Boundary Forest District

Archaeological Overview Assessment

Phase 3 Report (1997)

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Prepared for:

Boundary Forest District
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Martin Handly and Robert Lackowicz oversaw this project, and co-authored the sections on archaeology, past and present environment, and complementary datasets, as well as acting as report editors. As the Boundary Forest District overlaps with adjacent regions with respect to background data for palaeoenvironment and archaeological constructs, portions of those discussions are drawn from previous research by KWHC for these areas (i.e., Handly et al. 1996; Lackowicz et al. 1996), as well as from the earlier report for this study (Handly and Lackowicz 1997). Ms. Kellie Seguin contributed the historical research section of this report as well as conducting the air-photo interpretation (i.e., orthographic) analysis and discussion.

Field-testing of the preliminary archaeological potential maps was conducted by Martin Handly, Tracy Johnson, Adam Christian (Spallumcheen Indian Band), Steven Isaac (Okanagan Indian Band), Roxanne Lindley (Westbank First Nation), and Robert Watt (Sinixt-Arrow Lakes First Nation). Sincere thanks are extended to Adam, Robert, Roxanne, Steve and Tracy for their good humour and hard work through hot weather and dusty roads.

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1.0 INTRODUCTION

The Boundary Forest District (BFD) encompasses the Kettle and Granby River drainages. It is surrounded by the Pentiction Forest District to the west, the Vernon Forest District to the north, and the Arrow Forest District to the east. Larger towns located within the BFD include Greenwood and Grand Forks, with smaller communities including Christina Lake, Midway, Rock Creek, and Westbridge. Two provincial parks, Granby in the northeast and Gladstone in the east, are also located within the boundaries of the district.

The Boundary Forest District archaeological overview assessment (AOA) was initiated at the request of the Ministry of Forests in late February, 1997. The primary goal of the study was to create a predictive model that delineated areas of archaeological site potential within the BFD on 1:20,000 scale digitized and paper maps (Figure 1.1). These maps could then be overlaid on Small Business Forest Enterprise Program and licensee forest development plan maps, so as to determine those areas that might require an archaeological impact assessment study (AIA). Kutenai West Heritage Consulting Ltd. (KWHC) conducted background research on the existing archaeological, environmental, historic, and ethnographic databases. In conjunction with Timberland Consultants Ltd., this background research was used to formulate predictor variables that were translated into the geographical information system (GIS) program PAMAP, and used to create 1:20,000 and 1 :125,000 scale digitized and paper archaeological potential maps for the BFD.

1.1 Objectives and Methods

For Phase 1/2 of this study, KWHC performed a critical review of all available archaeological inventory, overview, and impact assessment studies previously conducted within the BFD. A search of the Archaeology Branch database was made for all heritage consulting manuscripts relating to the study area within their library. Past and present environmental conditions were researched using the libraries at Simon Fraser University (Burnaby), Okanagan College University (Kelowna), and Selkirk College (Castlegar). Due to the limited extent of systematic archaeological investigations within the BFD, information was also gathered from the Kettle River drainage area in northern Washington. This data was obtained during visits to the State Archaeology office in Olympia, Central Washington University in Ellensburg, and Eastern Washington University in Cheney.

A review was made of available graphical and digital datasets that could provide relevant information to the Phase 3 predictive modelling component of the AOA process. These datasets included information on geography, geomorphology, topography, faunal distribution, surficial geology, soil drainage, biogeoclimatic zonation, and forest cover. These datasets were obtained from the BFD files in Grand Forks. This combined information was used to generate an information-gap analysis (IGA; Handly and Lackowicz 19971, which summarized the quantity and quality of archaeological knowledge for the study area. That report used methodology complementing the current provincial IGA conducted by Equinox Research and Consulting Ltd (Franck, Muir, and Bush 1997).

The Phase 3 report elaborates upon the data gathered during the Phase 1/2 portion of this study. This phase also included the development and implementation of a predictive model for AIA studies in the BFD, mapping known sites, predicted site zones, and areas of negative results. The development of the predictive model incorporated the results of the Phase 1/2 report, with the actual criteria definitions largely derived from the documentary research conducted during Phase 1/2. Field-testing of the archaeological potential maps evaluated the areas captured, as well as excluded, by the selected variables. Phase 3 also included recommendations for future archaeological impact assessment and inventory studies. Specifically, the predictive model development involved the following activities:

(1) The known archaeological site database was consulted and mapped to assess archaeological site location and distribution. Attributes such as slope, aspect, location to water (and rank of water system), soil drainage, forest cover, and geomorphological landform placement were examined for each site type (e.g., lithic scatter, cultural depression, burial, etc.). It was hoped that temporal periods of site occupations could be correlated with the inferred palaeoclimatic and palaeoenvironmental changes in the study area, but the database was too limited for this application.

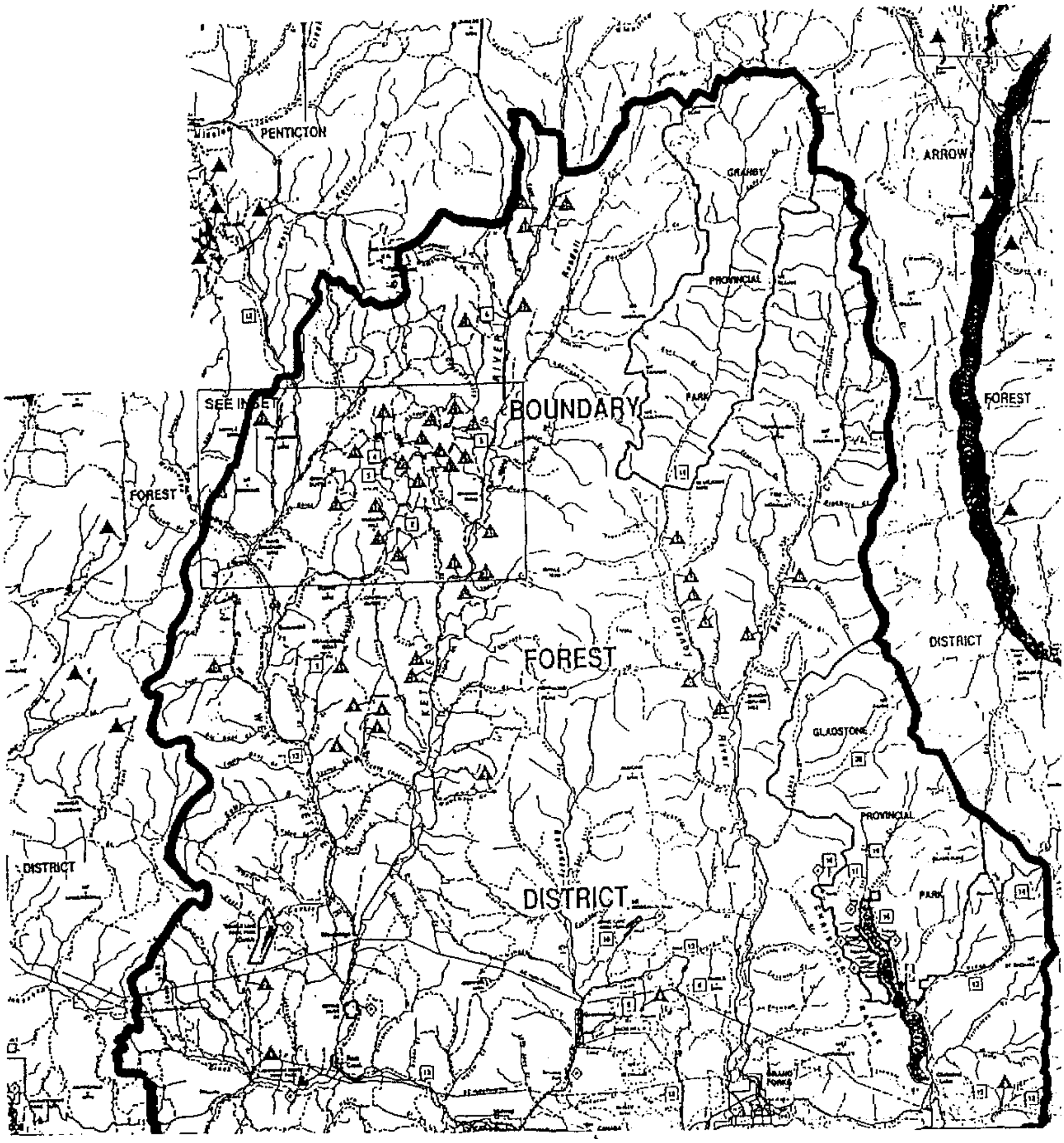

Figure 1.1: Location of BFD Study Area, Southeastern BC (Scale 1:650,000)

(2) The absence or presence of the following criteria were considered and adopted for the predictive model: known archaeological site concentrations, potable water sources, specific geomorphological landforms (e.g., benches, ridges, and alluvial, glaciofluvial, glaciolacustrine terraces, etc.), slope percentage, bedrock geology, soil types, talus slopes, meadows/marshes, and old-growth forest. Other variables considered but not included as factors were known trail networks, ungulate wintering range, freshwater fisheries, glacial erratics, and aspect.

(3) Where applicable, numeric predictor variables (i.e., distance in metres) were included as factors in the archaeological site prediction model. After consultation with BFD personnel, a tripartite (Low, Medium, High) risk-index was adopted.

(4) Variables were modelled in the geographic information system PAMAP by Timberland Consultants Ltd. Polygons were delineated and mapped using the criteria defined in the previous stages.

(5) Four archaeological site potential maps selected by BFD personnel were field-tested by KWHC over a period of 30 person-days. This process included a combination of vehicular traverses, foot-traverses, and/or shovel testing. Both zones captured and excluded by the selected variables were examined to assess the utility of the preliminary archaeological potential maps.

(6) The results of the field-testing component were analyzed and used to revise the predictor variables and improve their accuracy in selecting zones of medium and high archaeological site potential. Known archaeological sites that were not captured by the predictive model were commented upon, with a rationale for their omission io justify their exclusion from the model.

(7) Adjusted predictor variables were given to Timberland Consultants Ltd., and used to generate the final 1:20,000 scale and 1:125,000 scale archaeological site potential maps.

(8) Based on the results of three completed phases for the BFD-AOA, KWHC provided management recommendations to the BFD. Our primary recommendation is that any future land-altering activities crossing medium or high archaeological potential polygons be subject to a detailed archaeological impact assessment prior commencment of work. Other recommendations relate to recording heritage trail networks and our conclusions regarding future archaeological inventory and impact assessment studies within the study area.

2.0 ARCHAEOLOGICAL BACKGROUND, BFD

2.1 Previous Archaeological Investigations in BFD

In 1968, Barlee noticed human skeletal material and dentalia shell eroding from the north side of the Highway 3 roadcut, approximately 8 km east of Grand Forks. Two burials were noted eroding out of the ridge crest (i.e., glaciolacustrine terrace) created by the transection of the landform by excavation of Highway 3. The matrix in which the burials were recorded was a very fine-grained silty sand. The two burials were situated about 2 m apart on the ridge crest. Both appear to have been covered by large river cobbles (approximately 2 to 10 kg in weight), which were located between 40 and 60 cm bs (below surface). Burial #1, closest to the ridge crest edge, was partially eroded down the hillside, while the second burial was being actively eroded by wind action. Barlee collected the exposed materials from Burial #1 and excavated Burial #2; however, no details of the excavation methodology are presented except for screening with 8mm mesh.

Burial #1 contained fragmentary human remains and fourteen pieces of dentalia shell. Burial #2 appeared to contain the remains of a male, interred in a flexed position on his right side, with the head lying towards the east. Burial #2 contained 1735 undecorated dentalium shells, seven incised dentalium shells, four fragments of a broken jadeite adze blade, two scrapers (produced from Jasper and agate), one incised, groundstone pipestem, one fragmentary laminated wooden bracelet, red ochre concentrations, and several pieces of wood which appeared to be rounded and/or polished. Barlee (1969) notes that other burials may be located in similar physiographic settings in the immediate area. This was the second burial which Barlee (1969) had heard of being disturbed as a result of road construction; the first occurred around 1946, just east of Grand Forks, and was impacted by City Works graders. Evidence of burned cedar above these burials was noted by Barlee (1969).

Copp (1974) presents a summary of an archaeological inventory assessment conducted in the Okanagan and Similkameen Valleys, as well as a brief review of upland investigations immediately adjacent to the Boundary Forest District. Copp (1974:1) used a five-person survey crew to conduct a judgmental, visual ground surface reconnaissance of these various areas; no subsurface testing was employed for site discovery. Copp (1974:17-66) provides an excellent review and summary of locational characteristics and artifact types associated with both pictograph and rockshelter sites, much of which is suitable for predictive modelling. In his conclusion, Copp (1974:109-l 10) notes that future archaeological inventory studies should be directed towards two main areas: a) uplands and b) “isolated boulders, rocky outcrops, rockshelters, and cliff faces” within the valleys. One archaeological site (DiQt-1, Allendale Lake), recorded by Copp (19741, is associated with mid-elevation adaptations within the BFD. Site DiQt-1 is comprised of two boulder petroforms (2m x 1.5m x .25m), possibly burials, overlooking Allendale Lake (Copp 1974:70-71, 85.86, 103-l 04). The assignation of DiQt-1 as a possible burial was based on ethnographic information.

The Department of Highways retained archaeologists to conduct a number of surveys for projects dating between 1974 and 1976 in the Grand Forks Highway District (GFHD). Each of these surveys utilized a similar methodology in that vehicular and surficial surveys were solely employed, i.e., subsurface testing was not implemented. They are also limited by a lack of maps and discussion for the exact areas surveyed. In their table summarizing the 1974 project, Bussey and May (1974:9) state that the Midway, Carmi, and Westbridge bridge locations were examined, with no conflicts except for a ca. AD 1914 hotel building at the Westbridge location. Burnip and Harden (1975) only include discussions of 1975 highway projects in conflict with archaeological sites. No conflicts are listed for the BFD area, and the projects examined for the GFHD are not stated. Bates and McMath (1976:13) state in their summary table that the Carsons custom approach, Highway 3 and 41 intersection, and Alpine Inn intersection at Christina Lake were assessed, with no conflicts evident.

Pike (1975) evaluated twenty-two bedrock quarry sites with a two-person survey crew within southcentral and southeastern BC (see Freisinger 1979a; Preto 1970). Pike conducted a literature review of extant Archaeology Branch quarry sites, contacted local mineral collecting organizations, and consulted bedrock geology maps (where available) prior to commencing fieldwork. Ground surface reconnaissance of prob. able quarry sites was conducted during the evaluation. Two bedrock quarry sites were noted just to the west of the BFD study area within the Okanagan Valley (Pike 1975:8-10): a) White Lake opalite quarry (DhQv-45; also Copp 1974:78-80); and b) Uppenborn opalite quarry (DiQs-1). Due to the proximity of these two quarry sites, both of these lithic raw materials may be present in the BFD.

Roberts (1976) presents the results of a two-person archaeological ground reconnaissance survey of the proposed Nicola-Selkirk-Cranbrook BC Hydro transmission line corridor. Phase I of the project involved aerial photographic interpretation in conjunction with known ethnographic patterns of subsistence to delineate areas of archaeological potential. The Phase II portion involved the ground reconnaissance of the transmission line corridor; however, it appears that no subsurface testing was conducted (Roberts 1976:5). The areas of concern for this study included Mile 88-126 (Okanagan Crossing to Kettle River Crossing), Mile 126-142 (Kettle River Crossing to Grand Forks), and Mile 142-160 (Grand Forks to Cascade) (Roberts 1976:1 O-l 6). A total of one heritage (DgQs-6) and four archaeological (DgQq-1, DgQs-5, DgQr-16, and DgQr-17) sites were evaluated. With respect to DgQs-6 (Okanagan Crossing to Kettle River Crossing), there used to be a wagon road leading through the site. Informants contacted by Roberts (1976:1 O-l 1) indicated that this wagon road was last used around 1901 by several aboriginal families for access up Jolly Creek for the purposes of hunting.

The four archaeological sites were recorded between the Kettle River Crossing to Grand Forks (Mile 126-142). Three sites are recorded on the lowest terraces of the Kettle River (DgQs-5, DgQr-16, and DgQr-17) or adjacent to Boundary Creek (DgQq-1). These sites consisted of lithic scatters (i.e., DgQq-1, DgQs-5, DgQr-16, and DgQr-17), burnt bone scatters (i.e., DgQs-5 and DgQr-17), fire-broken rock concentrations (i.e., DgQs-5), or cultural depressions (i.e., DgQq-1) (Roberts 1976:11-14). At DgQr-17 a "thick seam of volcanic ash [Mazama?] is visible in a cat cut at the mouth of the creek . [d]eposition above the ash is approximately 40 cm thick" (Roberts 1976:12).

Wilson (1978) conducted an archaeological impact assessment of a proposed uranium mine site near Beaverdell for Norcen Resource Developments. Several small lakes, marshes, and meadows are present in or near the study area, and extensive areas of disturbance were noted as a result of timber harvesting activities and road construction. A total of seven field days were required for the two-person crew to evaluate the 1750 ha property; however, only 10% (e.g., 175 ha) was evaluated either through a visual ground surface inspection or subsurface shovel testing program (Wilson 1978:1,10). Although the location of survey transects and shovel testing locations are presented (Wilson 1978:8,10), no discussion of the number of shovel tests excavated is described. No archaeological or heritage concerns were noted within the development area. Wilson (1978:7) notes that previous work in both the Okanagan and Kettle Valleys has been directed towards the valley bottoms while the upland regions remain poorly investigated.

Brandon (1979) discusses an extensive impact assessment project for governmental and private clients in the Kootenay and Boundary regions. Surficial survey was the predominant method employed, although subsurface testing was performed at some areas of dense ground cover (Brandon 1979:8-9). Two BC Parks referrals at jewel Lake and Christina Lake are summarized (Brandon 1979:32-34). Brandon evaluated the northem shore of Jewel Lake as being of high archaeological site potential. Subsurface testing was apparently not employed during his evaluation of this location, which did produce a precontact subsurface lithic scatter site (DhQp-1) during a recent AIA evaluation of the park expansion (Handly, Lackowicz, and Zibauer 1996). Reports of vandalism at recorded pictograph sites DgQn-6 and 7 on Christina Lake led to Brandon revisiting those areas. Both sites are noted as being threatened by natural erosion processes such as spalling, lichen growth, and carbonate deposits, with DgQn-6 being the more damaged of the two due to its open exposure. Brandon recommends (1979:34) that the carbonate deposits on the panels at DgQn-7 be removed. Brandon also assessed upgrading of highways and roads near Grand Forks, Beaverdell and along Highway 33 (Brandon 1979:66-67), portions of which had been assessed by Bates and McMath (1976). Surficial survey was employed, with no conflicts noted. One site (DgQr-5) is noted fifty metres east of a construction zone.

A report by Freisinger (1979a) is the first of a two-part study providing the results of an archaeological inventory study in the Kettle River valley drainage. Survey methodology involved the use of a three-person survey crew judgmentally traversing the alluvial, and possibly glaciofluvial, terraces within portions of the Kettle River valley (Freisinger 1979x21). This survey orientation was chosen by Freisinger (1979a:14) for two reasons: a) the assumption that the ethnographic "subsistence pattern was primarily riverine orientated [sic] and secondarily orientated towards lakes and mountain areas"; and b) the increased land-altering development occurring in the valley bottom. It should be noted that several "spot surveys in upland mountain areas were carried out" (1979a:21); however, these upland survey areas are not identified. No maps are provided concerning those areas that were evaluated which contained negative survey results.

In total, Freisinger (1979a:23,78) recorded fifty-four archaeological sites: twenty-six general activity sites (i.e., lithic scatters, burnt bone, fire-broken rock, etc.), eleven cultural depression sites, eight isolated finds, four resource extraction / utilization areas, three pictograph sites, and two burials. These sites were clustered in the following areas: Cascade Canyon and Falls (n=5); Christina Lake and Christina Creek (n=22); Kettle River (n=21); and the lower Granby River (n=6). Using known archaeological site distribution along the Kettle River, Freisinger (1979a:56) estimates that there are 1.3 sites / river kilometre, indicating that about 173 archaeological sites may be present along the entire Kettle River drainage in Canada. Since subsurface testing was not implemented as an archaeological site discovery technique *during* this study, it should be stressed that these estimates err to the conservative, and that a higher archaeological site density figure can be expected.

Detailed faunal and lithic analyses are also presented (Freisinger 1979a:60-69). The most common identifiable faunal remains appear to be deer (DgQn-12, DgQn-20, DgQn-21, and DgQo-1 0), elk (DgQn-12 and DgQo-1 0), bird (DgQn-20), red fox (DgQn-20), mountain goat (DgQo-5), and mountain sheep (DgQo-5). With respect to lithic artifacts, grey to black argillite (43%) is the most common lithic material recorded, followed by black to brown chert (32%), chalcedony (7%), basalt (6%), granite (3%), nephrite (3%), quartzite (3%), andesite (2%), slate (1 %), and greywacke (1%).

Freisinger (1979b) is a supplementary report to Freisinger (1979a). As with the previous study, Freisinger (1979b:1-2) conducted a systematic, but judgmental, visual ground surface survey between Midway and Rock Creek along the Kettle River, with spot checks conducted between Rock Creek and Westbridge. The major focus of this inventory study was also towards the lower terraces associated with the Kettle River and "[u]pland montane areas were not examined due to lack of time and funding" (Freisinger 1979b:22).

In total, thirty-one general activity sites, nine cultural depression sites, two burials, and one isolated find site were encountered during the field study (Freisinger 1979b:1). These sites were located around the following localized areas: Midway (n=5); Meyers Creek (n=6); Bubar Creek (n=5); Rock Creek (n=6); Kettle River Provincial park (n=5); Zamora (n=13); and other areas (n=3) (Freisinger 1979b:6-21). One limitation with this study is that no maps are provided concerning those areas that were evaluated which contained negative survey results. As with the previous study, subsurface testing was not implemented as an archaeological site discovery technique. Freisinger (1979b:23) indicates that future research in this portion of the Kettle Valley should be directed towards the following areas: a) West Kettle River; b) Upper Christian Valley; c) Kettle River from Grand Forks to Midway (Washington State); and d) the Boundary, *Meyers,* and Nicholson Creek drainages.

Four highway developments within the study area are summarized by Brolly (1984) within a survey of 145 MoTH referrals in six highway regions. These referrals are located near Greenwood, Rock Creek, and Westbridge. One of the areas crossed terrain that was considered to be of low archaeological site potential, while the remainder had favourable potential (Brolly 1984:18). No discussion of the survey methods is presented, and no cultural materials were encountered.

