

8.0 ENVIRONMENTAL ASSESSMENT

This section describes the potential interactions, issues and concerns of project activities on the valued components. Planned appropriate mitigation measures are identified and an assessment of the potential residual environmental effects (after mitigation is applied), including cumulative environmental effects is provided. A detailed screening of the potential environmental effects and the associated Audit Record is provided in Appendix A.

8.1 Effects Assessment

8.1.1 Water Quality

8.1.1.1 Potential Interactions, Issues and Concerns

The Project may have an adverse effect on water quality in Cypress Provincial Park due to:

- the potential for sediment inputs from the construction and operation of the venue facilities; and
- from the pollutant loads in drainage run-off originating from the site during construction and operation.

Project construction related activities could adversely affect water quality. Soil erosion from construction sources and subsequent deposition of substrates and entrainment of fines sediments into the streambed may affect water quality through increased turbidity. As well, benthic vertebrate production may be adversely affected by turbidity-related reduction in algae, benthic and aquatic insect production. Concentration and duration of exposure are key variables of turbidity-related in-stream impacts as these factors affect fish behaviour and survival.

Specific activities that can disturb soils and subsequently increase erosion potential include: clearing, grubbing, excavation and grading of the Freestyle and Snowboard facilities and the water reservoir site. Accidents, equipment malfunctions and unplanned events that could possibly occur during the Project include a hazardous materials spill, which can also adversely affect water quality. Based on the level of risk, these effects have been rated as **Moderate**.

There are no water courses or drainages in the area to be cleared for the Freestyle facilities, however depending on weather conditions at the time of construction sediment could be washed downhill and into Cypress Creek. There are existing drainages along the edges of the Fork and Panorama runs where the Snowboard



facilities are to be constructed. These areas will be regraded plus there will be some earth work involved in the construction of the halfpipe. These activities may cause sediments to enter drainages along the existing ski runs that drain into Cypress Creek.

The construction of the snow making reservoir and the preparation of the Reservoir Pump house area may also cause sediment to enter water courses. There are several small drainages around the proposed reservoir location that drain into Montizambert Creek. These drainages do not flow into the Yew Lake wetland and this Lake wetland will not be used to filter out project related sediments. An approved sediment and erosion control plan will be in place, however; based on the level of risk, these effects have been rated as **Moderate**.

The construction activities associated with the installation of the Creek Pump House in Cypress Creek have the potential to cause sediment input into Cypress Creek. The location for the Creek Pump House is at the south end of the large culvert, near the present Day Lodge, which has been previously disturbed from the initial installation of the culvert. An area approximately 6 m by 4 m will be disturbed at this location. The riparian vegetation present is comprised of grasses and small shrubs that do not provide shade. This effect has been rated as **Moderate**.

During the operation phase and post-Games use of the snow making system, the discharge of snowmelt/stormwater run-off has the potential affect water quality due to the potential for higher than normal volume flows in the spring and the increased risk of sediment inputs into watercourses. Based on the level of risk, these effects have been rated as **Moderate**.

An increase in the post-Games use of park trails may cause erosion, sediment inputs into watercourses and wetlands that drain into watercourses affecting water quality downstream. There is a risk of inputs of sand and salt to watercourses due to the sanding and/or salting of the access highway. However, this is an existing effect and is not expected to increase in duration, magnitude or extent during legacy operations.

Accidents, Malfunctions and Unplanned Events

Known hazardous materials that will be used during the construction, operation and decommissioning phases of the Project include fuels, lubricants, and solvents. There is a possibility that these materials could be accidentally introduced into surface water if a spill occurs. The accidental introduction of hazardous materials into a watercourse would temporarily degrade water quality and have subsequent environmental effects on freshwater fish and fish habitat. A Spill Contingency Plan will be prepared as part of the Environmental Management Plan to ensure that any



effects to water quality from accidental events are restored to meet regulatory criteria (e.g., CCME guidelines) within one year.

8.1.1.2 Mitigation

Part of the Environmental Management Plan for the Project will include a detailed Sediment and Erosion Control plan that will be prepared in conjunction with Department of Fisheries and Oceans. This plan will be designed to minimize sediment input into local watercourses to ensure water quality standards are not exceeded. Other mitigation measures to reduce the effects in water quality include:

- Earth works involved in the clearing and grading of the areas for site development will be completed during dry-periods. A qualified environmental monitor will oversee all activities near water courses and will have the ability to stop work if required.
- The Yew Lake wetland will not be used to filter out project related sediments from the water column.
- The Creek Pump House will be sited at a disturbed area so that extensive riparian habitat is not affected.
- During dormant snowmaking periods the Creek Pump House sump should be completely covered, if possible, so that water can bypass the sump and flow naturally in the stream channel.
- Road salt will not be used during the clearing of snow from the Cypress Bowl Road and parking areas.
- Mitigation measures that would effectively improve water quality and positively affect fish populations involve improving drainage patterns on the Baden-Powell Trail, ensuring that the rerouted trail is directed away from springs, wetlands and sensitive areas.
- VANOC will monitor for water quality during construction, operations and decommissioning, and collect baseline water quality information before construction.
- VANOC will also assess the potential for ARD related to the project site development and develop a management plan prior to construction to include provisions to protect the water quality from being impacted from ARD associated with the project's development.



8.1.1.3 Determination of Significance

The significance of the effects of sedimentation on the water quality of Cypress and Montizambert Creeks is considered to be **Low** after the implementation of sediment and erosion control measures. The significance of the disturbance of the creek bed of Cypress Creek from the installation of the creek pump-house is considered to be **High** on water quality prior to mitigation by increasing the sediment load and changing the natural bed load dynamics. However, with careful, design of the Creek Pump House and with the implementation of the sediment and erosion control plan this significance can be reduced to **Low**.

Mitigation of the risk if deleterious substances entering streams is important and subject to provincial and federal regulations, including the *Fisheries Act*. By implementing the EMP the significance of toxic substances entering the watercourse can be reduced to **Low**.

Environmental Monitors will be present during construction activities that occur near water course and during heavy rain events to ensure sedimentation is not an issue. With the implementation of the mitigation measures and the ongoing monitoring the effects to water quality are considered to be not significant.

8.1.2 Water Quantity

8.1.2.1 Potential Interactions, Issues and Concerns

The proposed Project will result in the diversion of water from Cypress Creek plus the potential for increased volumes of snow on Black Mountain and a subsequent increase in runoff during the spring melt. There is the potential to lead to downstream erosion and flooding with the Cypress Creek watershed.

Pumping of water from Cypress Creek for snowmaking during and after the Games has been rated as having a **Moderate** affect on water quantity. Discharge of snowmelt/stormwater run-off has the potential to **Moderately** affect water quantity due to the potential for higher than normal volume flows in the spring.

The decrease in winter water volumes due to Olympic snow making activities will decrease the amount of water flowing in Cypress Creek during the Games period. According to the preliminary Environmental Assessment (ENKON 2002) a minimum of 30% of mean annual discharge must be maintained at all times. This will be achieved by limiting the water withdrawal to 30 L/s. Water will be withdrawn during the high flow season. During the remaining months the design of the Creek Pump House will ensure that water continues to flow through Cypress Creek. The mean annual discharge of Cypress Creek should remain relatively unchanged because



water from Cypress Creek is being used for snowmaking and meltwater will be directed back into Cypress Creek.

Increased snowmelt discharge and stormwater run-off due to snowmaking would reduce the likelihood of a low snow year and associated low snowmelt runoff. It would have a minimal effect on an average to above-average snowfall year. The intent of snowmaking is to ensure a snowbase of 100 cm to 140 cm for the 2010 Games. Based on a four-year average, the CRA has had an average of 171 cm snowbase during the February 5-21 period for the Games. If snowmaking is necessary for snowbase preparation for the Games, the increased snowbase from below average snowfall conditions may increase water quantity during an early summer low flow period. The improved water quality and quantity conditions would also benefit downstream fish populations by improving water quality parameters and prevent the death of fish fry during low flow by maintaining minimum summer flow.

