Archaeological Overview Assessment for
Crystal Mountain Ski Resort Expansion

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ARCHAEOLOGICAL OVERVIEW ASSESSMENT FOR

CRYSTAL MOUNTAIN SKI RESORT EXPANSION

Introduction

Our company, Kutenai West Heritage Consulting Ltd. (**KWHC**) conducted an archaeological overview assessment (**AOA**) and preliminary field reconnaissance (**PFR**) of the proposed Crystal Mountain Ski Resort Expansion, located approximately 9km west of Westbank within the Okanagan Valley, on August 20th and 23rd, 2001. The study was conducted on behalf of Pheidias Development Management Corporation and Crystal Mountain Resorts Ltd.. An interim letter report was also prepared on September 15th, 2001, detailing the preliminary recommendations of the study.

The purpose of this study is to evaluate the Crystal Mountain Ski Resort Expansion area in terms of its potential to contain archaeological sites, prior to the commencement of land-altering activities. To facilitate this process, the following activities were conducted:

(1) background research on recent archaeological, environmental, geologic, and ethnographic information related to the study area;

(2) consulting and evaluating the known archaeological site database with respect to known site distributions and densities, previous archaeological studies and reconstructed land use, settlement and subsistence patterns;

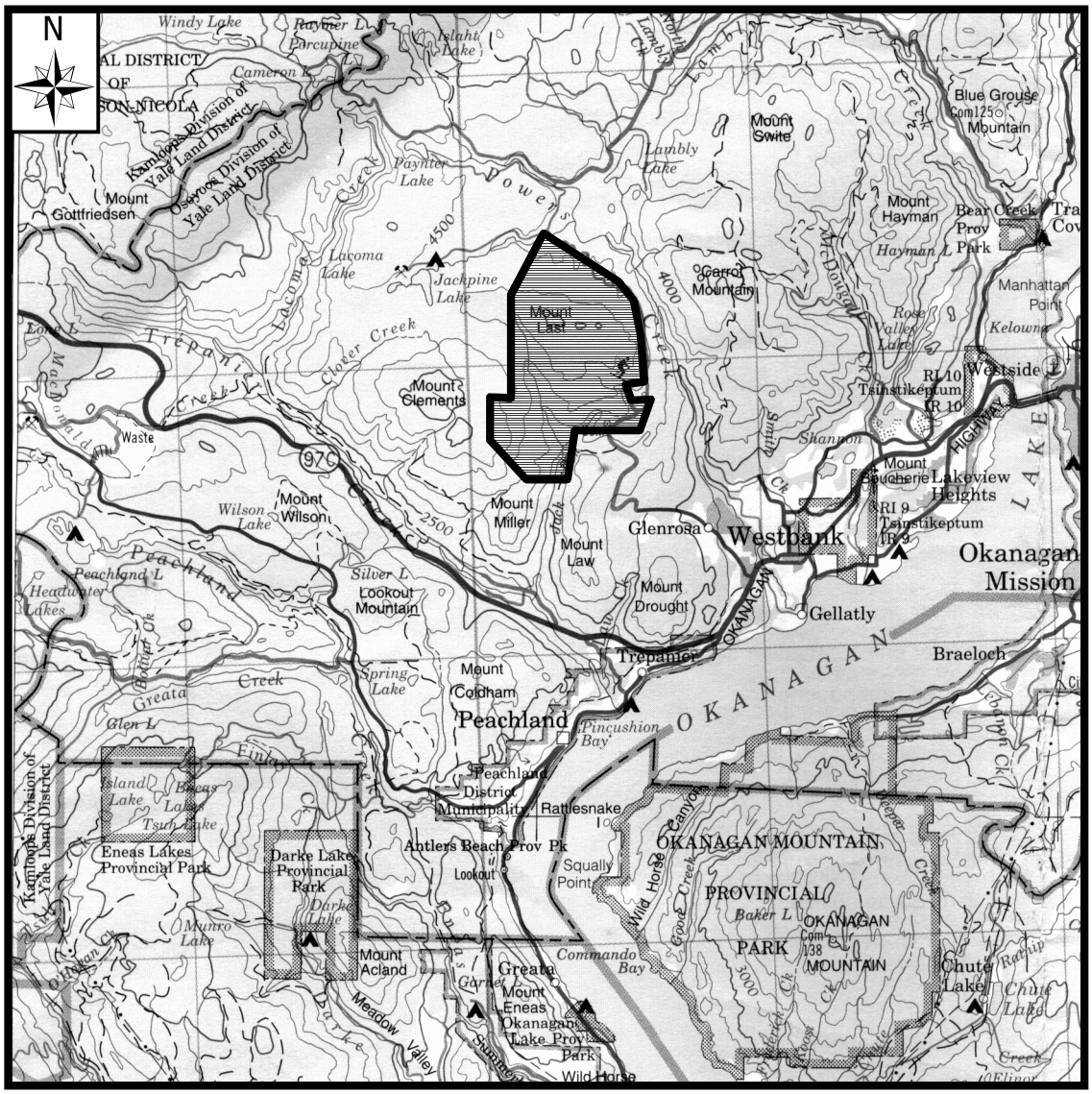
(3) conducting a **PFR** within the subject property. This involved an archaeologist and one or two aboriginal field assistants performing vehicular and/or pedestrian surveys within selected areas. Following Archaeology Branch guidelines, the survey primarily focused on above-ground features;

(4) identifying specific locations within the subject property which had a higher potential for containing archeological sites (i.e., terraces or benches; subalpine parkland; meadows, marshes and undefined lake margins; defined river, creek and lake margins; older growth pine and cedar stands; and surficial and bedrock geology);

(5) and summarizing the results of the **AOA** and **PFR** within this final report and providing recommendations that outline the manner in which the study results should be implemented.