The Grand Forks bridge relocation project *was* assessed by *Bussey* (1984) on behalf of the Heritage Conservation Branch and MoTH due to the presence of a previously recorded lithic scatter site (DgQo-13) near one option. The AIA focused on the two crossing options, the existing bridge site, and revisited DgQo-13. The bridge options and existing bridge site were subjected to a visual foot-survey and judgemental subsurface testing program. Various areas were found to be disturbed by previous land-altering activities, but 40 shovel tests (50x50cm) were excavated, 4 existing geotechnical pits examined, and 42 surface exposures (50x50cm) cleared. One depression was exposed and determined to be non-cultural (Bussey 1984:6-7). One possible flake was located at a road-cut edge at the south side of the westerly option (Bussey 1984:9) but no other cultural materials were located in the assessed areas. DgQo-13 is located on the upper terrace of the north bank of the Kettle River, and was assessed for its archaeological significance. Traverses at 2 m intervals were conducted and surficially evident artifacts mapped and collected, with extensive cultivation disturbance noted. Artifacts recovered totalled fifteen, 11 of black siliceous siltstone, 1 grey chert, and 3 of undetermined microcrystalline materials. Two additional possible flake fragments were located on the terrace to the east of DgQo-13, suggesting to Bussey (1984:9) that the site may extend to that area.

Two 1x1 m evaluative units (EUs) were excavated, with subsurface deposits extending to 20cm below surface. A total of 212 lithic artifacts were recovered from the EUs, all of black siliceous siltstone (possibly black argillite, Freisinger 1979a), except for one beige chert and one brown quartzite flake. No temporally diagnostic artifacts were recovered. Given its surficial disturbance, the assemblage recovered, and the number of comparable sites located in the region, Bussey recommends that the site not be subjected to further mitigative measures if the bridge option that would impact DgQo-13 is chosen (1984:15-16).

Wilson (1989:4,8,10-12,37) evaluated two bridge approaches near Grand Forks: a) Spragget Bridge and b) Highway 3 and 68th Avenue. The new Spragget Bridge approach (i.e., road and bridge) were already constructed at the time of field inspection, therefore no subsurface testing was undertaken (Wilson 1989:10). The Spragget Bridge location is situated within site DgQo-13 which had been subjected to a visual ground surface inspection and artifact collection program by Freisinger (1979a,1979b), as well as limited excavations by Bussey (1984). A brief visual inspection of a parking area adjacent to the bridge crossing noted fifteen black chert or siliceous siltstone artifacts, including an endscraper and large biface (Wilson 1989:10). This appears to indicate, contrary to Bussey (1984) perception of DgQo-13 being too disturbed to warrant further excavation, that undisturbed deposits may be present in the study area (Wilson 1989:10). A large portion of DgQo-13 appears to have been destroyed during construction of the Spragget Bridge approach.

The Highway 3 and 68th Avenue bridge approach was evaluated since it appears to be located in close proximity to DgQo-2, a burial site situated within an abandoned gravel pit above Highway 3 (Wilson 1989:10). The site was originally noted in 1952, recorded in 1972, and evaluated finally by Freisinger (1979a). Large quantities of grave goods, abalone shell and human skeletal remains were encountered (Wilson 1989:12). A visual ground surface inspection of both the gravel pit area and actual bridge crossing was conducted with no archaeological materials being encountered.

Three precontact surface and subsurface lithic scatter sites were located by Zacharias (1990) during an assessment of a 4.1 km re-alignment of Highway 3 between Bridesville and Rock Creek. Surficial survey of the area was performed using 20m wide traverses, with subsurface testing also employed using an unstated number of shovel tests. The three sites (DgQs-7, 8 and 9) have each been disturbed by land-clearing activities. Artifacts observed and/or recovered included a basalt flake and core fragment (DgQs-7), a rhyolite core and a small amount of chert and basalt debitage (DgQs-8), and a rhyolite debitage and one core fragment (DgQs-9). The sites are situated in a grassy field 400m away from Johnstone Creek but adjacent to a dry creek channel, on a ridge within 50m of Nathan Creek, and upon a terrace within 50m of Nathan Creek, respectively. Each is interpreted as a small transient campsite or lithic workshop. Due to the limited number of artifacts recovered, no further mitigative actions are recommended for the three sites (Zacharias 1990:29).

An 8.0km section of the Christian Valley Road and the Able Gravel Pit, located north of Westbridge, were evaluated during the impact assessment by Rousseau and Muir (1991:16, 38-41). The road section and gravel pit were both subjected to a systematic ground surface inspection as surface visibility was excellent due to recent clearing and tree removal. Judgmental shovel testing was also conducted in several areas along the road ROW; however, neither the number of shovel tests nor the location of the areas shovel tested is presented. No archaeological concerns were noted in either area.

A provisional assessment of the heritage resource potential of the Kettle River Valley from Rock Creek to Highway 6 to the north, was also conducted during a brief 'drive-through' by Rousseau and Muir (1991:14-15, 38-42). Rousseau and Muir (1991:41-42) suggested that this portion of the Kettle Valley to the west of the present study area should display strong cultural affinities with the Columbia Plateau in general, and the Okanagan Valley in particular, due to the physical connection between the Columbia and Kettle Rivers. With regard to archaeological site potential in the area, they suggest that small, isolated, Early to Middle Period sites (ca. 10,500 to 3,500 BP) should be located on the higher kame and/or glaciolacustrine terraces situated on the valley walls. Late Period sites (ca. 3,500 to 200 BP) should be slightly more numerous than Middle and Early Period sites, and should be situated on lower alluvial terraces at or near the confluence of streams (Rousseau and Muir 1991:41-42). Additionally, they concluded that the southern portion of the Kettle Valley should display a higher concentrations of archaeological sites than the northern sections of the valley (Rousseau and Muir 1991:42).

Zacharias (1991) provides a letter report on an inventory and AIA on the 4 km long Highway 3 realignment near Johnstone Creek Provincial Park, following up on her 1990 survey because of design changes. DgQs-2 , a small precontact lithic scatter with postcontact log buildings not revisited in 1990 (see Freisinger 1979b:21), was relocated and the eastern 2 km of the proposed ROW reexamined. Assessment consisted of

20m survey transects with judgmental subsurface testing and screening employed in areas of dense ground cover (Zacharias 1991:2-3), although the number and exact location of the shovel tests is not discussed. No new archaeological or heritage sites were located. DgQs-2 was systematically mapped, and **noted** as not being in conflict with the new ROW. Chert artifacts and a boiling stone represent the located surface material. A recommendation is made that a subsurface ash layer be monitored if future developments occur to ensure that it is not part of a buried cultural deposit (Zacharias 1991:6).

An impact assessment by Rousseau, Merchant, Muir, and Bailey (1993:5,13-l 4,) was conducted for the Trapping Gravel Pit, located between Kelowna and Beaverdell, on Highway 33, near the confluence of Trapping Creek and the West Kettle River. Much of the topsoil associated with the gravel pit and northern expansion area had already been removed prior to field inspection (Rousseau et al. 1993:5,34). It appears that a visual ground surface inspection of the study area was conducted, but since no undisturbed surficial deposits were encountered, shovel testing was not conducted. No archaeological concerns were identified. The area near the confluence of Trapping Creek and the West Kettle River was also given a brief overview assessment (Rousseau et al. 1993:34). They suggest that the confluence area displays a medium potential for containing archaeological sites and that "prehistoric sites existing in this locality will be found on the terraces immediately beside the river and creek, and they are likely fairly small, and relate to short term hunting and/or plant resource collection pursuits" (Rousseau et al. 1993:34).

Bussey (1993:1-l 3) reports on an impact assessment conducted for EC Gas for three compressor stations near Midway. Prior to commencing fieldwork Bussey (1993:3) completed a review of archaeological site forms held at the Archaeology Branch, a brief review of relevant archaeological, ethnographic and historic references, and an analysis of topographic information related to each of the compressor stations. Compressor station No. 1 is situated on a discontinuous terrace upstream from the confluence of Boundary Creek and the Kettle River (1993:6). Since ground surface visibility was good across the terrace surface and the area had been extensively impacted by previous land-altering activities; e.g., placer mining, field-clearing, and possible structural foundations; foot traverses, but no subsurface tests, were implemented (Bussey 1993:7). Compressor Station No. 4, near Pope and Talbot Ltd. (Midway Division), was situated near the base of a colluvial slope (Bussey 1993:9). Extensive ground surface disturbance provided good ground surface visibility during the foot traverses that were initiated. No shovel testing was conducted. The final compressor station (No. 5) was located in a pre-existing gravel pit, also near Pope and Talbot Ltd. (Midway Division). Extensive ground surface alteration was noted throughout the final compressor station location; however, a visual ground surface inspection was still undertaken (Bussey 1993:9). No archaeological concerns were noted at any of the three proposed compressor station locations.

Choquette (1993a) presents the results of an archaeological impact assessment conducted for a residential subdivision of four lots within Grand Forks, near the Kettle River. Although a very brief discussion of local vegetation and geomorphology related to the glaciofluvial terrace is provided, no references related to relevant regional palaeoenvironmental or contemporary environment, aboriginal adaptations, Euro-Canadian history, previous archaeological research and culture-history are included (Choquette 1993a:1). The study area was situated on two separated terrace segments. Both the upper and lower terraces were evaluated through a visual ground surface inspection. Eight (8) geotechnical pits had also been previously excavated on the lower terrace section and no shovel tests were placed in this area. Additionally, no shovel tests were placed on the upper terrace; however, this area appears to have been impacted by previous land-altering activities. No cultural materials were encountered during the visual ground surface inspection or the evaluation of the geotechnical pits.

Choquette (1993b) conducted a 1:250,000 scale archaeological overview assessment for the Nelson Forest Region, including brief reviews of archaeology in the Boundary Forest District (i.e., Monashee Mountains zone). Generalized discussions of the geology, geomorphology, palaeoecology, contemporary environment, archaeology, and ethnography are presented (1993b:4-13); however, the majority of this information is not readily applicable to the Boundary Forest District. As well, the discussions concerning cultural-historical constructs used for describing precontact material culture are derived from the Purcell and Rocky Mountain Trenches, with the western portion (i.e., Canadian Plateau) receiving a much more limited review. Limited data is presented concerning previous archaeological research, actual archaeological site distribution, site types, and/or site density within the study area (Choquette 1993b:42,75-76). A significant limitation to this study is the lack of 1:250,000 scale archaeological potential -maps. Choquette (1993b:35-40, 76-77) provides a brief discussion of landform-specific attributes associated with medium or greater archaeological site potential, as well as potential archaeological site locations within the BFD: a) upland grassland around Bridesville for Early Period occupations; and b) upland / alpine areas surrounding the Kettle and Granby River Valleys for Middle Period occupations. He suggests in the future that either 1:50,000 and 1:20,000 scale mapping be conducted of archaeological site potential assessments (1993b:36), in association with possible infield-testing (i.e., ground-truthing), to more accurately delineate zones of medium or greater archaeological site potential in the study area.

Wilson (1993) provides a summary of an impact assessment conducted for Powerhouse Developments Inc. concerning a proposed hydroelectric project on the Kettle River near Cascade Falls, south of Christina Lake. A two-person field crew was used to implement both a surficial ground surface inspection and shovel testing program within those areas that would be impacted during dam construction, transmission line erection, and the resultant pondage area [Wilson 1993:7-9). Transects were performed 20m apart parallel to the Kettle River banks, as well as evaluating adjacent well-drained terraces. In total, 112 shovel tests were excavated, and fourteen small evaluative units (.25m^2) placed within recorded site boundaries, during this impact assessment (Wilson 1993:9).

During the investigations, eleven previously recorded archaeological sites (see Freisinger 1979a, 1979b; Wilson 1989) and two new archaeological sites (e.g., DgQn-37 and DgQn-39) were assessed for possible negative impacts. These two sites were characterized by a small cultural depression (i.e., cache-pit, DgQn-37) and an isolated lithic find (DgQn-39). Wilson (1993:25) notes that two archaeological sites will be impacted by the proposed dam construction activities while five will be negatively affected by the pondage: "[l]ong term inundation removes cultural deposits from future study and likely accelerates erosion as well as having deleterious effects on certain types of deposits". Only DgQn-20, within the dam pondage and consisting of subsurface deposits of lithic, faunal, and fire-broken rock concentrations, is considered as requiring further archaeological mitigation prior to dam construction (Wilson 1993:25-27). The remainder of the sites appear to be too extensively disturbed by previous land-altering activities to require further assessment.

Choquette (1994) reports on the salvage excavation of a hearth feature located on the south bank of the Kettle River near Grand Forks. The site (DgQn-40) was located by the landowner during construction of a quonset building. Subsurface testing was limited to the exposed feature at the request of the Okanagan Tribal Council. The exact size of the feature is not presented. Excavation was by 5 cm arbitrary levels and screened with 1 .5mm mesh. One vitreous basalt flake fragment was the only artifact recovered. One radiometric charcoal sample of the hearth (Beta-70325) resulted in a date of 1650 +/- 50 BP (calibrated to one sigma: 1510-1570 BP with intercept at 1540 BP). A surficial survey of the surrounding area located one black argillite flake on a road/path exposure near the Kettle River. Although Choquette (1994:11) suggests this second flake as evidence for an earlier occupation tied to the Ksunku Period at Kettle Falls (ca. 5000-3200 BP), this material is that commonly described by Freisinger (1979a, 1979b) for Late Period sites along the Kettle River.

Handly and Zibauer (1996a) present an AOA and AIA of harvesting areas in the upper Goatskin Creek drainage for the Boundary Forest District. The AOA includes summaries of the contemporary environment, ethnography and previous archaeological research in the area; however, although early Holocene physiographic landforms are included in the predictors defined for archaeological potential (Handly and Zibauer 1996a:20), no discussion of palaeoenvironment is provided in the text. Mapping of archaeological site potential was performed on NAD27 1:50,000 scale paper maps based on 1:20,000 scale TRIMs and 1:15,000 scale air photos, with predicted site densities of < 1 / km^2 (Low), 1-5 /km' (Medium), and > 5 / km' (High). A "brief field inspection" of the general area was conducted prior to the mapping (Handly and Zibauer 1996a:19).

Of twenty-one cutblocks and associated access roads evaluated, all or portions of sixteen (76.2%) were captured by the potential maps. The AIA portion of the report focuses on SBFEP cutblocks not included in the AOA evaluation. Nine cutblocks and their access roads, including an extension of the Goatskin Creek Main FSR, were surficially surveyed and subjected to a judgemental subsurface testing program (27 shovel tests in total). Traverses focused on well-draining terraces and stream margins. No archaeological sites were located, although a blazed trail in conflict with the FSR was encountered. A recommendation to avoid the trail and create a 20m buffer was made (Handly and Zibauer 1996a:28).

An AIA performed for four cutblocks within the upper Goatskin Creek drainage is presented by Handly and Zibauer (1996b). Survey areas focused upon alluvial terraces adjacent to Goatskin Creek, and other flat landforms situated near water or on glacially-derived surfaces. A total of eight shovel tests were excavated in two cutblocks, with the remaining areas deemed to be of low archaeological site potential (Handly and Zibauer 1996b:16-17). No cultural materials were encountered during the study.

The Jewel Lake area surveyed by Brandon in 1979 was reassessed by Handly, Lackowicz, and Zibauer (1996) during a proposed expansion of the provincial park campground. The north end of the lake was surficially examined and subjected to 121 shovel tests, focusing on the beach, morainal bench, and other flat landforms. Much of the area was found to have been disturbed by previous land-altering activities, although one small lithic and faunal scatter (DhQp-1) was located on the present beach. The artifacts are made from mottled grey-black chert and basalt, with calcined avian and mammal bone coming from the same excavation level. A possible sand dune or palaeo-beach was also encountered approximately 30m from the present shoreline. As this site is one of very few recorded at a higher elevation for the region (1,220 m asl), the site was capped by lm of gravel fill. A recommendation was made that the possible buried beach deposit be monitored if future land-altering activities occur (Handly et al. 1996:28).

Two reports by Zibauer, Handly, and Lackowicz (1996a, 1996b) discuss AIA studies in the upper Goatskin Creek drainage for Pope and Talbot Ltd. and the Boundary Forest District SBFEP. A total of eight harvesting areas and portions of two forest service roads (FSR) were assessed. Seventy-one shovel tests were excavated upon various knolls, terraces, and other flat landforms within the harvesting areas, along the FSR right-of-way, and near the heritage trail recorded in 1995 (see Handly and Zibauer 1996b). One large post-contact site (ca. 1920s) was located near the eastern end of the trail (DkQp-1), comprised of a log cabin, corral, and numerous features. A cluster of circular to ovate depressions was located adjacent to Goatskin Creek, outside of the proposed harvesting activities (DkQp-2). Although some appear to be the result of natural actions from an old fluvial channel, eight were interpreted as possible cache pits based upon the presence of a charcoal lense within excavated shovel tests. No other artifacts were located at this site. Recomendations include that the two sites and the heritage trail have buffers established to preserve their integrity, and that sections of the FSRs not ribboned at the time of assessment be surveyed at a later date.

2.2 Analysis of Previous Archaeological Studies, BFD

In an IGA study conducted by Equinox Research and Consulting Ltd. (Franck, Muir, and Bush 1997:23), archaeological impact assessment (AIA) and archaeological inventory studies (AIS) containing the following data were excluded from further analyses: (a) minimal or no subsurface testing conducted; (b) surveys implemented from vehicles (e.g., cars, boats, helicopters) with no intensive and/or extensive foot traverses conducted; (c) survey traverses conducted at widely separated intervals; (d) no indication of survey areas presented on maps, maps of inappropriate scale (e.g., >1:250,000), or lacking maps; and (e) discussions where the location of survey areas could not be identified through referring to the text. Similar criteria have been used to classify the excavation, AIA, and AIS studies in the BFD.

Table 2.1 illustrates that only 46% of the archaeological investigations conducted within the BFD can be considered as ‘intensive surveys’ (i.e., subsurface testing and mapped survey areas were indicated). During those 12 studies, approximately 805 ha of land surface was evaluated (avg. 67 ha / survey, range 5 to 210 ha). MoTH initiated the the most archaeological investigations in the BFD (42%), followed by private developers (19%), and various other agencies (29%). The data indicates that intensive surveys were not conducted prior to 1990, with the exception of Wilson in 1978. However, with the exception of Rousseau and Muir (1991), all archaeological investigations since 1990 have included intensive survey procedures.

Table 2.2 summarizes the types of background information gathered by archaeologists prior to, and during, archaeological investigations in the **BFD.** Aboriginal consultation by archaeologists does not appear to have been conducted in the BFD prior to 1993. Several types of background research are also poorly rep. resented in the majority of archaeological discussions; i.e., past environments, regional archaeological construct& Euro-Canadian historical background, and local archaeological investigations. The most represented areas of research are ethnographic and contemporary environment presentations.

Fieldwork methods for conducting archaeological assessments form the basis for Table 2.3. Although visual ground surface inspections of potential development areas (i.e., foot traverses and surficial surveys) dominate the majority of studies, less than half of these studies used subsurface testing to determine the nature and extent of buried archaeological deposits. Except for Wilson (1978), shovel testing programs were not an integral component of most studies until after 1990. For those consultants who employed subsurface testing, 83% provided descriptions of the soil and sediment matrices.

