ARCHAEOLOGICAL OVERVIEW ASSESSMENT
OF LANDSCAPE UNITS K16 - 18 AND K20 - 24,
KOOTENAY LAKE FOREST DISTRICT

prepared for Meadow Creek Cedar Ltd.

by

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Credits

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Management Summary

The Provincial Forest lands encompassed within Landscape Units K16 - 18 and K20 - 24 of the Kootenay Lake Forest District were assessed for archaeological potential via aerial photograph analysis. A total of 467 landform-based polygons were identified as having potential to contain significant archaeological sites. The archaeological potential of the polygons was assessed via criteria derived from precontact land and resource use models developed for the upper Columbia River drainage. Numerical scoring of the criteria resulted in 100 polygons being assessed as having High archaeological potential and 367 polygons assessed as Medium.

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1. Introduction

This report accompanies the mapping of archaeological potential on Provincial Forst lands in Landscape Units K16 - 18 and K20 - 24 in the Kootenay Lake Forest District. It summarizes the background information that is the basis upon which the polygons were delineated and assessed, and describes the methodology employed. The report concludes with discussion and evaluation of the results and recommendations for future management.

The work was carried out under contract for Meadow Creek Cedar Ltd. with funding from the Forest Investment Account.

2. Study Area Environmental Background

Landscape Units K16 - 18 and K20 - 24 encompass parts of the Selkirk and Purcell Mountains drained by the Lardeau and Duncan Rivers. The east boundary of the study area consists of the Purcell Mountain crest except at the southeast corner where the study area is bounded by the Purcell Wilderness Conservancy. In similar fashion, the northwest boundary is the Selkirk Mountain crest extending south to the Lardeau drainage below the upper two thirds of Trout Lake; at the southwest corner the boundary is Goat Range Provincial Park.

This terrain was produced by several episodes of mountain building accompanied by the emplacement of granitic intrusions and the warping, fracture and uplift of sedimentary rocks. These processes and their accompanying stresses resulted in the metamorphosis and fusion of some of the sediments into hard, fine-grained stone such as quartzite that would later prove to be valuable material for toolmaking.

The bedrock underlying most of the landscape units (LUs) consists of Cambrian to early Mesozoic quartzite, conglomerate, thin-bedded dolomite, greenstone, amphibolite, phyllite and siliceous argillite of the Hamill, Lardeau and Horsethief Creek Groups and the Chancellor and Badshot-Mohican Formations (Reesor 1996). To the west of these north-south striking strata are Jurassic plutons with associated horneblende, biotite, granodiorite and granite.

Some time before 70 million years ago, downfaulting created the Purcell Trench, a north-south trough that developed further as an erosional form during the Tertiary. This area was extensively glaciated during the Pleistocene Epoch of the last few million years, although evidence of only the most recent glacial activity has been recognized at the present time. The most extensive advance comprised a coalescent ice sheet that covered all but the highest peaks. The Purcell Trench was subsequently occupied by a large trunk glacier that advanced well south of the present International Boundary after 25,480 + 320 B.P. (Fulton 1971) and valley glaciers advanced partway down the major valleys from cirques at the heads of tributary valleys. Most cirques are still occupied by glaciers and their headwalls typically abut to form steep horns and knife-edged arretes. This deep scouring has created extremely rugged upland topography exept for where cirque glaciers have coalesced into small ice caps, plus a few more level areas, now unglaciated, that were previously occupied by latest Pleistocene ice caps. Below the broader U-shaped upper valleys scoured by ice tongues, the lower sections of most of the major watercourses are deeply entrenched into steep-sided canyons, except for the Lardeau and Duncan Rivers whose lower valleys become wider.

Final deglaciation is suggested to have commenced about 15,000 years ago (Ryder 1981). Parts of the upper Columbia River drainage became ice-free sooner than areas further west (Choquette 1996). A mechanism for this that has significant palaeoclimatic implications for human inhabitation has been suggested by Clague (1989: 43): the early retreat of mountain glaciers in some areas may have resulted from a reduction in precipitation in the eastern Cordillera due to growth of the Cordilleran Ice Sheet to the west. Ice covering the British Columbia interior may have depleted or diverted moist air masses that previously had flowed across the central Columbia Mountains, making the air reaching that area rather dry. This, in turn, likely limited the extent of ice accumulation compared to the area to the west, so that intense valley glaciation, took place instead of extension of the ice dome. Local glaciers may have been retreating at a time when both the Fraser and Laurentide ice sheets were growing. Higher elevations apparently became ice-free first (Clague 1989), while melting ice blocks lingered at some places in the valley bottoms. The large deep lakes that characterize the upper Columbia drainage, such as Kootenay, Trout and Duncan, occupy the basins previously occupied by these glacial remnants.

The vast majority of the landscape is moderately to steeply sloping. However, some level terrain lies above and adjacent to Kootenay and Duncan lakes and high terraces are present above the lower courses of the Lardeau River and Meadow Creek. Remnants of level deltas occur above the mouths of many of the major tributary streams. These landforms appear to be graded to the elevation of a 595 m a.m.s.l. stand of Glacial Lake Columbia that was dammed at the Grand Coulee by the Okanagan ice lobe and to higher levels of Kootenay Lake, the historic level of which is at an elevation of 532 m a.m.s.l.. Radiocarbon dates on a much smaller lake at an elevation of 488 m in the Selkirk Trench to the west indicate that both the prominent 595 m terrace system surrounding Kootenay and Duncan lakes and higher early postglacial levels of these lakes were emergent landsurfaces prior to 10,000 years ago (Choquette 1996). Most of the watercourses in the LUs have relatively narrow floodplains flanked by colluvium (much in the form of avalanche debris) and alluvial fans.

With regard to the postglacial palaeoecology of the study area, it is necessary to extrapolate palaeoenvironments from surrounding regions. The Columbia River drainage was apparently deglaciated relatively early when compared to equivalent latitudes in North America. Sheltered from the retreating Continental and Fraser ice domes by mountains, the region would have been under the influence of predominantly dry northerly airflow in late Pleistocene times. Pollen studies have identified a pioneer community of grass, sage, cattails and scattered conifers as the first widespread vegetation in most of the upper Columbia River drainage 12,000 or more years ago. This cold desert "steppe tundra" habitat gave way after about 10,500 years ago to coniferous forests as a warming climate permitted their invasion of the valley bottoms and mountainsides. Fire was already part of the regional ecology by 11,000 years ago; it apparently increased in frequency until the trend to aridity and high solar insolation peaked around 8000 years ago when Douglas fir open canopy forest and savannah grasslands were probably widespread. Vegetal communities in the upper Columbia basin were relatively simple in composition between 10,000 and 7,000 years ago and were characterized by pronounced altitudinal and latitudinal zonation (Choquette 1987a).