This report is intended to be an operational tool that provides an archaeological overview assessment for the study area. It indicates those locations within the area that are more likely to contain archaeological sites, in the event that the appropriate governmental agencies determine that future studies are required.

Figure 1: Location of Crystal Mountain Ski Resort Expansion (NTS 82E, Scale 1:250,000)



The development area is situated near the headwaters of Jack Creek, with Powers Creek just beyond the eastern development boundary. Jackpine Lake and Lambly Lake are located to the west and northeast, respectively. Elevations within the development area range from 800m along Jack Creek to 1540m at the top of Mount Last. The majority of the development is located along the slopes and top of Mount Last, while a small section extends up along the slopes of Mount Clements, to the west. Terrain along the Mount Last ridge is very gently sloping to rounded, while the hillside display a continuous, moderate slope. Large sections of the Mount Last ridge have an open meadow / parkland environment; closed to moderately open forests dominate the slopes and Jack Creek valley. In general, lower elevation land-forms along Jack Creek and its tributaries are rounded to rolling and bedrock-controlled; thin sediment mantles are common. Several small areas of level, glaciofluvial terrace remnants and benches are present, however, overlooking Jack Creek and its unnamed tributary to the west.

Proposed Development Type and Facilities

The subject property has been proposed for an expansion of the existing Crystal Mountain Ski Resort into a 4-season destination resort. Projected land-altering activities associated with the expansion that could negatively impact any archaeological deposits present on the subject property include (see Enkon Environmental Limited 2000; 2001; Pheidas Project Management Corporation 2001):

- residential (single family and condominium) units and hotel units (total ~3,860 units)
- golf course(s)
- resort core area and retail space
- Teahouse restaurant (previously constructed at top of hill from 1967-1970)
- additional ski runs and ski lifts (to a total of twelve lifts)
- ancillary land-altering developments (i.e., road building, landscaping, sewer and water lines)

Existing Developments and Disturbance Factors

The following previous land-altering disturbances were noted during the **PFR**:

- land clearing and leveling and road construction associated with the existing resort core area, ski lifts and access roads
- numerous skid roads and landings associated with previous timber harvesting activities (situated mainly along the slopes of Mount Last and Jack Creek)

ABORIGINAL COMMUNITY DISCUSSIONS AND ETHNOGRAPHIC SUMMARY

KWHC met with Ms. Roxanne Lindley (Westbank First Nation) on August 7th for an initial discussion of the development. **KWHC** then met with Ms. Lindley on August 14th to discuss scheduling of the proposed field inspection. The fieldwork component was undertaken on August 20th and 23rd, with Ms. Lindley present on both days; Ms. Rhianna Lindley (Westbank First Nation) also accompanied us on August 20th. Crystal Mountain Resorts Ltd will forward a copy of this report to their office.

The study area lies within the traditional territory of the Okanagan Nation, specifically the Westbank First Nation. It is stressed that the present project does not attempt to identify and/or define "Traditional Land Use" areas within the study area for this Nation. Relevant ethnographic and historic references related to Okanagan peoples include Tolmie and Dawson (1884), Boas (1900, 1928), Elmendorf (1935-36), Ray (1939), Teit (1975), Turner (1978), and Turner, Bouchard, and Kennedy (1980).

Ethnographic accounts describe a semi-sedentary settlement pattern, with winter residency in low elevation, semi-permanent villages located along major rivers and lakes, and the remainder of the year spent at a succession of temporary hunting, fishing, and plant gathering locations, primarily in mid-elevation to upland areas. Two main habitation structures were located at these villages; the semi-subterranean pithouse and the matlodge. The pithouse, used exclusively in winter, was constructed by first digging a circular pit 1 to 2 m deep, in dry sandy soil, and covering it with layers of boughs, grasses, or rush mats. The roof consisted of a pole frame initially covered with pine needles or dry grass, and then earth. Entrance to the pithouse was gained from the roof. Ethnographic records suggest that the use of winter pithouses may have decreased prior to contact, and were being replaced by matlodges as winter habitation structures.

Matlodges, which were used year-round, continued to be employed during the post-contact period. This circular or square structure was similar in construction to the pithouse, yet built above ground and with lighter materials, such as reed mats. In winter, heavier materials could be used, including a combination of hides, reeds, bark, and earth. Features of the matlodge which may be archaeologically visible include an excavated floor (30 to 60 cm in depth), backdirt from the floor piled up against the outer wall for added protection from the elements, and post moulds along the inside wall where the ends of the poles were buried in the ground. Sweat lodges, built in a similar manner to the matlodge, yet of a smaller size, were used year-round at both semi-permanent village sites and at auxiliary sites such as hunting or fishing camps.

