

REPORT ON

**OVERVIEW-LEVEL IMPACT ASSESSMENT OF THE
SPORT OF HANG GLIDING AND PARAGLIDING**



Submitted to:

B.C. Hang Gliding and
Paragliding Association
c/o Ste 332-33173 Old Yale Road
Abbotsford, B.C.
V2S 2J4

DISTRIBUTION:

2 Copies - B.C. Hang Gliding and Paragliding Association
2 Copies - Golder Associates Ltd.

August 24, 2006



061-450028

GENERAL SUMMARY: OVERVIEW IMPACT ASSESSMENT OF HANG GLIDING AND PARAGLIDING IN CANADA ¹

Hang gliding and paragliding are closely related sports, both being a form of foot launched aviation or free flight. The objective for pilots is to catch rising currents of air with the glider (or wing) in order to: engage in recreational flying (launch to landing), perform acrobatic flying, and/or compete in cross country flying which can involve traveling hundreds of kilometers. Recreational flying is the most common of these three activities, and this type of flying is used by pilots to safely and progressively improve flight and piloting.



Gliding into the Town of Oliver BC. Photo by Amir Izadi.

The main difference between hang gliding and paragliding is in the construction of wings and harnesses and in the type of flying experience. The hang glider uses sail stretched across a frame with an airfoil shape and is controlled by a pilot attached hanging prone below the centre-of-mass of the sail. By shifting his or her weight in the appropriate direction, a pilot can control the hang glider's angle of attack (air speed) and directional course. The paraglider has no airfoil shape until

the pilot inflates the glider by lifting it into the wind, which gives it an airfoil shape. The paraglider pilot is suspended below the sail and uses risers (attached to the sail by lines) during launch to inflate the wing and brake handles to control the paraglider's angle of attack (air speed) and directional course.

Different types of foot-launch flying can occur depending on wind conditions:

- Sled Riding - when there is minimal wind for soaring and no thermal lift, pilots can just glide from launch to landing in a relatively straight path which is relatively short in duration due to no updrafts available to soar;
- Ridge Soaring – when there is steady wind, a suitable ridge, and pilot skill, pilots can fly along the length of a ridge feature in the landscape, relying on the lift provided by

¹ While this general summary is an integral part of the report, it should not be used in lieu of reading the entire report, including the appendices. Information presented in this summary section is based upon an analysis of paragliding and hang gliding as a recreational and competitive sports and a review of four flying sites in British Columbia (conducted April – May 2006).

the air which is forced up as it passes over the ridge. With this type of flying, it is possible ‘top land’ on or close to the launch site; and,

- Thermal Flying – when there are thermals available, pilots find thermals and try to fly within the center of the thermal circle, where the air is rising the fastest in order to gain altitude. Once thermal flying is mastered, pilots can glide from one thermal to another for “cross-country” flying.

There are approximately 200,000 pilots world wide practicing these sports with the majority of these being in Europe. In Canada, there are approximately 850 pilots, with approximately 300 of these pilots residing in British Columbia, approximately 300 pilots in Quebec, and the remainder of pilots spread among the other Canadian provinces.

In Canada, the Hang Gliding and Paragliding Association of Canada/L’Association Canadienne de Vol Libre (HPAC/ACVL), secured the authority from Transport Canada to self-regulate its own hang gliding and paragliding activities, subject to Canadian Aviation Regulations. HPAC/ACVL is the body that is responsible for licensing pilots, instructors and flying schools in Canada and for negotiating and management the national insurance program. All pilots are required to undertake flight training through HPAC/ACVL-certified schools and to carry third-party liability insurance issued by HPAC/ACVL.

It is at the level of the local/regional flying clubs that management of individual flying sites and land use agreements occurs. Local clubs are responsible for information dissemination to club members, orienting visiting pilots, site development and maintenance, protecting sites from vandalism, and development and enforcement of safety standards (including fire



A gaggle of paragliders thermaling in Valle de Bravo, Mexico. Photo by Amir Izadi.

prevention measures) and codes of conduct. Local clubs and pilots place a high value on their sites and subsequently go to great lengths to ensure that relationships with landowners are also effectively managed and protected. Provincial associations (currently one in B.C. and one in Quebec) support local flying clubs in securing site

acquisition and land use agreements, management of tenured flying sites and in maintaining relationships with government agencies and the public.

Land is the sport's greatest asset since it is necessary for both launch and landing, however, very little time is spent on land as it is primarily used for transit to the sport's destination (which is the sky). The nature of the sport requires the use of land for both launch areas and landing zones. Hang gliders can launch from a 30' x 10' ramp and paragliders need no more than a quarter of an acre to launch. Launch areas are generally located on the top edge of a moderately steep slope that is relatively free of obstacles (i.e., trees, shrubs). Pilots access launch sites generally via existing Forest Service Roads or other existing access roads by carpooling in personal vehicles unless another mode of transport (i.e., shuttle bus) is available. For landing, two to three acres of relatively cleared land free of obstacles is necessary for hang gliders, although paragliders can land in areas as small as one acre. Landing sites are accessed by existing road networks. Even with the need for minimal land area to carry out the sport, availability of appropriate areas for flying sites are scarce due to competing land uses, specific climatic requirements for launch, flight, and landing, and availability of appropriate landing zone areas.

Once an appropriate flying site is identified, there is also the need to develop and maintain land use agreements and associated relationships to ensure access and use of sites. Launch and landing areas of flying sites can be either publicly or privately owned and thus, land use agreements are with the appropriate public agency or private entity/person. With support of provincial flying associations (if present) local flying clubs typically formulate formal land use agreements (for example, when flying sites exist on Crown Land or private commercially owned land). In some cases informal land use agreements are made with private land owners (generally these are verbally agreement with small farmers and other small land holders).



Flying in Dominican Republic. Photo by Jim Orava.

As with all recreational activities, paragliding and hang gliding have the potential to interact with a number of valued ecosystem components, both biophysical and socioeconomic in nature. These include the following:

Biophysical:

- Soil - there is potential for soil exposure and eventual erosion of exposed soils by wind, water, or foot and vehicular traffic as well as soil compaction resulting from repeated foot and/or vehicular traffic. Given that hang gliding and paragliding has a relatively minimal footprint on land resources, uses no 'permanent' structures, and utilizes existing access roads, the potential impact to soils is likely relatively low.



Mount Kobau, overlooking Oliver BC. Photo by Amir Izadi

- Surface Water - given that hang gliding and paragliding generally avoids surface water resources other than crossings along existing roads, the potential for the sport to impact surface water is likely relatively low.
- Vegetation, including Species of Management Concern - there is potential for loss of native plant cover and root systems and the loss of plant diversity due to trampling, vegetation removal, or due to the spread of invasive plants and an introduction of invasive or non-native plant species by accidental seed spreading or exposure of soils providing an opportunity for weeds to become established. However, given that hang gliding and paragliding has a relatively small footprint on land resources by using existing open areas for launching and landing and where possible utilizing existing access roads, the potential for impacts to vegetation is likely moderate to low.
- Wildlife, including Species of Management Concern - there is potential for the disruption of normal wildlife behavioral patterns (i.e., foraging, resting, and breeding) from human activities, pets, and vehicles, and increased potential for direct wildlife mortality resulting from vehicular accidents on access roads, and a potential for direct loss of availability and suitability of wildlife habitats due to vegetation removal. Since there are minimal sounds that are emitted from gliders, it is anticipated that hang gliders and paragliders should have relatively low impacts on wildlife.
- Livestock - there is potential for disturbances resulting in stress to livestock from vehicular traffic and uncontrolled pets and changes to livestock movements resulting of damage to gates and fences, or gates not being left as found. However, given that

the nature of hang gliding and paragliding activities are relatively non-intrusive with respect to noise and the physical area of land use is relatively small, the potential for impacts to range resources is likely to be low.

Socioeconomic:

- Aesthetics - there is potential for aesthetic disturbances due to clearing of forest areas, slope grading amounting of launch platforms and litter due to public usage. Efforts are made by individual flying clubs and local pilots to maintain and in some instances improve the aesthetics of the launch areas. From a community benefits perspective, cleared launch areas are also used by the public (non-pilots) as observation/viewing areas to enjoy surrounding vistas.
- Local Economy - The sport can have a positive economic impact (although deemed to be low and seasonal in nature) on local communities when pilots travel from outside a locality to use a flying site and when pilots undertake expenditures to start up and continue with the sport (pilots invest on average \$5000 - \$10,000 for initial equipment purchase and initial instruction, and on average and additional \$2,000 per year for equipment updates, insurance, club memberships etc.) Organized flying events and competitions also generate economic benefits to the local economy.

- Land Use - there is the potential for competing land use due site users sharing the same land areas with other recreational activities, with public physical infrastructure site maintenance activities (e.g. of weather stations or radio towers) and with commercial activities such as residential development,



Coming in for a landing. Photo by Amir Izadi.

given the nature of the two sports (with the destination being the sky) the potential for the sports to negatively impact the ability for other users (recreational, public and commercial) is likely to be low. In securing land use rights, both formal land tenureship agreements (public and private) as well as more informal land agreements with land owners are generally adhered to by the flying clubs that have secured these arrangements. Enforcement of specific parameters of the land use agreements is carried out and implemented by local flying clubs and pilots using the sites.

- Safety - positive health impacts of the sport of hang gliding and paragliding include access to and recreational use of the natural environment, exercise and positive psychological experience and wellbeing. HPAC/ACVL and most flying clubs/associations have their own safety standards/codes of conduct which provide safety guidelines for the pilots using a specific site. These standards typically include a strict no smoking policy and a no fire policy when using flying launch and landing zones and associated access roads. However, even with well-enforced safety guidelines and practices, hang gliding and paragliding have been viewed as recreational activities that can pose a safety risk to pilots. A number of accidents and incidents occur every year, which are reported to HPAC/ACVL as mandated by Transport Canada. Individual flying clubs also have an accident/incident reporting protocol and process for reporting accidents and incidents and for investigating the associated causes.
- Heritage and Historic Sites - any recreational activity has the potential to disturb or damage historic or heritage sites and features, including those protected by the Heritage Conservation Act. Given that paragliding is a low impact sport involving minimal disturbance to the terrestrial environment, and that most hang gliding and paragliding activity takes place on land which has been previously disturbed (due to industrial logging, agriculture, etc.) the likelihood of disturbance or damage to historic or heritage sites is low.



Gliding over the Lower Similkameen Valley.

The likelihood of occurrence and levels of significance of these impacts will be site specific depending on the conditions present at a particular site and how much the site is used. Also, site specific development and enforcement of codes of conduct, safety standards and site specific maintenance activities are currently being implemented by local flying clubs and pilots.

Acknowledging these two factors, the following are general mitigation measures², which are

² These mitigation measures are provided as the common mitigation measures practiced at existing flying sites. A complete discussion of the currently used and suggested mitigation measures are provided in Section 5.0 of the report.

currently practiced as an integral part of the flying community's general policy, to address the above potential impacts of the sport: (the application of these measures are tailored to site specific needs and conditions);

- Provision of training and certification/rating of pilots;
- Allowing flying only from sites which a pilot is rated for;
- Provision of third party liability insurance;
- Development and implementation of a site safety plan/policy and launch, flight and landing codes of conduct;
- Ensuring visiting pilots are aware of a site's code of conduct, rules and other pertinent information (e.g., site access, launch/landing fees, locations of authorized landing zones, boundaries);
- Reporting of incidents and accidents;
- Practicing fire prevention and vigilance, for example absolutely no campfires or smoking;
- Limiting the footprint of the sport on land resources;
- Education of members about the various valued ecosystem components at the flying sites and sharing this information with other recreational users;
- Use of existing roads and paths, as opposed to the building new ones;
- Obeying road or area closures;
- Applying the 'pack it in and pack it out' approach to sites;
- Stabilization of soils by planting of native plant species;
- Minimize the proliferation of weedy plant species;
- Protection of known critical wildlife habitats (i.e., feeding areas, riparian areas, nesting/calving sites) and heritage/historic features;
- Avoid disturbing or startling wildlife species and livestock;
- Maintaining positive relationships with landowners at launch and landing sites;
- Working collaboratively with public and/or private land owners to develop land use agreements where appropriate;



Hang glider landing at Mt. Woodside, Agassiz, BC. Photo by Martin Henry.

- Sharing information on the sport with local governments and local community to educate people on the sport and ensure effective integration of flying site development and usage with local community plans; and,
- Development and implementation of mechanisms to ensure protection of heritage and historic features.

The development of site-specific land use management plans for each flying site will be essential to identify the valued ecosystem components which exist at specific launch and landing sites. These management plans will also include site-specific mitigation measures which are either currently being practiced or are recommended to be established in order to protect and/or minimize impacts to the valued ecosystem components.



