Golder Associates Ltd.

10th Floor, 940 6th Avenue S.W.
Calgary, Alberta, Canada T2P 3T1
Telephone (403) 299-5600
Fax (403) 299-5606

REPORT ON

HISTORICAL RESOURCES IMPACT ASSESSMENT FOR THE MUSKEG RIVER MINE PROJECT

PERMIT NUMBER 97-107

Submitted to:

Shell Canada Limited
400 - 4 Ave. SW
Calgary, AB T2P 2H5

December 1997

972-2237

Golder Associates Ltd.

10th Floor, 940 6th Avenue S.W.
Calgary, Alberta, Canada T2P 3T1
Telephone (403) 299-5600
Fax (403) 299-5606

February 10 1998

Proj. No. 972-2237

Judith A. Smith
Manager, Environmental Services
Oil Sands Division
Shell Canada Limited
400 - 4th Avenue SW
P.O. Box 100, Station M
Calgary, AB T2P 2H5

RE: Final Report - Historical Resources Impact Assessment for the Muskeg River Mine Project

Dear Judy

Attached is the final report on the Historical Resources Impact Assessment for the Muskeg River Mine Project. This report provides details of the historical resource investigations completed on Lease 13.

The report is designed to: a) satisfy the requirements of the Alberta Historical Resources Act for the proposed development; b) provide a comprehensive assessment of historical resources impacts and mitigation strategies for all stages of the development; and c) document the field studies undertaken in regions of the development area where no previous investigations of historical resources had been completed.

Should you have any questions about this report, please contact me at 299-5640. Please note that two copies of this report has also been forwarded to Joan Damkjar of Alberta Community Development.

Yours very truly,

GOLDER ASSOCIATES LTD.

John R. Gulley, M.Sc., P. Biol.
Oil Sands Project Director

attachment

cc. Doug Mead (Shell)
Ian Mackenzie (EIA Project Manager)
Joan Damkjar (Alberta Community Development)

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ACKNOWLEDGMENTS

Project Director	Rebecca J. Balcom
Project Manager	Brian M. Ronaghan
Permit Holder	Brian M. Ronaghan
Report Author	Brian M. Ronaghan
Field Investigators	Brian M. Ronaghan
	Grant Clarke
	Dana Dalmer
	Tom Hoffert
	Sid Rempel
	David Cooper
	Kristin Kavanaugh
Lithic Analysis	Tom Hoffert
	Dana Dalmer
Report Editor	Rebecca J. Balcom

EXECUTIVE SUMMARY

Shell Canada Limited intends to develop an oil sands extraction facility in the western portion of its Bituminous oil sands Lease No. 13. On their behalf, Golder Associates has completed an Historical Resources Impact Assessment of the proposed mine facilities located north of Fort McKay on the east side of the Athabasca River. Historical resource studies have been a component of two previous proposals for this lease. This has resulted in a situation where some areas of the lease have been cleared of historical resource concerns, while others have been investigated, but outstanding study or avoidance requirements remain before development can proceed. Still other areas had not been examined. The objectives of the 1997 Golder Associates historical resources program was to bring all areas scheduled for development in the Muskeg River Mine Project to the same level of historical resource management status, that is, having the requirements of an Historical Resources Impact Assessment (HRIA) completed. For a large portion of the Muskeg River Mine Project, this status has already been achieved, for other portions dedicated field studies involving both inventory and assessment were necessary.

Two levels of study were undertaken to meet this objective. In previously investigated areas, the original project records (maps and field notes) archived at the Provincial Museum of Alberta were obtained so that the location of all sites, especially those for which mitigation requirements have been established or those considered potentially significant, could be incorporated in the Project planning base maps. The intent of these procedures was to bring the information available to a level whereby mitigation requirements could be established for all historical resources throughout the previously examined portion of the development area. This will be especially important as mining proceeds over a 45 year period. With accurate mapping, sites can be temporarily avoided, if required, and mitigation programs can be implemented effectively, before development proceeds. This previously existing information has been incorporated into the analysis conducted for the present project and is summarized in the main body of this report.

The second stage of the program involved an in-field inspection of those portions of the proposed Muskeg River Mine Project that had not been subject to an acceptable level of previous study. Since design of an appropriate mitigation program to offset project impacts is best based on an effective comparison of the significance of the resources involved, a strategy of inventory and assessment comparable to that employed in the successful 1980 Alsands HRIA was implemented in areas of new impact. This provides a comparable assessment of both the potential of terrain features in these areas and of the individual sites found. Features selected for examination were chosen on the basis of air photo and GIS sensitivity analysis. Criteria selected for the sensitivity analysis were based on the results of previous study and employed a simple model using vegetation communities (as a reflection of elevation) and distance from standing or flowing water as determining factors. Assessment employed the same techniques applied in the 1980 study.

EXECUTIVE SUMMARY

A few previously recorded sites exist in areas that have been not examined in a systematic fashion but are scheduled for development in the Muskeg River Mine Project. In these instances, attempts were made to relocate and re-assess those sites; the same level of effort given new sites was proposed for intact known sites. The results of these efforts are presented in this report.

In the analysis stage of the project, all sites were ranked as to their comparative significance according to a systematic set of physical site parameters that are generally accepted for this area of the Province. The focus was placed on recognition of those sites that represent unusual information sources, and hold potential to provide important new information to that already available in the archaeological samples from the Lease, and its surrounding environs.

A mitigation program recommended to offset the negative impacts of the Muskeg River Mine Project is presented in the final section of this report. Its design is based on a variety of considerations: the results of earlier studies, the outcome of the 1997 field program, consideration of the effectiveness of the programs conducted, a developing understanding of the nature of site distribution patterns within the Muskeg River Mine Project area, and a comparative ranking of the historical resources encountered within proposed development zones.

This program should meet all the requirements of the Alberta Historical Resources Act for an Historical Resources Impact Assessment of the proposed Muskeg River Mine Project development area.

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1.0 INTRODUCTION

Shell Canada Limited intends to develop an oil sands extraction and processing facility on its Bituminous Oil Sands Lease No. 13. The Muskeg River Mine Project (Project) is the latest in a series of proposals to develop Lease 13; no previous proposal has proceeded. Historical resource studies have been a component of previous proposals for this lease since 1974. Because different lease areas were proposed for development in the past, and different strategies and levels of intensity for discovery and assessment of historical resource sites were used, the level of historical resources information varies for different areas of the lease. As well, regulatory response to individual studies completed under the Alberta Historical Resources Act has resulted in some areas of the lease being cleared of historical resource concerns, while in other areas, outstanding study or avoidance requirements remain before development can proceed and still other areas have never been examined and require inventory and assessment.

The purpose of this section is to establish the intent of the historical resources program undertaken in support of the present development application and to outline the structure of this report, which details the nature and results of the program. The focused historical resource investigation adopted in 1997 endeavors to: 1) satisfy the requirements of the Alberta Historical Resources Act for completion of an Historical Resources Impact Assessment (HRIA) for all areas currently proposed for development; and 2) develop a comprehensive assessment of historical resources impacts and mitigation strategies to address impacts through all stages of development. Results of previous studies have been evaluated and incorporated all with the results of field studies undertaken in areas not previously investigated.

Previous archaeological studies in the Project area have identified a unique and important distribution of archaeological sites that appears to stand in significant contrast to similar areas within the Lower Athabasca River basin. The strategy for the Project HRIA considers relevant research issues from previous archaeological studies in the area builds on this information to make a current contribution to understanding of regional prehistory, especially the issue of site distribution patterns.

Section 2.0 of this report describes the location and nature of the Project, as well as anticipated impacts to historical resources from proposed development activities. The proposed construction

schedule is also reviewed since it has a direct bearing on the mitigation program recommended in the final section of the report.

Section 3.0 discusses the historical cultural context of the present study. Because this report, and recommendations, incorporates information from previous historical resource studies within and adjacent to Lease 13, this section also reviews previous studies and their recommendations, and reviews current management status of the sites identified within the regulatory review framework of the Alberta Historical Resources Act.

Section 4.0 discusses the 1997 Historical Resources Impact Assessment program for the proposed Project, by reviewing the objectives of the study, defining the project area and discussing the research basis for the field investigations under Archaeological Research Permit 97-107.

Section 5.0 presents 1997 field study results with detailed information on resources identified and recommendations for their management in the context of the proposed development.

Section 6.0 combines 1997 information with information from previous studies to summarize all known historical resources that will be affected by the proposed Project. Presentation of this information is preceded by a review of the coverage provided by all previous historical resource studies completed in the Project area, accompanied by a prediction of the actual number of archaeological sites that might actually be present in the development area. Subsequently, summary site distribution information is provided by discussions relating to the age of the sites present in the Project area and by review of the environmental context that would have served as a backdrop for the prehistoric occupations identified. The discussion relating to site significance presents the evaluation criteria used to obtain a comparative ranking of the significance of the affected resources and applies those criteria to the sites within proposed development zones.

Section 7.0 outlines a mitigation strategy to offset impacts of the proposed development through permanent conservation of materials and information as well as through analysis and interpretation of this information to better understand the regional history and prehistory.

2.0 PROJECT LOCATION, DESCRIPTION AND POTENTIAL IMPACTS

2.1 Project Location and Setting

Shell Canada Limited's Muskeg River Mine Project (Figure 1) is situated approximately 60 km north of Fort McMurray on the east side of the Athabasca River, north and east of the Community of Fort McKay. Lease 13 comprises approximately 79 sections of land lying within the Clearwater Lowlands portion of northeastern Alberta. Its western margin follows 10 km of the east bank of the Athabasca River. The Fort Hills, a Tertiary erosional upland mantled by glacial deposits (Bayrock 1971), lies a few kilometres north and east, of them is the upper Muskeg River basin. South of Lease 13 is the lower Muskeg River basin and to the east is the Kearl lake basin. Portions of the Muskeg River, and Jackpine, Shelley and Muskeg creeks run through Lease 13.

The Athabasca River in the vicinity of Lease 13 has cut down 15 m through Holocene and Pleistocene sediments, Lower Cretaceous Clearwater Formation sandstones, McMurray Formation oil sands and, in places, Upper Devonian Waterways Formation Limestones (Norris and Carbone 1973). This process occurred relatively rapidly and did not result in the development of terraces. However, on a broad low terrace at the base of the high bluffs overlooking the river, along the western margin of Lease 13, a shallow lake (Cree Burn or Isadore's) has formed in an abandoned oxbow.

East of the Athabasca River, the terrain is a gently rolling outwash plain with linear southwest/northeast trending ridges formed as flood waters receded after a catastrophic postglacial flood 9,900 years ago (Smith and Fisher 1993, Reeves 1997). The ridges consist of outwash gravels draped by the same alluvial sands that comprise the mineral soil throughout the region, and range from only a few metres long to several kilometres, but few rise move than 3 m above intervening muskeg areas. Development of relatively thick muskeg deposits in low, water-saturated areas throughout this region has been a continuous process, characteristic particularly of the later stages of the Holocene (modern) climatic interval, and may have substantially reduced the landscape variation that probably characterized the earlier part of the Holocene.

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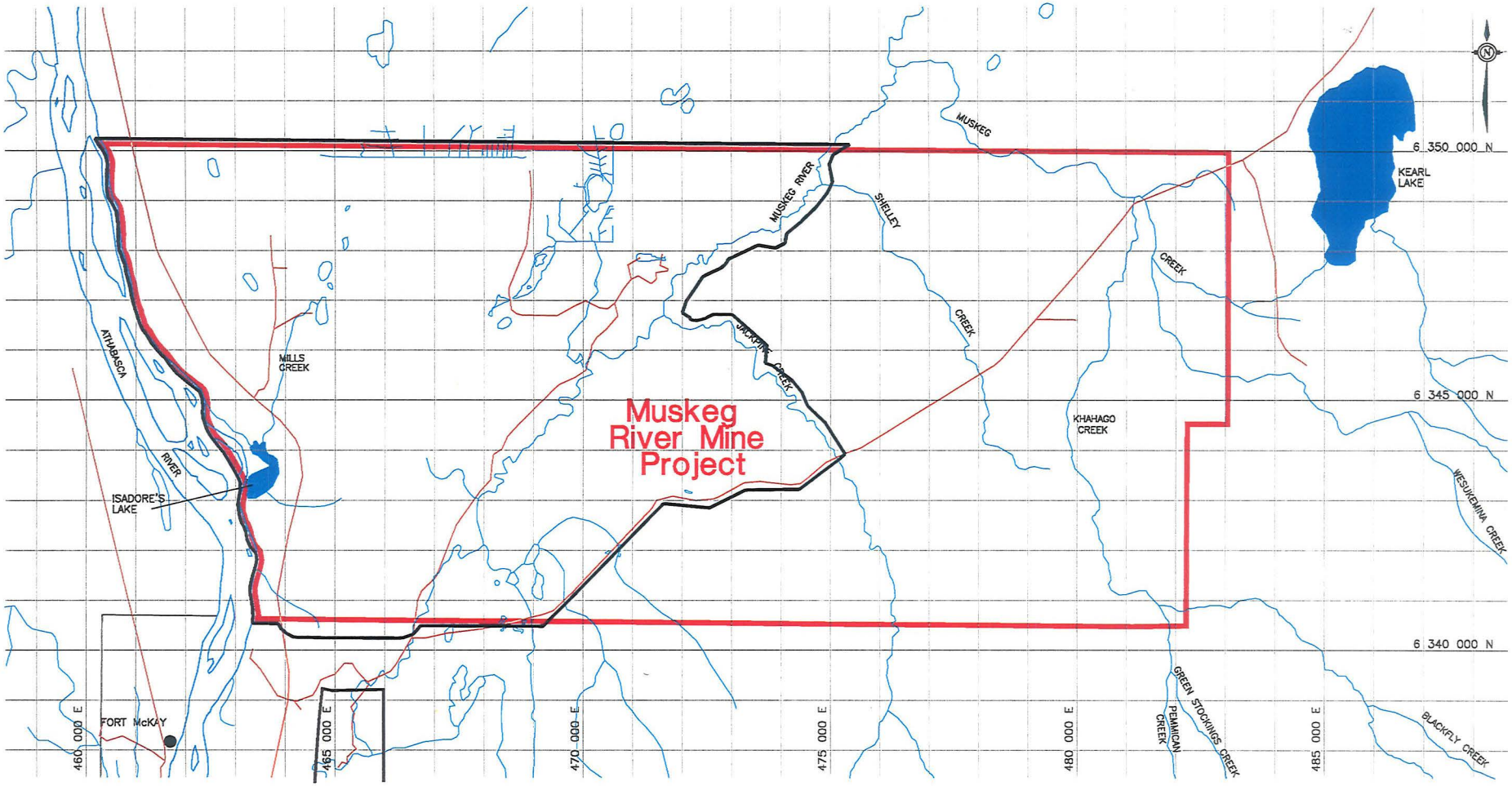

0 1000 2000 3000 4000 5000

SCALE IN METERS

REFERENCE

DIGITAL DATA SETS 74D, 74E, 74I
84A AND 84H FROM RESOURCE DATA DIVISION
ALBERTA ENVIRONMENTAL PROTECTION, 1997.