By 6000 years ago, a major climatic change was underway as the Maritime westerlies began to exert a dominating influence (ibid.). The predominant trend in vegetal configuration became longitudinal, and west-facing windward slopes became cloaked with dense forests. An increasingly varied and diverse vegetational mosaic evolved during a series of increasingly colder cycles within the last 6000 years. A global cooling trend had begun to affect the region, resulting in the regrowth of cirque glaciers at higher elevations beginning around 5000 years ago. The interval between ca. 6000 and 2500 years ago in the Kootenay drainage was characterized by high fluvial discharge and the region may have supported generally more extensive aquatic ecosystems, including larger resident fish and waterfowl populations as well as more productive riparian communities. Conditions between about 4000 and 2500 years ago were cooler than during subsequent millenia (Baker 1983) and were characterized by generally low forest fire frequency; forests expanded at the expense of grassland throughout the region. The maritime elements of the regional flora such as cedar and hemlock made their first appearances 4000-5000 years ago and became common after 3000 b.p. There is evidence for a second Neoglacial advance between ca. 3500 and 2500 years ago. This was followed by a relatively brief warm and dry interval during which forest fire frequency and parkland-grassland habitats increased while fluvial discharge notably decreased and local hydrological baselines were lowered. The final glacial episode, the "Little Ice Age", reached its maximum expression between ca. AD 1630 and AD 1870 when it had become the most severe glacial episode in the upper Columbia drainage since the Pleistocene retreat more than 12,000 years ago.

At the present time, the paucity of palaeofaunal data from the study area limits our knowledge of the evolution of its wildlife populations The continental conditions of droughtiness and high fire frequency between ca. 9000 and 7000 years ago probably supported greater ungulate populations in the Purcell and Selkirk Mountains than were known historically, but this is hypothetical at present because of poor bone preservation and the lack of systematic archaeological investigaton. When the westerly winds had begun to sweep regularly across the region after 6000 years ago, ungulate populations west of the Purcell Mountain crest would have declined as forest cover reduced their critical ranges. It is clear, however, that such populations would have not been static over the subsequent period. Fluctuations in deer, elk and caribou populations in response to climatic variation have been documented in the archaeological and ethnohistoric records further south (c.f. Choquette and Holstine 1982) that were probably reflected in the Kootenay Lake vicinity as well. For example, the abundance of deer and elk seem to covary inversely during warm and cold intervals, respectively. Caribou would undoubtedly have been favoured during the colder portions of the climatic cycles. An expansion of the range of whitetail deer north of 50 North Latitude is apparent from reports of Schaeffer's Ktunaxa informants (Schaeffer 1940); this is probably related to European land use practices.

The large lakes and rivers in the study area supported large populations of a variety of fish species including rainbow, cutthroat and bull trout, ling cod, and sturgeon. The presence of landlocked salmon in Kootenay Lake may be taken to indicate that anadromous salmon once ran at least that far. In historic times, Pacific salmon could not ascend the falls on the Kootenay River below Kootenay Lake. As mentioned previously, the 10,000 b.p. dates on the 488 m lake in the Selkirk Trench provide an upper limiting age for the present 532 m a.m.s.l. level of Kootenay Lake that is controlled by these falls. Allowing time for the Kootenay River to exhume the falls, it can be concluded that salmon could have been ascending into the study area during early postglacial time, as the mouth of the Columbia River and many of its major tributaries are well to the south of all of the Pleistocene ice fronts and salmon runs were undoubtedly established in that drainage long before any of British Columbia's other rivers could support them.

Despite the fact that anadromous salmon did not enter Kootenay Lake during the later Holocene, mention of this resource is also warranted because of its great importance in the aboriginal economy and its influence on human movement patterns through the area. Regional palaeoenvironmental data has been synthesized into models of Holocene palaeoclimatology and palaeohydrology for the upper Columbia River drainage (Choquette 1985, 1987a) that have been used as a basis for predicting the Columbia's past salmon carrying capacity. The models define a series of climatic cycles during which climatically induced variations in fluvial discharge and sediment load would have affected salmon carrying capacity either positively or negatively. Periods of high fluvial discharge and relative stability from about 4500 and 2500 years ago and again from about 1500 and 500 years ago probably fostered large salmon runs that in turn would have supported large resident human populations and trading centres in the study area vicinity (see also Section 3.2).

The environmental effects of the Little Ice Age were severe enough that they resulted in the disappearance of bison, antelope and prairie chicken from the

East Kootenay and northwestern Montana areas. Given the extent of recent glaciation, the animal residents in the study area would undoubtedly have been affected even more seriously by this very severe climatic episode, and its effect on human populations is undoubtedly one reason for the relative scarcity of aboriginal presence during the contact era.

3. Archaeology

3.1 Previous Investigations

The first archaeological work in the study area was a brief archaeological reconnaissance in 1966of the then-proposed Duncan Reservoir pondage. The survey was carried out by boat and focused primarily on the shores of Duncan Lake, although some upland traverses were also made (Fladmark 2005: pers. comm.). Four precontact archaeological sites were recorded on the east side of the lake, all associated with beaches. Prior to this reconnaissance, one site had been recorded on the basis of information provided by Mrs. F.E.M. Bildstein, a local resident who had found ground stone artifacts including pestles above the west shore of Duncan Lake near Howser. The shoreline of Kootenay Lake was the subject of a multi-year rock art survey in the late 1970's (Baravalle 1981). In 2002 parts of the Duncan Reservoir were resurveyed and two additional sites and three isolated finds were documented (Choquette 2002).

Other quasi-systematic archaeological field investigation in the LUs has consisted predominantly of localized archaeological impact assessments of proposed forest industry developments (e.g. Magee 1998, Kutenai West Heritage Consultants 1998, 1999, 2001, Campbell 2000, Handly 2002, 2003, Wood 2004, 2006, Burke 2005: pers. comm.).