Hunting and fishing occurred year round, with the most intensive hunts in the fall, while the majority of fishing occurred between early spring and late autumn. Plants were gathered from early spring to late fall. Temporary basecamps were usually located in mid-elevation valleys, mid-elevation lakes or subalpine parkland settings, away from the main winter village sites, and were occupied by several family groups. Hunting basecamps were established in productive game locations, with berrying and/or root collecting often conducted nearby. Temporary housing structures erected at short-term sites include rectangular or oblong lean-tos, and conical pole frame structures. Coverings include mats, bark, brush, or grass.

A wide variety of plants are recorded for use as food, technology, and medicine, including black tree lichen, mushrooms, pine tree cambium, roots and other underground parts, seeds, nuts, and berries. Huckleberry appears to have been probably the most important plant resource. Several plants, including tree lichen, camas, onion bulbs, and other roots, and many animal foods, were prepared by steam cooking in circular earth ovens or pits. These pits may have been up to 1.2m deep, 1.5m wide, and 3m long. The pit was lined with round volcanic rocks, which were heated and then covered with a number of layers: a layer of dirt under a layer of fern fronds, skunk cabbage leaves, damp pine needles, sedges, or other vegetation; a layer of the food to be cooked; another layer of vegetation; and a final layer of dirt. Pouring water down several passages in the pit made steam. Cooking time ranged from overnight to up to three days.

Major fishing basecamps in the study area have been recorded ethnographically between Okanagan Falls and Oroville, in areas where salmon were plentiful. These sites had a large summer to early fall population. Smaller fishing stations were situated throughout the study area at locations where individual species were abundant. Harvesting methods included gill, dip, and drag netting, spearing, set line fishing with floats and sinkers, trolling, poisoning, and trapping with stone weirs or box-type or funnel-shaped baskets. The fish were either cooked for immediate use or preserved by air or smoke drying on racks, and then stored in elevated or underground caches.

Several methods of burial are noted for the study area, with individuals buried in either a flexed or extended position. Individual burial location was variable, with the following site locations noted: (a) sandy bench, terrace, river gravel beds; and (b) talus slopes where rockslides occurred. Shallow graves were sometimes covered with rocks, logs, or robes, while a circle of rocks may have surrounded deeper graves. Pictographs (rock paintings of dreams or events, applied with ochre) are noted as frequently being created by boys and girls during puberty, although adults also made them.

Archaeological Site Expectations

A review of ethnographic references from throughout the southern interior suggests there are potential similarities with regard to archaeological site patterning. We have adapted a generalized archaeological predictive model to the study area using information from the known ethnographic, ethnohistoric, and archaeological data (also see Alexander 1992a, 1992b; Tyhurst 1992). The study area has been divided into two zones, reflecting ethnographic activities as well as physiographic and elevational characteristics of the study area; the Montane Forest and Subalpine Parkland zones. We have inferred what type of ethnographic site types should be present for these areas, and identified the archaeological site correlate which should be represented (Table 1). The predictive model implemented here cannot be assumed to reflect aboriginal adaptations over the last 10,500 years given the presence of information gaps. It likely best addresses archaeological assemblages associated with the last 4,500 years as this is the best-known archaeological period and incorporates ethnographic and historic data from after the time of Euro-Canadian contact (see Bussey and Alexander 1992; Eldridge and Mackie 1993).

Table 1: Ethnographic Activities and Inferred Archaeological Sites, Montane Forest and Subalpine Parkland Zones (adapted from Alexander 1992b; Tyhurst 1992)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Residential / Transitory Basecamps		
i) Matlodges	Present	Lithic scatters, Faunal scatters, Hearths and Fire-broken rock concentrations
ii) Sweat lodges	Present	Shallow circular depressions, Hearths Fire-broken rock concentrations
iii) Menstrual lodges	Present(?)	Lithic scatters, Faunal scatters, Hearths
iv) Plant Food Preparation	Present	Deep circular depressions (root roasting pits), Berry drying trenches and Fire-broken rock concentrations
v) Mammal Food Preparation	Present Absent	Faunal scatters and Hearths Drying Racks
vi) Food Storage-Above Ground	Absent	Tree Caches
vii) Food Storage-Below Ground	Present	Small, deep circular depressions (i.e., cache pits)
Plant Gathering	Present	Bark stripped culturally modified trees
Hunting - Communal and Individual	Present	Lithic scatters (monitoring stations), Petroforms (e.g., drives and blinds), and circular depressions (blinds)
Kill and butchery sites		
i) ungulate	Present	Lithic scatters, Faunal scatters
ii) marmot	Absent	Snares along talus slopes
Burials	Present	Shallow ovate depressions, Petroforms (boulder piles)

In general, the Montane Forest and Subalpine Parkland zones would have been used during the snow-free period (i.e., May to October), with the Montane Forest zone mainly used as a transportation corridor to access the more open Subalpine Parkland zone. Residential and temporary basecamps would be erected within the forested environment or along the margins of the subalpine meadows, while hunting and gathering activities would occur throughout these areas. As can be seen from the above table, there is the potential for a wide variety of archaeological site types to be present within site-specific locations of the study area.