Golder Associates

SHELL CANADA LIMITED

STUDY AREA

12 JAN 98	Figure 1	DRAWN BY: CG

The Lease 13 area lies in the Boreal Mixedwood forest region (Strong and Leggat 1981) with the distribution of vegetation communities reflective of variation in elevation and drainage pattern. Elevated topography supports lodgepole pine and/or trembling aspen-associated communities, with white spruce associations at intermediate elevations. Low, saturated areas support black spruce/tamarack-associated communities and bog or fen-associated shrub and sedge-dominated communities.

Faunal resource distribution in the Lease 13 area is similar to surrounding areas, with modest potential for ungulates, including moose, deer (recently); caribou and wood bison (prehistorically). Fish (whitefish, goldeye, pike) are present in the Athabasca River and, in modest numbers, in the Muskeg River. Other species, including a wide variety of furbearers, are present throughout Lease 13 and surrounding areas.

2.2 Project Description

Shell Canada Limited's proposed Muskeg River Mine Project will be developed in the western portion of Lease 13 in an area south of the proposed Syncrude Aurora North Project and with, minor exceptions, west of the Muskeg River. The Project will include all of the components necessary to develop and operate an independent oil sands mining operation. Final processing of the bitumen will be conducted at another location and will require transportation facilities that are not considered in this report. Project development components are illustrated in Figure 2 and can be summarized as follows:

- a large mine area (2106.3 ha) to be developed progressively over 23 years period;
- a plant site that includes a camp, an office and shop complex, preliminary processing facilities, a crusher/conveyer system and liquids storage facilities (200.1 ha);
- three dumpsites for overburden disposal (548 ha);
- two muskeg storage areas (189 ha);
- a tailings storage area (961 ha);

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AURORA PROJECT

SUSAN LAKE GRAVEL DEPOSIT

PROPOSED AURORA ACCESS AND UTILITY CORRIDOR

GRAVEL PIT

YEAR 2022-2023

YEAR 2017-2021

YEAR 2012-2016

YEAR 2007-2011

YEAR 2002-2006

YEAR 2017-2021

WEST DUMP

N.E. DUMP

RMS

RMS

SOUTH DUMP

TAILINGS POND

EXISTING ROAD

963

MILLS IS.

ISADORE'S LAKE

KINGS ISLAND

CREE TURN LAKE PROPOSED PROVINCIAL HISTORICAL RESOURCE SITE

PROPOSED PLANT ACCESS AND UTILITY CORRIDOR

INDUSTRIAL CAMPSITE

EXISTING ROAD

SHELLEY

RIVER

JACKPINE

CREEK

MUSKEG

PIPES

JACKPINE

MUSKEG

462 000 m E
464 000 m E
466 000 m E
468 000 m E
470 000 m E
472 000 m E
474 000 m E

6350 000 m N
6348 000 m N
6346 000 m N
6344 000 m N
6342 000 m N

N

0 300 600 900 1200
SCALE IN METERS

COORDINATE SYSTEM: NAD27

REFERENCE

BASED ON NORWEST DRAWING TITLED MINE AND TAILINGS PLAN STATUS AT YEAR 2000, DATED 10/01/97

NOTE: RMS – RECLAMATION MATERIAL STOCKPILE

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PROJECT DEVELOPMENT COMPONENTS

12 JAN 98	Figure 2	DRAWN BY: CG

- auxiliary facilities, including haul and access roads, and a utility corridor (169.4 ha); and

- granular fill obtained from nearby Susan Lake Gravel Pit.

2.3 Project Development Activities and Scheduling

Shell Canada Limited proposes to have an application before the Alberta Energy and Utilities Board in early 1998. Allowing a year for regulatory/public review and approvals, followed by mobilization, initial site preparation and construction is scheduled to begin in the first quarter of 1999. A potentially significant activity in terms of historical resources will occur early in the construction phase of the Project, before construction of facilities, when the land surface will be cleared and grubbed, and drainage ditches excavated to enable effective dewatering of development zones. After an area has been cleared and drained, the muskeg will be removed and stockpiled for future reclamation.

2.3.1 Clearing

The first areas to be cleared will be the tailings pond, the plant and crusher site, the initial overburden disposal area and any haul road areas that require drainage. About 1,800 ha will be cleared in pre-production and about 3,755 ha will be cleared over the life of the Project. Bulldozers will be used for clearing, mostly under frozen ground conditions, with salvageable timber recovered and the remaining vegetation piled and burned. Pre-production clearing will be completed by August 1999 to allow sufficient time to start construction of the plant, industrial facilities and the initial access roads.

Most mine areas will be cleared a minimum of three years in advance to permit successful ditching, drainage and muskeg removal. Clearing of the initial mine area (#1) is scheduled for late 1999/early 2000. Successive mine areas will be cleared in the winters of 2004/2005 (#2), 2009/2011 (#3), 2014/2015 (#4), 2019/2020 (#5) and 2025 (#6) respectively. During the construction period, 8.1 km of temporary roads, 18 km of service roads and 16.5 km of permanent roads will be constructed. Clearance along the alignments for the gravel haul road (30 ha), the starter dike haul road (12.9 ha), the transportation/utility corridor (114.9 ha), the south dump haul road (7 ha) and the NE haul road (11.6 ha) is scheduled for late 1999.

Ditch alignments, drainage ponds and external distribution lines will also require forest clearance before construction. The Stage 1 ditch (25 ha) and drainage pond #1 (4 ha) will be cleared in winter of 2001. The Stage 2 ditch (47 ha) and drainage pond #2 (35 ha) will be cleared in the winter of 2006, and the Stage 3 ditch (32.5) and drainage pond #3 (4 ha) will be cleared in the winter of 2011. The Stage 4 ditch (27 ha) will be cleared in the winter of 2016. External distribution lines will be cleared in the winters of 2000 (15 ha), 2006 (35 ha) and 2012 (75 ha).

2.3.2 Drainage

Drainage of development areas will involve both surface drainage and basal aquifer dewatering. Surface water will be handled by diversion ditches and mine water ditches. Before mining begins, diversion ditches will be constructed to divert clean water around the mining area and into the Muskeg or Athabasca rivers depending on slope of the terrain. Existing finger ditches on the former Alsands Project area will be used, but additional ditches will be necessary elsewhere to divert surface water into main diversion ditches. About 26 km of diversion ditches will be built over the life of the Project (see Figure 2). After collection, contaminated mine water will be transported by pipeline to the plant settling ponds.

Diversion ditches will be excavated in the first quarter of 2000 and will finish in the winter of 2001. Finger ditches will be excavated on the same schedule. Sedimentation ponds will be excavated in the second quarter of 2000.

Basal aquifer dewatering will be required in advance of mining. This will be accomplished by emplacement of about 38 dewatering wells at approximately 450 m intervals around the perimeter of the mine. A perimeter road and an aboveground power line will be required to service these wells.

2.3.3 Muskeg Removal

Once required construction areas are dry, muskeg will be removed using rubber-tired loaders and initially hauled to the muskeg dumps. Later, during mining phases, muskeg will be hauled directly to areas requiring reclamation. Pre-stripping will start in November 1999 to accommodate the required dyke construction schedule. This will result in the crusher site being ready for construction in early 2001. Excavation of the crusher site will provide the overburden necessary to

begin construction of the starter dyke, which will be ready to accept tailings in January. The office/plant area will also be stripped in early 1999. Mine pit #1 will be pre-stripped in the winter of 2000 and will be completely stripped by July 2002. Pre-stripping of the starter dyke area will begin in the second quarter of 1999 and will be completed in the second quarter of 2000.

2.3.4 Haul Road Construction

Haul road construction is an essential stage of Project development. The access road to the Susan Lake gravel pit will be developed during the winter of 1999/2000. Access roads to the south overburden disposal area and the starter dyke will be built in the first quarter of 2000. In-pit road construction will begin in the summer of 2002. Subsequent road construction will proceed as required but schedules have not been established. Over the life of the mine, 412 km of temporary roads, 94 km of service roads and 31 km of permanent roads will be constructed (see Figure 2).

2.3.5 Electrical Power Distribution

A 138 kV electrical power line will be necessary to supply power to the Project. Initially, a substation will be built at the entrance to the site facilities (Figure 2). Overhead power lines will supply the Project, first to the cable shovel for pre-stripping and to the dewatering wells, then, later to Mine Pit #1, with a subsequent extension along the northern margin of the full mine.

Delivery of power to the Project would be provided by Alberta Power Ltd. from their Ruth Lake substation. Two new 144 kV power lines will be required to supply the Project. Approvals for these facilities would be obtained by the supplier but it is assumed that the existing utility corridor adjacent to Highway 63 would be used. Power to the plant would be supplied via the utility corridor shown in Figure 2.

2.3.6 Gravel Resources

Gravel for road construction will be obtained from the Susan Lake Gravel Pit. Approvals for any expansion of these facilities would be the responsibility of the suppliers.

2.3.7 Natural Gas Supply

A supply of natural gas will be required to service the Muskeg River Mine Project. Regional supply is provided by Nova Gas Transmission Ltd. A number of options for supply to the Project area are being considered and will incorporate the needs of other users in the area. Details of the pipeline that will provide gas will be the subject of a separate application but, again, it is assumed that the Highway 63 and Project utility corridor alignments will be used.

2.3.8 Water Supply

The Project has been designed to minimize the amount of water withdrawn from the Athabasca River by using basal aquifer, surface water and natural runoff. However, a water intake facility on the Athabasca River employing two pumps and a pipeline will be necessary. The final configuration of these facilities has not yet been determined.

2.3.9 Mining

Before mining, overburden will be removed by truck and shovel. Overburden and centre reject material will be hauled initially to the tailings dyke area for construction of these structures, then later to the overburden disposal areas (see Figure 2). Oil sands will be hauled to the crusher site for pre-processing, then will be transported by conveyor to the extraction plant. Wet tailings and waste from the plant will be transported by pipeline to the external tailings pond, then to the consolidated tailings dyked off areas within the exhausted portions of the mining pits. Mining will proceed in a staged fashion through a total of six mining blocks over the 23-year life of the mine. Mining cuts will average 1000 m long and 115 m deep and will have a bench height of 15 m. The complete mine plan is illustrated in Figure 2.

2.3.10 Product Transportation

The final product of the mining and extraction process will be diluent and bitumen. They will be initially stored on-site, then transported by pipeline to the Shell Canada Limited Scotford Plant for final processing into commercial products. The pipeline that will deliver bitumen to Scotford will be the subject of a separate application, and is not considered here.

2.4 Potential Impacts to Historical Resources

2.4.1 Historical Resources

Historical resources are defined by the Alberta Historical Resources Act (1987) as:

"any work of nature or man that is primarily of value for its palaeontological, archaeological, prehistoric, historic, cultural, natural, scientific or aesthetic interest, including but not limited to, a palaeontological, archaeological prehistoric, historic or natural site, structure or object."

Consequently, historical resources include, as well as the sites where events took place in the past, all of the objects that they contain and any of the contextual information that may be associated with them, and will aid in their interpretation, including natural specimens and documents or verbal accounts. They are generally divided into three types prehistoric archaeological, historic period archaeological and structural, and palaeontological. Natural objects and features have also been occasionally managed under the provisions of the Historical Resources Act.

Prehistoric archaeological resources in northern North America are the archaeological sites, objects and affiliated materials that represent occupations by Aboriginal peoples before the arrival of European goods, people and the historical records that characterize their culture. In this region of the province, these consist of locations where activities took place and the remains of these activities, usually stone artifacts and features such as hearths. Generally, associated animal bone and other organic artifacts have disintegrated in the acid soils of the area. These materials can span the entire 10,000 years of recognized prehistory in this region of the province.

Historic archaeological and structural resources generally include the sites, artifacts, structures and documents that relate to the Euro-Canadian occupation of the region and date to the last 250 years. These include remains related to the early fur trade in the region, and to later economic developments such as trapping, forestry, and oil sands exploration and production. A key component of the historic period record are the sites, artifacts and affiliated resources relating to post-contact Aboriginal people's use of the landscape. These involve archaeological sites and objects, such as standing and collapsed cabins, campsites and graves. Also included are traditional sites and resources, such as special places, hunting and plant collecting areas, traplines and their

associated remains, oral traditions and various documents. These resources are usually identified through consultation procedures such as "Traditional Land Use" studies.

Palaeontological resources consist of physical remains representing evidence of extinct multicellular plants and animals, and related contextual information, that inhabited the region in prehistoric times. These can include fossils, bone deposits, shells and the impressions of these remains and can occur in both bedrock and unconsolidated glacial and postglacial sedimentary deposits.

Historical Resources are non-renewable resources that may be located at or near ground level or may be deeply buried. Alteration of the landscape can result in damage to or complete destruction of significant historical resources. These alterations may involve displacement of artifacts, resulting in the loss of valuable contextual information, or destruction of the artifacts and features themselves, resulting in the complete loss of important site information. The loss of historical resources is permanent and irreversible. Impacts to historical resources as a result of development projects are generally described as falling into two categories: direct and indirect.

Direct impact occurs during construction and operations stages of any project and are a direct result of activities associated with the project. Indirect impacts occur as a result of the development, but are not directly related to it, and can take place outside direct impact zones. For example, development of an industrial project such as the Muskeg River Mine Project, can result in increased use of surrounding facilities and landscapes, resulting in surface disturbance not accounted for possibly leading to increased vandalism or accidental impact.

The frequency and intensity of these kinds of impacts can be accelerated in areas where numerous developments of a similar or related type are proposed. Together with direct development impacts, assessment of indirect impacts forms the basis for estimating the cumulative effects of development in a region.

Construction activities associated with development of the Muskeg River Mine Project will have varying physical effects on historical resources within proposed development area. Negative effects can be identified at two levels of intensity.

2.4.2 Direct Impacts

Direct impacts to historical resources will result from the numerous ground-disturbing activities associated with development of the Project. For the purposes of this discussion, it is useful to group development activities into types that will result in disturbance or partial destruction of historical resources, and those that will result in total destruction of historical resources within development zones.

The forest clearance stage of development is a critical stage relative to historical resources, because it is almost the only stage of construction that will not result in complete destruction of historical resources within impact zones. Forest removal is usually done in winter, under frozen ground conditions. In these circumstances, the cutter bars used for this purpose occasionally strike the ground, exposing the upper surface of the mineral soil horizon, and the bulldozer treads displace the forest litter, but do not disturb much of the frozen material below. These disturbances have both positive and negative effects on archaeological sites and materials. Most of the archaeological record of the region is contained in the upper horizons of the current sediment profile, reflecting the long-term stability of the vegetative regimes in the boreal forest. Archaeological materials may become exposed as a result of these activities, some may be removed and others may be displaced from their original positions. This type of impact has a negative effect on the sites affected but, in a positive sense, previously unknown sites may be revealed, so that undisturbed portions may be studied and sampled. Post-clearance archaeological studies in the former Alsands project area (Ives 1982a) has served to confirm these positive and negative aspects of forest clearance procedures.