Table 2.1: Archaeological Coverage within the BFD, IGA Analysis

Author	Study	Client	Intensive Survey	Hectares surveyed (Approx.)
Barlee (1969)	Excavation	AB	NA	
Bussey and May (1974)	AIA	MoTH	NO	
Burnip and Hardern (1975)	AIA	MoTH	NO	
Bates and McMath (1976)	AIA	MoTH	NO	
Roberts 11976)	AIA	Hydro	NO	
Duff and Rousseau (1978)	AIA	MoTH	NO	
Wilson (1978)	AIA	Private	Yes	175
Brandon (1979)	AIA	Private	NO	
Freisinger (1979a)	AIS	AB	NO	
Freisinger (1979b)	AIS	AB	NO	
Brolly (1984)	AIA	MoTH	NO	
Bussey (1984)	Excavation	MoTH	NA	
Wilson (1989)	AIA	MoTH	NO	
Zacharias (1990)	AIA	MoTH	Yes	017'
Rousseau and Muir (1991)	AIA	MoTH	NO	
Zacharias (1991)	AIA	MoTH	Yes	010*
Bussey (1993)	AIA	Private	Yes	005
Choquette (1993a)	AIA	Private	Yes	006
Rousseau, Muir, Merchant, and Bailey (1993)	AIA	MoTH	Yes	058
Wilson (1993)	AIA	Private	Yes	210
Choquette (1994)	Excavation	Private	NO	
Handly, Lackowicz, and Zibauer (1996)	AIA	Parks	Yes	009
Handly and Zibauer (1996a)	AIA	MOF	Yes	065
Handly and Zibauer (1996b)	AIA	Private	Yes	030
Zibauer, Handly, and Lackowicz (1996a)	AIA	MOF	Yes	150
Zibauer, Handly, and Lackowicz (1996b)	AIA	Private	Yes	070
			Total Intensive Survey	805 ha

Legend: AB=Archaeology Branch; MoTH=Ministry of Transportation and Highways; Hydro=BC Hydro; Private=Private Developers; Parks=BC Parks

*coverage may partially overlap

Table 2.2: IGA Consultation and Background Research - Previous Archaeology

Legend: AC=Aboriginal Consultation; ETH=Ethnography; PE=Palaeoenvironment; CE=Contemporary Environment; HIST-Historical; LA=Local Archaeology; RA=Regional Archaeology

Author	AC	ETH (No.)	PE (No.)	CE (No.)	HIST (No.)	LA (No.)	RA (No.)
Barlee (1969)	NO	NO	NO	NO	Yes	NO	NO
Bussey and May (1974)	NO	NO	NO	NO	NO	NO	NO
Burnip and Hardern (1975)	NO	NO	NO	NO	NO	NO	NO
Bates and McMath (1976)	NO	NO	NO	NO	Yes	No (02)	NO
Roberts (1976)	NO	NO	NO	No	NO	NO	NO
Duff and Rousseau (1978)	NO	No (01)	NO	Yes (01)	NO	No (01)	NO
Wilson (1978)	NO	Yes (03)	Yes (07)	Yes (05)	NO	Yes (05)	NO
Brandon (1979)	NO	Yes (06)	Yes (03)	Yes (03)	NO	NO	NO
Freisinger (1979a)	NO	Yes (21)	NO	Yes (03)	Yes (10)	Yes (02)	Yes (17)
Freisinger (1979b)	NO	Yes (21)	NO	Yes (03)	Yes (10)	Yes (02)	Yes (17)
Brolly (1984)	NO	Yes (00)	NO	Yes (00)	Yes (00)	NO	NO
Bussey (1984)	NO	Yes (02)	NO	Yes (06)	NO	Yes (00)	NO
Wilson (1989)	NO	NO	NO	NO	NO	Yes (04)	NO
Zacharias (1990)	No	No (01)	NO	No (01)	Yes (03)	Yes (02)	No (02)
Rousseau and Muir (1991)	NO	Yes (06)	NO	Yes (00)	NO	NO	NO
Zacharias (1991)	NO	Yes (02)	NO	Yes (01)	Yes (01)	Yes (03)	NO
Bussey (1993)	Yes	Yes (21)	Yes (12)	Yes (05)	Yes (03)	Yes (30)	Yes (30)
Chcquene (1993a)	Yes	NO	NO	Yes (00)	NO	NO	NO
Rousseau et al. (1993)	NO	No (03)	NO	Yes (01)	NO	NO	NO
Wilson (1993)	Yes	Yes (06)	NO	NO	Yes (09)	Yes (07)	NO
Chcquene (1994)	Yes	Yes (02)	NO	NO	NO	NO	Yes (10)
Handly and Zibauer (1996a)	Yes	Yes (09)	NO	Yes (07)	Yes (12)	Yes (09)	NO
Handly and Zibauer (1996b)	Yes	Yen (10)	NO	Yes (06)	Yes (14)	Yes (15)	NO
Handly et al. (1996)	Yes	Yes (11)	Yes (22)	Yes (09)	Yes (16)	Yes (10)	Yes (21)
Zibauer et al. (1996a)	Yes	Yes (19)	Yes (23)	Yes (06)	Yes (15)	Yes (18)	Yes (13)
Zibauer et al. (1996b)	Yes	Yes (17)	Yes (21)	Yes (06)	Yes (13)	Yes (28)	Yes (07)
Summary	AC No=17 Yes=9	ETH No=10 Yes=16	PE No=20 Yes=6	CE No=9 Yes=17	H No=12 Yes=14	LA No=12 Yes=1 4	RA No=19 Yes=7

Table 2.3: IGA Methodology and Results - Previous Archaeology

Legend: VT=Vehicular Traverse; FT=Foot Traverse; SS=Surficial Survey; ST=Shovel Testing ST#=Shovel Test No.; EU=Evaluative Unit; EU#=Evaluative Unit No.; MD=Matrix Description

	VT	FT	SS	ST	ST#	EU	EU#	MD
Barlee (1969)	NO	Yes	Yes	NO	00	Yes	01	NO
Bussey and May (1974)	Yes	NP	Yes	NO	00	NO	00	NO
Burnip and Hardem (1975)	Yes	NP	Yes	NO	00	NO	00	NO
Bates and McMath (1976)	Yes	NP	Yes	NO	00	NO	00	NO
Roberts (1976)	Yes	Yes	Yes	NO	00	NO	00	NO
Duff and Rousseau (1978)	NO	Yes	Yes	NP	Unk	NO	00	NO
Wilson (1978)	Yes	Yes	Yes	Yes	Unk	NO	00	NO
Brando" (1979)	NO	Yes	Yes	NO	00	NO	00	NO
Freisinger (1979a)	NO	Yes	Yes	NO	00	NO	00	NO
Freisinger (1979b)	NO	Yes	Yes	NO	00	NO	00	NO
Brolly (1984)	Yes	Yes	NP	NO	00	NO	00	NO
Bussey (1984)	NO	Yes	Yes	Yes	40	Yes	04	Yes
Wilson (1989)	Yes	Yes	Yes	NO	00	NO	00	NO
Zacharias (1990)	NO	Yes	Yes	Yes	Unk	NO	00	Yes
Rousseau and Muir (1991)	Yes	Yes	Yes	Yes	Unk	NO	00	NO
Zacharias (1991)	NO	Yes	Yes	Yes	Unk	NO	00	Yes
Bussey (1993)	NO	Yes	Yes	NO	00	NO	00	Yes
Choquette (1993a)	NO	Yes	Yes	Yes	00	NO	00	Yes
Rousseau et al. (1993)	NO	Yes	Yes	NO	00	NO	00	NO
Wilson (1993)	NO	Yes	Yes	Yes	112	Yes	14	Yes
Choquette (1994)	NO	No	Yes	NO	00	Yes	01	Yes
Handlyet al. (1996)	NO	Yes	Yes	Yes	121	Yes	1.25	Yes
Handly and Zibauer (1996a)	NO	Yes	Yes	Yes	17	NO	00	NO
Handly and Zibauer (1996b)	NO	Yes	Yes	Yes	08	NO	00	NO
Zibauer et al. (1996a)	NO	Yes	Yes	Yes	61	NO	00	Yes
Zibauer et al. (1996b)	NO	Yes	Yes	Yes	13	NO	00	Yes
		FT	SS	ST	ST#	EU	EU#	MD
Summary	No=18 Yes=08	No=01 Yes=22 NP=03	No=00 Yes=25 NP=1	No=13 Yes=12 NP=OI	368	No=21 Yes=05	21.25	No=16 Yes=10

2.3 Known Archaeological Site Types, BFD

This subsection summarizes archaeological site attributes within the BFD area. The types of known archaeological sites are discussed, as well as their frequency and spatial distribution. A total of 105 archaeological (precontact) sites are recorded. The majority of these sites include multiple site types; therefore, the total number of recorded archaeological site types equals 163 (Table 2.4).

Table 2.4: Known Archaeological Site Types, BFD

Types	NO.	Percentage
Surface and Subsurface Lithic Scatters	074	45.4
Calcined Bone Concentrations	023	14.1
Fire-Broken Rock Concentrations	020	12.3
Cultural Depression Habitation Sites	016	09.8
Cultural Depression Subsistence Features	013	08.0
Burial Sites	006	03.7
Pictograph Sites	004	02.5
RockshelterSites	003	01.8
Petroforms	002	01.2
Quarries	002	01.2
Total	163	100

A comparison between site location and landform was conducted by KWHC during our research of the area. This information is presented in Table 2.5. The majority of sites are recorded along the main glaciolacustrine and glaciofluvial terraces associated with the Kettle River drainage, followed by sites associated with various large lake margins (i.e., Christina and Jewel Lakes).

Table 2.5: Known Site Type Distribution by Landform, BFD

Landform Type	No.	Percentage
River Terrace (Post-Glacial Origin)	065	61.9
Lake Margin	019	18.1
Alluvial Terrace	011	10.5
Bedrock Exposure (Pictograph, Rockshelter, Quarry)	009	08.6
Ridge	001	00.9
Total	105	100

Table 2.6 shows the location of sites by latitude within the study area (see Franck et al. 1997). This indicates that the majority of archaeological investigation occurred between 49°00’ and 49° 20’ (n=102, -97%).

Table 2.6: Recorded Archaeological Sites by Latitude, BFD

Latitude	NO.	Percentage
49” 00’ 49° 10’	097	92.4
49° 10’ - 49° 20’	005	04.8
49° 20’ - 49° 30’	001	00.9
49° 30’ - 49° 40’	000	00.0
49° 40’ 49° SO’	001	00.9
49° 50’ - 50° 00	001	00.9
Total	105	100

Table 2.7 refers to the amount of intensive archaeological survey conducted within each major biogeoclimatic zone, and summarizes the distribution of known archaeological sites. The majority of archaeological research was conducted in the lower elevation BCC Zones: e.g., the PP (Ponderosa Pine), IDF (Interior Douglas Fir), and Interior Cedar-Hemlock (ICH) (n=104, 99%).

Table 2.7: Biogeoclimatic Zonation, Intensive Archaeological Survey Area, and Archaeological Site Distribution, BFD

BCC Zone	ECC (hectares)	BCC (% of BFD)	Survey (hectares)	Survey (% of total)	Survey ha / BGC (%)	Sites (no.)	Sites (% of total)
PP	013,777	02.1	006	0.76	0.044	53	50.5
ICH	227,955	34.6	009	01.1	0.004	13	12.4
IDF	148,806	22.6	284	36.0	0.191	38	36.2
MS	120,147	18.2	175	22.2	0.146	00	00.0
ESSF	129,746	19.7	315	40.0	0.242	01	00.9
AT	018,914	02.9	000	00.0	0.000	00	00.0

Table 2.8 refers to the amount of intensive archaeological survey conducted to date within the elevational range of the BFD at 200m intervals, in addition to summarizing the distribution **of archaeological** sites within those units. The majority of previously recorded archaeological sites have been located between 401 and 800m asl (n=97, 92.4%).

Table 2.8: Elevation Range and Intensive Archaeological Survey Area, BFD

Elevation Range (m asl)	ha	ha % of BFD	survey (ha)	Survey (% of total)	Survey ha /Elevation (%)	Sites (no.)	Sites (% of total)
401.600	017007	02.6	221	28.4	1.30	67	63.4
601-800	040760	06.2	000	00.0	0.00	30	28.6
801.1000	082817	12.6	058	07.5	0.07	05	04.8
1001-1200	139566	21.2	009	01.2	0.01	01	00.9
1201-1400	150757	22.9	175	22.5	0.17	00	0.00
1401.1600	096464	14.6	315	40.5	0.33	02	01.9
1601-1800	066530	10.1	000	00.0	0.00	00	00.0
1801-2000	046578	07.1	000	00.0	0.00	00	00.0
2001-2200	017335	02.6	000	00.0	0.00	00	00.0
2201.2400	001166	00.2	000	00.0	0.00	00	00.0

2.4 Known Archaeological Site Types, Kettle Valley, Washington State

This subsection presents a brief review of the known archaeological resources and published archaeological reports concerning the Kettle Valley drainage in Washington State. A more extensive review of the archaeological data, such as was presented for the known archaeological site types in the EFD, was not conducted due to the lack of access to relevant databases.

The study area begins at the Canadian border and ends at the confluence of the Kettle and Columbia Rivers, but excludes the large number of reports related to salvage archaeology and monitoring within the Roosevelt Dam pondage area. This information was collected through a review of archaeological site forms and reports on file at the Office of Archaeology and Historic Preservation, Olympia, Washington (Contact: Dr. R. G. Whitlam ▪ State Archaeologist) and a review of recently published cultural resource management reports at the office of Archaeological and Historical Services, Eastern Washington University, Cheney (Contact: Ms. Rebecca Stevens). The types of known archaeological sites within the Washington State portion of the Kettle River drainage are discussed below. A total of fifty-seven archaeological sites were recorded within this area. The majority of these sites are composed of multiple site types; therefore, the total number of recorded archaeological site types equals 128 (Table 2.9).

Table 2.9: Known Site Types, Kettle Valley Drainage, Washington State

Types	NO.	Percentage
Surface and Subsurface Lithic Scatters	046	35.9
Calcined Bone Concentrations	029	22.7
Fire-Broken Rock Concentrations	017	13.3
Cultural Depression Habitation Sites	010	07.8
Cultural Depression Subsistence Features	014	11.3
Burial Sites	005	03.9
Pictograph Sites	001	00.8
Rockshelter Sites	002	01.6
Petroforms	004	03.1
Total	128	100

As with studies in the BFD, the majority of recorded sites are located within valley bottoms, and subsurface testing has been relatively limited. A comparison between site location and landform was conducted by KWHC. This information is presented in Table 2.10.

Table 2.10: Known Site Type Distribution by Landform, Kettle Valley Drainage, Washington State

Landform Type	No.	Percentage
River Terrace (Post-Glacial Origin)	28	49.1
lake Margin	11	19.3
Ridge	08	14.0
Bedrock Exposure (Rockshelters)	02	03.5
Alluvial Terrace	02	03.5
Kettle and Drum, Esker Topography	02	03.5
Saddle	02	03.5
Talus / Colluvial Slope	02	03.5
Total	57	100

2.5 Regional Archaeological Constructs and Past Environments, Bf D

The following section of the report provides a brief review of regional archaeological cultural-historical frameworks adjacent to the BFD study area. These are presented within the context of their past and contemporary environmental conditions, noting that considerable changes have affected the study area since the end of the last (Wisconsin& glacial period, ca. 13,000 years ago. Changes in environmental conditions have affected the types of faunal and floral resources available to precontact peoples. From an archaeological standpoint, they are also inferred to have an impact on archaeological site distribution.

Since no palynological and detailed geomorphological studies have been conducted within the BFD, it is impossible to precisely detail these environmental alterations. However, the broad climatic trends that potentially influenced the placement of archaeological sites are discussed for the nearby Arrow and Vernon Forest District (Handly et al. 1996; Lackowicz et al. 1996). Those findings have been expanded on for this study. Following Hebda (1995), four general climatic periods are discussed: (1) postglacial; (2) xerothermic; (3) mesothermic; and (4) modern.

The primary limitation associated with the following palaeoenvironmental discussion lies in the scarcity of available pollen cores within the study area. The situation has somewhat improved to the north, east, and west of the study area, but remains almost entirely lacking from the BFD. The cores that are available are almost exclusively limited to valley bottoms, but still represent an insufficient number for microenvironmental variations to be clearly defined (Wright 1976:27). As in modern times, vegetation would have varied with elevation in the past, and these differences have important implications to the development of time-specific archaeological prediction models. Knowledge of the climate and biotic composition of sub-alpine and alpine zones remains negligible and within the realm of speculation, yet these areas include large tracts of the total study area, and provided a very important resource base for precontact peoples through hunting and plant gathering (see Section 3.0).

The common use of materials such as gyttja and marl for dating pollen cores is problematic. Recent findings demonstrate that these samples often give deceptively early readings (Brown et al. 1989); this is also true for shell (Clague 1982; Fulton et al. 1989:261). The implications are that incompatible dates are being used within a common framework. A corollary to this problem is the lag-time between climatic changes and biotic adaptations. Based on variations in Holocene pollen percentages, Bryson et al. (1970) suggest that vegetation patterns in Minnesota and Wisconsin lag 50-200 years behind climatic changes. Other researchers have found that desert plants adapt almost immediately to climatic change, while long-lived trees can have lags in the order of centuries (Brubaker 1986; Ritchie 1986; also Webb 1986). These variations could also be occurring with regard to biotic adaptations in the study area. However, without more palynological and geomorphological research within the boundaries of the BFD, there is little that can be done to remedy these difficulties.

2.5.1 Postglacial Environment, Geomorphology, and Fluted Points (ca. 13,000 - 10,500 BP)

Environment

Along with the Rocky Mountain and Cascade glacier systems, the Cordilleran ice-sheet of the Wisconsinan glaciation covered most of British Columbia at its last maximum (ca. 15,000 BP), and extended into the northern portions of Washington, Idaho and Montana (Clague, Armstrong and Mathews 1980). Human habitation of southern BC was not possible for some time after the terminal Pleistocene (ca. 13,000 BP), when ice began to retreat (Mullineaux et al. 1978), and vegetation and associated fauna entered the area. However, the geomorphological effects that occur during deglaciation are considerable, involving complex inter-relationships between the retreat (and occasional re-advance) of individual glaciers, aeolian, glaciofluvial and glaciolacustrine aggradation and erosional processes, localized climatic variations, underlying geology, and resultant contemporary watershed systems and landforms (Ryder 1971, 1982; Clague 1975, 1986; Holland 1976). Effects can differ from valley to valley and from upland to upland. Thus, in order to be directly applicable to archaeological models, detailed microenvironmental data are required. The near-complete lack of such information within the BFD requires generalizations of postglacial developments. These have been derived mainly from the few available pollen samples and studies in surrounding areas.

Deglaciation in the southern interior occurred by the exposure of upland areas before valley bottoms (Ryder 1982; Clague 1989). Unfortunately, there is a distinct lack of pollen cores from upland zones, which limits our ability to define the temporal placement of their initial exposure and vegetation history. Glacial retreat in the BFD probably began 13,000 years ago, and progressed quite rapidly. A valley core from Pemberton Hill Lake east of Kamloops suggests that complete deglaciation was in effect by 10,500 BP (Hebda 1995:67). This correlates with ca. 10,000 BP dates from the Arrow Lakes (see Fulton 1971, 1984:43; Fulton and Smith 1978; Clague et al. 1980; Clague 1981), and in northern Washington, where cores suggest the presence of vegetation between 11,500-10,000 years ago (Mack, Rutter, Bryant and Valastro 1978a, 1978b; Mack, Rutter and Valastro 1978, 1979; see also Porter 1978).

Glacial meltwaters resulted in the formation of numerous glacial and proglacial lakes above current water levels, as evidenced by the presence of raised well-developed terraces and deltas at the mouths of tributary valleys (Kidston 1993:16). These lakes could have formed from numerous factors (see Ryder 1982:69-72; Clague and Evans 1994), but the dominant means is by blockage of trunk or tributary valleys by insufficiently diminished glacial extensions and depression of the land-surface from the weight of the Cordilleran glacier mass (Ryder et al. 1991:373).

While no glacial lake chronology has been defined for the Kettle Valley drainage, inferences are possible. Atwater (1986) summarizes the extent of glacial activity in the Kettle/Columbia valleys in northeastern Washington. Two major lobes and one sub-lobe (the maximum extent of ice) are located south of the BFD. These include the Columbia River Lobe, extending to the Spokane River, the Okanogan Lobe approximately 40km to the west, and the Sanpoil sublobe, encompassing the upper reaches of the Sanpoil River. As glaciers receded, the Okanogan Lobe and perhaps portions of the Columbia River Lobe formed ice-dams that blocked the Columbia River, resulting in an extensive waterway named Glacial Lake Columbia. This lake had relatively stable stands of -715m asl and ~520m asl (which resulted after the upper blockage was breached), as well as several possible shorter terms lake stands (Atwater 1986; Kiver and Stradling 1986, cited in Luttrell et al. 1994:2.7). Catastrophic floods resulting from breaches of Glacial Lake Missoula to the east may have impacted on the Columbia and Kettle River Valleys during this period (Atwater 1986).

These factors are visible in soil datasets available from the Nelson Forest Region office. Much of the Kettle and Granby River drainages, including presently small tributaries, are overlain with glaciolacustrine and glaciofluvial sediments that were deposited during this dynamic period. It is interesting to note, however, that the effects of the Pleistocene glacial epochs have not greatly modified the physiography of the forest district. Holland (1976:74) states that the well-rounded mountains, wide valleys, and gently rolling topography that characterize much of the BFD were subjected to significant erosion. Rather, the main effect of the glacial ice was manifested in the deposition on a thick mantle of drift.

The initial vegetation at Waits Lake near Colville, northeastern Washington is described as a forest tundra environment with no modern analogue (Mack et al. 1978b), which may date to -11,500 BP. This is typical of initial postglacial environments elsewhere (Mack et al. 1978, 1978a, 1979; Hazell 1979; Baker 1983:112), and consists mainly of open areas of sages and grasses with increasing amounts of lodgepole pine. However, at Pemberton Hill Lake, the lowest pollen zone, estimated to range from 10,500 to 9,800 BP, describes a somewhat different pioneering environment. There is little in the way of tundra grasslands present. Instead, lodgepole pine forest or parkland occupied the region immediately after glacial retreat (Hebda 1995:67). Considering the similarity between the BFD and Okanagan Valley, the above differences suggest that the BFD may have undergone a somewhat different biotic evolutionary process than that found to the east in the Arrow Forest District, perhaps due to the moister, maritime influences found west of the Columbia Mountains (Hebda 1996 pers. comm.). Alternately, it is also possible that the forest-tundra environment occurred prior to the formation of the lowest deposits of the Pemberton Hill pollen core (i.e., pre-10,500 BP). In summary, the initial postglacial climate (ca. 13-10,000 years ago) was significantly colder and moister than present, with unstable landforms resulting in extensive aggradation of river valleys and aeolian erosional processes. This continued until vegetation stabilized the exposed surfaces (Hebda 1982, 1995; Baker 1983:112-l 14).

The inter-relationship between vegetation and wildlife is complex (e.g. Patton 1992) and a knowledge of local biotic variations is necessary; however, the current pollen cores cannot provide sufficient data for the above palaeoenvironmental periods or for upland areas. Only general expectations of faunal resources within the following defined periods are described here. The open lodgepole pine and tundra grassland environment of the immediate postglacial period has no modern analogue, and the fauna associated with that ecology is predominantly speculative. It is possible that now-extinct 'megafauna' species (e.g., mastodon or mammoth) amongst many others (see Kurtén and Anderson 1980) could have occupied the study area in addition to diverse contemporary ungulates and other mammals. It is also possible that bison entered the Kettle Valley via the Columbia Plateau, although no evidence has been recovered to date.

Archaeology

The habitability of the upland areas before 12-1 1,000 BP within the BFD is uncertain, given our lack of knowledge of glacial retreat. It is therefore inferred that occupation of the study area was not likely prior to 11,000 BP. The Fluted Point Tradition, characterized by bifacial flaked spear points that have been basally 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). The nearest evidence for morphologically similar point forms are from surface collections near Shuswap Lake, Thompson River drainage (Rousseau 1993; Stryd and Rousseau 1996) and near Wenatchee, Washington (see Mehringer 1988; Mehringer and Foit 1990; Gramly 1993). This information suggests that similar locations adjacent to the study area were ice-free before 11,000 BP, given the temporal span of these points (1 2,500-10,500 BP).

2.5.2 Xerothermic Environment and the Early Period (ca. 10,500 to 7,000 BP)

Environment

Approximately 10,500 years ago, the climate began to warm rapidly, speeding the final stages of deglaciation and altering the biotic landscape (Mathewes 1985). The period after the full retreat of the glaciers, ca. 10,000 BP, is variously called the Altithermal, Hypsithermal, or Xerothermic interval. The system adopted by Hebda (1995), discriminating between an earlier, dryer "xerothermic" and a later, moister "mesothermic" period, is used here. The xerothermic was considerably warmer and drier than the present climate, especially during its maximum at ca. 7,500 BP (Mathewes 1985:419; Hebda 1995). The tree-line advanced in elevation by over 100 m (Osborn and Luckman 1988:124-125) and grasslands, comprised mainly of sages as well as grass species, reached their greatest extensions, perhaps up to 1300 m asl (Hebda 1982, 1995). Thus, it is very possible that grasslands also existed in relatively high elevations in the BFD during this warming period. This extension of grasslands and raised tree-line suggests that faunal types adapted to grasslands (i.e., various ungulates) would have had a much wider range than present, and that the sub-alpine and alpine adapted species would have been located at higher elevations.

