Jumbo Glacier Resort Master Plan

Appendix 9-A

Community Fire Protection Strategy

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JUMBO GLACIER RESORT **INVERMERE, B.C.**

COMMUNITY FIRE PROTECTION STRATEGY

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1.0 INTRODUCTION

This report outlines a strategy for providing fire protection / suppression resources within the Jumbo Glacier Resort community. The resort policy will be to function independently from Invermere, but to exchange information and to share resources for coordination of training and other needs, and to protect Jumbo Glacier Resort through effective building and other fire risk measures, fire prevention, communications as well as fire suppression response by a rapid fire attack force within the Resort. These measures contemplate both the initial and future development phases with allowance for further expansion leading to projected build out of the development site. It is not within the scope of this report to outline equipment and personnel requirements relating to the resort and / or Invermere.

2.0 RESORT OVERVIEW

Development of the Jumbo Glacier Resort will center around the creation of a resort vacation community extended to support recreational activities. The resort base will be located at about 1700 m (5577 ft.) elevation in the Jumbo Creek valley, which will experience a winter climate, including continuous freezing temperatures and cumulative accumulations of snow during periods of continuous use. The new gondola proposed as part of the first phase of the project will carry skiers to an elevation of approximately 3000 m (9842 ft). providing a vertical drop of 1245m (4085 ft), one of the highest in North America. The resort will be located approximately 36 km from Panorama, B.C. Canada and 50 km from Invermere, B.C.

Within the resort community the majority of the buildings and a majority of the floor area to be constructed will be for transitory residential use by visitors, with the remainder designated for supporting ski facilities, commercial and entertainment / assembly spaces designated for concurrent use by the resort population.

A limited proportion of the residential buildings are anticipated to be created specifically for Jumbo Glacier Resort employees. A minor amount of light industrial building spaces are anticipated to be constructed but principally for operating the ski area and to provide ancillary services.

At full utilization of available building sites, there will be 5502 bed units of accommodation available, both private and rental and 750 beds of employee accommodation. This capacity is to meet the projected demand for facilities of approximately 600,000 skier visits per year on completion of the three phases of development and its expansion.

The development will be undertaken in three phases as shown in Volume 4 of the Ski Area Master Plan. This plan anticipates a gross area at build out of 104 ha (257 acres). This reflects the main components of the project, namely:

- the resort daylodges and lift departure points
- two hotels
- a variety of condotel units, townhouses, timeshare units and single family chalets
- supporting commercial facilities (restaurants and retail shops) centered on a pedestrian resort core

The planned expansion of the ski facilities includes the construction of new gondolas, aerial trams and chairlifts to be completed over twenty years in accordance with the Master Plan, Section 4.3.4. .

A summary of the facilities at total build out is shown in Volume 4 of the Master Plan. The area of the operating license and its surrounding territory are Crown Lands. The development and the expansion of the resort will be made under agreements with the government of the Province of British Columbia under the terms of the Commercial Alpine Skiing Policy (CASP). Phases of the expansion as noted above, are taken from the Ski Area Master Plan, volume 4.

Location

Jumbo Glacier Resort will be located at a sawmill site in the Jumbo Creek drainage approximately 55 kilometers (approximately 34 miles) west of the District of Invermere and approximately 36 kilometres (approximately 22 miles) from the resort of Panorama. Invermere is and reached by a Highway 95/93, and Panorama by an 18 kilometres road west of Invermere. The road continues for another 20 kilometers to the Mineral King Mine and then with a forestry road of approximately 16 kilometres to the sawmill site.

Air Access

The regional commercial airway system is presently servicing Cranbrook Airport, the nearest airport with two airlines having regularly scheduled flights connection to Vancouver and Calgary. It is anticipated that there will be a helicopter landing pad and ancillary facilities in conjunction with heli-skiing provided at the resort and this will also be utilized to serve emergency needs

Study Objective

The principal objective of this study is to review and recommend (establish) an acceptable level of community fire protection for the Jumbo Glacier Resort development, for its initial phases through expansion to the planned built out phase, with consideration for long term needs, in addition to and in support of the observations outlined in the Master Plan Section 7.7.3.8.