The disruption of natural drainage patterns is rated as a **Low** effect on water quantity since most of the construction activities will occur away from drainages and watercourses. Construction of the Creek Pump House will occur during periods of low flow so that downstream effect to water quantity will be minimized. It is expected that water parameters would return to normal within one year after construction.

VANOC will ensure minimum base flows are maintained in Cypress Creek, and VANOC will continue to monitor for water quality during construction, operations and decommissioning, and collect baseline water quality information before construction.

Accidents, Malfunctions and Unplanned Events

A forest fire within the park would require local water sources to be utilized and may potential effect water quantity in the park. Water used for combating forest fires would not significantly affect the quality or quantity of water in Montizambert and Cypress Creek. Most, if not all of the water used in combating fires would be absorbed into the dry soil, only a very small amount may find its way to watercourses. The water that is contained within the reservoir can also be utilized for combating forest fires so that water from creeks may not be required.

8.1.2.2 Mitigation

The following mitigation measure will be in place to ensure effects to water quantity are minimized.



- Water will be pumped for Cypress Creek during period of high flow (e.g., November and December).
- The minimum of 30% of mean annual discharge during water uptake periods will be maintained through a low flow release structure at the Creek Pump House.
- Construction of the Creek Pump House will occur during periods of low flow.

8.1.2.3 Determination of Significance

The snowmaking regime may create higher peak flows during the freshet of 2010 which may slightly increase the potential for channel erosion in Cypress Creek and sediment input to the creek. However, the water volume from the snowmelt is not expected to be higher than an average or slightly above average year because the required snowbase for the Games can be achieved with an average February snowbase at Cypress, based on Environment Canada weather data. To prepare for the Games the 1992-1999 average snowbase of 171 cm will be sufficient for competition snow conditions. If this is true, the spring snowmelt water volume would not be higher than an average spring and will certainly not be higher than the natural snowmelt during the 1999 high snowfall year. Based on this assumption, the snowmelt after the Games should not produce higher than average higher peak water flow, and cause erosion problems beyond the extent to which Cypress Creek is already subject. Furthermore by ensuring that minimum winter season flows are maintained and a minimum of 30% of mean annual discharge is maintained at all times the significance of this effect on water quantity can be considered **Low**, and not significant.

8.1.3 Fish Resources

8.1.3.1 Potential Interactions, Issues and Concerns

The potential effects from sediment input from construction activities may affect fish and fish habitat downstream of the Project area. Alteration of physical instream habitat and riparian vegetation could occur during construction of the Creek Pump House and the water reservoir. Due to potentially poor water quality from land clearing and excavation for the snowmaking reservoir and the installation of the Creek Pump House benthic invertebrate production may decrease due to an increase in fine materials settling on the creek bed, which would affect food and nutrient level for downstream fish and coastal-tailed frogs. These effects are considered **Moderate**; although, dilution of turbid water and settling out of sediment



would tend to minimize any downstream effects of turbidity on fish-bearing sections of Cypress Creek.

Discharge of snowmelt/stormwater run-off has the potential to affect downstream fish populations due to the potential for higher than normal volume flows in the spring and the increased risk of sediment inputs into watercourses. However, effects to fish populations are considered to be **Low** since the nearest confirmed fish population within Cypress Creek is outside the Assessment Area (FISS 2005). There is a barrier to fish migration in Cypress Creek approximately 360 meters upstream of Highway 1 that is well below the venue site.

Accidents, Malfunctions and Unplanned Events

The significance of the effect on downstream fish populations from the transportation of deleterious substances is considered to be **Low** because less than 1% of downstream fish resources are expected to be affected. Fish occurrence has only been recorded outside the Assessment Area and if deleterious substances were accidentally added to watercourses, downstream fish resources would likely not be affected due to the dilution effect of water.

8.1.3.2 Mitigation

The sediment and erosion control plan will decrease the risk of affecting benthic invertebrates and downstream fish and will be implemented to ensure that the *Fisheries Act* is not violated. Other specific mitigation measures to reduce impacts to fish resources include:

- Limiting work to the fisheries work window for the Vancouver region (August 15 to September 15) unless certain conditions exist at time of construction.
- Installing and maintaining appropriate erosion control measures, such as siltation fencing, temporary diversion berms, and sandbag, rock or straw bales, as determined by a qualified environmental monitor.
- Monitoring sediment control measures during construction and following major storm events.

8.1.3.3 Determination of Significance

The significance of these effects on fish populations are considered to be **Low** because sections of creeks that may be affected by construction are non-fish-bearing and fish populations are a significant distance downstream.

The significance of the disturbance of the creek bed of Cypress Creek from the installation of the Creek Pump House is considered to be **High** on downstream fish



populations prior to mitigation by increasing the sediment load and changing the natural bed load dynamics. However, with careful, design of the Creek Pump House and with the implementation of the sediment and erosion control plan this significance can be reduced to **Low**. As a result effects to fish and fish habitat are considered not significant.

8.1.4 Vegetation

8.1.4.1 Potential Interactions, Issues and Concerns

Potential effects to vegetation include the alteration and loss of vegetation species from the clearing of venue sites. Vegetation cleared for the Freestyle facilities will consist of 0.06 ha of old-growth forest, 1.22 ha of second-growth forest and 0.35 ha of shrub and brush. However, effects to old growth may be reduced through further design details. As the disturbance is confined locally, with duration for recovery greater than 10 years and a low magnitude, this activity has been rated as **Moderate**. No new clearing will be conducted for the Snowboard facilities and vegetation that is to be removed there is limited to shrubs and grasses.

The parking lot cliff where the Freestyle facilities are to be constructed is a locally unique site that may provide habitat for rare plants that require rocky, dry conditions (i.e. alpine anemone, cliff paintbrush, lace fern and smooth douglasia). This habitat would be permanently lost due to the blasting however, only a small portion of this habitat within the Assessment Area will be lost. As a result, the effect is expected to be **Low**.

The effect of land clearing and excavation for the water reservoir on vegetation is expected to have a **Moderate** effect. This effect is primarily due to the permanent nature of the structure and the presence of a unique ecosystem that currently exists on the site and adjacent to the site (i.e., Yew Lake old-growth stand). Although the reservoir site is an abandoned gravel pit where early succession shrubs and plants are becoming established, it has formed a somewhat unique, wetland habitat. The Vancouver Natural History Society has suggested that locally, unique plants have established themselves at the gravel borrow pit. These species are not considered at risk by provincial and federal regulations and are only considered unique because they are not normally seen in subalpine areas, but are common at lower elevations.

Clearing for the re-routed Baden-Powell trail is rated as a potentially **Moderate** effect on vegetation due to the permanence of the disturbance, despite the small scale of the clearing necessary for the proposed trail. Furthermore the rerouted trail will pass in close proximity to subalpine wetlands that may support rare or uncommon species of plants.



Vegetation clearing during construction can expose soil which will allow space for opportunistic species to colonize. Non-native invasive plant species threaten biological diversity as well as negatively affect native species by outcompeting or hybridizing with native species, or by altering ecological communities or ecosystem processes. Non-native species have already become established in areas of the park such as the old gravel borrow pit. This area will be revegetated with native plants and will be monitored to ensure that the native species become established. Furthermore weed management measures are incorporated into the EMP, therefore the introduction of non-native invasive species is rated as a **Low** effect.

The use of salt and/or sand for road and parking lot maintenance is a presently occurring effect at Cypress Mountain. If there is an increase in sand/salt use the increase would be incremental, thus the effect is expected to be **Low**.

Accidents, Malfunctions and Unplanned Events

Unexpected effects could occur if there should be a forest fire or spill of hazardous materials. Depending on the severity, there may be a loss or alteration of habitat that could affect plant species or sections of communities. Depending on the time of year, and extent of a forest fire or the release of hazardous materials, the effect to habitat loss and alteration could be **High**. To minimize the possibility of an accidental hazardous materials spill or forest fire affecting vegetation, environmental protection plans and contingency plans for spills and fires will be put in place.