The cores from Dunbar Valley in the Arrow Forest District (Hazell 1979; Hebda 1995:69-70) show that much of the landscape from 10,000 BP until a short time after 8,000 BP was open and dominated by shrubs such as juniper, soopolallie, and willow, as well as birch and alder. Lodgepole pine was common in sheltered and well-developed soil areas, while the relatively high percentage of sage pollens show that significant open grasslands existed. After 8,000 BP, the forest canopy began to close, with increases in the amount of pine, birch, Douglas-fir, and larch pollen, and a corresponding decrease in juniper, consistent with the beginnings of the moister mesothermic interval. The transference to a more mesic climate by 7,000 BP is supported by a core at Lower Little Slocan Lake (Hebda 1995:71-72). This sample shows at 8,000 BP the presence of an open mixed pine, spruce, fir, larch and Douglas-fir conifer forest with extensive grasslands in south-facing bluffs. After 6,800 BP, this transformed into a denser mixed-forest cover with a notable decrease in sage and grass pollen types. In comparison, the Okanagan Valley data shows a somewhat different biotic environment than found in the Columbia Mountain region during this time period. Evidence of a xeric effect is not apparent until after 8,400 BP, when evidence of grassland pollens dramatically increase. The commencement of the moister mesothermic environment appears to also be delayed until sometime after 6,600 BP (Alley 1976).

Archaeology

Following the Fluted Point Tradition, the Early Stemmed Point Tradition, probably originating in the Great Basin ca. 10,500 BP, 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 weakly to strongly developed shoulders are characteristic of this complex. Within the Columbia Plateau large stemmed projectile points with indented basal elements are characteristic of the Windust Phase (ca. 10,500 to 8,000 BP) (see Leonhardy and Rice 1970; Ames 1988). As with Fluted Point Tradition, the majority of these artifact types on the Columbia and Canadian Plateau have been recovered as surface finds (see Calm 1994:4.18).

Through stratigraphic and palynological correlations, the Shonitkwu Period at the Kettle Falls locality has been estimated to date between ca. 9,800 and 8,800 B.P. (Chance and Chance 1981:405-406,421-423). Artifacts characteristic of the Shonitkwu Period include microblades and keeled microblade cores, large notched-cobble net weights, and leaf-shaped and lanceolate projectile points (Chance and Chance 1981:421-423). Activities assumed to be occurring at this time involve salmonid fishing, as reflected by the use of net weights, varied faunal resource procurement (e.g., turtle, wild fowl, grizzly bear), as well as limited floral exploitation (Chance and Chance 1981:422).

Although Kettle Falls has become the dominant interpretive model for northeastern Washington archaeological chronologies, more recent work from the Lake Roosevelt basin and Chief Joseph Dam have suggested that the Kettle Falls sequence is not applicable throughout northern Washington (Calm and Luttrell 1994:3.62-64). The raw material types and artifact frequencies instead point to Kettle Falls being a specialized area of fishing activities, with relatively heavily utilization of tabular quartzite of the Colville Formation and particular artifact classes, whereas cryptocrystalline materials and other artifact types are more common outside of this area. In comparing cultural materials and archaeological constructs between adjacent regions, Calm and Luttrell (1994:3.63-67) state that there may be intra-regional variability in artifact types over coeval time periods, i.e., that different artifacts may be produced within a region at the same time period, possibly in relation to adaptive strategies or seasonality. An obvious correlate to this would be that similar artifact types were being used between regions at similar times when comparable activities were occurring.

Grabert (1970, 1974) defines the Okanagan Phase for sites older than 6,000 years ago. Okanagan Phase sites are most commonly associated with higher elevation landforms with weathered glacial till and compacted soils (Copp 1979:159, cited in Baker 1990:28). Grabert (1970:264, 1974:70) believes that large, leaf-shaped and stemmed projectile points are associated with this phase, as are ridge-backed core-scrapers or knives, and numerous flake tools. Basalt is the most common lithic raw material used, although quartzite is present. Subsistence patterns are virtually unknown, due to the lack of preservation of any faunal material except for freshwater mussels (Copp 1 979:159, cited in Baker 1990:28). The Okanagan Phase is also interpreted as being a manifestation of the Old Cordilleran Tradition (Stryd and Rousseau 1996:183).

2.5.3 Mesothermic Environment and the Middle Period (7,000 to 4,500/3,500 BP)

Environment

As noted above, between 8,000 and 7,000 years ago the climate altered into moister weather patterns and cooled slightly, inaugurating the mesothermic period. Cores from Lower Little Slocan Lake and Dunbar Valley describe an environment for this period that is estimated as being 1-2°C warmer than modern times, but with essentially modern precipitation values (Hazell 1979; Hebda 1995). In comparison to the xerothermic period, grasslands retreated southward and to lower elevations, as did the tree-line (Hebda 1982). These reductions are relative, however, *for* grasslands and tree-line were still above modern levels. Lake levels rose in response to the increased levels of precipitation (Hebda 1995), and undoubtedly inundated any sites that had been located along the previous shorelines. Gradually, the forest cover approached that found at present. At Lower Little Slocan Lake, a mixed conifer forest, dominated by pine but with substantial amounts of spruce, fir, larch and Douglas-fir existed in the lowlands between 7,000 and 5,000 BP. The trend toward an increasing density of forest cover continued from the preceding period, with dry openings dropping in number.

Approximately 4,500 years ago, western hemlock and possibly western redcedar enter many pollen records, suggesting a cooling of the climate to modern levels (Hebda 1995:71). The contrasts between the Arrow Forest District and the Okanagan Valley noted above are lessened within the mesothermic interval. After 6,600 BP, moister conditions and a cooling from the xerothermic high are evident based on the decrease in sages and a general increase of arboreal types of pollen at Kelowna Bog, particularly hazel, alder, and birch (Alley 1976:1140-l 141). The mesothermic period essentially marks a transition to modern (i.e., pre-fire suppression) vegetation zones, and while specific localities would vary, the types of faunal resources available to precontact peoples were likely analogous to those found during modern periods.

Archaeology

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-l 89). Diagnostic artifacts associated with the Early Nesikep Tradition include: large lanceolate, corner-notched, and barbed projectile points displaying straight or recurved lateral blade element outlines, deep, v-shaped corner-notches, straight to convex basal margins, basal-lateral and basal margin edge grinding, and occasional multiple basal thinning flakes; and wedge-shaped microblade core technology (Stryd and Rousseau 1996:188-189,192). The subsequent Lehman Phase (ca. 6,000 to 4,500 BP) is identified by: thin, pentagonal, projectile points with obliquely v-shaped corner to side-notches, displaying heavy basal margin grinding and abrasion; tabular circular scrapers with continuous unifacial retouch; 'horseshoe-shaped' convex endscrapers; and, an absence of microblade technology (Stryd and Rousseau 1 996:189-191,194). 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 ,1 98). Terrestrial fauna (e.g., deer, elk, rabbits, and rodents), plant resources, and freshwater molluscs and fish are also suggested to have been integral to Middle Period adaptations (Hebda 1983:251; Arcas 1985:93; Stryd and Rousseau 1996:187,191).

Stryd and Rousseau (1996:191-197) suggest that the Lochnore Phase (ca. 5,500 to 3,500 BP) may be the earliest manifestation of the Plateau Pithouse Tradition (PPT) on the Canadian Plateau. The PPT is characterized by the use of semi-subterranean pithouses for winter dwellings, a logistically organized, semi-sedentary subsistence and settlement pattern, a hunter-gatherer subsistence focus on salmon procurement, and the use of cache-pits for food storage. Diagnostic artifacts associated with Lochnore Phase include: thick, leaf-shaped to lanceolate projectile points, biconvex to diamond shaped cross-sections, with wide, shallow side-notches, and pointed to convex basal margin outlines which display heavy basal margin grinding and abrasion; bipointed leaf-shaped to lanceolate projectile points; round to oval scrapers with continuous retouch; occasional macroblade and microblade technology; and notched pebbles (possible net-sinkers) (Stryd and Rousseau 1996:193,195). The introduction of small (3.0m to 4.5m diameter, 0.35m to 0.50m depth), oval, semi-subterranean pithouses or mat lodges and circular to oval interior food storage pits, in the latter half of the Lochnore Phase (ca. 4,500 BP) is also supported (Wilson et al. 1992; Stryd and Rousseau 1996:193-196). Extensive use of terrestrial fauna, birds, salmonid and non-salmonid fish species, and molluscs is recorded (Stryd and Rousseau 1996:196), although evidence for plant collecting/processing is absent.

Columbia Plateau studies in Washington state indicate a comparable adaptive and subsistence strategy to that described for the Middle Period in British Columbia (Calm and Luttrell 1994:3.65-68, 4.19, 4.25) The Kartar Phase was defined by Campbell (1985) for the period between 7,000 and 4,000 BP during the Chief Joseph Dam Cultural Resources Project, and has marked similarities to data presented by Stryd and Rousseau (1996). Pithouses appear by 5,000 BP within main and tributary valley settings, potentially indicating a trend to increasing sedentism (i.e., longer, more stable seasonal settlements) and a lessened foraging subsistence strategy (see Binford 1980). Artifacts, particularly projectile points, also show similarities in technique and through their decrease in size from the preceeding Early Period (Campbell 1985; Galm and Luttrell 1994).

Chance and Chance (1985) note that the Ksunku Period at the Kettle Falls locality began ca. 5,000 to 4,200 B.P. They suggest that this period represents a more generalized economy than that seen in the Shonitkwu Period, characterized by high frequencies of fractured mammal bone (probably ungulate), turtle shells, and salmonid remains in the archaeological deposits. Artifacts and features associated with the Ksunku Period may include: lanceolate and leaf-shaped projectile points; increased percentages of black argillite lithic raw materials (possibly indicative of increased use of the Kettle River drainage); numerous unlined firepits and boiling stones; and archaeological sites situated on islands and/or promontories (Chance and Chance 1985). Again, Galm and Luttrell (1994:3.66) suggest that areal differences between the techni-Cal/subsistence systems at Kettle Falls and other locations in northeastern Washington may be present, due to the data retrieved during the Chief Joseph Dam excavations (see Campbell 1985) and work in the Lake Roosevelt basin (Calm and Luttrell 1994).

Crabert (1970, 1974) states that Indian Dan assemblages (ca. 6,000-3,000 BP) are analogous to Okanagan Phase sites in many aspects of material culture. Flake tools remain common, and leaf-shaped and stemmed projectile points still appear, but are smaller than in those encountered at Okanagan Phase sites. Projectile types are also more varied, with the appearance of large basally notched and barbed types during this time period. Site location is different, and comprised mainly of open areas and rockshelters. Groundstone pestles and milling stones, and 'earthen ovens' (root-roasting pits) may also be present during the Indian Dan Phase, although pithouses are absent (Grabert 1970:264, 1974:70; Copp 1979:159, cited in Baker 1990:28). Faunal remains from these sites are more varied than in the Okanagan Phase, and include ungulates, fish, and freshwater mussels.

2.5.4 Modern Environment and the Late Period (4,500/3,500 to 200 BP)

Environment

The limited palynological data available for the study area suggests that the time period from 4,500 BP onward was essentially similar to current times, although with several short-term cooling intervals, known as neoglacial events. The pollen record from Kelowna Bog shows two major peaks for birch within the modern period, associated with enhanced levels of alder and hazelnut and extremely diminished levels of pine (Alley 1976). These peaks (at ca. 3200-2000 BP and from ca. 1500 years ago to the present) may be associated with neoglacial stades, i.e. glacial advances, where a cooler and moister environment would be expected, interrupted by slightly warmer and dryer conditions. It is also possible these spikes may be the result of fire-clearing in the immediate area or drainage changes of the bog (Alley 1976:1141).

The timing of neoglacial advances has been the focus of considerable research (e.g., Heusser 1956; Porter and Denton 1967; Denton and Karlén 1973; Duford and Osborn 1978; Ryder and Thomson 1986; Osborn and Luckman 1988; Reasoner and Hickman 1989; Luckman et al. 1993). From examining modern glacier margins, most of these reports conclude that cooler, moister periods did occur between approximately 3,300-2,000 BP and 900-100 BP, resulting in the lowering of tree-tines by 50-100 m in elevation (Osborn and Luckman 1988:1 25; Reasoner and Hickman 1989:307,314). The latter neoglacial event appears to mark the maximum extent of glaciation since the end of the Pleistocene, and is labeled the 'Little Ice Age'. One report from the Rocky Mountains (Reasoner and Hickman 1989:314) states that a subalpine lake core (separated by 2 km and 250 m of elevation from an alpine lake core) does not record climatic variations as well as those placed adjacent to glacier margins. Extrapolating that evidence to the BFD and that Little Ice Age pollen cores essentially correspond to modern biotic zones in most areas, it can be inferred that neoglacial advances had localized or relatively short-term effects on biotic and faunal resource distributions.

The present-day environment does not correspond exactly to that found in the time period before Europeans entered the area. Systematic efforts at fire-suppression have altered the natural botanical landscape, and accordingly the distributions of animals. Other disturbances have resulted from large scale activities such as those produced by hydroelectric dam construction, which affected freshwater and anadromous fisheries, as well as large-scale cultivation of agricultural land. Regardless, current environment is described by archaeologists using the biogeoclimatic ecosystem classification format developed by the provincial Ministry of Forests. This system describes variation in soils, climate, elevation, and vegetation through a series of zones, subzones, variants, and site series. Within the Boundary Forest District, five broad biogeoclimatic zones are defined: PP (Ponderosa Pine); IDF (Interior Douglas-Fir); ICH (Interior Cedar Hemlock); MS (Montane Spruce); ESSF (Engelmann Spruce - Subalpine Fir); and AT (Alpine Tundra). The dominant characteristics for each are presented in Table 2.11 (from Braumandl et al. 1992).

Table **2.11: Biogeoclimatic** Zone Characteristics

Zone	Trees	Shrubs	Elevation (m asl)	General Climate
PP	ponderosa pine	grasses balsamroot	500-950	- very mild winters, light snowfall - very hot, dry summers
IDF	Douglas fir lodgepole pine ponderosa pine western larch paper birch western redcedar	falsebox birch-leaved spirea Oregon grape saskatoon soopolallie	500-1350	cool winters, light snowfall hot, dry, summers
ICH	western redcedar western hemlock white spruce lodgepole pine Douglas fir subalpine fir	falsebox devil's club black huckleberry	660.1400	- cool, wet winter - warm, moderately dry, summers
MS	lodgepole pine white spruce subalpine fir	grouseberry birch-leaved spirea twinflower Utah honeysuckle	,100-l 600	- cold winter, moderate snowfall - short, warm summer
ESSF	subalpine fir Engelmann spruce lodgepole pine amabilis fir mountain hemlock	black huckleberry rhododendron false azalea	1275-2050	- long, cold winters with heavy snowfall - cool, short summers
AT	krummholz conifers	willows buttercups sedges grasses Sitka valerian	>1800	- very long, cold winters with heavy snowfall very cool, short summers

Richards and Rousseau (1987:49-52; also Stryd and Rousseau 1996:198) have defined the Late Period on the Canadian Plateau as being represented by the Plateau Pithouse Tradition. Within the Arrow Lakes region to the east of the BFD, local cultural-historical sequences pertaining to the PPT have been defined by Turnbull (1977), Eldridge (1981,1984), Mohs (1982), and Rousseau (1982). Common material culture Patterns during this period include: the use of semi-subterranean winter pithouses; the use of subterranean cooking and cache pits; semi-sedentary settlement and subsistence pattern, with winter sedentism at pithouse villages; a reliance on anadromous fish (i.e., salmon) runs; the use of root-roasting pits and earth ovens for processing vegetal and root crops; the use of boiling stone for cooking; sophisticated woodworking and fishing technologies; and increased intra- and inter-regional trade (Richards and Rousseau 1987:50-51). The Canadian Plateau (and Arrow Lakes) Late Period is comprised of three temporal subdivisions: the Shuswap Horizon (Deer Park Phase); the Plateau Horizon (Vallican Phase); and the Kamloops Horizon (Slocan Phase).

The typical features associated with Shuswap Horizon (ca, 3,500.2,400 BP) occupations include very large (10.7 m in average diameter) circular to oval semi-subterranean pithouses. External storage and cooking hearths are infrequently present (Richards and Rousseau 1987:25). Eight projectile point types, displaying a "relatively high degree of stylistic variability' characterize Shuswap Horizon lithic assemblages (Richards and Rousseau 1987:25; Fig. 16a-d'). A preference for locally obtained lithic raw materials is also noted (Richards and Rousseau 1987:27).

Associated with Plateau Horizon (ca. 2,400-1,200 BP) occupations are medium-sized (6.1 m in average diameter) circular to oval semi-subterranean pithouses. These lack a raised rim but contain raised benches within the internal perimeter. Internal storage and cooking pits are common, as are centrally-located hearths. Pithouse cross-sections tend to be steep-walled with flat floors. The intensive use of root-roasting pits, both within the boundaries of housepit villages, as well as in mid-altitude and subalpine contexts (Richards and Rousseau 1987:34; Pokotylo and Froese 1983), appears to commence during the start of the Plateau Horizon, and continues until the postcontact period. Plateau Horizon projectile points display a marked degree of stylistic similarity, with bilaterally barbed, basal and/or corner notching, and incurvate, parallel, and excurvate blade element outlines (Richards and Rousseau 1987:34). Two size classes of these projectile point types are noted. The larger size was probably for use with atlatl darts, while the smaller size may indicate the use of the bow and arrow. Key-shaped unifaces/bifaces and occasional microblades and microblade cores are also recovered from Plateau assemblages (Richards and Rousseau 1987:34). There is substantial evidence for the occurrence of extensive intra and inter-regional trading networks in the widespread dispersal of various lithic raw material types and Northwest Coast Olivella and Dentalium shell across the Rocky Mountains (Richards and Rousseau 1987:39).

Pithouses of the Kamloops Phase (ca. 1,200.200 BP) tend to be larger than their Plateau Horizon counterparts (8.7 m in average diameter), but smaller than Shuswap Horizon pithouses. They are highly variable in shape, displaying oval to circular, and rectangular to square, outlines (Richards and Rousseau 1987:43). Prominently raised rims are usually present, and the rectangular pithouses are often associated with possible side entrances. Small-sized internal cooking and storage hearths, as well as central hearths also occur. Large numbers of small-sized storage pits may also be situated in close proximity to large salmon fisheries (Richards and Rousseau 1987:43). The use of root-roasting pits appears to continue throughout the Kamloops Horizon (Richards and Rousseau 1987:48). Small to medium-sized, side-notched projectile points, characterized by deep side-notches, and straight or slightly convex or concave basal margins, predominate in the Kamloops Horizon lithic assemblages. Evidence for extensive trade networks increases during this period and burial inclusions, displaying extensive investments in both manufacture and transport, may indicate that 'ranked' social status had emerged in Plateau peoples (Richards and Rousseau 1987:47-49).

The Pre-Takumakst Period at Kettle Falls occurred between ca. 3,200 to 2,600 B.P., following a decrease in use of the Kettle Falls locality from ca. 4,200 to 3,200 B.P. (Chance and Chance 1982:423-424). In comparison to the Ksunku Period, cryptocrystalline, rather than black argillite, lithic raw materials dominate pre-Takumakst Period assemblages (Chance and Chance 1982:423). Chance and Chance (1982:423) also note that the occupations during this period seem to be of fairly low intensity. Contracting and square-stemmed projectile points, and low numbers of cobble cutting tools, are also recorded as being diagnostic of this period (Chance and Chance 1982:423). They observe that the Takumakst Period (ca. 2,800 - 1,700 B.P.) is a time of moderately high population density and the first apparent use of the Kettle Falls locality as a major fishery site (1982:424). Task specialization, probably related to intensive fish procurement and processing activities, have also been suggested (Chance and Chance 1982:425). Brown argillite, rather than the cryptocrystalline silicates seen in the Pre-Takumakst Period, dominate the lithic assemblages at this time, with quartzite choppers (i.e., the "Takumakst Chopper") also being present (Chance and Chance 1982:425). It has been further posited by these researchers that this period reflects the initial intensive use of the Kettle Falls locality by Interior Salish aboriginal peoples (1982:425).

The Sinaikst Period (ca. 1,700 to 500 B.P.) may represent the period of highest population density at the Kettle Falls locality (Chance and Chance 1982: 428). The large number and diversity of projectile point morphological types, in conjunction with very high frequencies of 'exotic' lithic raw material types, have been used by Chance and Chance (1982:426) to infer that the Kettle Falls locality was a major aboriginal trading centre. Increased sedentism may also be occurring during the Sinaikst Period, as evidenced by large, deep, pithouse structures possibly being used throughout the year, rather than just as winter dwellings (Chance and Chance 1982:426). During the Shwayip Period (ca. 500 to 200 B.P.), Chance and Chance (1982:428) see a decrease in population density from the preceding Sinaikst Period. Chance and Chance (1982:428) also suggest that possible social and/or economic stratification may have occurred, with aboriginal peoples during the Shwayip Period. Small, side-notched projectile and small quartzite knives dominate lithic assemblages during this period (Chance and Chance 1982:427-428).

Crabert (1970:264, 1974x59-72; also Copp 1979:160-161, cited in Baker 1990:28-29) has defined two archaeological phases during the last 3,000 years specifically applicable to the Okanagan Valley: Chiliwist (3,000 to 900 BP) and Cassimer Bar (900 to 200 BP). A perceived continuation in the Chiliwist Phase from the Indian Dan Phase is noted in the recovery of large leaf-shaped, basal-notched, and stemmed projectile points, although side-notching is also utilized, particularly in the North Okanagan. Cryptocrystalline raw materials (e.g., cherts, chalcedonies, and obsidian) appear to become increasingly common in comparison to the use of basalt in manufacturing stone tools. Other diagnostic features and artifacts associated with the Chiliwist Phase are the appearance of small pithouse villages with deep, steep-walled pithouses, the appearance of microblades, and the emergence of groundstone adzes. In addition, faunal resources may include salmon as well as ungulate and freshwater mussels.

During the Cassimer Bar Phase several differences in technical systems are noted from the preceding Chiliwist Phase. These include the replacement of the deeper, steep-walled housepits with shallow, saucer-shaped pithouses and rectangular matlodges, a larger overall settlement size, and the appearance of smaller corner-removed, comer- and side-notched projectile points. Utilized faunal species include ungulates, anadromous and freshwater fish, and molluscs (Grabert 1970:264, 1974:69-72).

2.6 Previous Attempts at Archaeological Risk Indices - BFD

One of the main objectives of the AOA process is to provide a "statement of archaeological resource potential" within a study area, and following from this, develop "recommendations concerning the need for further archaeological impact assessment studies" (Archaeology Branch 1995:8). When assessing the archaeological potential of a given area the archaeologist provides an assessment concerning the 'probability' that an archaeological site may, or may not, be located in a given area. This can be visualized as an archaeological risk index or risk continuum, running from negligible or low risk (e.g., low probability of encountering an archaeological site) to high risk (e.g., high probability that an archaeological site will be encountered).