As the vast majority of the resort facilities are to be provided through construction of new buildings, an opportunity is provided to integrate fire protection strategies with the construction programme, without the typical limitations imposed by a significant inventory of existing building stock. Built in automatic fire protection systems will be evaluated as a component and / or option for the implementation of an acceptable community fire protection strategy for this area.

Since the response will be independent of the District of Invermere insofar as fire department response is concerned, this report will provide some parameters for defining the on-site response to fires.

This report will also reference various mandatory Provincial Acts and / or regulations relevant to the responsibilities of the Authorities having jurisdiction, with respect to the establishment, development and maintenance of the community fire protection services.

3.0 APPLICATION REQUIREMENTS

Both the Fire Services Act of B.C. and the Local Government (formerly Municipal) Act lay out requirements pertaining to fire protection and prevention within a community.

Fire Services Act

The Act lays out a municipal duty to inspect buildings and to authorize persons to exercise powers within various sections of the Act. These include the right to order improvements to fire and life safety, maintenance of fire and life safety systems, fire drills and other aspects of fire safety planning.

The Act empowers the "local assistant" to the Fire Commissioner to inspect buildings. A local authority having jurisdiction must provide for a regular system of inspection by an officer of buildings in the municipality. The full scope of requirements applicable to fire safety are outlined in the body of the B.C. Fire Code.

Local Government Act

The Local Government Act empowers a municipality to establish a fire department with responsibility for fire prevention and suppression with broader powers to respond to other emergencies. The Act also provides for the collection of charges for provision of the above services.

The following provides a brief précis of the powers provided under the Local Government Act. The Act also empowers local governments to regulate the conduct of persons at or near fires and to require them to assist in protecting threatened property or to assist in fighting fires. Other powers include:

- regulation of flammable and combustible materials or other damaged goods
- safety of forestry operations that may endanger safety in the woods or endanger adjacent property
- safe installation and operation of gasoline or other combustible liquids
- use of open fires and similar hazards
- wood control and occupant safety in public buildings
- removal of fire hazards
- cleaning of chimneys and flues that may otherwise cause a fire hazard
- right to inspect premises for fire hazards
- right to prevent and suppress fires including demolition of buildings to prevent the spread of fire
- the right to issue permits for outdoor fires

- the right to deal with any matter within the scope of the Fire Services Act.

We would expect that Jumbo Glacier Resort will ensure that the above will be diligently followed, both for the safety of the resort community of tourists and for their own business interests. In other words, fire prevention against significant loss arising from destruction by fire and both a statutory duty and prudent practice to assure that the assets of the Resort and public safety are maintained.

4.0 GENERAL STRATEGY

In the last twenty years there has been an increase in public awareness relative to fire risk in both the home and community. Prior to the 1980s, there was a propensity for the public to accept a certain level of risk in buildings as an everyday reality. As such, individual building safety was of less concern than uncontrolled fire spread or conflagrations that might threaten an entire district or community. Individual fires involving large life loss, however, were a concern, which was reflected in higher standards of safety and enforcement in public assembly buildings. Higher frequency of fires with small life losses in each building were tolerated, while single incidents of fire loss with large numbers of fire deaths were less tolerated due to political repercussions in such cases. This policy manifested itself statistically in large numbers of residential fires, which represented a significant fire problem collectively but were not considered a “fire problem” due to the relatively few lives lost in each individual fire. This had a parallel impact on the fire suppression resources due to a higher frequency of fires in dwellings. The net result was a significant collective fire risk necessitating an organized response strategy (fire department).

Building construction requirements, up until the 1980s, primarily emphasized compartmentation to restrict the amount of property and life loss. This changed with large numbers of fire deaths in hotel facilities such as the MGM and Grand Fire in Las Vegas, which demonstrated that significant lives could be lost due to the effects of smoke on occupants. Shortly after this and similar fires, codes began to mandate internal fire protection systems as a necessary “active” means of achieving acceptable safety in buildings.

Communities such as Scottsdale, Arizona and Vancouver and other municipalities started to create sprinkler bylaws to address the individual fire risk within all buildings including dwellings. The rationale for this was not just reduction in lives lost but the recognition that dependence on reactive forces such as fire departments, which not always may guarantee the necessary response,

contributed to the aggregate number of fire deaths. In effect, the impact of fire departments is limited by the time taken for an alarm to be registered and to respond, set up operations and actually suppress a fire. Often this time exceeds the time for occupants to safely evacuate.