3.2 Culture History

Because of the dearth of controlled archaeological data, especially from excavation, it is necessary to extrapolate a culture history sequence from adjacent areas. Most of this information has been synthesized into a number of archaeological complexes which are constellations of attributes related to patterns of precontact human land and resource use (c.f. Choquette 1984, 1987b, 1993 and 1996).

Evidence of human presence in the southern Purcell and Selkirk Mountains has been found on some of the earliest postglacial landforms, including those associated with stands of proglacial lakes, and in very early postglacial sedimentary contexts. The initial discovery of quarries for tool-making stone in the now heavily vegetated Purcell and Selkirk Mountains is best explained as having taken place at a time when vegetal cover was much sparser than during the later Holocene after Maritime coniferous forest had invaded the region. Finds of large spear points in the present-day forests above Kootenay Lake offer further support for suggesting that the valley sides of the Purcell Trench may have been hunting terrain for people prior to the establishment of heavy vegetal cover.

An archaeological trait constellation, the Goatfell Complex, has been defined to encompass the cultural deposits associated with these early landforms and sediments. Fine-grained microcrystalline stone such as tourmalinite, quartzite and siliceous metasiltite predominates in stratigraphically defined artifact assemblages. The sources of these materials are in quarried outcrops in the southern Purcell and central Selkirk mountains. The stone tool technology was primarily based on the production by percussion of large expanding flake blanks from large bifacial cores, edges of which were prepared by grinding. Large discoidal unifaces, large side scrapers, large stemmed weakly shouldered and lanceolate spear points plus a variety of large marginally retouched flakes are typical tools. Cultural ties are apparent with the early cultures of the Great Basin and the east slope of the Rocky Mountains at this early time level. The Goatfell Complex settlement pattern and economy are inferred to have consisted of winter inhabitation of lakeside camps and summertime hunting, gathering and quarrying in the surrounding mountains.

At the present time, the pre-Mazama stratigraphic context and the early postglacial palaeohydrological setting indicate that the Goatfell Complex dates between about 11,000 and 8000 years ago but there are as yet no directly dated occupations. The largest spearpoints occur associated with upland landscapes above the elevations of the later proglacial lakes. There are also components associated with landforms related to the earliest stages of the riverine regimes, for example, beside abandoned river channels and on fluvial bars and high erosional terraces. These components demonstrate a continued focus on the biface core and large expanding flake technology utilizing the same types of microcrystalline stone as described previously. However, cobble gravels were apparently more extensively utilized as tool stock than previously and the projectile points are slightly smaller stemmed and lanceolate forms. The reduction in projectile point size may represent the adoption of the spear thrower and different hunting methods. If these components are later, as their landform setting suggests, this change in hunting technology may reflect adaptation to the changing early Holocene ecology, but at present there is too little available data to formally evaluate such an hypothesis.

The relatively abundant evidence of early postglacial human inhabitation of the Purcell Trench vicinity is a noteworthy feature of the archaeology of British Columbia. In contrast, there is very little controlled data from the West Kootenay area for the time period between about 7000 and 5000 years ago. This is reflected in a virtual hiatus at the Kettle Falls fishery during the Slawntehus Perod (Chance and Chance 1985). The present evidence from the study area consists of surface finds of large side-notched and side/corner-notched points similar to those dating to this time in adjacent regions. While the sparseness of data may reflect less intensive human use of the area (the data from Kettle Falls indicate a collapse of the early Holocene fishery), it could also be the result of the very limited systematic archaeological investigation in the region, especially in upland settings. It is apparent that the Rocky Mountain region supported significant human populations during this time.

As mentioned above, climatic conditions apparently became moister within the last 7000 years, especially after 5000 years ago as global cooling increased the influence of the Maritime Westerlies as the mean position of the storm track shifted southwards. In archaeological sites around Creston, in northern Idaho, and as far up the Kootenay River as the Libby, Montana vicinity, the distinctive siliceous metasiltite known as Kootenay Argillite is abundantly represented; the source of which is just south of the present study area. This indicates that the north arm of Kootenay Lake was an important part of the aboriginal seasonal round, especially between about 5000 and 2500 years ago when Kootenay Argillite attained its highest proportions in upriver artifact assemblages. In other parts of the region, this time period is characterized by a greater orientation to the resources of aquatic and riparian habitats by the resident human populations. It has also been hypothesized that salmon carrying capacity reached its maximum during this time period (Choquette 1985).

The Inissimi Complex was defined for this time period to encompass a distinctive set of artifact assemblages on the Kootenay River and its major tributaries, from the big bend in northwestern Montana at least as far downstream as the north arm of Kootenay Lake. Sites containing Inissimi Complex assemblages occur on terraces and fans directly associated with specific hydrological features graded to later Holocene baselines, notably confluences, outlets, large eddies, beaches and rapids. Characteristic features of the Inissimi Complex are predominance of Kootenay Argillite and a distinctive form of projectile point with an expanding stem, a ground convex base, and acute to right-angled shoulders that is not found in surrounding regions. Other projectile points similar to those of contemporary components in adjacent areas (such as medium-sized contracting stemmed and leaf-shaped forms common to the west and south) occur in lower frequency. Bilaterally notched pebble sinkers are also found in Inissimi Complex deposits.

The abundance and distribution of Kootenay Argillite in Inissimi Complex sites along Kootenay Lake and the Kootenay River as far upstream as Libby, Montana has been interpreted to reflect the use of canoes. The seasonal round is hypothesized to have consisted of wintering near the important deer winter ranges at the south end of the Purcell Mountains and a summer focus on the salmon fishery at the falls along the lower Kootenay River, which is hypothesized to have been at its maximum during this time period. Prior to the return to the wintering area, a northward swing was made to obtain stone from quarries above the west side of the North Arm of Kootenay Lake and to hunt on the east side of the lake. Based on the abundance of Inissimi points in artifact collections from along the shores of Kootenay Lake and along the lower Kootenay River, it is apparent that Inissimi Complex sites are numerous. Considering the strong Mariitime influence on the climate, the rain shadow effect may have enhanced the carrying capacity of the ungulate range on the east side of Kootenay Lake's north arm during this period.