Several other archaeological site attributes have also been suggested for inclusion in the determination of an archaeological risk index (i.e., site variability, density, or distribution [Archaeology Branch 1995:8]). Only Choquette (1993b) has attempted to define potential archaeological site density for the BFD, identifying the following four categories of archaeological potential density: (a) High=0.5 sites/km^2; (b) Moderate=0.2 to 0.5 sites/km^2; (c) Low=0.1 or less sites/km^2; and (d) Unproven=0.2 or more sites/km^2. However, as he (1993b:38) notes, the frequencies associated with each archaeological potential assessment were derived from all regions within the Nelson Forest Region, which had been subjected to varying levels of systematic archaeological investigation. Within the BFD, no discussion of previous spatial concentrations of archaeological sites is presented, nor is there any synthesis of archaeological site type distributions, Because of the level Of previous archaeological enquiry present in the BFD, these archaeological site density figures must be considered highly speculative. Three previous archaeological risk indices which have been used in the study area are briefly summarized below.

For Bussey's (1993:3,6) evaluation of three compressor stations in the Midway area, she was asked to develop a series of "Impact Potential Definitions" for Westland Resource Group to aid them in selecting the preferred location for the compressor station. Four categories were identified for defining levels of negative archaeological impact potential: (a) Negligible; (b) Low; (c) Moderate; and (d) High (Table 2.10). When used with respect to a given landform or area, these categories reflect the increasing probability that archaeological sites will be negatively affected by a proposed land-altering development.

Table 2.10: Archaeological Potential Definitions, Bussey (1993:3,6)

Impact Potential	Description	Action Required
Negligible	unlikely to contain archaeological resources due to presence of - areas covered by water and/or waterlogged - steep and/or unstable slopes - extensive previous subsurface disturbance areas previously investigated during a archaeological impact assessment and/or inventory study which have provided negative results	**None**
Low	infrequent archaeological resources due to presence of - level /undulating upland landforms away from water - rugged uplands and steep slopes	**AIA in selected areas**
Moderate	relatively frequent archaeological resources due to presence of - level terrain in uplands and/or secondary valleys - abrupt break-in-slope along level terrain elevated landforms in uplands and/or secondary valleys - proximity to extant and/or extinct lake and river systems	AIA in selected areas
High	frequent archaeological resources due to due to presence of **proximity to known archaeological sites** - **similar landforms as those associated with known** archaeological sites level terrain in major river valleys - abrupt break-in-slope along level terrain - elevated landforms in major river valleys **proximity to extant and/or extinct lake and river systems**	AIA in all areas

Choquette (1993b:23-40) conducted an archaeological overview assessment for the Nelson Forest Region and Commission on Resources and Environment in which he identified general areas of unproven, low, medium, and high archaeological potential. Site type categories and landform-specific attributes associated with medium or greater archaeological site potential are also presented (Choquette 1993b:38-40) (Table 2.11). With respect to site type categories, major habitation and resource access (i.e., extraction and processing) sites were considered to be the most informative groups for identifying archaeological potential (Choquette 1993b:38). Other criteria discussed, but apparently not included in the determination of site potential, were "seasonal ungulate ranges and movement corridors, root grounds, fish spawning channels, and waterfowl nesting areas and flyways" (Choquette 199313339). Additionally, bedrock geology and its relation to aboriginal quarrying activities, was also mentioned. The non-inclusion of this information for explicit site potential definition may simply be a reflection of the scale at which predictive modelling was undertaken.

An archaeological overview assessment of the upper Goatskin Creek drainage (Handly and Zibauer 1996b) idenitified specific forest development areas which should be subjected to detailed archaeological impact assessment studies. A brief field inspection of the Goatskin Creek drainage, associated with a review of 1:20,000 scale TRIM maps and air-photo series, was used to determine specific areas of medium or greater archaeological site potential. Medium and high archaeological potential assessments were assigned after considering a number of criteria associated with the study area: physiographic location and environmental context; relevant ethnographic subsistence and settlement patterns; relevant historic documentation; and previously recorded archaeological and heritage sites (Table 2.12). These categories (Low, Medium, and High) were used to indicate the relative probability for a given area to contain archaeological sites.

Table 2.11: Archaeological Potential Definitions, Choquette (1993b:35-40)

Arch. Potential	Description	Action Required
unproven	insufficient information to determine whether Moderate or High	Ground-truthing(?) AIA in selected areas
LOW	infrequent archaeological resources (1 site/1000ha) due to • outside the following parameters for Moderate or High	AIA in selected areas
Moderate	relatively frequent archaeological resources (2-5 sites/l 000ha) areas immediately adjacent to High potential areas - travel corridors level postglacial lake margins	AIA in selected areas
High	frequent archaeological resources (>5 sites/1000ha) • proximity to known archaeological sites (e.g., major habitation and resource access sites) inferred proximity to resource access sites - constricted travel corridors (i.e., passes1	AIA in all areas

Table 2.12: Archaeological Potential Definitions, Hand& and Zibauer (1996b)

Arch. Potential	Description	Action Required
LOW	infrequent to negligible archaeological resources due to - landform types outside of those listed for Medium and High	None
Medium	relatively frequently occurring archaeological resources due to proglacial and periglacial lake strandlines, deltas, and beaches - alluvial, glaciolacustrine, glaciofluvial, and kame terraces • flat to gently sloping landforms in close proximity to or "overlooking" extinct and/or extant streams, rivers, ponds, marshes, and lakes; contemporary or inferred ungulate movement or browsing areas; and contemporary floral exploitation areas	AIA in selected areas
High	frequently occurring archaeological resources due to presence of alluvial, glaciolacustrine, glaciofluvial, and kame terraces particularly at the confluence of large fluvial systems - concentrations of previously recorded archaeological sites, contemporary aboriginal transportation corridors, and landforms associated with known aboriginal use.	AIA in selected areas

3.0 ETHNOGRAPHY

3.1 Aboriginal Community Consultation

KWHC met with local aboriginal community representatives in order to discuss the BFD-AOA project. Letters were sent regarding the Phase 1/2 aspects of this study on March 10th to the Okanagan Band, Osoyoos Band, Penticton Band, Sinixt-Arrow Lakes First Nation, Spallumcheen Band, and Westbank First Nation. On April 16th, a meeting was held between KWHC, representatives of the BFD, and Okanagan Tribal Council in Westbank, with Mr. Byron Louis (Councillor - Okanagan Indian Band), Mr. Richard Terbasket (Councillor - Lower Similkameen Indian Band), Mr. Brian Eli (Chief - Westbank First Nation), and Mr. Rob Hutton in attendance. Each of the aboriginal community representatives stated their objection to the AOA process, as they believe it does not include a satisfactory level of consultation. They stated that the Ministry of Forests and forestry licensees should provide Ethnographic Overview Assessments (EOAs) concurrent to any archaeological overview assessment. These EOAs would be intended to assess traditional use within harvesting areas as an interim measure to the initiation of larger scale Traditional Use Studies (TUS).

A meeting was also held with Ms. Marilyn James (Spokesperson), Mr. Robert Watt (Representative), and Ms. Jackie Heywood of the Sinixt-Arrow Lakes First Nation on April 25th in Nelson to discuss the BFD-AOA study objectives. Ms. James had no objections to the AOA, as long as the Sinixt were informed and consulted on the predictive model criteria prior to their implementation. She stated that the Sinixt view themselves as the primary aboriginal occupants of the BFD, and regard the Christina Lake, Kettle River Valley, and particularly the trail network leading to the Okanagan Valley as being of extreme cultural importance,

Upon completion of Phase 1/2, KWHC contacted the above aboriginal communities on June 6th to discuss that report's findings, as well as to inquire whether they would have bandmembers interested in conducting fieldwork when testing the preliminary archaeological potential maps. Given that our prior meeting had been through Natural Resources Committee of the Okanagan Tribal Council, we attempted to contact Mr. Hutton by telephone and facsimile in May and June to set up a meeting with that agency. No replies were made to our inquiries. The Westbank First Nation did contact our office in mid-June, with a meeting occurring on July 4th. The representatives present at that meeting were generally positive about the aims of the overview assessment, but stated a concern with the amount of time allotted for the referral process. They also stated that a Westbank bandmember (Ms. Roxanne Lindley) would be available for fieldwork when testing the preliminary archaeological potential maps. Mr. Steven Isaac (Okanagan Indian Band), Mr. Robert Watt (Sinixt-Arrow Lakes First Nation), and Mr. Adam Christian (Spallumcheen Indian Band) were working with KWHC on unrelated projects, and were amenable to also conducting the BFD field-testing when asked.

3.2 Ethnographic Patterns of Adaptation

Phase 3 of this study involves the in-depth presentation of aboriginal ethnographic patterns of adaptation which were used for developing a predictive model for the BFD. Presented below is a brief review of ethnographic sources, concentrating on activities that leave behind archaeological evidence (see Elmendorf 1935-36; Ray 1936, 1939; Kennedy and Bouchard 1975; Teit 1975a, 1975b; Turnbull 1977; Bouchard and Kennedy 1979, 1984, 1985; Turner, Bouchard, and Kennedy 1980; Mohs 1982 for detailed discussions of Interior Salish lifeways).

Ethnographic information of the Interior Salish and Kettle River peoples describe a semi-sedentary settlement pattern with "wintertime occupancy of river villages and summertime camping at fishing, berrying, and root digging grounds" (Ray 1936:14; also Bouchard and Kennedy 1979; Mohs 1982:48; Turnbull 1977:128,134-35). The flexible, balanced subsistence strategy was designed to exploit the "limited, widely dispersed and seasonally variable" food resources (Mohs 1982:48), with hunting, fishing, and gathering the main activities. Hunting and fishing occurred year round, with the most intensive hunts in the fall; the majority of fishing occurred between early spring and late autumn (Turnbull 1977:127; Mohs 1982:53,57). Plants were gathered from early spring to late fall (Bouchard and Kennedy 1985a:29,36,48).

Ethnographic and ethnohistoric documentation of Interior Salish-Lakes semi-permanent village sites is limited and biased. The few site locations that are well documented tend to be those defined by the mat-lodge, a temporally later house structure (Ray 1939:136; Teit 1975a:226). Estimates of winter village populations range between 50 and 200 individuals (Elmendorf 1935-36:56; Ray 1936:124). The semi-permanent village sites were generally winter site locations, and were situated at lower elevations in riverine environments (Mohs 1982:48). Two main habitation structures were employed by the Interior Salish-Lakes and Kettle River peoples at village locations: the semi-subterranean pithouse and the mat lodge. The pithouse, used exclusively in winter (Ray 1939:136), was constructed by first digging a circular pit 1 m to 2 m deep, in dry sandy soil, and covering it with layers of boughs, grasses, or rush mats (Teit 1975a:227-229). The roof consisted of a pole frame covered with pine needles or dry grass, and then covered with earth. Entrance to the pithouse was gained through the roof (Ray 1939:135; Teit 1975a:226-27, 1975b:192-94).

Ethnographic records suggest that use of winter pithouses decreased prior to contact, replaced by mat lodges as winter habitation structures (Ray 1939:136; Teit 1975a:226). Mat lodges, used year-round, continued to be employed during the post-contact period (Mohs 1982:61,64). This circular or slightly square structure was similar in construction to the pithouse yet built above ground and with lighter materials, such as reed mats (Teit 1975a:227; Bouchard and Kennedy 1985:49). In winter, heavier covering material could be used, including a combination of hides, reeds, bark, and earth (Mohs 1982:65). Features of the mat lodge which may be visible archaeologically 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 (Elmendorf 1935-36:4-5; Teit 1975a:227-228; Mohs 1982:64-65; Bouchard and Kennedy 1985:49). During the winter occupation in the valleys, deer hunts occurred on the lower river terraces (Clover 1962:336 cited in Bouchard and Kennedy 1984:105).

Temporary basecamps were established in association with seasonal resource procurement activities, including fishing, hunting, berrying and root collecting. These basecamps were primarily located away from the riverine settings of the winter village sites, in more upland settings, and were occupied by a small population of several family groups (Mohs 1982:53). 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 (Teit 1975a:227-229; Mohs 1982:65; Bouchard and Kennedy 1985:50).

A major salmon fishing basecamp appears to have been situated at Cascade Falls on the Kettle River (see Freisinger 1979a:14; also Kennedy and Bouchard 1975). These site types had a large summer/early fall population (Turnbull 1977:127-28). Smaller fishing stations were situated throughout the region, at locations where individual species were abundant (Bouchard and Kennedy 1985:29-35). 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 (Mohs 1982:58; Bouchard and Kennedy 1985:38-40,44). The fish were then cooked for immediate use or preserved by air or smoke drying on racks, and then stored either in elevated or underground caches (Mohs 1982:58,60).

As hunting, trapping, and collecting occurred primarily in the upland areas away from the main tributaries, these activities did not receive as much ethnohistoric attention (Turnbull 1977:124,128). Hunting basecamps were established in productive locations for game, with berrying and/or root collecting often conducted nearby. The length of time spent at these temporary basecamps would vary between a few days and a few months, depending on the location and productivity of the area, and the season of harvest. Ray (1975:136) notes that the principle deer hunting areas included "the extensive and more mountainous areas of the headwaters of the Kettle River". Although hunting basecamps were established by June in the uplands, the most productive hunting period appears to have been from the end of September into October, prior to the animals migrating to the valley floor (Bouchard and Kennedy 1984:104). During the late fall to early winter (e.g., October to early November) people started to make their way back from the hunting basecamps to the winter villages (Bouchard and Kennedy 1984:104-105).

Site specific monitoring locations are not mentioned ethnographically; however, Bouchard and Kennedy (1985:30-31) summarize methods used to capture ungulates, specifically deer, at such locations. Methods included driving deer down to water using dogs, driving them down a runway toward a bluff lined on one side with hunters and with a barrier or stakes and saplings on the other, driving them through a narrow passageway, herding them toward other hunters, using snares on autumn migration trails, stalked in winter by hunters on snowshoes, and waiting at salt licks. Bouchard and Kennedy (1985:31) and Teit (1975a:245) note that a killed animal would be prepared on site and the carcass brought to the basecamp as soon as possible. If a hunter could not retrieve the kill immediately, clothing was placed on top to prevent animals from eating the meat. In winter, the carcass or portions of it would be cached in the snow and retrieved as needed. A rack or sweat lodge frame could be used to dry meat quickly if the amount was small (Teit 1975a:240).

A wide variety of plants were utilized for food, technology, and medicine by the Interior Salish/Lakes peoples, including black tree lichen; mushrooms; green shoots (e.g., cow parsnip, chocolate tips, cactus, balsamroot, stinging nettle); tree cambium (e.g., ponderosa, lodgepole); roots (e.g., bitterroot, black camas bulbs, yellow avalanche lily corms, tiger lily bulbs, biscuit root, wild caraway, balsamroot, spring beauty), and other underground parts; seeds, nuts (e.g., pinenut, hazelnut); berries (e.g., huckleberry, blueberry, wild gooseberry, chokecherry, strawberry, thimbleberry wild raspberry, black caps, thornberry, soapberry); and seeds or nuts (e.g., balsamroot, White Bark pine, Ponderosa Pine and hazelnut) (Turner, Bouchard, and Kennedy 1980:146-147; Bouchard and Kennedy 1985:45-46) (Figure 3.1). Plant food (Turner ing activities were not only dispersed throughout the spring, summer and fall, but where also spatially and elevationally distributed across the landscape. During the spring {March to May), low elevation bulbs, shoots, and roots were being gathered, while at the same time corms, cow parsnip, and Indian Carrot were acquired in the mid, but mostly high elevations.

Turner et al. (1980:146; see also Teit 1975a:237) note that huckleberries were probably one of the most important plant resources. 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 (Teit 1975a:240; Turner et al. 1980:38; Mohs 1982:63). The pit was lined with round volcanic rocks, which were heated, and then covered with a number of layers: a layer of dirt, then a layer of fern fronds, skunk cabbage leaves, damp pine needles, sedges, or other vegetation, then a layer of the food to be cooked (often different foods were combined to increase their flavour), then another layer of vegetation, and a final layer of dirt. Steam was made by pouring water down several passages in the pit. Cooking time ranged from overnight to up to three days (Turner et al. 1980:44,147-148).

Sweat lodges were used year round by men and women, at both semi-permanent village sites where they may be earth-covered (Teit 1975a:229), and at auxiliary sites such as hunting or fishing camps (Bouchard and Kennedy 1985:51). Sweat lodges were built in a similar manner to the mat lodge, yet were of a smaller size. Areas within the village site were designated for women only and were marked off by a wooden palisade (Elmendorf 1935-36:70-71). Within this area, lodges, mat tents, sweat lodges, menstrual huts, and bathing pools were located (Teit 1975a:228; Bouchard and Kennedy 1985:50-51). Mohs (1982:68) notes that there were exclusive locations for men also, generally situated away from the main village. Structures at these locations included sweat lodges and lean-tos.

Teit (1975a:288; see also Ray 1939:61-67) observed two methods of burial. Individuals were buried in a flexed position in either a sandy bench, terrace, or mound location, or on a talus slope where rock slides occurred. Shallow graves may be covered with rocks; deeper graves may be surrounded by a circle of rocks. Mohs (1982:71) notes that Interior Salish-Lakes peoples were often buried in gravel beds along river banks without ceremony.

Pictographs, representing dreams or events were often recorded by boys and girls during puberty; pictographs recorded by adults were less frequent (Teit 1975a:283). Pictographs were frequently applied using red ochre.

3.3 Local Historical Ethnographic Accounts

Local history articles and books were reviewed for data pertaining to aboriginal activities in the Boundary country. Those articles that were found to be most useful included first hand accounts of Natives by early Euro-Canadian settlers, and local historical accounts and articles referring directly to Native land use and activities in the study area. Historically, the Okanagan groups appear to have been the largest Native population in the area prior to the arrival of Euro-Canadian settlers. Hatton notes that their annual movement every fall through the Bridesville/Rock Creek area, to Conkle Lake lasted until at least 1920 (1981:13). Glanville points out that many tribes claim the Boundary area as part of their territory, but there exists no definite tribal boundaries because these Native groups were related in terms of linguistics, frequently shared resources and inter-marriage (1987:3).

Figure 3.1 Availability and Location of Selected Plants

	March	April	May	June	July	August	September	October
CAMBIUM								
Lodgepole Pine				L/M/H				
Ponderosa				L/M				
SEEDS/NUTS								
Balsamroot				L	L	L		
White Bark Pine						H		
Ponderosa						L	M	
Hazelnut								H
BULBS								
Mariposa		L	L					
Nodding		L	L	L				
Yellowbell		L	L	L	L			
Black I Blue Camas				L	L	L		
Tiger Lily					M	M	H	
CORMS								
Spring		M	n					
Yellow								
SHOOTS								
Chocolate Tips	L							
Balsamroot	L	L						
Cattails		M	M					
Cow Parsnip			M/H					
ROOTS								
Bitterroot		L	L					
Indian Car-			H	H				
Indian Cel-				I				
Desert				L	L			
False					M	M	M	
Wild Valerian						H	H	
BERRIES								
Wild Strawberry			L	M				
Soapberry			L	M	M			
Black Raspberry			M	hk	n			
Thimbleberr				L	L	M		
Wild Raspberry					M	M	H	
Saskatoon					L	L	M	
Red Twinberry					M	M		
Mountain					M	H		
Mountain Huckleberry					M	H		
Grouseberry					H	H		
squaw currant					L	L		
Wild					L	M		
Black Hawthorn					L	M		
Red Osier Dogwood						L	M	
Chokecherry						L	M	
Oregon Grape						L/M		
Blue							Mm	
Kinnickinick							L/M	

Legend
L Ponderosa
hi Interior
H Engelmann Spruce-Subalpine Fir, Alpine

Missionaries living in the Christina Lake area as early as 1808-1811, recorded the existence of Natives from Washington State living in the area during the summer months (S... However, Barlee asserts that the entire Boundary Country was uninhabited when the first Euro-Canadian settlers arrived, since the Natives may have been wiped out by a possible plague originating from ... lower down the Columbia River (1969b:88). These people may have been driven out of the area by ...s, smallpox, measles and/or intermittent fever brought by the settlers in the Boundary Country. The Catholic priest DeSmet reported in 1842 that the population of the Lakes and Kettle Falls people to be 500 and 600, respectively (James cited in Hogan ...ville 1987:4). It is stated that those Natives living along the Kettle River were taken in by other groups in both British Columbia and Washington (James cited in Hogan 1992:114; Glanville 1987:4).

Intermarriage and daily contact between Natives and the settlers was common (Sandner 1994:5-6,25, Pettijohn 1959:19,21; White 1960:46). Upon his arrival in the Boundary Country in the 1850's, Edgar Dewdney hired aboriginals to accompany his party up the Kettle River (Wier 1956:38). The hiring of Native guides appears to have been a common practice for initial explorers in the area (Glanville 1987:s). ... Marcus Samuel and Joseph Oppenheimer established a trading post at the mouth of the Kettle River to compete with the well established Hudson Bay Company for trade with Natives (Atkins 1976:123). There is also mention of individuals from the Colville Reservation making frequent visits to Carson in or around 1897, where they would visit the local blacksmith shop, owned by Donald Dan McLaren. Mr. McLaren spoke Chinook (Interior Salish) and was invited by Chief Toroda to attend a 'potlatch' on the Reservation (Roylance 1988:32). Scott tells of Plains Natives from across the Rocky Mountains visiting the area to hear the Church's Preachers, one of whom is said to have visited the tribes in their encampments (1964:52).

Extensive Native trail systems, that at one time accessed traditional fishing and hunting areas as well as encampments, were discussed for the Boundary Country. Foot paths have been identified, but they also used dugout canoes along the rivers and lakes (Glanville 1987:2). Freisinger confirms the existence of an established and recognized Native trail system (e.g., the Colville-Okanagan trail) running between Kettle Falls and the Okanagan Valley via the Columbia River (1979c:22), while Glanville discusses an Indian trail which leads from Christina Lake to the 'Colville Road' (1987:9). The original Native horse trail between Cascade and Grand Forks was well used until the beginning of the nineteenth century (Barlee 1969:87-88). The trail system included foot paths up the Granby River heading towards the Arrow Lakes or the Okanagan (Glanville 1987:9). White provides extensive details concerning two trails leading from North Fork to the Okanagan that were used by the Natives prior to Euro-Canadian settlement:

> "One of the trails followed the Cranby River on the east side and crossed Burrell Creek just above where it empties into the Cranby. The trail enters into a steep rocky canyon for about three miles, At the end of the canyon the valley widens abruptly. The trail follows along this flat valley to Howe Creek, approximately fifty miles from Grand Forks....Crossing Howe Creek, the trail went on for about five miles. At this point the trail entered a very narrow canyon with sheer walls rising in some places from the river's edge. The trail crossed from one side of the river to the other many times in the entire length of the canyon. The old-timers called it 'the ten mile canyon'. Then the trail turned west and so into the Okanagan....The other trail leaves the Granby River and follows Burrell Creek for about twenty-five miles, then swings away to the northwest in a gradual climb, topping out high above Franklin Creek...passes through the Lightning Peak country, into where Vernon, B.C. is today...the Cranby River trail could not be used during high water. Then could turn northeast up Howe Creek as this trail connects the two main trails" (1979:11-12).