Also, a reactive force must be constantly maintained while internal systems can, once installed, be maintained at relatively little cost. Consequently, fully sprinklered communities are one effective way to manage the fire risk within a community. It is therefore proposed that physical facilities in the Resort be fully sprinklered. Other measures will also be implemented in the community as a whole, in construction and after occupancy, to reduce fire risk to a level that can be managed easily through relatively modest resources. This means that the personnel made available be provided with modest equipment to prevent and suppress those fires, which do occur.
The B.C. Building Code assumes that an adequate fire department response is available. The provision of automatic sprinklers in buildings is an offsetting measure that mitigates the fire risk where an organized fire department is not available to reduce radiation from fires that might ignite adjacent buildings. The Code states that where a building has any storey that is not sprinklered and fire fighting cannot reach it within 10 minutes, and then the spatial separation (distance between buildings) shall be doubled.

Managing Fire Risk In Communities

The strategy for management of fire risk in any community depends upon the following factors:

(i) Risk Spectrum – The types and nature of fire risks within the community. Typical risks include building fire risk, wile fire, outside storage and utility fires as well as such things as vehicle and transportation related fires. Accurate prediction of fire risk cannot be made on the basis of community development plans alone but should reflect hazards based on a physical review of similar resorts. It is proposed to survey the following sites to provide a more accurate prediction of fire risks in the Jumbo Glacier Resort:

- Kimberley
- Fernie
- Panorama

It is anticipated that further discussions with local the Fire Department will be entertained prior to finalizing the planning of the resort.

(ii) Building fire risk is a function of fire risk arising from contents or processes, materials, fuel arrangement, construction and related factors. The impact of fire on life safety depends on the number and disposition of occupants. For instance, assembly buildings are generally reorganized to have a higher fire risk due to the higher concentration of occupants. For facilities in which the deposition of occupants is such that their reaction to fire is slower or possible only with assistance, more time is required to mobilize and evacuate the building.

(iii) The communications systems for notification of an alarm and the system by which an acceptable response is initiated. This includes response to incidents other than fire, for example the coordination of response by other agencies such as fire and ambulance services.

(iv) The infrastructure provided to improve the efficiency of response. This includes waterworks, hydrants, roads and access routes to facilitate suppression or rescue. Generally, it is recognized today that the more comprehensive controls provided for mitigation or control of building fire risks the less onerous the infrastructure requirements should be. This is due to the fact that traditional infrastructure standards are more conservative and were established prior to universal standards for suppression in all buildings. This is particularly true of road widths, fire hydrant spacing and water main sizing.

At the same time, non-building related fire risks may vary within a particular community. In this case, the wild fire risk is anticipated to be higher than a typical community due to the proximity of forested areas, although it may be mitigated by other factors such as the climate, type and density of vegetation (e.g. ground cover and trees) and natural separations (e.g. large avalanche tracks and previous fires).

(v) The effectiveness of fire prevention, pre-fire planning and maintenance and testing. This, if well planned and controlled, can significantly reduce the need for sophisticated suppression resources by eliminating the frequency and severity of fires. Fire prevention includes rules applicable to open fires (burn permits), fireworks (firework permits) and other hazards that may otherwise lead to a higher fire frequency within the community.

(vi) The planning of fire response should be based on a clear understanding of responsibility and resources of government agencies. This would impact on a coordinated strategy for fire prevention, suppression, communications for fire and non-fire emergencies such as avalanche prevention and response.

5.0 FIRE RISK PROFILE

The building programme and chosen type of construction as well as building contents and occupancy (operations) primarily dictate the risk associated with individual buildings. This fire risk is used to determine the suppression and other resources necessary in an emergency. Risk can be assessed by a survey of operating facilities as previously described. Fire risk management manifests itself in some automatic or manual means of suppression. The infrastructure for automatically fighting fires typically includes some estimate of the demand for water and the total capacity of storage of water for fire purposes. Most risk assessment methods use one of the following approaches, all of which are based on statistical, historical or anecdotal evidence regarding the quantities of water required to extinguish fires. It is assumed that there is a direct correlation between fire risk and required volumes of water for extinguishment.