Forest clearance will, however, result in total destruction of aboveground historic period resources and many of the traditional resources related to aboriginal use of the landscape. Palaeontological resources are unlikely to be affected by this type of activity, since it rarely intersects bedrock formations where these resources most commonly occur.

For the most part, the magnitude of direct impact associated with forest clearance can be considered either moderate or low (see Table 1) depending on the inherent scientific and or cultural significance of the resources affected. It may be negligible if no sites are present within impact zones. High magnitude impacts are possible if an extremely significant site is affected and disturbance happens to be severe. As is the case with all historical resources, the geographical

extent of these impacts is localized to actual physical impact zones and their duration is immediate to the sites affected. All physical impacts to historical resources are irreversible.

Excavations for drainage ditches, emplacement of water wells, trenching for pipelines, grading for facility locations and road construction, and mining all represent the types of disturbances that will completely destroy near-surface archaeological and above-ground historic period resources. Those activities, particularly mining, that intersect deeply buried sediments, including loosely consolidated McMurray Formation sands, are likely to pose a threat to palaeontological resources if present. Because the physical impacts of these activities on historical resources is severe, their overall magnitude is based entirely on the significance of the resources affected and ranges from high through moderate to low and negligible (Table 1). Again, the geographical extent of these impacts is localized to actual physical impact zones, their duration is immediate and the impacts are irreversible.

The effects of muskeg removal on prehistoric archaeological sites and materials is unknown at present. Certainly, any materials of this nature contained within these deposits will be destroyed during excavation. However, as will be discussed in subsequent sections of this report, development of muskeg in this, and other regions of the southern boreal forest, date to the latter portion of the Holocene climatic interval, and archaeological sites that pre-date muskeg formation may be present at the base of these deposits. Currently, there is no evidence to support this proposition. However, the water-saturated conditions that characterize muskeg deposits suggest excellent preservation conditions for archaeological remains, particularly organic materials.

Areas selected for muskeg storage before reclamation would also be affected. If forest areas are cleared for muskeg storage, the impacts described for forest clearance would apply. If pre-storage levelling is required, impacts would be more severe and could be rated as having a high, moderate or low magnitude depending on the significance of the site affected. Impacts to historical resources would be confined to those areas subject to these activities, would be immediately felt and would be both permanent and irreversible.

Table 1 Impact Classification Definitions

Resource	Direction	Magnitude	Geographic Extent	Duration	Reversibility	Frequency
Historical Resources	**Negative:** Disturbance or destruction of historical resources	**High**: In areas of severe physical impact when resources of high scientific or interpretive value are affected **Moderate**: In areas of moderate or partial physical impact when high or moderate value resources are affected **Low**: In areas of minimal physical impact or when few or low value resources are affected **Nil**: In areas where no physical impact takes place or no sites occur	**Local**: Sites in the immediate development area are directly affected **Regional**: Sites in the region may be indirectly affected by increased use or demand for other facilities	**Immediate**: Direct physical impacts are felt immediately **Long-Term**: Indirect impact occurs over the life of the project	**Irreversible**	N/A
Historical Resources	**Positive**: Increase in the understanding of the character and distribution through information recovered in Impact Assessment and Mitigation phases of study	**High**: If a unique or highly significant site(s) is identified and information is recovered before development impact occurs **Moderate**: If sites similar to others in the region are found and information is recovered before development impact occurs **Low**: If few, low value or even no sites are found	**Local**: Specific information is recovered from sites within the immediate development area **Regional**: Comparisons with information obtained in other studies improves understanding of regional history and prehistory	**Short Term**: Submission of project report to Alberta Govt. allows improved regional management decisions **Long-Term**: Information and artifacts are available to other researchers	**Reversible**: If information is lost or is not collected or not curated properly	N/A

Overburden removal will result in complete destruction of all archaeological sites within development zones scheduled for this type of activity. The physical impacts of this activity on historical resources will be severe. Overall magnitude of impact will be based entirely on the significance of the resources affected and range from high through moderate to low and negligible (Table 1). Again, the geographical extent of these impacts would be confined to actual physical impact zones, their duration would be immediate and the impacts irreversible. Within areas scheduled as disposal locations for overburden, similar impacts to those described for muskeg storage area would apply. Removal of the Clearwater Formation shales, which overlie oil sands deposits in this region, will affect any paleaontological materials they might contain. The scientific significance of the fossils in this deposit (fossil ammonites pelecypods and calcareous foraminifera; Carrigy 1974a) is considered to be relatively low. Physical impacts to these deposits would be confined to areas affected but would be severe, immediate and irreversible.

Mining activities may have limited affect on archaeological and historic period resources because resources will have been removed in earlier development stages. However, paleaontological materials may be directly affected by removal of McMurray Formation sands. This formation is not especially rich in fossils but is reported to contain molluscs, agglutinated foraminifera, fish teeth, spores and pollen grains (Carrigy 1974a). The scientific significance of these deposits is reflected in the "unknown" rating for this area on the sensitivity map issued by the Royal Tyrrell Museum of Palaeontology.

More significant are the fossils in the Devonian Waterways Formation, which underlies the oil-bearing strata of the McMurray Formation. This significance is reflected in the high sensitivity rating the Royal Tyrrell Museum of Palaeontology assigns areas that contain natural exposures of this formation; along the Athabasca River and the lowest section of the Muskeg River in this area. It is anticipated that mining activities will not affect these deposits.

2.4.3 Indirect Impacts

While related to the Project, construction of specific infrastructure facilities not included in the application, such as highway upgrades, gas and power transmission lines, and gravel extraction, will be subject to separate regulatory review processes. The impacts of these projects will be outlined in studies done in advance of review. The non-specific indirect impacts of the Muskeg

River Mine Project are difficult to predict, however, because it is not possible to forecast the levels of non-project-related activities that may ensue within the general region as a result of increased commercial or recreational activity.

Given the shallow burial of archaeological sites throughout the region, these types of resources are especially sensitive to many forms of surface impacts, as are on-surface historic period and traditional resources. Unregulated use of off-road vehicles or unregulated recreational developments, for example, could result in impacts to historical resources. Known significant sites could be directly affected but knowledge of their presence, coupled with effective educational programs, can significantly offset these types of impacts. However, without regionally extensive inventories, it is impossible to know how many historical resources are actually present in the area and whether any of these might be affected by activities that are conjecture at this point.

3.0 CULTURAL CONTEXT AND PREVIOUS ARCHAEOLOGICAL RESEARCH

The prehistory of the Lower Athabasca River basin region is plagued by problems characteristic of other portions of the boreal forest (Ives 1981b). After retreat of glacial ice and associated meltwaters, forest quickly colonized the landscape. Despite an extended period of lower moisture levels from about 8,000-4,000 years ago, vegetation maintained a continuous hold on the sediments of the region through the entire postglacial period. As a result, very low rates of sedimentary accumulation characterize all areas of the Boreal Forest except in major river valleys. Consequently, the entire prehistoric and historic archaeological record is usually confined to the upper 30 cm of mineral soil horizons where there is a continuous reworking of the loose sediments by tree throw and root action. Such conditions make it difficult to distinguish occupations relating to different periods within the 10,000-year record of human occupation in the region.

Compounding this problem are factors relating to the acidic nature of the soils in this region. Strong chemical weathering processes characteristic of the soils in these areas work effectively to remove any of the organic components of the archaeological record. The bone, leather, wood and plant materials that would have been essential parts of the original archaeological deposits of the region have long ago been eliminated, typically leaving only stone artifacts and their production debris as testimony to the activities that once took place. Finally, unlike the Plains where large-scale communal hunting of herd animals took place, hunting in the Boreal Forest typically involved capture of single animals in highly dispersed locations, frequently distant from campsite locations. Consequently, the spear, dart and arrows points, which elsewhere can be used as a means to obtain an approximate age for the archaeological assemblages they accompany, are often absent in sites in the Boreal Forest.

These factors limit definition of the recognized prehistory of northeastern Alberta. In contrast, extant documents, records and oral testimony provide a firmer basis for understanding the historic period of the region. The following provides a general summary of both periods in the study area.

3.1 Cultural Context

Generally, Alberta prehistory is divided into three major periods: the Early, Middle and Late Prehistoric Periods (see Vickers 1986). These correspond to periods of cultural development that are marked by changes in the weapon systems used, but also reflect complex cultural evolutionary

processes that include major technological advances. The prehistory of northeastern Alberta, however, is less well-defined than areas farther south, such as the Plains and Parklands regions. The sequence discussed below follows a recent summary provided by Ives (1993).

3.1.1 Early Prehistoric Period (10,000-7,500 years ago)

Most archaeologists believe that the Aboriginal people of North America began to move onto the continent during the last Ice Age while the sea levels were considerably lower than at present, because of the amount of water stored as ice on continental surfaces. As a consequence of reduced sea levels, the Bering Strait became a wide, open plain that extended from Siberia to Alaska. It is believed that small populations of people expanded into this previously uninhabited area as animal and plant life became plentiful. These groups would have continued to expand their territory into areas that contained adequate food supplies and were free of ice. One possible avenue that may have been used to enter continental North America could have been along the exposed continental shelf on the west coast (Fladmark 1989). A second route may have involved the use of an "ice-free corridor" along the eastern edge of the Rocky Mountains as the Keewatin and Cordilleran Ice Sheets began to retreat (Ives et al. 1989). Some Aboriginal people believe that they have lived here since Creation.

The Early Prehistoric Period is characterized by the presence of spear heads in archaeological assemblages (Figure 3). Little information from the early part of the cultural sequence has been recovered from the study region. Although Clovis is the first well documented archaeological culture in North America, no Clovis sites have been found in the Regional Study Area. The people who made Clovis points were highly nomadic, primarily hunting the mega-fauna of the Late Pleistocene Epoch, such as mammoth, camel, bison, muskoxen and horse, as well as various smaller game and aquatic resources. The next archaeological culture is Folsom, which was well established on the Northern Plains by 10,000 years BP. (Frison 1991). Clovis and Folsom projectile points are well-crafted spear heads that have been thinned at the base end by precise removal of flakes.

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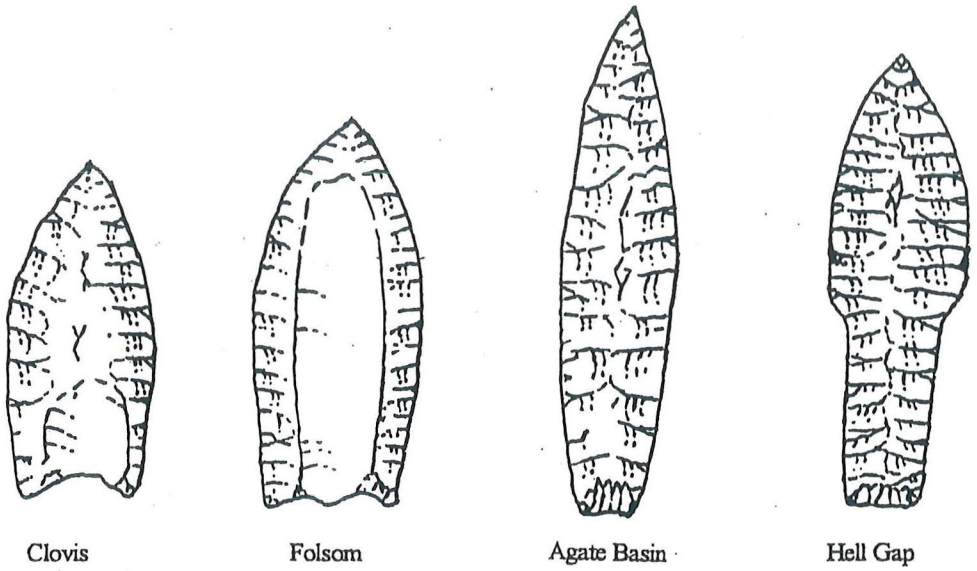

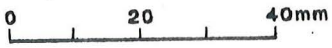

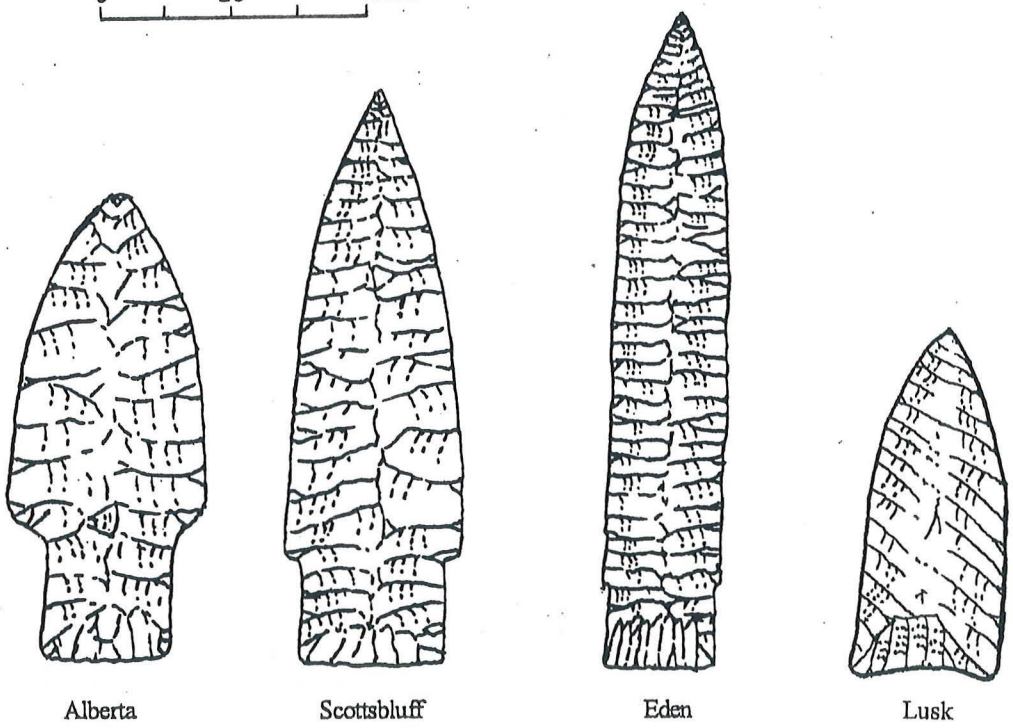

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EARLY PREHISTORIC PERIOD
PROJECTILE POINT STYLES

27 JAN 98	Figure 3	DRAWN BY: CG

These flakes were removed to facilitate hafting the spear head to a wooden shaft, and are often referred to by archaeologists as "flutes." There have been no fluted projectile points recovered from the Regional Study Area, although one fluted point made from Beaver River Sandstone has been recovered near Cold Lake (McCullough Consulting Ltd. 1981a).

Although prehistoric peoples may have been present in the general study area as early as 10,000 to 10,500 years ago, recent geological studies (Smith and Fisher 1993) have established a relatively concrete potential beginning date for the prehistory of the area surrounding the Project. About 9,900 years ago, a massive discharge of meltwater from Glacial Lake Aggasiz scoured the study area land surface on its way north to the Arctic Ocean. This would have removed any traces of prior occupation and would have established the landscape for subsequent colonization by vegetation communities, animals and human hunters.

