SEA-TO-SKY HIGHWAY IMPROVEMENT PROJECT

ASSESSMENT REPORT

With Respect to:

Review of the Application for an Environmental Assessment Certificate
Pursuant to the *Environmental Assessment Act*, S.B.C. 2002, c. 43
And
The Requirements of a Screening Report Pursuant to the
Canadian Environmental Assessment Act, S.C.1992, c. 37 as amended

Prepared by

Environmental Assessment Office

May 2004

BRITISH COLUMBIA

SEA-TO-SKY HIGHWAY IMPROVEMENT PROJECT ASSESSMENT REPORT

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LIST OF ACRONYMS

AIA	Archaeological Impact Assessment
AIUS	Aboriginal Interest and Use Studies
ARD	Acid Rock Drainage
BCAIA	British Columbia Archaeological Impact Assessment Guidelines
BCEAA	British Columbia *Environmental Assessment Act*
BCWQG	BC Water Quality Guidelines
BMP	Best Management Practices
BTWG	Biophysical/Technical Working Group
CACs	Criteria Air Contaminants
CAG	Community Advisory Group
CEAA	*Canadian Environmental Assessment Act*
CEQG	Canadian Environmental Quality Guidelines
CMHC	Canada Mortgage and Housing Corporation
CMT	Culturally Modified Tree(s)
CSD	Context Sensitive Design
CWS	Canadian Wildlife Service
dB	Decibel
DBFO	Design-Build- Finance-Operate
DFO	Fisheries and Oceans Canada
DoS	District of Squamish
EAO	Environmental Assessment Office
EC	Environment Canada
EMP	Environmental Management Plan
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GVRD	Greater Vancouver Regional District
HAZMAT	Hazardous Materials Contractors
HC	Health Canada
HOV	High Occupancy Vehicle
INAC	Indian and Northern Affairs Canada
IR	Indian Reserve Land
Ldn	Day-Night Average Noise Level
Leq	Equivalent Sound Level
LRSP	Livable Region Strategic Plan
MEM	Ministry of Energy and Mines
ML	Metal Leaching
MoT	Ministry of Transportation
MSRM	Ministry of Sustainable Resource Management
NO_X	Nitrogen oxides
NWPD	Navigable Waters Protection Division
PAG	Potentially Acid Generating Rock
PEP	Provincial Emergency Program
RCLH	Rubble Creek Land Hazard (formerly the Garibaldi Civil Defense Zone)
RMOW	Resort Municipality of Whistler

LIST OF ACRONYMS (Cont.)

SEWG	Socio-Economic Working Group
SLFN	Squamish and Lil'wat First Nations
SLRD	Squamish-Lilloet Regional District
TDM	Transportation Demand Management
TC	Transport Canada
TLC	Technical Liaison Committee
TWFN	Tsleil-Waututh First Nation
VEC	Valued Ecosystem Component
VOC	Volatile Organic Compound
WLAP	Ministry of Water Land and Air Protection
WP	Work Package

EXECUTIVE SUMMARY

Background

The Sea-to-Sky Highway Improvement Project (Project) extends from immediately east of Nelson Creek canyon in the District of West Vancouver to Function Junction in Whistler, a distance of approximately 95 kilometres (km). The Project excludes the section of highway between Culliton Creek and Cheakamus Canyon because highway improvements in this area were approved and work underway when the Ministry of Transportation (MoT) applied for an environmental assessment certificate for the Project in August 2003.

The communities of the Howe Sound area (West Vancouver, Lions Bay, Squamish), the Resort Municipality of Whistler, Pemberton and Mount Currie are all linked by the Sea-to-Sky Highway 99 Corridor. The highway requires upgrades to address current deficiencies in safety, reliability and mobility, and to serve future travel needs, including transportation demands during the 2010 Winter Olympics.

For the purposes of the environmental assessment review the scope of the Project included:

- the works necessary to improve the existing highway;
- methods and locations for disposal of rock, surplus material and other waste;
- construction, use and maintenance of new ancillary facilities such as equipment storage and marshalling areas, barge access areas and gravel borrow areas;
- ancillary road system modifications adjacent to the Sea-to-Sky Highway associated with construction, operation and maintenance of the Project;
- all off-site facilities such as construction camps or other infrastructure services associated with and necessitated by implementation of the Project;
- any off-site environmental compensation works associated with and necessitated by implementation of the Project;
- all activities associated with the construction, operation and maintenance of the upgraded highway, including ongoing maintenance and traffic management; and
- any other physical works or activities which, in the view of the Environmental Assessment Office (EAO), form an integral part of the Project.

The EAO and federal Responsible Authorities defined the scope of the environmental assessment in Terms of Reference issued to the MoT on June 24, 2003 and has considered the potential environmental, economic, social, heritage and health effects of the Project.

In the Sea-to-Sky Highway Improvement Project Application (Application) the MoT originally proposed two split grade options for the section of the alignment between Horseshoe Bay and Sunset Beach:

- two new northbound lanes on the bench up-slope of the existing highway from Eagle Ridge Interchange (on Highway 1) to Pasco Road with upgrading of the existing two-lane Highway 99 for use by southbound traffic from Pasco Road to Marine Drive; or
- two new northbound lanes from immediately east of Nelson Creek canyon on Highway 1 to Pasco Road on the bench up-slope of the existing highway, approximately 1 km of which would be a tunnel at the south end, with upgrading of the existing Highway 99 to be used for two lanes of southbound traffic.

In April 2004, the MoT replaced these split grade alignments with two revised options for the section alignment between Horseshoe Bay and Sunset Beach: a four-lane overland route (known as Option B) and a two lane, two way tunnel and partial overland option (known as Option D). With Option B the existing Highway 99 between Horseshoe Bay and Sunset Beach remains a two-lane, two-way alignment for local traffic. With Option D, the two-lane tunnel will operate in conjunction with the existing two-lane Highway 99, with traffic split between the two routes to provide adequate traffic capacity. The existing highway will be upgraded from Marine Drive to south of Pasco Road.

Federal Harmonization

The Project is subject to federal review (screening level assessment) under the *Canadian Environmental Assessment Act* (CEAA) as it requires a federal authorization under legislation contained in the CEAA Law List Regulations.

First Nation Interests

The entire Project study area is within the asserted traditional territory of the Squamish Nation. This study area is overlapped to the north by the asserted traditional territory of the Lil'wat Nation (approximately between Rubble Creek and Function Junction). The southern end of the alignment between Horseshoe Bay and Lions Bay is marginally within the asserted traditional territories of the Tsleil-Waututh Nation and the Musqueam Indian Band.

The Squamish and Lil'wat Nations and/or their technical consultant took part in working group meetings during pre-application and during the Application review. The MoT and the Squamish and Lil'wat Nations agreed on various Project related Protocols, MOUs and funding agreements. Tsleil-Waututh Nation participation in the pre-application phase of the environmental assessment began in the spring of 2003. The MoT and Tsleil-Waututh Nation finalized a Protocol Agreement in May 2003 that provided the framework for the Tsleil-Waututh to participate in the EA review process. The Squamish and Lil'wat Nations provided a joint submission on the Application and the Tsleil-Waututh First Nation also provided written comments on the Application.

The Squamish and Lil'wat are concerned that the assessment of potential cumulative effects from the Project, as required by the federal CEAA, is incomplete because it did not consider the impacts of induced growth, attendant development and its impacts on First Nations or the full scope of all existing development in the Sea-to-Sky corridor including the existing highway. The Canadian Environmental Assessment Agency, on behalf of the federal Responsible Authorities responded to the Squamish and Lil'wat to advise that CEAA does not require assessment of induced growth unless the type of projects, the area of impact and the environmental components that would be affected could reasonably be identified and are likely to interact with the Project.

Public Comments

The MoT undertook a comprehensive public consultation program prior to, and during, the review of the Application. The EAO also conducted a fifty-nine day public comment period on the Application from August 20 to October 17, 2003. Residents of the District of West Vancouver and the Village of Lions Bay provided 55 of the 105 written submissions to the EAO during the public comment period.

West Vancouver residents expressed concerns about potential increases to traffic at the Caulfield interchange, impacts to emergency response times, and issues of local access and mobility from the proposed split grade alignments originally proposed in the Application. In response to these and other design issues, the MoT initiated further consultation in the District of West Vancouver in January 2004. The MoT conducted two open houses in the West Vancouver area on February 16 and 22, 2004 to present revised options for the preliminary alignment between Horseshoe Bay and Sunset Beach and met with twelve stakeholder groups and service providers in the community. The MoT reported the results of these consultations in the *Sea-to-Sky Highway Improvement Project Clarification Report – Horseshoe Bay to Sunset Beach (West Vancouver Segment),* April 2004 (West Vancouver Clarification Report) and presented Option B and Option D for certification.

In the Village of Lions Bay, residents were concerned about noise and impacts to safety and connectivity from the four-lane alignment proposed by the MoT in its Application and from the MoT's proposal to pave a section of the BC Rail line for use as a traffic detour during Project construction in the Lions Bay area. In January 2004 the MoT initiated additional consultations with the Village of Lions Bay that included an open house and public meeting on February 28, 2004 to present revised options for the preliminary alignment through the community (Work Package 3A). The results of these consultations are reported in the *Sea-to-Sky Highway Improvement Project Clarification Report – Village of Lions Bay*, March 2004 (Lions Bay Clarification Report). Based on additional consultation with the community of Lions Bay since March 2004, the MoT has since decided to proceed to preliminary design with the four lane divided highway option only and has communicated this to the Village of Lions Bay in a letter to the Mayor and Council on May 7, 2004.

Working Group Review of the Application

The EAO created a Biophysical Technical Working Group and a Socio-Economic Working Group to provide technical analysis and advice during the review of the Application and subsequent review of the West Vancouver and Lions Bay Clarification Reports. The working groups benefited from the participation of representatives from federal government departments, provincial ministries, local governments in the Sea-to-Sky corridor and representatives from the Squamish, Lil'wat and the Tsleil-Waututh First Nations.

Summary of Key Review Issues

<u>Project Design</u>
The primary design issue discussed during the review was the proposed alignment options between Horseshoe Bay and Sunset Beach. The District of West Vancouver Council favours a tunnel option and is concerned about the potential environmental impacts of the four lane overland route (Option B) relative to the proposed option for a two lane, two way tunnel (Option D). During the environmental assessment, the District of West Vancouver commented that prior to the development of Option B and Option D, the MoT committed to investigate a tunnel of between 1.0 and 1.4 km in length, whereas, the length of Option D as currently proposed by the MoT for comparative purposes with Option B is approximately 1 km. The District observes that if the tunnel proposed in Option D were extended by 400 metres it would increase the environmental benefit of the tunnel substantively. The MoT responded that it had investigated many options including longer tunnels to assess trade-offs between such factors as property requirements, safety performance, environmental impacts and cost. The MoT estimates that extending the tunnel from 1.0 to 1.4 km would have an additional net cost of $10-15 million while making the grade steeper and adversely affecting the safety performance.

The District of West Vancouver has concluded that Option B and Option D (as currently designed) have the potential for significant adverse environmental effects. This conclusion is not shared by the federal and provincial representatives to the working groups, who are satisfied that neither Option B nor Option D are likely to cause significant adverse effects.

Community Noise Impacts

The Project does have the potential for increased noise near some residential areas during the construction phase because of the volume of construction activity scheduled for nighttime hours and the noise associated with this type of activity. The MoT predicts that these levels of construction noise will temporarily inconvenience some residents. The MoT will develop a Noise Control and Mitigation Plan and schedule the noisiest construction activities for daytime hours where feasible. The MoT will also promote good communication with local communities to help manage construction noise impacts.

The working groups also considered the potential for impacts from increased noise from Project operations. The Village of Lions Bay expressed extensive community concern about potential noise impacts to their community. These concerns have been further addressed and the MoT has committed to working with the Village of Lions Bay to reduce current highway noise by 4-5 decibels and will make best efforts to incorporate other noise mitigation measures, which could result in a further 5 decibel reduction.

The Squamish Nation is concerned about potential noise impacts from Project operation to the community living on IR#24. The MoT has committed to further analysis of noise impacts and mitigation measures on IR#24 during the detailed design phase when the physical characteristics of the alignment are better known. This analysis will be done in cooperation with the Squamish Nation.

Geochemical Issues

The Project will include extensive rock cuts and primarily between Sunset Beach and Lions Bay and will generate waste rock that is potentially acid generating material (PAG) or metal leaching (ML) and will require careful disposal. The MoT will use the Britannia Mine Site as the primary method for disposal of PAG/ML materials and may also use ocean disposal for some PAG material, subject to permit from Environment Canada. The MoT will also, as part of its environmental management planning, adopt a proactive approach to the management of PAG rock cut surfaces and of rock cuts which may have the potential for metal leaching in the future. The plan will be reviewed by the Ministry of Energy and Mines and will include water control measures where feasible.

Water Quality

Contamination of a water source can result from point and non-point sources created during Project construction (e.g. blasting, siltation, spills) or during Project operations (deposit of substances on the road surface from vehicle tires and exhaust and from de-icing chemicals and winter abrasives). Precipitation eventually flushes these substances from the road surface into ditches and streams and can result in fluctuations in water quality. The MoT will implement a three-component Water Quality Monitoring Program including: water quality audit and performance monitoring; water quality sampling and analysis of runoff from PAG/ML rock cuts; and water quality field sampling monitoring protocol.

Fisheries and Aquatics

To the extent possible, the MoT has avoided impacts to aquatic habitat from the proposed highway alignment with the exception of seven sites identified in the Application where unavoidable impacts to fish habitat will occur. The MoT proposes to develop and implement a Fish and Fish Habitat Mitigation Compensation Plan to achieve no net loss of the productive capacity of fish habitat. The MoT also proposes to offset impacts to amphibian habitat through opportunities provided by fish habitat compensation works or through other separate enhancement initiatives. These initiatives will be further discussed with Fisheries and Oceans Canada (DFO) during the final design phase and the development of compensation measures for impacts to fish and fish habitat.

Conclusions

The EAO and federal Responsible Authorities are satisfied that:

- the Application adequately identified and assessed the potential significant adverse environmental, economic, social, heritage and health effects of the Project;
- public and First Nations consultation, and the distribution of information about the Project have been adequately carried out by the MoT;
- issues identified by the public, First Nations, federal, provincial and local government agencies, that are within the scope of the EA, were adequately addressed by the MoT during the review of the Application; and,
- practical means have been identified to prevent or reduce to an acceptable level any potential adverse effects of the Project.

1. INTRODUCTION

The communities of the Howe Sound area (West Vancouver, Lions Bay, Squamish), the Resort Municipality of Whistler, Pemberton and Mount Currie are all linked by the Sea-to-Sky Highway 99 Corridor. The highway requires upgrades to address current deficiencies in safety, reliability and mobility, and to serve future travel needs, including transportation demands during the 2010 Winter Olympics. These upgrades constitute the proposed Sea-to-Sky Highway Improvement Project (Project).

Accident rates along this predominantly two-lane highway are substantially higher than the provincial average for comparable roads and, on average, are more severe than the overall average for the province. Between Horseshoe Bay and Whistler there were 27 road related fatalities between 1996 and 2000. Improvements in the corridor are needed to bring the accident rates down to the provincial average for similar classes/types of highways.

Travel along the highway is subject to recurring delays from activities such as minor construction works, rock scaling, rock falls, debris flows and other natural events. The MoT predicts that improvements to the corridor will reduce travel time between Horseshoe Bay and Whistler compared to travel times in future years if no highway improvements are made. Upgrades are also necessary to meet the requirements to host the Vancouver/Whistler 2010 Winter Olympics.

The MoT plans to use a Design-Build-Finance-Operate (DBFO) procurement model for the Project.[1] The number of contracts could range from one overall contract for the entire alignment to separate contracts for each major construction segment. The procurement strategy and ownership/management framework will meet the overall fiscal requirements of the Province of British Columbia and deliver the Project on schedule.

2. PROJECT DESCRIPTION

The Project, which begins near Horseshoe Bay and ends at Function Junction near Whistler (Figure 1), may be carried out in stages or sections known as Work Packages (WP). Volume 1, Section A of the Sea-to-Sky Highway Improvement Project Application (Application) outlines a proposed base case construction schedule. The work required for the Project is described in detail in Volume 1, Section B of the Application. Volume 3, Section A5 of the Application provides an overview of the construction program. Table 1 shows the current preliminary Project construction schedule and may be subject to change after the DBFO contractor is selected.

The work from Culliton Creek to Cheakamus Canyon (North) was underway before the Project was declared reviewable under the British Columbia *Environmental Assessment Act* (BCEAA) and is not part of the current environmental assessment.

[1] Through a request for proposals, the MoT will grant a concession to a third party to design, construct, operate, maintain and finance the highway in exchange for a defined stream of revenues. The MoT notes in the Application that motorist-paid tolls on the highway are not being considered for the Project.

Figure 1 – Preliminary Alignment

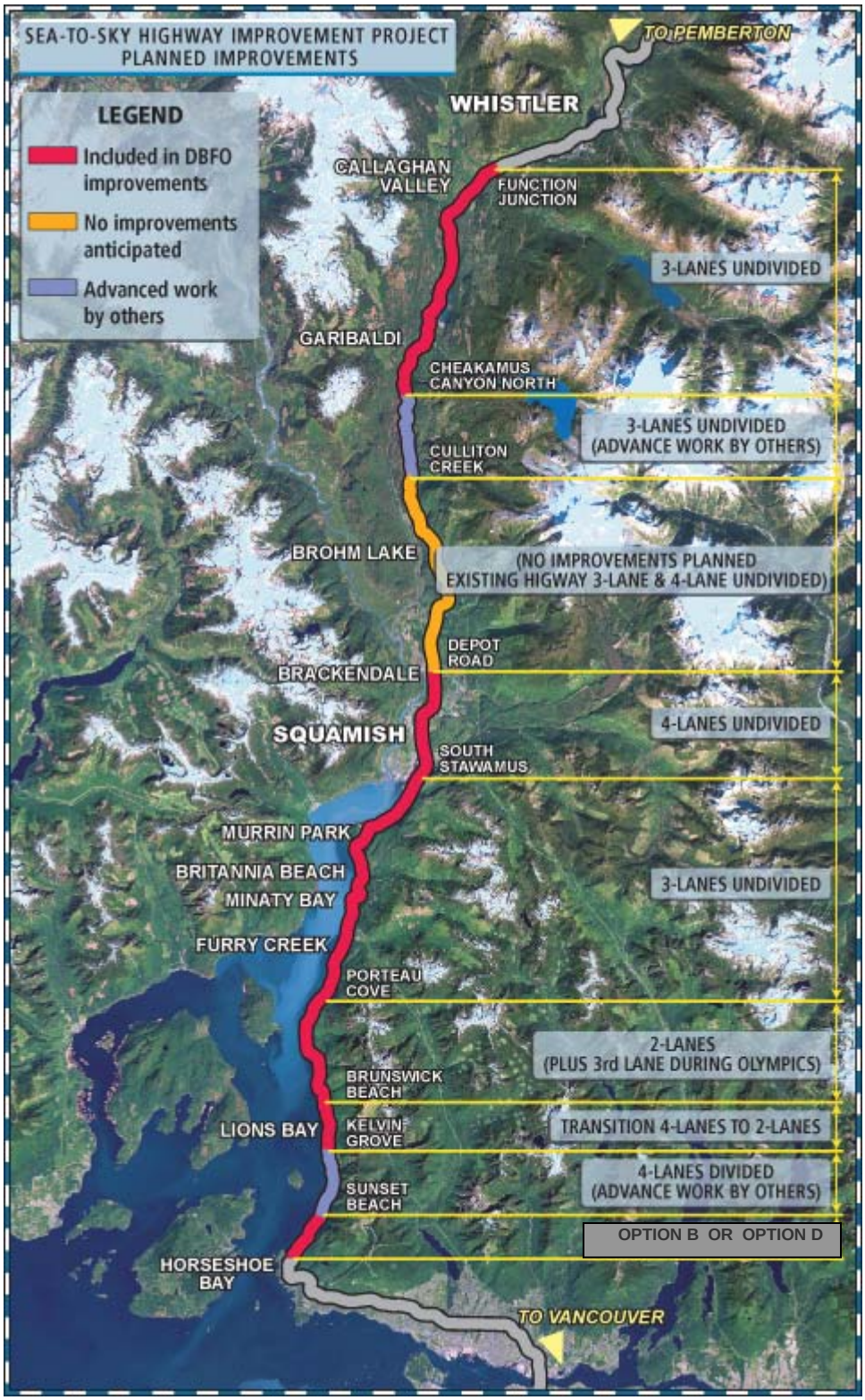

Table 1 – Work Packages and Locations

Work Package	Approximate Location	Begin	End
WP 1	Horseshoe Bay	2005	2008
WP 2	Sunset Beach to Lions Bay	2004	2007
WP 3A	Urban Lions Bay	2007	2008
WP 3	Lions Bay to Furry Creek	2004	2009
WP 4	Furry Creek to South Stawamus	2007	2008
WP 5	South Stawamus to Depot Road	2005	2007
WP 6	Depot Road to Culliton Creek	2005	2008
WP 7	Culliton Creek to Cheakamus Canyon (North)	2003	2004
WP 8	Cheakamus Canyon (North) to Function Junction	2004	2008

The MoT has designed the construction schedule to avoid road closures due to construction during December, January and February. Minor, intermittent delays may occur at any time of the year. Delays between fifteen to thirty minutes in length are limited to the period from March to November. The general works for the Project are summarized below. While the Project includes improvements to existing access road connections and consolidation of some accesses, no new access roads are proposed as part of the Project.

WP1 - Horseshoe Bay to Sunset Beach
The options for the preliminary alignment between Horseshoe Bay and Sunset Beach are described in the *Sea-to-Sky Highway Improvement Project Clarification Report – Horseshoe Bay to Sunset Beach* (West Vancouver Segment)*,* April 2004 (West Vancouver Clarification Report) and replace the options presented in the original Application document. The MoT proposes two options for certification, known as Option B and Option D.

Option B is an overland route with four new lanes up-slope from the existing Highway 99 corridor. The existing highway would then serve only local and ferry traffic. The MoT indicates that the long-term capacity and safety of Option B are superior to all other options (ref: Accident Cost (PV) Table on page 12 of West Vancouver Clarification Report). No highway improvements are necessary on the existing highway between Marine Drive and Pasco Road since it reverts to local traffic use only.

Features of Option B include:

- construction starts at north end of Westport Road Overpass;
- widen deck of the existing Nelson Creek bridge to achieve six lane cross section;
- four-lane bridge crossing of Larsen Creek;
- new grade separated right hand exit to Eagleridge Drive, Marine Drive, Horseshoe Bay Village, and BC Ferries terminal; Highway 99 through traffic stays on inside lanes, adjacent the median;
- new grade separated on-ramp south of Pasco Road for merging northbound traffic entering from the local road to the existing highway;
- widen the existing Highway 99 to four lanes from south of Pasco Road to Ansell Place interchange;
- northbound access to Pasco Road via Ansell Place Interchange;
- southbound right-in, right-out, left out turning movements provided at Pasco Road;
- replace the Horseshoe Bay overhead structure;
- Marine Drive intersections become local road intersections; and

- local southbound traffic Eagle Ridge Interchange merges with BC Ferries terminal outbound traffic similar to the current situation.