8.1.4.2 Mitigation

In order to reduce the effects to vegetation the following mitigation measures will be applied:

- The clearing of vegetation will be confined to the smallest area possible.
- The area around the reservoir will be revegetated with natural plant species.
- Final venue plans will be designed so that the removal of old growth trees is not required. If any old growth trees need to be removed they will be addressed on a tree by tree basis through discussions with BC Parks, CBRL and stakeholders.
- The Baden-Powell re-route alignment will avoid sensitive areas such as subapline wetlands.
- Staging and temporary storage of equipment will be in previously disturbed areas.
- VANOC will encourage the Ministry of Transportation to avoid using salt on roads thereby minimizing the affect on vegetation adjacent to roadways.



8.1.4.3 Determination of Significance

The significance of the vegetation clearing is considered **Low** since a relatively small area of vegetation (2.6 ha) will be cleared and these areas have already been previously disturbed. Furthermore, vegetation clearing will not result in the loss of any Red or Blue listed species or any species listed on Schedule 1 of the *Species at Risk Act*. The disturbed area around the reservoir will be revegetated with native plant species. Also, this site has also been previously disturbed from the gravel borrow pit activities, therefore the significance of vegetation clearing is considered **Low** and not significant.

8.1.5 Sensitive Sites

8.1.5.1 Potential Interactions, Issues and Concerns

Potential effects to sensitive sites will occur from the disturbance, alteration or loss of vegetation and/or habitat within close proximity to where these sensitive sites occur. Clearing for the re-routed Baden-Powell trail is rated as a potentially **Moderate** effect on sensitive sites, since the upper portions of the re-route will be in close proximity to subalpine wetlands.

The effect of land clearing and excavation for the sensitive sites near the water reservoir is expected to have a **Moderate** effect. The reservoir site is proposed at a disturbed, abandoned gravel borrow pit thus it would not affect intact habitats. However, several common plant species have established themselves at this locale; they are common for the region but unique for sub-alpine areas. This effect is primarily due to the permanent nature of the structure, the potential effect to breeding habitat for a rare dragonfly species and the presence of a unique ecosystem that currently exists on the site and adjacent to the site (i.e., Yew Lake old-growth stand). There is also the potential to lose unique dragonfly breeding habitat at the proposed snowmaking reservoir, if a change in drainage occurs due to the construction activities.

Accidents, Malfunctions and Unplanned Events

A breach of the reservoir could result in a substantial volume of water flowing into the Yew Lake wetland. The results of this would be detrimental to the ecosystem. The reservoir will be designed to engineering standards and will comply with the Dam Safety Regulations under the British Columbia *Water Act*. The reservoir will be monitored annually to ensure the structural integrity of the berm is maintained.



8.1.5.2 Mitigation

The following mitigation measures will be applied to reduce effects on sensitive sites:

- The Baden-Powell re-route alignment will avoid sensitive areas such as subapline wetlands.
- Sensitive areas along the new trail will be roped off and signage will be posted informing the public about the importance of staying out of these sensitive areas.
- Construction activities at the reservoir site will maintain a 30 m set back from the dragonfly breeding habitat.
- The outside berm of the reservoir will be revegetated with natural plants occurring in the area.
- Any loss of old growth trees will be addressed beforehand on a tree by tree basis through discussions with BC Parks, CBRL and stakeholders.
- The extent of sensitive areas will be confirmed by the Environmental Monitor, BC Parks and CRBL and discussed with construction crews prior to the commencement of work.

8.1.5.3 Determination of Significance

Sensitive sites will be avoided through design and mitigation measures outlined above. The significance of the effects to sensitive site is considered **Low** based on the mitigation measures outlined above. There has also been several design changes to the venue facilities in order to avoid sensitive sites. The overall effects to sensitive sites are considered not significant.

8.1.6 Terrestrial Wildlife

8.1.6.1 Potential Interactions, Issues and Concerns

Potential effects to terrestrial wildlife include habitat alteration, loss or fragmentation, sensory disturbance and direct mortality.

Alteration of terrestrial wildlife habitat will occur during construction activities as a result of the physical removal of vegetation, grubbing and regarding. Land clearing and excavation for the water reservoir and Freestyle facilities is considered to have a **Low** effect on terrestrial wildlife. Habitat in the Assessment Area has been



previously disturbed from the existing ski areas and is likely most suitable for small mammals and herptiles. Clearing for the re-routed Baden-Powell trail is rated as a **Low** effect to terrestrial wildlife, this is due to the fact that tree clearing for the trails will be site-specific and minimized. Sensitive areas that provide suitable habitat for amphibians will be avoided.

The effect of forest fragmentation from vegetation clearing is considered to be **Low** for terrestrial wildlife. Although the clearing is permanent in nature; terrestrial wildlife will recover from the clearing activities and loss of habitat very quickly due to the limited area to be cleared. The identified species at risk (Section 7.3.3) are not likely to utilize habitats within the Assessment Area and are not expected to be effected from the project.

Most wildlife species are likely to exhibit some degree of sensitivity to human disturbance during the Games period and from the construction equipment. This sensitivity varies based on aspects of their behaviour, including the degree to which they adapt and habituate to human disturbance. This disturbance could result in temporary displacement of certain species from preferred habitat, abandonment of nests, dens or breeding areas and stress-related reduction in reproductive success. If mammals and herptiles remain in the zone of disturbance they would be subject to sensory disturbance but these effects would be short-term and are rated as **Low**.

Testing of sport facilities and operations during the Games period is expected to have a **Low** effect on the terrestrial wildlife, because the disturbance will be temporary with a short recovery period. The interaction will be limited to the winter season and no sensitive wintering areas for terrestrial wildlife have been identified in the Assessment Area.

Blasting areas and duration will be minimized to ensure effects on terrestrial wildlife are minimized. Because the recovery period for terrestrial wildlife is expected to be in the short-term the effect is rated as **Low**.

The noise from pumps and snow guns is predicted to have a **Low** level of effect upon terrestrial wildlife due to sensory disturbance to active winter-resident mammals. Effects are expected to be short-term and localized. Continued use of snowmaking equipment would have a **Low** effect terrestrial wildlife because it would affect only winter-resident and mammals and would be passive in nature and localized to cleared skiing runs only.

Increase sensory disturbance to nocturnal mammals from outdoor lights during the Games could disrupt the natural hunting patterns of nocturnal animals and the resting period of mammals. The significance of this effect is considered **Low** since outdoor lights are currently in place around the ski area. Furthermore, only winter resident mammals will be affected, and only forest habitat adjacent to light



standards would be affected (although there will be some residual light in edge habitat). Interior forests would remain relatively free of artificial light.

There will likely be an increase in sensory disturbance to terrestrial wildlife due to increased public use of legacy facilities, which can lead to avoidance of areas by terrestrial wildlife. The significance of this effect is considered to be **Low** because it is estimated that less than 1% of the resident wildlife population of the Assessment Area, and the existing use of the CRA, is affected.

Direct mortality to terrestrial wildlife may occur from collisions with vehicle traffic during the construction and operation phases. Overall vehicle traffic is not expected to increase during the two week Games period relative to traffic during a peak period in the ski season. Traffic will be restricted to small vehicles used by the Games personnel and bus traffic. A traffic management plan will be implemented, that will include low vehicle speed levels. Construction crews will be briefed on potential interactions with wildlife. The effects from vehicle traffic on terrestrial wildlife are rated as **Low**.

Accidents, Malfunctions and Unplanned Events

Accidents, malfunctions and unplanned events such as collisions between wildlife and Project-related vehicles or hazardous materials spill may interact with wildlife in a manner that results in the alteration of habitat, changes in wildlife movement patterns and/or the loss of individual animals.

Accidental fires would be of concern as they would contribute to an incremental loss of wildlife habitat. The proponent will incorporate a fire suppression plan into the EMP plus the fire risk is typically monitored within the park and activities are adjusted accordingly.