Past and Present Environment and Regional Archaeological Models

Following Hebda (1995), four general climatic periods are discussed for the study area: (1) postglacial (pre-10,500 years ago); (2) xerothermic (10,000-7,000 years ago); (3) mesothermic (7,000-4,500 years ago); and (4) modern (4,500 years ago-present). Glaciers retreated from the valley bottoms by 11,000 or 10,000 years ago, although the climate remained much colder and more moist than present (Fulton and Smith 1978; Clague et al. 1980). This resulted in a biogeoclimatic zone described either as a steppe-tundra, consisting mainly of tundra grasslands (Mack et al. 1979; Baker 1983:112) or an open lodgepole pine parkland (Hebda 1995:67). It is unlikely that significant populations were possible in the area prior to 11,000 years ago, given the probable presence of large glacier remnants. The Fluted Point Tradition, characterized by bifacial spear points that have been thinned through the removal of one or more basal flakes, has been proposed for the time period between 11,200 and 10,000 BP (see Carlson 1983, 1996; Rousseau 1993; Stryd and Rousseau 1996). Similar point forms are seen in surface collections near Shuswap Lake within the Thompson River drainage (Stryd and Rousseau 1996).

After 10,500 years ago, the climate became both warmer and drier than present (i.e., xerothermic; Mathewes 1985:419; Hebda 1995). This lasted to 7,500-7,000 years ago, and resulted in grassland expansion (Hebda 1982, 1995), a tree line risen in elevation over 100m (Osborn and Luckman 1988:124-125), and lake levels generally lower than when compared to today. The environment appears to have altered into an extensive Ponderosa Pine-type biogeoclimatic zone, with a mixed open forest including pine, birch, spruce, Douglas-fir, and shrubs likely present at upper elevations (Hebda 1995:69-72). After 10,500 years, the Early Stemmed Point Tradition, probably originating in the Great Basin to the south, continued until 7,000 to 8,000 BP (see Carlson 1983:73-86,1996:7-8; Rousseau 1993:148-150; Stryd and Rousseau 1996:180-181). Large parallel to expanding stemmed projectile points with shoulders occur within this time period.

Following the peak of the arid climatic period, weather patterns again altered, increasing the amount of moisture to modern levels, although mean temperatures were still warmer by one or two degrees Celsius on average (i.e., mesothermic [7,000 to 4,500 BP]; Hebda 1995). The grasslands gradually receded and the forest canopy began to close and approach that found in modern (pre-fire suppression) times (Alley 1976:1140-1141). Excavated Early Nesikep Tradition (ca. 7,000 to 4,500 BP) sites are presently restricted to the Mid-Thompson and Fraser River Valleys in south-central British Columbia (Sanger 1969; Stryd and Rousseau 1996:187-189). The diagnostic artifact associated with Early Nesikep Tradition sites are large lanceolate, corner-notched, or barbed projectile points with basal margins that may be ground or thinned (Stryd and Rousseau 1996:188-189,192). Microblades are also used. Subsequent Lehman Phase (ca. 6,000 to 4,500 BP) tools include thin pentagonal projectile points, circular scrapers with continuous retouch, and 'horseshoe-shaped' convex endscrapers (Stryd and Rousseau 1996:189-191,194). Microblade use does not appear to continue into this time period. An ungulate hunting orientation in the Southern Canadian Plateau upland is suggested for both the Early Nesikep Tradition and Lehman Phase (Stryd and Rousseau 1996:191,198).

From 4,500 years ago to the present, precipitation and temperature rates essentially reached current levels (Hebda 1995). Although several re-advances of mountain glaciers have occurred between 4,500 years ago and present (e.g., Denton and Karlen 1973; Osborn and Luckman 1988; Reasoner and Hickman 1989), little evidence indicates these had a substantial impact on the subsistence patterns of aboriginal peoples living in the Southern Interior.

Richards and Rousseau (1987:49-52; also Stryd and Rousseau 1996:198) have defined the Late Period as being represented by the Plateau Pithouse Tradition, which is divided into four time periods: the Lochnore Phase (ca. 5,500 to 3,500 BP); the Shuswap Horizon (ca. 3,500-2,400 BP); the Plateau Horizon (ca. 2,400-1,200 BP); and the Kamloops Horizon (ca. 1,200-200 BP) (Richards and Rousseau 1987; Stryd and Rousseau 1996). Small oval, semi-subterranean pithouses or mat lodges, and circular to oval interior food storage pits appear in the latter half of the Lochnore Phase (ca. 4,500 BP) (Wilson et al. 1992; Stryd and Rousseau 1996:193-196). Common technical patterns appear to include: a semi-sedentary settlement pattern, with winter sedentism at pithouse villages; a reliance on salmon runs; the use of root-roasting pits and earth ovens for processing plant foods; the use of boiling stones for cooking; sophisticated wood-working and fishing technologies; and more extensive trade networks (Richards and Rousseau 1987:50-51).

Archaeological Background

Borden Blocks are the manner in which Canadian archaeologists derive a rough estimate of a recorded site's position. Each Block is a standardized square of ten minutes longitude by ten minutes latitude, identified by four alpha characters and a single numeric variable (e.g., AbCd-01). The development is located within Borden Block DlQw. A data search of the Archaeology Branch files indicates that no previously recorded archaeological sites are present within the study area. An archaeological impact assessment was conducted for Gorman Bros. Lumber on Mt. Clements (Cutting Permit 194, Block 8) and along Law Creek (Cutting Permit 340, Block 1), west and south of the proposed development, respectively (Handly 2000:6-7,10-11); no archaeological sites were recorded.