Option D consists of two new lanes up-slope from the existing Highway 99 corridor and includes a two-lane, two-way tunnel of approximately 1 km in length. The new tunnel route and the existing Highway 99 would each carry two-way traffic. Construction of the tunnel route would start at the north end of the Caulfield Interchange. Option D includes upgrading of the existing highway between Marine Drive and Pasco Road to accommodate a portion of the through traffic and improve traffic safety.

Features of Option D include:

- two new bridge crossings over Nelson Creek;
- reconstruct the Westport Overpass structure to accommodate the 6-lane cross section;
- two lane, two way 1 km tube tunnel and parallel safety tunnel;
- widen the existing Highway 99 to four lanes from south of Pasco Road to Ansell Place interchange;
- same in/out turning movements at Pasco Road as provided in Option B;
- new off-ramp south of Pasco Road to existing Highway as provided in Option B); and
- southbound lane rejoins the Upper Levels Highway south of the reconstructed Westport Road Overpass.

Common features of Option B and D:

- connection to the north without backtracking to Caulfield, so no additional traffic is directed to the interchange; and
- connection to the existing highway corridor 700 metres south of Pasco Road which lowers the profile slope of the new lanes from 8% to 4.5%, enables the Pasco Road intersection to support a left-out protected turn lane to create direct highway access northbound and avoids encroachment on Cypress Provincial Park.

WP2 - Sunset Beach to Lions Bay
The MoT proposes to upgrade the existing alignment between Sunset Beach and Lions Bay from two lanes to four lanes and expand the Ansell Place Interchange to accommodate four lanes of traffic. Proposed bridge work includes:

- a new two-lane southbound bridge downstream of the existing two-lane bridge at Charles Creek with the upstream half of the existing bridge rebuilt after the new bridge is complete; and
- concrete overlay on the decks of the existing four-lane bridges at Montizambert Creek, Strip Creek, Newman Creek, and Lone Tree Creek.

WP 3A – Urban Lions Bay
In the Application, the MoT initially considered either a two lane or four lane divided highway through Urban Lions Bay. These options were refined after additional consultation with the Village of Lions Bay between January and March 2004 and refinements to these two-lane and four-lane options are presented in the *Sea-to-Sky Highway Improvement Project Clarification Report – Village of Lions Bay,* March 2004 (Lions Bay Clarification Report). Both options include measures to reduce travel speeds and noise, a bike lane, landscaped median, additional lighting and traffic calming measures. The two-lane option would move fewer lanes of traffic through the community and meet vehicle traffic capacity to approximately 2017. The

construction footprint for each of these options is materially the same and includes the width of the roadbed, intersection considerations, and noise mitigation measures. The two-lane option would include a larger center median. Based on additional consultation with the community of Lions Bay since March 2004, the MoT has since decided to proceed to preliminary design with the four lane divided highway option only and has communicated this to the Village of Lions Bay in a letter to the Mayor and Council on May 7, 2004.

WP 3 - Lions Bay ('M' Creek) to Furry Creek
The MoT will upgrade the 'M' Creek to Furry Creek segment for safety and reliability in select locations through rock slope stabilization, improved highway geometrics and enhanced passing opportunities. There are no plans to widen this section to include a continuous three-lane cross-section. Potential bridge work includes:

- deck widening of the existing two-lane bridge at M Creek;
- downslope widening of existing concrete arch near Loggers Creek;
- concrete overlay on the deck of the existing four-lane bridges at Harvey Creek, Alberta Creek and Magnesia Creek;
- upstream widening of the existing two-lane bridge at Loggers Creek; and
- replacement of existing two-lane timber-deck bridge at Deeks Creek with two or three traffic lanes and downstream sidewalk.

WP 4 - Furry Creek to South Stawamus
Upgrades to the existing highway between Furry Creek and South Stawamus will create a three-lane cross-section to provide for alternating passing lanes. Just north of Minaty Bay Hill, the MoT will either retain the existing alignment or construct a short bypass that would connect with the existing alignment (see Application Volume 1 Map and Drawing Folio – Drawing 41DK-PAHS-0420 & 0421).

Proposed bridge work includes:

- twinning the existing Furry Creek two-lane timber-deck north bridge and concrete box-beam deck south bridge on the upstream side with a new northbound structure;
- possible replacement of the existing Britannia Creek two-lane steel through-truss bridge with a new three-lane and upstream sidewalk raised profile structure on the existing alignment;
- twinning of the existing two-lane bridge at Gonzales Creek on the downstream side with a new two-lane southbound structure or replacement of the existing bridge with a new three-lane structure downstream and decommissioning of the existing bridge; and
- widening of the existing two-lane bridge at Shannon Creek on the upstream side for two additional traffic lanes (no temporary crossing is required).

WP 5 - South Stawamus to Depot Road
The highway through Squamish between South Stawamus and Depot Road will be upgraded along the existing alignment to four-lanes plus full turning movements at the signalized intersections. Urban design features, such as raised medians and curb and gutter will be considered, particularly near signalized intersections. Proposed bridge work includes:

- replacement of the existing two-lane Stawamus River bridge with a raised, longer span, four-lane bridge. Northbound lanes will be along the existing alignment, southbound lanes will be on the downstream (west) side;
- replacement of the existing two-lane Mamquam Blind Channel bridge with a new four-lane two-span structure centered about the existing alignment; and

- twinning the existing two-lane Mamquam River bridge with a new downstream structure for two southbound lanes and modification of the existing bridge.

WP 6 - Depot Road to Culliton Creek
The highway between Depot Road and Culliton Creek is currently three-lanes. The only highway improvement work being considered in these sections is a two kilometre south bound passing lane north of the Cheekye River Bridge.

WP 7 - Culliton Creek to Cheakamus Canyon (North)
Construction is underway to widen the existing two-lane highway to three-lanes and to improve the alignment in this section. This work is not part of the Project under review.

WP 8 - Cheakamus Canyon (North) to Function Junction
The existing highway between Cheakamus Canyon (North) and Function Junction will be upgraded to a three-lane cross-section to provide for alternating passing lanes. Currently, it is a two-lane highway with a couple of short four-lane segments which will be preserved. Proposed bridge work includes:

- downstream widening of the existing two-lane Rubble Creek bridge to accommodate a third traffic lane;
- construction of a new two-lane northbound parallel bridge on the upstream side of the existing two-lane Cheakamus River bridge and modifications to the existing bridge for southbound lanes;
- construction of a new two-lane northbound parallel bridge on the upstream side of the existing Daisy Lake bridge and modifications to the existing bridge for southbound lanes;
- widening to both sides of the existing Brandywine Creek bridge; and
- maintaining the existing two-lane Callaghan Creek bridge for one-lane southbound traffic and twinning the existing bridge with a new two-lane structure on the downstream (East) side for northbound traffic.

There are also new BC Rail line overpasses proposed south of Brandywine Falls Park and south of Function Junction.

<u>Ancillary Works</u>
The Project may also include the following ancillary activities and temporary works:

- the section of BC Rail line between Magnesia Creek and Furry Creek may be paved and used as a southbound traffic lane during the 2010 Olympic event;
- construction, use and dismantling of a barge loading facility at Sunset Marina as well as the use of the existing ferry facility at Porteau Cove Provincial Park;
- construction, use and dismantling of temporary bridges at Deeks Creek, Britannia Creek and Mamquam Blind Channel;
- creation, use and restoration of construction staging and equipment storage areas;
- creation and use of aggregate production and suitable material stockpiling sites;
- creation and use of surplus material disposal sites such as the existing MoT Westport and MoT Brunswick Pits for non-Acid Rock Drainage (ARD) and non-Metal Leaching (ML) surplus material and use of Britannia mine site for disposal of ARD/ML material;
- disposal of materials at designated ocean disposal locations of Watts Point site in Howe Sound and the Point Grey site in Burrard Inlet; and
- relocation of hydro towers.

Use of the BC Rail Line

The MoT is in discussions with BC Rail to finalize a formal agreement to use the BC Rail line during the Olympics as an additional southbound lane for traffic between Magnesia Creek and Furry Creek. Access from the highway to the rail bed in the vicinity of Brunswick Beach would either be just to the north of Magnesia Creek Bridge or just to the south of the 'M' Creek Bridge. Use of the rail line as an additional southbound lane is also proposed in the area of Britannia Beach. The concept is to pave outside of and between the tracks, similar to a streetcar system and use the additional lane primarily during the peak morning hours, when two northbound lanes are required for the Olympic transportation needs. No rail operations will occur on this section during the Olympics. The MoT proposes to restore the rail line to its original condition after an additional lane is no longer required.

Major Work Items and Construction Activities for the Project

Rock Excavation

- construction of access roads
- drilling of blasting holes into rock face and loading of explosives
- placement of blasting mats to contain fly rock, where required
- detonation of blast
- loading of blasted material into haul trucks
- transport of surplus material to barge loading areas, storage areas, fill sections and/or disposal sites
- additional scaling and trimming to achieve safe, stable slopes

Retaining Walls

- clearing and grubbing of overburden material
- construction of access roads
- excavation of side slope to form footing base for retaining wall
- temporary shoring works, (i.e.: grouting, shotcrete)
- transport of pre-cast concrete wall segments to site
- hoisting and assembly of wall segments
- drilling of anchor holes into hill side and fastening of tie backs or installation of restraining straps
- transport, placement and compaction of back fill

Bridges

- clearing and grubbing of overburden material
- installation of piling, if required
- excavation of ground to form base for abutment and column footings
- placement of formwork and reinforcing steel for foundation, abutments and columns
- pouring of concrete for foundation, abutments and columns
- installation of superstructure (steel or concrete girders, etc.)
- placement of formwork and reinforcing steel for bridge deck
- pouring of concrete for bridge deck
- construction parapet walls
- membrane and asphalt concrete pavement of bridge deck

Grading and Asphalt

- clearing and grubbing
- cut and fill to set the sub-grade elevation
  - excavation of excess material from cut sections
  - transport of excess material to fill sections or to temporary stockpile storage areas
  - grading and compaction of sub-grade foundation
- production, transport of granular material for road base to the site
- grading and compaction of granular material in layers
- paving of road base with asphalt surface in two layers
- apply pavement markings and erect signage
- installation of concrete median barriers and guard rails, where required

Tunnel (If Option D Constructed)

- rock excavation
- transport of surplus material to storage area and/or disposal sites
- transport of pre-cast tunnel liner panels to site
- assembly of tunnel liner and grouting
- construction of entrance portal structures
- pouring of concrete road base
- installation of electrical and mechanical equipment (lighting, ventilation and fire suppression, if required)
- other ancillary works including emergency escape passages

Test Section

One goal of the MoT is to minimize traffic disruptions during Project construction and this presents major challenges in areas of rugged terrain where construction requires blasting and slope stabilization works. In the Application, the MoT proposed design strategies and construction methodologies to meet this goal but wished to test these on an actual section of highway to fully gauge their effectiveness.

The MoT identified a one kilometre section of highway just north of Sunset Marina, between Montizambert Creek and Strip Creek as a suitable location to test some of the proposed construction methods and traffic management strategies because the area presents construction and traffic management challenges, contains no stream crossings or other sensitive habitat and would allow the MoT to validate its approach and methodologies for minimizing traffic impacts to the traveling public (Ref: Volume 1 Map and Drawing Folio – Drawing 41DK-PAHS-0404 & 0405).

The MoT applied to the Environmental Assessment Office (EAO) on July 18, 2003 for permission to build this test section and provided a construction timetable. After consultation with local governments, provincial and federal agencies and First Nations, the EAO and federal Responsible Authorities concluded that any local concerns associated with the test section could be easily mitigated and approved the request on August 11, 2003. Test section construction was scheduled from mid-September 2003 to the end of June 2004 with no work between December and February that might delay vehicle traffic and impact to winter tourism in the corridor. The approval required the MoT to report on the test section construction by November 28, 2003 and this was done.

The MoT reported that, in practice, test section construction began on November 3, 2003 after delays in selecting a contractor. While less work than planned was completed by the end of November 2003, the MoT was able to test some traffic management regimes, verify some

geotechnical assumptions and collect information to refine a future Request for Proposals for the Sunset Beach to Lions Bay section (WP2) to obtain more accurate or competitive prices. Assumptions about median walls and alternative retaining wall designs were tested in March and April 2004 when the MoT resumed test section construction.

3. CONSIDERATION OF ALTERNATIVES

As described in Volume 1, Section A4 of the Application the MoT evaluated a number of alternatives to the Project. This included alternative transportation corridors to link Vancouver to Whistler and, within the existing corridor, alternative means of transportation to reduce or eliminate the need for upgrades to Highway 99.

Alternative Corridors
The MoT considered five alternate corridor routes to Whistler:

- Harrison Mills to Mt Currie corridor route;
- Indian Arm/Indian River corridor route;
- Seymour River corridor route;
- Hybrid Seymour River-Indian River corridor route; and
- Capilano River corridor route.

Using information from previous studies the MoT concluded that these other corridor options would cost from 78% to 200% more than the proposed Project, would introduce a major highway into relatively inaccessible ecosystems, could not be completed in time for the 2010 Winter Olympic Games and would not eliminate the need for safety and reliability upgrades on the existing Highway 99.

Alternative Means of Transport within the Existing Corridor
Within the existing corridor, the MoT considered maintaining the *status quo* (no upgrade), a marine option, a rail option and a Transport Demand Management (TDM) option. The details are provided in Volume 1, Section C of the Application.

The MoT predicts that as traffic volumes increase over the next twenty years, maintaining the *status quo* (no improvements) would increase accident frequency and driver delay due to queue delay and slower traveling speeds, reduce opportunities to perform needed highway maintenance and have negative economic impacts in communities along the corridor. The *status quo* option also does not meet the provincial commitments for hosting the 2010 Winter Olympic Games.

While a high-speed commuter ferry service operating between Squamish and Vancouver is operationally feasible and would provide a realistic means of transport if tolls were instituted on private vehicles between Horseshoe Bay and Squamish, the MoT estimates that this option would cost about $271.3 million, may only capture about 3% of drivers and do little to mitigate the need for highway improvements.

A rail and ferry service combined would capture less than 5% of the current traffic demand and would not defer the needed improvements to the highway. A higher speed railway proposed and passenger ferry/bus service could cost in excess of $1 billion and $271 million respectively to implement and are not cost-effective alternatives to the Project.

The MoT also concluded that TDM measures alone will not eliminate the requirement for safety and reliability upgrades to the current highway. Section 12.2 of this Assessment Report presents TDM issues in more detail.

The EAO and the federal Responsible Authorities are satisfied that the MoT has carried out an adequate assessment of project alternatives.

4. PROVINCIAL AND FEDERAL REVIEW OF THE PROJECT

Basis for the Provincial Review

The *British Columbia Environmental Assessment Act* (BCEAA) includes a provision [Section 7(1)] allowing the proponent of a project that is not reviewable under the *Reviewable Project Regulations* (BC Reg 370/2002) to request that the Project be designated as reviewable and subject to an environmental assessment.

On January 20, 2003 the MoT requested the EAO to designate the Project a reviewable project. The EAO granted this request and, on June 27, 2003, set out the scope, procedures and methods for the environmental assessment in a procedural order (Section 11 Order) also the EAO also provided detailed Terms of Reference to the MoT specifying the information required for the MoT's Application.

Basis for the Federal Review

A project is subject to the *Canadian Environmental Assessment Act* (CEAA) where a federal authority either: proposes a project; sells, leases, or otherwise transfers control or administration of land to enable a project to be carried out; contributes money or any other form of financial assistance to a project; or exercises in relation to the project a regulatory duty (such as issuing a license, permit and approvals) that is included in the *Law List Regulation*.

For the Project, the MoT will require an authorization under section 35.2 of the federal *Fisheries Act,* a permit under the *Canadian Environmental Protection Act,* for ocean disposal of excavated materials and approvals under the *Navigable Waters Protection Act* where bridge works are constructed over navigable waters.

Pursuant to a tentative agreement between the Squamish Nation and the MoT, a permit under the *Indian Act* will be used to rectify the existing land tenure situation on IR#24 and accommodate the additional Reserve lands required for the project. Indian and Northern Affairs Canada (INAC) did not participate in the review of the project as a Responsible Authority until this land tenure information was known on March 23, 2004. INAC respects and accepts the expertise of Fisheries and Oceans Canada (DFO) and Environment Canada (EC) in coming to their conclusions on the environmental effects of the project.

Responsibility for the Navigable Waters Protection Act (NWPA) was transferred from the Minister of Fisheries and Oceans to the Minister of Transport on March 29, 2004. Therefore, Transport Canada (TC) is now identified as a Responsible Authority. Review of the impact of this project on navigation was conducted by the Navigable Waters Protection Division (now a division of TC). Pursuant to the EA protocol between TC and DFO for the transition period March 29 - October 1, 2004, the substantive review of other environmental impacts of this project and preparation of the CEAA Screening Report was undertaken by DFO. TC supports conclusions drawn by DFO throughout this document regarding adverse effects.

Each of these legal instruments is included on the *Law List Regulation,* thus triggering CEAA. The CEAA review of the Project is a screening level assessment and the Responsible Authorities are DFO, EC, INAC and TC.

Cooperative Review Process

The Canada/British Columbia Agreement for Environmental Assessment Cooperation provides for coordinated environmental assessment processes to avoid uncertainty and duplication where a project is subject to review under the BCEAA and CEAA. For cooperative reviews, the CEAA assessment is conducted using the process established by BCEAA and the results are documented in a common environmental assessment report. To complete a screening under CEAA, the RAs will base their CEAA conclusion on relevant factors reported in this Assessment Report and on other requirements for federal decision-making.

5. PROJECT COMPONENTS AND SCOPE OF ASSESSMENT

Scope of the Project

The procedural order issued by the EAO (Section 11 Order) specifies that the Project includes the following on-site and off-site physical works, as well as the activities associated with construction, operation and maintenance of these works:

(a) the works necessary to improve the existing highway, including:
  (i) any road development in a new right-of-way or road widening or relocation along an existing right-of-way,
  (ii) modification of existing access roads to and from the Highway (whether through reconstruction, relocation, elimination or other changes),
  (iii) development of any new road-related structures and excavations, and modification of any existing structures and excavations (whether through additions, removals or other changes), and
  (iv) modification of water diversion and drainage structures serving the Project (whether through additions, removals or other changes);
(b) methods and locations for disposal of rock, surplus material and other waste;
(c) construction, use and maintenance of new ancillary facilities such as equipment storage and marshalling areas, barge access areas and gravel borrow areas, and any use, modification or decommissioning of any existing ancillary facilities for Project-related purposes, including the adjacent BC Railway right-of-way;
(d) ancillary road system modifications adjacent to the Sea-to-Sky Highway associated with construction, operation and maintenance of the Project;
(e) all off-site facilities such as construction camps or other infrastructure services associated with and necessitated by implementation of the Project;
(f) any off-site environmental compensation works associated with and necessitated by implementation of the Project; and
(g) all activities associated with the construction, operation and maintenance of the upgraded highway, including ongoing maintenance and traffic management.

Scope of the Assessment

The scope of the assessment was set out in the Terms of Reference issued to the MoT on June 24, 2003.

6. LAND REQUIREMENTS AND LAND USE PLANNING

Provincial land use plans provide the framework and context for setting environmental, land use and resource management goals over provincial Crown land. Environmental assessment is conducted within the context of existing land use plans. While environmental assessment examines the effects of a project on adjacent land uses, it is a project-specific review mechanism and has no authority to act as a land use planning mechanism or to re-open previously approved land use plans.

Volume 3, Section A of the Application describes the land requirements for the Project and considers the relationship between the Project and land use planning in the corridor. The MoT predicts that the principal land use impacts during Project construction are related to land required for construction purposes and, potential access problems in areas of construction. Minimal impacts on other land use are predicted. Table 2 presents the MoT's estimates of the property required for the Project to accommodate alignment Option B or Option D, lane widening, bridge widening, possible tunnel construction, interchange modifications and staging areas during construction.

The majority of the property acquisitions are at the southern end of the alignment between Horseshoe Bay and Sunset Beach. Option B has requires more property acquisition than Option D and encroaches on lands that are currently undeveloped. Between Sunset Beach and Whistler, the majority of the highway widening and realignment will be confined within the existing Highway 99 right-of-way. Where properties are required for right-of-way purposes, with the exception of the proposed Options B and D in West Vancouver, the MoT reports these are typically slivers of land from the edge of private property, crown land, utility rights-of-way and BC Rail right-of-way.

Under applicable provincial statutes and legislation, the MoT has standard policies and procedures for land acquisition for highway construction to ensure that each owner is treated fairly and reasonably in the acquisition process. The MoT contacts impacted owners and analyzes their individual situations. In some cases the MoT may acquire a whole property, while in other cases the MoT may require only a portion of a property or temporary access to a property during Project construction.

Table 2 – Preliminary Estimates of Property Requirements

Segment Property Ownership	Property Requirements (hectares)
Horseshoe Bay to Lions Bay	
Crown Land	1.6
BC Rail Right-of-Way	0.4
Utility Right-of-Way	5.4
Municipal (Option B)	14.4
Private Property (Option B)	13.4
Subtotal	35.2
Lions Bay to South Stawamus	
Crown Land	1.0
BC Rail Right-of-Way	0.4
Utility Right-of-Way	1.9
Private Property	5.6
Subtotal	8.9
South Stawamus to Depot Road	
Crown Land	0.1
I.R. 24	0.7
Private Property	1.0
Subtotal	1.8
Cheakamus Canyon to Whistler	
Crown Land	2.7
Provincial Park	4.54
BC Rail Right-of-Way	2.0
Utility Right-of-Way	1.3
Private Property	1.6
Subtotal	12.14
Total	58.04

Source: SNC Lavalin estimates

Notes:

i) Property requirements were estimated using preliminary information and are subject to change upon completion of property title search and finalization of alignment and design.

ii) For Horseshoe Bay to Lions Bay Option B areas are shown since they exceed requirements for Option D.

7. INFORMATION DISTRIBUTION AND PUBLIC CONSULTATION

The EAO encourages proponents to seek public input early in project development as part of pre-application activities and, when an application is filed, report the results of consultations, propose measures to address public issues and outline steps for further consultation during the application review period.

The MoT has employed a process known as Context Sensitive Design (CSD) to help plan the Project. CSD is a collaborative, interdisciplinary approach where highway design is not only a technical exercise to meet safety, reliability and capacity goals but is also an effort to create a project that is sensitive to physical settings, community needs and preserves aesthetic, cultural, historic and environmental resources. The MoT, through its Owner Engineer (SNC Lavalin) established two structures for MoT/community dialogue:

Technical Liaison Committee (TLC) This is an interagency working group that meets regularly to review project issues and includes representatives from: the municipalities of West Vancouver, Lions Bay, Squamish and Whistler; the Squamish-Lillooet Regional District; the Greater Vancouver Regional District (GVRD); the Squamish and Lil'wat First Nations; BC Rail, BC Ferries, Utility Agencies; and the Greater Vancouver Transportation Authority (Translink). The TLC serves to streamline agency coordination and TLC meetings update participants on the status of the Project, review issues and impacts and promote contact with/between the MoT and stakeholder groups. TLC activities include workshops, discussion of corridor wide details such as service and signage needs, and efforts to harmonize Project design with Official Community Plans or Area Plans or future recreational and development needs. There are Technical Liaison Subcommittees in West Vancouver and Squamish where more technical consultation is required between the Owner's Engineer and senior municipal staff. Minutes of TLC meetings are posted on the EAO website.