(i) The Fire Underwrites Survey (FUS). This uses a grading schedule to determine the level of community fire protection and provides required volumes of water based on insurance experiences with large fires. Based on the resort Master Plan the maximum water demand for suppression of fires is 2500 Usgpm (approx. 9,500 lpm).

(ii) The Fully Sprinklered Community. Where a community has a very limited firefighting capability (e.g. where a reasonable response time for fire department response can not be anticipated) it is usual to provide automatic sprinkler systems to mitigate the risk as a general strategy to control and extinguish fires.

In such cases, the above method may be used to estimate fire flows or the water flow requirements may be based on hydraulic demand needed for adequate suppression of building fires plus a hose demand which varies, depending upon the classification and degree of risk. In this instance, it is proposed to provide initially a built environment that is equipped with internal fire suppression systems in lieu of a sophisticated fire department.

The benefits of sprinklers is that they minimize the risk of fire spread from building to building. There is also a significant improvement in life safety to the extent that life loss arising from fire can be virtually eliminated. This has intangible benefits including reduced liability and an enhanced resort reputation for public safety. With automatic sprinklers, the probability of a systemic failure leading to higher water demands as reflected in FUS calculations is greatly reduced. The maximum fire flow in a fully sprinklered community should be between 1000 to 1250 Igpm (4546 to 5455 lpm,) or approximately 50% of the FUS requirement. This can result in significant benefits such as reductions in the water mains sizing and distribution.

6.0 WATER SUPPLY REQUIREMENTS

The fire flow requirements and water supply requirements have been established by McElhanney Consulting Services Ltd. and are quoted from the Master Plan as follows.

Water will be supplied initially to split reservoirs with an aggregate capacity of approximately 1500m3 (397,500 Usgal)) fed by a an initial well or wells supplying 4 l/sec (63 Usgpm) to 6 l/sec (95 Usgpm). The reservoirs will be at an elevation of approximately 1875m relative to the base resort at an average elevation of approximately 1725m.

The water supply tanks include a quantity of water dedicated for fire protection from each half of the split reservoir (poured in place concrete tanks). The total firewater capacity is 684 m3 or 684,000l (180,693 Usgal). This arrangement is designed to provide a fire flow of 150 l/sec. Future expansion of the water supply and additional reservoir capacity will enable the system to accommodate higher fire flows with expansion of the fire water supply to about 2000m3 (530,000 Usgal). This appears conservative and will more than meet the anticipated water demand for a fully sprinklered community.

It is recommended that the water demand be reworked prior to construction since the main sizes (depending on length of run, looping, etc) could be significantly reduced relative to designs for unsprinkelered subdivisions. More precise calculations prior to development may also preclude the need to construct the future reservoir components (wells) for fire water purposes. Hydrant type and distribution (distance between hydrants) could be modified to achieve some future cost savings.

The fire flow requirements, as reviewed by McElhanney Engineering, show that the fire flow requirements for other than single family chalets will be based on sprinklered buildings and with a hose allowance added. The flow calculated using this approach appears to be 41. litres / second with a required fire flow duration of 90 minutes.

The water works requirements for single family are calculated to be 95 litres/second for 120 minutes based on the Insurance Services Office requirements. This assumes unsprinklered 1 and 2 family dwellings. This fire flow calculation may be significantly reduced for sprinklered chalets bringing the fire flow in line with those calculated for sprinklered, Ordinary Class I group occupancies. The difference would be a higher duration of 120 minutes. In our view, the calculated fire storage requirements based on 95l/second (1500 Usgpm) for two hours should be reasonable for most sprinkler applications. Although this fire flow is significantly less than Fire Underwriters Survey requirements, it is a reasonable fire flow requirement recognizing that available flow is only as good as the capability of the fire departments to use the water. Also, high volumes of water for structural fires are not anticipated due to the effectiveness of sprinklers in automatically suppressing fires with relatively modest amounts of water compared with suppression of fires in unsprinklered buildings.

7.0 OTHER FIRE RISKS

A complete assessment of fire risk should be made prior to construction based on a detailed on site review. Nevertheless, a general review of fire risk that exists outside the proposed buildings translating external to internal fire risks may be made. These include.

- exterior building fires
- fires in exterior storage, materials
- wild fires
- vehicle and transportation related fires.