The earliest evidence of prehistoric use of the area is a spear point recovered from the Beaver River Quarry on Syncrude's Lease 22 (Syncrude 1974). This style of point resembles specimens known as Agate Basin, which have been dated elsewhere along the southern margin of the forest at 8,500-7,500 years ago (Buchner 1981), but are known to occur on the Northwestern Plains as early as 10,500 years ago (Frison 1991). Somewhat similar styles of point have been recovered outside the study area at the Gardiner Lake Narrows site in the Birch Mountains (Sims 1976b). In addition, a broken specimen recovered from the Lease 13 project area (Sims 1975) exhibits attributes similar to a style known as Hell Gap which, in the southern Plains, dates between 10,000 and 9,500 years ago.

It has been suggested (Ives 1993) that certain less distinctive point styles also recovered in the Birch Mountains may relate to initial penetration of the early spruce forest of the region, ultimately deriving from Alaskan populations that date as early as 10,700 years ago. Generally these specimens, and perhaps some of the others listed above, fit within a cultural entity known as the Northern Plano Tradition (MacNeish 1964), which is believed to date between 7,000 and 8,000 years ago in the Canadian Shield area of the District of Mackenzie and relates to caribou hunting following deglaciation (Gordon 1975). However, without firmly dated intact archaeological assemblages that can be directly linked with these point types, the questions of dating and origins of first populations remain unresolved.

Occupation of the region, except during the earliest portion of this period, coincides with a climatic interval known as the Hypsithermal, which dates from around 9,000 to 5,000 years ago (see Anderson et al. 1989, Ritchie 1976, Schweger et al. 1981). In more southerly environments, this extended period of warm and dry conditions resulted in a retreat of forest margins as much as 120 km (Litchi Federovitch 1970), and drying of many lakes in the Parklands (Schweger and Hickman 1989). However, in the Regional Study Area it would appear that the effects of this extended period of drought were ameliorated, with the possible exception of significantly higher rates of forest fire, and that the modern mixedwood forest had been established by 6,000 years ago (Vance 1986). With modern fire control practices, and the absence of fires purposely started by Aboriginal peoples to enhance habitat productivity (Lewis 1977), it is suspected that the grassland components of this generalized ecozone would have been far greater than is observed today. Certainly during the Hypsithermal climatic interval, grasslands would have been a prominent feature of the regional vegetative cover and would have supported larger numbers of grazing herbivores than would be predicted for later periods.

3.1.2 Middle Prehistoric Period (7,500-1,200 years ago)

The beginning of the Middle Prehistoric Period is characterized by the first appearance of dart points in the cultural chronology (Figure 4). Dart points are typically slightly smaller than spear points and are associated with the advent of the spear thrower or atlatl. The use of spear throwers greatly improved the distance a spear could be thrown. In spite of the presumably increased environmental productivity during the early portion of this period, no radiometrically dated sites have been identified in the vicinity of the Project area. Specimens recovered from surrounding regions exhibit formal qualities similar to samples dated elsewhere. Large side and corner notched points occur in both the Shield Archaic (6,500-1,700 B.P.) of the forest/barrenlands transition zone (Wright 1972) and the Mummy Cave sequence (7,500-5,500 B.P.) on the Plains (Vickers 1986). A single point recovered from within the Lease 13 area has been tentatively assigned a Shield Archaic affiliation (Ronaghan 1981) and may relate to a Middle/Late Shield Archaic occupation that may date between 3,500 and 1,750 years ago. However, without a firmly associated assemblage and means of absolute dating, it is difficult to assess the significance of this find.

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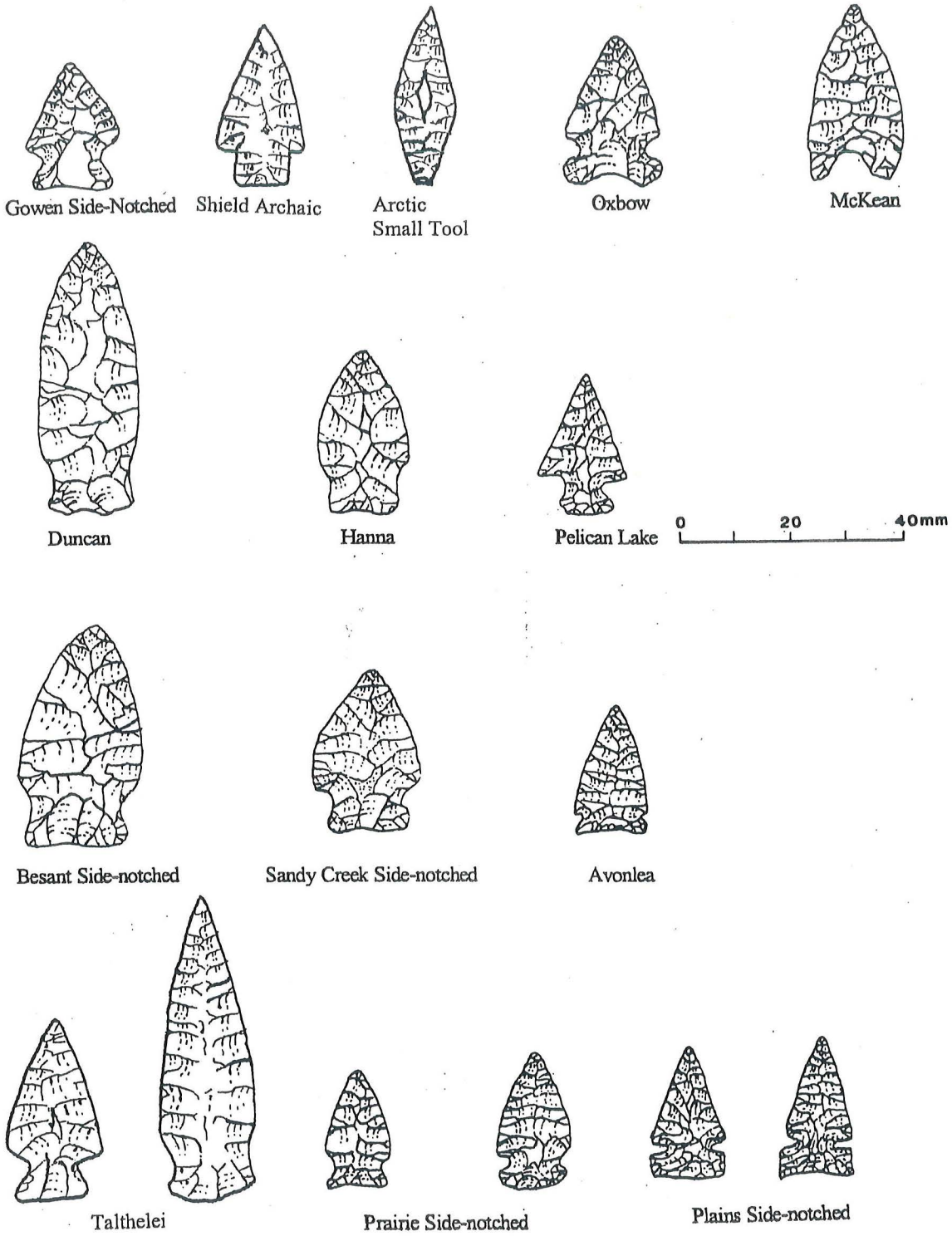

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LATE AND MIDDLE PREHISTORIC PERIOD PROJECTILE POINT STYLES

27 JAN 98	Figure 4	DRAWN BY: CG

Limited indications of Middle Prehistoric Period use of the region were obtained from the Wentzel Lake site in the Caribou Mountains to the northwest (Conaty 1977), where non-diagnostic stone tools and debitage have been recovered in stratified beach deposits. More tangible evidence of Middle Prehistoric use of the area has been recovered from the Bezya Site within the Muskeg River Mine Project area (LeBlanc and Ives 1986). Excavations at this site produced a large collection of microcores, ridge flakes, core tablets and microblades, which are thought to relate to an occupation by group(s) affiliated with others classified as belonging to an archaeological entity referred to as the Northwest Microblade tradition, defined in studies at Fisherman Lake in the Northwest Territories (Millar 1981) and in southwest Yukon (Workman 1978). A date of 3,990 years ago was obtained from charcoal believed to be associated with this assemblage of stone artifacts.

As well as the distinctive microcore and blade materials described above, a series of side and corner notched points recovered from the Eaglenest Portage and Gardiner Lake Narrows Sites (Ives 1993) are believed to be best compared with the same Complex (Pointed Mountain) of occupations recovered from Fisherman Lake in the Northwest Territories that include the Northwest Microblade Tradition materials (Millar 1981). Again, no dates are available, but they are presumed to post-date 3,900 years.

Materials suggesting influences from the Plains and Parklands of central Alberta have also been recovered from archaeological sites to the south and west. McKean Complex points have been reported from sites in the Lac La Biche area and Oxbow style points have been obtained from sites at North Wabasca Lake, the Birch Mountains and along the Lower Athabasca River (Ives 1993). These specimens span a period between 5,500 and 2,500 years ago in more southerly areas. Contrasting northern influences are suggested in the presence of a few specimens that may relate to southward expansion of another that includes use of microblade technology, archaeological complex known as the Arctic Small Tool Tradition, between 3,500 and 2,650 years ago (Wright 1975, Gordon 1977b). Two specimens from the Gardner Lake Narrows site in the Birch Mountains may relate to an occupation of the study region by these peoples, but no dates are available.

The final stage of the Middle Prehistoric Period is presumed to be represented by materials relating to the Taltheilei Shale Tradition defined for the Barrenlands of the Mackenzie District (Gordon 1977a, 1977b). This complex of materials includes large lanceolate and stemmed points in its early expressions and smaller corner and side notched specimens in its later expressions. This tradition spans a period between 2,650 years ago and the earliest historic times (A.D. 1750). It is also

considered to represent Athapaskan speaking peoples ancestral to the historic Dene of the region (Gordon 1976, 1977b). Although the occasional specimen recovered in Alberta has been associated with the Early and Middle Period Taltheilei Shale Tradition occupations (Ives 1993), no major presence has yet been defined. The later stages of this occupation are considered to fall in the Late Prehistoric Period discussed below.

3.1.3 Late Prehistoric Period (1,200-300 years ago)

The beginning of the Late Prehistoric Period coincides with the appearance of new technological advances in the material culture of the region. Changes in hunting equipment include the replacement of the atlatl by the bow and arrow. This is recognized archaeologically by a reduction in the size of the projectile point, especially around the neck, because an arrow shaft is necessarily smaller in diameter than an atlatl dart shaft (Figure 4). The bow and arrow allowed for more effective exploitation of big game because of its superior rate of fire, accuracy and the fact that no startling body movement is necessary to deliver the weapon (Reeves 1990). This period lasts until the introduction of firearms, and other cultural materials of European origin, distributed through the fur trade.

The Late Prehistoric Period begins at approximately 1200 years B.P. in this region and corresponds with the beginning of the Late Taltheilei phase. Late Taltheilei assemblages contain large lanceolate points as well as arrow points. Bone projectile points also occur in some Taltheilei assemblages (Gordon 1975). Within the Lower Athabasca region the small corner and side notched specimens that occur in a series of site assemblages are probably best considered as representing occupations by Late Taltheilei tradition groups (Ives 1993). The best Late Prehistoric record available for the region comes from excavations at the well stratified Peace Point Site in Wood Buffalo National Park (Stevenson 1985, 1986). Although a series of well-separated occupation surfaces containing well-preserved faunal remains and features, such as hearths and activity areas, were defined, only one projectile point, a small side notched specimen dating 1,040 years ago, was recovered. This fine-grained archaeological record provides excellent information on site formation process and structural use of space, but provides little information on pertinent cultural questions relating to the appearance of Athapaskan speaking peoples in the region, as has been inferred in Gordon's (1977a) interpretation of Taltheilei Tradition chronology and site distributions.

A 1792 entry in Alexander Mackenzie's journal indicates that when the Cree entered the study region they found the Athapaskan-speaking Beaver Indians resident in the area around the Athabasca/Clearwater River junction and that a group referred to as the "Slave" occupied lower portions of the Athabasca River basin (Mackenzie 1971:123). On the basis of linguistic and other evidence, archaeologists suggest that the initial movement of Athapaskan speaking peoples into the study region occurred in Late Prehistoric Period times between 1,500 (Gordon 1977a) and 1,200 years ago (Ives 1993).

3.1.4 Prehistoric Use of Beaver River Sandstone

Much of the prehistoric record of the study area exhibits an almost exclusive use of a single raw material type, known as Beaver River Sandstone (BRSS; see Fenton and Ives 1982, 1984, 1990), for production of stone artifacts. Because use of this material is so key to the prehistory of the region, its distribution and use will be discussed in some detail. Although at present there is no way to demonstrate it, the vast quantities of lithic waste materials of Beaver River Sandstone observed and recovered in near-surface contexts in archaeological sites within the study region are thought to relate to Late Prehistoric occupations by Late Taltheilei and other, as yet undefined, Late Prehistoric occupations. However, initial use of this material may have occurred as early as the Fluted Point tradition of Early Prehistoric times (McCullough Consulting 1980).

The Beaver River Sandstone type source was originally defined as "the siliceous cemented sandstone found at the Beaver River Quarry site (HgOv 29) and the subadjacent Beaver River borrow pit"(Fenton and Ives 1982:175). The source area for this material was stated to be the area surrounding the quarry and gravel pit, approximately one township in size, with outcrops occurring in localized regions along the Athabasca River (Fenton and Ives 1990). It is a fine-to medium-grained, light grey, bimodal, silica-cemented sandstone that may contain a low percentage of fine black grains (Fenton and Ives 1982). The name Beaver River Sandstone is used by archaeologists to describe the material that has this specific composition and localized source area. The material found at the Beaver River Quarry is of a rather coarse composition and is not fully consistent with most archaeological specimens recovered from sites in the region, leading Fenton and Ives (1990:133) to distinguish both fine - and coarse-grained varieties of this material, and to believe that an additional high quality outcrop had not been recorded.

Geologically, the source formation containing Beaver River Sandstone is situated at or near the top of the lower member of the McMurray Formation, which is Lower Cretaceous in age (Fenton and Ives 1984:130-131). The McMurray Formation itself lies unconformably over the karstic topography of the preceding Devonian Age Waterways Formation (Fenton and Ives 1984:130). Beaver River Sandstone-bearing portions of the McMurray Formation only outcrop in areas along the Athabasca River and possibly along some of its major tributaries. Very little Beaver River Sandstone has been observed in local tills or fluvial deposits. This may suggest that the materials used by people in the past were quarried from local outcrops rather than being collected from a wider distribution of naturally dispersed materials. This material comprises up to 99 or 100% of the material in lithic assemblages in the Fort McKay region (Fenton and Ives 1982:176). This is especially true for large sites close proximity to presumed exposed source locations along the Beaver River.