AOA RESULTS

The purpose of the AOA / PFR was to assess the likelihood of archaeological sites being located within the proposed development and assist in directing future archaeological field studies, if required. The development was assessed using the following data: 1) 1:20,000 scale TRIM; 2) 1:15,000 scale aerial photographs; 3) forest cover information (Enkon Environmental Limited 2000; Pheidas Project Management Corporation 2001); 4) surficial geology maps (Pheidas Project Management Corporation 2001); and 1:250,000 scale bedrock geology maps (Tempelman-Kluit 1989). Based upon previous assessments that **KWHC** has conducted in the region, the presence of the following specific criteria were then used to rank archaeological site potential within the study area.

High Archaeological Potential Polygons

- Glaciofluvial landforms (<20% slope)
- Subalpine parkland (<20% slope)

Criterion 1; Glaciofluvial Landforms

Early postglacial features (i.e., glaciofluvial landforms) are higher elevation landforms that were possibly used by aboriginal peoples for camping and subsistence activities from the time of glacial retreat onwards. The Pheidas Project Management Corporation report (2001:3-23 to 25; Figure 3-2) indicates that glaciofluvial sediments are present along the southern portion of Jack Creek and far northern margin (near Powers Creek). The remainder of the development displays colluvial sediments (Mount Last, east slope of Mount Last and upper sections of Jack Creek) or morainal deposits (north, west and east slopes of Mount Last). If level terraces were present in these areas they would be considered to have high archaeological potential.

Criterion 2; Subalpine Parkland

Level portions within and surrounding parkland environments are stated within ethnographic literature as containing substantial summer residential basecamps, with the subalpine areas also used for hunting and

plant gathering activities. The reliance of these locations to aboriginal people is stressed within the ethnographic literature, indicating that a High ranking is warranted. The Pheidas Project Management Corporation report (2001:3-23 to 25; Figure 3-2) also noted that the upper south and southeast facing slopes had thin, well to moderately drained sediments overlying volcanic bedrock. The initial aerial photographic analysis and photographs contained in Enkon Environmental Limited (2000) and Pheidas Project Management Corporation (2001) show numerous contiguous subalpine meadows there, either along the height-of-land leading from the existing ski hill to Mount Last or along the south and southwest facing slopes overlooking Jack Creek. The landform slope data (Pheidas Project Management Corporation 2001:3-7) indicates that these areas are less than 15% in slope and this, in conjunction with the presence of the subalpine meadows, strongly suggests that these areas would have a high archaeological site potential.

Moderate Archaeological Potential Polygons

- Secondary stream margins (<20% slope)
- Meadow / wetland and indefinite lake margins (<20% slope)
- Older growth lodgepole pine stands (<20% slope)
- Bedrock geology formations with chert formations (<20% slope)

Criterion 3; Secondary Stream Margins

Smaller creeks are stated in ethnographic records to have been used as transportation corridors and for hunting locations by aboriginal peoples, and fluvial terraces or benches may have short-term campsites. The landform slope data (Pheidas Project Management Corporation 2001:3-7; Figure 3-1) indicates that areas adjacent to Jack Creek and its tributaries range between 16 and 45% slope. Given this, the potential for archaeological site placement along these watercourses is not considered probable, but these areas should be briefly assessed during the PFR for confirmation.

Criterion 4; Meadow, Wetland and Indefinite Lake Margins

Elevated and/or level landforms surrounding these features are believed to have archaeological site potential given that they are recorded as areas used for hunting ungulates, other large or small mammals, and waterfowl. The aerial photographs indicate that several small wetlands are present along the height-of-land leading to Mount last from the existing ski hill. Given that this area averages between 10 and 15% slope, these features are considered to have moderate archaeological potential and should be assessed during the PFR to confirm their potential. As well, smaller meadows (see above) are present within the lower elevations as a result of a Natural Disturbance Type 4 (NDT4) environment. This represents a grassland / open forest which is maintained by frequent low intensity fires; these areas would probably be assessed as moderate archaeological potential.

Criterion 5; Older Growth Lodgepole Pine and Cedar Stands

The presence of older growth western red cedar and lodgepole pine stands were selected for culturally modified tree potential, given that the majority of these site types in BC are produced from cedar or lodgepole pine. This criterion reflects the potential for aboriginal, culturally modified trees to be present within a given development. In the case of the study area, if present, these would most probably be represented by bark-stripped lodgepole pine trees produced through the removal of the bark to access the cambium layer. The Enkon Environmental Limited (2000:5) and Pheidas Project Management Corporation (2001:1-5, 3-26 to 29) reports indicate that the upper slopes of Mount Last are within the MSdm2 biogeoclimatic zone which contains mainly lodgepole pine and Engelmann spruce with an understorey of falsebox, black huckleberry and grouseberry. The lower elevations of the study area (below 1300m) are within the IDFdk2 which has lodgepole pine and Douglas fir with an understorey of saskatoon berry, birch-leaved spirea and bluebunch wheatgrass. Age class data suggests that lodgepole pine stands within the study area range between 41 and 120 years old. This suggests that archaeological culturally modified lodgepole pine trees (i.e., pre AD 1846) are not probable. (No culturally modified lodgepole pine trees were observed during the subsequent **PFR**).