7.1 Roof Coverings

The use of untreated wood shingles is a hazard that cannot be reduced by internal fire protection systems. Fires involving untreated wood shingles can rapidly generate sparks that ignite adjacent roofs, brush and dry forests. It is therefore recommended not to use wood shingles on roofs or to limit the use of wood shingles and other roof coverings to the fire retardant type designated as a

minimum of that specified by the B.C. Building Code (refer to following section) but not less than Class C. This includes wood shingles in single family chalets.

7.2 Fires in Exterior Storage

The fire risk associated with exterior storage varies, depending on the nature and quantity of materials, height of storage and other factors. The fire risk associated with external storage will be reduced by fire prevention inspections (to confirm conformance with the B.C. Fire Code), as referred to in a later section and (for unusual cases), the provision of private hydrants (where excessive travel distance to hydrants exists). More details are included in the section detailing specific criteria to be used for design purposes.

7.3 Wild Fires

The responsibility for fighting forest fires lies with the provincial and federal forest fire fighting agencies. In B.C., the Ministry of Forest Fire Protection Branch has a province wide infrastructure to prevent and control forest fires. Also, on Crown Lands, they are responsible for their on fire fighting resources. Clearance to property lines is important to reduce the risk of a forest fire involving single or multiple structures. The minimum recommended distance to buildings is dealt with later in this report. The Master Plan includes appropriate recommendations designed to reduce the exposure to resort fires and forest wild fires.

It is anticipated that individual sprinklered dwellings will pose little or no risk to the forested areas except where external (e.g. storage) fires are involved. There is also some risk of ignition of vegetation from chimney or uncontrolled trash burning, etc. Chimneys should be equipped with spark arresters to address this concern.

8.0 BUILDING CODE AND RELATED REQUIREMENTS

The B.C. Building Code will be used as a basis for design of all buildings in the resort. It is not the intent here to reproduce all the requirements of the B.C. Building Code. Rather, it is the objective to assess what design criteria should be laid out to limit the required fire department response capabilities to that actually available.

It is assumed that the maximum capability of the responding fire department will be determined by:

1. The suppression capability that can be reasonably available within the Resort within a response period of approximately five minutes.

2. Available financial and other resources required to provide a full scale fire department along the lines of a municipal fire department. It is anticipated that the available resources on site will provide a first response capability capable of extinguishing typical fires within the community with relative nominal amounts of water. The assumption is that major structural (building) fires will not occur. This is a reasonable assumption provided all buildings are fully sprinklered and:
   a) significant outside storage hazards do not exist,

   b) significant wild fires do not occur.

These assumptions must be properly examined since the fire flow requirements of either of these two scenarios could easily overtax the available fire flows and particularly the storage capacity available within the resort.

8.1 Forest Fires

The Ministry of Forests has no legislative requirements pertinent to clearance between structures and forest lands. However, they have recommended guidelines, which are published with two objectives:

A. To minimize structural fires arising from ignition of vegetation leading to the need for response from provincial forest fighting agencies.

B. To minimize ignition of structures arising from the impact of forest and brush fires on public property / buildings.

The master Plan includes recommended measures that follow the appropriate sections of the Ministry's guidelines . The recommended clearance requirements are based on the creation of defensible zones between wildfire and the structure.

Zone 1 – calls for vegetation management within 10m of the structure. This has the objective of reducing the probability of a serious fire around a structure arising from densely arranged vegetation that could be ignited from radiation emitted from a forest / brush fire.

Zone 2 – calls for a further 30m vegetation management zone (in addition to the previous 10m) clearance. This zone is expected to support slower moving fires. This is a function of vegetation, climate, and topographical and other factors. Local conditions will be consulted through the local Ministry representatives.

The above guidelines are provided to assure reasonable protection of the natural flora and likewise reasonable protection against wildfire impacting the built environment in the Jumbo Glacier Resort. It is anticipated that water supplies within the resort community will enable fires in properties meeting these criteria to be mopped up relatively easily using the available fire suppression resources within the community. The water supply requirements will exceed that required for small hose or other equipment need to mop up a structural fire and / or assist with the suppression of forest fires that may otherwise affect the fire safety of structures.