8.1.6.2 Mitigation

Mitigations measures to reduce the effects of direct mortality on mammals include:

- Unnecessary vegetation clearing or disturbance will be avoided. Large woody debris will be left placed on the forest floor or at forest edges if feasible.
- Existing habitat conditions will be maintained wherever possible.
- Human disturbance will be kept to a minimum by restricting and managing access and human activity during construction and operation.
- Use of outdoor lights will be limited to the extent possible, with lights turned off when not required for Games operations or maintenance of Games facilities.



- Light fixtures will be designed to reduce the amount of light emitted upwards.
- Employees and contractors will be required to drive responsibly by enforcing low vehicle speeds on all project-related roads.
- Waste materials (e.g., food, oils) that may act as wildlife attractants will be properly contained and removed from the project site.
- To avoid small mammal and amphibian mortality the grizzly bars at the Creek Pump House will be sized to prevent the entrapment of small animals.
- Wildlife protection measures that include provisions to reduce attractants through proper waste disposal, education and awareness of potential wildlife interactions and hazardous materials and spill contingency procedures will be adhered to.
- Employees and contractors will be provided with a wildlife management plan, including bear awareness training and overall wildlife management strategies, policies, and procedures (e.g., especially those designed to prevent direct mortality of terrestrial wildlife).
- The speed limit for construction and operational personnel will be 40 km/hr and may be lower under specific conditions such as areas where specific wildlife concerns have been identified.

8.1.6.3 Determination of Significance

The significance of the effect of disturbance to terrestrial wildlife is expected to be **Low** due to the short term nature of vegetation clearing and the minimal amount of clearing necessary for the Cypress Venue facilities. Habitat loss and sensory disturbance from clearing would be spatially limited to the facility areas, therefore only a small portion of the wildlife populations within park would be affected. Local populations should recover in a relatively short time period and if wildlife is displaced it would be temporary. The direct mortality events are expected to be rare, and replacement of terrestrial mammals due to recruitment is likely to occur within a few years.

Species that are known or expected to occur within the Assessment Area are not at risk and are likely to be part of sustainable populations that can act as source populations when territories become available. Therefore, the combination of the effects of the Project on terrestrial wildlife is considered **Low** and is not significant to regional populations.



8.1.7 Avifauna

8.1.7.1 Potential Interactions, Issues and Concerns

Potential effects to avifauna include habitat alteration, loss or fragmentation, sensory disturbance and direct mortality.

Vegetation clearing for the Freestyle facilities and the reservoir will remove breeding and security habitat for bird species. This habitat is comprised mostly of second growth forests that are used by birds for nesting and foraging. Based on observations in the Project area it is expected that 5 to 10 birds per hectare occur in these areas. This is considered to be less than one percent of the resident bird population. Habitat alteration, loss and fragmentation from land clearing and excavation for the Project facilities is considered to have a **Low** effect on birds. Furthermore, habitat within the areas to be cleared is considered low suitability for breeding birds and extensive suitable habitat is present within other areas of the park.

Sensory disturbance will occur from the construction activities and the operation activities during the Games period. The increased use of the park facilities post-Games can also cause disruptions to the natural patterns of birds in the park. Sensory disturbance from clearing would be spatially limited to the facility areas and the alignment for the rerouted Baden-Powell trail, therefore only a small portion of the bird populations would be affected. Disturbances due to construction to birds are anticipated to be short-term and temporary and local bird populations are expected to recover from sensory disturbance within one year. The noise from pumps and snow guns may have a **Low** level of effect upon birds that are resident year round due to sensory disturbance. Effects are expected to be short-term and localized plus most bird species that utilize habitat within the park will not be present during the winter season. Blasting of the parking lot cliff area to develop the Freestyle skiing venue is required but will be short term in duration and recovery, and therefore the effect on birds is expected to be **Low**. There will likely be an increase in sensory disturbance to birds due to increased public use of legacy facilities, which can lead to temporary abandonment of nests, resulting in nest predation and avoidance.

Light pollution poses a threat to birds during the spring and fall migration. Many species of birds migrate at night and artificial lights may attract and confuse birds during migration, particularly when the sky is cloudy and the ceiling is low (Gauthreaux and Belser 2002). Artificial lighting in urban settings increases the risk of collision with buildings and falling onto roadways (Podolsky 2002). This can lead to the direct mortality of individual birds. Excessive lighting can also disrupt the behaviour of birds. Birds may deviate from their typically migration routes, which



causes birds to expend their energy reserves and directs them to sub-optimal habitat. This can lead to indirect mortality if birds are unable to redirect themselves to their regular flight paths. Due to potential effects outside of the winter season, the use of outdoor lighting at the Cypress Venue is expected to have a **Moderate** effect on avifauna. Increased sensory disturbance to owls and winter resident birds from outdoor lights during the Games could disrupt the natural resting period of winter resident species of birds.

The effect of an increase in intra and interspecific competition in adjacent areas due to displacement out of the Assessment Area is considered to be **Low**. Much of the CRA habitat will be unaffected by the legacy configuration and the areas outside the CRA will remain unchanged. If animals are displaced to areas outside the CRA, less than 1% of bird populations will likely be affected by increase competition in adjacent areas and most would adapt to the increased competition.

Accidents, Malfunctions and Unplanned Events

The accidental spill of fuel or other hazardous substances could have a negative effect on birds if it directly affects breeding habitat. Accidental fires would be of concern as they would contribute to an incremental loss of bird habitat. The proponent will incorporate a fire suppression plan into the EMP plus the fire risk is typically monitored within the park and activities are adjusted accordingly.

8.1.7.2 Mitigation

The following measures will be employed to minimize the effects on birds:

- Area to be cleared will be minimized where possible. Any removal of old growth trees will be addressed beforehand on a tree by tree basis through discussions with BC Parks, CBRL and stakeholders in order to minimize effects.
- Undertake clearing activities outside of the peak migratory bird nesting season (May 1 to July 31) if feasible; if this is unreasonable due to construction timelines, complete a comprehensive survey for active nests to identify and protect nests from machine work until the nests are confirmed inactive. Disturbance of in active nests protected by the Wildlife Act will require permission from the Ministry of Environment.
- Wildlife trees will be retained where possible.
- The use of outdoor lighting will be limited to the extent possible. Lights will be turned off when not required for Games operations or maintenance of Games facilities.



- Blasting will occur outside of the breeding bird period, or a survey for active bird nests should be conducted prior to blasting and any other activities where there could be harm to nesting birds.
- Transmission lines will be placed underground where appropriate.
- Light fixtures will be designed that reduce the amount of light emitted upwards.

8.1.7.3 Determination of Significance

The significance of forest fragmentation from vegetation clearing is considered to be **Low** for birds. Although the clearing is permanent in nature; birds will recover from the clearing activities and loss of habitat very quickly due to the limited area to be cleared. It is estimated that <1% of the resident bird population will be affected and there is ample habitat in surrounding areas.

The significance of the effect of sensory disturbance to birds is expected to be **Low** due to the short term nature of the construction activities and the minimal amount of clearing necessary for the Cypress Venue facilities. The significance of the effect of disturbances from additional lighting is considered **Low** since outdoor lighting is already present within the Assessment Area. Only winter resident birds would be affected. The extent of disturbance to songbird migration due to winter season outdoor lights is estimated to be **Low**, provided that night-time outdoor lights will not be utilized during the peak periods of songbird migrations. Overall effects to birds are considered not significant.

8.1.8 Air Quality

8.1.8.1 Potential Interactions, Issues and Concerns

During the construction, operation and decommissioning there will be minor emissions of greenhouse gases, nitrogen oxides (NO_x), sulphur dioxide (SO₂) particulate matter (PM) and carbon monoxide (CO) due to combustion of diesel fuel or gasoline in vehicles. There is also the potential for generation of dust during vehicle movement. These emissions will be of short-term duration and will be restricted to the local area around the site.