Criterion 6; Bedrock Geology Formations

Geologic texts describe a bedrock formation within the study area that may contain fine-grained stone types that are well suited for stone tool production (Tempelman-Kluit 1989). The summit of Mount Last falls along the geological boundary of the Ek (Kitley Lake Formation), a massive, yellow to buff trachyte to trachyandesite with a finely crystalline groundmass. Ash flows and minor mudstones are also represented. The possibility of bedrock and/or float quarries of lithic raw materials (specifically chalcedonies and cherts) suitable for stone tool production are considered strong for this formation. Lithic quarry sites can be identified through adits where hard-rock mining occurred, or as float cobbles within the sediment mantle. Generally large and dense scatters of tools and manufacturing waste are also characteristic of these site types. These lithic outcrops would most likely be exposed on the subalpine meadows on the ridge from the existing ski hill to Mount Last.

Additional Information

The following animal species, which were commonly used by local aboriginal groups for various purposes, are also known to inhabit the area (Pheidas Project Management Corporation 2001:3-35 to 36): black bear, fisher, marten, moose, mule deer, porcupine, rocky mountain elk, ruffed grouse, snowshoe hare and white tail deer. Mule deer and white tail deer have been noted in the southeast section of study area, southern arm of Jack Creek and immediately south of the study area in the present telemark ski area (Enkon Environmental Limited 2000:34). Fish species that might have been exploited by local aboriginal groups include rainbow trout and kokanee in Jack and Powers Creeks. Eastern brook trout is also present, but is a non-indigenous (i.e., introduced) species (Enkon Environmental Limited 2000:5; 2001:III-3; Pheidas Project Management Corporation 2001:1-1 to 2).

PFR RESULTS

Our PFR involved both pedestrian and vehicular traverses (Figure 2). The vehicular traverses followed the main forestry access roads that lead through the southern, eastern, west-central and north-central portions of the development area. Pedestrian traverses were used along the ridge between the existing ski hill and Mount Last (across the open subalpine meadows), along portions of the existing telemark trail to the south of Jack Creek and in various meadows along the lower southern and southwestern slopes of Mount Last. As a result of the investigations fifteen (15) areas were selected as having moderate or greater archaeological potential (Figure 3).

Areas 7, 9, 10 and 12 (Criterion 1); Glaciofluvial terrace remnants, north bank of Jack Creek

A large glaciofluvial terrace remnant is represented in four locations directly north of the Jack Creek wetland and south of the existing ski hill. This landform has been impacted by access road construction and logging activities; however, significant portions remain relatively undisturbed. These gently sloping to level, well-draining landforms would have provided suitable locations for a small hunting or gathering sites and I consider these areas to have moderate to high archaeological potential.

Area 14 (Criterion 1); Glaciofluvial terrace remnant, east bank of Jack Creek tributary

The fifth terrace remnant overlooks the east bank of a Jack Creek tributary stream. Sections of the terrace have been significantly impacted by previous timber harvesting activities and access road construction; however, a portion is still relatively undisturbed. This level, well-draining landform would also have provided a suitable location for a small hunting or gathering site and I consider this areas to have moderate to high archaeological potential.

Areas 1, 2, 3, 4, 5 and 6 (Criteria 2 and 6); Ridge from existing ski hill to Mount Last

The height-of-land from the existing ski hill to within 600m of Mount Last was pedestrian traversed by a three person survey crew. Several poorly draining wetland / ponds are present in the hollows along the ridge. Sediments around these features were rocky and no elevated landforms suitable for shovel testing are present around their margins. The most striking characteristic of this area is the large expanses of gently sloping to rounded open meadows along the thinly mantled ridges. Although no definitive archaeological materials were encountered, large numbers of lithic raw materials, suitable for the production of aboriginal stone tools, were observed and collected. Thinly banded, clear chalcedony was noted exposed on the majority of the meadow ridges. As well, two large nodules of reddish-brown, vitreous chert were also recovered from two meadow openings approximately 50m apart. These two material types were found eroding from bedrock exposures. A large piece of vitreous black basalt, similar to aboriginally used lithic materials encountered near Pennask Lake, to the east, was also recovered from an existing cutblock access road immediately to the south of one of the meadows. In total, eleven locations within these six areas contained examples of these three raw materials. The most commonly encountered material was the clear chalcedony (n=8 locations). The presence of these three lithic materials in a spatially restricted area suggests that large bedrock or float quarries, possibly associated with medium to large-sized stone tool production locations are strongly supported in these meadows. In addition, the potential for ungulate monitoring and hunting sites within the meadows and along the meadow margins is considered high.