Community Advisory Groups (CAG) These are groups of individuals nominated within their own communities who participate in the design review process to identify and compare provincial and community needs, issues, goals and objectives. This brings the design process closer to the community and the goals of Official Community Plans. There are CAGs for the Greater Vancouver Regional District (Strachan Point, Montizambert Creek, Ocean Point), Lions Bay, Squamish-Lillooet Regional District, Furry Creek, Britannia Beach and Pine Crest Estates/Black Tusk Village. Minutes of CAG meetings are posted on the EAO website.

To develop its Application, the MoT also conducted broader-based public consultation. This included public open houses and town hall meetings between October 9 – 31, 2002. Volume 4, Section B of the Application describes the MoT's pre-Application consultation activities and proposed measures for further consultation during the review of the Application.

When the MoT submitted its Application for screening, the EAO, in accordance with the *Public Consultation Policy Regulation* (B.C. Reg. 373/02), reviewed MoT's reporting on past and future public consultation programs and issued a written assessment to MoT on July 30, 2003. The EAO was satisfied with the public notice provided by the MoT for the public meetings and open houses which MoT organized in communities in the vicinity of the Project during the pre-application phase. The EAO concluded that the purpose, objectives, and scope of the MoT's public and stakeholder consultation program were

clear and consistent and the roles, responsibilities, and authority of all participants were clearly defined and communicated.

The EAO also found that appropriate processes and involvement forums were used to share information and facilitate the input of participants during both the *Conceptual Project Scope* and the *Planning and Preliminary Highway Design* phases of consultation and that the structure and function of the TLC and the CAG effectively coordinated issues and involved stakeholders to ensure local issues and concerns were consistently understood and considered.

Consultation During the Application Review Period

After the Application was accepted for formal review, the EAO and the MoT undertook measures to notify the public, provide information about the Project and create opportunities for public participation in the environmental assessment. The MoT carried out two structured consultation programs during this environmental assessment review. The first coincided with the start of the public comment period on the Application in August 2003 and targeted all corridor communities. A second program, between January and March 2004, focused on the communities of West Vancouver and Lions Bay to further explore preliminary alignment options in these communities.

Consultation Activities - August to October 2003

In August 2003, the MoT advertized the start of the environmental assessment review and the dates for the public comment period in the *Squamish Chief*, *Whistler Question*, *North Shore News*, *Vancouver Sun*, *The Province* and the *Kamloops Daily News*. The MoT then organized, advertized and conducted a series of open houses to present the Project, study findings and conceptual design drawings. The open houses included a moderated public forum where a panel of MoT environmental and engineering staff and EAO representatives answered written questions submitted to the moderator. Table 3 provides the location, dates and attendance levels at each of the open houses. Table 4 summarizes the various issues raised at the open houses and cross-references them to sections in this Assessment Report where related issues are discussed.

Table 3 - Location, Dates and Attendance Levels at the MoT Open Houses During the Public Comment Period on the Application.

Date	Location	Number of Attendees	Number of Written Questions
September 12, 2003	Whistler	20	10
September 15, 2003	Furry Creek	35	17
September 16, 2003	Squamish	40	33
September 18, 2003	Lions Bay	70	50
September 24, 2003	West Vancouver	90	68

The EAO also carried out notification and consultation measures to gather public input during the review of the Application. The EAO posted the Application on its Project Information Centre, provided notice of the start of the formal review and conducted a fifty-nine day public comment period on the Application from August 20 to October 17, 2003.

During the public comment period, the EAO received 105 written letters and submissions. Table 5 shows the number of comments received from various communities along the corridor and the primary concerns by location. The most frequently expressed public concerns were about matters of Project design, Project operations, speeding and safety concerns, noise, connectivity, Transportation Demand Management (TDM), preliminary design detail and the use of the BC Rail line. Appendix 2 of this Assessment Report summarizes the content of each of these public comments and of the written responses provided by the MoT to each writer.

Table 4 - Main Questions Raised at the MoT Open Houses

Issue/Question	Related Discussion in Assessment Report
Lack of detail in the preliminary alignment drawings	Section 12.1
Transition from four lanes at Lions Bay	Section 12.3
Highway capacity and four lanes all the way to Whistler	Section 12.1
Proposed speed limits	Section 12.1, 12.3
Rock removal and disposal impacts	Section 11.4
Tunnel at Nelson Creek	Sections 11, 12
Use of BC Rail right-of-way during the Olympics	Section 2
Noise Impacts	Section 12.3
Aquatic impacts from stream crossings and runoff	Section 11.2
Air quality	Section 11.6
Construction impact on trails and recreational facilities	Section 12.5
Cycling facilities along the corridor	Section 12.1
Construction Traffic Management	Section 2, 12.4
Emergency vehicle access during construction period	Section 12.4
Transportation Demand Management	Section 12.2

Table 5 -Summary Analysis of Public Comments Received by the EAO During the Public Comment Period on the Sea-to-Sky Highway Improvement Project Application

Location of Writer(s)	Number of Letters/Documents	Primary Concerns
Vancouver	10	Transportation Demand Management
West Vancouver	21	Tunnel Option Caulfield Interchange/Pasco Road Access Emergency Response Ferry Traffic Construction Impacts (Westport)
Lions Bay	34	Noise Impacts/ Data Collection Methods Speeding/Safety Impacts Kelvin Grove Access Merging four lanes to two lanes

Location of Writer(s)	Number of Letters/Documents	Primary Concerns
Britannia Beach	2	Contaminated Sites Interchanges
Furry Creek	6	Noise/Speeding
Squamish	11	Recreation Impacts (Murrin Park) Highway Design Impact on commuters to Whistler
Pinecrest/Black Tusk	3	Community Water Supply Interchanges Noise
Whistler	3	Access Traffic Management
Other	15	Alternative Transportation Modes (Train) Cycling Opportunities Environmental

The MoT Consultations with West Vancouver and Lions Bay in 2004

There was significant concern expressed in West Vancouver and Lions Bay about the alignment options proposed for these communities in the Application. In response, the MoT decided in January 2004 to proceed with additional public consultations and refine the preliminary alignment in West Vancouver and Lions Bay to better address concerns and issues raised. The MoT held additional open houses in the West Vancouver area on February 16 and 22, 2004 to present revised options for the preliminary alignment between Horseshoe Bay and Ansell Place. In Lions Bay the MoT held an open house and public meeting on February 28, 2004 to present revised options for the preliminary alignment through the community (Work Package 3A) and associated noise reduction measures.

The results of these consultations and the revised alignment options for each community proposed by the MoT for certification are described in the West Vancouver Clarification Report and the Lions Bay Clarification Report.

The EAO conducted a focused public review of the Lions Bay and the West Vancouver Clarification Reports. The reports were posted on the EAO Project Information Website. The EAO also notified all members of the public who previously commented on the Application, and who reside in the Lions Bay or West Vancouver area, of the availability of the respective clarification reports and invited comments. The EAO received no public comments on the Lions Bay Clarification Report.

The EAO did receive public comments on the West Vancouver Clarification Report. The information provided here by the EAO is for information purposes only. It was not compiled or analyzed using statistical methods and the EAO does not offer any conclusions on whether this information represents general public opinion in West Vancouver.

The EAO received one form letter, with 45 signatories, in support of Option B. The EAO also received a report on an informal poll conducted by the Western Residents Association which indicated that 182 of 186 respondents favoured a tunnel option. Five other letters were also submitted to the EAO.

Two writers expressed concerns about the potential noise, property value and quality of life impacts to the Westport Road, Westhaven, Eagle Harbour and Sahalee neighborhoods from Option D because of the location of the southern portal and southbound exit route which brings traffic closer to the Westport area. The writers were also concerned about the construction phase of the Project and the associated impacts to the Westport area from the construction of Option D.

Three writers expressed concerns about the potential environmental impacts of Option B. Other concerns included potential visual impacts from Option B and the potential for noise impacts to Gleneagles School, particularly during and also post, construction. These writers also commented that a 1.4 kilometre tunnel would reduce the environmental impacts of Option D.

8. FIRST NATIONS PARTICIPATION

The EAO plans and conducts environmental assessments to include meaningful participation by First Nations with asserted traditional territory in the area of a project. This effort begins at the pre-application stage and continues through to the referral of a project to Ministers. The BCEAA requires that the assessment of the potential effects of a reviewable project take into account and reflect government policy. EAO consultations with First Nations are guided by the *Provincial Policy for Consultation with First Nations* (October 2002).

The Project falls within the asserted traditional territories of four First Nations:

- Squamish Nation
- Lil'wat Nation (also known as the Mt. Currie Indian Band)
- Tsleil-Waututh Nation (also known as the Burrard Indian Band)
- Musqueam Indian Band

The entire Project study area is within the asserted traditional territory of the Squamish Nation. This study area is overlapped to the north by the asserted territory of the Lil'wat Nation (approximately between Rubble Creek and Function Junction). The southern end of the alignment between Horseshoe Bay and Lions Bay is marginally within the asserted traditional territories of the Tsleil-Waututh Nation and the Musqueam Indian Band.

<u>Pre-Application</u>
The EAO invited First Nations involvement during pre-application and during formal review of the Application through participation on the working groups established to advise the EAO on biophysical and technical design issues and socio-economic and community issues raised by the Project.

The Squamish and Lil'wat Nations and/or their technical consultant attended working group meetings during pre-application on November 28, 2002, March 3, 2003, and March 10, 2003. During the pre-application period the MoT and the Squamish and Lil'wat Nations also agreed on various Project related Protocols, MOUs and funding agreements. Terms of Reference for Aboriginal Interest and Use Studies (AIUS) were also developed and the Squamish and Lil'wat First Nations then completed and submitted their AIUS in July 2003 and August 2003 respectively.

Tsleil-Waututh Nation participation in the pre-application phase of the environmental assessment began in the spring of 2003. The MoT and Tsleil-Waututh Nation finalized a Protocol Agreement in May 2003 that provided the framework and funding for the Tsleil-Waututh to participate in the EA review process. It also provided the resources for the Tsleil-Waututh to participate in the archaeological study program and to prepare a Traditional Use Study (TUS) report related to the proposed Project.

The Musqueam Indian Band was invited by the EAO and the MoT to participate in the environmental review process during the pre-application phase but did not actively participate in the working groups.

Application Review

When the EAO set the scope, procedures and methods for the Project review (Section 11 Order) in June 2003, it outlined measures for First Nation participation during the review of the Application. The EAO invited each First Nation to submit comments on the Application either through their participation on working groups, or individually. The EAO required the MoT to make reasonable efforts to consult with First Nations in accordance with the existing agreements reached between the MoT and the respective First Nations and the consultation program proposed in the Application (Volume 4, Section A). The EAO also required that consultations with First Nations seek to resolve and reach agreement on measures to avoid, mitigate or, where appropriate, accommodate for aboriginal interests identified in aboriginal interest and use studies or other studies which may be potentially affected by the Project.

The Squamish and Lil'wat Nations participated in all working group meetings during the review of the Application either directly or through their technical consultants (Westland Resource Group and UMA Engineering). The Tsleil-Waututh Nation attended one meeting of the Biophysical/Technical Working Group (September 16, 2003). The Musqueam Nation did not attend working group meetings.

The Squamish Nation and Lil'wat Nations provided a joint submission with comments on the Application on October 28, 2003 and Westland Resource group provided comments on the West Vancouver Clarification Report on April 30, 2004. Technical and legal firms working for the Lil'wat and Squamish Nations submitted other comments on behalf of the First Nations throughout the pre-Application and Application review phases. The Tsleil-Waututh Nation provided written comments on October 23, 2003.

During the Application review, the MoT conducted two open houses/community meetings for the Squamish Nation (September 22 and 23, 2003) and one community meeting for the Lil'wat Nation (October 16, 2003).

The main issues identified by First Nations during the review of the Application are presented throughout this report and the range of issues identified in First Nation written comments on the Application are summarized as part of Appendix 1.

9. FIRST NATION INTERESTS

The *Provincial Policy for Consultation with First Nations* (October 2002) describes the Province's approach to consultation with First Nations on aboriginal rights and/or title that have been asserted but have not been proven through a Court process. In this Policy, potentially existing aboriginal rights and/or title are defined as, and referred to as, "aboriginal interests". In accordance with legal and policy requirements, the Province considers aboriginal interests in relation to an environmental assessment to ensure that First Nation issues and concerns are identified, and the Province's legal obligations towards First Nations are met. First Nation consultation requirements are established for every environmental assessment, within the framework of the Policy and any future updates of that Policy. First Nations with interests in the area of the proposed project (i.e. the project is in proximity to the First Nation's claimed traditional territory) or whose rights may be affected are provided the opportunity to be consulted by the proponent and the EAO.

The federal government also considers aboriginal interests when conducting environmental assessments. While "environment" is defined in biophysical terms under CEAA, the definition given for "environmental effects" is broader and includes "...*any change that the project may cause in the environment, including any effect of such change on the current use of lands and resources for traditional purposes by aboriginal persons*…." Accordingly, the current use of lands and resources for traditional purposes is considered in a CEAA assessment.

This section of the Assessment Report is an overview of the measures taken to consider aboriginal interests and is not a presentation of the specific interests identified for the MoT by First Nations. Sections 11 and 12 of the Assessment Report discuss issues identified by First Nations during their review of the Application and participation on the working groups.

The MoT provided support to the Squamish and Lil'wat Nations to enable each First Nation to complete an AIUS. The main purpose of each AIUS was to identify impacts on aboriginal title and rights of each First Nation from the proposed highway upgrades and to recommend mitigation or compensation for impacts that cannot be avoided. The AIUS were intended to identify, document, and report on past, present, and planned future Squamish and Lil'wat Nation interests in the land, which might potentially be affected by the proposed highway improvements.

Since the filing of the AIUS reports in July and August 2003, the Squamish and Lil'wat Nations have discussed the potential impacts of the Project on aboriginal interests with the MoT and the Province of British Columbia and worked with the MoT and the Province towards agreements on measures to mitigate or avoid these impacts. To meet its legal obligation to First Nations of consultation and accommodation of aboriginal rights and title, the Province established two separate forums to negotiate and resolve issues. One forum focussed on addressing issues that were directly attributable to the proposed Project, many of which could be primarily addressed by the MoT. The second forum, to which the Province assigned senior level representatives from several Ministries, focussed on broader issues related to potential impacts on aboriginal rights and title. These negotiations took place between September 2003 and May 2004. As a result of these discussions, the Squamish and Lil'wat Nations have indicated that

they are now satisfied that their interests in respect of the Project will be accommodated by the Province. The Lil'wat Nation advised the EAO by letter on March 17, 2004 that the Lil'wat Nation was satisfied that its interests were being accommodated by the Province. The Squamish Nation advised the EAO by letter on March 26, 2004 that the Squamish Nation had entered into an Accommodation Agreement-in-Principle with the Province in respect of the Project, which resolves the outstanding issues of consultation and accommodation in respect of the Project.

During this environmental assessment the Tsleil-Waututh Nation and the Musqueam Indian Band did not identify specific impacts that the Project may have on their respective aboriginal interests. In comments submitted based on their review of the Application, the Tsleil-Waututh First Nation made several recommendations related to the potential need for modifications to/expansion of the environmental study program that had been implemented by the MoT. The Tsleil-Waututh Nation also commented that approximately ten kilometres of the southern portion of the proposed Project are within Tsleil-Waututh territory and is the only portion of their territory within a Gulf Islands ecosystem. The Nation requested that the Project budget include a significant contribution for expansion of park and/or protected areas in the Horseshoe Bay area.

The MoT considered these comments and provided a written response to the response to the Tsleil-Waututh on February 11, 2004. The MoT noted that in this particular section of the corridor, the MoT is working with the Environmental Stewardship Division within the Ministry of Water, Land and Water Protection (WLAP) to ensure that parks related issues are addressed. It is the intent of MoT to protect sensitive plant communities through restrictive covenants and potentially through the extension of existing park boundaries.

10. CONSIDERATION OF ARCHAEOLOGICAL EFFECTS

The MoT invited the Squamish Nation, Lil'wat Nation, Tsleil-Waututh First Nation and the Musqueam Indian Band to participate in a Culture and Heritage Assessment program for the Project.

This included an archaeological impact assessment (AIA) to address potential historical and cultural heritage issues for the Project. The objectives of the AIA were to identify potential impacts to heritage sites, and to develop appropriate mitigation strategies for significant heritage sites in potential conflict with proposed highway improvements and associated temporary and ancillary works. Archaeological assessments were limited to locations that could reasonably be expected to be directly or indirectly impacted by the planned activities. The assessments were carried out in accordance with the objectives outlined in the *British Columbia Archaeological Impact Assessment Guidelines (BCAIA)* (Apland & Kenny 1998). The Squamish Nation, Lil'wat Nation and the Tsleil-Waututh Nation each selected a consulting archaeologist to represent them in the AIA. The work was coordinated by a Historical and Cultural Heritage Coordinator working on behalf of the MoT. The Musqueam Indian Band did not participate in the archaeological work.

Seventeen areas of inferred archaeological site potential were inspected and are presented in Volume 3, Section G, Tables Table 2-1 and Table 2-2 of the Application. No archaeological sites were identified as being in direct conflict with the proposed project impacts. Two terrestrial archaeological sites that are protected under the *Heritage Conservation Act* (HCA) were identified, but neither is in conflict with the proposed Project activities and no direct effects are anticipated. The Squamish and Lil'wat AIUS report also documented the existence of several

Culturally Modified Trees (CMT's) within the corridor. The MoT has committed to avoiding impacts to these CMT and to reaching an acceptable arrangement with the First Nations if impact cannot be avoided in the event of changes at the detailed design stage.

When the MoT developed Option B it conducted additional archaeological investigations of this section of preliminary alignment on February 28, 2004. No additional archaeological sites were encountered. The archaeological issues for Option D are the same as previously documented in Volume 3, Section G of the Application.

11. CONSIDERATION OF ENVIRONMENTAL EFFECTS

11.1 WATER QUALITY

Volume 3, Section D and Appendix D and Volume 5, Section A of the Application predict the potential impacts of the Project on water quality during construction and operations and propose mitigation measures and a water quality monitoring program.

Background

The Application states that contamination of a water source can result from point and non-point sources created during Project construction (e.g. blasting, siltation, spills) or during Project operations (deposit of substances on the road surface from vehicle tires and exhaust and from de-icing chemicals and winter abrasives). Precipitation eventually flushes these substances from the road surface into ditches and streams and can result in fluctuations in water quality. Sheet runoff which flows across the surface of the roadway and runs down shoulders or slopes will generally constitute most of the non-point sources for contaminants.

The MoT predicts that impacts to watercourses from highway construction and operations would generally occur downstream of the alignment. Where community water sources (reservoirs and collection systems) are upstream of the alignment the potential for impacts is reduced. Groundwater well systems may be affected over a longer period of time as it takes longer for chemicals and other contaminants to penetrate into local groundwater systems. Major water uses that could be affected by the new highway construction include:

- raw water for drinking water supply;
- recreational water quality and aesthetics;
- freshwater aquatic life;
- agricultural uses; and
- industrial water supplies.

The MoT proposes to alleviate impacts on water quality from highway construction and runoff. The MoT's Environmental Management Plan (EMP) will include an Sediment and Drainage Management Plans and a Water Quality Sampling Program to be implemented by the Project contractor.

The Water Quality Sampling Program will consist of:

- a multi-phased water quality audit and performance monitoring program (already underway);
- water quality sampling and analysis of runoff from PAG/ML rock face cuts during the pre-construction, construction and post construction phases of the Project; and

- water quality monitoring during construction for parameters such as suspended sediments, pH and conductivity.

The first phase of the water quality audit included baseline sampling and analysis of surface water streams, groundwater wells and domestic water supplies and the findings are presented in Volume 3, Sections D4 and D5 of the Application. Phase two will occur approximately six months after construction has started on a section of the alignment. Groundwater wells will be randomly sampled. Streams, creeks, rivers and open water bodies will also be randomly sampled to ensure no water quality changes are taking place. During Phase Three, the MoT will also complete post-construction sampling of surface water, groundwater wells and water supply sites within a constructed section. If post-construction sampling indicates that water quality is sub-standard, mitigative measures will be developed and applied, and monitoring extended, until water quality standards are met.

The MoT also proposes to minimize impacts to water quality during construction through measures such as:

- requiring the contractor to prepare Sediment and Drainage Management Plans which must be approved by environmental agencies prior to construction start-up;
- adhering to best management practices (BMPs) and use of appropriate guides such as Washington State Department of Transportation Highway Runoff Manual, "Guidelines For Environmental Design of Highway Drainage (1992)", guidelines developed for the construction of the Vancouver Island Highway Project and any other appropriate guides established during the life of the Project;
- implementing standard forms of erosion control and siltation control; and
- retaining a qualified environmental monitor to conduct water quality monitoring.

The MoT proposes regular site inspections, implementation of required erosion control techniques and ditching plans to minimize potential impacts to water quality during highway operations. Also, the Design-Build-Finance-Operate (DBFO) contractor will apply additional mitigation measures and extend the monitoring. Emergency response plans will also be in place to reduce the environmental impacts resulting from fuel or chemical spills on the highway (see discussion of Accidents and Malfunctions in section 15 of the Assessment Report).

<u>Working Group Review of the Application</u>
An expanded description of the written comments submitted by the BWTG members on water quality issues are presented in the Issue Tracking Table in Appendix 1A of this Assessment Report. The primary water quality issues discussed by the Biophysical Technical Working Group (BTWG) were:

- impact of first flush rainfall events during highway operations;
- water quality monitoring parameters for a water quality monitoring program;
- BMPs;
- potential impacts to water quality from the use of de-icing products and abrasives; and
- ditch maintenance and water treatment measures.

The MoT anticipates that traffic volumes will not reach levels where pollutants left on the surface of the roadway become water quality concerns during first flush rain events. The MoT will monitor first flush events as part of the proposed water quality monitoring program and expects that new ditch designs using swales, check dams and lined channels will reduce suspended solids reaching streams.

The MoT will include oil and grease in the pattern of testing for the water quality audit and performance monitoring program and noted that in the past, monitoring for oil and grease has identified levels at the edge of the pavement but not in the ditches adjacent to the roadway at levels detectable by laboratory testing. The MoT also clarified that sampling points are located in the ditches before runoff reaches the stream.

The BTWG also discussed the potential impact to water quality from the use of de-icing products. The MoT estimates that the quantity of de-icers will increase by 41.5% and abrasives by 31.5% over the length of the upgraded highway. The MoT predicts that high precipitation rates, the presence of large flowing rivers in proximity to the Project and the expanded road surface area for rainfall/meltwater runoff, will offset the potential impact of increased use of these products on receiving waters during operations. The MoT also identified a trend towards the use of anti-icer agents from de-icers (road salt) to reduce salt inputs. The MoT predicts that improvements in drainage designs will maintain water quality during highway operations.