South Okanagan Grasslands. Photo by Amir Izadi.

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
1.0 INTRODUCTION	1
1.1 Purpose of this Assessment	1
1.2 Scope of this Assessment	1
2.0 THE SPORT OF HANG GLIDING AND PARAGLIDING	3
2.1 Common Terminology	3
2.2 Background	4
2.3 Current Management of the Sport in Canada	6
2.4 Current Regulations and Pilot Certification	7
2.5 Activity Summary	10
2.5.1 Launching	10
2.5.2 Flying	11
2.5.3 Landing	11
3.0 SAFETY	12
4.0 IMPACT ASSESSMENT	13
4.1 Physical and Biological Components	15
4.1.1 Soil and Surface Water	15
4.1.2 Vegetation	16
4.1.3 Wildlife	17
4.1.4 Species of Management Concern	17
4.1.5 Livestock	18
4.2 Socioeconomic Components	19
4.2.1 Aesthetics	19
4.2.2 Local Economy	19
4.2.3 Land Use	22
4.2.4 Physical Services and Infrastructure	24
4.2.5 Safety	25
4.2.6 Heritage or Historic Sites	28
5.0 MITIGATION MEASURES	28
5.1 Biophysical Effects and Mitigation Measures	29
5.2 Socioeconomic Effects and Mitigation Measures	32
5.2.1 Aesthetics	32
5.2.2 Engagement With Communities and the Local Economy	33
5.2.3 Land Use	34
5.2.4 Safety	37
5.2.5 Heritage and Historic Features	38
6.0 CONCLUSIONS AND RECOMMENDATIONS	39
7.0 CLOSURE	40
8.0 REFERENCES	41

9.0 STATEMENT OF LIMITATIONS.....46**LIST OF TABLES**

Table 2-1	HPAC/ACVL Pilot Rating Requirements
Table 4-1	Levels of Significance
Table 4-2	Components of the Natural and Human Environment (Valued Ecosystem Components) which have a Potential to Interact of the Sport of Paragliding and Hang Gliding
Table 4-3	Average Pilot Expenditures for Four Flying Sites in B.C. (N=50)
Table 4-4	Flying Site Operational Expenditures
Table 4-5	Search and Rescue (SAR) Statistics
Table 5-1	Biophysical Effects and Mitigation Measures

LIST OF APPENDICES

Appendix I	Background Information on HPAC/ACVL and BCHPA
Appendix II	HPAC/ACVL Pilot Certification and Ratings, and Draft Instructor Certification and Tandem Endorsement
Appendix III	British Columbia Regulatory Context
Appendix IV	Background on Four B.C. Flying Sites and Associated Baseline Information
Appendix V	Maps and Figures for Four B.C. Flying Sites
Appendix VI	Hang gliding and Paragliding Pilot Survey
Appendix VII	CDC Maps and Lists of Species and Ecological Communities of Management Concern that Potentially Utilize the British Columbia Sites

1.0 INTRODUCTION

1.1 Purpose of this Assessment

Golder Associates Ltd. (Golder) has been commissioned by the B.C. Hang Gliding and Paragliding Association (BHCPA) to conduct an environmental assessment of flying activities at selected sites in British Columbia. Golder understands that an overview-level impact assessment document is required as a basis for providing an understanding of the environmental impacts related to the sport of hang gliding and paragliding for audiences such as landowners, provincial and federal approving agencies as well as insurance agencies. The scope of this assessment is not intended to create site-specific Environmental Assessment for the agency review, but to create a companion document to be used in the determination of impacts during the review and approval process for future Licenses of Occupation, or other forms of land tenure depending on the location of specific sites.

Of critical importance is to demonstrate that the destination of hang gliding and paragliding is the sky, rather than the land. The land is utilized as an access to the sky on short term basis and it is temporarily 'accessed' rather than 'used' as is typical of other recreational sports such as mountain biking, use of all terrain vehicles and hiking. In addition, the 'footprint' used by the sport is relatively small because of



Hang glider launching at Mt. Woodside, Agassiz, BC. Photo by Dan Fabian.

the use of previously developed areas (i.e., forest lookouts, communication towers, etc.), carpooling is widely practiced, launch ramps are often non-permanent, and the required land base is relatively small.

1.2 Scope of this Assessment

This impact assessment process is not driven by any particular legislation or regulation and was instead determined to be a reference and information source for the future development of land management plans and land tenure agreements or renewals with

private landowners and the Province. Additionally, this assessment will help provide overview-level information when entering into land tenure negotiations and in discussions with Parks Canada regarding access to potential flying areas in National Parks.

Since member organizations may be required to go through a federal environmental review process (i.e., for activities taking place in a National Park) under the *Canadian Environmental Assessment Act* (CEAA), Golder has opted, for this report, to generally follow several of the protocols required for a CEAA screening assessment (i.e., description of biophysical and socioeconomic environments, assessment of impacts, and mitigation measures (existing and recommended).



Road to launch, Green Mountain, Vancouver Island, BC.
Photo by Amir Izadi.

For the purposes of this overview-level report, Golder has not conducted any detailed studies or inventories of fish and fish habitat, wildlife, vegetation, or species of management concern, nor included any CEAA-specific information such as effects of environment on the project activity, accidents and malfunctions, residual effects, or cumulative effects analysis. Golder has not conducted any archaeological assessments, or assessments regarding the potential

for contaminated water or soils as these would only be necessary based on potential future regulatory requirements.

The information for this assessment was collected through:

- Review of available information related to the sport of hang gliding and paragliding;
- Review of provincial census information and other government sources;
- Review of government land use plans and mapping information;
- Review of existing Licenses of Occupation, special use permits and other land use agreements for four flying sites (Woodside, Malahat, Kobau and Golden);
- Verbal interviews and email exchanges with a number of members of the British Columbia Hang Gliding and Paragliding Association (BCHPA), private land owners and flying school operators;
- 50 completed Pilot Surveys (developed specifically for this overview impact assessment);

- Review of available hang gliding and paragliding impact studies, management plans, and operational policies such as those developed by the Queensland Parks and Wildlife Service, New South Wales Department of Environment and Conservation Deutscher Hangegleiterverband (Germany), and South African National Parks; and,
- 2 site visits - one to the Vancouver Island (Malahat) and one to the Fraser Valley (Woodside) flying sites - to observe flights and landings, where possible. For information related to the Golden and Kobau sites, Golder relied on photographs, video images, secondary written information and documentation and information provided by members.

2.0 THE SPORT OF HANG GLIDING AND PARAGLIDING

2.1 Common Terminology

The following gliding terminologies are used frequently amongst pilots, with some being used throughout this report (based upon personal communication, BCHPA, 2006):

Hang glider: Commonly referred to as a glider. In its modern form, a glider with a rigid structure that is controlled by weight shift. The rigid structure is constructed from materials such as aluminum alloys, and carbon fibre composites, while the sail is made of a durable impermeable coated Dacron polyester fabric. Components of a hang glider include down tubes and a cross tube which the pilots grasps to control the aircraft.

Paraglider: Commonly referred to as a glider or wing. In its modern form, a glider with no rigid structure that is controlled by weight shift and deformation of the sail. The glider consists of a lightweight impermeable nylon sail and a set of polyaramid (Kevlar) and/or polyethylene (Dyneema) lines that function together in a way similar to a ram air parachute. There are openings near the leading edge of the sail that allow air to inflate the sail during flight which maintains it is the shape of efficient air foil.

Pilot: anyone engaged in paragliding or hang gliding flight activities

Harness: Both paraglider and hang glider pilots use a harness to attach themselves and their instruments and supplies to the glider.

Instruments: Many pilots use all or some of the following instruments in flight: Vario, GPS, two way radio.

Variometer or Vario: A sensitive barometric device for determining altitude and rate of descent or ascent.

Global Positioning System or GPS: Uses satellite signals to determine and record a pilots position in three dimensions. Useful for determining direction and speed while in flight.

Two way radio: Used to communicate with other pilots or people on the ground; many pilots have Certificates of Proficiency in Amateur Radio granted by Industry Canada, so that they can legally transmit on the Amateur Radio bands. Two way radios also allow pilots to receive weather information from nearby airports and forecast centres.

Reserve: A reserve parachute, safety equipment carried in the event of an in flight incident or failure of the glider. The reserve is carried inside the harness. Sometimes also referred to as a chute.



Launching with a paragliding tandem passenger, Bridal Falls, BC.
Photo by Bob Fletcher.

Launch: The area that pilots take off from at the beginning of their flights; also the act of taking off. Launching is not referred to as ‘jumping’.

LZ or Landing: The area where pilots land.

Hang Gliding and Paragliding Association of Canada (HPAC/ACVL): The national association for the sport, often pronounced H-pack.

United States Hang Gliding and Paragliding Association or USHPA: The American equivalent of HPAC/ACVL.

2.2 Background

Hang gliding in Western Canada started in the early 1970s. Paragliding is a relatively newer sport but is gaining popularity with pilots. There are approximately 850 registered pilots Canada wide. Out of this number, there are approximately 300 pilots residing in British Columbia.

Hang gliding and paragliding are both forms of foot launched aviation or free flight. The objective for pilots is to catch rising currents of air with the glider (or wing) in order to: a) engage in recreational flying (launch to landing), b) perform acrobatic flying, or c) compete in cross country flying (which can involve traveling hundreds of kilometers). Recreational flying, the most common, is used by pilots to safely and progressively improve flight and piloting.

The main difference between the two sports is in the construction of wings and harnesses and in the flight experience. The hang glider uses a Dacron sail stretched across an aluminum frame with battens inserted to give it an airfoil shape. The pilot hangs prone below the sail in a pod type harness connected to a hang strap with a carabiner which is in turn connected to either the keel or kingpost of the hang glider. The forward and backward movements of the pilot within the triangular A-frame controls the glider speed and angle of attack.

The paraglider has no airfoil shape until the pilot inflates the glider by lifting it into the wind. In the case of the paraglider, it is the air which gives it an airfoil shape. The paraglider has many lines (or strings) attached to the bottom of the sail which all meet down below at the 'risers' or straps which the pilot uses during launch and flight to control the wing. The pilot is suspended



Soaring above the cliffs at Dallas Road, Victoria, BC. Photo by Amir Izadi.

below the sail in a harness connected to the risers. Brake handles also meet at the risers and are used to control the glider speed and angle of attack (*Pers. Comm.*, BCHPA, 2006).

The BCHPA (2006) summarizes the differences between hang gliders and paragliders in flight as follows:

- Paragliders are lighter, smaller and easier to transport than hang gliders;
- The learning curve with paragliding is faster;
- Launches are easier to abort in a paraglider;
- Hang gliders fly at a faster speed than paragliders;

- The hang gliding pilot is hanging very closely to the glider and so their control inputs are very direct and feedback from the glider is felt through the A-frame;
- The paraglider pilot is hanging further away from the wing and feedback is felt through the brake handles and risers and seat of the harness;
- A high performance paraglider can glide as far and as fast as a beginner hang glider;
- Hang gliding wings can fly in higher wind conditions and more turbulent air than paragliders;
- Paragliding wings do much better in light conditions where a hang glider might not have enough lift;
- Paragliding wings can be manipulated to make more aerobatic (acro) movements; and,
- Both paragliding and hang gliding require a different set of pilot skills. Both types of pilots carry a reserve parachute and wear helmets.

2.3 Current Management of the Sport in Canada

The sport of hang gliding and paragliding is considered to be self-regulating. In Canada, the Hang Gliding and Paragliding Association of Canada/L'Association Canadienne de Vol Libre (HPAC/ACVL), a non-profit corporation secured the authority from Transport Canada to self-regulate its own activities, subject to Canadian Aviation Regulations. In addition to representing and supporting the interests of the sport



View from Mount Kobau of the Town of Cawston. Photo by Amir Izadi.

at a national level, HPAC/ACVL also provides Third Party Liability Insurance and formal pilot certification ratings.

The Canadian provincial associations including but not limited to the British Columbia Hang Gliding and Paragliding Association (BCHPA), the Alberta Hang Gliding & Paragliding Association (AHPA), Manitoba Hang Gliding Association (MHGA), the Association Québécoise de Vol Libre (AQVL), and Hang Gliding and Paragliding Association of Atlantic Canada (HPAAC) administer the sport at a provincial and/or regional level. Specifically, they provide liaison and communications between the local clubs, governments agencies, and HPAC/ACVL, facilitate negotiations on land use issues as they affect flying sites (and provide resources to local clubs/societies in support of this

process, oversee) oversee the effective management of tenured flying sites and help cultivate relationships in sectors with whom the flying community does business.