8.2 Structure Fires

The current B.C. Building Code requirements assume response by a local fire department within a period of 10 minutes. Since this resort community is assumed to be fully sprinklered, the need for an organized fire department is limited to a fast response / rapid attack force which will encounter fires in the early stages rather than fires that have progressed to fully involve structures. This can only be effective in conjunction with a fully sprinklered strategy as previously described.

To achieve this, one has to examine possible failure modes associated with structures fully sprinklered in accordance with the B.C. Building Code. Failure modes are submitted in the following table taken from a presentation to a UBC Workshop on Performance Based Design presented by John Ivison, P.Eng.

PREVENTABLE FAILURES			
Factors	Shortcomings in Design	Human Factor	Lack of Monitoring / Supervision
Water Shut-off	237	533	247
Partial Protection		254	
Inadequate Water Supply	243	15	27
System Frozen	44		
Slow Operation	20	7	
Defective DPV		53	
Faulty Building Construction	182		
Obstruction of Distribution		235	
Hazard of Occupancy	214		16
Exposure Fire Overpowered System	52		
Inadequate Maintenance		252	
Total (2651)	992	1369	290

The above table shows that there are three primary categories of failures as follows:

1. Shortcomings in Design – a typical scenario is illustrated by fires in speculative or mult-tenant buildings that are provided with base sprinkler protection designed for an ordinary hazard group. The lack of acceptable design / review or regulation can lead to the introduction of occupancies that cannot be controlled by the base system provided in the building.

   The introduction of special hazards into buildings such as tire or carpets on racks introduce fires that may not be controlled by sprinkler systems.

2. Human Factors – These predominate as factors leading to system failure. Approximately 90% of sprinkler system failure is related to human failure.

3. Lack of Monitoring / Supervision – Valves inadvertently closed is a common cause of sprinkler failure. Building Codes require monitoring of sprinkler valves in most instances. Also, unsupervised systems (i.e. not connected to a Central Station or Fire Department) can lead to either excessively large fires or later intervention that may result in fires beyond the capabilities of a rapid response fire department. Several measures therefore can provide a higher level of reliability to reduce the probability that early intervention is not achieved, namely:

- Supervision of all essential valves or in the case of single family chalets, installing the take-off for the sprinkler supply upstream of the take-off for domestic water. This means that the shutting of the sprinkler system also shuts off the domestic supply. Consequently, since the owner will generally minimize the interruption of the domestic supply, then interruption of the automatic sprinkler system is less likely.

A potential problem would exist with those owners who might wish to winterize their homes, i.e. shut-off heating. This is an unlikely scenario given that the resort has its high season in winter. However, to avoid this danger, which poses the potential for frozen plumbing as well as sprinkler lines, it is recommended that a Fire Bylaw be created to regulate the fire prevention within the resort community. Such a by-law would mandate a minimum level of heat within a building to eliminate temperatures below the freezing point.

- Connection of all automatic sprinkler systems to a Central Station or Propriety Station (constantly supervised station within the Resort). This will provide more rapid response to activation of a sprinkler or other device increasing the likelihood of early intervention. It also has the advantage of preventing significant water damage arising from flow of sprinklers. Otherwise, in some cases, sprinklers may extinguish or control the fire but flow for excessive periods without intervention.

A brief comment is also required on the failure factors listed in the table below:

FACTOR	CONSEQUENCE / PROBLEM	RESPONSE
Water Shut-Off		- Regular inspection of municipal valves. - Supervision of all standpipe / sprinkler valves
Partial Protection (significant unsprinklered areas)		- Not permitted. Mandate acceptable sprinkler coverage.
Inadequate Water Supply		- Eliminate high risks beyond available fire flow. - Process permits with acceptable review / analysis of sprinkler designs to prevent overtaxing the supply. - Mandate private water supplies to cover high-risk anomalies. - Inspect risks regularly to prevent inadequately protected buildings.
System Frozen		- Minimize unheated buildings. - Mandate minimum temperatures in buildings.