The MoT advised that ditch maintenance is managed under contracts between the Province and its highway maintenance contractors. The ditches are inspected regularly by the MoT Area Managers and the privatized maintenance contractor and an annual ditching plan must be supplied by the contractor each year. The alignment has limited space for treatment ponds but they will be constructed where feasible. The MoT expects that highway BMPs will enhance the removal of solids and any associated sorbed pollutants through adsorption, filtration and settlement.

Another water quality concern raised in public comments and by the Electoral Area D representative of the Squamish-Lilloet Regional District is the potential for highway widening in the Pinecrest/Black Tusk area to increase the risk of accidents or spills adjacent to Retta Lake which serves as the primary drinking water source for the Pinecrest Estates community.

The MoT has since completed a multiple accounts evaluation for preliminary alignment options in the Pinecrest/Black Tusk area and prefers an option that expands the existing highway to three lanes and includes a new drainage system as part of the design to protect the communities' drinking water source. The MoT has also committed to further dialogue with the community to address community concerns.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not have significant adverse effects to water quality.

11.2 FISHERIES AND AQUATIC RESOURCES

Volume 2, Section B of the Application describes aquatic values, impact assessment methodologies and the potential impacts of the Project on aquatic and riparian values including freshwater fish and amphibian species and their habitats. Appendix B in Volume 2 of the Application summarizes habitat values, proposed works, potential impacts and recommended

mitigation measures at each water feature from Horseshoe Bay to Squamish and from Squamish to Whistler. The West Vancouver Clarification Report discusses the potential relative impacts of Option B and Option D.

Background

The MoT and its consultants conducted detailed study of the corridor to assess the potential impact of the Project on fisheries and aquatic resources. This work included development of a list of all known and suspected water features along the existing Highway 99 alignment based on map review, consultant reports, and drainage inventory summaries. Field teams visited every watercourse and wetland potentially impacted by the proposed highway improvement program following the review of background information. Aquatic and terrestrial searches for amphibians and reptiles were done and fish sampling conducted at many sites. The presence of benthic macroinvertebrates and their relative abundance was noted where there was a potential to provide food for fish and/or aquatic wildlife. Finally, a photographic record and drawing were made at each site.

Of 537 potential water feature sites identified prior to the field visits, 361 sites are confirmed to have water features (*i.e.,* roadside drainage ditch, watercourse, lake, ponds, wetlands or estuarine tidal marshes). Of these 361 sites, fish were confirmed or likely to occur in 109 of these sites and amphibians were found at 40 sites. The MoT reports that headwall construction, culvert works or bridge works are planned at approximately 41 fish-bearing water features (rivers, streams and wetlands) along the corridor.

The Application notes that short-term impacts from temporary modifications within sensitive habitat features may result from clearing and grubbing during construction and highway operations, decommissioning and traffic accidents or other unplanned events. It also summarizes potential impacts to freshwater fish and or amphibian habitat resulting from highway upgrading as follows:

- direct loss or alteration of fish and/or amphibian habitat;
- impacts to fish passage;
- impacts to amphibian movement;
- altered drainage patterns;
- water quality degradation; and
- loss or impairment of food and nutrient supply to downstream fish populations.

To comply with the DFO's Habitat Conservation and Protection Guidelines (1998), the MoT has considered the preferred management options for the protection of fish habitat values in order of preference during the design of the highway. The DFO hierarchy of preferences is:

- Project relocation;
- Project redesign;
- mitigation; and
- compensation.

The MoT has mitigated many potential impacts to aquatic values through design measures and predicts that other potential impacts can be largely mitigated through planning, standard construction methods and current BMPs. The bridge and culvert designs described in the Application were developed with input from DFO and WLAP during pre-application. To the extent possible, the MoT has avoided impacts to aquatic habitat from the highway design with

the exception of seven sites identified in the Application where unavoidable impacts to fish habitat will occur:

- Larsen Creek – reconstruction of overhead structure;
- Middle Creek – culvert extension;
- Thistle Creek – culvert extension;
- Mashiter Spawning Channel – highway widening;
- Cheakamus River tributary near the old shed site at sample sites SW 84 and 85 – highway widening;
- Wetland at sample site SW 181 - highway widening; and
- Millar Creek - highway widening.

The MoT proposes to develop and implement a Fish and Fish Habitat Mitigation Compensation Plan to achieve no net loss of the productive capacity of fish habitat. Based on preliminary calculations, the MoT estimates that 2,100m^2 of instream habitat and 12,000m^2 of riparian vegetation will be impacted by the Project, including the above referenced sites. The MoT also proposes to offset impacts to amphibian habitat through opportunities provided by fish habitat compensation works or through other separate enhancement initiatives. These initiatives will be further discussed with DFO during the final design phase and finalization of compensation measures for impacts to fish and fish habitat.

In the West Vancouver area, Option B will run along the western edge of the swamp in the Larsen Creek headwaters and impinge on the very western edge of the swamp habitat. It was suggested that approximately 0.68 ha of wetland habitat within the Larsen Creek headwaters could be affected however MoT has committed to avoiding infilling of the wetland through relocation and design. There is double the area of impervious surface in the Larsen Creek headwaters with Option B compared the initial overland option proposed in the Application. In the May 5, 2004 response to working group comments, the MoT provided a review of hydrological issues pertaining to Larsen Creek (Hayco and Company Consultants) and notes that this surface area would only impact between three and four percent of the total catchment area. The MoT notes that design elements will be chosen to ensure water quality and hydrology are maintained and that hydrological function and flow velocity can be maintained through the application of storm water design measures such as constructed wetlands, retention ponds, and bio-filtration swales.

Option D requires two new bridge crossings of Nelson Creek, a high value fisheries stream. Water quality and hydrology concerns are similar to those identified for the previous tunnel option proposed in the Application. There is the need to protect water quality in Nelson Creek, and the need to preserve hydrological function in the Larsen Creek watershed.

A list of potential aquatic impacts and recommended mitigation measures are included in Volume 2, Section B, Tables 3-4 to 3-8 of the Application. The tables provide a general reference of mitigation measures for each phase of the Project including construction, highway infrastructure footprints, highway operations, decommissioning and structures.

The MoT will also, prior to construction, describe measures to minimize potential impacts to fish and fish habitat in its EMP and will:

- retain an environmental monitor;
- require the contractor to prepare Sediment and Drainage Management Plans;
- identify and delineate no disturbance zones; and

- develop plans to revegetate and protect exposed soils.

To address potential impacts during Project operations, the MoT proposes to conduct post construction monitoring of fisheries compensation initiatives, undertake operational activities in accordance with MoT policies and procedures and conduct regular maintenance inspections.

Working Group Review of the Application

An expanded description of the written comments submitted by the BWTG members on fisheries issues and aquatic resources are presented in the Issue Tracking Table in Appendix 1A of this Assessment Report. The main issues identified and discussed by the BTWG included:

- design issues;
- impacts to fish habitat; and
- environmental standards.

The DFO requested clarification from the MoT on steps taken to meet DFO's hierarchy of preferences for the avoidance of impacts to fish and aquatic habitat. The MoT provided two response letters on November 28, 2003 that included an attachment describing how it applied the hierarchy of preferences at each of the main stream crossings including Larsen Creek, Middle Creek, Mamquam Blind Channel and Mamquam River.

The MoT also revised plans for the Horseshoe Bay overhead structure to eliminate any need to relocate Larsen Creek and ensure the long term maintenance of existing in-stream habitats. The MoT will install an open bottom structure at Middle Creek unless there is technical rationale for a closed bottom structure acceptable to WLAP and DFO. All new or upgraded bridgeworks will be clear span structures with the exception of the crossings of the Mamquam Blind Channel and Mamquam River which will require in-stream piers.

After a field trip to observe the wetland area encroached by Option B, DFO reported in its comments on the West Vancouver Clarification Report that the area may not play a major role in maintaining base flows during low water periods. DFO would strongly prefer that if Option B is selected, the MoT make efforts to avoid impact to the wetland by adjusting the routing away from the western edge of the wetland. If a commitment to avoid the wetland cannot be made at this time DFO would like to see a long term monitoring plan developed to ensure that mitigation measures for flows are successful. The DFO also notes that an authorization may be required for work in the upper Larsen Creek area if Option B is selected and for the additional crossings of Nelson Creek if Option D is selected.

At Mamquam Blind Channel, the MoT expects to construct and use a temporary bridge for eight months while the existing bridge is demolished and a new structure built in the same location. The Canadian Coast Guard (Transport Canada) noted it prefers the Mamquam Blind Channel bridge be rebuilt as a clear span bridge with no reduction in overhead clearances. The MoT will consider this possibility during detailed design of the structure but notes there are substantial design constraints.

The DFO has also advised the MoT to adhere to the most current environmental standards and BMPs throughout the six year construction phase. The MoT will apply up to date management practices as they are developed, Land Development Guidelines and develop EMP's for each Work Package so that improvements in standards and practices are continually incorporated in the Project construction phase.

DFO also considered whether the underground excavations required for a tunnel option may create acid rock drainage and whether the volume of slurry produced in the tunnel could create sedimentation problems because of limited area to construct sediment control structures. The MoT has since confirmed that there is enough space to manage water from the tunnel both during and following construction.

The MoT also assessed the potential marine impacts from use of barge-loading sites at Porteau Cove and Sunset Marina. While some construction work is required to modify the existing facilities to accommodate barge traffic resulting from the Project, the main potential for impacts to marine resources would be vessel movement and barge-loading operations. Vessel wake and prop scour (and dredging) can cause the short-term re-suspension of settled sediments.

The MoT predicts that potential impacts from vessel operation can be mitigated by drawing on standard safe operating procedures. This would mean selecting shallow draft tugs and barges, not overloading barges and implementing no-wake policies at barge-loading locations to avoid disturbance to the nearshore environment through wave action. These practices can be supplemented by BMPs for erosion and sediment control at potential upland sources during Project construction. Review agencies were satisfied with the marine assessment and no further information was requested of the MoT.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not have significant adverse effects to fish and aquatic resources.

11.3 WILDLIFE AND VEGETATION

Volume 2, Section A and Appendices of the Application describe wildlife and vegetation values, impact assessment methodologies, potential impacts, proposed mitigation measures and a conceptual compensation strategy. The West Vancouver Clarification Report discusses the similarities and differences between Option B and Option D regarding potential impacts to wildlife and vegetation.

Background

During pre-application the MoT proposed terms of reference and workplans for a wildlife and vegetation study that were reviewed by BTWG.

Along the project corridor, over 900 habitat polygons were identified and mapped from recent air photos. Of these, 157 were sampled to fulfill ecosystem mapping requirements, 193 sites were examined for rare plants, 88 sites were sampled for songbirds, 58 for owls, in addition to the incidental information collected on wildlife during each of these surveys.

The MoT's assessment included all at-risk wildlife and vegetation components of the study area including: wildlife occurrence and wildlife habitat; wildlife species and vegetation communities and species identified from both Federal (COSEWIC) and provincial (CDC red and blue lists) systems; and key species of interest. Wildlife evaluated by the MoT included amphibians,

reptiles, birds, and mammals. Amphibians in riparian environments were included in the fisheries and aquatic habitat assessment.

Vegetation

The MoT predicts that the primary impact of the Project will be direct loss of vegetation from clearing for right-of-way and ancillary sites, including the barge loading sites. Control of vegetation for highway maintenance purposes may also remove ecosystems from the existing landscape.

The four-lane overland route (Option B) through West Vancouver will require the clearing of 13.5 hectares (ha) of vegetation. Overall, there will be a total vegetation clearing of 111 ha for the entire Project. The tunnel option through West Vancouver (Option D) will require clearing of approximately 10 ha of vegetation for a total clearing of 108 ha for the entire Project. Option B will impact 1.57 ha of blue-listed plant community while Option D will impact 1.64 ha. Within the Larsen Creek headwaters area, Option B affects 0.68 ha of swamp habitat, while Option D affects 0.11 ha.

Option B will impact approximately 1.4 ha of the Douglas fir/Arbutus woodland–rock outcrop ecosystem at Eagle Ridge. Although the area of loss of the Eagle Ridge woodland–rock outcrop complex is less than with previous overland options described in the original Application, it is more internal in location (polygons 406, 407, 408, 409 and 418). Option D is predicted to impact 0.05 ha of Douglas fir/Arbutus woodland–rock outcrop ecosystem at Eagle Ridge.

Other areas with red or blue-listed plant communities affected by the Project are located near Murrin Park, Cheakamus Canyon and Brandywine Creek. Overall, the MoT predicts relatively small losses to red or blue listed plant communities.

Additional potential impacts from the Project to vegetation and plant species considered in the Application include:

- disturbance to the plant community;
- fragmentation of the plant community;
- disturbance to adjacent plant community habitat; and
- loss of diversity.

The MoT rated eleven polygons as high for marbled murrelet nesting habitat and predicts no habitat loss in ten of these polygons. Clearing and grubbing for Project construction between Sunset Marina and Montizambert Creek on the east side of Doodson Corner may remove some potential nest trees. To eliminate that risk, the MoT will conduct pre-construction surveys to determine the nesting potential of this and surrounding areas by marbled murrelets. The MoT states that the inventory and appropriate adjustment of Project design, if murrelets are found in the polygon, will adequately address potential habitat impacts to marbled murrelets.

Working Group Review of the Application

An expanded description of the written comments submitted by the BWTG members on vegetation issues is presented in the Issue Tracking Table in Appendix 1A of this Assessment Report. Discussion of the BTWG focused on mitigation of potential impacts to red and blue listed plant communities and sensitive ecosystems.

The MoT proposes to implement a Sensitive Ecosystems Management Plan as part of its EMP and will:

- confirm the location of rare and sensitive plant communities;
- delineate buffers around the communities;
- manage both land and water access to sensitive sites; and
- control invasive species.

To offset potential residual impacts following the implementation of mitigation, the MoT proposes to implement a compensation strategy. The conceptual strategy includes a plan to develop a wetland habitat near the Callaghan Creek Forest Road to compensate for potential losses to amphibian habitat. The second component of the strategy involves the purchase or placement of restrictive covenants on lands appropriate to compensate for loss of red and blue listed ecosystems and dry arbutus habitat. In January 2004, the MoT met with WLAP and Canadian Wildlife Service (CWS) representatives to outline the MoT's habitat protection efforts. The MoT has reviewed the ecosystem mapping for the corridor and identified a number of parcels that would be suitable as compensation. The MoT predicts that, generally, habitat protection will be achieved through: the adjustment of BC Parks boundaries to encompass the sensitive ecosystem; adding a Restrictive Covenant to a land title if the impacted property owner is willing to be a signatory to the covenant; and/or transfer of the title to a conservation group. The details of the MoT's strategy will be documented in the MoT's EMP.

In its response to reviewer comments on the West Vancouver Clarification Report and the potential for increased habitat loss from Option B, the MoT reported that to compensate for loss of dry arbutus habitat vegetation associated with Option B it has identified approximately 2.5 ha of privately owned property that would be excellent compensation area. The MoT acknowledges that the protection of this area would require the cooperation of the private property owner and could be achieved through restrictive covenants or transferring title to a conservation group. Alternatively, the MoT has identified equivalent ecosystems on Bowen Island and on the Sunshine Coast. The BTWG noted that, for compensation purposes, habitat obtainable in the same ecosystem as the area of impact is preferred to areas more distant.

The SLFN asked the MoT to clarify why regionally rare and significant plants of the area were presented in the Application but the plants listed by the First Nations were not included. The MoT noted that it developed a spreadsheet containing a database of plant species documented during its vegetation surveys and forwarded this database to the Squamish and Lil'wat Nations.

The District of West Vancouver is concerned that if Option B is chosen, the road will have a North-South alignment through the wetland and will go through a second growth stand of predominantly Hemlock, Douglas-fir and Western Red Cedar. Additionally the famous "Squamish" winds have a major influence in this area with signs of natural blowdown evident in the area at present and clearing of the area will only accelerate this process.

An attachment to the West Vancouver Clarification report, prepared by a certified arborist retained by the MoT (Dr. Julian Dunster), reports that windthrow prediction is not a simple matter beyond identification of the most obvious trees that might be clearly considered to be already unstable and acknowledges that the potential for windthrow of trees in this area is an issue. The arborist's response advises that more detailed information about this site is required before it is possible to investigate more specific windthrow mitigation options.

At its meeting of May 7, 2004, the BTWG reviewed the issue of forest edge impacts and the information provided by the MoT in response to working group comments on the West Vancouver Clarification Report. If Option B is selected, the MoT will be expected to undertake more detailed site assessments to delineate features such as forest types, topography, species, age, and tree heights and investigate more specific windthrow mitigation options where feasible.

Wildlife

Project development activities with the potential to impact wildlife, including species at risk, include:

- noise from Project construction and operation;
- changes in wildlife movement patterns to avoid construction or the location of a new alignment; and
- clearing and grubbing, disturbance of nests, removal of top soil and increase in vehicular traffic.

The MoT reports that the greatest potential impacts to wildlife are those associated with direct habitat loss and sensory disturbance, particularly from drilling and blasting of rock cuts. In the West Vancouver area, Option B has more potential to bisect wildlife corridors than Option D, although the MoT predicts that a bridge at Larsen Creek will ensure that any wildlife corridor along the creek can be maintained for Option B. Construction activities are also expected to have high impacts on reptile habitat.

The MoT anticipates potential for adverse effects to amphibians where the Project footprint abuts or encroaches into wetlands in West Vancouver (Option B), near the Rubble Creek Land Hazard (formerly known as the Garibaldi Civil Defense Zone) and Brandywine Creek. Mitigation options proposed by MoT include creation of rock piles and restoration of disturbed areas with the placement of coarse woody debris and plantings of native species.

Impacts to other wildlife species are predicted to be minimal and to address potential impacts the MoT proposes to:

- minimize habitat clearing, wherever possible, most notably around eagle nests and red and blue listed plant communities;
- minimize the duration of construction activities;
- restrict clearing activities within the bird breeding period;
- retain and protect raptor nests and roost trees;
- re-vegetate with native species;
- implement the wildlife protection measures to be specified in the MoT's EMP;
- manage interaction between Project personnel and wildlife;
- follow MoT procedures regarding operations; and
- implement contingency and emergency response plans.

Working Group Review of the Application

An expanded description of the written comments submitted by the BWTG members on wildlife issues is presented in the Issue Tracking Table in Appendix 1A of this Assessment Report. Primary issues were:

- the need for the construction schedule to accommodate the breeding and nesting season for the various species of birds identified in the highway corridor; and
- wildlife monitoring during the construction phase.

The MoT commits to identify construction windows for each relevant bird species of concern to CWS and complete additional nest surveys prior to the start of construction in each work package to verify locations of raptor and heron nests and potential marbled murrelet and Coopers' hawk nests. The SLFN requests that a Registered Professional Biologist (RP Bio.) be specified as the wildlife professional responsible for monitoring trees with nesting potential for marbled murrelet and that efforts be made to minimize highway and vehicle impacts on migrating wildlife.

To also offset any unmitigated impacts of culvert extensions on amphibian habitats the MoT will include special considerations for amphibians during the design of specific fish habitat compensation works, along with additional measures to address any amphibian habitat impacts that can not be offset in conjunction with fish habitat compensation (i.e. Tailed Frog habitats).

Members of the BTWG commented that Option B will result in habitat fragmentation. While the passage for wildlife movement proposed at the Larsen Creek crossing provides some mitigation, additional measures could further mitigate (not eliminate) the overall wildlife movement 'barrier' impact associated with Option B. In discussion at the BTWG meeting of May 7, 2004 the MoT noted that it may be possible to implement additional measures (such as larger lifted culverts) to further accommodate wildlife passage. If Option B is selected, the MoT will consult further with government agencies on design measures to improve wildlife passage.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not have significant adverse effects to wildlife and vegetation.

11.4 GEOCHEMICAL

Background

Volume 1, Section C2 and associated Appendices of the Application discuss the potential acid rock drainage (ARD) and metal leaching (ML) effects from the Project on aquatic ecosystems and propose mitigation options. In the *West Vancouver Clarification Report,* the MoT notes that neither Option B nor Option D will increase the potential for ARD/ML relative to the predictions made in the Application for the previous alignment options because the rock formations impacted by these Option B and Option D are not acid generating.

The Application states that ARD/ML is a complex process that can potentially have adverse effects on aquatic ecosystems. ARD/ML may result from rock cuts and/or from excavated material and can elevate metal concentrations in streams and rivers and/or the marine environment. In freshwater and marine water, aquatic organisms such as fish and benthic invertebrates could be exposed to these constituents through a variety of pathways including dermal uptake, absorption though the gill membrane, and ingestion of water and/or prey.

Specific examples of potential adverse effects from ARD/ML in watercourses include, but are not necessarily limited to:

- toxic interactions from reduced pH and increased metal concentrations;
- sediment toxicity where trace metal concentrations are high; and
- reduced habitat availability caused by precipitate settling.

Between Sunset Beach and Lions Bay, aluminum and copper loadings in sensitive streams in proximity to proposed rock face cuts are expected to be within BC Water Quality Guidelines (BCWQG) but will likely exceed Canadian Environmental Quality Guidelines (CEQG) standards during a first flush storm event. In the drainage ditches below the rock cuts along this section of the alignment, aluminum and copper levels will likely exceed the BCWQG and CEQG standards under first flush conditions. Between Squamish and Whistler, aluminum and copper loadings will exceed both BCWQG and CEQG standards in ditches beneath rock cuts near Cheakamus Canyon North, Rubble Creek Land Hazard and Brandywine Creek under first flush conditions.

The MoT identified eleven sensitive streams containing amphibians and/or fish in proximity to the above mentioned rock face cuts. When assessing the potential effects of first flush conditions the MoT used conservative assumptions and anticipates that actual loadings to the sensitive streams during Project construction and operations may be less than predicted. The MoT will conduct a detailed risk assessment during detailed design to refine the nature and extent of the MoT's water quality monitoring program and assess the need for mitigation.

Rock cuts, primarily between Sunset Beach and Lions Bay will generate waste rock that is potentially acid generating material (PAG) and will require disposal. The MoT estimates the total volume of rock excavation, based on preliminary design, to be 40,000 m^3 of which 7,000 m^3 is within the very distinct zone of alteration south of Lonetree Creek. Testing done in December 2003 indicates that the greenstones to be excavated during highway construction near Daisy Lake can be classified as non-PAG material.

The MoT has a number of strategies to manage PAG materials:

- designing the highway to minimize the rock excavation in areas with PAG rocks;
- disposing of PAG rock from the Horseshoe Bay to Squamish section at the Britannia Mine Site or by ocean dumping at the Point Grey Disposal site using the Sunset Marina Barge Loading Facility; and
- encapsulation.

Where PAG materials exist, the MoT will take a proactive approach to mitigate potential for acid rock drainage and metals leaching from rock cuts. Measures may include:

- shotcreting rock slopes or otherwise minimizing infiltration of surface water through PAG/ML materials;
- diverting surface flows or otherwise minimizing the volume of water that is in contact with PAG/ML materials;
- designing ditches that will enhance dilution of acidic or metal contaminated drainage;
- preventing exposure of sensitive species to acidic drainage or metal leaching from rock cuts; and
- treatment of acidic or metal contaminated water prior to discharge to creeks.