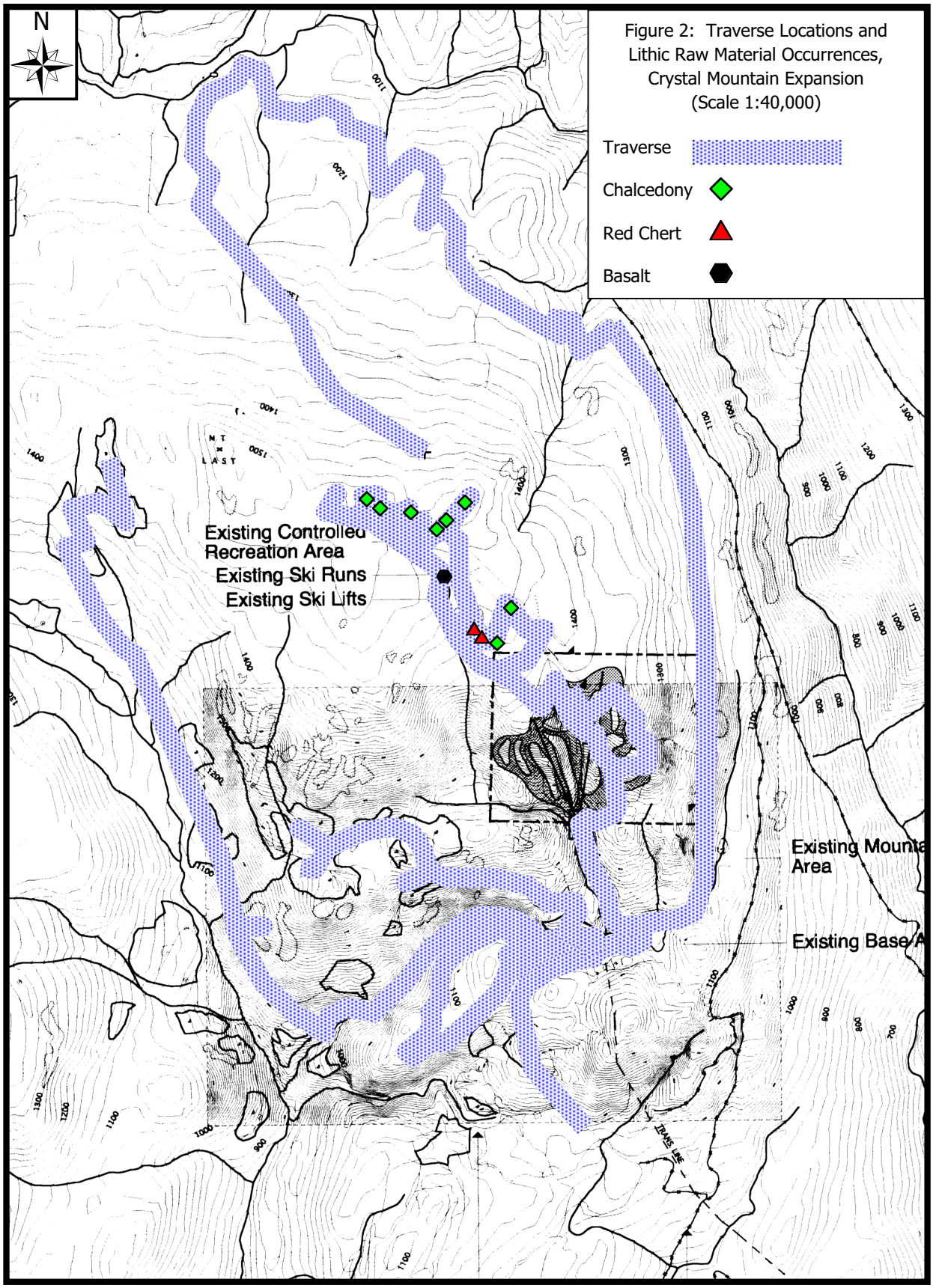

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Figure 2: Traverse Locations and Lithic Raw Material Occurrences, Crystal Mountain Expansion (Scale 1:40,000)
Traverse
Chalcedony
Red Chert
Basalt
Existing Controlled Recreation Area
Existing Ski Runs
Existing Ski Lifts
Existing Mounta Area
Existing Base A