With regard to the last 2500 years in the West Kootenay area, there is again little systematic archaeological data. In the Purcell Trench south of Kootenay Lake, some late Holocene archaeological sites are situated on the Kootenay River floodplain itself, in contrast to earlier sites which are instead restricted to the fringes of the great Kootenay River delta. This suggests a change in settlement pattern that is probably related to the end of the cool moist climatic conditions that prevailed between ca. 5000 and 2500 years ago. A different seasonal flow regime after about 2500 years ago apparently affected the level and size of Kootenay Lake along with the nature of flooding on the Kootenay River delta, with a concomitant shift in human adaptation and seasonal land use patterns. The Lower Ktunaxa lifeway known ethnographically represents the end product of these latest evolutionary changes; they continued to travel up Kootenay Lake by canoe well into the postcontact period. The vicinity of the confluences of Meadow Creek and the Lardeau and Duncan rivers was an important and long-used fishing location for kokanee and bull trout (Alexander 1998).

The study area was also frequented by another group of Ktunaxa, the Qatmuk'nek. Their seasonal round included both the winter ungulate range at the Columbia River's headwaters in the Rocky Mountain Trench and a summer salmon fishery on the Arrow Lakes. This transhumance included passage through the study area via the Jumbo and/or Earl Grey passes and the valleys of Glacier and/or Hammill creeks, and travel up and down the Lardeau Valley corridor. The time depth of this settlement pattern is not yet known, but diagnostic artifacts of Kootenay Argillite dating typologically as old as ca. 5500 years have been found at its east end in the Rocky Mountain Trench. Another aboriginal group also used the route through Earl Grey Pass, which was known locally as the Kinbasket Trail (Alexander 1998). The Kinbasket Band were a Secwepemc group with relatives in the Neskonlith Band of the upper Thompson drainage. They had moved into the upper Columbia drainage during the contact era, a pattern which had likely occurred during precontact times as well when it may have been a product of the cyclic fluctuations in salmon carrying capacity.

Downriver of Kootenay Lake, there is again little systematic archaeological data for the latter half of the Holocene, but it comprises more than that from the immediate study area vicinity. The palaeohydrological settings and other characteristics of some sites suggest that some significant changes in human land and resource use patterns took place during the last 5000 years in this area as well. Population increase after the early Holocene drought is represented in the West Kootenay by the Deer Park Phase, characterized by inhabitation of winter pithouse villages on Lower Arrow Lake between about 4000 and 2500 years ago (Turnbull 1977). This intensive human inhabitation focus has been hypothesized to correlate with increased fluvial discharge and greater salmon carrying capacity in the upper Columbia drainage after 6000 years ago (Choquette 1985). As with the Kootenay River above Kootenay Lake, 2500 b.p. marks the beginning of a drastic reduction in fluvial discharge. Evidence of intensive root processing in the South Slocan may reflect a collapse in the salmon fishery that was followed by an apparent population decline in the lower Kootenay - Columbia area at this time. During subsequent millenia, human population appears to have increased again, but to a lesser degree. This trend continued almost to the contact era, although evidence of an immediately pre-epidemic population decline may reflect the impact of the Little Ice Age of the last 400 years. The southward shift in the focus of the Sinixt took place during this period. This group of Salish speakers previously inhabited the Slocan and Arrow Lakes localities and seasonally travelled on a circuit that took them northward up Kootenay Lake and then westward to the upper Arrow Lakes via the Lardeau Valley and Trout Lake.

The ethnohistory of the Sinixt has been extensively documented by Bouchard and Kennedy (1985, 2000) while the major ethnographic works on the Ktunaxa are Schaeffer (1940) and Turney-High (1941).

4. Study Methodology

This study comprises an assessment of the archaeological potential of Provincial Forest lands in Landscape Units K16 - 18 and K20 - 24. The assessment takes the form of polygons drafted onto 1:20,000 scale TRIM contour maps, accompanied by a database containing the criteria upon which the definition of the polygons is based and the scoring that supports the ranking of the polygons into Medium or High archaeological potential.

The individual polygons consist of landforms or landscapes identified via stereoscopic analysis of aerial photos. The criteria for polygon definition were derived from the geological and palaeoenvironmental background information summarized in Section 2 above. The criteria are linked with the prediction of potential occurrance of archaeological sites through the traits used to define the archaeological complexes discussed in Section 3.2, especially settlement pattern, lithic preference, subsistence base and palaeoenvironmental context as extrapolated from the soil and sediment associations of the cultural deposits. These archaeological complexes are essentially models of past human land and resource use that have been synthesized from the existing heritage record. For the little known period between ca. 7000 and 5000 years ago, a generalized hunter-fisher-gatherer land/resource use model was employed. These models were then applied to the terrain units defined from the air photo analysis. The result is a set of GIS compatible polygons that reflect the potential of various parts of the LUs to contain archaeological sites.

The criteria by which the polygons are assessed represent a bridge between the terrain units and the human land and resource use models. To achieve objectivity in defining the archaeological potential of the polygons and to promote broader understanding of the process amongst resource managers, each criterion is numerically scored relative to its contribution to the delineation and evaluation of the polygon in question. A four part scoring system has been used: "0" indicates that the criterion in question has not contributed to the definition of a given polygon, "1" indicates a minor contribution, "2" a more significant contribution, and "3" indicates that the criterion is a major determinant of the polygon's assessment or definition.

Each criterion is described below with specific reference to the biogeography and archaeology of the LUs. The criteria are subdivided into two categories that reflect the regional perspective (macrosite criteria) and the local perspective (microsite criteria). The distinction between the two is discussed in more detail in Section 6 below.

4.1 Macrosite Criteria

The following attributes are considered to be the primary determinants of archaeological potential within the regional context.

4.1.1 Known Sites

Where the level of previous investigation has been sufficient to support it, the distributions of known sites can provide a relatively reliable measure of the intensity of precontact human utilization within the given study area in which they occur and also some indication of the types of past human activities that might have taken place.

For example, focused occupation, particularly that of a winter settlement or base camp characterized by a significant duration and continuity of human presence, would have had a range of other activities associated with it. Besides those related to procurement and processing of subsistence resources, such ancillary activities would have included a range of social and ceremonial practices that could be represented as archaeological sites. Thus the vicinity of a habitation focus would be characterized by a higher site density than would other parts of the landscape even if they were characterized by similar topography.