The MoT will also implement a surface water monitoring program immediately prior to, during and after construction for all eleven of the sensitive streams identified in proximity to the rock

cuts. The monitoring will determine the actual metal loadings to the sensitive streams from the final rock cut faces and whether or not the measured loadings exceed the BCWQG or CEQG criteria. If mitigative measures are required, the surface water quality monitoring program will be extended by the MoT to study the effectiveness of mitigation measures.

Working Group Review of the Application

An expanded description of the written comments submitted by the BWTG members on geochemical issues is presented in the Issue Tracking Table in Appendix 1A of this Assessment Report. The main concerns identified and discussed were:

- feasibility of disposal options for PAG materials;
- controlling ARD/ML from rock face cuts; and
- management of ARD/ML issues during and after construction.

The MoT proposes to use either ocean disposal or the glory holes at the Britannia Mine Site as the primary method for disposal of PAG materials. EC in its written comments on the Application indicated that, subject to permit requirements, the ocean disposal option was feasible. The MEM prefers that the MoT use ocean disposal and/or the Britannia Mine Site for disposal of all PAG materials and avoid the need to encapsulate any PAG because encapsulation requires a long-term commitment to monitoring to ensure its effectiveness.

The MEM, DFO and EC requested that the MoT confirm with the Ministry of Sustainable Resource Management (MSRM) and/or WLAP that use of the Britannia Mine Site would be technically feasible and acceptable. On February 5, 2004 the MSRM issued a letter to the EAO noting that the Britannia Mines Jane Basin glory hole has capacity for the disposal of ARD/ML rock from the Project and, if properly managed, may actually provide a benefit if coordinated with MSRM requirements for positioning of materials. The MSRM noted that a preliminary assessment of the disposal material indicates that the material is of the same nature (acid generating rock) as the sulphide ore bodies remaining in the Jane Basin area. The relatively small amount of disposal material from the Project would not significantly increase acid generation at the site nor adversely impact discharge from the 4100 portal or the operation of the new water treatment plant planned for December 2005.

The MoT commits to apply BMPs in the handling, stockpiling, transportation and placement of PAG material. The MoT also commits not to segregate PAG materials from non-PAG materials within rock cuts unless it is a discrete zone that can be removed cleanly without the potential for contaminating non-PAG materials with those with the potential for ARD/ML.

Because acid generation from exposed rock cuts may not be evident until some years following Project construction, the MEM and the MoT discussed the need for a longer-term monitoring of PAG rock faces exposed by rock cuts. The MoT notes that minimizing the volume of water over the face of rock cuts is difficult due to topography, the volume of rain and the current uncertainty of which sites, if any, would require mitigation. The MoT will, as part of its environmental management planning, adopt a proactive approach to the management of PAG rock cut surfaces and cuts which may have the potential for metal leaching in the future. The plan will include water control measures where feasible.

The MoT further commits to retain a qualified consultant to monitor material characteristics during construction to confirm assessments and to identify any materials with the potential for ARD/ ML that were missed in the planning stages. The contractor will follow approved waste disposal strategies and where necessary, recommend specific mitigative strategies to address

unexpected conditions encountered during construction. The MoT will also ensure that ARD/ML predictive information, PAG management plans, mitigation measures and monitoring requirements are available and understood by the contractor during the design and construction phases of the Project.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not result in significant adverse geochemical effects.

11.5 CONTAMINATED SITES

Volume 1, Section C4 and Appendices of the Application describe the MoT's preliminary investigation of potential contaminated sites and requirements for further investigations. Remediation measures are identified where possible. No new impacts to contaminated sites are predicted from selection of either Option B or D in West Vancouver.

The primary sources for contamination along the corridor are sulphate producing rock types (ARD), spills of hydrocarbons or chemicals through vehicular accident and long term degradation of the surface or groundwater conditions through the use of winter de-icing chemicals or winter abrasives. The MoT conducted an investigation along the alignment to identify sites where potential contamination may exist and may be encountered during Project construction.

Field investigation in July 2002 concluded that there are few sites where soil or groundwater contamination is likely to exist along the existing Sea-to-Sky Highway corridor. (The methodology employed by MoT is described in Volume 1, Section C Part 4.2 and 4.3 of the Application). The MoT's preliminary contaminated site investigation identified two contaminated sites that could be impacted by the construction phase of the Project:

Britannia Mine Site: Particular care will be required in dealing with soils because it is unlikely that any disturbed soils could be relocated any further than the mine site property. The MoT proposes close coordination with WLAP to ensure that remediation efforts on the site are not compromised. Clearing and grubbing during the initial stage of construction will require some disturbance of the surface soils. The MoT proposes an agreement with WLAP prior to the start of construction so that any soils that require relocation can be safely dealt with and retained within the affected area of Britannia Mine operations.

Gonzales Creek: An accident on Highway 99 immediately north of Gonzales Creek resulting in a hydrocarbon spill occurred at a property near the creek in February 2001. Petroleum hydrocarbon products migrated under Highway 99 and down through the sub-surface soils and fill towards Howe Sound. The contaminant levels exceeded the British Columbia Contaminated Sites Regulation (CSR) standards for residential/parkland development.

To mitigate potential ARD contamination, the MoT will implement a comprehensive ARD/ML management plan which includes a water quality monitoring component. In the event of spill

contamination, the MoT anticipates that existing emergency protocols and current legislation will be adequate to address such events that may occur on the highway. In regards to potential contamination from de-icing chemicals, the MoT predicts that high precipitation rates, the presence of large flowing rivers in proximity to the Project and the expanded road surface area for rainfall/meltwater runoff, will offset the potential impact of increased use of these products on receiving waters during operations. The MoT also identified a trend towards the use of anti-icer agents over de-icers (road salt) to reduce salt inputs.

The Project will involve the removal of roadside soils which have received salt runoff for a number of years and therefore may be contaminated with salts. When WLAP develops salt standards for soil and if the roadsides soils are found to be above the numeric standards, the removal and transport of these soils will likely require a soil relocation agreement between the MoT and WLAP. This agreement would likely be similar to the existing agreement between WLAP and MoT on heavy metals in right-of-way soils.

Overall, the MoT predicts that issues relating to potential contaminated soil or water on the Project will be limited.

Working Group Review of Application

An expanded description of the written comments submitted by the BWTG members on contaminated sites is presented in the Issue Tracking Table in Appendix 1A of this Assessment Report. During the review of the Application and contamination issues the BTWG focused on:

- construction works at the Britannia Beach mine site; and
- mitigation requirements for construction in vicinity of the Gonzales Creek hydrocarbon spill.

EC was concerned about the potential impacts to the ongoing remediation work on contaminated sites in the Britannia Beach area. The MoT met with MSRM to discuss Project plans through this area. Although the mitigation and remediation plan for the Britannia Beach site has yet to be finalized, the MSRM has indicated that the highway improvements will not interfere with remediation efforts, the proposed water treatment plant, mine drainage control or the offshore effluent disposal projects. In addition, the MoT met with the Britannia Mine Remediation Project to discuss remediation issues adjacent to the existing highway.

The MoT reports that the construction of the highway over any potentially acid-drainage producing soils will improve the current situation by creating an anaerobic state with a sealed surface. This removes oxygen and surface seepage water which significantly reduces the potential for acid drainage or metal leaching processes to occur.

EC also noted that the MoT's EMP should include mitigation methods for the containment and collection of any liquid phase hydrocarbons in the vicinity of the Gonzales Creek hydrocarbon spill. The MoT responded that the Gonzales Creek Hydrocarbon Spill site is currently being monitored by Levelton Engineering Ltd. and a remediation plan may be implemented prior to construction of the highway. If highway construction proceeds within the area affected by this contaminated site, then the MoT will coordinate with Levelton Engineering Ltd. who are managing the site for Scamp Industries, and with Hemmera Environmental who are managing the site for Interfor (owners of the property on which the spill occurred), to ensure that remediation is done prior to construction.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not result in significant adverse effects to or from contaminated sites.

11.6 AIR QUALITY

Background

Volume 2, Section C and Appendices of the Application describe potential Project impacts on air quality. The West Vancouver Clarification Report - also discusses potential impacts to air quality from Option B and Option D.

For Option D, the maximum predicted ambient concentrations will increase at the north or south tunnel exit/entrance depending on the direction of ventilation but is predicted to be neutral to slightly negative and well below applicable ambient guidelines.

Air quality impacts from Option B are unchanged from prior overland options except that the spatial distribution of pollutants from the northbound lanes will be farther away from the existing residences in Horseshoe Bay than previously described in the Application.

To gather baseline data and develop predictions about the potential impact of the Project on air quality, the MoT:

- examined available ambient air quality, meteorological and climate data;
- identified major sources of emissions in the air shed;
- estimated emission of air contaminants from the existing and improved highway;
- predicted the effect of these emissions on ambient concentrations using dispersion models and protocols agreed to with WLAP;
- compared predicted concentrations with federal and provincial ambient air quality objectives; and
- characterized local and regional changes in emissions in conjunction with data on regional emissions, results of other similar studies and predictive modelling analysis to assess the potential impact of the Project on regional and local air quality.

The MoT predicts that in addition to the vehicle traffic from the improved highway, the use of construction equipment, staging areas, aggregate production, stockpiling sites, and disposal sites may all impact air quality. The construction, use and dismantling of a third lane along the BC Rail right-of-way could also impact air quality while it is in use. Vehicle travel along the highway results in emissions of Criteria Air Contaminants (CACs) and Greenhouse Gases (GHGs) as a result of fossil fuel combustion. GHGs are a concern due to their potential effects on climate change. The Application also considered the potential impact to air quality from traffic generated during the 2010 Olympic Games and notes that the Vancouver 2010 Bid Corporation identified a number of emission reduction strategies for the highway with the potential to achieve a no net increase in emissions during the Olympic Games.

Based on the emissions estimates, the Project is predicted to result in an increase of CAC emissions (by mass) of 9 to 10% in 2010 and 2025 compared to the status quo scenario (no highway improvements). Due to future federal vehicle emission standard regulations, air quality related to the Project is predicted to have an overall improvement with respect to the present-day air quality (CAC emissions will decrease 45% for the highway improvement in 2010/2025 vs. the 2000 baseline scenario). Predicted ambient concentrations of CACs from dispersion modeling for all scenarios were below the applicable ambient air quality guidelines and ambient concentrations are predicted to decrease in future years due to reductions in emissions from vehicles from technological improvements. Ground level photochemical ozone production is also predicted to decrease in future years relative to baseline levels.

There will be a neutral to low impact based on the increase in projected traffic volumes compared to the predicted impacts from increases in traffic without the highway upgrades. The MoT's current predictions of air quality impacts are largely based on projected traffic in 2010 and 2025 and valid to the degree that the projected future traffic levels are accurate.

Maintenance specifications on the highway will provide for cleaning to manage road dust and protect air quality. The MoT reports that if actual vehicle counts increase when the highway is operational and people are adversely affected, road dust management practices should be maintained at an appropriate frequency to off-set potential increases and include provisions to clean the highway where dirt, debris, sand and/or gravel have accumulated to protect air quality in accordance with the local by-laws.

Overall estimates are for GHG's to increase in future years as the estimated vehicle travel demand increases in the Sea-to-Sky corridor, with or without highway improvements. The Project is predicted to result in GHG emissions approximately 9% higher in 2010 and 2025 than the status quo scenario (no highway improvements). The MoT notes that the estimates do not reflect the possible improvements in fuel economy that could be achieved due to de-congestion on the improved highway itself and that GHG emission estimates are best assessed on a larger scale (e.g. Canada/World) to determine if GHG emissions are increasing or decreasing or meet the Kyoto protocol targets.

During Project construction the MoT predicts ambient air quality concentrations below all applicable federal and provincial guidelines. This does not include the potential contributions from road dust from on-road vehicles during construction which may exceed ambient guidelines on a site specific basis during periods of high construction activity. Fugitive dust and diesel particulate matter are of concern during the construction phase as they could contribute to ambient concentrations close to (or over) the British Columbia Level B Objective. The MoT reports that the degree to which air quality could be impacted cannot easily be quantified for short-term periods because of uncertainty in quantifying the level of construction activity and road dust in specific areas. The maximum predicted emission concentrations from construction activities are presented in Table 6 and a summary of predicted air quality impacts is presented in Table 7.

The MoT believes air quality can be best managed through use of pollution prevention measures and BMPs during construction and proposes to undertake measures to:

- establish a Vegetative Debris Disposal Plan for clearing and grubbing activities;
- where possible, remove fill material in one trip to minimize amount handled on stockpiles and transferred between construction equipment;

- minimize the time that unpaved surfaces are exposed or water unpaved hauling and unpacked surfaces as frequently as needed to minimize road dust;
- on drier days, ensure soil piles are watered (approximately twice daily) and cover smaller soil piles, or vegetate longer term piles;
- cover the load of haul/dump trucks that are hauling finer grained materials over larger distances; and
- near residences within 50 m of the road (for example in Lions Bay and/or near Squamish), monitor PM_{10} and $PM_{2.5}$ during a few of the driest days each season to ensure that ambient air quality impacts are being appropriately managed.

To meet local air quality bylaws during highway operations, MoT will ensure that road dust management practices are followed in accordance with the MoT's highway maintenance specifications.

The MoT predicts these pollution prevention methods and management practices will reduce the potential impacts of pollutants, especially particulate matter. The MoT will also use data from Horseshoe Bay, Squamish and Whistler air quality monitoring stations to gauge actual ambient concentrations, the impacts of construction activities and the appropriate level of pollution prevention management.

Table 6 - Maximum Predicted Concentrations Resulting from Construction Activities

Pollutant	Averaging Period	Back-ground[1] ($\mu g/m^3$)	2000 Baseline ($\mu g/m^3$)	Construction ($\mu g/m^3$)	Baseline + Construction ($\mu g/m^3$)	Background + Baseline + Construction ($\mu g/m^3$)	Ambient Guideline ($\mu g/m^3$)
SO_2	1-hour	37	7.9	4.0	12.0	49.0	450
	24-hour	22.6	2.76	1.40	4.15	26.8	160
	Annual	6.8	1.79	0.42	0.46	7.3	25
VOC	1-hour	n/a	256.9	6.4	263.3	n/a	n/a
	24-hour	n/a	102.1	2.5	104.6	n/a	n/a
	Annual	n/a	57.8	1.4	59.2	n/a	n/a
NO_X	1-hour	n/a	334.0	331.6	665.6	n/a	n/a
	24-hour	n/a	132.9	131.9	264.8	n/a	n/a
	Annual	n/a	75.1	74.6	149.7	n/a	n/a
NO_2[2]	1-hour	74	133.4	133.2	166.6	240.6	400
	24-hour	58	113.4	113.2	126.5	184.5	200
	Annual	20	32.6	32.5	40.0	60.0	60
PM_{10}	24-hour	36	3.1	6.8	9.9	45.9	50
	Annual	15	2.0	4.4	6.4	21.4	n/a
$PM_{2.5}$	24-hour	12	2.0	5.7	7.7	19.7	30
	Annual	6.1	1.4	4.0	5.4	11.5	n/a
CO	1-hour	1000	2299.6	333.5	2633.1	3633.1	14300
	8-hour	750	1318.8	190.3	1502.3	2252.3	5500
NH_3	1-hour	n/a	7.9	4.0	12.0	49.0	n/a

[1] Based on maximum 98th percentile concentration of StS ambient stations
[2] NOx converted to NO_2 using the Ozone Limiting Method (0.1*concentration + 100$\mu g/m^3$)

Table 7 - Summary of Predicted Air Quality Impacts

Parameter	Direction	Frequency of Occurrence	Magnitude	Geographic (Spatial) Extent	Duration (Temporal) Extent	Overall Consequence	Likelihood of Adverse Effect	Level of Confidence
SO_2 1-Hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
SO_2 24-Hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
SO_2 Annual	Positive	Continuous	Low	Local	Medium-term	Low	N/A	High
NO_2 1-Hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
NO_2 24-Hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
NO_2 Annual	Positive	Continuous	Low	Local	Medium-term	Low	N/A	High
PM (PM_{10}) 24-Hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
PM (PM_{10}) Annual	Positive	Continuous	Low	Local	Medium-term	Low	N/A	High
PM_{10} 24-Hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
PM_{10} Annual	Positive	Continuous	Low	Local	Medium-term	Low	N/A	High
$PM_{2.5}$ 24-Hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
$PM_{2.5}$ Annual	Positive	Continuous	Low	Local	Medium-term	Low	N/A	High
CO 1-hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
CO 8-hour	Positive	Occasional	Low	Local	Short-term	Low	N/A	High
NH_3 24-hour	Negative	Occasional	Low	Local	Short-term	Low	Unlikely	High
Fugitive Dust								
PM_{10} 24-hour	Negative	Occasional	Low	Local	Medium-term	Low	Unlikely	Medium
$PM_{2.5}$ 24-hour	Negative	Occasional	Low	Local	Medium-term	Low	Unlikely	Medium

Review of the Application

An expanded description of the written comments submitted by the BWTG members on air quality issues is presented in the Issue Tracking Table in Appendix 1A of this Assessment Report.

At the BTWG meeting of December 4, 2003, the primary air quality issues discussed included:

- GHG Reduction and the application of TDM measures;
- fugitive dust emissions and burning of vegetative debris; and
- degree of certainty about future improvements in emission controls.

The BTWG and the MoT discussed the relationship between TDM strategies and air quality impacts (in particular GHG) from the Project. The MoT noted the importance of TDM along the Sea-to-Sky corridor and has facilitated a TDM study for the corridor with the ultimate goal of improving the corridor's air quality and extending the life of the planned highway improvements. The MoT anticipates that TDM options could reduce the number of annual average daily trips on the highway and reduce GHGs from levels predicted in the Application.

However, the delivery of TDM measures in the Sea-to-Sky corridor is beyond the MoT's sole control and authority. The MoT has committed to participate in multi-jurisdictional efforts at TDM should these develop in the future. The EAO agrees that TDM measures could benefit air quality in the corridor and implementation requires the participation of local governments, TransLink, the MoT and other authorities. The MoT's commitment to participate in future multi-jurisdictional efforts is satisfactory for the purposes of the environmental assessment.

To help address potential air quality impacts from particulate matter during Project construction, the MoT will adhere to municipal prohibitions against the burning of vegetation and currently has no plans for the burning of vegetation debris within the GVRD.

The MoT will also develop and implement a Vegetation Debris Management Plan and monitor for air quality parameters during construction. The details of the air quality monitoring program will be included in the EMP and provided to agencies for review and comment prior to the start of construction on each work package.

For predictions made in the Application about expected improvements to vehicle emission levels from fuels reformulations and vehicle control technologies, the MoT confirmed that only improvements already in place under legislation/regulation are considered in the modeling.

The MoT will be required, prior to the start of construction on any work package, to develop an Air Quality Monitoring and Mitigation Action Plan and Vegetation Debris Management Plan as part of the EMP for that work package, provide WLAP reasonable opportunity to review and comment on the plans and then implement the plans to the satisfaction of WLAP.

The MoT has also agreed to monitor air quality at IR#24 during and after construction and to take appropriate actions if problems are identified.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and

provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not result in significant adverse effects to air quality.

12. CONSIDERATION OF SOCIO-ECONOMIC EFFECTS

12.1 PROJECT DESIGN ISSUES

Background

Volume 1, Section B of the Application describes the general components of the Project see also Map Drawings and Folios - Volume 1-3). Revised options for the preliminary alignments from Horseshoe Bay to Sunset Beach and through the Village of Lions Bay are presented in the West Vancouver and the Lions Bay *Clarification Reports*.

The design process for a highway upgrade has several stages: pre-design, preliminary design and detailed design. The environmental assessment of the Project is a strategic level review, using preliminary design, to determine whether there is the potential for any significant adverse effects and whether actions can be taken during Project design, construction or operation to avoid or reduce adverse effects to an acceptable level. Preliminary designs are intended to meet the primary goals of safety, reliability and capacity and incorporate community input from pre-design consultations. There is flexibility at the preliminary design stage to modify the alignment to respond to community and reviewer input in cases where changes are technically and economically feasible and may help avoid or mitigate potential environmental or socio-economic impacts.

Under BCEAA, if a proponent receives an environmental assessment certificate and later wishes to modify a project design, the proponent must apply to the EAO for an amendment to the certificate if the design and/or operation of a project is substantially different from the certified project. The EAO then reviews any proposed amendment and, where appropriate, initiates a broader review with other government agencies and First Nations before deciding whether to accept or reject a proponent's request. Under CEAA, if the modification to project design deviates considerably from the original project, then a new environmental assessment of the modifications may be undertaken, using the original assessment to the extent possible.

Working Group Review of the Application

This section of the Assessment Report summarizes design issues identified by working group or local government representatives on a community by community basis. An expanded description of Project related design issues is presented in Appendix 1B of this Assessment Report. All issues discussed in this section can be addressed post-certification. Reviewer comments focused on a wide range of Project design issues including: planning horizons for the Project; cost/benefit factors; connectivity; design options for West Vancouver, Lions Bay and the section of highway between Brunswick Beach and Furry Creek; and TDM measures.

The Mayors of the corridor communities and the SLFN requested that the planning horizon for the Project extend beyond 2025 and employ a goal of minimizing potential negative impacts to each community. The MoT noted that the planning horizon includes short, medium and long-term planning and the current improvements are intended to meet demand without promoting growth to levels that might exceed the region's ability to provide services (e.g. housing, infrastructure).

The MoT has noted that the planning horizon used is consistent with other highway projects of this type. To develop projections to 2050 is difficult because there is not enough reliable data available.

Local governments also commented on the potential expense of paving the BC Rail line from Magnesia Creek to Porteau Cove as a third lane during the Olympics and then dismantling this lane after the Olympics. In response to this concern, the MoT has retained a highway engineering consultant to further examine options for this area and is aware of the importance of minimizing "throw away" costs. The EAO has based its review of the Project on a preliminary alignment that includes the third lane option using the BC Rail line. If improvements to this option are later developed by MoT and require an amendment to the Certificate, the MoT must apply to the EAO for the amendment in accordance with the requirements of BCEAA.

The Squamish-Lillooet Regional District believes that although the fifteen kilometre section of highway north of Lions Bay to Furry Creek is not slated for widening as part of the current Project, the MoT's socio-economic assessment should analyze the population, economic and commuter impacts of the eventual four-laning of this section of road because the resulting four-lane highway access to Vancouver and the Lower Mainland from Squamish will likely produce major impacts on the communities of Howe Sound. The MoT focused its socio-economic assessment on the current upgrades because it is uncertain exactly when four-lane improvements will be done on this section (2017 or later) and what other changes by then will also influence corridor use. For the purposes of this environmental assessment, the EAO has relied on the socio-economic assessment provided in Volume 3 of the Application and additional information from the West Vancouver and Lions Bay Clarification Reports.

Horseshoe Bay to Sunset Beach

The District of West Vancouver Council favours a tunnel option and prefers a three kilometre tunnel over Option D because it believes a three kilometre tunnel would be the most cost-effective option over the long-term. The MoT did not include a three kilometre tunnel option in its Application because the MoT believes this option would be prohibitively expensive, cannot be constructed by 2009 or within the $600 million budget allocated for the Project and would yield a lower benefit/cost premium ratio than either Option B or Option D.