During the Games period the activity with the greatest impact on air quality within the park will be the release of emissions from the shuttle buses that will be used to transport spectators to the venue. A capacity of approximately 12,000 people is expected each day of competition. The proposed transportation plan for the



Cypress Venue would employ approximately 175 buses to transport athletes, judges and spectators to the venue. This would be the total amount of buses traveling on Cypress Bowl Road per day. Approximately 300,000 vehicles drive the Cypress Bowl Road on an annual basis. This equates to an average of 822 vehicles per day. It is anticipated that the overall emissions from the total bus trips would not be greater than what is presently occurring from vehicular traffic on the Cypress Bowl Road.

8.1.8.2 Mitigation

Mitigative measures for controlling fugitive dust emissions during the project activities will be detailed in procedures that the contractors will be required to follow (i.e., watering down roads and exposed portions of the project site, covering exposed soil piles). Other measures that will be implemented to minimize the effects on air quality include:

- An overall Transportation Plan is being development for the Games that will maximize the use of proven and reliable lowest emission transportation options.
- A no idle policy will be in place for buses once they reach the parking area at the Cypress Venue.

8.1.8.3 Determination of Significance

Significant effects to air quality are defined to occur when ground-level concentrations associated with emissions from activities exceed ambient air quality standards that have been established by the government to protect human health and the environment. In this case, the National Ambient Air Quality Objectives from the Canadian Council of Ministers of the Environment (CCME 1999) are the standards used.

The effects of vehicle and equipment emissions during the construction and decommissioning and the Games period are not expected to exceed CCME ambient air quality objectives, although no monitoring of emissions has been carried out. Emissions will be short term and intermittent and will not be unlike those that are occurring from the vehicular traffic traveling to Cypress Provincial Park on an average day. Dust generation is expected to also be low in volume and infrequent. Therefore the effects to air quality are considered **Low** and not significant.



8.1.9 Noise

8.1.9.1 Potential Interactions, Issues and Concerns

The Project will generate noise during construction and decommissioning, due to the use of heavy machinery and vehicles. The contribution to noise levels is only expected on site and during a short period of time, i.e. only during the construction/decommissioning periods. There will be an increase in noise from truck traffic on the Cypress Bowl Road, however this effect will occur sporadically and over a short period of time. It is not expected to substantially increase ambient noise levels on the road, due to the already existing vehicle traffic on this road.

There will be noise generated during the operation phase from the traffic to the venue, the capacity crowds on site during events and the operation of the snow guns for snowmaking. Noise levels from the crowds during the Games period is not expected to be significantly different than the noise levels that are occurring at present from recreational skiers.

The snow guns combine small amounts of air and electricity with large quantities of water to provide a high efficiency snowmaking system with energy savings, and minimum noise level. Noise levels from typical snowmakers range from 64.0 to 73.0 decibels (Table 8-1)

Table 8-1 Noise levels for the SMI “Polecat” Snowmaker.

Position	Noise Level dB (A)
Front at 25 m	73.0
Front at 50 m	63.9
Side at 10 m	72.3
Side at 20 m	66.7

These noise levels are similar to those from inside a car traveling at 50 km/hr (Noise Pollution Clearinghouse 2006). As Table 8.1 shows noise decrease by approximately 6 dB(A) as the distance from the source doubles, therefore at 100 m from the noise from the front and side would be 58 dB(A) and 55 dB(A), respectively. Based on known noise levels from the snowguns, noise disturbance is expected to have a **Low** effect and a short-term recovery period for recreation use and access.



8.1.9.2 Mitigation

The following mitigation measures are proposed to reduce the noise levels associated with the Project.

- Limit construction activity between the hours of 07:30 and 17:30 (Monday to Friday and between 08:00 and 17:00 (Saturdays) as per West Vancouver Noise Bylaw.
- Noise generated during blasting will be minimized through the use of minimal effective charge, shock matting, *etc.*
- Ensure all internal combustion engines are fitted with appropriate muffler systems.
- The use of engine brakes will be prohibited unless a situation demands their use.
- Low-noise pumps will be used for the snow making system and pump houses will be appropriately sound-proofed.
- The snow making system will only be operated during the winter season when ambient noise is already a factor.

8.1.9.3 Determination of Significance

Overall, the Project's effect on ambient noise levels will only be site-specific and affect the occasional and temporary users of the park. The impacts will be short-term in duration (e.g., less than one year). Overall, the effect of construction and operation on ambient noise levels is considered **Low** and not significant.

8.1.10 Viewshed

8.1.10.1 Potential Interactions, Issues and Concerns

The Snowboard facilities are being constructed on an existing ski run. The Freestyle facility will result in the removal of 1.6 ha of forest and create a new ski run on Black Mountain. This additional run is not expected to alter the viewshed of Black Mountain. The Cypress Venue is being constructed within an existing ski area, therefore the addition of a new run is considered to have a Low effect on the viewshed. The Freestyle facilities will have an eastern aspect. Based on the topography of the area this new run can only be seen from within the Cypress Bowl area. It will not be viewable from further down the mountain in areas such as West Vancouver and Vancouver.



Temporary lights will be set up for the Games period. Upon conclusion of the Games these lights will be removed therefore no lasting effects of light pollution are expected. The current ski operation offers night skiing. This activity is expected to increase with the upgrades to the ski area being proposed by CBRL.

Effects of additional lighting on nocturnal mammals and resident bird species has been discussed in previous sections (8.1.6 and 8.1.7 respectively).

8.1.10.2 Mitigation

The following measures will be implemented to reduce any effects to the viewshed within Cypress Provincial Park.

- Areas to be cleared will be minimized where possible.
- Only the minimal amount of light structures will be installed.
- Light fixtures will be designed that reduce the amount of light emitted upwards.
- Lighting will be positioned properly and directed downwards.

8.1.10.3 Determination of Significance

In summary, potential visual effects of the Project may be experienced primarily during construction and operation. Overall, the effects of light pollution and changes to the viewshed will be minimal when compared to baseline conditions. While the overall look of the Cypress Mountain ski area will be changed for the Games period this will be short-term and temporary. Effects to the viewshed are considered **Low** and not significant.

8.1.11 Recreation Access and Park Use

8.1.11.1 Potential Interactions, Issues and Concerns

The potential effects to recreational access and park use by the public will be an alteration to the park enjoyment from the modification of natural habitat during construction and restricted access to sections of the park during construction and operation. The decommissioning and legacy of the Project will also affect the park use from the alteration of trails and the construction of new ski facilities.

Recreational Access

Access to the top of Black Mountain via the Baden-Powell trail is a major concern expressed by user groups. The existing route passes through the area to be affected from the construction of the Freestyle facilities. This issue is being



addressed by re-routing the Baden-Powell trail along the northern side of Black Mountain within the forested area adjacent to the Fork Run. The new trail will connect to a trail that is currently not maintained but will be upgraded so that access for hikers to the top of Black Mountain is not impeded. Based in the level of concern, clearing for the re-routed Baden-Powell trail is rated as having a potentially **High** effect on recreational access and use. The trail's re-routing will be permanent and although trail use will recover within one year of its re-opening, park users' experiences will be affected because of the heritage nature of the Baden-Powell trail.

Park access may be negatively affected during the period of facility pre-Olympic test competitions and Olympic Games period. Portions of the Park will be closed to the public during test competitions and the Games period. During the Games period, Park access will be restricted at an established check point along the Cypress Bowl Road for security and safety reasons. The Olympic Games runs over a period of 17 days, although events at the Cypress Venue will only be on 12 days. Cabin owners will have access to their sites but they will be asked to go through the established check point.

There will likely be one or two test competitions that would be held over 2-3 day periods during the winter of 2009. These security and safety protocols will be tested during the pre-Olympic competition events. While compete access is likely not going to be restricted during these test events there will be a period of inconvenience to park users and cabin owners.

To ensure public safety, access to portions of Cypress Provincial Park may be restricted during the construction period. The primary areas that will be affected include Black Mountain, the reservoir site and the access road to the reservoir site. The movement of machinery and the temporary storage of equipment will also alter the access to section of the park at the base of Black Mountain. Other than the changes to the Baden-Powell trail, no other trails will be directly affected. Based upon concerns over restricted access to the park this effect has been rated as **Moderate**.