It is at the level of the local clubs/societies that day to day management of individual flying sites occurs. Local sites are generally found, used, maintained, managed, and protected by the local pilots and (if present) the local flying club/society responsible for the site. In this regard, the flying club board members and/or local pilots frequenting a site provide information and resources to other pilots using the site, manage site maintenance, and enforce rules, equipment requirements and safety at local sites (individual flying sites have specific requirements for safe launching and landing based upon unique characteristics of site access, exposed launch area, wind lift and proximity to appropriate landing areas). Because flying sites are relatively hard to find and land use agreements with both public and private parties require much time and resources to get established, local pilots and clubs place a very high value on their sites and subsequently are very careful in ensuring that sites and relationships with landowners are effectively managed and protected.

2.4 Current Regulations and Pilot Certification

Hang gliding and paragliding are the least regulated segments of aviation due to the nature of these sports and the early efforts of the HPAC/ACVL to secure the authority to self-regulate its own activities, subject to Canadian Aviation Regulations. In Canada, the sport of paragliding and hang gliding is self-regulated by the Hang gliding and Paragliding Association of Canada (Hang Gliding and Paragliding Association of Canada/L'Association Canadienne de Vol Libre, 2006). Provincial associations (in B.C., this is the British Columbia Hang Gliding and Paragliding Association, or BCHPA) administer the sport within each province (Refer to Appendix I for background information on HPAC/ACVL and BCHPA). Each pilot who is a member of HPAC/ACVL has Third Party Liability Insurance coverage (\$3,000,000) which covers landowners for lawsuits brought against them by non-participants. Pilots often sign a waiver, in which they release the landowners for liability for any injury which a pilot suffers while using a landowners property.

Operations of hang gliders and paragliders in Canadian airspace are governed by the Canadian Aviation Regulations (CARS) that are administered by Transportation Canada¹. Under CARS, hang gliders and paragliders are not required to be registered or to bear identification marks on their gliders and there are no airworthiness standards or requirements imposed. In addition, the Canadian Aviation Regulations do not impose any

¹ The Canadian Aviation Regulations, under the federal *Aeronautics Act*, are a compilation of regulatory requirements designed to enhance safety of the Canadian aviation industry. As with international organizations regulating the sports (such as the Federation Aeronautique Internationale or FAI), Transportation Canada makes no distinction between the two types of aircraft (hang glider and paraglider).

training requirements for hang glider or paraglider pilots and the regulations do not require these pilots to hold any pilot license or permit to operate their aircraft. Airspace is divided into 7 different classes. The classes are in a hierarchy with Class A having the most requirements and Class G airspace having the least requirements. Class F airspace is the type of airspace that encompasses CYAs (advisory) and CYRs (restricted) which are areas that are set aside for special use. Many areas of high hang gliding and paragliding activity such as the Fraser Valley and Southern Vancouver Island have CYAs specifically designated for hang gliding and paragliding.

Hang gliding and paragliding activities generally occur in Class F and G airspace. However, after successful completion of the Hang Glider Air Regulations (HAGAR) examination, which is a Transportation Canada requirement as well as a legal requirement, hang glider and paraglider pilots may



Ground skimming in ridge lift. Photo by Amir Izadi.

also use Class E² airspaces. HAGAR is now (as of April 2006) administered by designated schools on a fee-for-service basis on behalf of Transport Canada. HAGAR exam components cover the operational provisions of the CARs and Air Traffic Services and Procedures that are appropriate to the operations of gliders in accordance with flight under the Visual Flight Rules (VFR). Pilots must also have a working understanding of the general topics of Air Law and Procedures, Flight Instruments, Navigation, Flight Operations, and Human Factors and be able to apply these subjects practically.

Formal pilot certification is provided through certified Canadian paragliding and hang gliding schools and is a national requirement which all pilots must meet in order to be licensed to fly by HPAC/ACVL (HPAC/ACVL, 2006). Typically, student pilots learn the sport at the sites closest to their homes, and as a result develop an early appreciation of the special concerns for their local sites. The HPAC/ACVL rating system consists of five levels each for hang gliding and paragliding (refer to Table 2-1). A pilot can hold

² Class E airspace - Controlled airspace within which both IFR (instrument flight rules) and VFR (visual flight rules) flights are permitted, but VFR flights do not have to establish two-way communications with the appropriate ATC (air traffic control) agency prior to entering the airspace. ATC separation is provided only to IFR aircraft. All high level controlled airspace above FL (flight level) 600 within the SCA (Southern Control Area), NCA (Northern Control Area) and ACA (Arctic Control Area) is Class E airspace. Also, low level airways, low level fixed area navigation (RNAV) routes, control area extensions, transition areas, or control zones established without an operating control tower may be classified as Class E airspace. (Source: Transport Canada, 2006)

one rating for hang gliding and a separate rating for paragliding. The introductory level is considered a Student Diploma and is aimed at introducing pilots early on to the HPAC/ACVL rating system and to make them aware of the Association. The sequential ratings include Student Diploma, Novice, Intermediate, and finally advanced. Applications to advance in ratings are made to the HPAC/ACVL Business Manager and documentation of attainment of qualification has to accompany the application.

**Table 2-1
HPAC/ACVL Pilot Rating Requirements**

Rating	Paragliding	Hang gliding
Student Diploma	<ul style="list-style-type: none"> • Beginner course that includes: • Five supervised flights • Flight test • Written examination • Five minutes airtime 	<ul style="list-style-type: none"> • Beginner course that includes: • 20 supervised flights • Flight test • Written examination • Five minutes airtime
Novice	<ul style="list-style-type: none"> • 30 supervised flights • Flight test • Written examination • Two hours airtime 	<ul style="list-style-type: none"> • 75 supervised flights • Flight test • Written examination • Two hours airtime
Intermediate	<ul style="list-style-type: none"> • 80 flights above 250 metres or 40 flights above 250 metres & 40 flights below 250 metres of 10 minutes or more duration • Ten inland flights • Five different sites • HAGAR examination administered by Transport Canada • Ten hours airtime • Basic first aid recommended 	<ul style="list-style-type: none"> • 150 flights • Ten inland flights • Five different sites • HAGAR examination administered by Transport Canada • Ten hours airtime • Basic first aid recommended
Advanced	<ul style="list-style-type: none"> • 150 flights • 10-km cross-country flight • Written examination • Fifty hours airtime • Basic first aid recommended • Advanced maneuver clinic recommended 	<ul style="list-style-type: none"> • 200 flights • 10-km cross-country flight • Written examination • Fifty hours airtime • Basic first aid recommended

A Master rating is awarded by the HPAC/AVCL Board of Directors to pilots who have contributed significantly to the sports of hang gliding and paragliding in Canada. An applicant for a Master's rating must have an advanced rating and 50 hours of flight time in the activity for which the rating is sought. Applicant's accomplishments are also rated against specific criteria with score of 25 points being required to qualify a pilot for a Master's rating (refer to Appendix II for HPAC/ACVL pilot certification ratings).

There are numerous pilots, a few of which are in Canada, who are professional hang gliding and paragliding pilots. These pilots compete for prize money at international events, are often sponsored like other professional athletes, and fit into a highly structured competition and point-standing network. It is often the case that these professional pilots work as test pilots for manufacturers bringing out new gliders which must be certified for a certain level of pilot.

2.5 Activity Summary

2.5.1 Launching

Launching consists of the following activities:

- Unpack wing and lay out wing on launch area;
- Check and untangle, if necessary, wing lines (paragliding) and check rigid structure (hang glider);
- Turn on of GPS, vario (altimeter), and two-way radio;
- Electronic equipment check;
- Hang Glider:
 - Strap into the harness lying in the prone position and clip into the hang glider; and,
 - Pick up the hang glider and run down a mountain or a ramp with it when wind conditions are favorable.
- Paraglider:
 - Strap harness on to risers;
 - Inflate glider with air in order to check wing (paraglider) while observing wind sock;
 - Lay out wing again (if necessary); and,
 - Launch while running slightly forward when wind conditions are favorable.



Paraglider launching at lower Bridal Falls, Chilliwack, BC. Photo by Bob Fletcher.

2.5.2 Flying

Potential flying days are limited by the need for specific wind speeds and wind directions for take off and landing. Individual pilots are responsible to check conditions (i.e., from a local airport, Environment Canada weather information, viewing wind socks, consulting with more experienced pilots on launch where uncertain, or, in the case of a visiting pilot, with local pilots who are familiar with the site). Typically, the most suitable days for hang gliding and paragliding are in the spring, summer, and fall months.

Different types of flying can occur depending on wind conditions. When there is minimal wind for soaring and no thermal lift, pilots can just glide from launch to landing in a relatively straight path which is relatively short in duration due to no updrafts available to soar (this is termed “Sled Riding”). Pilots can also fly along the length of a ridge feature in the landscape, relying on the lift provided by the air which is forced up as it passes over the ridge. This type of flying is highly dependent on a steady wind, ridge suitability, and pilot skill. With this type of flying, it is possible ‘top land’ on or close to the launch site, which saves time returning from the landing site (this is referred to as “ridge soaring”). To gain altitude, pilots find thermals (termed “thermal flying”) and try to fly within the center of the thermal circle, where the air is rising the fastest.

Once thermal flying is mastered, pilots can glide from one thermal to another to go “cross-country” flying. With cross country flying, the pilot gains altitude in one thermal and then glides down to the next available thermal. In cross country flying, pilots need a familiarity with local flying regulations, restricted airspaces, and local landowner issues (*Pers. Comm.*, BCHPA, 2006; Wikipedia, 2006).

2.5.3 Landing

Similar to an airplane, the hang glider and paraglider lands into the wind while flying low (approximately 1 m) over an unvegetated or cleared area (i.e., landing zones, which are usually grassy areas that are not being cropped) in order to lose air speed. At just the right speed the hang glider pilot pushes on the control bar which points the nose of the hang glider up which essentially stalls the wing to create a soft landing. The paraglider uses the brake gear to slow down and gently glide to a stop and then lets the wing drop to the ground behind. Hang gliders are then dismantled and paragliders are packed up in a backpack.



A paragliding tandem flight.
Victoria, BC. Photo by Torge
Schumann.

3.0 SAFETY

As previously mentioned, all hang glider and paraglider pilots in Canada are encouraged to carry third party liability insurance which is a standard requirement of all the flying sites throughout the world. In B.C., all flying pilots are required to carry \$3,000,000 third party liability insurance. HPAC/ACVL and all pilots upon becoming members of this organization are automatically covered by this level of third party insurance.

The following are the general safety considerations for hang gliding and paragliding (*Pers. Comm.*, BCHPA, 2006):

- Most flying sites are rated and pilots flying the sites are expected to hold corresponding HPAC/ACVL ratings;
- Pilots should use a 2-way radio during flight;
- Pilots must carry reserve parachutes, and use helmets;
- Most pilots should have a first aid kit and cell phone;
- Pilots should be aware of and, in the case of visiting pilots, informed of any restricted airspace and of local launching and landing protocols;
- Pilots must observe the standard safety protocols established HPAC/ACVL of launching and landing a paraglider or hang glider (these standard safety protocols are an offshoot of CARs or Canadian Aviation Regulations);
- Pilots must observe the standard right of way rules for navigation in flight, often referred to as 'Ridge Rules', which are an elaboration of the right of way rules for navigation in the CARs;
- Accidents and incidents must be reported to the club safety officer. In addition, an accident report must be filed by the pilot(s) involved and submitted to HPAC/ACVL;
- There is a strict no smoking policy and no fires are allowed on access roads, the launch sites, or landing areas.



Hang glider ready to launch. Photo by Amir Izadi.

Detailed safety considerations, codes of conduct and general pilot etiquette for the individual flying sites are included in Appendix IV.

4.0 IMPACT ASSESSMENT

Potential impacts of paragliding and hang gliding have been identified on the basis of: a) Golder's general understanding the sport, b) specific features of the sport as it is carried out at the four flying sites of Woodside, Malahat, Golden and Kobau, and c) professional judgment as to the sport's interaction with the biophysical characteristics and socioeconomic dimensions within the vicinity of the four flying sites. Appendix III provides details on current environmental and social legislation relevant to the sport of hang gliding and paragliding, including federal environmental and social legislation. Appendix IV and associated Figures in Appendix V, describe the characteristics for each of the four flying sites as well as biophysical and socioeconomic baseline information for the immediate flying sites and the local area.

Where applicable, a significance rating has been assigned for the potential impacts identified. For the purposes of this report, level of significance of impacts have been qualitatively determined based on the following impact assessment criteria:

- Magnitude: the size or degree of the impact compared with baseline conditions;
- Extent: the area over, or throughout which, the effects will occur;
- Duration: the time period for which the effect will last;
- Frequency: the rate of re-occurrence of the effect (or conditions causing the effect);
- Permanence: the degree to which the effect can be or will be reversed (typically as measured by the time it will take to restore the environmental feature); and,
- Likelihood: the potential for effect to occur.