The District of West Vancouver is concerned about the potential environmental impacts of Option B relative to Option D. The District of West Vancouver commented that prior to the development of Option B and Option D, the MoT committed to investigate a tunnel of 1 to 1.4 kilometres in length, whereas, the length of Option D as currently proposed by the MoT for comparative purposes with Option B is only approximately 1 kilometre. In a letter to the EAO of April 30, 2004 the District observed that if the tunnel proposed in Option D were extended by 400 metres it would increase the environmental benefit of the tunnel substantively. The SLFN expressed similar concerns about environmental impacts of Option B, and favour a 1.4 km tunnel because it would have fewer impacts on the land and cultural values of the area.

Emergency access and connectivity were concerns with the overland and tunnel options presented in the original Application and Option B and Option D were developed to respond to these concerns. Options B and D include:

- new grade separated on-ramp and off-ramps near Pasco Road to enter and exit the existing highway;
- northbound access to Pasco Road via the Ansell Place Interchange;
- converting Marine Drive intersections to local road intersections; and

- replacement of the Horseshoe Bay Overpass.

In the West Vancouver Clarification Report, the MoT reports that Option B and Option D both address community concerns about traffic flow at the Caulfield Interchange and emergency response. The MoT estimates that Option B best meets local access and mobility functions, has the social benefit of fewer and less severe accidents with lower insurance payout costs and leaves the existing highway available for local traffic.

The environmental assessment examines whether the two proposed preliminary alignment options between Horseshoe Bay and Sunset Beach have the potential for significant adverse effects but is not intended to select a preferred option. Decisions about what project designs to present in an application for an environmental assessment certificate are the discretion of the proponent.

Lions Bay

Project design impacts on noise levels in the community, access across the highway and traffic speeds in the community were concerns identified during the review of the Application. Noise issues are discussed in section 12.3 of this Assessment Report. The Lions Bay Clarification Report presents design options to maintain or improve connectivity and access with the community. The two preferred intersection designs at this time are: (i) mini-changes at Kelvin Grove and Brunswick Beach; or (ii) an underpass at Kelvin Grove and lower connection to South-view Place/Lions Bay Avenue and a mini change at Brunswick Beach. Traffic speeds will be managed by traffic calming measures (context-sensitive design, speed-limiting curves and raised center medians with landscape features). The MoT is also consulting with the RCMP to discuss ways to facilitate more effective speed enforcement. Examples may include additional pullouts for enforcement use.

Furry Creek

Issues to be further examined during Project development are excessive speeds in the passing lanes on Furry Creek hill and the safety concerns and noise issues this creates. The MoT commits to work with the community to identify practical solutions to mitigate these concerns as the Project moves through preliminary design.

Britannia Beach

Issues to be further examined during Project design are access and egress to the highway from the community and harmonizing highway development plans with community economic development plans for the Mining Museum and waterfront area. The MoT commits to work with the community to identify practical solutions to mitigate these concerns as the Project moves through preliminary design. The community also supports the proposed bypass route east of Britannia Beach which would covert the existing highway to an access road.

Indian Reserve #24 (IR#24)

Issues of concern to be further addressed at IR#24 include community connectivity (ensuring that highway widening does not create a barrier between the residents on each side of the highway), risks to pedestrian safety or children who travel to and from schools located near the highway, avoidance of adverse impact to small business development on IR#24 near the Stawamus Road intersection, creating an “identity” for IR#24, and protecting environmental values near the Stawamus River. The MoT has committed to work closely with the Squamish Nation in the design of the alignment through IR#24 to mitigate the potential impacts of the Project on IR#24.

Urban Squamish

The District of Squamish is concerned that widening the highway through urban Squamish would further isolate pockets of development on either side of the highway. The District believes that the Project should include amendments to the municipal road network to enhance east-west connectivity and that access to industrial and commercial properties adjacent to the highway is also critically important. The District also expects Project design to: provide safe pedestrian passage at all bridges; a continuous, paved pedestrian/ bike path from Valleycliffe to Brackendale; and access and parking for significant trail heads such as the Mamquam Spawning Channel, the Malamute and other trails.

The MoT commits to work with the District of Squamish to identify practical solutions to mitigate access and connectivity concerns as the Project moves to preliminary design. The MoT will include some measures to accommodate bicycle traffic along the highway. Existing signalized intersections will remain to facilitate east-west bicycle and pedestrian movements and the MoT will retain or rebuild pedestrian overpasses across the highway near the Mamquam River Bridge and Garibaldi Way.

Pinecrest Estates and Black Tusk Village

Issues of concern to be further addressed are access/egress from the highway and further protecting Retta Lake (the primary community potable water source) from risk of contamination from accident related spills off the highway. To protect the water supply the MoT proposes to install a new highway drainage system. The community would prefer that the MoT realign Highway 99 to the east, adjacent to the west side of Daisy Lake and convert the existing highway to a service road. The MoT commits to work with the community as the Project moves to preliminary design.

Whistler

The RMOW did not identify any specific Project design issues but is concerned about any increased traffic congestion that may impact air quality, public health and the resort experience in the Whistler Valley.

Mount Currie

The Lil'wat Nation expressed concern about connectivity near Mount Currie and increased risk to the safety of pedestrians crossing the highway. The MoT predicts that the highway upgrade will add an additional 120 vehicles per day to the highway north from Whistler to Mount Currie. The MoT will continue discussions with the Lil'wat Nation on connectivity concerns as the Project moves from preliminary to detailed design and will develop solutions to mitigate impacts.

Conclusion

During this cooperative environmental assessment the EAO, DFO, EC and INAC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO, EC and INAC are satisfied that design issues have been sufficiently considered for the purposes of this environmental assessment.

12.2 TRANSPORTATION DEMAND MANAGEMENT

Background

Volume 1, Section A, 4.2.4 of the Application identifies and assesses the feasibility of potential TDM strategies which can be defined as any policy or regulation that facilitates or encourages multi-occupant vehicle use and/or reduces total trip making, particularly, but not exclusively, during congested periods. TDM generally seeks to achieve one or more of the following:

- trip reduction (eliminate the need, opportunity or incentive to travel);
- mode change (encouragement of HOV lanes or increased use of public transit);
- temporal change (encourage vehicles to travel in less congested periods); and
- route change (encourage travel on less congested routes)[2].

The MoT retained TSi Consultants to complete a TDM study. In its final report issued in November 2003, TSi noted that, for the Sea-to-Sky corridor, route change is unlikely as there is no alternate highway route between Vancouver and Whistler. Temporal changes are also unlikely because peak travel is linked to tourism with peaks in the winter season on Friday and Sunday evenings.

The TDM options identified as most available for the highway are trip reduction and mode change. These are discussed in detail in the final TSi report and are not repeated in this Assessment Report. A copy of the TSi report is available on the EAO Project Information Centre.

The MoT has already investigated some mode change options including:

- high occupancy vehicle (HOV) lanes;
- car pooling/ridesharing programs, facilities and services;
- encouraging alternative modes of transportation; and
- promotion of bicycling.

The MoT reports in the Application that enforcing the appropriate use of HOV lanes would be difficult and expensive due to the mountainous terrain, remote nature of the highway and overall length. The highway would also be relatively uncongested to the year 2025 and beyond and thus offer little incentive for carpooling or ridesharing.

The MoT notes a joint initiative of the districts, municipalities and villages along the corridor could most effectively develop and implement car pooling because this measure involves cooperation and coordination amongst the corridor communities. The Project does not include specific physical facilities for carpooling/ridesharing measures since a corridor-wide TDM plan has not yet been developed. The MoT could support carpool/rideshare programs and facilities by providing safe and convenient highway access to carpool/ridesharing parking lots.

As discussed in section 3 of this Assessment Report, bus and rail options would not eliminate the requirements for highway upgrades and would divert a low percentage of drivers from their cars. The MoT will support potential improvements to bus and ferry service by providing, where

[2] Sea-to-Sky TDM Study Final Report, TSi Consultants, November 2003, p.17

appropriate, bus pull-outs to facilitate safe and convenient bus passenger loading and unloading and highway access to potential bus and ferry terminal locations.

The Project specifies varying levels of improvements to different parts of the corridor. Where new construction is proposed, a minimum 1.5 metre wide shoulder will be provided to accommodate bicyclists along the highway. Where highway upgrading will be deferred to a later stage, the existing shoulders will remain at the current widths.

As the TDM study progressed the findings were shared with the TLC and work-shopped to evaluate potential TDM measures and identify implementation strategies and recommendations. A series of measures were identified, rated as either high, medium and low priorities and include:

- Parking Pricing and Supply Management
- Parking Priority
- Strengthened Conventional Inter-Urban Transit
- Combined Transit/Recreation Pass
- Promotion of a Sustainable Resort
- New Premium Transit
- New Marine Services

The TLC also made nine recommendations, several of which fall under the authority of government agencies other than MoT and require support from the corridor districts, municipalities and communities to implement.

Review of the Application

An expanded description of the written comments submitted by the Socio-Economic Working Group (SEWG) members on TDM issues is presented in the Issue Tracking Table in Appendix 1B of this Assessment Report. The Resort Municipality of Whistler was pleased with the MoT's decision to study TDM measures and fund the TSi study and recommended that the TDM measures presented in the study move to implementation. The Lil'wat Nation noted that improvements to the transit service between Whistler and Mount Currie would provide better commuter access between the two communities.

The EAO notes that recommended TDM measures, other than bicycle lanes on the highway shoulders, require the participation of many jurisdictions, are beyond the sole authority and control of the MoT and are beyond the scope of the environmental assessment for this Project. The MoT has committed to participate in future multi-jurisdictional discussions towards delivery of other TDM measures if a forum is assembled.

12.3 NOISE

Background

Noise is commonly referred to as "*unwanted sound"*, because it interferes with human activities and/or creates annoyance. Determining what sounds constitute noise is somewhat subjective since it depends on the situation, the activities engaged in as well as individual attitudes and sensitivity. Figure 2 shows common levels of noise in a community represented in A-weighted decibels (dBA).

Volume 3, Section C of the Application and Appendices report on the potential noise impacts of Project construction and operations and propose measures to mitigate impacts. Volume 3, Section C, Appendix 1B of the Application provides the time series data from baseline monitoring at the southern end of the corridor and at IR#24. Volume 3, Section C Appendix 4 describes predicted noise exposures from construction activities.

The Application includes reporting on potential noise impacts from use of the BC Rail line as a traffic detour during Project construction. The MoT subsequently decided that it will not require use of the rail line as a detour for traffic during Project construction.

The MoT Noise Impact Assessment Methodology

The MoT assessed the potential noise impacts of Project construction and operation by quantifying noise levels at selected points along the existing corridor to establish baseline levels and then predicting changes to the baseline from highway construction activities and future Project operations. This included the following tasks:

- identify all noise sensitive land uses (residential, passive parks, schools) along the corridor;
- establish, through continuous noise monitoring, representative baseline (pre-project) noise environments at noise sensitive land uses along the corridor;
- estimate construction phase noise exposures at sensitive locations including the noise from actual highway building activities;
- predict any changes in highway traffic noise exposures attributable to the Project, during the 2010 event, in 2018 (10 years after project completion as required by MoT noise policy) and during the 2025 project design horizon year; and
- assess the significance of projected noise impacts from highway construction and operation and, where warranted, identify feasible mitigation measures.

Noise Related to Highway Construction

The communities nearest the proposed construction zones are located at: the southern end of the corridor between Horseshoe Bay and Brunswick Beach; IR#24; and within the District of Squamish. Fourteen of the nineteen sites used for baseline monitoring were placed in these communities at locations the MoT considered representative of sites that will be exposed to maximum levels of noise from Project construction, operations, or both. The MoT conducted baseline monitoring from October 21–25, 2002 and, for IR#24, from April 5–7, 2003.

Project construction will require the use of extensive night time construction activities and this greatly increases the potential for community noise impacts. The MoT estimates that the general construction activities most likely to contribute to increased noise exposures near the sites used for baseline monitoring are: clearing and grubbing, excavations and rock drilling, retaining wall construction, grading and asphalt paving, pile foundations for bridges and bridge sub-structure and precasts. Rock drills will be used wherever significant excavation and/or widening of highway cuts in rock will be required and the MoT notes that their considerable noise output (assuming two drills active) has been accounted for in the noise assessment section of the Application.

The noise impact assessment assumes that over a typical nine-month phase of the construction program there may be construction activities implemented concurrently within a given 200 metre section of highway. In these cases overall noise emissions in that section of highway will increase. While the MoT cannot currently predict to what degree two or three construction phases can coexist within a single 200 metre highway section, it conservatively assumes there

will be overlap and treats noise emissions from concurrent activities as additive. The MoT predicts that the middle years of the construction phase, from 2005 to 2007, will involve the greatest construction noise exposure along the corridor while 2003, 2004 and 2009 will be relatively quiet years.

Table 4-3, Volume 3, Section C (p.30) of the Application estimates the range of construction noise from concurrent construction phases and concurrent phases along a contiguous 200 metre section of the alignment. Given the volume of construction work scheduled for nighttime hours, the MoT estimated the potential for construction noise to interfere with human speech and sleep. The Application reports that speech interference occurs outdoors at a separation of one to two metres when intrusive noise levels approach or exceed 60 dBA. The degree of interference increases with the level and duration of the noise. Indoors, some speech interference may begin when noise levels outdoors at the house facade reach the 70 to 75 dBA. Table 8 summarizes the potential of general outdoor noise levels to interfere with speech and sleep.

Figure 2 - Common Levels of Noise in a Community

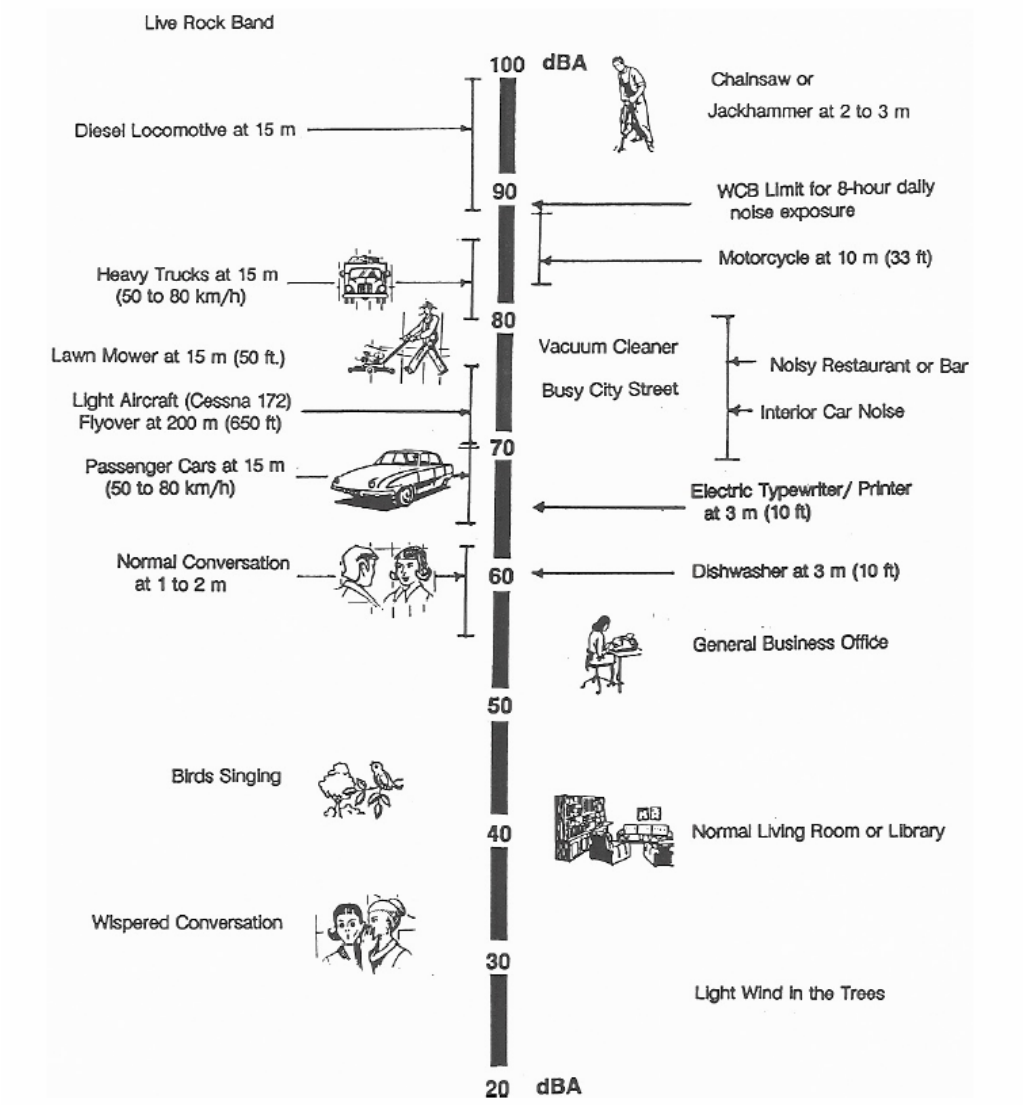

Table 8 - Potential Severity of Human Activity Interference Impacts in Residential Areas Associated with Various Levels of Outdoor Noise[3]

Average Outdoor Noise Level L_{eq} (dBA)	Speech Interference			Sleep Disturbance (Indoors)	
	Outdoors	Indoors			
		Windows Open Slightly	Windows Closed	Windows Open Slightly	Windows Closed
30 – 40	None	None	None	None	None
40 – 50	None	None	None	Threshold	None
50 – 60	Minor	None	None	Minor	Threshold
60 – 70	Moderate	Minor	None	Moderate	Minor
70 – 80	Major	Moderate	Minor	Major	Moderate
80 – 90	Severe	Major	Moderate	Severe	Major

To estimate community reaction to construction noise levels, the MoT extrapolated from a study by the U.S. Environmental Protection Agency that synthesized 55 case studies of community reaction to *new* noises introduced to urban residential neighbourhoods. The study categorized potential community reactions into five types depending on the degree to which the existing community noise levels were increased or decreased by the new noise:

Category I No Reaction (although noise is generally noticeable)
Category II Sporadic Complaints
Category III Widespread Complaints
Category IV Strong Appeals to Local Officials
Category V Vigourous Action

The predictions of community reaction to Project construction noise, based on the monitoring data collected at the sixteen baseline sites, are summarized in Table 5-3 of Volume 3C of the Application. The MoT predicts that at residences nearest to construction activities, average outdoor construction noise levels will exceed Leq 70 dBA with some regularity and will occasionally, if the setback distance involved is very small, exceed Leq 80 dBA. The MoT reports that there is substantial potential for community noise impact due to speech interference and sleep disturbance within localized residential enclaves closest to the highway alignment and that sleep disturbance will be of substantial concern where major construction activities are conducted near residential enclaves during the night time construction window – particularly between 22:00 and 05:00 hours.

The findings suggest that the anticipated levels of negative community response will be high during some, if not all, phases of highway construction. The MoT reports that at many locations, the highest negative response ratings result from noise associated with pile driving or excavation works (with or without rock drills) in combination with very limited setback distances. In all cases the projected community response is strongly influenced by the fact that seven of the twelve daily construction hours are at night (between 22:00 and 07:00 hours). While the

[3] Equivalent Sound Level (Leq): This is the steady sound level which, over a given time period, would result in the same sound energy exposure as the actual time-varying community sound level. *Where night time noise levels are generally much lower than daytime levels* (e.g. most highway noise situations), Leq(24) is an appropriate measure of community noise exposure. The Canada Mortgage and Housing Corporation (CMHC) has identified a daily average exterior noise level of Leq(24) 55 dBA to represent the threshold above which road and rail noise can begin to interfere with essential activities such as outdoor speech and indoor sleep.

MoT expects that excavation work will generally proceed during both the day and night, the MoT also notes there may be potential to restrict pile driving to daytime hours, particularly where this latter work would not itself disrupt highway traffic.

Mitigation of Construction Noise Impacts

The Application identifies several approaches to reducing the potential impacts of highway construction noise on the community and minimizing adverse community reactions. Physical noise control measures can be applied at three points: the noise source; along the sound path from source to receiver; and at the receiver (i.e. the residences).

Management and Educational Controls of Noise at the Source avoids creation of unnecessary noise through the management of the construction site, scheduling of activities and the education of both construction crews and the potentially affected communities. It may include limiting construction activities to normal daytime or early evening hours (preferably 07:00 to 20:00 hours), notifying affected communities of the nature and likely duration of any particularly noisy operations such as blasting or pile driving, posting construction site speed limits consistent with minimum noise generation, and encouraging quiet construction practices on-site.

Engineering/Operational Controls of Noise at the Source focuses on the appropriate operation, modification/enhancement or maintenance of equipment or processes such as fitting gas or diesel-powered equipment with silencers (mufflers), using the quietest model of equipment or construction techniques, providing the appropriate covers, hoods, shields for all equipment and regular maintenance of all equipment.

Control of Noise Along the Source-Receiver Path considers ways to block the sound path between the noise source and the receiver. An example is the use of noise barriers (usually the line of sight) between a noise source zone and the noise-sensitive receivers. Noise reductions from 5 to 15 dBA may be achieved when individual noise sources are effectively shielded.

The MoT recommends that each of these types of mitigation measures be considered for the Project. The MoT notes that good communication with local communities is also important to help manage construction noise impacts. The Contractor(s) can meet with community representatives to identify the noisiest construction activities within each community and discuss whether these activities can be conducted during normal daytime working hours. For construction activities that must be done at night, proposed measures to minimize noise should be discussed with the community and agreed upon. The contractor(s) should communicate with the affected communities on a regular basis to advise them well in advance of the types of activities that will take place and notify them of changes in the estimated start and/or completion dates for the various phases of construction.

Noise Related to Highway Operations

To assess potential noise impacts from highway operations the MoT modeled and compared the expected increases in traffic volumes to 2025 and during the 2010 Olympics with 2001 traffic volumes. Although single louder noise events may result from the exhaust systems or engines of passing vehicles, the primary source of noise from vehicles traveling a highway is tire noise.

In November 1993, the MoT adopted a “Revised Policy for Mitigating the Effects of Traffic Noise from Freeways and Expressways”. (The summary of the policy is posted on the EAO Website). The policy states that mitigation measures will be considered and carried out if found feasible, cost-effective and widely supported by the affected residents, if and where, ten years after

completion of a MoT freeway or expressway project, the predicted total (project plus baseline) community noise level, expressed in terms of Leq(24)[4], is:

- between 55 and 65 dBA, and exceeds the corresponding pre-project (baseline) noise level by an amount which varies from 10 dBA at a pre-project level of 45 dBA, to 3 dBA at a pre-project level of 62 dBA; or
- 65 dBA or more and exceeds the corresponding pre-project level by at least 3 dBA.

The Project is not classified as either a freeway or expressway which means it is not formally subject to the MoT noise mitigation policies, however the MoT chose to use the policy as a guideline for mitigation of potential noise impacts from Project operations. The MoT predicts that noise from traffic volumes during Project operations will not reach the threshold for mitigation as set out in the MoT's noise mitigation policy. The MoT acknowledges that traffic noise levels at the facades of some residences fronting Highway 99 already exceed those considered (by the CMHC and U.S. EPA) appropriate for residences as normally constructed.