Recognition of a dense pattern of archaeological sites, containing the fine-grained variety of this material along the east bank of the Athabasca River in the vicinity of Cree Burn (or Isadore's) Lake and stretching into the hinterlands along the Muskeg River, indicates that other sources should be considered. Several researchers have considered this issue and attempts have been made to identify quarry locations for the fine-grained variety along the Athabasca River and its tributaries along the east side of the River. Ives and Fenton have suggested that bedrock outcrops maps can be used to predict possible exposures of intact BRSS deposits where the Athabasca and Muskeg rivers and some of their tributaries have cut sufficiently deep to intersect the target McMurray Formation deposits. They located three in-place outcrops of BRSS along the east side of the river but all exhibited only the coarse-grained variety (Ives and Fenton 1985); no outcrops were found on the slopes below the large Cree Burn Lake archaeological site. Ronaghan (1982a) searched a portion of the Athabasca River valley slopes as part of the proposed Alsands water intake facilities but did not identify BRSS exposures. Head and Van Dyke (1990) searched the lower portions of Mills Creek as part of mitigation activities within the area of the Cree Burn Lake Site and recovered several blocks tentatively defined as BRSS, but this identification has been questioned by J. Ives of the Archaeological Survey, Provincial Museum of Alberta (Reeves 1995).

The possibility of secondary (i.e., redeposited) sources of this material was investigated by Fenton and Ives (1984) through inspection of gravel pits, road cuts and natural exposures in the hinterlands back form the main river valley. Very limited evidence of this type of source material was encountered. Reeves (1995) has identified large boulders that may be BRSS exposed along reaches

of the Muskeg River and Jackpine Creek but has not confirmed their makeup. He has also noted a considerable number of "perched" boulders on ridges and table lands throughout the Muskeg River Mine and Aurora Project areas. He believes that these were emplaced by the Lake Aggasiz catastrophic flood of 9,900 years ago and that some may be BRSS (Reeves 1995:79). These suggestions have not been investigated. Reeves (1995:73) has further complicated the issue by citing a personal communication from a Syncrude geologist suggesting that the BRSS identified at the Beaver River Quarry is a large bedrock plate displaced and deposited by the Aggasiz flood and is therefore not an in situ occurrence. With all of these uncertainties it is evident that the issue of the location and distribution of the source(s) of BRSS has not been resolved and requires further study. The dense forest that blankets the study region is a major impediment to answering this question.

3.1.5 Protohistoric/Historic Period: 200 - 100 yr. B.P.

The appearance of European trade items in native occupations marks the beginning of the Historic Period. Taltheilei assemblages represent pre-European contact Dene or Athapaskan-speaking people in this region. The distribution of Taltheilei sites in the region is generally coincident with the known distribution of the Dene people at the onset of the fur trade (Van Dyke and Reeves 1985:92). Taltheilei sites in the Lower Athabasca region likely relate to the Beaver, Sekani, Slave and/or the Chipweyan people. The Taltheilei tradition has also been traced back over 2,600 years to the Yellowknife, Dogrib and the Chipweyan in the Barren Grounds and in the Great Slave-Great Bear Lakes region of the Northwest Territories (Gordon 1976a). It is difficult to determine the precise geographical boundaries that separated the different linguistic groups who lived in northern Alberta in the distant past, although information is available for the period immediately preceding European contact (Figure 5).

The Beaver Indians occupied the majority of northern Alberta including the entire Peace River valley below its confluence with the Smoky River, the district around Lake Claire and the Athabasca River valley south to Methy Portage and the Clearwater (Jenness 1963:382-384). MacGregor (1981:16) states that the Chipweyan, the Slave and the Sekani bordered the Beaver Indians to the east, north and west respectively. In a map showing the locations of Native group distributions, ca. A.D. 1700 (Figure 5), Magne (1987:224) does not mention which group was adjacent to the Beaver Indians on the west but places the Slave Indians to the north, the Chipweyan to the northeast and the Yellowknife Indians farther north, above Great Slave Lake. The

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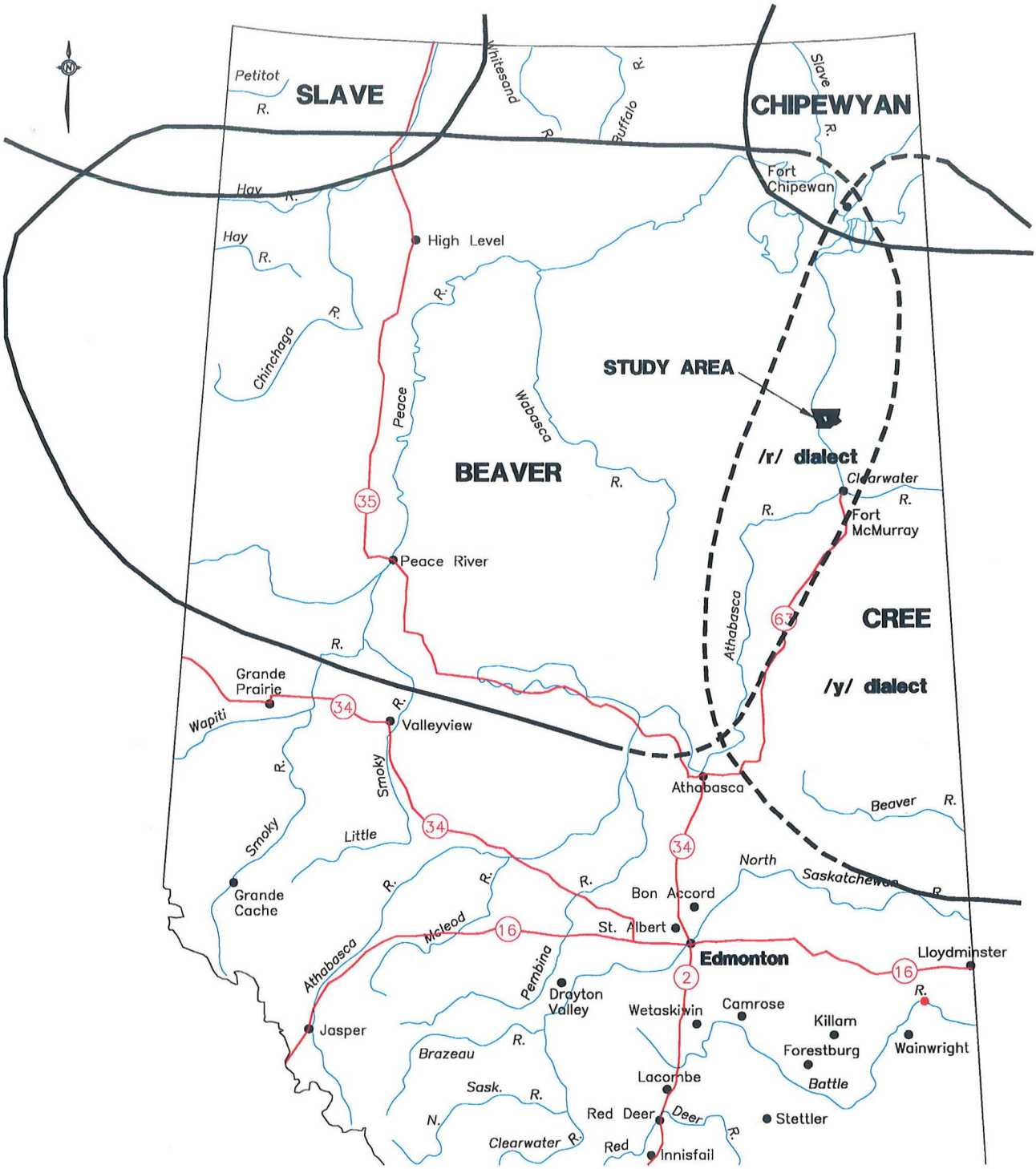

REFERENCE

AFTER MAGNE 1986

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POSTULATED NATIVE GROUP DISTRIBUTION c.a. A.D. 1700

12 JAN 1998	Figure 5	DRAWN BY: RFM

Algonkian-speaking Cree are also included along the eastern edge of the Athabasca River. With the exception of the Cree, all these groups are Dene peoples. The area along the foothills of the Rocky Mountains, between the upper Athabasca and the upper North Saskatchewan, was inhabited by another Athapaskan-speaking group, the Tsuu T'ina, formerly known as the Sarcee. The Sarcee, despite their linguistic ties to the Athapaskan speaking groups to the north, were politically aligned with the Algonkian-speaking Blackfoot Confederacy to the south (Ives 1985:25).

Before European contact, the Beaver Indians had been experiencing pressure from the Western Cree who were aggressively expanding their territory (Palmer 1990:9). The Cree pushed the Beaver Indians to the Peace River region to the west. It is usually thought that this territorial expansion was quite recent, as a result of the fur trade. Russell (1991), however, contends that there is evidence that the Cree were present and had knowledge of the Athabasca region well before the arrival of Europeans in the area. This would mean that the westward migration of the Cree was earlier and not a direct result of the fur trade. The Cree and the Beaver Indians eventually formed an alliance at Peace Point (approximately 80 km by air from Lake Athabasca) and agreed on territorial boundaries. Peace Point served as the border between the two groups (Russell 1991:164). The Cree are also said to have driven the Slave Indians out of their territory to the Slave River at approximately the same time as they pushed the Beaver Indians to the north and west. Nevertheless, the Cree were the indigenous group in the study region when Europeans first arrived in the late 1700s.

3.2 Regional History

3.2.1 Contact Period

Extensive trade networks had been in place between native peoples long before the Europeans were guided to the area, and, European trade goods began to arrive in the region through these networks decades before the first Europeans. Anthony Henday, the first European to enter Alberta, observed this trade network during his 1754 trip to an area near present-day Red Deer (MacGregor 1981). Henday was employed by the Hudson's Bay Company and had travelled west from York Factory on the shore of Hudson Bay with a group of Cree, during his stay in Alberta, Henday tried to entice the local Blackfoot people to come to Hudson Bay to trade, but they declined. On his return in the spring of that year, Henday again encountered the same

group of Blackfoot people. During this second meeting Henday observed the Blackfoot trading furs to his guides. It is evident that the Blackfoot and Cree peoples had previously established a trading network in which the Blackfoot procured the furs and the Cree delivered them to the Bay (MacGregor 1981). A similar established network would, no doubt, be in place with the Dene along the lower Peace and Athabasca river basins.

The fur trade continued to be the primary reason for Europeans to venture into the interior over the next few decades. These Europeans typically remained on the Plains and Parklands, expanding the line of fur trade posts up the Saskatchewan River. Under pressure from the rapidly expanding North West Company, the Hudson's Bay Company began to build inland posts beginning with Cumberland House in 1774. In 1778, Peter Pond, an employee of the North West Company, built the first fur trade post in the Athabasca region at the junction of the Athabasca and Embaras rivers (MacGregor 1981:36). Pond was also the first of the Europeans to take trade goods into the Athabasca region over Methy Portage (Palmer 1990:12) and was the first European to see the tar sands outcrops. Approximately eight years later Pond and his associates built another post at the mouth of the Clearwater River. In 1788, the North West Company built Fort Chipweyan on Lake Athabasca, which became their central post in the Athabasca region.

Alexander Mackenzie used some of the fur trade posts in the region as staging points in his efforts to find a river that flowed west to the Pacific Ocean. In 1789, just one year after the post had been built, Mackenzie left Fort Chipweyan and travelled north along the Mackenzie River to the Arctic Ocean. Later, in 1792, after spending time in England to learn more about astronomy and navigation, he set out to establish Fort Fork on the Peace River (Russell 1991:31). During this time Mackenzie described the tar sands outcrops along the Athabasca River. Mackenzie left the west permanently after spending the winter of 1793 on Lake Athabasca, seven years after his arrival in the Athabasca region (Russell 1991:31).

Four posts were established at the confluence of the Clearwater and Athabasca rivers between 1788 and 1821 (Chalmers 1974). Other posts in the region include an unnamed post at Fort Creek constructed by John Clark (1802), Pierre au Calumet's North West Company post also at Fort Creek (1819-1821), Berin's Hudson's Bay Company House at Fort Creek (1819-1821), which was later moved to the mouth of the McKay River, and St. German's House (after 1788-1802) (Chalmers 1974). In 1821 the last of the posts was shut down. In 1870, however, the region was given another chance when Henry Moberly built Fort McMurray for the Hudson's Bay Company

(Palmer 1990:144). The Hudson's Bay Company, again discouraged by the lack of trading, moved north in 1898 to establish Fort McKay. Several independent traders kept Fort McMurray alive until the arrival of the Alberta and Great Waterways Railway in the early 1920s, which eliminated the problem of bringing furs past the rapids on the Athabasca River (Palmer 1990:144-145). The presence of the railway also opened up the Athabasca region for oil and mineral exploration.

Based on early journal reports of the presence of insitu tar sands in the region, geological exploration began in the 1880s. Robert Bell of the Geological and Natural Survey of Canada examined the area in detail. In 1882, he recognized the Lower Cretaceous age of the tar sands strata and proposed a Devonian origin for the bitumen (Carrigy 1974b). He further suggested that a hot water extraction method might be feasible and that a pipeline to Hudson Bay might be able to deliver the oil for shipment to overseas markets. In 1888, R. G. McConnell of the same organization provided the first estimates of the extent of the resource, at not less than 4.2 million tons (Carrigy 1974b). In 1906 Count Alfred Von Hammerstein drilled the first well at the mouth of the Horse River, finding only salt. Later, in 1913, Sydney Ells with the Mine Branch in Ottawa, began a detailed survey of the tar sands exposures and by 1915 was able to lay demonstration pavement of this material in Edmonton (Carrigy 1974b).

In 1920, Mr. D. Diver made the first attempt at insitu production by lowering a heating unit to the bottom of a well near Fort McMurray. During the 1920s, K.A. Clarke and S.M. Blair of the University of Alberta erected hot water pilot extraction plants, first at the university, and later at the Dunvegan Railway yards in Edmonton. In 1927, R. C. Fitzsimmons formed the first commercial venture to develop tar sands, the International Bitumen Company, and established a plant at Bitumount, which by 1930, produced 8,400 gallons of bitumen (Carrigy 1974b). After K.A. Clarke was awarded the patent for his hot water process in 1928, the Research Council of Alberta erected a pilot extraction plant along the Clearwater River near Waterways in 1930. By 1936, the Abasand Oil Company formed by Max Bell completed construction of a 400 ton per day extraction plant on the Horse River, which was destroyed by fire in 1941. Through the latter part of World War II, the Canadian government undertook a drilling and coring program intended to outline reserves for emergency use, which culminated in the discovery of the rich Tar Island deposit now being exploited by Suncor (Carrigy 1974b).