Park Use

Construction of the reservoir will alter a disturbed area that has regenerated with several plant species that are common in the region but are unique for subalpine areas. Some recreational users visit the old gravel borrow pit to view these locally, unique plant species.

In addition to the habitat alteration at the reservoir site, the natural environment of the park will also be affected from the clearing of the second growth forest for the Freestyle facilities. This would effect the public enjoyment of the park for



recreational hiking during the construction phase. Also, the upgrades to the Windjammer run as a result of the halfpipe construction may also affect small sections of old growth forest. As stated the Freestyle and Snowboard facilities are being design so that no old growth trees will have to be removed. However, based on the level of public concern these effects are rated as **Moderate to High**.

Park access would not likely be impeded for more than one year, due to the vegetation clearing for the Freestyle facilities, but the public enjoyment of the natural environment at the site of the Freestyle facilities would be negatively affected. Due to the permanent nature of the disturbance it has been evaluated as a **Moderate** effect.

Due to the long-term nature of the permanent venue facilities, effects to recreation access and park use are rated as **Moderate**. It is anticipated that the park will be used more frequently and by more users after the Games. In addition, the CRA recently began offering mountain bike access during the summer season thus; CRA is now a four-season facility. The increased venue legacy use has a positive and negative result in that the Park is used more often, likely by more people, which can negatively affect the natural experience of users and affect the physical quality of the Park (e.g., erosion on trails).

8.1.11.2 Mitigation

In order to reduce the effect to recreational access and park use by the public the following mitigation measures will be applied:

- The clearing of vegetation will be confined to the smallest area possible.
- The area around the reservoir will be revegetated with natural plant species.
- The rerouted Baden-Powell trail will be opened to provide access to the top of Black Mountain before access to the area around the Freestyle facilities is restricted.
- Trail heads will not be blocked by construction equipment.
- VANOC will not restrict cabin owners' access to their properties during test competitions, pre Games, or the Games period.
- The Baden-Powell trail will be rerouted away from sensitive subalpine wetlands.
- Blasting activities near the Freestyle facilities will be conducted before the mountain bike park opens (12:00).



- Staging and temporary storage of equipment will be in previously disturbed areas that do not restrict access to park facilities (i.e., will not block access roads and trails).

8.1.11.3 Determination of Significance

As mentioned previously (Section 6.3.2) the construction of the venue facilities will be conducted during 2006 and 2007. Based on climatic conditions, most of this construction will occur during the snow free season (i.e., April to October/November). The majority of the effects will be to recreational users that enjoy the alpine ski area during the spring, summer and fall. Winter recreational users will be less impacted by construction, plus the other areas of the park, outside the assessment area, will not be affected. In total the restricted access to certain areas of the park, mainly the Freestyle site and the reservoir site, will be short in duration (i.e., less than one year), therefore the significance of this effect is rated as **Low**.

The areas to be cleared for the facilities will be approximately 2.6 ha. These areas (i.e., the Freestyle and reservoir sites) are previously disturbed sites. Large areas of old growth forest will not be affected. Furthermore the areas that are disturbed around the reservoir will be revegetated with natural plant species. The significance of these effects is considered **Low**.

As a direct result of the public consultation process and in keeping with the sustainability principles, venue plans have progressed in a manner that is designed to lower the effects to the environment. Therefore, the effects to recreational access and park use are considered not significant.

8.1.12 Cultural Environment

8.1.12.1 Potential Interactions, Issues and Concerns

The Archaeological Overview Assessment (AOA) has demonstrated the risk of archaeological impact is **Low** specific to the 4.9 ha area of the proposed Cypress venue construction given past disturbance of these lands. The construction scheduled for May 2006 includes the stripping and grubbing of the Freestyle site, and or site preparation for the snowmaking water reservoir. These areas have been selected to minimize the risk of archaeological resources, as they have been previously harvested and used for gravel extraction purposes.



Notwithstanding this, before construction, VANOC commits to undertaking an Archaeological Impact Assessment (AIA) of the lands to be disturbed by the 2010 venue plans at Cypress. The AIA will be undertaken by a qualified archaeological consultant once the snow is sufficiently cleared for an assessment. First Nations will be invited to participate in the AIA process. A site visit and discussion with BC Parks and the First Nations will occur as part of the AIA. Measures designed to mitigate impacts to archaeological resources, including CMTs, will be made in consultation with First Nations, and the AIA draft report will be provided for review by the First Nations before being finalized. If required, VANOC will commit to having an archaeologist on site during the initial clearing works for the freestyle venue and the reservoir facility if construction proceeds before the AIA is completed.

During construction, VANOC will ensure that employees and contractors involved in project construction are aware of and comply with requirements regarding discovery of any archaeological remains, including knowledge that archaeological remains in the Province of BC are protected from disturbance, intentional or accidental, by the Heritage Conservation Act (1994). In the event that any previously unidentified archaeological remains are encountered during site clearing and construction, all ground altering or other activities which threaten the archaeological site will be stopped, and VANOC will promptly advise the archaeological consultant, the affected First Nations and the Archaeology Branch at the Ministry of Tourism, Sports and the Arts, of the existence and location of the newly identified sites. If the Archaeology Branch at the Ministry of Tourism, Sports and the Arts confirms the presence of newly identified sites VANOC will follow any mitigative measures specified by the Archaeology Branch with respect to those sites.

VANOC will ensure that employees and contractors involved in project construction are instructed on the location of identified archaeological resources within the project site, and the means to protect archaeological resources within the project site.

8.1.12.2 Mitigation

An AIA will be conducted in the Assessment Area in the spring of 2006 once the area is free of snow. In order to reduce the other effects to the cultural environment the following mitigation measures will be applied, in consultation with First Nations:

- Where a previously unidentified archaeological or heritage site is encountered during construction, work at that location may not resume until the Environmental Monitor has been notified and the appropriate provincial cultural and historical resources division (Archaeology Branch, B.C., Ministry of Tourism Sports and the Arts) has been informed.



- No further work will be undertaken in the immediate vicinity of the site until a qualified archaeologist examines it and permission to proceed is granted by the provincial agency and the archaeologist.
- Should work be allowed to continue around an archaeological or heritage site, specific mitigation measures will include:
 - reduction/relocation of the footprint and protection of the site using fencing or flagging;
 - installation of geotextile, wooden mats and/or corduroy to temporarily ramp over the site;
 - assignment of a qualified archaeologist or palaeontologist to monitor construction operations; and/or
 - excavation of the site, under the supervision of a qualified archaeologist or palaeontologist to salvage, preserve and record resource materials according to provincial heritage resource guidelines.

8.1.12.3 Determination of Significance

VANOC will work to ensure compliance with all mitigative measures recommended in the AIA report as approved by Archaeology Branch at the Ministry of Tourism, Sports and the Arts.

A significant environmental effect of the project activities on the cultural environment would involve the destruction or disturbance of all or part of an archaeological, historic or palaeontological site considered to be of local, regional territorial, national, or international value. The AIA should confirm the presence of CMTs and/or archaeological sites within the Assessment Area. Any identified sites will be avoided through changes to the venue design and construction therefore effects to the cultural environment will be **Low** and not significant.



8.2 Cumulative Effects

Cumulative effects occur when two or more actions combine to result in an incremental effect that is greater than the effects from any single action. The assessment of cumulative effects is done to ensure that incremental effects resulting from the combined influence of various actions are considered.

According to criteria developed by BC Parks there are five ways in which cumulative effects may occur in protected areas. These include:

- Sensory disturbance.
- Contaminant transportation.
- Habitat loss and fragmentation.
- Viewshed degradation; and
- Experiential degradation.

Other activities considered in the cumulative effects screening include the installation and operation of the new Black Mountain chairlift, the construction and operation of the new day lodge and the expansion of the ski area and mountain bike park on Black Mountain.