The existing site inventory reflects the focus of previous archaeological investigation in the study area. Seven precontact sites are on the shore of Kootenay Lake on private land in LU K16 and there are 3 recorded precontact sites at the south end of LU K18. Southeastern LU K20 contains 5 known precontact sites and 2 isolated artifact finds while 1 precontact site and 1 isolated find have been documented at the east edge of LU K21. No sites are known for the northern two thirds of the study area, but there has been virtually no archaeological investigation targetted to landforms with more than moderate archaeological potential. This small and skewed sample severely limits what is known about the intensity of human habitation in the study area, to the extent that the present inventory of archaeological sites is too sparse to support extrapolations of potential site distribution or density.

This criterion was instead incorporated into the assessment of individual polygons. A score of 3 for this criterion represents the presence of one or more known archaeological sites while a score of 2 is assigned to polygons adjacent to known sites. A score of 1 reflects the location of a polygon between, but at some distance from, known site occurrances. A score of 0 indicates a lack of known sites in a locality, but the very limited site inventory must always be kept in mind.

4.1.2 Corridor

The physiography of a region exerts a major influence on the movements of both animals and humans. The broad corridors represented by the Purcell Trench and the valley containing the Lardeau River and Trout Lake would obviously have been major precontact travel corridors, both on foot and especially by canoe on Kootenay and Trout lakes. They are scored 3.

The intermontane travel route across the Purcell Mountains along the valleys of Toby, Jumbo, Glacier and Hammill Creeks was also a significant corridor; polygons along it are scored 2. Polygons in the less significant connecting routes between the Duncan and Lardeau valleys comprising the valleys of Healy and Hall creek and the Poplar – Kuskanax creek route between the Lardeau Valley and Arrow Lakes are scored 1 for this criterion. The latter corridors contained pack trails developed by miners and prospectors but the intensity of their use in precontact time is undocumented. Other valleys in the LUs head in steep headwalls lacking passes and score 0 for this criterion.

Besides the valley systems, some ridges are continuous for kilometres and along some of them pedestrian travel would have been feasible, especially during climatic intervals that would have promoted more open vegetation at high elevations. These have been scored 1 for this criterion.

The score assigned to this criterion thus reflects the relative importance of a travel route based on what is known about past movement patterns. Additional considerations include steepness of terrain, ecological variability, resource concentrations and connectivity.

4.1.3 Bedrock Geology

As discussed in Choquette (1981), stone suitable for tool manufacture is neither ubiquitous in the region nor restricted to a single source. Twenty-three discrete sources of flakable stone have been identified in the upper Kootenay – Columbia over the past 30 years and the approximate locations of at least four more are known. Because of the non-biodegradable nature of this material and the capability to use stone to track movements of people across the landscape relative to the location of the discrete sources, this criterion is of great importance to the archaeology of Ktunaxa territory. Since workable stone was an essential underpinning of the precontact economy, stone sources were sufficiently strong attractions that they appear to have been significant determinants of the foci for subsistence resource exploitation as well as of routes of transmountain travel. They are thus extremely valuable tools for predicting archaeological potential.

While much of the mountainous terrain in the study area is in the immediate vicinity of granitic plutons and consists of flanking zones of moderately to highly metamorphosed sedimentary rock. Where this metasedimentary stone is sufficiently siliceous, it could have served as tool stock in the precontact flaked stone industry. In particular, the Hamill Group includes pure quartzites (Reesor 1996), outcrops of which were quarried at Jumbo Pass. Cobbles of this material were also exploited as tool stock by the early postglacial inhabitants.

Scoring for this criterion is based on the potential for a polygon to contain outcrops of the Hamill Group.

4.1.4 Ungulate Range

The study area is typical of much of the West Kootenay area in that its rugged mountainous topography and high precipitation values, particularly snowfall, do not favour large populations of ungulates, especially grazers. The palaeoenvironmental record makes clear that ungulate range would have been significantly higher under conditions of more open forest and more frequent wildfire such as prevailed ca. 9000 - 7000 and 2000 - 500 years ago.

Scoring for this criterion reflects the generally moderate quality of the ungulate range from a regional perspective, as well as the strong influence of topography. The narrow, typically steep-sided valleys scored 1 whereas the relatively few significant expanses of more level terrain score 2 when palaeoenvironmental reconstructions are factored in.

4.1.5 Solar Aspect

Southerly exposures tend to support a more open vegetal cover than other aspects, making them the preferred locations of trails for both animals and humans. In northerly latitudes, human habitation sites, especially late fall, winter and early spring settlements, tend to be situated to take advantage of solar heating.

Scoring for this criterion is based both on micro- and macrotopography, with the highest score accruing to south-facing landforms situated on or at the base of south-facing mountainsides.

4.2 Microsite Criteria

Scoring of each of these criteria reflects its relative importance in determining the specific location, along with the size and shape, of individual polygons.

4.2.1 Terrace/Fan

Elevated terraces are favourable camping areas because they tend to be better drained with regard to soil moisture and also avoid the effect of cold air drainage, an important consideration in late fall, winter and early spring. Level, typically well-drained landforms, terraces have also been selected as travel corridors, especially along the margins where vegetation tends to be more open.

4.2.2 Promontory

Bedrock prominences and ridges facilitated precontact movements across the landscape and many of these landforms are vantage points where localized ad hoc activities such as tool production and maintenance may have taken place.

4.2.3 "Saddle"

At the heads of some valleys are constrictions that are lower than the surrounding heights of land, making them the preferred routes for traversing drainage divides. The term "saddle" refers to the lower, more level terrain that exists at a height of land that could have been used as a pass. Such areas typically contain archaeological deposits because they were used as temporary rest areas and overnight campsites.

Some of the passes are in the immediate vicinity of present-day glaciers and in some cases these have advanced across the passes. Only the vegetated portions of the saddles have been mapped with polygons because of the likelihood that the Little Ice Age advances obliterated the precontact landscape now encompassed by these recent moraines.

4.2.4 Standing Water

Lakes and ponds attract wildlife and thus could have hunting grounds associated with them; those containing fish would have been obviously attractive for that reason. Lakeshores are also good camping areas, especially the north and east sides of smaller lakes and those parts of the Kootenay Lake shoreline that are sheltered from storms. When combined with scoring for relict watercourse, this criterion pertains to the previous existence of a water body, including proglacial lakes.