The Native trails may also have formed the basis of a trail system mapped by Edgar Dewdney, known as the Dewdney Trail (Weir 1956:18; White 1960:43). The Rock Creek portion of the Dewdney Trail was being used by Natives soon after the demise of this nearby mining town (Anderson 1969:9). In 1888, a trail was built from Inkaneep, an Indian village in the Okanagan Valley, through Camp McKinney to Rock Creek, although it is not clear whether an existing native trail was used (Basque 1992:13).

The movement of aboriginal people into the study area appears to have occurred on a semi-permanent and/or temporary basis, based upon seasonal subsistence needs (Freisinger 1979c:22). The generally recognized pattern was of bands annually traveling north to the Boundary Country from southern and central Washington, specifically the Kettle Falls - Colville area (White 1960:45; Graham 1971:108). This annual movement was taken via the Kettle River, named because of it's swirling water and whirlpools in the shape of kettles or pots (Marten 1958:26; Freisinger 1979c:72). They travelled to their annual hunt on horseback with wagons, and ponies and dogs carrying possessions tied to a travois (Marten 1958:26; Evans 1983:55; Sandner 1994:5). Euro-Canadian settlers report sighting Natives on their trip along Kettle River near Nicholson Creek, and inferred that they were Nez Perce "dressed in buckskins on their way up to their deer hunting camp where they remained a month or more - killing, skinning, drying and smoking meat and hides to pack to their reservation" (White 1960:45). Native groups would frequent such places as Christina Lake, Carson, Midway, Rock Creek, and Grand Forks, since these areas were popular for hunting and gathering due to the abundance of wildlife, plants, and roots in the area (Glanville 1987:1). After these groups completed their annual hunt, they would often stop at nearby towns to trade or sell buckskin gloves with the settlers (Hatton 1981:13).

Native fishing activities occurred in a few areas of the Boundary District. The Indians from the Colville Reserve came to the Cascade canyon area to spear salmon below the falls where they would dry the fish on racks at the Kettle River (Clanville 1987:1-2). This was considered by the Natives to be a prime fishing location up until the early twentieth century (Sander 1994:27; Barlee 1969:87; Thomson 1991-92:8). Graham notes that Christina Lake was also a popular fishing spot for the Fort Colville Indians who would travel to the area in the autumn (Graham 1971:108).

It was noted that the Natives traveled to the Boundary Country in the fall to fish, hunt, and trap, especially in the Christina Lake region; evidence of this includes pictographs, artifacts, and burial grounds (Reynolds 1958:9; Scott 1964:51; Barlee 1969b:87). Barlee states that this area was noted to have had two major villages, one located at the lakehead on the east side of Sandner Creek and the other located west of the Christina Creek outlet. Many minor camps have also been identified along the lake's shores at such locations as LaValley, Texas, and English Points (1969:87). The remains of winter pithouses have also been recorded in the study area around Christina Lake, and along the Kettle River from Grand Forks to Rock Creek (Freisinger 1979c:72; Glanville 1987:2). Freisinger identifies these multiple pithouse sites as representing the existence of Indian villages in the area, thereby inferring a permanent residency (1979c:22).

Sandner points to the Paulson area as being a place for harvesting huckleberries (1994:27), while Christian records the existence of Natives in the Christian Valley area as late as the summer of 1904 (1959:6). Along the Kettle River between Midway and Rock Creek is a flat area that was used for campsites, and pithouses could still be seen in the Midway area (specifically the airport area) near the creek mouths on the south side of the river three to four miles west of Midway (Barlee 1969b:87; Evans 1983:55). Evans points to the absence of permanent Native settlements in the Midway area, but indicates that this region was used as a meeting place en route to the hunting grounds (Evans 1983:55). The Rock Creek area was known as a large Native hunting/base camp, with pictograph panels present on the opposite side of the river (Barlee 1969b:86; Dahlo 1995:29).

Within the BFD, burials have been uncovered below the canyon on the west side of the Kettle River, on the flats of the Cascade townsite, and along the trail running between Cascade and Grand Forks (Barlee 1969b:87). At Grand Forks, a large burial site was unearthed containing twenty remains along with "jade adzes, dentalia shell beads, incised bone bracelets and necklace, carved antler digging stick handles, stone arrowpoints and other personal possessions" (Glanville 1 987:3). Simbreck indicates the existence of Native burials around Rock Creek but no locations are provided (1985:106). More recently, Hogan discusses several human remains uncovered in 1949 at Christina Lake (1992:113). References are also made to a spiritual site called the 'Hee-Hee' Stone located near MaryAnn Creek and Nine Mile Hill. It was noted that Natives would place offerings on or near the rock (White 1960:53; Weed 1976:48).

3.4 Inferred Archaeological Site Locations, BFD

Extensive ethnographic research and associated archaeological site modelling activities have been carried out in few locations within southern BC, and the lack of ethnographic and archaeological data for the BFD study (see Sections 2.0 and 3.0, above) precludes the development of such a model at this time. A review of the references associated with the majority of Interior Salish peoples adaptations indicates that there are broad similarities from an archaeological site patterning perspective. Rather than develop a 'region-specific' model for archaeological site prediction, we have adapted a previously defined archaeological predictive model to the BFD study area; however, information from the known ethnographic, ethnohistoric, archaeological data within the BFD was incorporated into this model to limit discrepancies.

Alexander (1992a, 1992b) and Tyhurst (1992) have developed a detailed model of archaeological site patterning (i.e., a subsistence-settlement pattern) through extrapolation from the known ethnographies, ethnohistories, and archaeological databases along the Fraser River, near Lillooet, BC, referring specifically to the *Ts'kw'aylaxw* (Pavilion) and *Xaxli'p* (Fountain) Bands. Research involved both detailed interviews with elders in these two communities, and both surface and subsurface testing of judgmentally identified areas. For the purposes of our study, the BFD has been divided into six zones, reflecting ethnographic activities, as well as physiographic and elevational characteristics (Table 3.1). During a review of 21 archaeological surveys throughout the BC Interior, several of these 'zones' (e.g., river valleys, open grasslands, lakes [lakeshores and islands], and the subalpine/alpine) were also identified (Eldridge and Mackie 1993:1 l-14) as areas of high archaeological site potential (see Tables 3.2 to 3.7).

Table 3.1: Inferred Physiographic Zonation, BFD (see Alexander 1992a, 1992b, Tyhurst 1992)

	locations in BFD	Period(s) of Use
River Valleys/Terraces	Kettle River and main tributaries	November-April July-August
lakes	Intermediate elevations	May-August (discontinuous)
Grasslands	Bridesville area southerly portions of Kettle River drainage	March-May November-March
Montane Forests	mainly within the valleys of the Interior Cedar-Hemlock, Interior Douglas Fir, Montane Spruce, and Engelmann Spruce • Subalpine Fir	May July August October
Montane Parkland	transition zone between Engelmann Spruce -Subalpine Fir and Alpine Tundra	May-July August-October
Alpine Tundra	Alpine Tundra	May June-July August-October

The model of archaeological site patterning presented by Alexander (1992a, 1992b), and to a lesser extent Tyhurst (1992), identifies specific ethnographic activity types which should be present in given environmental zones. While acknowledging that the two study locales are different environmentally, we believe that broad similarities should be present at the archaeological site type level, as inferred for the various zones. To assist in defining the types of ethnographic sites that may be found in each of these zones, we have included whether or not archaeological site correlates would be present for the inferred ethnographic sites, and the archaeological site types which should be representative of these inferred ethnographic activity types.

It should be stressed that the predictive model implemented here should not be assumed to reflect aboriginal adaptations over the last 10,500 years. It may conservatively be able to address archaeological assemblages associated with the last 4,500 years, since it is derived principally from ethnographic and historic data concerning aboriginal activities in and around the study area (see Bussey and Alexander 1992; Eidridge and Mackie 1993 for similar comments). At best, the inferred archaeological site types and activities discussed above should be seen as a sample of the possible activities, and artifactual representations, that may have occurred across the landscape.

Table 3.2: Ethnographic Activities and Inferred Archaeological Sites, Grasslands, BFD (see Alexander 1992b:148-1 50)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Transitory Basecamps		
i) Mat lodges	Present	Lithic scatters, Faunal scatters, Hearths Fire-broken rock concentrations
ii) Plant Food Preparation	Present	Deep circular depressions (root roasting pits) Fire-broken rock concentrations
iii) Mammal Food Preparation	Present	Faunal scatters, Hearths
	Absent	NA (Drying Racks)
iv) Food Storage-Below Ground	Present	Deep circular depressions (i.e., cache pits)
Plant Gathering	Absent	NA
Hunting		
i) Communal hunts (i.e., monitoring stations)	Present	Lithic scatters
ii) Individual hunts (i.e., drives and blinds)	Present	Petroforms (boulder piles), and circular depressions (blinds)
Kill and butchery sites		
i) ungulates	Present	Lithic scatters, Faunal scatters

Table 3.3: Ethnographic Activities and Inferred Archaeological Sites, Lakes, BFD (see Alexander 1992b:151-154)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Transitory Basecamps		
i) Mat lodges	Present	Lithic scatters, Faunal scatters, Hearths Fire-broken rock concentrations
ii) Plant Food Preparation	Present	Deep circular depressions (root roasting pits) Fire-broken rock concentrations
iii) Mammal Food Preparation	Present	Faunal scatters, Hearths
	Absent	NA [Drying Racks)
iv) Food Storage-Below Ground	Present	Deep circular depressions (i.e., cache pits)
Plant Gathering	Absent	NA
Hunting		
i) Communal hunts (i.e., monitoring stations)	Present	Lithic scatters
ii) individual hunts (i.e., drives and blinds)	Present	Petroforms (boulder piles), and circulai depressions (blinds)
Kill and butchery sites		
i) ungulates	Present	Lithic scatters, Faunal scatters
Fishing	Present	Petroforms (weirs)

Table 3.4: Ethnographic Activities and Inferred Archaeological Sites, River Valley and Terraces, BFD (see Alexander 1992b:154-165; Tyhurst 1992:356-372)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Residential Basecamp		
i) Semi-subterranean Pithouse	Present	Large, deep, circular depressions, Lithic scatters, Faunal scatters; Hearths; Fire-broken rock concentrations, cache pits
ii) Mat lodges	Present	Lithic scatters, Faunal scatters, Hearths Fire-broken rock concentrations
iii) Sweat lodges	Present	Shallow circular depressions, Hearths Fire-broken rock concentrations
iv) Menstrual lodges	Absent	Lithic scatters, Faunal scatters, Hearths
v) Plant Food Preparation	Present	Circular depressions (boiling pits) Fire-broken rock concentrations
vi) Mammal Food Preparation	Present	Faunal scatters, Hearths
	Absent	NA (Drying Racks)
Plant Gathering	Absent	NA
Hunting		
i) Communal hunts (i.e., monitoring stations)	Present	Lithic scatters
ii) Individual hunts (i.e., drives and blinds)	Present	Petroforms (boulder piles), and circular depressions (blinds)
Kill and butchery sites		
i) ungulates	Present	Lithic scatters, Faunal scatters
ii) marmot	Present	Small lithic scatter (snaring at talus slopes)
Fishing	Present	Lithic scatters, Faunal scatters, Hearths Fire-broken rock concentrations, Petroforms (weirs), Circular depressions (i.e., cache pits)
	Absent	NA (Drying Racks)
Burials	Present	Shallow ovate depressions, boulder piles

Table 3.5: Ethnographic Activities and Inferred Archaeological Sites, Montane Forests, BFD (see Alexander 1992b:145-148)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Transitory Basecamps		
i) Mat lodges	Present	Lithic scatters, Faunal scatters, Hearths Fire-broken rock concentrations
ii) Plant Food Preparation	Present	Deep circular depressions (root roasting pits) Fire-broken rock concentrations
iii) Mammal Food Preparation	Present	Faunal scatters, Hearths
	Absent	NA (Drying Racks)
iv) Food Storage-Above Ground	Absent	NA (Tree caches)
v) Food Storage-Below Ground	Present	Deep circular depressions (i.e., cache pits)
Plant Gathering	Absent	NA

Table 3.5: Ethnographic Activities and Inferred Archaeological Sites, Montane Forests, BFD (cont'd) (see Alexander 1992b:145-148)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Hunting		
i) Communal hunts	Present	Lithic scatters (i.e., monitoring stations)
ii) Individual hunts (i.e., drives and blinds)	Present	Petroforms (boulder piles), and circular depressions (blinds)
Kill and butchery sites		
i) ungulates	Present	Lithic scatters, Faunal scatters

Table 3.6: Ethnographic Activities and Inferred Archaeological Sites, Montane Parkland, BFD (adapted from Alexander 1992b:116-145; Tyhurst 1992:372-380)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Residential Basecamp		
i) Mat lodges	Present	Lithic scatters, Faunal scatters, Hearths Fire-broken rock concentrations
ii) Sweat lodges	Present	Shallow circular depressions, Hearths Fire-broken rock concentrations
iii) Menstrual lodges	Absent	Lithic scatters, Faunal scatters, Hearths
iv) Plant Food Preparation	Present	Deep circular depressions (root roasting pits) Fire-broken rock concentrations
v) Mammal Food Preparation	Present	Faunal scatters, Hearths
	Absent	NA (Drying Racks)
vi) Food Storage-Above Ground	Absent	NA (Tree caches)
vii) Food Storage-Below Ground	Present	Circular depressions (i.e., cache pits)
Plant Gathering	Absent	NA
Hunting		
i) Communal hunts (i.e., monitoring stations)	Present	Lithic scatters
ii) individual hunts (i.e., drives and blinds)	Present	Petroforms (boulder piles), and circulai depressions (blinds)
Kill and butchery sites		
i) ungulates	Present	Lithic scatters, Faunal scatters
ii) marmot	Absent	NA (snares at talus slopes)
Burials	Present	Shallow ovate depressions, Petroforms (boulder piles)

Table 3.7: Ethnographic Activities and Inferred Archaeological Sites, Alpine Tundra, BFD (adapted from Alexander 1992b:101-116; Tyhurst 1992:384,396)

Activity Type	Archaeological Site Correlate	Archaeological Site Types
Plant Gathering	Absent	NA
Hunting		
i) Communal hunts (i.e., monitoring stations)	Present	Lithic scatters
ii) Individual hunts (i.e., drives and blinds)	Present	Petroforms (boulder piles), and circular depressions (blinds)
Kill and butchery sites		
i) ungulates	Present	Lithic scatters, Faunal scatters
ii) marmot	Absent	NA (snares at talus slopes)
Burials	Present	Shallow ovate depressions, Petroforms (boulder piles)

4.0 PROFESSIONAL CONSULTATION

KWHC contacted the several museums within the study area in order to discover unpublished archaeological site information (e.g., Boundary Museum, Grand Forks; Greenwood Museum, Greenwood; Kettle Valley Museum, Midway). One curator at the Boundary Museum stated that many homeowners in the Christina Lake area routinely find artifacts dating to the precontact period. However, he noted these private landowners have indicated to him that they would not be willing to discuss their finds with professional archaeologists for fear of governmental interference, as well as their perception that aboriginal community members would become antagonistic towards them. Both the Greenwood Museum and Kettle Valley Museum deal mainly with Euro-Canadian (i.e., historic) concerns.

Discussions were held with Ms. Fenelle Williams (Archaeologist, U.S. Bureau of Natural Resources) and Mr. David Powell (Archaeologist, Yakama Indian Nation) regarding GIS predictive models that they have been conducting within adjacent portions of Washington State. In addition, KWHC also contacted the following archaeologists who have worked in the BFD: Mr. Richard Brolly (Arcas Consulting Archaeologists Ltd.); Ms. Jean Bussey (Points West Heritage Consulting Ltd.); Mr. Wayne Choquette (Resource Protection Advisor, Ktunaxa-Kinbasket Tribal Council); Mr. Michael Freisinger (Curator, Arizona State Museum); Mr. Jim Pike (Archaeology Branch); Mr. Mike Rousseau (Antiquus Archaeological Consultants Ltd.); Mr. Ian Wilson (IR Wilson Consultants Ltd.); and Ms. Sandra Zacharias (Deva Heritage Consulting Ltd.). Each was provided with a questionnaire asking about unpublished archaeological site information (see Table 4.1). Of the eight questionnaires sent out, a total of six responses were returned to our office. For the most part the respondents did not have any additional information concerning unpublished archaeological site information for the BFD. On the whole, this appears to reflect the lack of archaeological investigation that has occurred within the study area over the last twenty years.

Table 4.1: Sample Questionnaire

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1) **Are you or a member of your firm aware of archaeological (i.e., precontact aboriginal) sites located within the BFD that have not been recorded with the Archaeology Branch?**
2) **If yes, by what manner are you aware of their existence?**
3) **What types of sites are you aware of?**
4) **To your knowledge, have these sites been destroyed, are threatened with destruction, or are they existing?**
5) **If you are able, please provide commentary and describe the locations of these sites in as much detail as possible.**
6) **If your knowledge of these sites is derived from First Nation or other informants, would you be willing to provide their name and/or provide an introduction on our behalf so they can be contacted for this project?**
7) **Are you aware of areas of negative archaeological research (AIA studies, excavations, etc.) that have been conducted by archaeologists within the BFD but which have not been reported to the Archaeology Branch?**
8) **If yes. please provide commentary and describe the locations of these areas in as much detail as possible.**
9) **Could you please provide any personal observations regarding archaeological site placement and/or distributions within the BFD that you would like to share (e.g., geomorphological landforms or conditions conducive to site placement / perceived correlations between biogeoclimatic zonations and site types, etc.)**

One of the respondents knew of a private artifact collection which he had observed north of Rock Creek which had contained a large (~20cm) ground and polished nephrite celt, as well as a large (~12cm) chipped stone projectile point. No additional information about the locations of the sites from which these artifacts had been recovered was provided. Several respondents also provided additional reference sources for our background literature review. By far the most information concerning archaeological site information for the BFD was provided by Michael Freisinger. His comments centred around several **areas:** (a) methods for conducting archaeological surveys of logged and unlogged areas; (b) possible historic trails networks through the Granby River and Christina Lake corridors; and (c) possible archaeological site locations within the Granby River corridor, confluence of the Granby River and Burrell Creek, near Xenia Lake, Christina Lake to the Arrow Lakes and various alluvial fans, riverbanks, and upland (i.e., alpine) areas.

5.0 INFORMATION GAP ANALYSIS (IGA) SUMMARY

5.1 Objectives

The previous report (Handly and Lackowicz 1997) comprised the first stage of the BFD-AOA project, and presented the documentary research, consultation activities, and information-gap analysis conducted by KWHC. This section of the report discusses the results of the information-gap analysis, which was performed according to the criteria of, and in consultation with, the Archaeology Branch. Our IGA was complementary to the provincial IGA being conducted by Equinox Research and Consulting Ltd (Franck, Muir, and Bush 1997). Since the quality and quantity of base information available affect the reliability, accuracy, and efficacy of the resulting Phase 3 predictive model, an IGA was seen as a beneficial component to this study. The IGA addressed the nature and scope of previous archaeological inventory and assessment studies, and the scale, quality and coverage of digital datasets, and related inventories.

5.2 Summary of Limitations, BFD

5.2.1 Archaeology

The majority of previous archaeological surveys have not included intensive survey methods that are considered adequate for locating archaeological sites within an area (particularly subsurface testing). This translates into approximately 0.12% of the total BFD study area having been adequately tested. Over 90% of all recorded sites are located within the Kettle River valley bottom and around Christina Lake (<800 m asl), within ten minutes of latitude from the International Border. With respect to specific biogeoclimatic zones, intensive survey coverage ranges from 0% (AT) to 0.242% (ESSF).

Regional archaeological constructs are used to place and interpret site assemblages into a defined temporal and/or technological system that reflects the local precontact use of an area. Due **to** the lack of systematic data collection within the BFD, no such system has been developed for this district. Previous archaeologists have therefore been compelled to 'force' the data into adjacent constructs that do not reflect local adaptations (see Galm 1994:3.66-3.67).

Three studies have attempted to develop archaeological site risk-indices for various projects within the BFD. Two of these have been limited by their focus on site-specific areas that do not represent the diversity of the study area. The last focused on the entire Nelson Forest Region, and used incompatible environmental settings for presenting a generalized (1:250,000 scale) model that marginalized the BFD.

5.2.2 Past and Present Environment

Past environmental conditions are important for archaeological modelling, as they describe the changing environments that have occurred within the Holocene period. No pollen cores have been collected within the study area, limiting our ability to understand these climatic changes except by generalized reference to adjacent valley-bottom locations. In addition, few geomorphological studies have been conducted, therefore there is limited knowledge of glacial and postglacial lake formations, as well as subsequent landform changes. A final concern is that modern botanical studies mainly describe a post-fire suppression environment that reflects predominantly Euro-Canadian influences.

5.2.3 Ethnographic and Historic Data

Ethnographic and ethnohistoric information is used by archaeologists to understand the early contact lifeways of aboriginal peoples in a given study area, by providing insights into the manner in which they used the local landscape. Ethnographic accounts in the BFD are limited due to their lack of visitation. Those accounts existing must be recognized as biased due to the effects on aboriginal populations by disease, the establishment of the International Boundary, Euro-Canadian settlements, and the introduction of agriculture, ranching, and European goods. A related concern is that archaeologists did not consult or discuss their projects in the BFD with local aboriginal communities prior to 1993.