On the basis of a 1950 report indicating that large-scale economic development of the tar sands was feasible, the Government of Alberta began issuing the first permits to oil companies in 1951

(Carrigy 1974b). Great Canadian Oil Sands was formed in 1954 to take over the interests of Oil Sands Ltd., the descendant of the International Bitumen Company. In 1957, Shell Oil Company of Canada began in situ steam-driven experiments on Lease 26. Other pilot projects and commercial proposals were initiated in 1959 by companies such as: Cities Service Athabasca Inc., Pan American Petroleum and Atlantic Richfield (who proposed explosion of a nuclear device beneath the oil sands). Great Canadian Oil Sands Ltd. (GCOS) applied in 1960 for permission to construct a 31,500 bbl/day plant at Tar Island and was given approval in 1962. Also in 1962, Shell Oil Company of Canada applied for approval of a 130,000 bbl/day operation using an insitu steam-drive process. In 1964, a consortium of companies including Atlantic Richfield, Cities Service, Imperial Oil and Gulf Oil formed the Syncrude consortium, which received approval to build its Mildred Lake plant in 1972 (Carrigy 1974b). The GCOS (now Suncor Inc.) plant went on stream in 1967 and in 1978 the Syncrude plant began production. Shell Canada Limited applied for approval of a mining and extraction and processing plant on Lease 13, first in 1973, and again in 1981 in conjunction with others in the Alsands Project Group.

4.0 1997 STUDY AREA AND PROCEDURES

Shell Canada Limited's Project area has been subject to historical resources studies over the course of several previous proposals for development, beginning as early as 1974. This has resulted in a complex situation with respect to management of known areas and resources and the need to assess concerns in areas not previously examined. A focused program of studies was adopted to meet these needs.

4.1 Objectives

The objective of the 1997 historical resources program was to bring all areas scheduled for development in the Project to the same level of historical resource management status, that is, having the requirements of an Historical Resources Impact Assessment (HRIA) completed. To accomplish this objective, it was necessary to review the historical resource status of the entire lease area in the light of previously obtained information. Combining this information with consideration of current development plans provided the basis for a program of studies that focused efforts on outstanding historical resource concerns throughout proposed development zones. The intended outcome of these investigations was design of an effective mitigation strategy that would incorporate all existing concerns, that could be implemented as various stages of the development proceeded and would comply with the requirements of the Alberta Historical Resources Act.

Previous archaeological studies in the Lease 13 area have identified a unique and important distribution of archaeological sites that appears to stand in significant contrast to similar areas within the Lower Athabasca River basin. The strategy undertaken for the Project HRIA considered the relevant research issues arising from previous archaeological study, but recognized the fact that the greatest progress toward resolution of these questions can be made with the larger samples and problem-oriented analysis of mitigation studies. Nevertheless, the study was designed to build on previous results to increase current understanding of regional prehistory, especially the issue of site distribution patterns.

The first step toward achieving these objectives was to review previous archaeological research in and adjacent to the Project development area and to establish the status of the areas examined as well as the resources identified within them. The second step was to establish the area requiring additional examination before the requirements of an HRIA could be considered complete. This

information is presented below while discussion of the program implemented and its results are presented in subsequent sections.

4.2 Previous Archaeological Study on Lease 13

Because the results of previous archaeological studies on Lease 13 have a direct bearing on the program completed, they will be reviewed in some detail (see Tables 2 and 3; Figures 6 and 7).

4.2.1 Oil Sands Related Work

In 1974 Shell Canada sponsored a pilot survey of the proposed Lease 13 development project (Sims and Losey 1975). Forty-seven prehistoric archaeological sites were identified by visual examination of natural and man-made exposures in select areas of Lease 13. Areas examined included cuts along the Athabasca and Muskeg rivers and Hartley Creek, disturbances created by the Fort Chipweyan winter road (now Hwy. 63), the lease road and clearing for an airstrip, a plant and various exploration programs. Sites seemed to occur relatively frequently and tended to cluster along the Athabasca River and its tributary drainages. However, identification of three sites in the hinterlands of Lease 13 hinted at an unusual site distribution that has been further revealed and described in subsequent studies. Sims concluded that the site potential of the lease area was high and predicted that 185 sites might occur in the Lease 13 area.

The project proposed in the early 1970s did not proceed, but HRIA studies were conducted for a revised project sponsored by a Shell Canada-led consortium known as the Alsands Project. The first of these was conducted in 1979 by Losey and Conaty (1979). It entailed application of sampling strategy employing a randomized technique for selection of areas to be examined, and a small judgmental examination component. the study focused on in areas defined for a proposed plant site, a mine site, a gravel extraction area and a proposed transportation corridor (Figure 6). Despite considerable effort, only two sites were identified in the randomized (probabilistic) sampling portion of the program and four sites were recorded in the judgmental component of the study.

Table 2 Historical Resource Studies in the Lease 13 Area

Permit	Project/Type	Reference	Sites Recorded
74-10	Hwy. 963 HRIA	Losey et al. 1975:	4
74-31	Shell Lease 13	Sims and Losey 1975	47
75-08	Athabasca River Survey	Donahue 1976	12
75-14	Hwy. 963: 12 - Survey	Sims 1975	2
76-05	Athabasca River Survey	Sims 1976a	32
77-43	Hwy. 963 HRIA	McCullough and Reeves 1978a	8 new, 11 revisited
78-71	Hwy. 963 - test excavations	Head 1979	known sites
79-56	Alsands Plant and Mine Site	Conaty 1979	6
79-124c	Hwy. 963 excavations	Mallory 1980	known sites
80-91	Alsands Tailings Pond Gravel area, Mine, etc.; Energy Corridor Townsite, Airstrip	Ronaghan 1981a, b	59 new, 11 revisited
80-202	Northwest Utilities Pipeline - HRIA	Ronaghan 1981c	3 new 1 revisited
81-64	Alsands Plantsite and Mine Post -clearance Survey	Ives 1982a, 1988	25 new 1 revisited
81-153c	Hwy. 963 - Controlled Surface Collection of the Cree Burn Lake Site	Ronaghan 1982b	known site
82-41	Alsands Plantsite and Mine Post -clearance Survey	Ives 1988	8
83-53	Bezya Site excavations	LeBlanc 1986	known site
83-54	Beaver River Sandstone Geological Study	Ives and Fenton 1985	known site
88-32	Hwy. 963 Cree Burn Lake Site - excavation	Head and Van Dyke 1990	known site
96-13	SOLV-EX gas pipeline HRIA	Gorham n.d	1 new, 1 revisit, 3 hist.
96-72	Syncrude Aurora project Phase I	Shortt	8 new, 3 revisit

Table 3 Historical Resource Sites in the Lease 13 Area

Known Sites in or Near Development Zones				Known Sites in Lease but Distant From Proposed Development		Post-Contact Traditional Sites in Lease
HhOu 1	HhOu-31	HhOv 72	HhOv 112	HhOu 8	HhOv 51	Fred Boucher cabin
HhOu 2	HhOu-32	HhOv 73*	HhOv 113	HhOu 9	HhOv 52	4-25-95-10-W4
HhOu 3	HhOv 3	HhOv 74	HhOv 114	HhOu 10	HhOv 53	Raymond Boucher cabin
HhOu 4	HhOv 4	HhOv 75	HhOv 115	HhOu 11	HhOv 54	4-24-95-10-W4
HhOu 6	HhOv 5	HhOv 76	HhOv 116	HhOu 12	HhOv 55	Louis Tourangeau cabin
HhOu 7	HhOv 6	HhOv 77	HhOv 117	HhOu 13	HhOv 56	1-7-95-10-W4
HhOu 8	HhOv 10	HhOv 78	HhOv 118	HhOu 14	HhOv 61	Isadore Lacorde cabin/grave
HhOu 9	HhOv 11	HhOv 79	HhOv 119	HhOu 15	HhOv 62	(Mile 49)
HhOu 10	HhOv 16	HhOv 80	HhOv 120	HhOu 34	HhOv 63	15-18-95-W4
HhOu 11	HhOv 17	HhOv 81	HhOv 121	HhOv 22	HhOv 64	
HhOu 12	HhOv 18	HhOv 82	HhOv 122	HhOv 27	HhOv 68	
HhOu 13	HhOv 19	HhOv 83	HhOv 123	HhOv 28	HhOv 69	
HhOu 14	HhOv 20	HhOv 84	HhOv 124	HhOv 29	HhOv 146	
HhOu 15	HhOv 21	HhOv 85	HhOv 125	HhOv 49	HhOt-1	
HhOu 16*	HhOv 22	HhOv 86	HhOv 126	HhOv 50		
HhOu 17	HhOv 31	HhOv 87	HhOv 127			
HhOu 18	HhOv 32	HhOv 88	HhOv 128			
HhOu 19	HhOv 33	HhOv 89	HhOv 129			
HhOu 20	HhOv 34	HhOv 90	HhOv 130			
HhOu 21	HhOv 36	HhOv 91	HhOv 131			
HhOu 22	HhOv 37	HhOv 93	HhOv 132			
HhOu 23	HhOv 38	HhOv 94	HhOv 133			
HhOu 24	HhOv 39	HhOv 96	HhOv 134			
HhOu 25	HhOv 40	HhOv-105	HhOv 135			
HhOu 26	HhOv 67	HhOv 106	HhOv 137			
HhOu 27	HhOv 68	HhOv 107	HhOv 138			
HhOu 28	HhOv 69	HhOv 108	HhOv 139			
HhOu 29	HhOv 70	HhOv 109				
HhOu-30	HhOv 71	HhOv 111				

*significant sites

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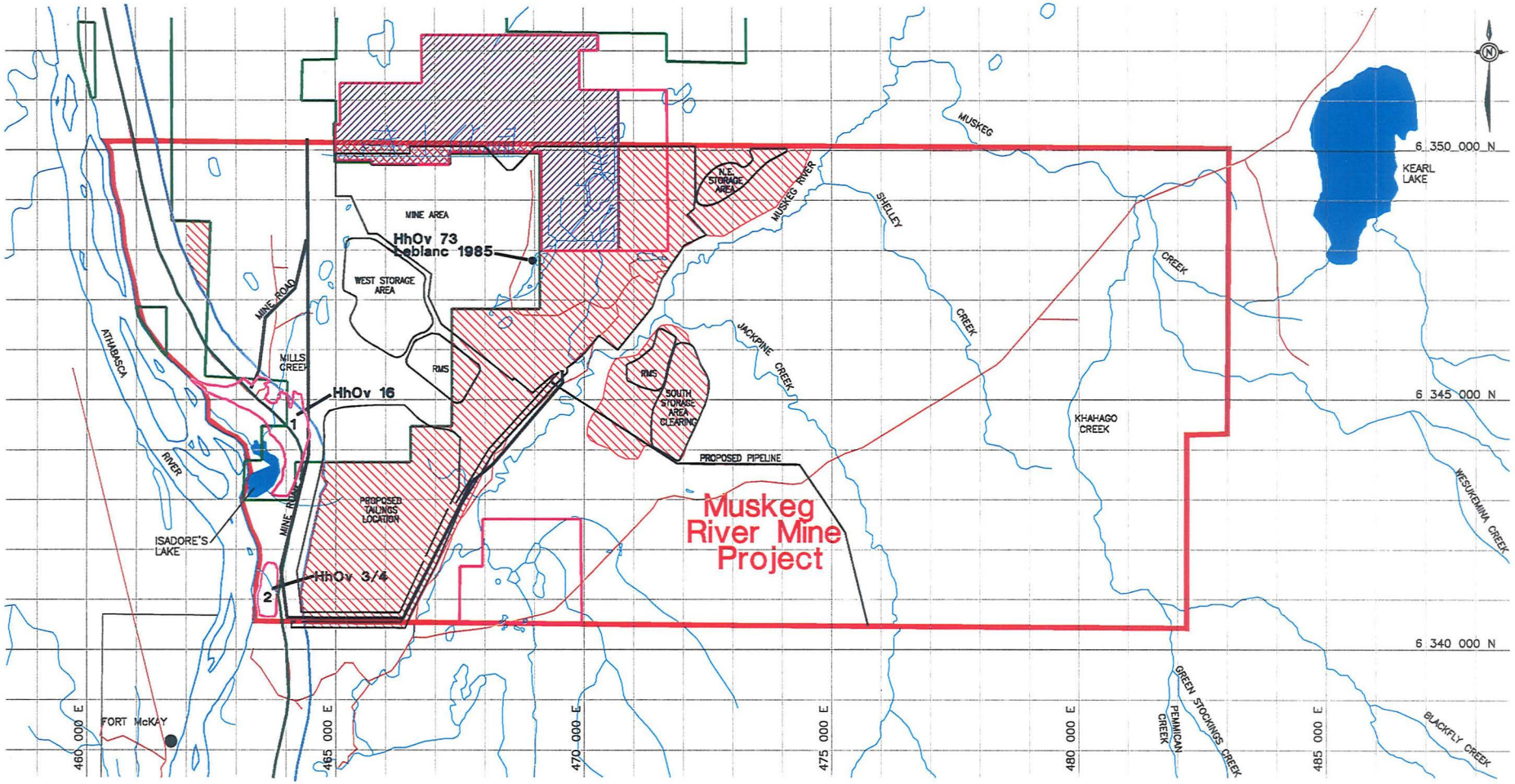

0 1000 2000 3000 4000 5000

SCALE IN METERS

REFERENCE

DIGITAL DATA SETS 74D, 74E, 74I
84A AND 84H FROM RESOURCE DATA DIVISION
ALBERTA ENVIRONMENTAL PROTECTION, 1997.