4.2.5 Watercourse

Rivers and streams and the associated riparian ecosystem support a diversity and abundance of subsistence resources as well as being sources of vital fresh water.

4.2.6 Relict Watercourse

The establishment of the postglacial drainage system was accompanied by significant changes in hydrology leaving discontinuous high terraces related to previous hydrological baselines. Although now considerably removed from water, landforms graded to previous watercourses or bodies of standing water are potential locations of early archaeological sites.

4.2.7 Confluence

Confluences of watercourses are significant predictors of archaeological site locations for several reasons. Most importantly, they usually correspond with confluences of valleys and thus represent junctions of travel corridors where temporary stopovers and activities would likely have been repeated frequently enough to produce archaeologically detectable cultural deposits. A second consideration is that the quality of water from tributaries is often better than that in the main stream, particularly during the freshet. Furthermore, confluences often are good fishing locations.

4.2.8 Watercourse Node

This refers to specific portions of watercourses that could have served to attract and/or focus human activity. Examples of watercourse nodes include: nickpoints and rapids that could have served as fords; large eddies and pools which were good fishing locations (Polygons K22-27, K22-29, K23-20, K24-13, K24-14 and K24-36), waterfalls (Polygons K20-50, K20-53, K21-04, K21-05, K23-33 and K23-38); and springs. Some of these natural features can have sacred associations.

4.3 Confidence

The need for this measure was expressed by Oliver Thomae of the Cranbrook Forest District in the context of future emergency situations such as fires. It is

desirable to be able to separate out those polygons where archaeological values are sufficiently well known that measures such as field investigation or mitigation are clearly necessary from other polygons whose definition is based on limited data or large extrapolative leaps in predictive modelling. As employed in this study, Confidence is a subjective measure that should be considered within the context of 'risk management'.
This criterion is a subjective combination of the predicted presence and density of archaeological sites along with an estimate of the potential significance of the archaeological values that might be contained within a given polygon. It is scored high, medium or limited confidence as 3, 2, or 1, respectively. A score of 1 equates with a lower level of confidence commensurate with data limitations or greater level of speculation and while it certainly speaks to a need for further investigation, this level of confidence reflects acceptance of the risk of losing data in the polygon if extenuating circumstances should arise that require rapid response.

5. Results

Analysis of aerial photographs and background information of Landscape Units K16 - 18 and K20 - 24 has resulted in the mapping of a total of 467 landform-based polygons where there is some likelihood that significant archaeological deposits and/or features are present (see maps and databases).

6. Evaluation and Discussion

As employed in this study, archaeological potential represents a relative measure of the likelihood of encountering precontact heritage resources in a given locality. A number of factors are reflected by this relative measure, including probability of site occurrance, possible density of sites and/or cultural deposits, and significance. At its most basic level, the definition of archaeological potential depends upon an adequate data base to support accurate predictions of the presence of sites. The ideal situation would consist of an inventory of all sites within the study area and information regarding the nature of past human use in terms of activities, seasonality, duration of occupation and nature of social unit(s), and the time span(s) of such use.

The concept of potential arises when this ideal is not met, leading to the compromise of attempting to identify areas where sites might be located. Within the resource management context, erring on the side of caution is a necessary element in this "compromise" since archaeological heritage is a precious, unique non-renewable resource that represents a significant component of the cultural identity of living groups, their ancestors and their future generations. Thus, where a lack of systematic archaeological investigation is reflected by the absence of hard data in an inventory, it must be assumed until proven otherwise that all or most human land and resource use patterns are represented in a given landscape unit, subject to the constraints of the past environmental conditions.

The amount of previous research, including palaeoecology, is also a limitation of the capability and accuracy of predicting archaeological potential. It is fortunate that the direction of some of the archaeological research in the upper Columbia River drainage has been conducted within an explicit palaeoecological paradigm, as this expands the supporting data base to incorporate such aspects of the environment as geomorphology and palaeohydrology. As discussed in Section 4, analysis of aerial photographs produced a data set that includes landform and hydrological associations. These provide a scientifically objective definition of at least some past environmental constraints, thereby partially delimiting the range of potentially applicable patterns of past human land and resource use that could be projected onto a given landscape.

The level and nature of spatial sampling that has taken place previously in a landscape unit is also an important consideration in this regard. A large enough proportion of the target land base must have been examined to support correlations between the known inventory and the actual distribution of sites over the landscape. Both negative and positive data (i.e. absence vs. presence of archaeological sites) must be taken into account and places where sites have not been found at a sufficiently intensive level of sampling (especially where sites may have been expected) must be considered as well as locations where sites are actually present.

Given the above, the assessment of archaeological potential in the present context of GIS mapping and large-scale and spatially extensive field investigations (via impact assessments) can be viewed as a means of incorporating science into resource management. As such, results of field investigations can be tracked and fed back into the predictive models as represented by the mapped polygons. An ultimate scientific objective would be for multivariate spatial analyses to identify archaeological patterns on the basis of attributes whose predictive capability has been objectively confirmed. The present study should be seen as part of the ongoing progress towards this objective when this mapping was begun in 1993.

Both macrosite and microsite criteria were considered during the analysis but only the former were used to rank the archaeological potential of the polygons. This is because archaeological potential derives from the characteristics of a broad environmental context, i.e. the combination of attributes such as location within a corridor, relationship to a particular resource such as stone or ungulates, solar aspect, etc. These macrosite criteria reflect the likelihood that an entire valley or even an entire landscape unit would have supported precontact human occupation or use and thus could contain archaeological sites. As discussed in Section 4, the values assigned to these criteria take into consideration such general characteristics as the intensity of previous investigation and the extent of the present archaeological inventory, the relative location of the study area in the upper Columbia River drainage as a whole, the geologic history with regard to physiography and relative accessibility of mineral resources, local palaeocology, etc. As such, the macrosite criteria are conceived of as components of the overall ecological synergy that in total gives potential archaeological value to polygons defined at the 1:20,000 scale.

