamside tree retention area, it was obvious the treetops had been pruned to reduce the likelihood of windthrow. Although the effectiveness of pruning can be variable, and windthrow prediction is not an exact science, pruning to reduce windthrow is an example of a BMP.

Discussion of Roads, Stream Crossings and Sediment Control

Roads assessed during the audit were being maintained to conditions appropriate for the level of use. Auditors found that the roads were well constructed and appropriately located. Drainage structures, including cross drains and ditches, were functioning properly and road prisms were structurally stable. Inactive spur roads were commonly deactivated to control runoff after harvesting was finished.

Road construction, deactivation and maintenance can have the potential to affect water quality and fish habitat, particularly at culverts and bridges. Much of the sediment related to logging activities that enters streams comes from ditches where roads cross streams. Owners that consistently used BMPs showed the best performance in protecting both water quality and fish habitat. It is the opinion of the auditors that with consistent use of BMPs, landowners can

significantly help protect water quality and aquatic habitat, particularly during intense rainstorms or rain-on-snow events.

Examples of BMPs applied on a site –specific basis observed during the field inspections include:

- the use of non-erodible road surfacing of roads at crossings;
- installation of cross drain culverts and sediment traps;
- armouring or seeding erodible soils;
- protecting potentially unstable soils such as steep slopes and gully side walls;
- minimizing the number of temporary crossings of small streams within a block during ground based harvesting operations.
- minimizing soil disturbance near streams;
- deactivating roads after use;
- grading roads in a manner that avoided spilling sediment onto culvert inlets and outlets or carrying surface materials onto bridge decks; and
- avoiding grader berms that prevent water from draining off road surfaces.

Opportunities for Improvement

For five of the seven MFs audited, the auditors found at least one site sampled where the use of BMPs may have reduced the amount of sediment entering a stream. The number of these sites, observed however, was small and the frequency of occurrence was low. The auditors concluded that there had been no material effect on water quality or fish habitat at all of these sites.

Nevertheless it is important that owners pay particular attention to sediment control practices on their road systems in order to reduce the potential for sediment delivery to streams. The application of site-appropriate erosion control measures during road construction and maintenance would reduce this risk.

5.0 Conclusion

The auditors found the forest management practices evaluated in the sample of MFs audited complied with the requirements of the council regulation for water quality and fish habitat for the period of August 3, 2005 to November 6, 2006.

Bob Kopp RPF, Lead auditor

February 9, 2007

Duncan, BC

Appendices

Appendix I Maps

Map of Vancouver Island – Coastal Region

All Managed Forests included in this audit are located on the eastern side of Vancouver Island extending south from Campbell River to the Sooke district north of Victoria.

Appendix II Definitions and Terms

Note that regulations are from the Private Managed Forest Land legislation including the *Private Managed Forest Land Act*; the Private Managed Forest Land Council Regulation; the Private Managed Forest Land Regulation; and the Private Managed Forest Land Council Matters Regulation.

Act means the *Private Managed Forest Land Act*

Community Watershed means a community watershed continued or established under the *Forest and Range Practices Act*

Council means the Private Managed Forest Land Council under section 4 of the *Act*

Fish Habitat means an area that is a fish stream or provides habitat for specified species of fish

Fish Stream means the portion of a stream that

1. is frequented by a specified fish species, or
2. has an average slope gradient of less than 20% for each 100 metres of slope distance, unless:
    a. a fish inventory, carried out in accordance with methods acceptable to the wildlife minister, shows that it is not frequented by a specified species of fish, or
    b. the portion of the stream is located upstream of a proven barrier to fish

Licensed water supply intake means a water intake that is in a water supply area or a community watershed contiguous to a water supply area; or is to provide water for human consumption and is licensed under the *Water Act* for a waterworks purpose or domestic purposes if the license is held by or subject to a water users community incorporated under the *Water Act*.

Owner means the person registered in the records under the *Land Title Act* as owner of the land for which there is a management commitment and that is classified as managed forest land under the *Assessment Act*.