LEGEND

- **1** Mallory 1980, Head 1979, Head and VanDyke 1990, Ronaghan 1980,1982
- **2** Mallory 1980, Head 1979
- Conaty 1979
- Ronaghan 1981B
- Energy Corridor – Ronaghan 1981A
- Highway 963 – McCullough and Reeves 1978
- Ives 1981,1982
- 1997 HRIA

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PREVIOUS HISTORICAL RESOURCES IMPACT ASSOCIATED STUDIES AND 1997 HRIA

12 JAN 98	Figure 6	DRAWN BY: CG

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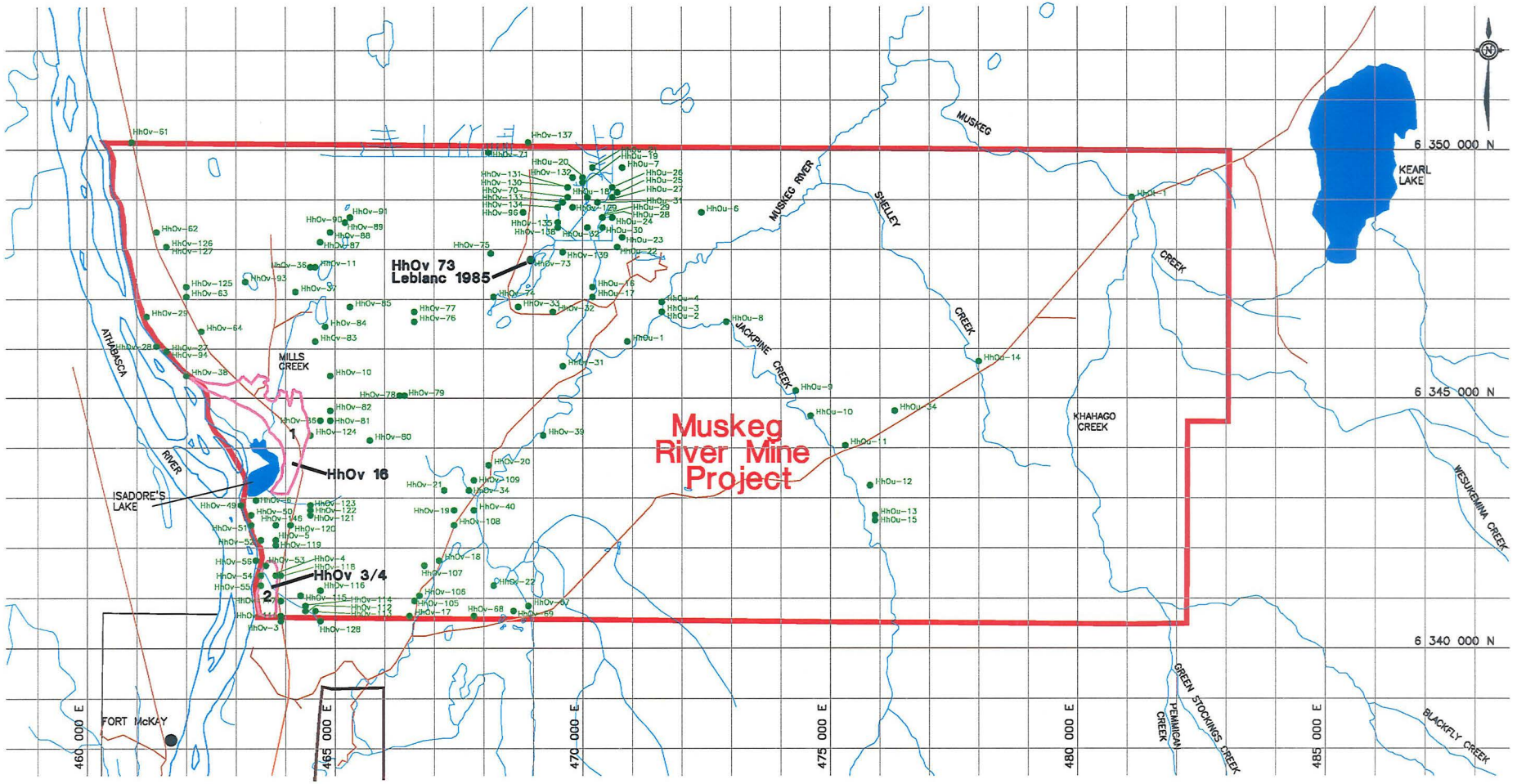

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SCALE IN METERS

REFERENCE

DIGITAL DATA SETS 74D, 74E, 74I
84A AND 84H FROM RESOURCE DATA DIVISION
ALBERTA ENVIRONMENTAL PROTECTION, 1997.

LEGEND

1 Mallory 1980, Head 1979, Head and VanDyke 1990, Ronaghan 1980,1982

2 Mallory 1980, Head 1979

HhOu 1 Borden Location and Number

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SHELL CANADA LIMITED

KNOWN ARCHAEOLOGICAL SITES ON LEASE 13

12 JAN 98	Figure 7	DRAWN BY: CG

Additional components of the proposed Alsands project were examined in 1980 (Ronaghan 1981b). Based on topographic considerations, an intensive subsurface test program was instituted on features believed to have significant historical resource potential. Raised features were examined throughout areas proposed for development of a second mining area, a tailings pond, two muskeg storage areas, a second gravel resource area and three water intake areas along the Athabasca River (Figure 6). This study recorded 42 prehistoric sites and one historic period site. Also included in the areas examined was a 90 m wide corridor paralleling the Hwy. 963 right of way, which was to include various facilities, and extended well outside the lease area (Ronaghan 1981a). An additional 27 prehistoric sites were recorded during that study.

In 1981 and 1982, after the collapse of the Alsands project proposal, Alberta Culture undertook a followup examination of the 1979 study areas, which had been cleared of forest cover under winter conditions (Ives 1982, 1993; Figure 6). Due to the excellent visibility, 25 sites were recorded in the initially proposed mine and plant site area. These sites were situated on the same kinds of features that had been productive in the 1980 studies and confirmed a high site density in the hinterlands of Lease 13. It is significant that winter forest clearance had left many of these sites relatively intact, retaining a potential for more detailed study.

Finally, as a followup to the above studies, Alberta Culture archaeologists returned to conduct research excavations at one of the sites identified in the second mine area examined in 1980 (LeBlanc 1986). The site ("Bezya"; HhOv 73) was determined to represent an occupation hitherto previously unknown outside the Northwest Territories and demonstrated a degree of resource variation not previously apparent. Sites identified in Shell's Lease 13 are shown in Figure 7.

4.2.3 Research Studies

Two earlier research surveys sponsored by the Alberta government may have a bearing on historical resource issues in the Local Study Area. Examination of exposures along the Athabasca River by Donahue (1976) and Sims (1976a) identified 12 and 32 sites respectively, 13 of which occur within the Lease 13 area.

4.2.4 Highway Transportation Corridor Studies

A considerable number of archaeological studies have been conducted in response to proposals to develop transportation facilities along a corridor paralleling the east bank of the Athabasca River (McCullough and Reeves 1978b, Head 1979, Ronaghan 1981a and 1982b, Head andVan Dyke 1990 and Gorham n.d.). These studies have resulted in identification of a dense concentration of sites near the valley rim, especially above an abandoned oxbow lake known variously as Cree Burn or Isadore's Lake. Many of these sites have suffered impacts, resulting in the destruction of several; mitigation studies have been done at other sites; and, some sites remain largely intact. The most significant of these sites, the Cree Burn Lake Site (HhOv 16), has been recently nominated for designation as a provincial Historical Resource (Lifeways of Canada 1997).

4.3 Historical Resources Act Status of Development Areas and Sites

In Alberta, historical resource management is a two-stage process, involving an Impact Assessment (HRIA) and a Mitigation stage (HRIM). When a final HRIA report is accepted, the first stage is considered complete for the area specified in the permit granted by Alberta Community Development (ACD). HRIA reporting requirements include formulation of management recommendations for the area in question and the resources identified. These recommendations are reviewed by ACD and the remaining requirements of the Act are established before development approval. Generally, fulfilling these requirements is considered to have mitigated project impacts and allows developments to proceed. Certain subareas and sites within Lease 13 are at different stages in this management process and require different levels of attention depending on their relationship to the currently proposed project. The following paragraphs identify the presumed status of previously examined development areas under the Act. Because these interpretations formed the basis of the permit application approved by ACD, they can be considered acceptable. Table 4 lists known archaeological and historical sites within or adjacent to Lease 13 Boundaries and indicates requirements established under the provision of the Alberta Historical Resources Act where these are available.

Table 4 Historical Resource Act Status of Previously Recorded Sites on Lease 13

Borden Number	Type	Permit	UTM E	UTM N	Setting	Condition	Significance	Recommendation	H.R. Act Status/ Outstanding Req.
HhOu 1	cs	74-31	709	459	Muskeg R.	disturbed	not assessed	None given.	
HhOu 2	cs	74-31	716	465	Muskeg R.	disturbed	not assessed	None given.	
HhOu 3	cs	74-31 79-56	716	465	Muskeg R.	disturbed	not assessed	None given.	
HhOu 4	ss	74-031 79-056	716	467	Muskeg R.	largely disturbed	not assessed	None given.	
HhOu 6	ss	74-31	724	485	ridge	disturbed	significant	Test excavate.	
HhOu 7	cs	74-31	708	494	lake	disturbed	not assessed	None given.	
HhOu 8	ss	74-031 79-056	729	463	Jackpine Creek	disturbed	not assessed	None given.	
HhOu 9	ss	74-031	743	449	Jackpine Creek	disturbed	not assessed	None given.	
HhOu 10	ss	74-031	746	444	Jackpine Creek	disturbed	not assessed	None given.	
HhOu 11	ss	74-031 89-052	753	438	Jackpine Creek	disturbed	not assessed	None given.	
HhOu 12	ss	74-031 79-056 89-052	758	430	Jackpine Creek	disturbed	not assessed	Shovel test.	
HhOu 13	ss	74-031 79-056 89-052	759	424	Jackpine Creek	disturbed	not assessed	Test excavate.	
HhOu 14	ss	74-031 89-052	780	455	Shelley Creek	disturbed	not assessed	Shovel test.	
HhOu 15	ss	74-31	749	423	Jackpine Creek	disturbed	not assessed	None given.	
HhOu 16	cs/ws	80-91	702	470	ridge	undisturbed	unknown	Test excavate.	
HhOu 17	hist.	80-91	702	468					
HhOu 18	cs/ws	81-64	701	488	hill	partially disturbed	not assessed	No further work.	
HhOu 19	ss	81-64	700	491	ridge	partially disturbed	not assessed	No further work.	
HhOu 20	ws	81-64	700	492	knoll	partially disturbed	not assessed	No further work.	
HhOu 21	if	81-64	702	494	knoll	partially disturbed	not assessed	No further work.	
HhOu 22	if	81-64	707	478	knoll	partially disturbed	not assessed	No further work.	
HhOu 23	if	81-064	708	480	ridge	partially disturbed	not assessed	No further work.	
HhOu 24	ss	81-064 82-041	706	484	ridge	partially disturbed	not assessed	Test excavate.	
HhOu 25	ws	81-064	707	489	ridge	partially disturbed	not assessed	No further work.	
HhOu 26	if	81-064	706	490	ridge	partially disturbed	not assessed	No further work.	
HhOu 27	c/ws	81-064 82-041	706	488	hill	partially disturbed	not assessed	Test excavate.	
HhOu 28	if	81-64	704	484	ridge	partially disturbed	not assessed	No further work.	
HhOu 29	if	81-64	704	484	ridge	partially disturbed	not assessed	No further work.	
HhOu-30	if	81-064	704	482	ridge	partially disturbed	not assessed	No further work.	
HhOu-31	if	81-064	703	487	ridge	partially disturbed	not assessed	No further work.	
HhOu-32	if	81-064	701	482	ridge	partially disturbed	not assessed	Test excavate.	
HhOu-34	ws	89-052	763	445	knoll	disturbed	unknown	Shovel test.	
HhOv 3	ss	74-31 76-005 78-071 79-56	639	403	Athabasca River	destroyed?	significant	Revisit.	

Borden Number	Type	Permit	UTM E	UTM N	Setting	Condition	Significance	Recommendation	H.R. Act Status/ Outstanding Req.
HhOv 4	ss	74-31 77-87 78-71 79-12 80-91	638	412	Athabasca River	destroyed	significant	Revisit.	Mitigation unspecified
HhOv 5	ss	74-031 79-056	638	419	Athabasca River	?	significant	Revisit.	
HhOv 6	ss	74-31	634	427	Athabasca River	?	significant	Relocate.	
HhOv 10	ss	74-031 79-056 80-091	649	452	Shelley Creek	disturbed	?		
HhOv 11	ss	74-031 80-202	646	474	Shelley Creek	disturbed	?	Revisit.	
HhOv 16	cs/ws	77-043 76-005 77-043 78-071 79-056 80-091 80-202 81-153 83-054 88-032	639	449	Cree Burn Lake	partially disturbed	high	Avoid.	Avoid (Dec. 2/81) Mitigation unspecified (Dec. 1/81)
HhOv 17	ss	74-031 79-056 80-091	665	404	Muskeg River	disturbed	unknown	Avoid.	Avoid (Dec. 2/81) NC (Deco 1/81)
HhOv 18	ss	74-31 79-56 80-91	671	415	Muskeg River	disturbed	significant	Surface collection.	Avoid (Dec. 2/81) NC (Dec. 1/81)
HhOv 19	ss	74-031	674	425	Muskeg River	disturbed	?	?	
HhOv 20	ss	74-031 80-091	681	434	Muskeg River	destroyed	none	No further work.	No Concern Released (NC)
HhOv 21	ss	74-31	672	429	ridge	destroyed	not assessed	Relocate.	
HhOv 22	ss	74-031 79-056	682	410	ridge	destroyed	not assessed	Relocate.	
HhOv 27	buried	75-8	616	457	Athabasca River			Relocate.	
HhOv 28	ss	75-8	614	458	Athabasca River	disturbed	none	None.	
HhOv 29	ss	75-8	612	464	Athabasca River	undisturbed	significant	Relocate.	
HhOv 31	if	74-31	696	454	hinterlands	destroyed	none	None.	
HhOv 32	ss	74-31	694	465	?	destroyed	none	None.	
HhOv 33	if	74-31	687	466	?	destroyed	none	None.	
HhOv 34	if	74-31	677	429	Muskeg River	destroyed	none	None.	
HhOv 36	if	74-31	645	474	Unnamed lake	destroyed	none	None.	
HhOv 37	if	74-31	642	469	Unnamed lake	destroyed	none	None.	
HhOv 38	if	74-31	620	452	Unnamed lake	destroyed	none	None.	
HhOv 39	if	74-31	692	44	?	destroyed	none	None	
HhOv 40	if	74-31	678	425	Muskeg River	destroyed	none	None.	
HhOv 49	ss	76-005	631	426	Athabasca River	unknown	significant	None given.	
HhOv 50	ss	76-005	633	424	Athabasca River	unknown	significant	None given.	
HhOv 51	ss	76-005	633	422	Athabasca River	unknown	significant	None given.	
HhOv 52	ss	76-005	635	419	Athabasca River	unknown	significant	None given.	NC
HhOv 53	ss	76-005	636	414	Athabasca River	unknown	significant	None given.	NC
HhOv 54	ss	76-005	635	412	Athabasca River	unknown	significant	None given.	
HhOv 55	ss	76-005	635	410	Athabasca River	unknown	significant	None given.	
HhOv 56	ss	76-005	634	415	Athabasca River	unknown	not significant	None given.	