Vancouver Island. Photo by Amir Izadi.

The measurement ratings for determining level of significance are provided in Table 4-1 below. Professional judgment is used to rate the potential effect where regulatory criteria or guideline values are absent, or are non-applicable.

**Table 4-1
Levels of Significance**

Level of Significance	Definition
High	<i>Biophysical:</i> Potential effect could threaten sustainability of the resource and should be considered a management concern. Research, monitoring and/or recovery initiatives should be considered <i>Socioeconomic:</i> Potential impact may substantially change existing social, economic and/or cultural parameters
Medium	<i>Biophysical:</i> Potential effect could result in a decline in resource to lower-than-baseline but stable levels in the study area after project closure and into the foreseeable future. Regional management actions such as research, monitoring and/or recovery initiatives may be required <i>Socioeconomic:</i> Potential impact may moderately change existing social, economic and/or cultural parameters
Low	<i>Biophysical:</i> Potential effect may result in a slight decline in resource in study area during the life of the project, but the resource should return to baseline levels. Research, monitoring and/or recovery initiatives would not normally be required <i>Socioeconomic:</i> Potential impact may result in minimal to no change to existing social, economic and/or cultural parameters

The significant ratings assigned in this report are an estimate of potential impacts for the sport as determined through baseline analysis of four flying sites. Since the significance of potential impacts most likely vary from site to site depending on specific conditions present at a particular flying site (for example, erosion at a launch area will depend on how susceptible the soil is to erosion and amount of rock present and the climatic conditions) the significant ratings assigned are not to be viewed as representative of



Paraglider pilot thermaling in Arrowsmith, BC. Photo by Amir Izadi.

paragliding and hang gliding activities that occur at all flying sites.

Paragliding and hang gliding as a sport has the potential to interact with the following Valued Ecosystem Components (VECs)³. These are summarized in Table 4-2 followed by a more detailed explanation of each relevant biophysical and socioeconomic component.

³ Valued Ecosystem Components (VECs) are defined as the environmental attributes or elements that are identified as having scientific, social, cultural, economic, historical, archaeological or aesthetic importance. The value of an ecosystem component may be determined on the basis of cultural ideals or scientific concern. (refer to the Canadian Environmental Assessment Agency’s website at http://www.ceaa-acee.gc.ca/012/015/part1_e.htm for further information on VECs).

Table 4-2
Components of the Natural and Human Environment (Valued Ecosystem Components) which have a Potential to Interact of the Sport of Paragliding and Hang gliding

Natural Environment	Human Environment
Physical & Biological Components	Socioeconomic Components
Soil - erosion, compaction, settling, stability (slides, slumps)	Aesthetics
Surface Water - quantity, quality, shore line/bottom alteration, flow variation, flood, drought, current, tides, wave action, littoral process	Local Economy
Vegetation - quantity, type, quality, successional change	Land use (Private, Crown Land)
Wildlife - population change, productive capacity, habitat modifications (i.e. nesting, breeding, feeding, etc.)	Physical Services and Infrastructure - Transportation, parking - Utility and Service Corridors
Species of Management Concern	Health and Safety
Range Livestock	Heritage and Historic Features

4.1 Physical and Biological Components

4.1.1 Soil and Surface Water

The following are the most likely potential impacts that the sport may have on soils and surface water:

- Exposure of soils by removal of plant material and erosion of exposed soils by wind, water, or foot and vehicular traffic. Exposure and erosion can affect soils by removing topsoil, organic matter and nutrients, causing plant roots to be exposed and susceptible to wind and disease, providing opportunities for establishment of weeds, preventing establishment of new plants, and causing sedimentation in streams; and,
- Compaction of soils due to repeated foot and/or vehicular traffic. Compaction can affect soils by reducing water permeability and infiltration rates, cause increased surface runoff of water, affect plant ability to properly grow, and make it difficult for animals to dig to find food and shelter.

Given that hang gliding and paragliding: a) has a minimal footprint on land resources (due to the nature of the sport using the sky as its destination), b) uses no 'permanent' structures, utilizes existing access roads, and c) avoids surface water resources, the potential for this sport to impact soils and surface water is likely to be of a relatively low significance, provided that the mitigation measures such as those discussed in Section 5

in this report are applied as required. The significance of the potential impacts might vary depending on but not limited to matters such as specific soil and surface water conditions and climatic conditions present at a particular flying site.

4.1.2 Vegetation

The following are the most likely potential impacts that the sport may have on vegetation:

- Loss of native plant cover and root systems and the loss of plant diversity due to trampling, vegetation removal, or due to the spread of invasive plants. Loss of native plant cover and changes to the plant community may lead to soil erosion, affect the foraging patterns and distributions of livestock and wildlife, and affect the habitat quality and availability for wildlife due to structural or compositional changes; and,
- Introduction of invasive or non-native plant species by accidental seed spreading or exposure of soils providing an opportunity for weeds to become established. Colonization and rapid spreading of invasive or non-native plant species can result in the loss of natural diversity of native plant communities, affect the foraging patterns and distribution of livestock and wild animals, degrade soils, reduce the quality and availability of food, nesting cover, and security cover for wildlife, affect livestock forage quantity, quality and availability, increase animal health threats due to toxic effects, change natural fire behavior, losses in aesthetic qualities and attractiveness, and reduce land values.



Slocan Ridge, BC. Photo by Amir Izadi.

Given that hang gliding and paragliding has a relatively small footprint on land resources by using existing open areas for launching and landing and where possible utilizing existing access roads, the potential for this sport to impact vegetation communities is likely to be of moderate to low significance, provided that mitigation measures such as those discussed in Section 5 in this report are applied as required. The sensitivity of the existing vegetation to disturbance, susceptibility to and aggressiveness of invasive species, climatic conditions and local ground maintenance requirements (i.e., tree removal in a forested area versus grass mowing in a field) at any particular flying site would influence the significance of the potential impacts.

4.1.3 Wildlife

The following are the most likely potential impacts that the sport may have on wildlife:

- Disruption of normal wildlife behavioral patterns such as foraging, resting, and breeding from human activities and uncontrolled pets, and from vehicle noise or exhaust. These types of disturbances can be more pronounced at certain times of the year such as when animals are breeding, or are energetically stressed (e.g., during winter) and can also lead to increased chances of predation;
- Increased potential for direct wildlife mortality resulting from vehicular accidents on access roads; and,
- Direct loss of availability and suitability of habitats for breeding, nesting, foraging, security and thermal cover due to removal of vegetation.

As this report did not research and assess impacts of the sport on specific wildlife species, the impacts are instead based on the potential impacts of the sport on wildlife habitats (i.e., impact to the soil landforms and vegetation) and the potential interactions of humans with wildlife in natural environments.

Golder understands that paragliders, and to a lesser degree hang gliders, move slowly relative to powered aircraft and according to interviewed pilots, birds in flight can easily fly faster and outmaneuver paragliders. It is noted there are minimal to no sounds that are emitted from gliders and it is therefore anticipated that hang gliders and paragliders should have relatively low impacts on wildlife; however, a high frequency of disturbance may result in increased impacts to wildlife. The significance of potential impacts at a flying site would vary depending on factors such as the sensitivity of the individual wildlife species to direct and indirect disturbance, habituation of wildlife species to the sport and humans in the natural environment, and the magnitude of the maintenance requirements (i.e., tree removal in a forested area versus grass mowing in a field).

4.1.4 Species of Management Concern

In addition to the above impacts to vegetation and wildlife, the following are the most likely potential impacts that the sport may have on species of management concern:

- Loss of species of management concern and sensitive ecosystems (i.e., grasslands, alpine/tundra, riparian areas, wetlands) due to trampling, vegetation removal, spread of invasive plants, and/or wildlife disturbance.

Similar to the above, the potential for the sport to impact species of management concern is likely to be of moderate to low significance, provided that mitigation measures such as

those discussed in Section 5.0 in this report are applied as required. However, the significance of the potential impacts would vary depending on matters such as whether there are any species of management concern actually located in the launch or landing areas, the sensitivity of the individual species to disturbance, the mobility of the individual species (i.e., can it move to a nearby area), and the magnitude of the maintenance requirements.

4.1.5 Livestock

The following are the most likely potential impacts that the sport may have on range resources:

- Disturbances to livestock from vehicular traffic and uncontrolled pets. These disturbances may cause stress to the livestock and disrupt normal livestock movements and foraging patterns; and,
- Changes to livestock movements, allowing animal access to areas that are protected or are being rested from grazing, or confining livestock to sites resulting in susceptibility to trampling and grazing pressure as a result of damage to gates and fences, or gates not being left as found.

Given that the nature of hang gliding and paragliding activities are relatively non-intrusive with respect to noise and the physical area of land use is relatively small, the potential for this sport to impact range resources (provided that mitigation measures such as those discussed in Section 5.0 in this report are applied as required) is presumed to be of low significance. The presence of range livestock in the launch/landing or access areas, the sensitivity of the individual livestock species to disturbance, and the habituation of livestock species to the sport would affect the significance of the potential impacts.



Ripley Lake/Kobau launch ramp looking towards the White Lake Grasslands. Photo by Amir Izadi.

It is noted there are minimal to no sounds that are emitted from gliders and it is therefore anticipated that hang gliders and paragliders should have relatively low impacts on livestock; however, high frequency of disturbance may result in increased impacts to livestock.

4.2 Socioeconomic Components

4.2.1 Aesthetics

There is potential for aesthetic disturbances due to clearing of forest areas, slope grading and mounting of launch platforms at launch sites. However, due to the relatively small amount of cleared land required for launch areas (approximately 0.25 to 1 acre), and the remote location of launch sites (typically they are on cliffs or high ridges) the significance of aesthetic impacts due to developing launch areas is low. For some launch sites, cleared launch areas are used by the public (non-pilots) as viewing areas to enjoy the aesthetics of the surrounding area. As a consequence of users (pilots and the general public) valuing the aesthetics of the area, efforts are made by flying clubs and local pilots to maintain and in some instances improve the aesthetics of the launch areas.

Erecting signs and wind socks in launch sites and landing zone areas may also generate aesthetic disturbances (although deemed low in significance). Lastly, there is potential for litter and waste being left at sites by uneducated users or general public, which can have negative impact on aesthetics in a flying site area.

4.2.2 Local Economy

To obtain a general understanding of how hang gliding and paragliding contribute to a local economy, an analysis of expenditures was undertaken in the following areas:

- Consumer purchases of goods and services directly related to the sport;
- Indirect purchases of goods and services related to use of flying sites; and,
- The operations of flying clubs that manage the individual flying sites.

In general, economic impacts as a result of use and operations of the four flying sites reviewed in this study are estimated to be fairly low and seasonal in nature. However the sport is contributing to supporting the service sector in local communities nearby the four flying sites and in some cases, the surrounding region.

The sport attracts pilots (and spectators) to the flying areas generally between the months of April and September. A Hang Gliding and Paragliding Pilot Survey was conducted, which asked pilots to provide information about their expenditures when they use one of the four flying sites (a copy of the Pilot Survey is included in Appendix VI). The estimated average expenditure per pilot user day for the four flying sites varies from \$44 for those using the Malahat site to over \$190 for pilots using the Golden Site (Table 4-3). Pilots using the Golden site travel some distance to access the site and thus are spending more in items such as gas and accommodation (versus pilots using the Malahat site, who

generally live closer to the flying site⁴. Taking into consideration estimated total annual number of pilot user days per site, annual pilot spending amounts to approximately \$4,400 for pilots using the Malahat site, up to \$275,500 related for pilots using the Golden site.

Table 4-3
Average Pilot Expenditures for Four Flying Sites in B.C.
(N=50)

	Woodside Site N=15	Malahat Site N=18	Kobau Site N=5	Golden Site N=12
Average expenditure per pilot per visit	115	44	61	192
Estimated total annual pilot user days	1200	100	192	1450
Total annual estimated pilot Expenditures	\$138,000	\$4,400	\$11,712	\$275,500

Source: BCHPA, 2006

Results from the pilot surveys indicate that pilot expenditure impacts primarily relate to:

- Transportation including cost of ferries, gas, car rental, etc. (51.9% of total estimated expenditures);
- Cafes and restaurants (21.8% of total estimated expenditures);
- Accommodation including campsites, hotels, motels and B&B's (8.5% of total estimated expenditures); and,
- Other retail expenditures such as groceries, souvenirs, other entertainment (17.8% of total estimated expenditures).