Private managed forest land means private land for which there is a management commitment and is classified a managed forest land under the *Assessment Act*

Regulation means the Private Managed Forest Land Council Regulation (BC Reg. 336/2004)

Specified species of fish means one or more of the following species of fish:

> anadromous salmonoids, rainbow trout, brook trout, kokanee, largemouth bass, smallmouth bass, mountain whitefish, lake whitefish, arctic grayling, burbot, white sturgeon, black crappie, yellow perch, walleye or northern pike

Stream means a watercourse, including a watercourse that is obscured by overhanging or bridging vegetation or soil mats, that contains water on a perennial or seasonal basis, is scoured by water or contains observable deposits of mineral alluvium, and

1. has a continuous channel bed that is 100 metres or more in length
2. flows directly into a fish stream, fish-bearing lake or wetland, or a licensed waterworks

Stream channel means the area between the outermost opposing stream banks measured at the point where rooted terrestrial vegetation begins.

Water supply area means that portion of a community watershed that is on MF land.

Wildlife minister means the minister responsible for the administration of the *Wildlife Act* and includes a person authorized in writing by that minister.

Appendix III Key Public Values, Objectives and Practice Requirements

The *Private Managed Forest Land Act* establishes forest management objectives, and the Private Forest Land Council Regulation (BC Reg. 336/2004) sets minimum standards of practice, for the protection of soils, water quality and fish habitat, and reforestation.

The Private Managed Forest Land Regulation (BC Reg. 341/2004) makes provision for the wildlife minister to establish an area on MF property as critical wildlife habitat for the survival of one or more species at risk.

The objectives and practice requirements are summarized below.

Soils

The soil conservation objective for areas where harvesting is carried out is to protect soil productivity on those sites by minimizing the amount of area occupied by permanent roads, landings, and excavated trails.

The regulations require an owner who carries out timber harvesting to:

- Restrict the amount of area occupied by unproductive soil as a result of access structures to the minimum necessary to safely and efficiently conduct harvesting.
- Adequately rehabilitate and reforest temporary access structures.
- Minimize soil erosion and minimize any increase of landslide hazard.
- Take reasonable measures to minimize impact of erosion events.

Water Quality and Fish Habitat

The water quality objective is to protect human drinking water both during and after harvesting. The objective for fish habitat during and after harvesting is to retain sufficient streamside trees and understory vegetation to protect the natural variation in stream temperature and to provide:

- sufficient cover and in-stream habitat for fish,
- a continuous source of nutrients and large woody debris,
- a vigorous mass of roots capable of controlling stream bank erosion; and
- a filter to prevent transport of sediment into stream channels

The regulation requires an owner who carries out timber harvesting in water supply areas and near fish habitat to:

- Retain understory vegetation and non-commercial trees within 5 metres of the edge of a stream channel to the fullest extent possible without damaging water supply installations, reducing water quality at supply installations or causing harm to fish or fish habitat.
- Ensure that woody debris or physical disturbance at a site do not result in damage to riparian areas that are seasonally occupied by one or more species of fish.
- Retain the minimum required number and size of trees on each side of every 100 metres of a stream channel as specified in the legislation for two classes of streams channels; e.g.: 1.5 to 3 metres wide & 3 metres and wider.
- Ensure that roads constructed with running surfaces wider than 5.5 metres are at least 30 metres from the edge of a stream channel (with a width of at least 1.5 metres) except at a stream crossing.
- Ensure that if yarding timber across a stream with a channel of at least 1.5 metres that the timber is suspended over the stream and that damage does not occur to the stream banks, streambed, retained trees, fish, fish habitat or a licensed water supply intake.
- Ensure that if broadcasting fertilizer in a water supply area, the fertilizer is not applied within 100 metres upslope of a licensed water supply intake or within 10 metres of a flowing stream that is observable from the air, and to ensure the application does not

cause nitrate levels in a stream to exceed 10 ppm downstream or cause water quality to fail to meet established water quality objectives.
- Notify the council within 24 hours of becoming aware of a landslide or debris flow if the event has deposited debris into a stream on the owner's land after August 1, 2004.

General requirements for streams in the regulation requires that an owner who constructs or deactivates roads, trails, quarries or disposal sites or carries out timber harvesting must:

- Ensure that access structures are stable and streams are maintained in their existing courses.
- Ensure the amount of soil erosion that enters a stream is minimized.
- Ensure that machine tracks within 5 metres do not result in exposed mineral soil that leads to sedimentation.