These potential cumulative effects have been evaluated for the valued components. A summary of the cumulative effects screening is provided below. The Cumulative Effects Screening Matrix and associated Audit Records are provided in Appendix A.

8.2.1 Water Quality

The likelihood of cumulative effects to water quality exists from the construction and operation of other activities because of potential sediment inputs into Cypress Creek. The potential for sediment input should only be a factor during land clearing activities. Based on the amount of activities that are planned for the Black Mountain area this cumulative effect has been rated as **Moderate**. However, residual effects to water quality for the Cypress Venue will be mitigated with the implementation of a sediment and erosion control plan. Therefore the contribution of the Project to cumulative effects on water quality is considered not significant.



8.2.2 Water Quantity

The other activities that are proposed with the Cumulative Effects Assessment Area will not be affecting the water quantity within Cypress Provincial Park. It is anticipated that the water supply for the new day lodge will be allocated under the current water licence that is held by CBRL. This water supply is from Montizambert Creek. Cumulative effects to water quantity are considered not significant.

8.2.3 Fish and Fish Habitat

Sediment transport is not expected to cumulatively affect downstream fish populations and fish habitat because the sediment and erosion control plan will limit sediment inputs and the natural dilution of turbid water will ensure acceptable water quality conditions for fish-bearing creek sections. Therefore cumulative effects to fish and fish habitat are considered not significant.

8.2.4 Vegetation

Habitat loss and fragmentation from the construction of the new facilities in the Cypress Mountain ski area will cause a Moderate cumulative effect upon vegetation. As with the Cypress Venue, future development is planned for previously disturbed areas and/or within young forest habitat that is fragmented by trails. There are no federal or provincial species at risk in the proposed areas to be developed therefore the cumulative effects vegetation are considered not significant.

8.2.5 Sensitive Sites

Other activities that are planned to occur within Cypress Provincial Park previously gone through an environmental assessment screening as part of the Master Plan (MELP 1997, amended 2004) and Controlled Recreation Area Master Plan. Sensitive sites around the Yew Lake area will be completely avoided by the proposed activities. The expansion of the ski area on Black Mountain will potentially impact old growth forest, but these impacts, should they occur, will generally occur along edges of isolated and fragmented patches. These activities have been evaluated under the BC Parks Impact Assessment process for cumulative effects and are considered not significant.



8.2.6 Terrestrial Wildlife

The cumulative effects that may potential affect terrestrial wildlife include sensory disturbance and habitat loss and fragmentation. There will be an incremental cumulative effect from sensory disturbance to terrestrial wildlife from the construction of the new facilities. This effect is expected to be Moderate because much of the Cumulative Effects Assessment Area will remain free of disturbances, leaving habitat available for terrestrial wildlife. The majority of operation should be limited to the winter season, thereby restricting affected species to only those that are known to be active or semi-active during the winter (e.g., subnivean species). Additional habitat loss and forest fragmentation from clearing and construction of the new facilities will result in a Moderate cumulative effect to terrestrial wildlife.

The alpine ski area has been in operation for a number of years and terrestrial wildlife have either relocated to other suitable habitats or have become habituated to the disturbances. A relatively small area of the Cumulative Effects Assessment Area will be affected by the Project and future activities, therefore cumulative effects to terrestrial wildlife are considered not significant.

8.2.7 Avifauna

The cumulative effects that may potential affect avifauna include sensory disturbance and habitat loss and fragmentation. There will be an incremental cumulative effect from sensory disturbance to avifauna from the construction and operation of the new facilities. This effect is expected to be Moderate because much of the Cumulative Effects Assessment Area will remain free of disturbance, leaving habitat available for bird nesting and foraging. Operational effects to avifauna, from the Cypress Venue and the other proposed activities will be minimal during the winter months because most bird species are non-resident or migratory.

There will be limited forest clearing for the new activities that will potentially be a source of cumulative effects upon avifauna. This cumulative effect is expected to be Moderate. The previous activities likely have an effect on avifauna in the Assessment Area, although, avifauna have the ability to seek out alternative habitat that is available within the Cumulative Effects Assessment Area. When considering planned mitigation, the Project, acting in combination with other present and future projects that will be carried out, will not significantly contribute to cumulative effects on avifauna.



8.2.8 Recreational Access and Park Use

The installation and operation of the new facilities at the Cypress Mountain ski area, in conjunction with the Cypress Venue, will have a Moderate cumulative effect on viewshed degradation and experiential degradation with regard to recreational access and park use. This is primarily because some user groups utilize the Cypress Bowl area as a starting point for recreational hiking into undisturbed areas of the park. These users will be negatively affected by the new activities because of the effect it will have upon their natural experience. Discussion over the development of an Olympic legacy to possibly upgrade the Howe sound Crest Trail could lead to an increase or enhanced recreational experience.

For safety reasons, access to some areas may be restricted during construction, thereby causing temporary inconveniences to park users. However, the facilities in the Cypress Mountain ski area will provide a beneficial effect to the users of the alpine ski area by providing more skiable terrain and improving the guest services. The negative effects on the construction activities from the Cypress Venue and other projects will be localized and short term in duration, therefore the cumulative effects to recreational access and park use are considered not significant.

8.2.9 Air Quality

Air quality is expected to be affected at a local scale by the Cypress Venue and other projects during construction activities, but should not contribute significantly to a reduction in the air quality of Cypress Provincial Park. Heavy equipment used in the activities such as blasting, clearing, grubbing, cut and fill operations and trenching will all generate emissions. Fugitive dust from these construction activities will also affect air quality by increasing airborne particulate matter. However, the extent of the effects depends on existing air quality and weather (humidity), size of affected area, and extent of dust-producing activities.

Construction schedules with the Cypress Venue and the other activities proposed for Black Mountain will likely coincide. At the time of preparation of this report, the type, number and duration of heavy equipment operations for the other activities is unknown, but the effects are expected to be short-term, intermittent, and reversible in nature and only affect a local area. Therefore the cumulative effects to air quality are considered not significant.



8.2.10 Noise

Noise from the construction of the Cypress Venue has the potential to act cumulatively with noise from other construction activities during the two construction seasons that are planned. It is expected that the cumulative effect of noise will be slightly detrimental and is rated as **Moderate**. However, the construction seasons are relatively short (i.e., less than one year in total) with the majority of heavy equipment use planned for the first season. This effect would only affect a small proportion of the overall park users. Wildlife may be temporarily disturbed but there is extensive suitable habitat in the park for wildlife to use. Therefore, the cumulative effect of noise is considered not significant.

8.2.11 Viewshed

The cumulative effect upon the viewshed degradation from the historic activities at the Cypress Mountain ski area and installation and operation of the new facilities, in conjunction with the Cypress Venue, is rated as being Moderate. These activities are occurring within the Controlled Recreation Area in the Intensive Recreation Zone of Cypress Provincial Park. They are also within the scope of both the Cypress Provincial Park Master Plan and the Controlled Recreation Area Master Plan. Aside from the Intensive Recreation Zone, there are portions of Special Feature and Natural Environment zones within the Cumulative Effects Assessment Area that offer access to undisturbed natural environment. Considering that the cumulative effects to the viewshed are restricted to the Controlled Recreation Area, these effects are considered not significant.

8.3 Accidents, Malfunctions and Unplanned Events

Accidents, malfunctions and unplanned events that could possibly occur during the lifetime of the Project include:

- Spill of hydrocarbons or other hazardous materials;
- Introduction of sediment into watercourses;
- Failure of the snowmaking infrastructure; and
- Forest fires.

VANOC is committed to having an Environmental Management Plan (EMP) in place prior to the project start-up that will address potential accidents and malfunctions



associated with the construction and operation of the activities at the Cypress Venue.