In addition to site visit expenditures, the survey results indicate that pilots spend on average \$5,000 for initial purchase of equipment. With the need to purchase new wings every 3 to 5 years at an estimated cost of \$3,800 per wing purchase, yearly additional equipment expenditure averages out to approximately \$1,200 per year. Every HPAC/ACVL member in B.C. (membership being a requirement for use of local flying sites) also pays \$140 a year for membership in the national association which includes payment for third party liability coverage for all land owners⁵

⁴ Because some users travel long distances to use the four flying sites, estimated expenditures do not necessarily occur within the communities close to the flying sites

⁵ With an estimated 300 members in B.C., total insurance payments coming from B.C. pilots are in the order of \$42,000.

Local income is also generated through training offered by local paragliding and hang gliding flying schools. For example, FlyBC, the flying school which uses the Woodside site for training, charges \$1,650 per student for a training program to obtain their flying license. With an estimated 25 students per year, gross income to FlyBC from training is estimated at \$41,250. Other income to FlyBC includes income from individual tandem flights and sales from paragliding and hang gliding equipment.

Large flying events and competitions, such as the Willi Muller Cross Country Challenge held annually at Golden can also generate significant economic impacts to the region. An economic impact analysis of this event was beyond the scope of this study however, economic impact analyses from other sporting competitions and events illustrate that even relatively small events can generate significant economic benefits to a local community (West North West Tasmania Recreational Planning Framework, 2001).



National Hang gliding championship, Vernon Hill, BC. Photo courtesy of the Okanagan Soaring Association.

Analysis of annual operational budgets of the Woodside and Golden flying site for a three year period indicates that site operations also impact a number of sectors (Table 4-4). Main operating expenditures for these sites go towards site improvement and maintenance costs, payments to private land owners for use of landing zone areas, annual license fees and property taxes (in the case of Woodside) and expenses to support fundraising activities (in the case of Golden^{6 7}).

⁶ Flying clubs managing the four flying sites studies retain no paid staff, with pilots and members of the Board of Directors volunteering their time to site operations.

⁷ Detailed budget information was made available to the authors for these two sites only.

**Table 4-4
Flying Site Operational Expenditures**

	2003	2004	2005
Woodside			
Site improvements/ maintenance	\$700.98 (15%)	\$6,879.90 (63%)	\$5,716.50 (51.5%)
Landing fees and gifts	\$2,600.54 (55%)	\$2,840.96 (26%)	\$3,208.51 (28.9%)
License Fees	\$964.61 (20.4%)	\$893.99 (8.2%)	\$1,897.11 (17.1%)
Property tax	\$194.37 (4.1%)	\$179.17 (1.6%)	\$221.74 (2.0%)
Admin fees	\$245.34 (5.1%)	\$117.01 (1.1%)	\$41.80 (0.4%)
Insurance	\$20.00 (0.4%)	\$10.00 (0.1%)	\$10.00 (0.1%)
TOTAL:	\$4,725.84	\$10,921.03	\$11,095.66
Golden			
Site improvements/ maintenance	\$993.53 (33%)	\$448.98 (7.9%)	\$3,797.20 (54%)
Landing fees	\$985.00 (32.5%)	\$1517.25 (26.6%)	\$975.00 (13.9%)
Admin fees (office, website, dues, etc)	\$316.25 (10.5%)	\$329.05 (5.8%)	\$150.00 (2.1%)
Fundraisers	\$722.25 (24%)	\$722.25 (12.7%)	\$1728.33 (24.5%)
Insurance	0	\$188.15 (3.3%)	\$390.71 (5.5%)
Evacuation/Safety Equipment	0	\$2500.00 (43.8%)	0
TOTAL:	\$3017.03	\$5705.68	\$7041.24

Source: Adapted from budget information received from R. Samplonius (Woodside site) and Alan Poster (Golden Site)

4.2.3 Land Use

The social impact of hang gliders and paragliders on the experiences of other land users can be analyzed through the concept of recreation conflict (Marcouiller, Scott and Prey, 2004). The most obvious area of conflict is among alternative recreational uses of a finite land base and occurs when the presence and/or behavior of some users interferes with the achievement of the desired recreation experience of others. This intra-use conflict can grow due to both increased aggregate demand for outdoor recreation and technological change that allows new forms of outdoor recreation, such as all-terrain vehicles (Manning and Valliere, 2001). The second area of conflict is that which can arise between recreational users and other forms of land use, such as residential development,

agriculture and forestry management. The challenge for land management in this context is managing group interaction with an eye towards maximizing complementary uses while minimizing those which result in competition or antagonism (Marcouiller et. al, 2004).

Based on analysis of the four flying sites, paragliders and hang gliders do share the same recreational area (including access roads, areas around launch and landing sites, and connecting access trails and paths) with other recreational users including ATVer's, mountain bikers, hikers, horseback riders, trappers and outfitters (presence of these recreational users groups vary from site to site). Other user groups, such as conservation and scientific groups, may also have land use agreements within the same areas. There is potential for these competing land uses to increase as these recreational and educational activities increase in popularity. However, given that the nature of hang gliding and paragliding (with the destination being the sky) the potential for this sport to impact the ability for other recreational users to carry out their activities is deemed to be fairly low.

Hang gliding and paragliding activities also interact with activities of private land owners and Government. Cooperative land use agreements are made with private land owners either through official agreements with private corporations (such as that with TimberWest for the Malahat site), or more informal (often verbal) land use agreements with smaller individual land owners (such as those made between the West Coast Soaring Club (WCSC) and private agricultural land holders for use of private land as landing zones). Key concerns and issues for private land owners are pilots respecting the boundaries of agreed upon landing use areas (including launch, landing areas, access roads and access trails), not trespassing outside of these boundaries without consulting land owners, and proper care and maintenance of the designated use areas that are owned by the landowner⁸.

If there is a flying club responsible for managing the operations of a flying site (as in the case of WCSC for Woodside and the Island Soaring Society (ISS) for the Malahat site) directors of these flying clubs appear to take responsibility for ongoing consultation and communication with private land owners, ensuring that any conflict issues with private land owners are addressed properly and efficiently, and to inform and educate pilots using the sites of the specific agreement with private land owners on land use for paragliding activities. Consultations with Directors of two flying clubs (WCSC and the Island Soaring Society, ISS) and with private land owners indicate that generally, flying clubs have developed good cooperative relationships with private land owners.

⁸ Consultations with the ISS and WCSC suggest that 90-95% of paragliding and hang gliding landings occur within designated landing zones for the Malahat and Woodside sites.

Cooperative land use agreements are also made with government agencies when launch and/or landing sites are located on Crown land. In this case, the Province authorizes non-exclusive use of Crown land to commercial recreation operators (in this case BCHA or local flying clubs) via licenses of occupation (Integrated Land Management Bureau, 2006). Under such licenses, the public may use the same land specified in these tenure agreements for non-commercial purposes. The Province may also issue commercial tenures to other operators for the same land as that issued to the paragliding/hang gliding applying agency (for example, portions of Crown Land on Mount Woodside have a woodlot tenure controlled by the Scowlitz Nation).

It is the Province's responsibility to ensure that all tenure holders are meeting their legal and management requirements (Ministry of Tourism, Sports and Arts, 2003). It is also the Province's responsibility to ensure complementary and integrated land management strategies amongst land tenure holders (as well as with adjoining landowners and interest groups). This includes implementation of guidelines to address any potential conflicts amongst users. Consultations, and a review of written land use agreements indicate that Crown land tenureship agreements and associated management planning requirements have generally been adhered to by the flying clubs which have Crown land licenses of occupation or SUP's (WCSC in the case of Woodside and BCHA in the case of the Golden flying site).

Paragliding and hang gliding has been viewed as being incompatible with certain national parks in Canada (refer to http://www.pc.gc.ca/pn-np/ab/waterton/activ/activ7_e.asp). Consultations suggest that in addition to the sport being prohibited under the National Parks Act, there is concern with public safety and potential liability to Parks Canada⁹.

4.2.4 Physical Services and Infrastructure

Launch and landing areas can be near existing and/or proposed structures such as communications sites (i.e., Woodside, Golden, Kobau), weather stations, radio towers (as in the case of Malahat) or outstations. Pilots may use the same access road as vehicles servicing these structures however, given that service vehicles are required to access these structures fairly infrequently, the impact of flying activities on the ability to access and service these structures is negligible to low.

The two flying sites visited both had designated parking areas close to launch sites, which they often share with other recreational users in the immediate area. Depending on where the landing zones are located, parking areas to access landing zones may be located in

⁹ Even though paragliders registered under the HPAC/ACVL carry liability insurance, there is concern that non-HPAC/ACVL members or other flyers without insurance will use flying sites located within national park areas.

public parking lots (i.e. in the case of Bamberton Beach for the Malahat site), or on private land owners property (in the case of a few landing zone areas for the Woodside site)¹⁰. The majority of flying site usage appears to occur on weekends, and any impact with local traffic and parking would most likely occur during this time. In particular, there is the potential for parking congestion and associated blockage to roadways if pilots park on highways or other public roadways. However, observations indicate that most individual flying clubs have developed parking management guidelines to effectively address parking and traffic issues for a specific site.

4.2.5 Safety

Positive health impacts of the sport of hang gliding and paragliding include access to and recreational use of the natural environment, exercise and positive psychological experience and wellbeing. Three out of the four flying clubs/associations assessed have their own codes of conduct which provide safety guidelines for the sport at the site. The type and amount of information



A paraglider in Bridal Falls, BC. Photo by Bob Fletcher.

included in these codes varies somewhat between clubs (refer to Appendix IV for site-specific safety standards/codes of conduct). Included in these codes of conduct are strict no smoking policy and a no fire policy using flying launch and landing zones and associated access roads. HPAC/ACVL also has a safety website which provides links to safety articles, accidents and incidents statistics, and information on how to engage in the sport in a safe and responsible way¹¹.

Consultations indicate that generally, when a pilot wants to fly at one of the four flying sites for the first time, they are directed to the safety information on a flying club's website (if there is a flying club/association administering flight activities at that site).

¹⁰ For example, in the case of the Woodside site, pilots have negotiated agreements with private land owners for vehicle access and parking on private land near landing zone areas.

¹¹ Accidents and incidents are typically reported to HPAC. Pilots post narratives of causative factors on their own club websites. In this way, information and education is available to other pilots on the nature and cause of the accident/incident. This process also assists with investigation of the specific incident/accident in question.

New pilots are also typically provided with health and safety information verbally from one of the flying club directors or other pilots who have used the site before (BCHPA, 2006). Individual flying clubs also have an accident/incident reporting protocol and process for reporting accidents and incidents, and for investigating the associated causes.

Even with well-enforced safety guidelines and practices, hang gliding and paragliding have been viewed as recreational activities that can pose a safety risk to pilots (Department of Environment and Conservation, 2004). At the national level, HPAC/ACVL posted the number of accidents and incidents for 2005 as part of its year end safety report, as required by Transport Canada. Local clubs have voluntary incident/accident postings on their websites; however, HPAC/ACVL reporting is compulsory. Out of a total of 10 reported accidents/incidents for paragliders in Canada, 3 occurred in British Columbia/Yukon. Out of a total of 8 accidents/incidents for hang gliders in Canada, 0 occurred in British Columbia/Yukon. Out of two reported paragliding fatalities in Canada, one occurred at the Golden, B.C. site (HPAC/ACVL website, 2006)¹².

However, when comparing hang gliding and paragliding to other outdoor recreational sports, British Columbia Provincial Emergency Program statistics offer an impartial view of the relative safety of hang gliding and paragliding when compared to other recreational activities (refer to British Columbia Provincial Emergency Program 2003/2004 and 2004/2005). Looking at the various recreational activities involving a search and rescue (SAR) within the Province of British Columbia (29 recreational activities in 2003/2004 and 28 activities in 2004/2005), the mean (average) number of SAR responses per recreational activity for the year 2003/2004 was 32, and for 2004/2005 was 35. In comparison, for 2003/2004, 5 SAR responses have been recorded for hang gliding or paragliding, and 6 responses recorded for 2005/2000, with the majority of these responses not requiring a search¹³ (by way of example, hikers and boaters requiring SAR responses each year number in the hundreds each).

The costs of responses and numbers of injured or dead are also of interest, in that these values reflect the severity of the incidents and the number of responders required. The data in Table 4-5 suggests that hang gliding and paragliding rescues are no more expensive than typical rescues. As well incidents do not result in a disproportionate number of injuries or deaths¹⁴.

¹² Accident, incident and fatalities numbers were only posted by HPAC/ACVL for 2005, so a linear trend analysis was not possible.

¹³ This refers to the fact that the majority of subjects were classified as “self-rescue” where subjects walked out or were never lost.