The archaeological potential of each polygon is thus a composite of its macrosite criteria. It is derived by totalling the numerical scores for Confidence and Macrosite Variables. The totals are then grouped into two modal classes (high and medium) within the ranked universes. Table 1 presents a breakdown of these potential classes by LU.

LU	**Total Polygons**	**High Potential**	**Medium Potential**
K16	12	5	7
K17	54	6	48
K18	75	21	54
K20	89	20	69
K21	65	22	43
K22	66	14	52
K23	39	5	34
K24	67	7	60
Total	467	100	367

Table 1. Breakdown of archaeological potential polygons by LU.

Microsite variables, on the other hand, have determined the placement of polygon boundaries and the sizes of the individual polygons. As such, they are specific to each polygon in relationship to the components of the immediately surrounding landscape, which either has low archaeological potential (and thus is not delineated with polygons at all) or which is delineated by separate polygons because of differences in microenvironmental characteristics such as landform or relationship to water. The archaeological significance of the microsite criteria is that they are responsible for the definition of a given polygon relative to its immediate surroundings. These criteria are best conceived of as independent descriptors of each polygon. However, the microsite scores for the polygons do not provide useful information regarding archaeological potential as such, because terraces, promontories and saddles or watercourses, lakes and confluences do not have archaeological potential in themselves - their potential relates to the relationship between their settings and the precontact human land and resource use models. The scores for each microsite criterion represent a measure of the contribution each has made to the delineation of a given polygon.

This information is provided primarily for future use when a sufficiently large number of polygons has been examined in the field so that the results of such fieldwork can be utilized as tests of the relative value of these criteria as predictors of archaeological site locations in a given landscape unit and, by extension, of the applicability of the various precontact land and resource use models to the landscape unit in question.

Those areas that have not been mapped as polygons are considered to have *low archaeological potential*, that is, areas where sites are not likely to be present. It must be emphasized, however, that this *does not imply the absence of sites and certainly does not imply a lack of heritage significance for those sites that may be present*. Indeed, the very scarcity and isolation of sites can convey upon them a relatively greater significance than for sites in denser zones because they may contain unique information.

Although they are grounded in a considerable depth of background research and experience, the scores placed on the macrosite criteria used in this study are still somewhat subjective and thus the ranks as sums of these scores are also subjective to some degree. It is to be hoped that this subjectivity will be steadily reduced as results of field investigations guided by the maps are factored back into the process.

Since the archaeological inventory upon which this study draws does not represent the product of systematic investigation, the study results must be considered as hypothetical. Furthermore, the maps are conservative in nature, given the non-renewable nature of the resource. Nevertheless, the assessment is based on considerable background material and experience and it represents a valuable planning tool to facilitate the integration of archaeological resource conservation with other types of future land use, especially that related to forest industry activities.

Forest development planning identifies areas where road and landing construction, harvesting and site preparation are proposed. Since all of these activities involve some degree of ground disturbance, they represent significant threats to the integrity of archaeological sites and features. By overlaying the locations of proposed forest industry activities onto the mapped polygons of archaeological potential, it is possible to identify potential circumstances that could result in the destruction of non-renewable archaeological resources. These areas of overlap represent potential conflicts which if unavoidable, should be examined in the field via archaeological impact assessments and appropriate avoidance or mitigative measures identified if results warrant. Over time, as discussed previously, the results of archaeological field investigations can be utilized to formally test and refine the models that serve as the basis for polygon definition.

It must be emphasized that the accuracy of polygon location is limited by the precision of the TRIM map base and also by the degree to which forest canopy closure allows for the accurate delineation of landform boundaries. Therefore, the locations of the polygon boundaries on the maps should not be viewed as exact and landform context as determined in the field (for example, during reconnaissance, cruising or layout) is desirable as an adjunct to the mapping if avoidance is chosen in the planning stages. With regard to using the archaeological potential maps to determine the need for archaeological impact assessments, the assessment of potential impact should be based on proximity (e.g. within 50 m) of a polygon to a proposed road, landing or block as opposed to direct overlap.

7. Recommendations

Maps of archaeological potential for Landscape Units K16 - 18 and K20 - 24 have been developed on the basis of biogeographic criteria, precontact human land/resource use models and stereoscopic air photo analysis. Areas delineated by polygons have some likelihood for containing archaeological deposits or features. As such, ***these polygons can be used to identify areas where more detailed investigations via preliminary archaeological field reconnaissance (PFR) or archaeological impact assessments (AIAs) should be undertaken***. The intensity of such investigation will depend upon the extent and location of previous disturbance.

At this juncture, it can be re-emphasized that environmental conditions have varied considerably over the past 12,000 years. Palaeoenvironmental reconstructions suggest more benign conditions in some of the mountainous parts of the upper Columbia drainage during the early Holocene than prevailed during any of the subsequent millenia. The archaeological record as now exists supports this supposition, given the character of the early Holocene sites that have been identified in the Duncan Reservoir at least. It is on this basis that much of the archaeological potential of the upland parts of the study area is predicated. However, there is minimal information at present that actually relates to the nature of the activities that would have taken place in the surrounding mountains other than the general postulate that higher ungulate populations could have drawn groups of hunters up the valleys of Howser and East creeks and the Westfall River and into the elevated level terrain above the valley bottoms. That is to say, the archaeological record indicates that during the early Holocene, humans occupied the shores of one or more of the ancestral lakes which subsequently lowered and diverged into Duncan and Kootenay lakes, but the extent of their use of the surrounding landscape is completely conjectural at present. The use of the Westfall River drainage in particular is highly speculative in this regard, and can only be determined by informed systematic archaeological investigation. The dendritic configuration of this drainage and the extent of disturbance from logging lends itself to the specific methodology employed in the ground truthing of LU I34 (Choquette 2001). It can be hypothesized that there are certain locations that would be most likely to have been repeatedly occupied if the valley was part of a seasonal subsistence round. Results of focused examination of landforms with the most strategic locations and the highest archaeological potential will reveal both the relative intensity of such occupation, (if such did indeed occur), as well as the likelihood that other, less favourable locations also would have been occupied. By this type of deductive approach, it is possible to refine the predictions of probable occurrence of archaeological sites (and thus reduce the number of polygons) in a confined drainage such as the Westfall, and even to eliminate the entire drainage (which equates with LU K23) if results are negative, as was done for LU I34. It is recommended herein that this methodology could be fruitfully employed in LU K23 as a cost-effective alternative to conducting numerous AIAs of marginal and moderate potential polygons when ongoing developments are proposed for them.