6.0 PREDICTIVE MODEL CRITERIA, BFD-AOA

6.1 Background

During a review of previously conducted AOA's in BC, Muir and Franck (1996) made two recommendations that have been incorporated into this study. The first deals with an assessment of the "quality, quantity, distribution, and reliability of previous archaeological research, the availability of ethnographic and traditional use information, as well as complimentary [sic] data sets" (Muir and Franck 1996:30) within a given study area prior to development of an archaeological predictive model. This concern has already been addressed in the initial Phase 1/2 information gap analysis study, summarized in Section 5.0, above. Secondly, Muir and Franck (1996:30) stress that:

> predictor variables and other assessment criteria used in mapping archaeological site potential should be well defined and consistently applied. (...) Each predictor variable should also be well justified (supported either empirically or theoretically). The data used to derive the criteria should also be thoroughly presented.

In Sections 2.0 through 5.0, above, we summarized the archaeological, environmental, ethnographic, and ethnohistorical data for the BFD study area. This information is used in relation to the archaeological site potential predictor variables presented in Sections 6.2 and 6.3, below.

Two clarifications are required at this time with respect to the predictive model presented herein. During the discussion of regional archaeological constructs and past environments (Section 2.51, it was noted that the environment and cultural adaptations have likely changed dramatically since deglaciation. Until further palynological research is conducted within the BFD, assumptions concerning archaeological site types and their associated patterning prior to ca. 4,500 years ago should be considered cautious. Except for the inclusion of glaciolacustrine, glaciofluvial, and other elevated terraces/landforms, our selected variables reflect this limitation in the knowledge base by having a Late Period focus.

Also, as noted by Eldridge and Mackie (1993:2), this type of approach to archaeological predictive modelling (see Bussey and Alexander 1992) attempts to integrate "archaeological, ethnographic, and environmental data to produce a simple but apparently effective predictive model." What is produced is a model of aboriginal land use, driven predominantly by environmental (i.e., topographic and physiographic) criteria and previous archaeological research. We agree to an extent with Altschul (1990:227 cited in Eldridge and Mackie 1993:16) who states that these types of models "by and large do not tell us anything we did not already know". Nevertheless, given the limited database of archaeological knowledge to work with in the BFD, we believe that this type of model is the most effective at this time. The archaeological site risk index and archaeological site predictor criteria described below are intended to provide a useful archaeological management tool for the BFD by eliminating areas thought to have limited or negligible site potential from requiring AIA studies. However, resource inventory studies are a preferable management tool, as these projects systematically test underlying model assumptions by including low archaeological potential zones.

Following development of our preliminary archaeological potential variables, four mapsheets were selected for field evaluation by Boundary Forest District personnel in conjunction with representatives from Pope and Talbot Ltd. and Weyerhaueser Canada Ltd. (i.e., TRIM 82E010, 027, 038, and 077). Twenty-four person-days of ground-truthing, involving vehicular and foot traverses and limited shovel testing was performed by a six person survey crew (Martin Handly and Tracy Johnson [KWHC], Stephen Isaac [Okanagan Band], Robert Watt [Sinixt-Arrow Lakes First Nation], Adam Christian [Spallumcheen Band], and Roxanne Lindley [Westbank First Nation]). Areas both containing and not containing archaeological site potential polygons were evaluated to examine the GIS model effectiveness in capturing appropriate landforms.

Where map predictions were lacking, the results of our field-evaluation were used to modify the predictor variables. The greatest change to our preliminary variables was an increase in the slope cut-off value from 10% to 15%, as the GIS model used appeared to minimize the TRIM dataset values for this criterion and exclude some gently sloping landforms. We defined the numeric values for "buffer" zones using subjective knowledge of known site locations, If sites are consistently located at the perimeter of these polygons, future values should be amended to extend the boundary.

The final archaeological site predictor variables and associated risk indices include:

High Archaeological Risk Potential Polygons

- Known archaeological sites; 200m polygon (i.e., buffer zone), <15% slope
- Named river and lake margins; 200m polygon (i.e., buffer zone), <15% slope
- Glaciofluvial and glaciolacustrine deposits; surficial exposures with >30% glaciofluvial or glaciolacustrine component, <15% slope.
- Subalpine / alpine meadow, and marsh margins; 100m polygon (i.e., buffer zone), <1 5% slope, and subalpine/alpine parkland, <15% slope
- Old growth forests (Age Class 9) within all BCC Zones, <20% slope

Medium Archaeological Risk Potential Polygons

- Streams (non-ephemeral); 200m polygon (i.e., buffer zone), <1 5% slope
- Non-alpine meadows and marshes; 100m polygon (i.e., buffer zone), 45% slope (including open range areas and meadows with a 45% slope contained within their boundaries)
- Bedrock geology; suitable lithic raw materials and bedrock/talus slope openings
- Vertical bedrock exposures, >90% slope
- Talus slope exposures, <15% slope present within O-1 00m
- Passes, <1 5% (subjectively identified - see below)

Low Archaeological Risk Potential Polygons

- All polygons outside of these parameters

6.2 High Potential Criteria

62.1 Known Archaeological Sites

Locations for all previously recorded archaeological sites were replotted onto 1:20,000 TRIM maps using the digitized locational data provided by the Archaeology Branch (Digital Source Map, Boundary Forest District office). The size of each archaeological site was also included with this data. A 200m polygon (i.e., buffer zone) in conjunction with <15% slope was defined around the perimeter of each precontact site. Since the majority of archaeological sites within the BFD were located using no subsurface testing programs, there is a high probability that unrecorded sites will be recorded in close proximity to known sites using modern survey techniques.

6.2.2 Named River and Lake Margins

Double line named rivers and lakes within the BFD had a 200m polygon (i.e., buffer zone) defined along their margins, in conjunction with a 45% slope. In addition, due to the problems encountered during the field evaluations (see Section 6.5, below), a 50m buffer was placed around all named lakes within the study area. Digitized forest cover and/or TRIM datasets were utilized in identifying these waterways (MoE n.d.; MoF 1995). Level to gently sloping landforms along these contemporary waterways are inferred to have a high probability of containing high concentrations of archaeological sites since the following activities may have occurred within these areas (see Sections 2.5 and 3.2):

(a) winter residential basecamp occupation (i.e., November to April) with large, deep, circular depressions, lithic and faunal scatters, hearths, fire-broken rock concentrations, boiling pits, cache pits, sweat and menstrual lodges, fishing locations, and burials present (i.e., shallow ovate depressions and boulder piles);

(b) late summer fishing camps near Cascade Falls (i.e., July-August) with lithic and faunal scatters, hearths, fire-broken rock concentrations, boiling pits, cache pits, possible sweat and menstrual lodges, and fishing locations (both for catching and processing); and

(c) establishment of temporary residential basecamps **in** the late spring (May) and ealy to late summer (June to August) occupations **at mid-elevation** lakes for hunting, plant gathering, and fishing. Archaeological manifestations of these activities would include lithic and faunal scatters, hearths, fire-broken rock concentrations, root roasting pits, cache pits, and petroforms (i.e., boulder piles, fish weirs, drives and blinds).

6.2.3 Glaciofluvial and/or Claciolacustrine Deposits

Surficial geology maps were used to locate glaciofluvial and/or glaciolacustrine deposits within the BFD (Digital Source Map, Nelson Forest Region office). Surficial exposures containing 230% glaciofluvial or glaciolacustrine soil components were selected for inclusion in this category (Table 6.1) when found in conjunction with <15% slope. We attempted to select terrace margins within these larger glaciofluvial and glaciolacustrine polygons. However, neither the GIS program nor our air-photo interpretation could isolate these small-scale features, although eskers were defined and placed within this category. Level portions along extinct waterway margins are inferred to have a high probability of containing archaeological materials since:

(a) as with the Named Rivers and Lakes criterion, winter residential basecamp occupation occurred in these locations from November to April with large, deep, circular depressions, lithic and faunal scatters, hearths, fire-broken rock concentrations, boiling pits, cache pits, sweat and menstrual lodges, fishing locations, and burials present (Le., shallow ovate depressions and boulder piles); and

(b) the data associated with Early Period adaptations ca. 10,500 to 7,000 BP (see Section 2.5.2, above) indicates that these well-draining glaciofluvial and glaciolacustrine landforms were among the earliest landforms exposed following deglaciation and were thus accessible since Early Period times.

By including all glaciofluvial and glaciolacustrine landforms with a less than 15% slope, regardless of whether or not they are in the valley bottoms, it is hoped that other postglacial landforms; i.e., proglacial and periglacial lake strandlines, deltas, beaches, and kame terraces, will also be captured.

Table 6.1: Glaciofluvial and Claciolacustrine Soil Expressions, BFD

Soil Symbol	Terrain Type	Moisture Regime
CO	glaciolacustrine	Mesic
LYA	glaciolacustrine	Mesic
KL	glaciolacustrine	Xeric
P	glaciolacustrine	Xeric
ASA	glaciofluvial	Xeric
BL	glaciofluvial	Xeric
G	glaciofluvial	Xeric
GS	glaciofluvial	Xeric
H	glaciofluvial	Xeric
HE	glaciofluvial	Xeric
KO	glaciofluvial	Xeric
KR	glaciofluvial	Xeric
KX	glaciofluvial	Xeric
PY	glaciofluvial	Xeric
R	glaciofluvial	Xeric
SH	glaciofluvial	Xeric
TR	glaciofluvial	Xeric

6.2.4 Subalpine /Alpine Parkland, Meadow, and Marsh Margins

Using 1:20,000 scale forest cover datasets, meadow and marsh margins associated with the Alpine Tundra BCC zone and slopes <15% had a 1 00m polygon (i.e., buffer zone) identified along their margins. Subalpine / alpine parklands with slopes <1 5% within their boundary also had a 100m buffer delineated. Level portions within and surrounding these contemporary parkland, meadows, and marshes are inferred to have a high probability of containing archaeological materials because:

(a) residential basecamps with mat lodges were established in these parkland areas from roughly May to July and August to October from which ungulate hunting, snaring, and gathering activities occurred in the alpine. Site types that may be represented include lithic and faunal scatters, petroforms (i.e., boulder drive-lines), hearths, fire-broken rock concentrations, sweat and menstrual lodges, root roasting pits, and burials.

(b) hunting, snaring, and gathering activities in the adjacent alpine meadows and marshes should be represented by lithic and faunal scatters, petroforms (i.e., boulder drivelines), and possible burials; and

(c) the imposition of a 100m horizontal buffer around meadow and marsh margins will hopefully take into account the changes through time in the elevational distribution of these subalpine and alpine ecosystems, as discussed in Sections 2.5.2 and 2.5.4, above, concerning the effects of the xerothermic period and neo-glacial advances on high elevation parkland and meadows ecotones.

Orthophotos of the Boundary Forest District, at a scale of 1:20,000, were interpreted and correlated to forest cover map overlays and trim maps, both at a scale of 1:20,000, in order to identify meadows and marshes, talus slope areas, and open ranges (also see Sections 6.3.2, 6.3.4, and 6.3.5). Areas excluded from the interpretation were the Granby and Gladstone Parks, and areas already harvested. It was assumed that areas already outlined on the trim map as open areas, meadows, marshes and/or rocky areas were classified as such in the forest cover map classification data. From this data, it can be assumed that open areas not marked on the TRIM map correlate directly to the forest cover classification and air photo interpretation.

6.2.5 Old Growth Forests

Using 1:20,000 forest cover datasets, the presence of old-growth forest stands within all biogeoclimatic zones (defined as Age Class 9, generally >251 years) that are also associated with <20% slope were identified. Moderately sloping to level landforms adjacent to these old-growth areas are inferred to have a high probability of containing culturally modified trees that were used for a number of aboriginal activities: e.g., bark stripping for tree cambium (e.g., ponderosa, lodgepole); basketry, canoe production, and shelter construction. Evidence indicative of culturally modified trees is summarized for the Interior of BC by Stryd (1997). According the Heritage Conservation Act, archaeological sites are defined as those sites which can be demonstrated to date prior to AD 1846. We have therefore assumed that for the old-growth forest predictor criterion that those stands in the study area greater than 250 years of age would have been of sufficient size and/or maturity to have been used by aboriginal peoples in an archaeological context.

6.2.6 Historic Trails (i.e., Non-Recreational)

We attempted to plot known historical (e.g., blazed) or protocontact aboriginal trail locations on the archaeological potential maps, associated with a 100m buffer zone. One problem is that several major known trails appear to have been replaced by modern transportation corridors, such as highways and roads. Secondly, a lack of detail is associated with previous mapping of trails within the study area. Given that the implementation of buffers would be ineffective if the actual trail position was not precisely known, this variable was not used. We believe it remains an important site type, given that trails can aid in identifying the subsistence and trade systems of precontact aboriginal peoples. We **recommend** that the trail network database be updated as information becomes available in order to address these heritage concerns (Section 6.7).

6.3 Medium Potential Criteria

6.3.1 Continuous Streams

Using 1:20,000 TRIM and/or forest cover datasets, continuously flowing (i.e., non-ephemeral) stream margins displaying <15% slopes had a 200m polygon (i.e., buffer zone) imposed along their margins. Level portions along contemporary streamcourses are inferred to have a moderate probability of containing archaeological materials since they were often used as transportation corridors (see Alexander 1992b:145) from the valley floor and subalpine / alpine parkland occupations in summer and fall. Short term transitory basecamps were established which could be identified by lithic and faunal scatters, hearths, fire-broken rock concentrations, root roasting pits, cache pits, and petroforms (driveline boulder piles and blinds),

6.3.2 Non-Alpine Meadows, Marshes, and Unnamed Lakes

Using 1:20,000 forest cover datasets, non-alpine meadows, marsh, and unnamed lake margins outside of the Alpine Tundra BGC zone with slopes cl 5% had a 1 00m polygon (i.e., buffer zone) placed along their margins. Open range areas and meadows with <15% in slope were also delineated. Level portions within and surrounding these non-alpine meadows and marshes are inferred to have a moderate probability of containing archaeological materials because elevated landforms such as knolls surrounding these areas could have been used as hunting stations for ungulates and other large or small mammals, as well as for butchering stations (manifested by lithic and/or faunal scatters, hearths, etc.).

6.3.3 Bedrock Geology

Several bedrock formations within the BFD contain suitable lithic raw material stocks for the production of lithic tools (Table 6.2): Rhyolite (Rhy); Creenstone (Gr); Chert (Ch); Greywacke (Gw); Limestone (Li); Argillaceous Limestone (Li/Ar); Argillaceous Slate (Sl/Ar); and Argillite (Ar) (Tempelmann-Kluit 1989). Using a 1:500,000 digital dataset (Hoy et al. 1994) in conjunction with 1:20,000 TRIM datasets and aerial photo interpretation, these areas were selected when zones of applicable bedrock geology coincided with bedrock and talus slope openings. A maximum slope cut-off value was not associated with this predictor variable, given that quarries in northern Washington state were observed to be commonly located on moderate to steep hillsides, at higher elevations than most site types (Benson and Lewarch 1989). Quarry sites could be identified through adits where hard-rock mining occurred, as well as through small to large areal scatters of decortication flakes, shatter, and workshop areas where lithic reduction activities took place.

Table 6.2: Bedrock Geology, BFD

Bedrock Name	Rhy	Gr	Ch	Gw	Li	Li/Ar	Sl/Ar	Ar
Trepanier Rhyolite	√							
Springbrook Formation (EP)		√	√					
Rossland / Nicola Groups (TrJv, TrJN)		√		√	√			
Brooklyn Limestone (TrB)		√	√		√	√		√
Knob Hill Croup (DCK)		√	√		√			
Attwood Group (PA)			√		√			
Anarchist Croup (CPA)		√	√					
Mount Roberts (CPmr)					√	√	√	
	Rhy	Gr	Ch	Gw	Li	Li/Ar	Sl/Ar	Ar
Total Sources by Type	1	5	5	1	5	2	1	1

Legend:
Rhy = Rhyolite; Gw = Creywacke; Ar = Argillite
Gr = Greenstone; Li = Argillaceous Limestone
Ch = Chert; Sl = Argillaceous Slate

6.3.4 Vertical Bedrock Exposures

Using 1:20,000 scale TRIM datasets and aerial photographs, bedrock exposures were identified where slopes reached or exceeded 90% (i.e., cliff faces). These types of landforms are identified in the archaeological and ethnographic records as having several potential cultural associations, including areas of pictograph panels (particularly along transportation corridors), hunting drives for ungulates, especially deer, and through rockshelters/caves for use as habitation sites or spiritual quests.

6.3.5 Talus Slopes

Talus slopes were identified within the BFD utilizing 1:20,000 TRIM datasets and orthographic photo interpretation. From archaeological and ethnographic data, this type of landform could have been used during precontact times for the following activities: quarrying if suitable lithic materials are included (see 6.3.3, above); as hunting stations for small mammls (e.g. marmot) if gently sloping landforms are in proximity; and as a burial location if gently sloping landforms are present at the talus base. A predictor variable comprised of talus slopes in conjunction with <15% slope present within 100m of their margins (i.e., flat areas above or at base of talus) was selected to capture these activities, which could be identified through small lithic or faunal scatters, rock features, or human remains.

6.3.6 Passes/Saddles

The inclusion of passes and saddles was viewed as an important objective, as these constitute restricted landforms that would be used for movement between valleys. By being located at a height of land with a relatively confined space, it is expected that these landforms could be used as short-term resting areas, campsites, or hunting stations (identified through small to medium-sized lithic and/or faunal scatters, hearths, FCR, etc.), KWHC and Timberland Consultants created various predictor variables and programs involving BGC zones, elevation ranges, sope, and proximity to water to define these landforms in a replicable manner. The TRIM data was found not amenable to such manipulation, however. Therefore, we note that all passes/saddles located on the 1:20,000 archaeological potential maps were selected by KWHC on a subjective basis, defined through hand-drawing on TRIM maps.

6.4 Predictor Variables Not Adopted in Study

Several other criteria were considered for their applicability to the current study but were not included. These include aspect, ungulate wintering range, freshwater fisheries, and glacial erratics. Aspect is commonly attributed a certain importance by many archaeologists, with southern facing landforms often attributed a higher archaeological potential rating than northern facing regions. Such assumptions appear to be based on the expectation of locating larger, more sedentary basecamps, as the greater amount of light and warmth would considerably benefit these living areas. We have not attributed an increased importance to aspect so that our model does not skew away from including smaller, logistically-oriented sites. This is based in part on preliminary research from Washington state surveys, which indicate that aspect is not a significant factor in site placement (Benson and Lewarch 1989:43).

Both ungulate wintering range and freshwater fisheries are obviously important factors for subsistence activities and subsequent site placement. We decided to not include these criteria as specific predictor variables due to the type of model we were implementing (i.e., presence/absence rather than a weighted variable schematic). The zones covered by ungulate wintering range (mainly valley bottoms) and freshwater fisheries were adequately captured by our other criteria, such as proximity to potable water and marshes, that their addition was not seen as necessary.

6.5 Evaluation of Field-Testing in Comparison to Predictive Model

Portions of four 1:20,000 TRIM maps (e.g., 82E010, 82E027, 82E036, and 82E077) were ground-truthed by Martin Handly, Tracy Johnson, Adam Christian (Spallumcheen Indian Band), Steven Isaac (Okanagan Indian Band), Roxanne Lindley (Westbank First Nation), and Robert Watt (Sinixt-Arrow Lakes First Nation), These four archaeological site potential maps were selected by the BFD personnel and were evaluated over a period of 30 person-days.

This ground-truthing process included a combination of vehicular traverses, foot-traverses, and/or shovel testing. Both zones captured and excluded by the selected variables were examined to assess the utility of the preliminary archaeological potential maps. Following the completion of the field-testing component, the utility of the predictor variables was analyzed and then used to revise and improve their accuracy in selecting zones of medium and high archaeological site potential. A detailed discussion of the archaeological sites located during our investigations, as well as a summary of the evaluated areas will be presented in our permit report for the BFD, Pope and Talbot Ltd. (Midway), and Weyerhaeuser Canada Ltd. (Lumby).

Mapsheet 82E010 (east of Christina Lake) was evaluated by a two-person survey crew through a combination of vehicular and pedestrian survey, predominantly along the old Cascade Highway which follows Bitter and O'Farrell Creeks through to the Santa Rosa summit. No shovel testing was implemented. For the most part, areas that were indicated on the draft archaeological potential maps captured landforms suitable for archaeological site placement. One area of concern was the confluence of Bitter and O'Farrell Creeks where a number of elevated, narrow, flat glaciofluvial terraces were not captured by the model. Discussions with Timberland indicated that due to the vagaries of the digital elevation model used for TRIM projections, this area displayed a 220% slope. Even with increasing the slope criterion to 15% on many of the predictor variables, small portions of these landforms were still not captured on the final maps.

Mapsheet 82E027 (confluence of Boundary and Henderson Creeks) was evaluated by a six-person survey crew using both vehicular and pedestrian survey. As with the previous mapsheet, the majority of landforms identified on the draft maps corresponded to landforms that would have been selected for archaeological investigation. One minor problem arose with respect to small areas of several glaciofluvial terraces that were not captured, again as a result of the GIS model indicating that these areas displayed a >10% slope. After discussions with the BFD staff and Timberland, it was decided that the 15% slope cutoff would allow for these small areas to be captured by the model 'without starting to capture too many extraneous areas. Vertical bedrock exposures were clearly delineated on the draft maps and several possible rockshelters were noted at the base of these exposures to the northeast of Henderson Creek. A shovel testing program was also initiated along a large, elevated, glaciofluvial terrace, approximately 6.4km north of the confluence of Boundary and Henderson Creeks and on the west side of Boundary Creek. A total of 69 shovel tests were placed in various locations along the terrace margin within 15m of the break-in-slope. This type of landform is typically one on which archaeological sites are located. In this case, no cultural materials were recovered during the shovel testing program; however, similar terraces are present up and downstream from this location and sites are likely to be present on some of these landforms.

Mapsheet 82E038 (confluence of Granby River and Burrell Creek) was evaluated by a six-person survey crew using both vehicular and pedestrian survey. Investigations on this mapsheet focused on several small valley bottom and mid-elevation pothole lakes. To the west of the Cranby River on Almond Creek the western shoreline of a small, marshy pond was shovel tested by a three person crew. The draft maps indicated that a small point extending from the west shore of the lake should be evaluated; however, soils in this area were generally very thin and rocky. No archaeological sites were located in this area as a result of the shovel testing. On the traverse out of the area a level glaciofluvial or alluvial terrace was encountered at the inlet of the pond just to the north of the point. No shovel testing was conducted here; however, soils were much deeper in this location. Increasing the slope to 15% on the next set of draft maps allowed for this area to be captured. To the east of the Granby River a pedestrian survey was conducted around a small pothole lake. This area had been extensively impacted by previous logging activities, including disk-trenching (i.e., scarification). Rather than shovel test in the disturbed areas around this lake, we decided to evaluate another small lake in the Cranby Valley, approximately 1.5km north of the confluence. The western shore of the lake had also been disk-trenched; however, the eastern portions were still intact. Two subsurface lithic scatter sites were located at the eastern outlet of the pothole lake, on the north and south sides, respectively. BFD97-2 is a large site (24m x 22m) located on the northern side of the outlet, on a flat to gently sloping landform. A total of 48 shovel tests were placed in this location, with 26 returning archaeological material. On the southern side of the outlet a much smaller site (BFD97-3), consisting of a total of 13 shovel tests with only two positives, was recorded.