		- Mandate annual trip tests of dry systems. - Establish qualification requirements for maintenance of systems. - Enforce building code measures to prevent freezing. - Minimize dry systems (heat buildings). - Mandate accelerators for systems with capacity over 500 Usgpm.
Defective DPV		- Minimize DPV's - Mandate annual trip testing.
Faulty Building Construction		- Fully sprinkler all spaces. - Enforce B.C. Building Code.
Obstruction to Distribution (fire shielded)		- Extended sprinkler protection to most areas, e.g. sprinkler, bathrooms and closets. - Regularly inspect premises to prevent obstructions. e.g. new offices introduced without extending sprinkler system. - Educate public/property owners.
Hazard of Occupancy		- Mandate higher standard of sprinkler protection for speculative buildings. - Mandate design review. - Mandate fire prevention inspections.
Exposure Overpowered System		- Sprinkler all buildings. - Protect garages and areas posing potential for well established fires. - Mandate fire prevention inspections.
Inadequate Maintenance		- Mandate maintenance / testing. - Educate property managers / owners. - Conduct fire prevention inspections.

The above provides a model for reducing the probability of sprinkler failure or conversely providing a high probability of successful control / extinguishment.

Other building code requirements of relevance are as follows:

1. Access Routes – The access routes specified by the B.C. Building Code are intended to provide reasonable access for firefighting purposes. It is anticipated that these can be met in most instances. Technically, one and two family dwellings are not required to face a street. In remote mountain areas such as Jumbo Glacier Resort, some access roads may not meet these requirements (for reasonable access) and may not allow easy access to be negotiated with a

conventional pumper, tanker truck or certain fast attack vehicles. In these cases, the access route requirements of 3.2.5.6. of the B.C. Building Code should be revised based on the access requirements of the vehicles anticipated to be used for rapid response to fires and on the requirement for sprinklers, which may be surpassing B.C. Building Code requirements. However, the access provided should be negotiable in all conditions by the emergency vehicles provided (probably modified four wheel drive vehicles) and not pose overhead, width or other restrictions to reasonable access of the emergency vehicles for which the access routes will be designed .

8.3 Water Supply

The Master Plan confirms that all buildings will be serviced by the water supply infrastructure. In general sprinkler installations will be in conformance with NFPA 13 and no exceptions should be made. However, alternate water supply arrangements for sprinklers can be made if in conformance with the applicable standard such as NFPA 13D. The minimum services will be as per the B.C. Building Code which specifies all services requirements based on the fixture units served, the distance from the water supply services and the piping material utilized.

8.4 Standpipe Systems

The B.C. Building Code requirements are predicated on the assumption that a reasonable fire department response exists. Consequently, small hose outlets for occupant use are not necessarily provided on standpipe systems. This is not appropriate for a rapid response group that may be appropriately trained for small hose but are not capable of handing full size hose. Also, the role of occupants in extinguishing fires is largely ignored under current codes. The failure of occupants to control certain fires has resulted from the lack of hose on systems in various instances. This usually has coincided with a delayed fire department response leading to a very large fire, which might otherwise have been easily brought under control by the person who discovered the fire. For this reason, the following buildings are proposed to be equipped with Class II standpipe and hose systems in addition to any requirements to Class I and II systems currently in the Code. A standpipe and hose system will be required for all buildings except those exempt under 3.2.5.9 (4) of the B.C. Building Coe. This means that a standpipe and hose system will be required in a building that is:

(i) more than 2 storeys in building height

(ii) more than 9 metres in building height

(iii) more than 600m2 in area irrespective of building height.

Hose connections shall be 38mm for buildings up to 4 storeys in building height and 64mm for all buildings greater that 4 storeys in building height. All buildings requiring a standpipe system should be equipped with 38mm hose connections equipped with hose. The latter should be located in the floor area for use by occupants and the rapid attack force. The standpipe systems should also be provided with a wall hydrant to improve the accessibility of water supplies for firefighting purposes.

Note that it is assumed that for large buildings private hydrants be provided such that all parts of the building be within 90m of a hydrant even if provided with a pumper connection, not just to the principal entrance described in 3.2.5.5 (3) of the B.C. Building Code. This applies whether or not the different sections of the building are cut off as described under Sentence 3.2.5.5. (4) of the Code.

As previously discussed, certain failure modes are assumed to be acceptable where large municipal fire departments are available to control and extinguish the fire, but cannot be allowed in a remote area where they could lead to infrequent but large fires beyond the capability of the local resort or nearby supporting fire departments.

The historic reliability of effectiveness of fire sprinklers is based on comprehensive application of fire sprinklers throughout facilities as substantially described in the design standard NFPA 13. Many recent revisions to the sprinkler design standard NFPA 13 have been made that introduce possible failure modes that may not be acceptable where only a limited fire department response is available.