The MoT policy also contains a noise exposure limit for schools based on the noise levels created by highway traffic inside exposed classrooms. Mitigation measures are to be considered if, during normal school hours, the Leq (1 hr) exceeds 47 dBA inside the classrooms. To reach this threshold level indoors, outdoor traffic noise levels near the façade of the school would typically need to reach 60 dBA or more.

To be considered cost-effective under the MoT policy, mitigation measures generally need to provide a predicted noise reduction of 5 dBA or more at front row, ground floor noise receiver locations and have an installed cost of not more than approximately $15,000 per effectively-protected residence. Final rulings as to whether such mitigation is practical and cost-effective in a given project situation are made by MoT project management.

The MoT predicts that with the modest projected traffic volume growth and the generally minor widenings and/or alignments changes planned, the effects of the Project on Highway 99 traffic noise levels at adjacent residences will be uniformly small. The MoT notes that exceptions may occur at Site 10 (Porteau Cove Provincial Campsite) due to the possible effects of traffic detoured onto the BCR Rail alignment during the 2010 Olympic event but predicts the temporary increase in community noise during this period would remain below the MoT policy threshold for mitigative measures.

Working Group Review of the Application

An expanded description of the written comments submitted by the SEWG members on noise issues is presented in the Issue Tracking Table in Appendix 1B of this Assessment Report. Health Canada focused its review on impacts from Project construction. Other working group comments focused on noise related issues from Project operations.

Health Canada

Health Canada noted the potential for disturbance from noise during the night time construction period and advised that all construction equipment should be as quiet as possible and if practicable, the quietest possible type of pile driver employed for night time use near residences such as site #3 (Ansell Place) where construction noise Ldn is predicted at 86 dBA.

[4] Leq(24) is a single-number descriptor of a community's average sound energy exposure over a 24-hour day. The Leq(24) is commonly used to describe noise environments from road and railway noise.

The MoT has advised Health Canada that the MoT will comply with Health Canada's requirements to keep noise levels within specified thresholds. At locations where noise could be disruptive to residents and businesses, additional measurements and assessment will be undertaken during the detailed design phases of the Project in order to finalize noise predictions, confirm mitigation requirements, and design noise reduction measures where necessary. Construction contractors will be required by the terms of their contracts to take measurements of noise levels and to ensure that noise levels comply with established objectives for daytime and night time work, as part of the EMP for the Project.

Health Canada also noted that the *World Health Organization Guidelines for Community Noise (1999)* recommends an indoor limit of 30 dBA for quasi-continuous noise and 45 dBA Lmax for intermittent noise during nap times for children. There is one daycare located in Lions Bay and one close to the highway corridor at the Totem Hall on the Squamish First Nation's IR#24 in Squamish. The MoT observes that current noise levels near Totem Hall including BC Rail noise events are high and may already exceed these guidelines. To address potential noise impacts the MoT proposes to require its Contractor to develop strategies that will limit Project-related construction noise exposures during nap times. The MoT also proposes to consider means to mitigate the impacts from operational (traffic) noise in the town of Squamish as part of the detailed design phase of Work Package 5.

There are no MoT policy requirements to control or follow-up, through field supervision and/or monitoring, the noise levels created during highway construction activities. However, during past major projects the MoT has required construction companies to adopt a noise control plan to minimize the disturbance of adjacent neighbourhoods. The EAO recommends that the MoT implement a similar noise control plan for the Project.

Lions Bay

The Village of Lions Bay representative to the working groups noted extensive community concern about potential noise impacts to the community. These concerns were also presented to the MoT by the Lions Bay CAG and in response the MoT carried out additional community consultations in January and February 2004 and reported the results in the Lions Bay Clarification *Report*.

Lions Bay questioned the reliability of the baseline noise measurements used by the MoT for the noise impacts assessment. The MoT subsequently recruited a third-party independent expert to conduct a thorough review of the existing noise data collected, the data collection methods and instrumentation, and the Traffic Noise Model files and approach used for the noise prediction and abatement evaluation. This review included a careful tour of the study area to examine the unique geometry of Lions Bay and review the sites where noise measurements were conducted.

The independent review[5] found that noise measurement sites were appropriately selected, methods were professional and followed applicable standards, and all of the data collected, except for one site, appears to be reasonable and valid. The report recommended that the noise measurements at this one site (190 Panorama Road) be re-done and that the MoT conduct noise measurements at several additional sites in the study area, including some

[5]See memo from Christopher W. Menge to John Cavanagh of January 23, 2004 (attached to the Lions Bay Clarification Report).

elevated decks that have frequent human use during good weather. The report concluded that the traffic noise modeling used to predict noise impacts from the Project and consider mitigation measures was reasonable and appropriate and it recommended that if noise abatement options being considered for the Lions Bay community proceed toward design and construction, more detailed and complete traffic noise modeling of the terrain, receivers, barrier and roadway geometry be completed. The MoT will carry out additional noise measurement and modelling as the Project moves through preliminary design and continue to work closely with the community.

Other identified concerns in Lions Bay and Brunswick Beach were:

- use of construction detours at Brunswick Beach;
- expanding from existing two lanes to four lanes through urban Lions Bay;
- merging four lanes back to two lanes near Brunswick Beach; and
- speeding through the community.

The MoT subsequently revised its construction plans to remove the need for a construction detour near Brunswick Beach and informed the EAO of this change on April 13, 2004. The transition point from four lanes to two lanes will be moved north of Brunswick Beach to "M" Creek to reduce potential noise impacts. The MoT has also committed to work with the community to reduce current highway noise by 4 to 5dB through mitigation measures such as open graded asphalt and speed reduction and to work with the community to make best efforts to incorporate noise barriers and other noise mitigation efforts where effective, which could result in a further 5dB reduction. The Village of Lions Bay would like to see open graded asphalt used for the entire length of the alignment through the Village.

The MoT proposes to mitigate speeds within the community with additional lighting and traffic calming measures such as a pedestrian pathway, lamp standards and landscaping to increase driver awareness of the Village of Lions Bay, thereby reducing speed and noise. MoT has also committed to consult with the police and the RCMP to determine if there are ways the MoT can facilitate more effective speed enforcement through design measures such as additional pullouts for enforcement use.

IR#24

The Squamish Nation noted that while the MoT has assessed the potential for increased noise from Project operations, it uses existing traffic noise levels as the baseline and does not consider the impact of existing noise levels. The Squamish Nation is concerned about potential noise impacts to people living on IR#24 from Project operations and requested that the MoT examine the use of other sound-reducing mitigation measures on IR#24 additional to those set out in the Application. The MoT has committed to additional analysis of noise impacts and mitigation measures on IR#24, in cooperation with the Squamish Nation, during the detailed design phase when the physical characteristics of the alignment are better defined. The MoT will consider the use of open graded asphalt, traffic calming and other viable options in consultation with the Squamish Nation.

District of Squamish

The District of Squamish noted that widening of the highway and increasing traffic volumes have the potential for increasing ambient noise levels at properties adjacent to the highway. Baseline noise data should be collected throughout the urban portion of the corridor and measures such as speed control, pavement type and buffering should be enlisted to maintain or reduce noise from present base levels. The MoT reports that it will work closely with the District as the Project moves to preliminary design.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not result in significant adverse effects from noise during Project construction or operation.

12.4 EMERGENCY SERVICES

Volume 3, Section A of the Application provides baseline information on emergency services in the highway corridor (ambulance, police and fire services).

The MoT predicts that once completed, the Project will improve travel times on the highway which will also benefit ambulance, police and fire services. Vehicle accident rates for the corridor are expected to drop to the provincial averages for similar sections of highway resulting in an estimated $517 million in accident cost reductions.

During Project construction, ambulance services will be affected by intermittent delays and night time closures. To mitigate impacts the MoT proposes to:

- communicate with the public in communities affected by construction so they factor construction delays into their decisions (e.g., where to go for care or whether to call an ambulance);
- maintain access to one highway lane for emergency vehicles to the extent possible; and
- work with the B.C. Ambulance Service to ensure access to helicopter services are available if required.

The MoT predicts minor impacts to police services from highway closures and delays during Project construction and notes that policies and procedures are already in place generally for dealing with such closures and delays. Some construction delays and closures could temporarily restrict RCMP access to Lions Bay but the MoT reports that the RCMP could draw on West Vancouver Police in such circumstances and existing protocols would provide for this. To mitigate the impact of closures and delays on police services the MoT proposes to:

- work with the RCMP to map high frequency crash areas to construction areas so that the RCMP can identify in advance those high-incidence areas that require RCMP response and for which access may be restricted due to construction; and
- maintain (as much as possible during construction) one lane that can be accessed as necessary by police vehicles.

Project construction will have some impact on fire protection services due to the location of some highway closures and the requirement to provide first response services on stretches of the highway between jurisdictions. For some communities, neighbouring fire protection services would temporarily need to service an area that traditionally has been outside their scope of services. Fire protection services in the communities of Lions Bay, Squamish, and Whistler will be most affected by intermittent highway delays and road closures. Pemberton and Lillooet will be unaffected.

The MoT reports that fire and rescue services already have measures in place to deal with closures and delays on the highway, and the schedule for delays or closures is communicated routinely by transportation authorities to fire protection services. Neighbouring fire rescue services have defined, formal divisions of territory for coordinated dispatch and first response capability. The MoT predicts that fire protection services will be able to adapt to construction related delays and closures. To mitigate construction impacts to fire protection services the MoT may:

- develop communication protocols between construction site(s) and fire protection services dispatchers to ensure that fire protection services are able to get to the front of traffic queues during delays and that neighbouring fire protection services are able to access service areas during times of temporary closures; and
- maintain (as much as possible during construction) one lane that can be accessed as necessary by fire protection services vehicles.

Working Group Review of the Application

An expanded description of the written comments submitted by the SEWG members on emergency service issues is presented in the Issue Tracking Table in Appendix 1B of this Assessment Report. The working groups had no additional comment on the MoT's plans for managing Project construction and impacts to emergency services and focussed instead on the potential impacts of Project operations.

The District of West Vancouver estimated that original overland and tunnel designs presented in the Application could increase emergency response times by up to ten minutes. The MoT subsequently revised the design of the alignment through West Vancouver and presented these changes in the West Vancouver Clarification Report. Option B and Option D are both designed to eliminate potential delays to emergency response times.

Of the communities along the corridor with emergency fire services, the Village of Lions Bay is nearest to the section of highway that is not slated for improvement as part of the Project (Brunswick Beach to Porteau Cove). The Village of Lions Bay notes that although the *percentage* of accidents relative to the total volume of traffic will decrease with the Project, the *total* number of accidents on the highway may increase with rising traffic volumes and this will increase pressure on the Lions Bay fire department to be a first responder to emergencies between Lions Bay and Porteau Cove.

This has financial implications for the residents of the Village of Lions Bay in the form of increased operational costs for its fire department as a result of the Project. The Village of Lions Bay believes these costs should not be absorbed by the community. The environmental assessment process is not the appropriate mechanism to resolve this issue, however the EAO acknowledges that this is a potential adverse impact of future Project operations.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not result in significant adverse effects to emergency services.

12.5 RECREATION

The potential impacts of the Project on upland recreation are described and assessed in Volume 3, Section E (and Appendices) of the Application. The MoT considered Project impacts to various recreational uses of the corridor including scenic motor touring, Provincial park visits, bicycle touring, rock climbing and backcountry recreation.

The MoT concludes that avoidance and mitigation strategies can effectively address most potential Project impacts to recreation but there will be adverse effects on recreation values at four provincial parks. Porteau Cove Provincial Park will be impacted during Project construction if used as a barge loading site. Construction may also require blasting within Murrin Provincial Park which may impact the recreational experience for rock climbers. The Project alignment will encroach upon Shannon Falls Park and Brandywine Park and an Order-In-Council will be required to adjust the park boundaries to accommodate the new right-of-way.

To facilitate review of recreational issues the MoT created a recreational focus group that includes participation from West Vancouver Parks Department and various cycling, hiking and rock climbing associations. The group has met three times between November 2003 and March 2004 to discuss Project impacts on recreational features along the highway corridor, identify appropriate mitigation measures where possible and ensure that the MoT's uplands recreation assessment captures the majority of concerns and issues from the recreation community at large.

Working Group Review of the Application

An expanded description of the written comments submitted by the SEWG members on recreation issues is presented in the Issue Tracking Table in Appendix 1B of this Assessment Report.

The District of Squamish notes that Squamish is a world renowned destination for rock climbing and wind surfing and it is important that the Project enhance their exposure and usage. Safe access and ample parking for the Murrin, Malamute and Chief venues should be a design priority.

The SLFN expressed several concerns about the issue of recreation and the potential impacts of the Project. The SLFN note that the commonly held understanding of recreation (hiking, biking, camping) and use of the backcountry is often in conflict with the First Nations access to or use of spiritual, sacred sites, hunting, or plant gathering. The SLFN expressed the view that increases in recreational activity has already reduced wildlife and plant populations, and further growth associated with the highway will worsen this problem.

Conclusion
During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not have a significant adverse impact on recreation.

12.6 AESTHETICS

Background
Volume 3, Section I of the Application describes the measures taken or proposed to identify and address Project aesthetics in the Highway 99 corridor. The MoT developed a Context Sensitive Design Engineering Practices report in November 2002 to provide a general inventory and assessment of the visual, aesthetic, and cultural attributes of the corridor. The report established a series of principles, guidelines and practices to inform the consistent and sensitive treatment of views, roadway structures, and facilities along the corridor.

The MoT's overall design goals for the entire corridor are to:

- maximize visual quality of the corridor, both from the highway and to the highway (opportunity exists to significantly enhance the current conditions);
- use aesthetic design treatment to maintain driver interest and attentiveness, and thereby encourage safe driving;
- provide aesthetic unity and character for the entire corridor while respecting and reflecting the unique landscape character, culture, and ecology of the corridor; and
- provide portals announcing the beginning and ending of the highway, as well as markers at important segments and transitions within the highway.

The MoT reports that at the detailed highway design stage there is considerable opportunity to incorporate measures that will improve the visual quality of the corridor and the corresponding aesthetic experience of those using the corridor. The MoT will retain landscape architects or equally qualified professionals to provide consulting services and use a consultative community process to refine the list of important features and to determine precisely how they should be highlighted.

Working Group Review of the Application
The Squamish and Lil'wat Nations are concerned that the visual effects of the highway upgrade on the aesthetic quality of their respective asserted traditional territories be examined by the MoT. The Squamish Nation would like to know what the highway will look like, particularly in areas of large rock removal which affect the appearance of the territory and areas of cultural importance. The Lil'wat Nation noted that some sites are used for spiritual bathing and there are transformer rocks within their territories that should be identified, protected and respected.

In its response to First Nation concerns, the MoT advised that the Application did offer specific descriptions of potential highway impact on the aesthetics of the corridor because design work was ongoing. The Context Sensitive Design Engineering Practices report includes the preservation of aesthetic resources. The MoT has committed that there will be conscientious

level of aesthetic treatment for the Project. These issues were discussed at the SEWG meeting of March 3, 2004. The Squamish Nation has since provided information to the MoT on unidentified cultural landforms along and adjacent to the highway corridor so that the MoT can prepare conceptual visual representations of impacts at any strategic locations. This can be completed after the environmental assessment review but prior to the start of construction.

The District of Squamish noted the MoT do not yet have a landscape architect to ensure the highway aesthetics are acceptable and would like to see additional aesthetics within Squamish as well as its vicinity. The MoT has committed to commission a landscape design consultant to work closely with the District of Squamish on the urban Squamish section of the highway improvements. The District of West Vancouver reported at the SEWG meeting of April 20, 2004 that it has also requested an assessment of the aesthetic impacts of Option B.

Conclusion:
During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not have significant adverse aesthetic impacts.

12.7 ECONOMIC

The Project will have economic impacts during construction and operations. Based on a construction cost of $600 million, the Project is estimated to generate $471 million of gross domestic product (GDP) with $240 million in direct GDP, $132 million of indirect GDP and $99 million of induced GDP (consumer re-expenditure of wages). The MoT estimates that Project construction will support 8,300 person years of employment, with 4,100 person years of direct employment, 2,400 person years of indirect employment and 1,800 person years of induced employment. The Project will result in about $183 million in federal, provincial, and municipal government revenues comprised of $162 million in direct and indirect government revenues, and $21 million in induced government revenues.

During the peak of construction, the Project will employ an estimated 1,400 workers which represents approximately 30 percent of the road construction work force in the greater Vancouver area. The MoT notes that within the GVRD there is a plentiful supply of construction workers and the vast majority of work sites are within a manageable distance to commute on a daily basis. There is a stock of reasonably priced hotels in the Squamish area so a modest requirement for housing for construction labour would likely be accommodated within the community. The MoT predicts that the majority of the construction workers on the Project will reside within commuting distance of the Project and that a construction labour camp will not be required.

The Project construction phase will have a limited and temporary negative economic impact on the Resort Municipality of Whistler producing a 0.3-2.4 percent decline in annual tourist spending. The $471 million in increased GDP as a result of construction activities will offset a portion of the potential drop in tourism activity in the Highway 99 corridor.

Tourism operations located along other parts of the corridor will face impacts similar to the tourism operations in Whistler, in proportion to their distance from Vancouver. The MoT will implement a Traffic Management Plan to help minimize construction related impacts on tourism in the corridor. The MoT has already committed that there will be no road closures for Project construction between November and February to accommodate the winter season at Whistler.

Working Group Review of the Application

An expanded description of the written comments submitted by the SEWG members on economic impacts is presented in the Issue Tracking Table in Appendix 1B of this Assessment Report. The Ministry of Small Business and Economic Development participated in the socio-economic working group review of the economic information presented in the Application. There were no concerns expressed about the predicted economic impacts of Project construction. The SLFN commented that although Project operations are predicted to result in $297 million in increased economic activity between 2010 and 2025, most of this activity is associated with the predicted increase in population in the corridor and it is unclear how much of this benefit might accrue to the First Nations.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not have a significant adverse economic effect.

12.8 LAND USE IMPACTS

As part of its socio-economic assessment, the MoT considered the Project in the context of existing land use plans including the Livable Region Strategic Plan (LRSP) and the Official Community Plans for West Vancouver, Lions Bay, Squamish, Whistler, Pemberton and Lilloet. Volume 3, Section A, 6 and 9 consider the impacts of Project construction and operation on land use in the corridor. The Application also reports on the requirements for Crown land from provincial parks along the current highway. Land use impacts on First Nations were reported in the AIUS and will be addressed in accordance with the *Provincial Policy for Consultation with First Nations* (October 2002).

The LRSP of the GVRD defines a growth strategy for the Lower Mainland that focuses future growth on the Burrard Peninsula, the North-East Sector, North Surrey and North Delta. Individual communities have established their own development plans in relation to the LRSP. The MoT reports that when compared to the predicted 1.1 million increase in population in the Lower Mainland between 2001 and 2025, the projected growth in population in the highway corridor as a result of the Project (10–11,000 people) will be relatively insignificant. The MoT also notes that most of the growth in the highway corridor will occur outside of the boundary of the GVRD, is not directly subject to the provisions of the LRSP and will not have a significant impact within the GVRD. The incremental traffic generated in the GVRD by the Project will amount to between 1,000 to 1,500 vehicles per day by 2025 which represents less than 1 percent of existing traffic on the First and Second Narrows bridges (19,990 – 177,000 vehicles per day).

The MoT predicts that construction activities will not have a significant impact on population growth in the corridor. The MoT also states that to date the Project has not encountered significant conflicts with existing OCPs and land use plans and that the Technical Liaison Committee (TLC) and Community Advisory Groups (CAG) are expected to deal with ongoing matters related to the integration of the Project with official community plans and land use plans.

Working Group Review of the Application

An expanded description of the written comments submitted by the working group members on land use issues is presented in the Issue Tracking Table in Appendix 1B of this Assessment Report. Working group concerns with construction impacts on land use focused on recreation sites and trails and are discussed in Section 12.5 of this Assessment Report.

The Squamish and Lil'wat Nations are concerned about the potential impact to use of their traditional territory from the population growth predicted to result from the Project. The First Nations also comment that the increased development of auto-dependent bedroom communities, where residents must drive long distances to and from work every day is inconsistent with the vision, policies, and goals of the Liveable Region Strategic Plan adopted by the GVRD and all of its member municipalities, and of the Squamish Nation's *Xay Temixw (Sacred Land) – Land Use Plan* and the *Lil'wat Cultural, Heritage, Resource, Protection Plan*. The SLFN expressed the view that indirect and induced effects of the highway on their traditional territory (particularly population growth, development, and backcountry recreation) should be included in the assessment.

The Squamish Nation also expressed concern to the working group that when current housing construction at Capilano is completed all reserve land will be utilized to capacity except that in the flood plain. Many Squamish Nation members live off reserve and many would like to return to live within Squamish Nation communities but there is no room to accommodate them. It is important to the Squamish Nation to be economically self-sufficient. The Squamish Nation is concerned that it does not have the capital to participate in increased economic activity and is therefore placed at a disadvantage. The Lil'wat Nation shares these concerns.

The EAO notes that the Squamish and Lil'wat Nations have since negotiated Accommodation Agreements-in-Principle with the Province and wrote to the EAO in March 2004 to advise that these agreements-in-principle resolve the outstanding issues of consultation and accommodation with respect to the Project.

Conclusion:

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that the Project will not have a significant adverse impact on land use.

13. NAVIGATION

No significant issues related to navigation were identified during the review of the Application. Transport Canada has advised that the Navigable Waters Protection Division would prefer that the Mamquam Blind Channel bridge be rebuilt as a clear span bridge with no reduction in overhead clearances and would like the MoT to provide any plans available for the existing Culliton Creek bridge since at the time it was built the creek was declared non-navigable. The bridges at Britannia Creek and Daisy Lake Channel have not been previously approved by the Navigable Waters Protection Division. Any changes to bridges over navigable waters will require approvals from Transport Canada.

14. EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The CEAA requires that environmental assessments include consideration of the effects of the environment on the project. In Volume 1, Section C5 of the Application the MoT assesses the potential risks to the construction, operations or maintenance of Project from the environment.

The primary risks identified by the MoT are debris flows, floods earthquakes, rock falls and snow avalanches.

Debris Flows
Information is available on the areas along the corridor with the potential for debris flows including studies by Thurber Consultants (1983) and Klohn Leonoff (1992). Between 1969 to 1991 there were 18 debris flow events resulting in a number of direct and indirect deaths as well as property damage. The direct deaths resulted from debris impacting dwellings in residential communities while deaths on Highway 99 were not the result of direct impact from debris.

North of Squamish, three creeks, Cheekye, Rubble and Miller, have a history of debris flows or debris floods. The existing Cheekye Bridge has been identified at risk should there be a repeat of the debris flow recorded in 1958. The MoT reports that the solution is to raise the grade when the structure is replaced and continue with progressive alert procedures in the interim. Debris floods on Rubble Creek pass beneath the existing structure but require maintenance to re-establish the channel depth. Miller Creek had in channel works undertaken following a debris flow several decades ago. There have not been subsequent events.

In the 1980's, protective structures and creek channelization works were constructed on Alberta, Harvey, Magnesia, Charles and Newman creeks. Further debris flow protection works of lower priority were identified in the 1983 Thurber and 1992 Klohn Leonoff reports. The most significant debris flow hazards remaining to be addressed are on Kallahne, Sclufield and Unnamed #1, #7 and #8 Creeks.