Mapsheet 82E077 (confluence of Damfino Creek and Kettle River) was evaluated by a six-person survey crew. Vehicular traverses were conducted along portions of Rendell Creek and the Kettle River to determine the fit between the defined polygons and topography. Except for the exclusion of several small glaciofluvial terraces on the west side of the Kettle River, congruence was noted between the preliminary maps and landforms. No shovel testing was conducted during these traverses. A small unnamed lake / marsh ca. 1.6km northwest of the confluence of Damfino Creek and Kettle River was selected for shovel testing since most of the eastern and western shorelines of the lake were not captured by the preliminary maps. A total of thirty-one shovel tests were placed on small, elevated, gently sloping to flat terraces along these two shorelines. Two positive shovel tests were recorded at a small (4m x 4m) precontact subsurface lithic scatter (BFD97-1) on the eastern shore of the lake. It appears that due to the narrowness of the landform and the steep slope to the east that the digital elevation model could not isolate the landform. Again, after discus. sions with Timberland, it was determined that the 15% slope cutoff would capture this area.

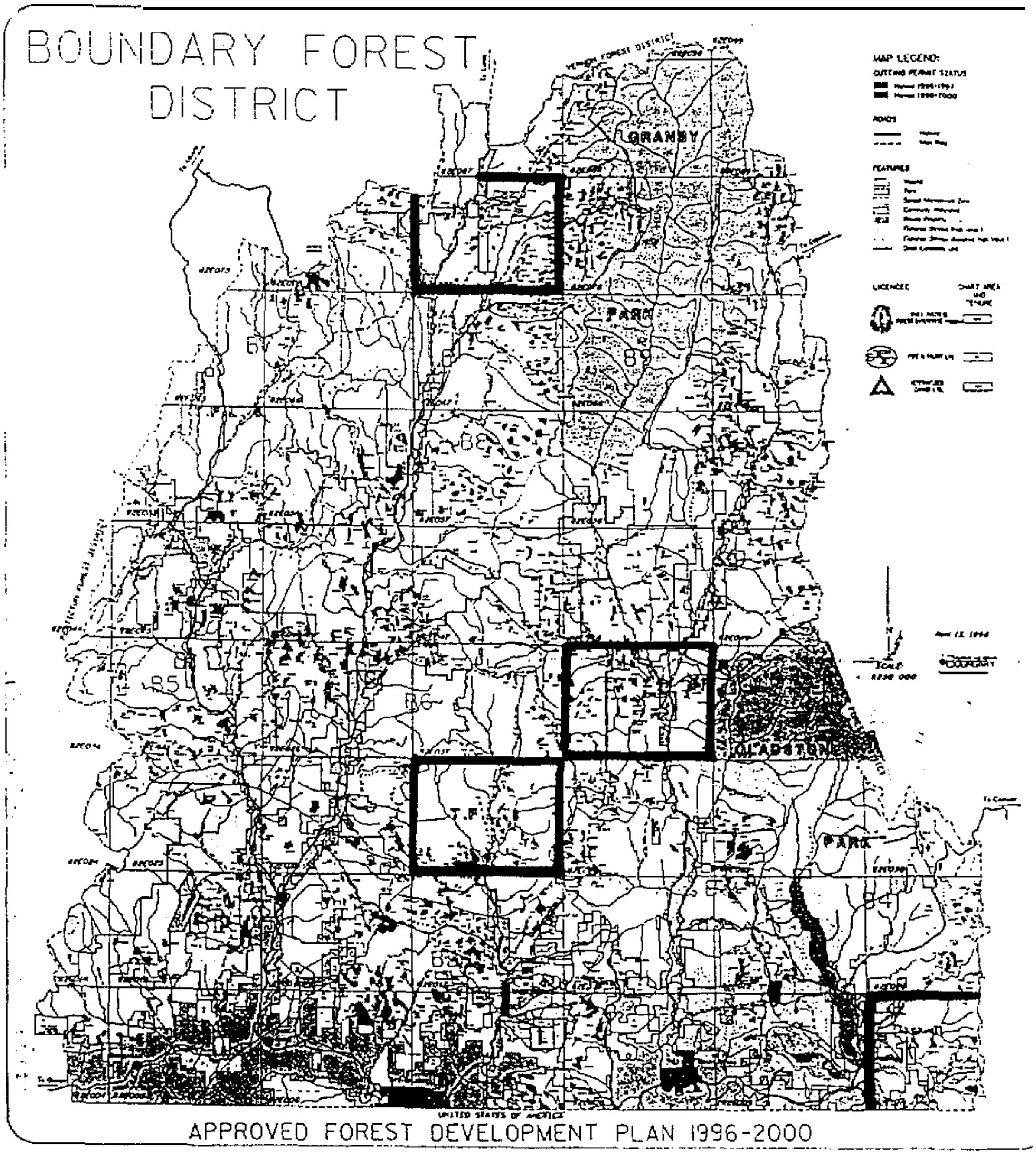

Figure 6.1: location of Evaluated Mapsheets, BFD Study Area, Southeastern BC (Scale 1:650,000)

6.6 Recommendations for BFD-AOA Archaeological Potential Maps

(1) The 1:20,000 scale archaeological potential maps represent the graphical expression of the archaeological potential criteria discussed above. They are intended to act as overlays for proposed forestry and related land-altering activities within the forest district. We recommend that land-altering activities which cross areas of Medium or High archaeological potential polygons be subjected to a detailed archaeological impact assessment prior to these land-altering activities commencing.

(2) Trail networks can aid in identifying the movement and subsistence patterns of aboriginal peoples. At present, these networks have not been adequately located, or they cannot be plotted on the present archaeological potential maps with enough detail so as to form site-specific lineal features. We recommend that if forestry or archaeological personnel encounter obvious trail systems, that the trails be mapped using a Global Positioning System (GPs), and input into the BFD-AOA potential maps using a 1 00m buffer for future AIA purposes.

(3) Glacial erratic are known from archaeological and ethnographic data to have been used for pictograph panels, as spiritual sites for offerings, and also as short-term camping locations; however, they cannot be identified at the level of scale used in this study. Such sites are sometimes known to Elders of contemporary First Nation groups, and these communities should be informed if glacial erratic are encountered during forestry activities. We **recommend** that if land-altering activities are anticipated within 50m of an observed large glacial erratic, that the immediate area surrounding the erratic be subjected to a detailed archaeological impact assessment prior to these land-altering activities commencing.

(4) The limitations associated with the archaeological and palaeoenvironmental data decreases the efficacy of any archaeological predictive model developed for the BFD. A similar perception was noted by the task-group reviewing existing archaeological inventories (Eldridge and Mackie 1993:21), which noted that the BFD has not been adequately surveyed in relation to other parts of the province. A long-term strategy for alleviating these biases in the existing database are for the MoF and/or Licensees to initiate an archaeological inventory study, such as that provided under FRBC program guidelines. These studies include a multi-year research design that systematically samples the entire district so that the local archaeological record can be properly identified. These studies can also include the collection of pollen cores for understanding specific climatic conditions and changes within the area. An inventory study could guide strategic and operational planning within the BFD, with regard to the effective management, protection, and/or mitigation of archaeological concerns. For the above reasons, we **recommend** that the BFD consider initiating such a program.

(5) Ethnographic and ethnohistoric information contributes information to archaeologists and aboriginal communities concerning the early contact lifeways of aboriginal peoples in a given study area. Since the existing ethnographic accounts are limited, we recommend that the MoF and/or Licensees initiate discussions with local aboriginal communities to implement ethnographic studies within the Boundary Forest District.

(6) Finally, with regard to updating the archaeological potential maps, we recommend the following process be adopted. Areas of negative archaeological investigation and newly recorded archaeological sites derived from MoF or Licensee activities should be updated annually on the archaeological potential maps and/or GIS system. Areas of negative archaeological investigation and newly recorded archaeological sites derived from non-MoF and non-Licensee activities should be updated every five years (i.e., 2002) on the archaeological potential maps and/or GIS system. As a component of this 5-year review the archaeological site predictor criteria should be re-evaluated by a professional archaeologist to determine their efficacy. If appropriate, these criteria should be amended at this time and new archaeological potential maps generated with the revised criteria,

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8.0 GLOSSARY OF TERMS

The following section provides definitions for technical terms used within KWHC reports. These definitions are derived mainly from Fladmark (1978), Binford (1980), Pellant (1992), Archaeology Branch (1995), and Chesterman and Lowe (1995).

Adit:	Entrance of a bedrock mine shaft.
Aeolian Deposits:	Sediments that have been laid down by wind action.
AIA:	An archaeological impact assessment (AIA) is conducted to identify and evaluate archaeological resources within a proposed study area, determine the archaeological significance of any resources identified, and provide management recommendations for these resources.
Aggradation:	Increase in river bedload deposits which produces an increase in valley floor elevation.
Alluvium:	A term for deposits laid down from fresh water activity, most commonly river sediments.
Altithermal:	See Xerothermic/Mesothermic.
Anvil:	Large flat boulder on which organic materials (i.e., bone, nuts, etc.) are crushed or broken.
AOA:	An archaeological overview assessment (AOA) is conducted to identify and evaluate archaeological resource potential within a proposed study area and provide appropriate recommendations for subsequent archaeological inventory and/or impact assessment studies.
Arbitrary level:	A standardized depth measurement used during excavation that does not necessarily conform to the natural soil stratigraphy.
Artifact:	Any portable object that has been modified by human activity.
asl:	"Above Sea Level"; refers to elevation above mean sea level.
Assemblage:	A collection of cultural materials from a specific area, most commonly from a site.
Association:	Cultural materials are associated when found in close proximity in an undisturbed context.
Atlatl:	An implement (i.e., spear-thrower) used to propel a large shaft and attached spear point.
Awls:	Small, pointed tool used for piercing holes through organic materials in prepartion for sewing.
Basal Grinding:	Intentional smoothing of the base of a chipped stone artifact, particularly a projectile point.
Basal Thinning:	Intentional removing of small flakes from the base of a chipped stone artifact to facilitate hafting.
Basecamp:	Site type where temporary residential activities, involving a limited number of individuals, are occurring. These sites are usually associated with non-winter types of activities and are located outside of the main valley bottom in more upland locations (i.e., root and berry gathering, ungulate hunting, etc.)
Biface:	A chipped stone artifact that has had flakes removed on both sides.
Biogeoclimatic:	Refers to an interpretive scheme used to classify the regions of BC into various zones, subzones, and site series based upon biological, geographical, and climatic characteristics.
Bipoint:	An artifact that is pointed at both longitudianl ends.
Blade:	A long, slender flake that is at least twice as long as it is wide. See Microblade, Macroblade.
Blank:	An advanced stage preparation of chipped stone artifact manufacture. Effectively the stage before the tool is completely formed.
Borden System:	A standardized code of four letters and a number (e.g., DkQm-1) that denote the general area of an archaeological site's location in Canada.
BP:	"Before Present", standardized notation for archaeological dates. Present defined as AD 1950.
Breccia:	Sedimenatry rock formation composed of angular fragments of various rock types derived usually from talus slope deposits set within a matrix of silts and/or sands.
Butchering Site:	A site or portion of a site dominated by evidence of butchering game animals.
Cache Pit:	Usually small (1-3m diameter) circular depressions that functioned as food storage areas.
Cairn:	Refers to stones intentionally piled to mark a location.
Calcined:	Refers to bone that has been burned and reduced to white/blue mineral constituents.
Chalcedony:	A very fine-grained (e.g. cryptocrystalline) silicate rock that is semi-transluscent and allows for very controlled knapping.
Chert:	An opaque fine-grained silicate rock used in the manufacture of flaked stone artifacts.
Chipped Stone Tools:	Identical to "Flaked Stone Tools", refers to stone artifacts that are created through the intentional removal of flakes.
Chitho:	A boulder or cobble spall crudely flaked on both sides that is used for scraping or cutting.
Clasts:	Fragments of underlying bedrock that have spalled or fractured.
Colluvium:	Sediments deposited by gravity at the foot of a slope.
Complex:	A set of similar artifact groupings that recur at different locations, which together may indicate a common technological and/or temporal affinity.
Component:	A group of artifacts that represent a single temporal period or occupation period at a site. "Multi-component" therefore refers to the site having been used at different time periods.
Concentration:	A notable quantity of artifact found within a localized area.
Conchoidal Fracture:	Refers to fine-grained rocks that have a predictable cleavage pattern when struck. These rocks can be most easily fashioned into flaked stone tools (e.g. chert, chalcedony, obsidian)

context: The spatial relationship of cultural materials in relation to the place that they were discarded.
Cordilleran: Relating to mountain ranges, specifically within BC.
core: A nodule of stone from which flakes or blades have been removed by human activity.
Core Tool: A core that has been modified so as to perform a specific function or functions (e.g. scraping).
cortex: The naturally weathered outer rind of a rock.
Cryptocrystalline: A term for extremely fine-grained rocks that have a glassy texture.
Cultural Deposit: Sediments, artifacts, or other items that have been modified or laid down in an area as the result of human activities.
Cultural Depression: The remains of any cultural activities that involve excavation at a site (see cache pit, root roasting pit, pithouse).
Culturallv Modified Trees: Refers to a tree that shows well-defined aboriginal use for either sustenance or technological purposes.
Culture History: Refers in this work to the identification and classification of archaeological materials and technology through time. It should not be considered synonymous with specific ethnic grou p(s).
d.b.s.: "Depth Below Surface", in centimetres.
Debitage: Unmodified flakes or other wastage that result from the manufacture of flaked stone tools.
Deglaciation: The process of decreasing glacial coverage. In the study area the Wisconsinan Glaciation appears to have begun to recede approx. at 15,000 BP; however, it does not appear that the area was habitable until approx. 10,500 to 11,000 BP.
Delta: Stream or river-borne sediments which empty into a lake forming a fan-shaped deposit.
Dentalia Shell: Small, slender shells originating from the Pacific Ocean.
Distal: Refers to the portion of an artifact that is farthest from the body of the user.
Downcutting: The act of a river or stream eroding soils and sediments in a valley.
Ecofact: Floral or animal remains that have been modified in some way by human activity, or which can aid in interpreting the site's use.
Endscraper: Tool used for scraping or planing functions on organic materials (also Scraper).
Erosion: The removal of rock, soil, and sediment through the action of water, wind, and ice action,
Ethnographic: Historical documentation of aboriginal culture and lifeways.
Evaluative Unit: An excavation unit for determining the stratigraphy and cultural deposits at a site with greater control than by a shovel test, usually 1x1m in size.
Faunal Remains: Animal bones found at archaeological sites.
Feature: Any non-portable item or items created by human activity (e.g., hearth, cache pit, post mold).
Fire Cracked Rock (FCR): Rocks that have been exposed to fire and evidence breakage or reddening.
Flake: A rock fragment removed from a core with the intention of creating a stone tool. May evidence use-wear or retouch if the flake itself was used as a tool, or may represent debitage.
Flake Scar: The concave area on a core resulting from the removal of a flake with conchoidal fracture.
Flaked Stone Tools: Identical to "Chipped Stone Tools", refers to stone artifacts that are created through the intentional removal of flakes.
Floral Remains: Plant amterials (i.e., seeds, pods, etc.) found at archaeological sites.
Fluvial Deposits: Sediments laid down by running water.
Geomorphology: The study of the earth's surface and changes that have occurred to it through time.
Glacial Erratic: A large boulder that has been transported by glacial activity.
Glacial Till: Sediments laid down directly as the result of glacial activity.
Glaciofluvial: Sediments laid down as the result of glacial-period riverine systems.
Glaciolacustrine: Sediments laid down as the result of glacial-period lake formations.
Graver: Small pointed tool used for incising and/or engraving on organic materials (bone, wood, etc.)
Groundstone: Artifacts that are manufactured by pecking and grinding into shape, rather than flaking.
Habitation Site: A location where people lived for a significant period of time.
Hammerstone: Any natural pebble or cobble used to create flaked stone tools.
Hearth: A fireplace.
Holocene: The period of time following the Wisconsinan Glaciation (e.g., 10,500 BP to the present).
Horizon: Refers to observed similarities in certain artifact groups over a wide area, but limited time span.
Housepit: see Pithouse.
Hypsithermal: See Xerothermic/Mesothermic
Indirect Percussion: A technique for manufacturing flaked stone tools by using a bone or antler intermediary between the hammerstone and core.
In Situ: Refers to cultural remains that are located in the area where they were deposited.
Isolated Find: An archaeological site defined by the recovery of only one or two artifacts.
Kill Site: An area where game animals were killed and/or butchered.
Lacustrine: Sediments that were deposited by lake action.
Lanceolate: Refers to items that are biconvex in paln view.
Lens: A discrete matrix stratum that is localized.
Lenticular: Refers to items that are biconvex in cross-section.
Level: A vertical sub-division of an excavation unit (see arbitrary and natural level).
Lithic: Refers to items of stone/rock.

Lithic Scatter:	An **archaeological** site defined by the presence of stone artifacts above or below the surface.
Locus:	Refers to a localized area within the overall site boundary.
Macroblade:	A blade that is greater than five cm in length.
Matlodges:	Refers to a temporary residential structure, built from long poles and covered by woven mats, which was erected by aboriginal groups during the non-winter period.
Matrix:	Refers to both natural and/or cultural sediments at a given location.
Megafauna:	Very large, extinct mammals (e.g., Mammoth).
Meltwaters:	Discharge of water occurring during deglaciation and/or the release of water from a proglacial lake. **See Proglacial lake.**
Mesic:	Warm, but wet, environmental conditions.
Mesothermic Period:	A climatic period believed to date 7,500 4,500 years ago, when precipitation rates reached essentially modern rates but where temperature averages were slightly higher.
Microblade:	A lineal blade that is less than five cm in length.
Microenvironment:	Environmental characteristics of a very small region (i.e., watershed).
Midden:	An area that refuse has been deposited.
Molluscs:	Freshwater or saltwater shellfish **(e.g., clams). See Dentalium and Olivella.**
Moraine:	A deposit that represents the limits of glacial activities. Often represented by undulating terrain such as ridges.
Natural levels:	A depth measurement used during excavation that conforms to the actual stratigraphy.
Neoglacial:	Short periods of glacial e-advance which have occurred during the Holocene.
Ochre:	A natural red or yellow pigment derived from iron oxide or hematite.
Olivella:	Small, slender shells originating from the Pacific Ocean.
Palaeoenvironment:	Past environmental and/or climatic conditions.
Palaeosol:	A buried soil horizon indicative of past soil conditions.
Palynology:	The study of plant pollen.
Patina:	A chemical reaction to the outer surface of an exposed stone object, leaving it discoloured.
Pecking:	A technique of shaping a groundstone tool by repeated soft blows with a hammerstone.
Percussion Flaking:	A technique of manufacturing a flaked stone tool by striking a core directly with a hammer of stone, antler, bone, or wood.
Period:	A sub-division of time based upon certain similarities in attributes.
Petroglyph:	An artistic expression incised or carved into stone.
Pestle:	Large ovate-shaped rock used for crushing organic materials (e.g., bone, nuts, etc.) against an **Anvil.**
Phase:	Observed similarities in artifact groups within a localized area and specific time period.
Pictograph:	An artistic expression painted onto a stone surface.
Pithouse:	A cultural depression that represents an excavated living floor for a house feature, normally larger than root roasting pits or cache pits. **See Housepit.**
Postcontact Period:	Refers to that time after the arrival of Europeans to an area.
Postglacial:	**See Holocene.**
Precontact Period:	Refers to that time prior to the arrival of Europeans or European goods.
Preform:	An artifact in a preliminary stage of chipped stone artifact manufacture, where the final shape has not yet been delineated.
Pressure Flakes:	Small flakes removed for shaping a flaked stone tool using an antler or bone implement.
Profile:	A cross-section of the soil stratigraphy at a particular location at a site.
Proglacial Lake:	A late glacial-period lake where at least one margin is formed by glacial ice.
Projectile Point:	A flaked stone artifact that refers to arrow, spear, or dart points.
Protocontact Period:	Refers to that time prior to the arrival of Europeans, but after the arrival of European goods in an area.
Provenience:	The horizontal and vertical location of an artifact at a site.
Proximal:	The portion of an artifact that is closest to the user.
Quarry Site:	A location where stone materials have been mined/gathered.
Radiocarbon Sample:	A quantity of organic material that can be analyzed for the time period at which it originated.
Retouch:	The removal of small flakes at an artifact's margins to improve its efficiency.
Riverine:	Having to do with a river and/or stream.
Rockshelter:	Shallow cave or overhang large enough to have been used as a habitation area.
Root Roasting Pit:	A usually small (1-3m) cultural depression that represents the remains of an earthen oven where roots and other foods were cooked. Often lined with rock.
scraper:	A tool used in the scraping of animal hides or other similar activities. By its shape it can be referred to as a sidescraper, endscraper, thumbnail scraper, etc.
Sedentism:	Long-term, residential stability by a group.
Shovel Test:	An excavation unit approx. 50cm in diameter used to locate underground cultural deposits.
Strandlines:	Raised beach deposits created by glacial and proglacial lake levels.
stratum:	A single depositional soil/sediment layer; plural is "strata".
Stratigraphy:	The depositional soil/sediment layers at a site.
Stade:	A period when there is a re-advance of glacial ice. **See Neoglacial.**

Surface Collection:	Archaeological materials located upon the groundsurface.
Surficially:	Visible on the ground surface.
Talus:	Angular rock concentrations forming at the base of a cliff, usually in a fan or conical-shape.
Temporal:	Referring to time.
Tradition:	Observed similarities in artifact production and types in an area that spans a long time period.
Tuff:	Rock produced from consolidated pumice (volcanic ash).
Typology:	The classification of artifacts based upon similarities in specific attributes.
Uniface:	A stone artifact that has been flaked on only one side (also unipoint).
Use wear:	Polish, striations or breakage that develop on a tool during use.
Utilized Flake:	A flake that exhibits use-wear but not retouch.
wedge:	Tool used for splitting apart bone and rock raw materials.
Xeric:	Warm and dry environmental conditions.
Xerothermic Period:	A climatic period believed to date 10,000 - 7,500 years ago, when precipitation rates were lower than modern rates and temperature averages were significantly higher.