¹⁴ These statistics should be viewed with caution since Search and Rescue is not called out to all paragliding and hang gliding incidents, just as Search and Rescue may not be called out for all of the incidents generated by other types of outdoor activities. This data therefore has more value in comparing the relative frequency of incidents than in predicting participant injury rates.

**Table 4-5
Search and Rescue (SAR) Statistics**

	2003/2004		2004/2005	
	Provincial Totals	Hang gliding/ Paragliding	Provincial Totals	Hang gliding/ Paragliding
Total SAR Responses	933	5	984	6
Total SAR Costs	\$1,115,636	\$6,874	\$1,535,240	\$7,703
Cost / Response	\$1,332	\$1,375	\$1560	\$1,284
Injured	193	1	230	1
Dead	63	0	53	0

Source: British Columbia Emergency Program 2003/2004 and 2004/2005.

At the time of writing this report, information from HPAC/ACVL on accidents, incidents and fatalities rates were not available. Information was obtained from the United States Hang Gliding and Paragliding Association (USHPA)¹⁵. For 2003, USHPA received 95 reports of paragliding incidents and accidents, which is a reported user incident/accident rate of 2.1%¹⁶ (Little, 2003). The main factors contributing to accidents were thermal turbulence (18.25%), strong wind (13.76%), asymmetric deflation (12.7%), flying too close to ground (12.17%), rotor (11.9%) landing outside landing zones (10.58%) and poorly inflated take offs (10.32%)¹⁷ (ibid). Effective pilot training, knowledge and enforcement of safety procedures, combined with properly maintained flying launch and landing zone areas appear to be the most effective factors in mitigating accidents and incidents. The USHPA reported an estimated average fatality rate between 1991 and 2005 of 1.33 per 1000 USHPA members, or a user fatality rate of .133% (Little, 2005).

Consultations indicate that for some sites, mechanisms to distribute site-specific health and safety information to pilots could be improved. At the national level in Canada, there are plans for a HPAC/ACVL Health and Safety Committee, which will have the mandate of reducing hang gliding and paragliding accidents in Canada. Activities of this Committee include mechanisms to increase accident/incident reporting and creation of a Safety Manual that is usable and effective at the national as well as local levels (Island Soaring Society, 2006).

¹⁵ This information is presented to illustrate the situation in the United States and is not representative of Canadian accident/incident and fatality rates.

¹⁶ The 2.1 % estimate was based on a reported number of USHPA Paraglider pilots for 2003 of 4526. Incidents are broadly defined as any outcome of a flight that was not intended by a pilot but did not result in injury. Accidents are defined as any incident resulting in an injury to the passenger or pilot.

¹⁷ Most accidents have multiple contributing factors.

4.2.6 Heritage or Historic Sites

In British Columbia, heritage sites are commonly related to First Nations use and occupancy (BC Assessment Policy, Audit and Legal Services Division, 2006). Section 13(2) of the Heritage Conservation Act (HCA) defines several categories of heritage sites that are automatically protected by this legislation. These include burial sites, aboriginal rock art, and any site containing artifacts, features, materials or other physical evidence of human habitation or use before 1846. Common pre-1846 sites include shell middens, habitation sites, culturally modified trees, rock paintings or rock carvings¹⁸. Historic sites refer to old homesteads, cabins, mining sites, or other areas classified as historic property. Historic sites may or may not be protected by the HCA, depending on whether they are designated or non-designated.

Any recreational activity – including paragliding and hang gliding - has the potential to disturb or damage historic or heritage sites and features, including those protected by the HCA. In relation to heritage sites, this can occur through removal, crushing or scattering artifacts, damaging shallowly buried cultural sites, or contributing to the possible loss of the cultural value of First Nations spiritual sites due to increased recreational use (Ministry of Water, Land and Air Protection, 2004). In relation to historic sites, damage can occur through actively destroying or altering historic buildings or properties. Given that paragliding is a low impact sport involving minimal disturbance to the terrestrial environment, the likelihood of disturbance or damage to historic or heritage sites and features is deemed to be low. Also, observations of the four flying sites indicate that most hang gliding and paragliding activity takes place on land which has been previously disturbed (due to industrial logging, agriculture, etc.).

The HCA provides substantial penalties for destruction or unauthorized disturbance of archaeological sites, including heritage sites. To identify the presence or absence of HCA-protected cultural materials often requires the assistance of a professional archaeologist. In some flying areas such as that for the Kobau site, it has been suggested that heritage or historical features may not yet be adequately identified (Ministry of Land, Water and Air Protection, 2003). As a result, unplanned or unforeseen damage to these sites could occur by pilots using the flying sites

5.0 MITIGATION MEASURES

The purpose of this section is to detail measures that will assist in avoiding potential negative impacts and support/enhance positive benefits of paragliding and hang gliding as a recreational sport. Information outlined in this section is based upon the key

¹⁸ The term culturally modified tree refers to a tree that has been intentionally altered by Native people participating in the traditional utilization of the forest (Arcas Associated, 1984).

potential impacts as identified in Section 4.0, and associated best management practices applicable to the sport. Most of the mitigation strategies outlined in the sections below are currently being implemented at many of the B.C. flying sites, however some of the mitigation strategies described below may not be appropriate at all sites.

Table 5-1 outlines existing and/or recommended mitigation measures to offset the potential biophysical impacts resulting from hang gliding and paragliding. Since the mitigation measures for socioeconomic impacts require more in-depth discussion, these are presented in paragraph form following Table 5.

5.1 Biophysical Effects and Mitigation Measures

**Table 5-1
Biophysical Effects and Mitigation Measures**

Valued Ecosystem Component	Description of Potential Project Interaction with VEC	Current and/or Recommended Mitigation Measures
Soils	<ul style="list-style-type: none"> • Exposure and erosion of soils • Compaction of soils 	<ul style="list-style-type: none"> • Learn about soil disturbance issues and how to recognize soil conditions in order to avoid areas and landforms that are sensitive to soil disturbances • Ensure members and clients are aware of soil disturbance issues and proper activity-based techniques to minimize damage to trails and roads • Learn to ‘Leave No Trace’ and ‘Tread Lightly’ • Use signage on existing trails to identify trails and sensitive areas • Read and obey trail and road signs and closures • Use existing parking or staging areas and stay on designated and existing trails, roads, and routes • Avoid existing trails if they are poorly placed, and are causing erosion problems • Avoid widening trail corridors • Avoid breaking branches, which can lead to vegetation destruction. • Minimize or avoid trail use during periods of high precipitation or when the soil is soft or wet • Consult local landowners before using non-designated trails to make sure you are not trespassing • Avoid creating new trails (without appropriate planning and consultation) and if new trails are required, reduce or minimize the number of trails • Where possible, rehabilitate closed trails in order to allow them to return to their natural condition • Provide a drop box or contact number for members or other recreationists to report soil disturbances or other problems • Consider the development of penalties or other forms of deterrence for off-trail use
Vegetation, including Species and Ecological Communities of Management	<ul style="list-style-type: none"> • Loss of native plant cover and root systems • Loss of plant diversity • Introduction of 	<ul style="list-style-type: none"> • Learn to identify B.C.’s species and ecological communities of management concern within the operating area and operate in a manner that is consistent with approved recovery planning approaches • Learn to recognize invasive plants and know which plant parts to be concerned about and become aware of the issues associated with invasive plants and learn proper activity-based techniques to minimize their spread

Valued Ecosystem Component	Description of Potential Project Interaction with VEC	Current and/or Recommended Mitigation Measures
Concern	invasive or non-native plant species	<ul style="list-style-type: none"> • Read guides, brochures, and pamphlets produced by provincial government agencies or local weed management groups on invasive plants. • Share your knowledge with other recreational users • Read and obey trail and road signs and closures • Use existing parking or staging areas and stay on designated and existing trails, roads, and routes • Protect known species and ecological communities of management concern and protect critical vegetation habitat features such as wildlife trees, woody debris, wetlands, and riparian areas • Avoid or minimize weedy areas, or restrict activities to those periods when the spread of invasive plants is least likely • Before entering and upon leaving sensitive areas, particularly grasslands, inspect vehicles, clothing, footwear, and gear for invasive plant seeds or plant parts. Remove seeds and plant parts, bag them, and dispose in the garbage. • Consider an invasive plant control program but do not pull invasive plants without first seeking expert guidance. • Report areas infested with non-native weeds to the nearest B.C. Forest Service office or local landowner. • During fire season, check vehicles regularly for plant material near exhaust pipes or other structures that can become hot during use, do not smoke or have campfires, and respect closures due to extremely high fire hazard conditions.
Wildlife, including Species of Management Concern	<ul style="list-style-type: none"> • Disruption or disturbance of normal wildlife behavioral patterns (i.e., foraging, resting, breeding) • Increased potential for direct wildlife mortality • Direct loss of availability and suitability of habitats 	<ul style="list-style-type: none"> • Learn to identify B.C.'s species of management concern within the operating area and operate in a manner that is consistent with approved recovery planning approaches. • Understand which wildlife species are using operating areas by documenting and reporting any known occurrences of species and by identifying and mapping populations and habitats. • Read guides, brochures, and pamphlets produced by provincial government agencies or local wildlife management groups on local wildlife species and species of management concern. • Share your knowledge with other recreational users. • Train pilots and clients to increase awareness on appropriate behavior in wilderness settings to minimize potential for human disturbance. • Read and obey trail and road signs and closures. • Observe posted road speeds and/or sustain slow speeds on gravel roads. • Use existing parking or staging areas and stay on designated and existing trails, roads, and routes. • Protect known habitats of species of management concern and sensitive ecosystems (i.e., grasslands, alpine/tundra, riparian areas, wetlands) and protect critical vegetation habitat features such as wildlife trees, woody debris, wetlands, and riparian areas. • Protect critical habitat features such as burrows, salt licks, wildlife trees, woody debris, riparian areas, wetlands, etc. and known nesting/calving sites. • Avoid landing in sensitive sites and avoid known nesting/calving sites or ungulate winter ranges. • Within tenures, place new developments within or immediately adjacent to existing developments or facilities so that impacts are clustered. • Avoid noisy, intrusive, or otherwise potentially harassing human

Valued Ecosystem Component	Description of Potential Project Interaction with VEC	Current and/or Recommended Mitigation Measures
		<p>activities during periods of the year when wildlife are under severe environmental and physiological stress, in particular during the winter survival and spring natality periods. Direct and/or deliberate harassment is not acceptable. Limit instream construction activities to local reduced risk timing windows and limit vegetation clearing to outside of the breeding bird window (typically April to August in Southern BC).</p> <ul style="list-style-type: none"> • Should it be necessary to undertake clearing activities during the breeding bird window, it is recommended that a breeding bird and nest survey be conducted by a qualified biologist to confirm the presence and/or absence of active nest sites and the species types using those nests, if any are found. In the event that an active bird nest or wildlife den is encountered during site clearing, the qualified biologist would either recommend to re-schedule clearing activities to avoid potential effects or would consult with the provincial regional MOE office and the federal Canadian Wildlife Service (CWS) so that appropriate mitigation measures can be taken • Limit clearing footprint to only necessary areas and visibly delineate those limits. • Implement site revegetation to help to re-establish terrestrial breeding, nesting, and shelter habitat for various wildlife species, while providing ground cover to minimize sources of sediment and exposed soils that may be prone to erosion. • Minimize the proliferation on non-native weed species, which generally have lower habitat values than the native tree and shrub species, by removing the cleared non-native vegetation species to an appropriate disposal location and by using high quality, weed-free native grass seed mixes and certified weed-free topsoil or mulch. • Implement a site restoration program (i.e., Site landscaping) utilizing native vegetation which avoids planting invasive, non-native species such as English ivy, periwinkle, and <i>Lamium</i> sp. Planting high quality, weed-free grass seed mixes and native trees and shrubs will help to prevent importation and distribution of non-native noxious weeds and will help to re-establish terrestrial breeding, nesting, and shelter habitat for various wildlife species, while providing ground cover to minimize sources of sediment and exposed soils that may be prone to erosion. • Do not feed or approach wildlife, even habituated individuals. • While in flight, allow birds (i.e., raptors) to come fly with the glider and do not chase or otherwise harass them. Stay at distances sufficient to prevent changes to the behavior of animals (more than 500 m line-of-sight is the default). • Take immediate action to increase separation distances when animals react to gliders. • Follow standards, regulations and guidelines established by local governments for the protection of wildlife species and habitats. • Control pets to minimize harassment and displacement of wildlife or leave pets at home to avoid wildlife harassment. • Avoid the use of pesticides and herbicides and other chemicals that may contaminate the environment and impair healthy ecosystem functions. • Implementing best management practices during construction or maintenance activities to minimize or prevent importation and distribution of non-native weed species. Practices should include ensuring that all equipment and machinery used during construction of the Project is thoroughly cleansed and inspected prior to being mobilized

Valued Ecosystem Component	Description of Potential Project Interaction with VEC	Current and/or Recommended Mitigation Measures
		<p>onsite.</p> <ul style="list-style-type: none"> • Where possible, incorporate coarse woody debris (i.e. raw logs, intact felled trees) and brush piles as habitat for small mammals, reptiles, amphibians, and birds into the site landscaping. It is anticipated that much of this material can be salvaged during the initial site clearing and stored until the Project is completed. • Carefully consider future and existing activities to avoid disturbing or removing important habitats. Be aware of potential implications such as alteration of animal movement patterns, displacement of animals from key habitats, and destruction of home sites and other habitat features. • Develop an access management plan that protects known sensitive species and their habitats from disturbance in known use areas. • Consider improving mitigation guidelines by initiating wildlife monitoring programs, under the direction of a professional biologist, and with the approval of MOE’s wildlife program, to modify guidelines to be more area and user specific and reflect local circumstances.
Rangeland / Agricultural Practices	<ul style="list-style-type: none"> • Disturbances to livestock / crops • Changes to normal or allowed livestock movements 	<ul style="list-style-type: none"> • Closing fences or leaving fences ‘as is’. • Avoiding landing in areas with livestock and calving areas. • When encountered, allow livestock the right of way. • Avoid startling grazing animals by making some small amounts of noise from time to time so that the animals are alerted of the approach of a glider • Practice good landing approach planning and execution to avoid coming too close to livestock • Avoid landing in crops other than forage if landing in an approved LZs is not feasible.