On another note, it must be emphasized that this study focuses on precontact archaeological resources; its methodology is not suitable to predict locations of culturally modified trees. These are also protected heritage resources but they are more reliably located by field survey of areas containing old growth forest. Therefore, ***it is recommended that the presence of culturally modified trees be determined by field examination in proposed forest developments where the age of trees exceeds ca. 100 years.***

It is further recommended that the process of mapping of archaeological potential be continued in the other landscape units in Kootenay Lake Forest District.

8. References

Alexander, J.W.E.

1998 Lardeau Duncan Memories. Creston: Ken E Alexander, publisher.

Baker, Richard G.

1983 Holocene Vegetational History of the western United States. in Wright, H.E. Jr. ed. Late Quaternary Environments of the United States, Vol. 2: 109-127. Minneapolis: University of Minnesota Press.

Baravalle, V.E. Richard

1981 Final report on a survey of Kootenay Lake, pictograph sites, B.C. On file, Archaeology Branch, Ministry Responsible for Culture, Victoria.

Bouchard, Randy and Dorothy Kennedy

1985 Lakes Indian Ethnography and History. Report prepared for the BC Heritage Conservation Branch, Ministry of Provincial Secretary and Government Services, Victoria.

2000 First Nations' Ethnography and Ethnohistory in British Columbia's Lower Kootenay/ Columbia Hydropower Region. Report prepared for Columbia Power Corporation, Castlegar.

Campbell, Bonnie

2000 Report on Archaeological Impact Assessment of Proposed Forestry Developments within the Kootenay Lake Forest District. On file, Ministry Library, Ministry Responsible for Culture, Victoria.

Chance, David H. and Jennifer V. Chance

1985 Kettle Falls: 1978, Further Archaeological Excavations in Lake Roosevelt. University of Idaho Anthropological Research Manuscript Series, no. 84.

Choquette, Wayne T.

1981 The role of lithic raw material studies in Kootenay archaeology. B.C. Studies 48: 21-36.

1984 A proposed cultural chronology for the Kootenay Region. in Gough, Stanley, ed. Cultural resource investigations of the Bonneville Power Administration's Libby Integration Project, northern Idaho and northwestern Montana. Archaeological and Historical Services, Eastern Washington University Reports in Archaeology and History 100-29: 303-316.

1985 Excavations at DiQj-18, South Slocan: A Test of a Model of Upper Columbia Basin Human Settlement Dynamics. On file, Ministry Library, Ministry Responsible for Culture, Victoria.

1987a A Palaeoclimatic model for the Upper Columbia River drainage basin. in McKinnon, Neil and Glenn Stuart, eds. Man and the Mid-Holocene Climatic Optimum. Calgary: The Students' Press, pp. 311-344.

1987b Archaeological investigations in the Middle Kootenai Region and vicinity. Chapter 3 in Thoms, Alston and Greg Burtchard, eds. Prehistoric Land Use in the Northern Rocky Mountains: a perspective from the Middle Kootenai Valley. Washington State University, Center for Northwest Anthropology, Project Report, no. 4: 57-119.

1993 Archaeological Resource Overview for the Nelson Forest Region. On file, Archaeology Branch, Ministry Responsible for Culture, Victoria.

1996 Early post-glacial habitation of the upper Columbia region. In Carlson, R. ed. Early Human Occupation in British Columbia. Vancouver: University of British Columbia Press.

2001 Results of Archaeological Survey in Landscape Unit I34, Invermere Forest District. Prepared for Tembec Forest Resource Management, Cranbrook.

2002 Archaeological Component of Duncan Reservoir Water Use Planning Process. Final Project Report prepared for BC Hydro, Vancouver.

Choquette, Wayne T. and Craig Holstine

1982 A cultural resource overview of the Bonneville Power Administration's proposed Garrison - Spokane 500 kv transmission line. Bonneville Cultural Resources Group, Eastern Washington University Reports in Archaeology and History, no. 100-20.

Clague, John

1989 Cordilleran Ice Sheet. In R. J. Fulton, ed. Quaternary Geology of Canada and Greenland. Geological Survey of Canada, Geology of Canada 1.

Fulton, Robert

1971 Radiocarbon geochronology of southern B.C. Geological Survey of Canada Paper 71-37.

Handly, Martin

2002 Archaeological Impact Assessments within the Arrow, Kootenay Lake and Revelstoke Forest Districts. Permit # 2001-080 Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

2003 Archaeological Impact Assessments within the Arrow and Kootenay Lake Forest Districts. Permit # 2002-169 Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

Kutenai West Heritage Consulting

1998 Archaeological Impact Assessments within the Arrow, Kootenay Lake and Revelstoke Forest Districts. Permit # 1997-100 Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

1999 Archaeological Impact Assessments within the Arrow, Kootenay Lake and Revelstoke Forest Districts. Permit Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

2001 Archaeological Impact Assessments within the Arrow, Kootenay Lake and Revelstoke Forest Districts. Permit # 2000-117 Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

Magee, M.J.

1998 Archaeological Field Reconnaissance and Impact Assessment, Small Business Forest Enterprise Program, Kootenay Lake Forest District. Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

Reesor, J.E. (comp.)

1996 Geology, Kootenay Lake, British Columbia. Geological Survey of Canada Map 1864A.

Ryder, J. M.

1981 Biophysical Resources of the East Kootenay Area: Terrain. British Columbia Ministry of the Environment, APD Bulletin no. 7.

Schaeffer, Claude E.

1940 The Subsistence Quest of the Kutenai. Ph.D. Dissertation, University of Pennsylvania.

Turnbull, Christopher J.

1977 Archaeology and Ethnohistory in the Arrow Lakes, Southeastern British Columbia. National Museum of Man, Mercury Series, 65.

Turney-High. H.H.

1941 Ethnography of the Kutenai. American Anthropological Association Memoir 56: 1-202.

Wood, Barry P.

2004 Archaeological Impact Assessments in Kootenay Lake Forest District. Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.

2006 2006-145 AIA Kootenay Lake Forest District 2005 Harvesting Areas. Report on file, Ministry Library, Ministry Responsible for Culture, Victoria.