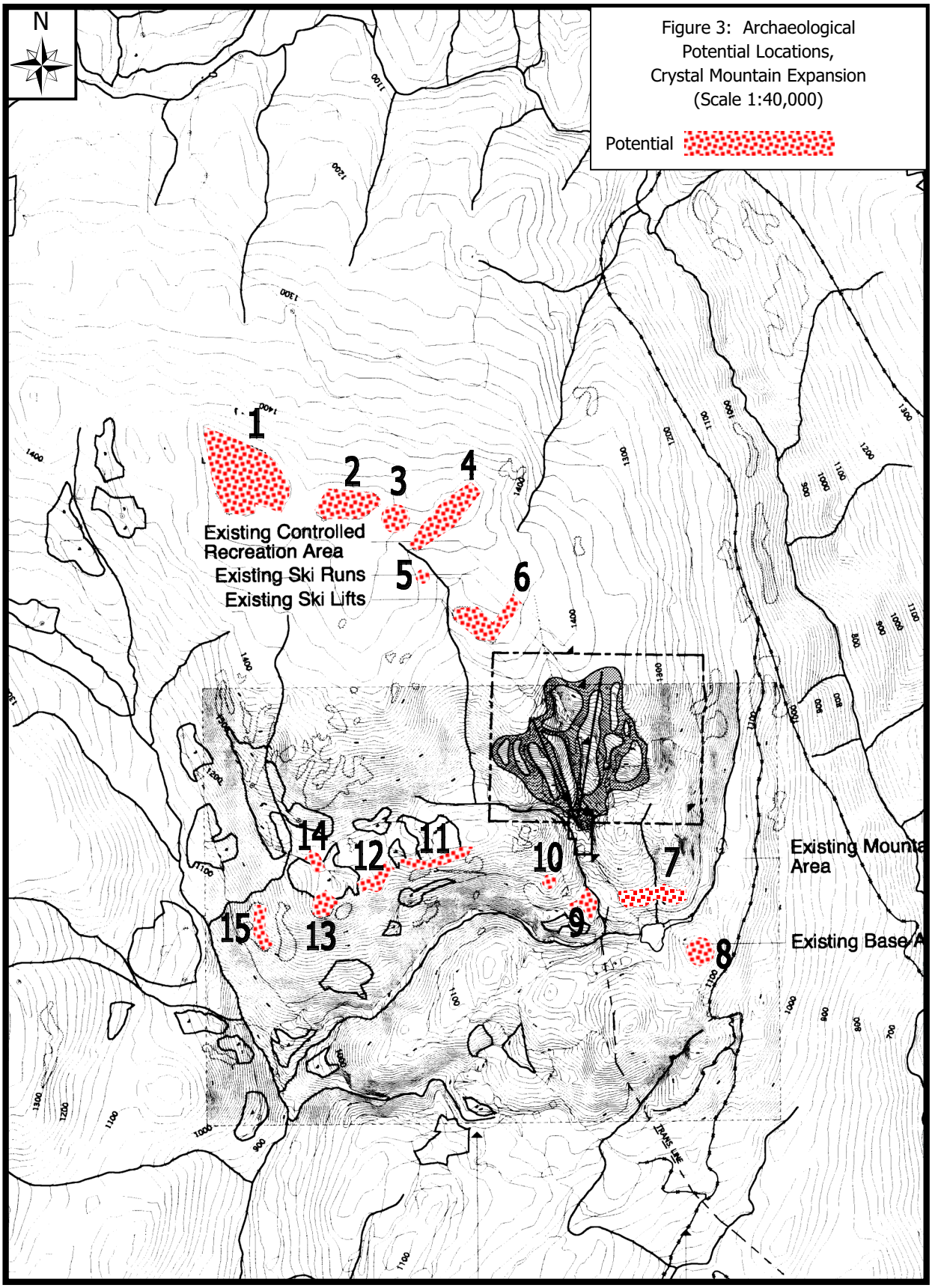
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Figure 3: Archaeological Potential Locations, Crystal Mountain Expansion (Scale 1:40,000)
Potential
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
Existing Controlled Recreation Area
Existing Ski Runs
Existing Ski Lifts
Existing Mounta
Area
Existing Base A

Area 8; Elevated knoll overlooking Jack Creek and wetland (Criterion 3)

Although the Jack Creek wetland appears to be a relatively recent creation, formed by the blocking of a culvert, the knoll to the south of the wetland is elevated and fairly level. Although sediment mantling along this landform is fairly thin, I believe that there is a moderate potential for a small hunting site to be located overlooking the wetland.

Areas 11, 13 and 15; Meadows overlooking Jack Creek and Jack Creek tributary (Criterion 4)

The first meadow (Area 11) stretches along a ridge overlooking Jack Creek to the south, while the two remaining meadows (Areas 13 and 15) are situated overlooking the confluence of Jack Creek and an unnamed tributary of Jack Creek. As with the subalpine meadows discussed above, these locations would be appropriate locations for ungulate monitoring and hunting sites within, and along the margins of, the meadow. No evidence of suitable lithic raw materials was noted during the pedestrian traverse of these areas. These three areas have been assessed moderate archaeological potential.

RECOMMENDATIONS

A) If future land-altering developments are planned near the following fifteen areas, we recommend that an archaeological impact assessment study be initiated:

- Area 1 - Subalpine meadow on Mount Last ridge
- Area 2 - Subalpine meadow on Mount Last ridge
- Area 3 - Subalpine meadow on Mount Last ridge
- Area 4 - Subalpine meadow on Mount Last ridge
- Area 5 - Subalpine meadow on Mount Last ridge
- Area 6 - Subalpine meadow on Mount Last ridge
- Area 7 - Glaciofluvial terrace remnant, north bank, Jack Creek
- Area 8 - Knoll overlooking Jack Creek wetland
- Area 9 - Glaciofluvial terrace remnant, north bank, Jack Creek
- Area 10 - Glaciofluvial terrace remnant, north bank, Jack Creek
- Area 11 - Meadow overlooking Jack Creek
- Area 12 - Glaciofluvial terrace remnant, north bank, Jack Creek
- Area 13 - Meadow overlooking Jack Creek and Jack Creek tributary
- Area 14 - Glaciofluvial terrace remnant, east bank, Jack Creek tributary
- Area 15 - Meadow overlooking Jack Creek and Jack Creek tributary

This assessment would focus on determining the actual archaeological potential of these areas and conducting surface and subsurface examination of landforms where appropriate. If archaeological sites were encountered, appropriate mitigative measures would be generated to ensure that any discovered archaeological resources were managed appropriately. If no sites are located during the **AIA**, further assessment should not be required.

B) We believe that, except for those areas identified above, the remainder of the development property has Low archaeological site potential and we recommend that no further archaeological studies are required.

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