Critical Wildlife Habitat

The objective for critical wildlife is to facilitate long-term protection of habitat by enabling government to assess whether critical wildlife habitat is present and to foster efforts to protect critical wildlife habitat when present on private managed forestland.

When an area of critical wildlife habitat is established on a private managed forest, an owner must carry out any timber harvesting and related activities, and any road construction, in accordance with the requirements of the notice given or amended by the wildlife minister.

Reforestation

The reforestation objective where timber has been harvested or destroyed is to promptly regenerate the areas with a healthy, commercially valuable stand of trees that is not impeded by competition from other plants or shrubs

The regulation requires an owner of an area that is harvested or destroyed after the area became the owner's managed forest to:

- Restock the area within 5 years of completion of harvesting or the date the timber was destroyed with a minimum of 400 well distributed crop trees per hectare on the Coast and 600 trees per hectare in the Interior
- Regenerate the area within 15 years of completion of harvesting or date the timber was destroyed with a set minimum number of well distributed trees that exceed the height of competing vegetation by 50% on the Coast and 25% in the Interior.

Appendix IV Summary of Observations for Managed Forests Sampled

MF #	Owner	Location	Samples: Harvest Blocks / New and Maintained Roads	Sample: Blocks Adjacent to Fish Streams	Sample: # Bridges & Major Culverts	Observations
7, 8, 65, 68 & 76	TimberWest	East Van. Island from Sooke & north to Quinsam R.	23 blocks 110 km road	23	5	• Forest practices were in compliance with regulatory requirements for water quality and fish habitat. • No evidence of environmental harm to fish habitat or water quality was detected • Recent roads were located outside riparian areas except at crossings, and there was minimal disruption of natural drainage patterns. • Roads and drainage systems were being maintained, and were in proper functioning condition. • The number of stream crossings has been minimized, and drainage structures are of appropriate cross sectional area. • Stream channel beds, banks, and embedded organic debris were not materially affected by practices. • Tree retention along streams met or exceeded the regulation at all sampled sites. Understorey vegetation and non-commercial trees are being retained within 5 meters of stream edges. • There was appropriate use of sediment control techniques, including grass seeding of disturbed soils, and ditch blocks and armouring at stream crossings. • The number of temporary stream crossings was kept to a minimum and removed in a manner that reduced site disturbance and facilitated recovery. • Forest harvesting activities were conducted adjacent to potentially unstable soils and gully sidewalls in a manner that minimized the potential for erosion and/or slope failure. • Minor amounts of sediments that were tracked onto some bridge decks by vehicles were entering streams.
19	Island Timberlands	Buckley Bay, Northwest Bay, Cowichan	28 blocks 132 km road	28	7 bridges & 1800mm culvert	• Forest practices were in compliance with regulatory requirements for water quality and fish habitat. • Recent roads were located outside riparian areas except at crossings, and there was minimal disruption of natural drainage patterns. • Roads and drainage systems were being maintained, and were functioning properly. • The number of stream crossing had been minimized, and drainage structures did not appear to constrict stream channels. • There was appropriate use of sediment control techniques, including grass seeding of disturbed soils, and ditch blocks and armouring at stream