5.2 Socioeconomic Effects and Mitigation Measures

5.2.1 Aesthetics

A number of the observed sites do undertake activities such as grooming sites, planting grass and other ground cover and tidying up vegetated areas. Building on this, effective mitigation measures to address any negative effects on aesthetics include:

- Minimizing the size of area cleared for launch site development and associated sloping work;
- Ensuring pilots are using the ‘pack it in and pack it out’ approach when using flying sites;
- Enforcing do not litter codes of conduct; and,
- Educating pilots to pick up any litter that may have been left by others.

5.2.2 Engagement With Communities and the Local Economy

Promotion of the sport is an ongoing issue with the flying community as they prefer not to promote the sport as 'high risk' in the event that it attracts the type of person who is not willing to spend the length of time it takes to be instructed to become a pilot and who



A pilot prepares to land his hang glider in Golden, BC. Photo by Amir Izadi.

is not safety-conscious. The following list indicates the types of marketing or promotional activities that the flying community has undertaken:

- Tandem flights with a certified instructor by general public and prospective students;
- Assisting in Search and Rescue efforts;
- Staging fly-ins where the general public is invited to observe launches and landings;
- Joint events which support other community organizations (e.g., food bank);
- Selling t-shirts.;
- Partnering with recreational sites to provide an additional activity at a site (e.g., Grouse Mountain);
- Flying competitions hosted by various clubs;
- Participating in half-time shows (e.g., BC Lions games);
- Participating via the flying schools at trade shows (i.e. outdoor recreation shows);
- Producing publications (e.g. HPAC's AIR Magazine);
- Maintaining various clubs websites and interactive forums to exchange expertise and experience;

- Providing awards to non-pilots (e.g., Solid Ground Award for contributions to the sport by making a new site accessible via a land tenure agreement); and,
- Ongoing communication with landowners and including them as third party insured.

There is the potential to increase the inflow of funds (and through this, increase economic activity) into a locality or region through promotion of hang gliding and paragliding as recreational sports. Specific economic generating strategies already being carried out by local flying clubs (planned and coordinated collaboratively with local communities, local governments agencies, flying clubs and the BCHPA) include staging events, such as fly-ins and paragliding/hang gliding competitions. Such events could be coordinating with other tourism or sporting related activities to maximize visitor stays and yields. An effective and widely dispersed information dissemination and marketing strategy to communicate and promote such events would further support economic gains, since such events add to the local economy if visitors come from outside the area. As with promotion of other recreational sports, promotion of paragliding and hang gliding in a locality can create an image of a locality being a recreational activity destination, further supporting inflow of other sports and tourism activities in the area.

5.2.3 Land Use

Public Land Use

BCHPA and B.C. based flying clubs/societies are obligated to adhere to Provincial land tenure and land management requirements. Within this framework, the Province of British Columbia identifies the potential for overlap with various land tenure holders, and as such, has outlined a process for ensuring that potential impacts and conflicts that exist with respect to this overlap are mitigated to the best extent possible. At the time of submitting new applications for land use agreements, or renewing expired applications, the applying group (in this case BCHPA or local/regional flying clubs) is required to identify if flying site operations overlap with current land tenure holders. As outlined by the Province of British Columbia (2005), if potential impacts or conflicts exist with respect to this overlap, the applying group is required to contact existing tenure holders and identify potential conflict issues and investigate strategies that will be used to avoid or minimize potential impacts or conflicts, and coordinate access and activities such that use by both parties are compatible. The Province will also consult with various provincial government agencies, local governments, First Nations, relevant advocacy groups, industry (if required) and other stakeholder groups as appropriate to ensure participation into decision around future Crown Land use.

The Province of British Columbia is also required to assess the potential impact of commercial recreation proposals on First Nation Interests. Crown Land applications are normally referred to First Nations for comments (Ministry of Tourism, Sports and the Arts, 2003). When undertaking new applications for land use agreements, the Province

indicates that it may be beneficial for applicants to contact First Nations that have an interest in the area to provide them with information of the activity (in this case, paragliding and hang gliding at an identified flying site), and respond to any questions and concerns raised regarding potential impacts that the activity may have (in this case flying site operations) on their interest. Such efforts can contribute to the timely completion of an application process.

Applications must ensure that any discussions undertaken between the applicant and First Nations are documented with respect to specific concerns raised, proposed solutions and any agreements that may be reached between parties. This information needs to be presented to the Province, as it may form part of the overall assessment of aboriginal interests and if necessary, any accommodation of those interests that may ultimately be considered.



Mt. Seven launch, Golden, BC. Photo by Amir Izadi.

Community Development Planning

Tenureship and management of Crown land for commercial and other forms of recreation is done in coordination with local community development planning. Typically plans for community development are laid out in the form of official community plans (OCP's) or as part of a rural land use bylaw, a subdivision servicing bylaw or other such administrative type tools. The objective of these planning tools is to allow development

and growth to flourish within a community without overly taxing the environment or residents.

OCP's include social, economic and environmental plans, and in this context current and future plans for recreational use and recreational development in the area. A review of community plans and/or community profiles pertaining to the areas where the four flying sites are situated revealed that paragliding and hang gliding activities that occur at Golden and Mount Woodside flying sites are mentioned in the Golden community profile and Mount Woodside Neighborhood Plan respectively (refer to Golden Economic Development Office, 2003; District of Kent, 2003b). Sharing information on paragliding and hang gliding activities with local government agencies and community groups can help ensure that information on the nature and implications of the sport is accurately portrayed in community development plans (or help ensure that paragliding and hang gliding activities are integrated into the community planning process if these activities are not already present in the OCP). Knowledge of local community plans can highlight to flying clubs (and pilots generally responsible for maintaining flying sites) any community development planning initiatives that may have future implications on hang gliding and paragliding activities in the area.

Private Land Use

It is important that all flying clubs and individual pilots develop and maintain good working relationships with private landowners and work collaboratively with them to ensure compatible use of private lands. Specifically, it is recommended that the flying clubs associated with a flying site should ensure that all written and verbal land use agreements with private land owners are up to date and clearly understood by all pilots using the flying site. All pilots (registered as well as visiting) should be provided with information (written and verbal) on the site specific use of private lands for both launch and landing. Acknowledging that some flying clubs/flying sites do have site-specific Codes of Conduct, the following information should be available/distributed to pilots and mechanisms be in place to enforce their implementation and compliance:

- Undertake a program to make all pilots aware of the boundaries of designated launch areas and landing zones and to the extent possible, have pilots stay within these designated zones;
- Provide all new pilots with a written map of the area, outlining launch and landing zone boundaries, designated parking areas and trails;
- If pilots are unable to reach designated landing zones (and if the general area for landings are located in an agricultural zone), pilots need to ensure that they attempt to avoid landing in planted fields to the best of their ability to avoid damage to crops;
- Inform all pilots of existing parking and staging areas;
- Inform pilots to stay on designated and existing roads and walking trails to get to and from launch sites and landing zone areas. Pilots should consult private landowners

before using non-designated trails, areas to obtain permission and ensure that they are not trespassing;

- Encourage pilots to close any private gates after use;
- Inform pilots to keep all launch areas (including parking areas) and landing zone areas clean and tidy, leaving no litter behind; and,
- Encourage pilots to inform land owners of any safety or maintenance issues (such as broken gates, flight hazards or obstacles).

5.2.4 Safety

It is recommended that flying clubs have in place a Health and Safety policy and associated program pertaining to the flying sites that they are responsible for. In addition to specifying pilot activities to promote health and safety, the policy and program should include a system to communicate health and safety information to pilots as well as a system for identifying, addressing and monitoring health and safety issues as they arise.



A paraglider prepares to take off. Victoria, BC. Photo by Amir Izadi.

A type of Health and Safety Guideline and Management Plan (HSGMP) could be available as a document for Directors of flying clubs/associations, and for all pilots/members (ideally, this would build upon an extensive array of existing safety information already developed by individual flying clubs/sites). Based upon findings

from the impact analysis, the HSGMP should address (but would not be limited to) the following issues:

- *Visitor Safety*: Measures to provide visitor safety, including keeping visitors and spectators a safe distance away from designated launch areas and landing zones;
- *Accidents and Incidents*: Measures to confirm whether accidents and incidents are being reported, including procedures for contacting emergency services in case of accidents, and address causative factors if possible;
- *Unloading and Parking*: Measures to provide safe parking and unloading areas for vehicles for each site, based on estimated average use rates;
- *Landing Areas*: Measures to identify emergency landing site(s) (in addition to designated landing zones) and provisions for notifying all pilots of these locations prior to launch;
- *Launch and Set Up Areas*: Measures for installation and inspection of all new launch platforms (ideally by a certified engineer) to confirm that it meets safety requirements;
- Measures to provide periodic inspection of launch platforms for instability or other safety issues;
- Measures to provide ongoing site maintenance to launch platforms, general launch areas, set up areas and related signage and parking areas;
- Measures to provide instructional and safety signage at launch sites;
- Measures to provide pilots with enough space in the launch area for undistracted inspection, assembly and donning of equipment and safe launch (may require specification of number of participants permitted in the set-up area at any one time);
- If possible, identification of appropriate climatic/wind conditions for safe flights based upon pilot skill level and strategies to address unfavorable climatic conditions and,
- *Flight*: Specifications for the number of pilots permitted in the air close to launch at any one time.

5.2.5 Heritage and Historic Features

The following are mitigation strategies intended to contribute to the protection of heritage and historic features adjacent to or within flying sites:

- Provide pilots with educational information on: a) the definition of heritage site, traditional use sites and historic features, b) any known heritage sites or historic features in the flying site area, and c) the need to respect these aspects of cultural history by not damaging or altering them in any way;
- Provide pilots with instructions on what to do if they think they have found a cultural heritage site; and,

- Each flying association should develop a policy on how to effectively protect and conserve heritage property. This could include: a) mechanisms to educate pilots on the presence of heritage and historic features in the area, b) guidelines for pilots on how to notify their flying association if they think they have found a cultural heritage site, and c) guidelines for Directors of flying clubs (or pilots managing flying sites) on how to notify authorities if a pilot thinks he/she has found a cultural heritage site.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The purpose of this overview-level impact assessment is to identify potential environmental, social and economic impacts of paragliding and hang gliding as a sport and outline mitigation measures (including best management practices) to address potential impacts. In addition to use as a companion document in the review and approval of future Licenses of Occupation (or other forms of land tenure agreements), information presented in this report can also assist the BCHPA with development of future site-specific Management Plans¹⁹.