The subsequent creation of residential sprinkler design standards NFPA 13D & then NFPA 13R, were based on a primary goal of life safety, with property protection a secondary goal. The primary objective has been facilitated through the development of the residential sprinkler (a type of fast response sprinkler) with superior earlier response characteristics; and reduced sprinkler system performance capacity installation simplifications which permitted a lower cost system. Cost has been a major factor in the development of these standards to facilitate greater adoption of this technology. It is understood that such sprinkler systems will be less reliable and will not be as effective in achieving property protection objectives. Therefore all buildings except single family chalets will be protected in accordance with NFPA 13. In the context of

Jumbo Glacier Resort and the proposed resort community fire protection measures and infrastructure, it is proposed to adopt some modifications to the above referenced sprinkler design standards.

All these standards will still form the basis of the sprinkler strategy; acceptable life safety will be achieved. To effectively pursue an acceptable level of community fire protection, supplemental enhancements are recommended primarily with respect to the extent of sprinkler coverage. Such improvements will better achieve fire detection and fire control, which are key elements of the community fire protection plan.

9.0 SUMMARY OF FIRE PROTECTION MEASURES

9.1 Automatic Sprinkler Systems

9.1.1 Single Family Chalets – Buildings will be sprinklered in accordance with NFPA 13D – attached garages, closets and bathrooms will be sprinklered. Also, roof spaces will be exempt

9.1.2 Townhouses and Condotel Buildings (if of combustible construction) up to 4 storeys will be protected in accordance with NFPA 13, including sprinklering of bathrooms, closets and roof spaces.

9.1.3 Higher buildings will be fully sprinklered with the addition of sprinklers to closets and bathrooms.

9.1.4 All other buildings to be fully sprinklered in accordance with NFPA 13.

9.1.5 Installation shall otherwise be in accordance with 3.2.5 of the B.C. Building Code, except where exceeded by this guideline.

9.2 Standpipe Systems

Refer to Section 8.4 of this Report.

9.3 Roof Coverings

All roof coverings should be of Class A, B or C type including Part 9 buildings to reduce the probability of fire spread from roof to roof.

9.4 Hydrants

All parts of a building shall be within 90m of a hydrant. Wall hydrants will be provided on all buildings requiring a standpipe system. The outlets shall be the same size as the largest outlet required for the system (38mm or 64mm, depending on building height).

9.5 Proprietary Signalling System

A constantly attended proprietary fire alarm system should be provided to receive alarms on a 24 hour basis from all buildings required to be equipped with an automatic sprinkler system of fire alarm system. All automatic sprinkler systems shall be arranged to provide an alarm at the proprietary control center (to be located near the ski patrol / emergency response team office) on the following alarm conditions:

a) movement of a valve handle that controls the supply of water to sprinklers;
b) loss of excess water pressure required to prevent false alarms in a wet pipe system;
c) loss of air pressure in a dry pipe system;
d) loss of air pressure in a pressure tank;
e) a significant change in water level in any water storage container used for fire fighting purposes:
f) loss of power to any automatically starting fire pump; and
g) a temperature approaching the freezing point in any dry pipe valve enclosure of water storage container used for fire fighting purposes (the Fire By-law will require a minimum temperature to be maintained in all buildings equipped with a wet pipe sprinkler system including Part 9 Buildings. Part 9 Buildings including one and two family dwellings, will be arranged to provide an alarm on sprinkler flow. The water supply for dwellings will be arranged such that shut-off of the fire protections system will also shut off the domestic supply. This will minimize interruption of the protection, reducing potential sprinkler failures.

The proprietary signaling system shall be designed to NFPA requirements and the building can serve other functions to permit an efficient use of the building and facilities.

9.6 Fire Alarm Systems

Fire alarm systems shall be provided in all buildings required to be equipped with a fire alarm system under the B.B. Building Code. The exception is that if a building is fully sprinklered, then it will not automatically require a fire alarm system if monitored as previously described and the building does not require a fire alarm system to be installed for other reasons. Sprinkler systems will be supervised by the fire alarm system in such cases and alarm and trouble conditions monitored by the Proprietary Control Centre.