MF #	Owner	Location	Samples: Harvest Blocks / New and Maintained Roads	Sample: Blocks Adjacent to Fish Streams	Sample: # Bridges & Major Culverts	Observations
						crossings. Use of sediment control techniques was most evident at the Buckley Bay and Northwest Bay operations. See comments on Cowichan Operation. • Stream channel beds, banks, and embedded organic debris were not materially affected by practices. • Tree retention along streams met or exceeded the regulation at all sampled sites. Understorey vegetation and non-commercial trees were retained within 5 meters of stream edges including small streams. • The number of temporary stream crossings used during harvesting was kept to a minimum and they were removed after use. • Ground- based operations were conducted in a manner that minimized soil disturbance adjacent to streams (≤ 5m distance) and in areas with sensitive soils. • Potentially unstable soils and gully sidewalls were appropriately protected and not destabilized as a result of forest harvesting. • Minor quantities of sediment in stream channels in some of the stream crossings assessed. • At Northwest Bay at one bridge replacement site, sediment entered the stream channel when the old gravel-decked log structure was removed. At the new bridge, fine material in the approach fill behind one abutment is not fully retained and is enabling some sediment to enter the channel. **Cowichan operation** • Road grading spilled sediment onto culvert inlets and outlets, and grader berms were preventing water from draining off road surfaces. The grader was carrying road surface material onto bridge decks. • More frequent use of cross- drains (interceptor culverts that redirect flows), sediment sumps, check dams, and armouring of erodible soil would reduce sediment transport potential. • Examples of observed practices with potential to introduce sediment include: small quantities of excavated material (spoil) above two culvert outlets, unstable organics in fill material at one culvert, and one instance of logs decked on top of a small stream culvert.

5 & 39	Hancock Forest Management	Cowichan Lake, Campbell Lake & Union Bay	12 blocks 59 km road	11	3	• Forest practices were in compliance with regulatory requirements for water quality and fish habitat. • Channel banks and beds were not adversely affected by harvesting adjacent to streams. Fish migration had not been impeded at stream crossings, and there was no apparent increase in sediment delivery to streams. • Sediment control measures, such as sediment traps in ditches, were appropriately employed to minimize the amount of sediment introduced into streams. • Most ditches and culverts had been cleaned after logging, and frequent water bars/fail-safes were installed to control water and minimize erosion • A high percentage of windthrow occurred in a 60 meter-long section of riparian tree retention adjacent to a small fish stream. • At one stream, a new bridge (log culvert) had been installed overtop of a collapsing wooden culvert. The hydraulic capacity of the collapsed culvert was restricted. This is a high-risk practice.
61	Western Forest Products	Holberg	2 blocks 10 km road	2	-	• Forest practices were in compliance with the regulatory requirements for water quality and fish habitat. • Effective erosion control strategies had been employed at stream crossings to minimize sediment input to watercourses. • Ditches and culverts were routinely cleaned after logging, and water bars/fail-safes were installed where appropriate. • New bridges had been designed and constructed in a manner that ensured minimal disturbance to aquatic habitat. Stream crossing deactivation on spur roads was also done in an environmentally responsible manner. • One old wooden culvert was found to be plugged with debris. This was likely the result of either an over-sight or had been plugged since de-mobilization. No harm to downstream fish was observed at this site. At a second stream crossing, road fill above the culvert outlet was steep and some ravelling of the road fill was occurring. Very little sediment, however, had entered the channel of this non-fish stream.
78	Kapoor Lumber	Leechtown	7 blocks 23 km road	3	-	• Forest practices were in compliance with regulatory requirements for water quality and fish habitat. • Roads were being well maintained and water management practices were effectively implemented. • No evidence of a reduction in site productivity or damage to riparian retention areas was observed.
363	510968 BC Ltd.	Malahat	1 block 0.7 km road	0	-	• Forest practices are in compliance with regulatory requirements for water quality and fish habitat. • Forest practices were effective in minimizing sediment with one exception. A 100 metre section of road surface was partially eroded by surface runoff resulting from recent heavy rain. The volume of sediment mobilized was

						small and did not affect fish habitat or water quality. • Harvesting had been conducted in a manner that did not affect fish habitat or water quality.
177	Totangi Forestry	Langford	1 block 1.0 km road	0	-	• Forest practices are in compliance with regulatory requirements for water quality and fish habitat. • Harvesting has not affected fish streams or water quality.

Appendix V Audit Photographs

Streamside tree retention in foreground, Quinsam River area.

Streamside tree retention below felled timber.

Streamside tree retention along a small stream.

Streamside tree retention, Black Creek.

Permanent bridge and streamside tree retention, Tsable River area.

Old domestic water catchment at McGee Creek near Sooke.

Open bottomed plate arch culvert.

Structurally sound old wooden culvert.

Rock used to stabilize cutbank at newly constructed road.

Non-erodible road surfacing reduces sediment transport to stream.

Filter cloth reduces sediment entering stream at bridge.

Logs do not fully retain road fill above a small stream.