Should a site-specific screening-level environmental assessment under CEAA be required (i.e., in order to secure a land tenure or an agreement to use federal lands such as National Parks), Golder recommends the following information be included in the environmental assessment report:

- Project²⁰ description and scope, including proponent contacts, project name, purpose and scope, location and drawings, general biophysical description, project activities, scheduling, etc.;
- Description of the existing environment, including a description of the project setting, the physical environment, the biophysical environment, and the socio-economic environment;
- Identification of project-environment interactions;
- Identification of potential environmental effects, including the magnitude, extent, timing, duration, reversibility, likelihood and significance of those impacts;
- Social, safety, and economic impacts;
- Mitigation measures to eliminate, reduce or control adverse environmental effects of the project;
- Identify residual impacts after the application of mitigation measures and their significance;
- Identification of the effect of the environment on the sport;

¹⁹ Management Plans are required by an applicant to renew or secure Crown land tenureship agreements. Details of the Province of British Columbia's Site Management Plan requirements can be found at http://www.tsa.gov.bc.ca/resorts_rec/tenure/commercialrecreation/mpt.pdf

²⁰ In this case, the 'project' is the sport of hang gliding and paragliding

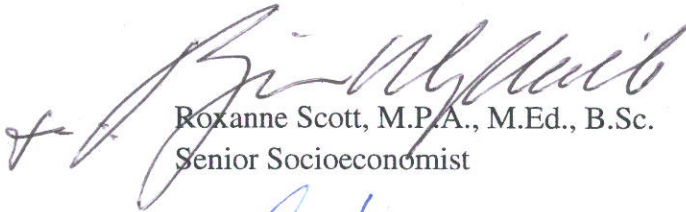
- Identification of the effect of accidents and malfunctions on sport-environment interactions; and,
- Identification any cumulative effects or those effects caused by the sport in combination with past, present, or future activities.

7.0 CLOSURE

We trust that this overview-level impact assessment report satisfies your present requirements. If you have any questions, or require additional details or further clarification on the contents of this report, please contact the undersigned.

Yours very truly,

GOLDER ASSOCIATES LTD.

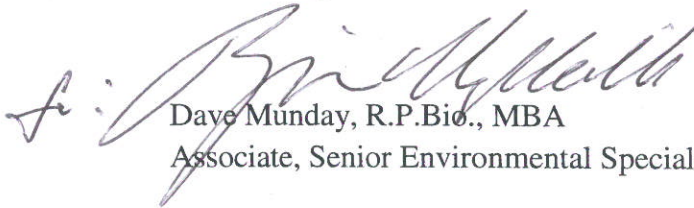


Roxanne Scott, M.P.A., M.Ed., B.Sc.
Senior Socioeconomist



Christy Jones, P.Ag., B.I.T.
Biologist

Reviewed by:



Dave Munday, R.P.Bio., MBA
Associate, Senior Environmental Specialist

RS/CJ/DM/tk

N:\ACTIVE\YEAR 2006\450\061-450028 (BCHPA - IMPACT ASSESSMENT)\WORDPRO\FINAL\BCHPA ASSESSMENT AUG 23 2006.DOC

8.0 REFERENCES

- Arcas Associates, 1984. *Meares Island Aboriginal Tree Utilization Study*. Unpublished report prepared for MacMillan Bloedel Ltd., Vancouver B.C. Copy on file at the Heritage Conservation Branch, Victoria, B.C..
- Braumandl, T.F. and M.P Curran. 2002 (reprinted with update). *A Field Guide for Site Identification and Interpretation for the Nelson Forest Region*. Forest Science Program, Ministry of Forests, Victoria, B.C
- British Columbia Ministry of Water, Land and Air Protection, 2004. *Best Management Practices for Recreational Activities on Grasslands in the Thompson and Okanagan Basins*. MWLAP, Ecosystem Standards and Planning Biodiversity Branch, Victoria, British Columbia.
- Cowichan Valley Regional District (CVRD) (1999) . *Electoral A Mill Bay/Malahat Zoning Bylaw No. 2000*. CVRD Planning Department, British Columbia.
- Demarchi, D.A. 1996. *An Introduction to the Ecoregions of British Columbia*. Ministry of Environment, Lands and Parks, Wildlife Branch.
- District of Kent 2005. *Statistical Profile Package 2005*. District of Kent, B.C.
- District of Kent, 2003a. *District of Kent Official Community Plan*. District of Kent, B.C.
- District of Kent, 2003b. *Mount Woodside Neighborhood Plan*. District of Kent, B.C.
- Department of Environment and Conservation, 2004. *Hang Gliding and Paragliding Policy*, NSW National Parks and Wildlife Service, New South Wales, Australia.
- Green, R.N. and Klinka, K. 1994. *A Field Guide to Site Identification and Interpretation for the Vancouver Forest Region*. Research Branch, Ministry of Forests, Victoria, B.C.
- Golden Economic Development Office. 2003. *Golden Community Profile 2003*. Golden Economic Development Office and the Town of Golden, Golden, B.C.
- KWC Planning Services. 2004. *Juan de Fuca Electoral Area Malahat Background Information for the Official Community Plan Update*. Prepared for the Cowichan Valley Regional District, Victoria, British Columbia.

Land and Water British Columbia (LWBC), 2005. *Land Use Policy Commercial Recreation*. File 12150-00.

Lloyd, D., K. Angrove, G. Hope, and C. Thompson. 1990. *A Guide to Site Identification and Interpretation for the Kamloops Region*. Research Branch, Ministry of Forests, Victoria, British Columbia.

Manning, R. and Valliere, W. 2001. *Coping in Outdoor Recreation: Causes and Consequences for Crowding and Conflict Among Community Residents*. *Journal of Leisure Research* 33, 4: 410-426.

Meidinger, D. and Pojar, J. 1991. *Ecosystems of British Columbia*. Research Branch, Ministry of Forests, Victoria, British Columbia.

Ministry of Water, Land and Air Protection. 2003. *Management Direction Statement for Mount Kobau Site, South Okanagan Grasslands Protected Area*. Province of British Columbia,

West Coast Soaring Club 2005. *Bridal Falls Hang Gliding and Paragliding Sites. Combined, Revised and Amended Management Plan*. West Coast Soaring Club, Mission, British Columbia.

Online Resources

B.C. Assessment Policy, Audit and Legal Services Division, 2006. *Heritage Sites Assessment Policy – Valuation Practices*. Accessed on June 3, 2006 at: http://www.bcassessment.bc.ca/pdf/process/policies/Policy_Value_HeritageSites.pdf

B.C. Conservation Data Centre. 2006. B.C. Ministry of Sustainable Resource Management. Victoria, British Columbia, Canada.. Accessed April 24, 2006 at: <http://srmapps.gov.bc.ca/apps/eswp/>

British Columbia Provincial Emergency Program (2006) PEP Ground Search and Rescue Report 2004/2005. Accessed July 10, 2006 at http://www.pep.bc.ca/volunteer/ground_SAR_Report-2005.pdf

British Columbia Provincial Emergency Program (2005) PEP Ground Search and Rescue Report 2003/2004. Accessed July 10, 2006 at http://www.pep.bc.ca/volunteer/ground_SAR_Report-2004.pdf

British Columbia Hang Gliding and Paragliding Association (BCHPA). 2006 Accessed May 23, 2006 at <http://www.bchpa.org/index.htm>

Government of Canada. 2006. *Species at Risk Act* Public Registry and Map Search. Ottawa, Ontario, Canada. Accessed April 24, 2006 at: http://www.sararegistry.gc.ca/default_e.cfm and http://www.sis.ec.gc.ca/ec_species/ec_species_e.phtml

Golden Flying Site. 2006. Pilot Information. Accessed March 7, 2006 at: http://cf.geocities.com/serge_lamarche/seven.html

GRAVSPORTS. 2006. Accessed May 23, 2006 at: http://www.gravsports.com/GTC%20Stuff/Golden_Canmore.htm

Hang Gliding and Paragliding Association of Canada / L'Association Canadienne de Vol Libre (HPAC/ACVL). 2006. Accessed May 23, 2006 at: <http://www.hpac.ca/>

Island Soaring Society (ISS). 2006. Accessed March 7, 2006 at: <http://www.islandsoaring.com/IslandSoaringSociety/tabid/258/Default.aspx>

Little, J. 2005. *2005 U.S. Paragliding Accident Summary*. Accessed June 1, 2006 at: <http://www.usnga.org/safety/PG2003AccidentSummary.pdf>

Little, J. 2003. *2003 U.S. Paragliding Accident Summary*. Accessed June 1, 2006 at: <http://www.usnga.org/safety/PG2003AccidentSummary.pdf>

Marcouiller, D., Scott, I. & Prey, J. 2004. *Addressing Recreation Conflict: Providing a Conceptual Basis for Management*. Accessed June 1, 2006 at: <http://www.wisconsinforestry.org/pdf/Assessing-Recreational-Conflict-lit-review.pdf>

Ministry of Environment. 2006. *Land and Resource Data Warehouse Catalogue Database and Maps*. Accessed April 24, 2006 at: http://maps.gov.bc.ca/imf406/imf.jsp?site=lrdw_catalog_ext.

Ministry of Environment. 2006. *Wildlife Guidelines for Backcountry Tourism/Commercial Recreation*. Accessed May 25, 2006 at: <http://www.env.gov.bc.ca/wld/twg/>

Ministry of Tourism, Sports and the Arts, (2003). *A Template to Help you Prepare a Commercial Recreation Management Plan*. Accessed on May 31, 2006 at: http://www.tsa.gov.bc.ca/resorts_rec/tenure/commercialrecreation/mpt.pdf

Ministry of Tourism, Sports and the Arts. 2006. Accessed May 18, 2006 at: http://www.tsa.gov.bc.ca/resorts_rec/tenure/commercialrecreation/mpt.pdf

Parks Canada, 2006. South Okanagan-Lower Similkameen National Park Reserve Feasibility Study. Accessed June 14, 2006 at: http://www.pc.gc.ca/progs/np-pn/cnpn-cnnp/os-os/index_e.asp

Province of British Columbia, 2005. *Commercial Recreation Application Package*.. Accessed May 31, 2006 at: http://www.tsa.gov.bc.ca/resorts_rec/tenure/commercialrecreation/complete.pdf

Statistics Canada 2001. 2001 Census. Accessed May 31, 2006 at: <http://www12.statcan.ca/english/census01/home/index.cfm>

Transport Canada. 2006. Accessed June 12, 2006 at: <http://www.tc.gc.ca/CivilAviation/RegServ/terminology/glossary/a2.htm>

West Coast Soaring Club. 2006. Accessed May 7, 2006 at: <http://www.westcoastsoaringclub.com/>

West North West Tasmania Recreation Planning Framework, 2001. *Economic Impact of Sport and Recreation*. Recreation Planning Framework for West North West Tasmania. Accessed on June 2, 2006 at: <http://www.development.tas.gov.au/sportrec/publications/cradlecoast/economic.pdf>

Wikipedia. 2006. Accessed May 23, 2006 at: <http://en.wikipedia.org/wiki/Paragliding>

Personal Communications

Duncan, B. May, 2006. Private Land Owner, Woodside Flying Site.

BCHPA, April - July, 2006 (Board Members A. Izadi, M. Nance, A. Polster, R. Samplonius), Personal Communications

Reich, J. June 9, 2006. FlyBC Paragliding. Personal Communication

Rich, P. April, 2006. Personal Communication

Cover Page Photographs

Left Picture: Hang glider waiting to launch at Golden, B.C. Photo by Margit Nance.

Middle Picture: Hang glider taking off from Upper Bridal Falls, Chilliwack, B.C. Photo by Dan Fabian.

Right Picture: Paraglider flying over Pemberton, B.C. Photo by Amir Izadi.

9.0 STATEMENT OF LIMITATIONS

This report was prepared for the exclusive use of the British Columbia Hang Gliding and Paragliding Association and its affiliates (i.e., the Hang Gliding and Paragliding Association of Canada/L'Association Canadienne de Vol Libre), and is intended to provide an overview-level impact assessment document as a basis for providing an understanding of the environmental impacts related to the sport of hang gliding and paragliding for audiences such as landowners, provincial and federal approving agencies as well as insurance agencies. The scope of this assessment is not intended as a site-specific Environmental Assessment for regulatory agency review, but to create a companion document to be used in the determination of impacts during the review and approval process for future Licenses of Occupation, or other forms of land tenure depending on the location of specific sites. This review is not intended to assess geotechnical, hydrological, geo-environmental, or archaeological resources.

The inferences concerning the conditions of the flying sites are based on information obtained from a limited review of available literature and data, and a site reconnaissance of the Malahat and Woodside sites conducted by Golder personnel. No extensive aquatic, wildlife, vegetation or air quality studies, and no archaeological, groundwater, hydrological, or soils investigations were conducted. In evaluating the proposed development, Golder has relied in good faith on information provided. We accept no responsibility for any deficiency or inaccuracy contained in this report as a result of our reliance on the aforementioned information.

The findings, recommendations, and conclusions documented in this report have been prepared for the specific application to the sport of hang gliding and paragliding and have been developed in a manner consistent with the level of care normally exercised by environmental professionals currently practicing under similar conditions in the jurisdiction. Golder makes no other warranty, expressed or implied.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.