The strategy adopted by the MoT, to mitigate risk from debris flows, combines construction of barrier walls at selected locations where existing natural catchments can be effectively enhanced, with ongoing management of debris flow risk through continuation of the existing MoT progressive alert program (Ref: Volume 1, Section C - Table 5-1 of the Application). Each year between October 1 and March 31 the MoT local staff assess and monitor the increasing hazard conditions of Hwy 99 north of Horseshoe Bay. A Yellow Alert is issued when a heavy

rain warning (> 50mm in a 24-hour period) is issued by Environment Canada, when weather observations from MoT weather stations and patrol reports validate the forecast, and when creeks begin to show signs of saturation and discolouration. During a Yellow Alert, mobile patrols monitor creeks and weather conditions and provide hourly reports. A Red Alert is issued when the heavy rainfall warning continues, when observed heavy rainfall is occurring and when creeks are saturated with varying degrees of discolouration. During a Red Alert the highway is closed to all traffic.

Floods

The MoT's Highway Engineering Design Manual, Supplement to TAC Geometric Design Guide dated February 2001 describes the design measures used to manage the risk to the alignment from floods including:

- designing bridge hydraulics to the 200-year return period peak flow;
- designing culvert hydraulics to the 100-year peak flow return period or, where damage due to a major flood would be critical to the 200-year return period; and
- criteria for the construction of embankments such as stream and ditch banks, bridge end fill slopes, and culvert inlets and outlets.

Earthquakes

The MoT's standard regarding seismic design is described in the memorandum issued by the MoT's Bridge Engineering Branch in June of 2000, titled "Revised Seismic Design Requirements for New Bridges in British Columbia". Structures are also designed to meet the Canadian Highway Bridge Design Code CAN/CSA-S6-00. Retaining wall design considers seismic induced loading, and retaining walls are also generally designed to CAN/CSA-S6-00 requirements. For design cases not specifically covered by these criteria, design will be in accordance with Project-specific design requirements developed in consultation with the MoT. The MoT will design and construct new bridges, overpasses and other structures to prevailing standards to provide post-seismic serviceability in the event of a 1 in 475 year return seismic event. Where existing structures are modified, the appropriate level of seismic upgrade will be incorporated.

Rockfalls and Slope Failures

Widening along the existing grade, as is anticipated from Sunset Beach to Lion's Bay and possibly Lion's Bay to Minaty Bay, will present the challenge of either extensive, high rock cut excavation to the east or construction of side hill embankment fills, retaining walls and pile supported structures on the west side.

Rock fall catchments for many of the existing cuts is minimal and substantially less than current design practice would recommend. A program of rock slope stabilization has been ongoing over the past 30 years to address rock fall/slide problems and has resulted in a significant improvement in the stability of the existing rock cuts.

The MoT's Technical Bulletin GM02001 sets out the standards to be used for new rock cuts for the Project. Project work will address rock fall issues from Sunset Beach to Lion's Bay. If the BC Rail line is used as a third traffic lane for the 2010 Olympics, the MoT notes that some additional rock slope stabilization could be required.

The risk of slope failure may exist with highway cut and fill slopes. The Application describes the primary causes of slope failure and the measures used to mitigate the risk. Particular care is required during highway construction to protect both the traveling public and workers from the

associated risks of slope failures. The risks are most prevalent during construction because slopes may be temporarily steeper than their natural angles of repose and are more susceptible to erosion due to their non-vegetated states during construction. These risks are alleviated by temporary shoring of slopes, using techniques such as soil anchoring, shotcrete, mesh, temporary retaining walls and other methods. They are used on a site-specific basis. The Workers Compensation Board (WCB) requirements deal with construction site slope stability issues and when their requirements cannot be met (i.e. due to spatial restrictions), the contractor is required to develop engineered solutions to ensure that safety standards are met.

The MoT concludes that the rock stabilization program and improved design standards for new rock cuts will mean a reduction in current levels of rockfall on the highway once the Project is completed. Slope failure hazards will be managed through accepted engineering practices, compliance with WCB regulations and continued standard highway maintenance procedures.

Snow Avalanches

The MoT conducted an assessment of the risk to the Project from snow avalanches in accordance with the Canadian standards for avalanche mapping, as outlined in the "Guidelines for Snow Avalanche Risk Determination and Mapping in Canada" and the "Land Managers Guide to Snow Avalanche Hazards in Canada", both prepared by the Canadian Avalanche Association and in 2002. These documents define the typical thresholds to initiate action for highway corridors as avalanches with a size Class > 2 and a return period of 30 years or less. Size 2 avalanches are large enough to bury, injure or kill a person while those greater than Size 2 have (as a minimum) the potential to bury a car, destroy a small building or break a few trees. In its investigation, the MoT identified no significant avalanche hazards along the existing Highway 99 corridor between Horseshoe Bay and Function Junction. Several large avalanche paths are located above the highway on the east side of the corridor south of Squamish. Avalanches in these paths typically stop well above the existing alignment. Sloughing has been recorded from some of the steep cut slopes along the highway, and will be expected to continue in the future. Expansion of the existing highway and addition of new lanes in the split grade alternative areas may create additional areas prone to sloughing. The MoT predicts it can mitigate this operational concern by designing sufficiently large ditches to minimize sloughing of snow onto the highway in these areas or enlarging existing ditch catchments by increasing the height of the road shoulder.

Rubble Creek Land Hazard (RCLH) (formerly known as the Garibaldi Civil Defense Zone)

North of Cheakamus Canyon, the existing highway traverses the RCLH – a zone of elevated natural hazards relating to the geological history of the area. The RCLH extends from approximately the northern end of Cheakamus Canyon to the Pinecrest Estates near Daisy Lake. The Provincial Government created the RCLH by Order in Council in 1981 in response to the risk of reoccurrence of a large landslide (30-36 million m^3) that initiated in 1855 from the Barrier, a 200 metre high cliff composed of rubbly volcanic rock at the head of Rubble Creek. The runout from the landslide and subsequent related debris reached the Cheakamus River Valley and produced the Rubble Creek Fan.

In 2002 and 2003, Golder Associates Ltd. produced a memo for the Project outlining the hazards and risks in the area and a report evaluating the risk to highway users through the RCLH. The report concluded that there are; risks of reoccurrence of a rockslide from the Barrier reaching Highway 99; of wave runup from such a slide entering the Daisy Lake Reservoir; and of independently occurring debris flows.

Based in part on previous work carried out by others, Golder estimates that:

- the annual probability of death for highway users on a daily basis due to such landslide hazards is very low in comparison to other individual risks;
- the annual probability of death for a highway worker due to such landslide hazards is the same as other worker risks and individual worker risk criteria; and
- the societal (collective) risk due to such landslide hazards is low and in compliance with typical societal risk criteria.

The MoT concludes that the probabilities of death on the highway through the RCLH resulting from the RCLH natural hazards are comparable to the probabilities of death resulting from other events which regularly befall travelers and workers.

Review of the Application

An expanded description of the written comments submitted by the BTWG members on the potential effects of the environment issues is included in the Issue Tracking Table in Appendix 1A of this Assessment Report. During the issue scoping stage of the Project, the potential impact of hazards on the Project was identified by the Proponent. Terms of reference for a hazard assessment were prepared as part of the overall geotechnical assessment for the Project. The BTWG reviewed the MoT's assessment of the potential effects of the environment on the Project. The MoT representative to the BTWG was the primary technical reviewer on the issue.

The MoT's designated reviewer commented that the Application, while discussing the potential impacts of flows did not include details of the proposed barrier walls at Disbrow, Sclufield or Kallahne creeks and also recommended that the MoT review the debris flow sites identified by the 1983 Thurber report on a site by site basis for risk and select mitigative measures based on the assessed risk.

The MoT provided a written response and subsequently provided a design drawing on the barrier wall design and clarified that the sites identified in the Thurber study were last investigated as part of the Klohn Leonoff study of 1991. The MoT decisions for the current Project consider both the Thurber and Klohn Leonoff studies along with additional assessment undertaken for the proponent on Disbrow Creek.

The MoT also clarified that Kallahne sites #7 and #8 are in the section of highway (south of Porteau Cove) that will not be widened as part of the current Project and that MoT will assess these sites when designs for four lanes are prepared sometime in the future.

The MoT reported that while the probability of occurrence of a debris flow on Unnamed Creek #1 is indicated as high, there is no recorded history of an event and the design traffic volume is predicted to be low in comparison with creeks such as Harvey, Magnesia and Charles. There is no inexpensive option to improve catchment for Unnamed Creek #1 and the MoT estimates that mitigation at this site would cost $350,000 to $1.8 million.

Environment Canada commented that a 1 in 200 year flood event could inundate the highway in the area of Britannia Beach and noted that the Application does not include measures to address this problem. In response the MoT clarified that a flood mitigation study is underway for Britannia town site under direction of the SLRD with an independent consultant. The MoT will have access to the results of this study. On behalf of MoT, Intercad has undertaken an analysis of the Britannia Creek Bridge in their preliminary design report and commented on the hydraulic capacity of the existing structure and the proposed temporary up-stream bridge.

The Squamish and Lil'wat Nations and the MoT reviewer commented on the potential for increased risk of avalanche or debris flows from logging at elevations above the road. In discussion at the BTWG meeting of December 4, 2003 the MoF clarified that there is limited timber harvesting above the alignment and these operations are subject to MoF policies and the *Forest Practices Code of British Columbia Act* which requires a company to complete a terrain stability assessment before the final decision is made on whether to proceed to log within an area.[6] This measure is designed to minimize the risk of debris flows or avalanches resulting from logging activities.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied with the MoT's assessment of, and measures to address, the potential effects of the environment on the Project.

15. ACCIDENTS AND MALFUNCTIONS

Volume 2, Section B5 of the Application provides an assessment of the potential for accidents and malfunctions during Project construction and operation. Spills are the main environmental risk from an accident either during Project construction or operations.

The MoT's *Standard Specifications for Highway Construction*, Section 165, "Protection of the Environment" (Volume 1 Appendices), establish contractor responsibilities for environmental protection during construction and will be supplemented by Special Provisions that describe local conditions and special requirements. These may include lists of Designated Streams and Designated Environmentally Sensitive Areas, specific in-stream work windows, specific contacts and other Project or site-specific information.

The proponent recognizes that the highway crosses important fish-bearing waters and sensitive areas and understands that safeguards must be implemented to protect these systems from spills. The *Standard Specifications for Highway Construction* specifies contractual requirements for the transport, servicing and operation of equipment. In addition to these requirements, the Contractor will develop contingency plans describing alternative or back-up plans in the event of a spill, environmental emergency or failure of any of the protective measures. The Contractor will be required to prepare contingency plans for the clean-up of toxic or hazardous spills prior to construction and submit it, together with a list of spill abatement equipment, to be stored on the job site, to the MoT representative for review.

The MoT reports that the Contractor must immediately report any spill of any toxic or hazardous material verbally to the Ministry representative and the Provincial Emergency Program. The

[6] The *Forest and Range Practices Act* was brought into force January 31, 2004 to replace the *Forest Practices Code of British Columbia Act*. The new legislation includes a results-based focus that includes strengthening the role of resource professionals in the development and delivery of credible and workable resource management strategies.

Contractor must immediately take the necessary steps to abate the discharge and provide the necessary labour, equipment, materials and absorbents to contain and remove the spill, clean-up the affected area, dispose of waste materials at an approved disposal site, and restore the area to the satisfaction of the environmental regulatory agencies, at the Contractor's expense.

The Contractor must store onsite and use suitable equipment and materials for the mitigation of concrete spills into or in areas adjacent to watercourses.

Operations

During Project operations, the Application notes that the main parties involved with environmental response to fuel spills, floods, debris flows or other natural or man-made events during the operations phase are:

1. Road and bridge maintenance contractor;
2. Ministry of Transportation;
3. Ministry of Water, Land and Air Protection;
4. Provincial Emergency Program (PEP; and
5. Hazardous Materials Contractors (HAZMAT).

Procedures exist for dealing with fuel spills or dangerous goods spills as described in the Ministry's *Emergency Response Plan* book. The road and bridge maintenance contractor is responsible for initial response of any event that occurs on the highway. Small fuel spills contained to the highway pavement are routinely cleaned up by the contractor and reported to MoT. The maintenance contractor also provides initial response to any and all larger spill events. When the spill is >200 litres or has migrated off the highway right-of-way, MoT is contacted, as is WLAP, who then assume control of the situation, may continue to utilize the maintenance contractor's resources and may also utilize HAZMAT contractors. PEP may become involved if the magnitude or intensity of the event is of a size that triggers their involvement.

Potential Accidents and Malfunctions in the Tunnel

The Application states that an operations and incident response plan will be developed for the tunnel and approaches at detailed design modelled on those for the Cassiar and George Massey Tunnels. Procedures will be in place to respond to events such as fire or an accident or dangerous goods spill. The MoT reports that generally the risk of environmental impact due to dangerous goods spills are less severe in a tunnel situation, because tunnel drainage is enclosed. This provides an opportunity to isolate the contaminants before they enter the natural environment.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied with the MoT's assessment of, and measures to address, the potential effects of any accidents or malfunctions.

16. CUMULATIVE ENVIRONMENTAL EFFECTS

Background

CEAA requires that every screening include consideration of the environmental effects of any cumulative environmental effects and the significance of any cumulative environmental effects. A cumulative effects assessment must consider any residual impacts resulting from the *environmental* effects of the project after mitigation measures are applied. If these residual environmental effects lead to other effects (socio-economic, health, archaeological) those effects must also be considered in the cumulative effects assessment.

CEAA defines an environmental effect in respect of a project as any change that the project may cause in the environment, including any effect of any such change on health and socio-economic conditions, on physical and cultural heritage, on the current use of lands and resources for traditional purposes by aboriginal persons, or on any structure, site or thing that is of historical, archaeological, palaeontological or architectural significance; and any change to the project that may be caused by the environment.

When the MoT filed its Application in July 2004, it reported that the Project would not result in residual adverse environmental effects to Valued Ecosystem Components after mitigation and compensation were applied and therefore would not have any cumulative effects. Federal Responsible Authorities and other members of the working groups were of the opinion that the Project would have residual adverse environmental effects that should be assessed for their cumulative impact in combination with other existing or imminent projects in the Sea-to-Sky corridor.

The MoT subsequently worked with the RAs to develop a mutually acceptable workplan for the cumulative effects assessment, completed the cumulative effects assessment in December 2003 and submitted a final report in February 2004.

Options B and D in West Vancouver were developed after the MoT filed its cumulative effects assessment. On May 10, 2004 the MoT provided federal RAs with an addendum to the cumulative effects assessment consisting of additional information on cumulative effects included in the *Sea-to-Sky Highway Improvement Project Clarification Report – Horseshoe Bay to Sunset Beach* (April 2004). The MoT examined whether these options have potential for any cumulative environmental effects not previously studied and reported.[7] The MoT concluded that the two options do not measurably change Project impacts on acid rock drainage/metal leachate, birds, air quality and stormwater/water quality. Table 9 summarizes the potential impacts and cumulative effects of Options B and D on common vegetation.

[7] The two options proposed in Lions Bay did not require further assessment for cumulative impacts because there is no change to Project impacts on Valued Ecosystem Components along this section of the alignment.

Table 9 – Potential Impacts on Common Vegetation and Predicted Cumulative Effect.

	Horseshoe Bay to Sunset Beach Clearing (ha)	STS Common Vegetation Loss (ha)	Cumulative Common Vegetation Loss (ha)	Cumulative loss as % of Squamish Forest District (%)
Option B	13.5	111.3	32,573.3	3.05
Option D	10.1	107.9	32,569.9	3.05

The MoT concludes that the Project does not present a likelihood of significant cumulative adverse environmental effects.

Working Group Review of the Application and Cumulative Effects Assessment

An expanded description of the written comments submitted by the working group members on cumulative effects is presented in the Issue Tracking Table in Appendix 1B of this Assessment Report. The SLFN are concerned that the cumulative effects assessment did not examine the indirect and induced impacts resulting from the Highway 99 upgrade. This concern was particularly related to the effects of population growth and associated development on the First Nations territory and their ability to use their land and water for traditional and contemporary purposes. The SLFN are of the opinion that the cumulative effects assessment for the Project is incomplete because it does not consider:

- socio-economic impacts of induced growth, attendant development and its impacts on First Nations;
- the full scope of all existing development in the Sea-to-Sky corridor including the existing highway; and
- water quality impacts of increased vehicle use of the highway in combination with the hydrocarbon burden on aquatic systems from existing and future development in the corridor.

The Canadian Environmental Assessment Agency, on behalf of the RAs responded to the SLFN concern and advised that CEAA does not require assessment of induced growth unless the type of projects, the area of impact and the environmental components that would be affected could reasonably be identified and are likely to interact with the Project. For water quality issues, the MoT has confirmed that while oil and grease will increase as a result of the Project, the increases will be well below standard guidelines for water quality for drinking water and aquatic life. Based on this additional information, EC and DFO accepted exclusion of oil and grease from the cumulative effects assessment.

In the West Vancouver Clarification Report, the MoT considered five ecosystem components (acid rock drainage/metal leachate, birds, air quality, stormwater/water quality, and loss of common vegetation) when assessing the potential for either Option B or Option D to result in cumulative environmental effects. The MoT's findings are that the conclusions in its original cumulative effects assessment report of February 2004 remain valid.

The Canadian Environmental Assessment Agency requested the MoT to consolidate the analysis of the potential cumulative environmental effects of Option B and Option D into an addendum to the original cumulative assessment. The MoT provided the addendum to the RAs on May 10, 2004.

Conclusion

DFO and have reviewed the cumulative effects assessment completed by the MoT, including the addendum. Based on this information and provided the MoT implements the actions described in the Owner's Commitments and Responsibilities - Sea-to-Sky Highway Improvement Project, the DFO and EC are satisfied that there will be no significant cumulative environmental effects from the Project.

17. SIGNIFICANCE OF RESIDUAL ENVIRONMENTAL EFFECTS

DFO, EC, TC and INAC, responsible authorities as defined in the *Canadian Environmental Assessment Act*, have completed their review of the environmental impacts involved in the proposed construction and operation of the Project and have considered the Application; Clarification Reports; government, and First Nation comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups.

All relevant factors required by Section 16 (1) of CEAA were considered including the environmental effects of the Project and their significance. DFO, EC, TC and INAC conclude that the project is not likely to cause significant adverse environmental effects.

18. ENVIRONMENTAL MANAGEMENT PLANNING

The EAO and federal RAs require a proponent to outline a proposed Environmental Management Plan (EMP) as part of the environmental assessment process. Volume 5, Section A of the Application sets out the measures that the MoT proposes as part of its environmental management strategy for Project construction and operation.

The MoT will develop a comprehensive EMP prior to the start of construction, in accordance with Section 165 of the Ministry's *Standard Specifications for Highway Construction*, to convey an understanding of the project's environmental constraints (including construction timing) and how the Project will be undertaken to avoid/mitigate negative impacts. The MoT will submit components of the EMP to government agencies and First Nations for review and comment or acceptance (where required). The EMP will include:

- Air Quality Monitoring and Mitigation Plan
- Archaeology Management Plan
- Raptor/Heron Management Plan
- Bear/Human Conflict Reduction Plan
- Construction Schedule pertaining to permits and approvals, environmental tasks, environmental timing windows and work restrictions
- Contaminated Soils Management Plan
- Environmental Quality Management Plan
- Environmentally Sensitive Areas Management and Protection Plan

- Environmental Training Plan
- Equipment and Materials Plan
- Fisheries Mitigation/Compensation Plan
- Infrastructure Demolition Management Plan
- Materials Management Plan
- Noise Control and Mitigation Plan
- Potentially Acid Generating/Metal Leaching Materials and Acid Rock Drainage Adaptive Management Plan
- Riparian Restoration and Terrestrial Reclamation/Revegetation Plan
- Sensitive Ecosystem Management Plan
- Sediment and Drainage Management Plan
- Soil Conservation/ Stripped Organic Material Plan
- Spill Contingency and Response Plan
- Stripped Organic Material Management Plan
- Tailed Frog Management Plan
- Vegetation Debris Management Plan
- Waste Management Plan
- Water Quality Sampling Program
- Wildlife Mitigation Plan.

Working Group Review of the Application

An expanded description of the written comments submitted by working group members on environmental management planning is presented in the Issue Tracking Table in Appendix 1A of this Assessment Report. Working group comments focused primarily on planning to manage PAG/ML materials, water quality and air quality. WLAP, EC, TWFN and MEM provided suggestions for the Water Quality Monitoring Program. WLAP also wishes to review the a Vegetative Debris Disposal and Monitoring Plan and the Air Quality Monitoring and Mitigation Action Plan before they are finalized and prior to the start of Project construction. The SLFN stressed that the plans should include information on mitigation techniques, environmental inspector's roles and responsibilities and instructions to highway construction contractors to demonstrate how environmental protection measures will be applied during all phases of the Project (i.e. planning, construction, restoration and operation).

The MoT has committed to share copies of the EMP or relevant sections of the EMP with agencies and First Nations for review and comment, post-environmental assessment and prior to the start of construction.

19. FOLLOW-UP AND MONITORING

In the *Owner's Commitments and Responsibilities - Sea-to-Sky Highway Improvement Project* the MoT commits to develop an Environmental Management Plan prior to construction start-up, in accordance with or equivalent to the provisions of Section 165 of MoT's *Standard Specifications for Highway Construction*, to convey an understanding of the project's environmental constraints (including construction timing) and how the Project will be undertaken to avoid/mitigate negative impacts. As noted in Section 18 of this Assessment Report, the MoT will submit the component plans and/or the Environmental Management Plan to the appropriate environmental agencies for review and comment or, where required, for review and acceptance, before work commences. The MoT will require the Contractor to retain an environmental monitor to work on-site during all phases of highway construction. The monitor will work with the Contractor to ensure the protection of the environment, that mitigation measures are

appropriately implemented and to facilitate communication between the Contractor, environmental agencies, and MoT. The MoT further commits to undertake environmental quality audits to ensure the Contractor complies with the Environmental Management Plan.

Conclusion

During this cooperative environmental assessment the EAO, DFO and EC have considered: the Application; Clarification Reports; government, First Nation and public comments on the potential effects of the Project; responses from the MoT; and the discussions of the Biophysical/Technical and Socio-Economic Working Groups. Based on this information and provided that the MoT implements the actions described in the *Owner's Commitments and Responsibilities: Sea-to-Sky Highway Improvement Project*, the EAO, DFO and EC are satisfied that plans and timeframes for Project and post-Project monitoring will be satisfactorily developed as part of the Environmental Management Plan, and implemented.

20. PERMITS, LICENCES AND AUTHORIZATIONS

This is provided only for information purposes and is not a comprehensive list of all permits, licenses or authorizations that may be required for the Project.

Provincial

Fish Protection Act
Forest Act
Heritage Conversation Act
Highway Act
Land Act
Water Act
Waste Management Act

Federal

Fisheries Act
Navigable Waters Protection Act
Canadian Environmental Protection Act
Indian Act

First Nations

Squamish Nation Archaeological Permit