8.3.1 Hydrocarbon or Hazardous Materials Spills

Of primary concern are accidental discharge of hydrocarbons and hazardous material spills. Both of these issues can have a negative effect on terrestrial and aquatic habitat and the species they support. Known hazardous materials that will be used during construction, operation and decommissioning phases of the Project include fuels, lubricants, and solvents. The accidental introduction of hazardous materials into a watercourse would temporarily degrade water quality and have subsequent environmental effects on aquatic organisms. Sublethal environmental effects could include avoidance behaviour and disruption of feeding and migration patterns. If the material is highly toxic or spilled in a sufficient volume, mortalities could potentially occur at all life stages of aquatic species within the affected area. Changes in water quality could also affect other trophic levels, resulting in drift or direct mortalities of benthic organisms. Spills of these materials into the terrestrial environment could potentially affect soils, vegetation and wildlife.

The EMP will include a detailed Hazardous Material Spill Contingency Plan. This plan will include measures that will be implemented in anticipation of the release of hazardous materials during all phases of the Project and will be implemented as necessary in accordance with permits and anticipated field conditions. Details of this plan are included in Appendix E. It is anticipated that hydrocarbon or hazardous material spills will be cleaned up quickly through effective spill response planning, therefore effects in the environment should be low.

8.3.2 Introduction of Sediment into Watercourses

Major storm events during the construction or decommissioning phases of the Project may result in flooding of work areas and the subsequent release of sediments into water drainages. If the sediment control provisions fail, this could lead to a degradation of water quality and adversely alter physical habitat in Cypress Creek due to the deposit of sediments.

The EMP will include a detailed Sediment and Erosion Control Plan. Erosion control measures will be installed prior to commencing work. Measures will be implemented in anticipation of run-off of sediment laden water during all phases of the construction works and will be implemented as necessary in accordance with



permits and anticipated field conditions. VANOC will monitor the current weather predictions throughout the Project. In the event of heavy run-off, diversion berms and check dams will be used to slow flows and prevent erosion. Tarpaulins and plastic sheeting over exposed soils will also reduce erosion. Materials required to handle excess runoff following a storm event will be stored on-site at all times. In the event of a severe storm event that results in run-off that exceeds the capacity of the sediment control provisions, either additional measures will be undertaken to contain the run-off or work will be halted. Through this type of effective planning the effects to watercourses will be low.

8.3.3 Failure of the Snowmaking Infrastructure

A failure of the snow making reservoir could result in the release of 20,000m³ of water into Montizambert Creek and the Yew Lake area. The reservoir is being designed with a spillway at the north end to direct any overflow away from the compacted berm. Water that passes through the spillway would flow into Montizambert Creek and not into the Yew Lake ecosystem.

The EMP will include a Dam Safety Plan that complies with the Dam Safety Regulations of the *Water Act*. The Dam Safety Regulations provide guidance on the application process as well as reporting and inspection guidelines. Details of the Dam Safety Plan will be incorporated into the Water Licence Application. The Dam Safety Guidelines that have been developed by the Canadian Dam Association (CDA 2005) will also be followed. Components of these guidelines include:

- Dam safety management;
- Operation, maintenance and surveillance;
- Emergency preparedness;
- Dam safety review; and
- Dam safety analysis.

These guidelines provide an effective tool to ensure that incidents regarding the failure of the reservoir are address proactively. By following these guidelines and through the development and implementation of the Dam Safety Plan, effects from the failure of the reservoir will be low.



8.3.4 Forest Fires

Construction activities, such as forest clearing, grading and blasting have the potential to cause accidental forest fires since they will be occurring during the fire season (i.e., late spring to early fall). A Fire Contingency Plan will be developed, as part of the EMP, in accordance with the Forest Practices Code of British Columbia and the Forest Fire Prevention and Suppression Regulations in British Columbia. VANOC, the Contractor, and any subcontractor on the project will implement the Fire Contingency Plan as required and ensure that personnel are suitably trained in fire suppression (i.e., S-100 Basic Fire Suppression). The Contractor will be responsible for ensuring that all necessary fire-fighting equipment and water sources are located at the job site. There will be coordination of fire suppression activities with CBRL during the construction season to ensure resources are maximized. In addition, during the clearing and grubbing phase, on-site, there will be no open burning of slash material.

Accidental forest fires during the Games period are not expected since these activities will be occurring during the winter season.

8.4 Effects of the Environment on the Project

The definition of an 'environmental effect' under CEAA includes any change to the Project that may be caused by the environment. There is a number of planning, designs, and construction strategies intended to minimize the potential environmental effects of the environment on the Project so that the risk of serious damage or interruption of service can be reduced to acceptable levels. Mitigation measures include, among other things, designing structures to relevant codes, and scheduling of activities to allow for weather disruptions.

The types of environmental activities that could have an effect on the Project include the following:

- climate change;
- seismic activity;
- slope instability; and
- avalanches



8.4.1 Climate Change

Increasing concentrations of greenhouse gases in the atmosphere are believed to be causing global warming (IPCC 1990; IPCC 1995). Increased temperatures may contribute to an increase in ocean volume (i.e., sea level rise). Although estimates vary, global sea level rise is expected to be +0.5 m by 2100 (Wigley and Raper 1992; IPCC 1995; Forbes et al. 1997). Other atmospheric changes relating to climate change may include increased storm intensity (Emanuel 1987) and other changes relevant to coastal stability such as surface winds, ocean waves, storm surges and ice conditions (Forbes et al 1997). These actions will influence the climate within the Assessment Area. Climate change models project that there will be an increase in winter precipitation in western North America over the next 100 years. With the gradual increase in temperatures over this period most of this precipitation is expected to fall as rain. For the period leading up to and including the Games, precipitation will be influenced by shorter-term natural cycles so effects would be negligible.

8.4.2 Seismic Activity

The Pacific Coast is the most earthquake-prone region of Canada. Earthquakes are occurring on a regular basis however, most are too small to be felt. Earthquakes of the magnitude that can cause damage of varying degrees occur in the region about once every 20 years. The largest earthquake (magnitude 7.3) occurred in 1946 and was centered beneath central Vancouver Island (Cascadia Region Earthquake Workgroup 2005).

To ensure protection from seismic activity, the major elements of the permanent and temporary facilities will be designed and constructed in accordance with the current British Columbia and National Building Codes. Furthermore, as mentioned in Section 8.3.3 the reservoir will be constructed with a Dam Safety Plan in place that includes an emergency preparedness component. While it is difficult to predict the magnitude of the effects of an earthquake on the project, these proactive measures will be in place to ensure that effects from seismic activity are reduced.

8.4.3 Slope Instability

Slope instability resulting from weather events such as severe rain and/or thawing and freezing could result in slide events during the construction of the Freestyle and Snowboard courses. These slide events could potential lead to the increased input of sediments into water courses. The Sediment and Erosion Control Plan will include components to deal with heavy rain events during the construction period.



These include the installation of diversion berms and check dams. Furthermore, weather conditions will be monitored and the appropriate actions (e.g., work stoppage or covering of exposed soils) will be implemented. Most of the construction will be occurring in a relatively small area, therefore the risk to damage from slope failure will be low.

The reservoir is to be constructed in a relatively flat area therefore the risk of slope failure is considered low. Temporary above-ground facilities will also be located in areas that are not prone to slope failure. Slope instability will not be a factor during the operation of the Project (i.e., during test events and the Games period) since these activities will occur under winter conditions when the terrain in the Assessment Area will be covered with a layer of snow.

8.4.4 Avalanches

The terrain and snow condition within the Assessment Area are not conducive to avalanches. However, the potential for a small avalanche or snow slide does exist along Mt. Strachan to the west of the snow making reservoir. A snow slide may result if there is a period of extreme snow loading (>3 m in one week) in this particular part of the Assessment Area. While it is not expected that a snow slide would result in the failure of the reservoir, debris could be deposited within the reservoir that would require additional maintenance and repair.

While the risk of a snow slide in this area is low, snow loads around the reservoir will be monitored. The forest along the slopes to the west of the reservoir is in a mid-successional stage and as the forest becomes more established the risk to snow slides will reduce. Furthermore, the fence that will be constructed around the perimeter of the reservoir will act as a barrier to snow and debris in the event of a slide, therefore the effects from a snow slide are considered low.