Borden Number	Type	Permit	UTM E	UTM N	Setting	Condition	Significance	Recommendation	H.R. Act Status/ Outstanding Req.
HhOv 61	ss	77-43	609	499	ridge	disturbed	none	No further work.	
HhOv 62	ss	77-43	614	481	ridge	disturbed	none	No further work.	
HhOv 63	ss	77-043	620	468	ridge	disturbed	none	No further work.	
HhOv 64	ss	77-043	623	461	ridge	disturbed	none	No further work.	
HhOv 67	ss	79-56	689	406	knoll	?	none	No further work.	
HhOv 68	cs/ws	79-056 80-202	678	404	ridge	?	none	No further work.	
HhOv 69	ss	79-56 80-202	686	405	ridge	disturbed	significant	Avoid.	
HhOv 70	ss-bur	79-56 81-064	697	488	ridge	undisturbed	significant	Excavate.	NC
HhOv 71	buried	79-56 80-91	681	497	ridge	undisturbed	none	Mitigated.	mit. complete - NC
HhOv 72	buried	79-56	405	405	ridge	disturbed	significant	Test excavate.	
HhOv 73	buried	80-91 83-53	690	475	ridge	undisturbed	high significance	Excavate.	very significant - mitigation unspecified
HhOv 74	cs	80-91	682	468	ridge	undisturbed	significant	Excavate.	3 2x2 m units
HhOv 75	if	80-91	477	477	ridge	undisturbed	none	No further work.	NC
HhOv 76	if	80-91	666	463	ridge	partially disturbed	none	No further work.	NC
HhOv 77	if	80-091	666	465	ridge	partially disturbed	none	No further work.	NC
HhOv 78	if	80-091	663	448	ridge	undisturbed	none	No further work.	NC
HhOv 79	if	80-091	664	448	ridge	undisturbed	none	No further work.	NC
HhOv 80	if	80-091	657	439	ridge	undisturbed	none	No further work.	NC
HhOv 81	ws	80-091	649	443	ridge	undisturbed	significant	Excavate.	2x2 m test
HhOv 82	cs/ws	80-091	649	445	unnamed lake	unknown		Test excavate.	2 2x2 m units
HhOv 83	ss	80-091	646	459	unnamed lake	destroyed	none	No further work.	NC
HhOv 84	cs/ws	80-091	648	462	unnamed lake	disturbed	unknown	Test excavate.	Surface collection, 2x2 m unit
HhOv 85	if	80-091	653	466	knoll	undisturbed	none	No further work.	NC
HhOv 86	cs/ws	80-91/	647	443	Athabasca River	undisturbed	significant	Excavate.	4 3x3 m units
HhOv 87	cs	80-91/	647	479	ridge	undisturbed	significant	Test Excavate.	5x5 m excavation
HhOv 88	ss	80-91/	649	481	unnamed lake	partially disturbed	unknown	Test Excavate.	Surface collection, 2x2 m test
HhOv 89	ss	80-91/	652	483	unnamed lake	disturbed	none	No further work.	NC
HhOv 90	cs/ws	80-91/	652	484	unnamed lake	undisturbed	unknown	Test excavate.	2x2 m test
HhOv 91	cs/ws	80-91/	653	484	unnamed lake	undisturbed	unknown	Test excavate.	2x2 m test
HhOv 93	if	80-91/	633	471	unnamed lake	undisturbed	none	No further work.	NC
HhOv 94	ss	74-31 80-91	616	457	Athabasca River	undisturbed	none	No further work.	Avoid
HhOv 96	if	80-91	688	485	ridge	disturbed	none	No further work.	NC
HhOv 105	if	80-91	666	407	ridge	destroyed	none	No further work.	NC
HhOv 106	if	80-91	667	408	ridge	destroyed	none	No further work.	NC
HhOv 107	cs/ws	80-91	668	414	ridge	destroyed	none	No further work.	NC
HhOv 108	if	80-91	674	422	ridge	destroyed	none	No further work.	NC
HhOv 109	cs/ws	80-91	678	431	ridge	disturbed	significant	Avoid.	Avoid
HhOv 111	cs/ws	80-91 80-202	639	404	ridge	disturbed	unknown	Test excavate.	mitigation unspecified
HhOv 112	if	80-91	644	405	ridge	undisturbed	none	None.	NC
HhOv 113	cs/ws	80-91 80-202	646	405	ridge	undisturbed	significant	Excavate.	mitigation unspecified
HhOv 114	cs/ws	80-91	644	406	ridge	undisturbed	significant	Excavate.	mitigation unspecified
HhOv 115	ws	80-91	643	408	knoll	undisturbed	unknown	Test excavate.	mitigation unspecified
HhOv 116	if	80-91	647	409	ridge	undisturbed	none	None.	NC
HhOv 117	if	80-91	639	407	ridge	undisturbed	none	None.	NC
HhOv 118	cs/ws	80-91	639	412	ridge	undisturbed	significant	Test excavation.	mitigation unspecified
HhOv 119	if	80-91	638	418	ridge	destroyed	none	None.	NC
HhOv 120	if	80-91	641	422	ridge	undisturbed	none	None.	NC

Borden Number	Type	Permit	UTM E	UTM N	Setting	Condition	Significance	Recommendation	H.R. Act Status/ Outstanding Req.
HhOv 121	if	80-91	645	424	ridge	undisturbed	none	None	NC
HhOv 122	if	80-91	645	425	ridge	undisturbed	none	None	NC
HhOv 123	if	80-91	645	426	ridge	undisturbed	none	None	NC
HhOv 124	cs/ws	80-91	645	440	Athabasca River	undisturbed	significant	Excavate.	mitigation unspecified
HhOv 125	if	80-91	620	470	rise	destroyed	none	None.	NC
HhOv 126	if	80-91	616	478	ridge	undisturbed	none	None.	NC
HhOv 127	if	80-91	616	477	ridge	undisturbed	none	None.	NC
HhOv 128	cs/ws	80-202	647	403	ridge	undisturbed	significant	Avoid.	
HhOv 129	if	81-64	698	486	knoll	disturbed	not assessed	No further work.	
HhOv 130	if	81-64	697	490	?	disturbed	not assessed		
HhOv 131	cs/ws	81-94	697	490	?	disturbed	not assessed	Test excavate.	
HhOv 132	cs/ws	81-64	698	492	ridge	disturbed	not assessed	Test excavate.	
HhOv 133	ss	81-64	696	487	ridge	disturbed	not assessed	No further work.	
HhOv 134	if	81-64	695	486	ridge	disturbed	not assessed	No further work.	
HhOv 135	ws	81-64	695	483	ridge	disturbed	not assessed	Test excavate.	
HhOv 137	ws	81-64	689	499	ridge	disturbed	not assessed	No further work.	
HhOv 138	ws	81-64	695	482	knoll	disturbed	not assessed	Test excavate.	
HhOv 139	ss	81-64	696	477	knoll	disturbed	not assessed	Test excavate.	
HhOv 146		96-13	638	422					
HhOt-1		83-54 89-52	811	488					

if = isolated find, ss = surface scatter, cs = campsite, ws = workshop, nc = no concern.

4.3.1 1974 Sample Survey (Losey and Sims 1975)

The areas examined by Sims represent only a small portion of those proposed for development and did not employ techniques considered acceptable for an HRIA. This study was not intended to be nor would it be, considered equivalent to an HRIA for the areas examined. Because review mechanisms for these types of projects were not fully established at the time, the regulated status of the areas examined and the sites identified is uncertain. Except for sites that may occur in presently proposed impact zones, the coverage provided in that program will be discounted.

4.3.2 Alsands Plant, Mine, Gravel area (Conaty 1979, Ives 1982a, 1988)

Correspondence from ACD relating to the Conaty project was unavailable, but other correspondence refers to an acceptance letter from the Archaeological Survey and another from the Assistant Deputy Minister of the Historical Resources Division. It is evident that in both instances Alberta Culture had concluded that the experimental objectives of study did fully correspond with the objectives of an HRIA. The results of later studies indicate that not all significant resources were identified and that additional HRIA level work would be appropriate in these areas.

The post-clearance reconnaissance by Ives (1982) has confirmed the actual site density in the proposed Alsands campsite and mine examined by Conaty, and has extracted comparative samples.

The fact that, together these studies would probably constitute sufficient investigation to meet HRIA standards, is implied in two pieces of correspondence from Alberta Culture, wherein possible mitigation of impacts to these sites is discussed. In a letter to D. Dabbs of Alsands (Dec. 2, 1981), W. J. Byrne states "in accordance with our prior approval for development to proceed in this zone, Alsands will not be required to undertake additional mitigative work at sites recorded by Mr. Ives." This view is later modified in a letter (May 28, 1982) from S. Lobay of the Archaeological Survey to Mr. Dabbs, indicating that "these sites may require further work if threatened by land surface disturbance."

It is concluded that HRIA level studies have been completed for the proposed Alsands plant site and first five-year mine site and that mitigation requirements could be established by ACD after review of development plans. It is further concluded that if a post-clearance survey similar to that applied by Ives were to be implemented in the gravel resource area south of the Muskeg River, examined by Conaty (1979, see Figure 6), HRIA requirements would be considered to have been met. Again, this would require the confirmation of ACD, but that area is not scheduled for development under current plans.

4.3.3 1980 Alsands HRIA (Ronaghan 1981b)

Areas examined in this study are also shown in Figure 6. This study was reviewed and accepted by Alberta Culture in a letter dated Dec. 2, 1981 from Dr. W. J. Byrne to D. Dabbs of the Alsands Project Group. This letter establishes mitigation requirements for the sites recorded during the 1980 study. It is concluded that HRIA level requirements have been met in these areas and mitigation requirements can be implemented before development if necessary.

4.3.4 1980 Energy Corridor (Ronaghan 1981a)

Areas examined in this study are also shown in Figure 6. This study was reviewed and accepted by Alberta Culture in a letter dated Dec. 1, 1981 from Dr. W. J. Byrne to D. Dabbs of the Alsands Project Group. This letter indicates which of the sites recorded during the 1980 study are of concern but does not establish specific mitigation requirements for them. It can be concluded that HRIA level requirements have been met in these areas and that mitigation requirements can be established in discussion with ACD, once the nature of any proposed impacts in these areas are known.

4.3.5 Highway HRIA/ Mitigation

The studies relating to construction of Highway 63 have little bearing on the proposed Project, since they were all dedicated toward the highway alignment that is now built.

4.3.6 The Northwest Utilities Pipeline Corridor

An HRIA of this proposed route was completed in 1980 (Ronaghan 1981c). The corridor examined follows the southern boundary of the Project area, where the main access road into the plant site is proposed (Figures 2 and 6). This study and its recommendations were accepted by ACD. It is concluded this alignment can be considered to have been examined and was exempted from study in the 1997 program.

4.3.7 Other Areas in Lease 13

Areas that have not been subject to systematic examination will be subject to review by ACD and will most likely require the conduct of HRIA level activities. This opinion is based on the fact that previous studies in Lease 13 have demonstrated that a significant number of archaeological sites can be identified on favourable landforms throughout the area including, level drained terrain in proximity to creeks, rivers and lakes, and on raised features in hinterlands.

4.4 Study Area

Based on the preceding considerations, a study area was established for the 1997 program (Figure 6). It excludes the areas examined for the 1980 Alsands Mine and Tailing area Project (Ronaghan 1981b) as well as the 1981 Energy Corridor area examined for the Alsands Project Group (Ronaghan 1981a). It also excludes areas examined both by Conaty for the 1979 Alsands study (Conaty 1979) and by the Archaeological Survey of Alberta in 1982 and 1983. (Ives 1982a, 1988). In addition, it excludes the NUL pipeline corridor examined for CU Engineering in 1980 (Ronaghan 1981c). This study area is illustrated in Figure 6 and formed one of the supporting documents submitted to the Archaeological Survey, Provincial Museum as part of an application for an Archaeological Research Permit to conduct the 1997 program. After review of this application, permit number 97-107 was assigned to this project.

4.5 Background Research

Background research conducted before the field work portion of the 1997 program entailed review of the previous historical resource studies in the vicinity of the Project area, recovery of the available original field notes and records produced for archaeological studies in the areas proposed for development, and review of the models used in previous studies to establish the significance of the sites identified in the region. Field records were available for the 1980 Alsands Project and Energy Corridor survey, for the Survey NUL pipeline study and for the work completed by the Archaeological Survey of Alberta in 1981 and 1982, but not for the 1979 Alsands project or the 1973 Lease 13. These latter omissions are not considered a serious problem since much of the data are contained in the resulting reports. Only in the case of the 1973 Lease 13 Survey was there insufficient information to allow relocation of the sites identified (see Results 5.0).

These information sources allowed for accurate plotting of the areas investigated in previous studies and the sites identified during their field components. The data accumulated on sites within the Project area are shown in Table 4, while their locations are shown in Figure 7.

4.5.1 Archaeological Potential Model

One of the more important aspects of the background research for the 1997 program was development of a predictive model, based on terrain variables, that served as a means of structuring the field investigations in areas not previously examined. Geographic Information Systems technology was used to develop and display this model. Based on the results of previous studies it is evident that archaeological sites within the study area are strongly correlated with certain subtle terrain variations expressed throughout the area. Sites tend to exist on the raised landforms between intervening areas of water saturated terrain. This correlation was established by the 1980 Alsands Mine and Tailings pond studies (Ronaghan 1981b), was confirmed by the Archaeological Survey's work in the cleared Alsands Plant and Mine areas (Ives 1988) and has been recognized in subsequent reviews of this information (Reeves 1993). Features on which sites are located generally rise 1-3 m above the surrounding muskeg and although they vary in shape, appear to be oriented along a northeasterly direction (Plates 1 and 2). They consist of boulder/gravel fill and have been previously interpreted as representing glacial drift features (Bayrock 1971). More recent interpretations (Smith and Fisher 1993) suggest that these features represent braided channel deposits left in the wake of a massive palaeoflood that took place 9,900 years ago when a stand of

Plate 1: Elevated landform features in the Muskeg River Mine Project Area, view southwest. Note intervening areas of water saturated terrain.

Plate 2: More subdued terrain characteristic of the northern part of the Project Area, view south. Note distinctive linear features in the distance.

Glacial Lake Aggasiz breached a drainage divide near the Alberta/Saskatchewan border and spilled huge volumes of water down the Clearwater and Athabasca rivers over a 78-day period (see Figure 8). All of these features are mantled with a blanket of sand, probably of aeolian origin.

Regardless of their origin, the raised features in the Project area and north of the Muskeg River exhibit characteristics that distinguish them from surrounding terrain and proved to be attractive for prehistoric use. The small differences in elevation manifest in these features correlate directly with distinct differences in drainage characteristics, soil types and vegetation communities. The highest Xeric sites exhibit the best drainage and have developed eluviated and non-eluviated dystric brunisols that support open jack pine/low shrub/lichen communities (Plate 3). A slight drop in elevation results in slightly reduced drainage characteristics in Submezic upland locations, which result in development of similar soil types but the dominance of aspen stands with a shrubby understory (Plate 4). With lower elevation, white spruce associated communities are present in submesic/hydric sites. Transition zones between upland and peatland vegetation types often occur as bands surrounding saturated depressional areas. These sites exhibit gleyed soil types, reflecting their periodically saturated conditions and support black spruce, bog birch and willow-associated communities. In the lowest sites, bogs and standing water have resulted in the development of organic soils. Archaeological sites appear to be restricted to Xeric and Submesic situations.

It is evident that elevation, soil types or vegetation communities could be used as proxy indicators of archaeological potential, as each is linked to the same set of environmental parameters. Digitized information on the distribution of vegetation communities within the study area, based on classifications made on 1:20,000 scale air photographs, was the most detailed available at the beginning of the field season. This parameter was chosen as the basis for modeling archaeological potential. All communities considered to reflect well-drained terrain were ranked as having at least moderate potential. Communities reflecting poorly drained or saturated conditions were considered to have low or no potential for site discovery.

A further discrimination of potential was to ranking communities near water as having higher potential than hinterlands locations. Well-drained locations within one km of flowing water and 500 m of standing water were considered to exhibit high potential, while those at greater distance retained a moderate ranking for archaeological potential. Figure 9 displays the archaeological potential throughout the lease area. These rankings were then overlain with the study area

Plate 3: Open Jack Pine forest community typical of the highest elevation locales.

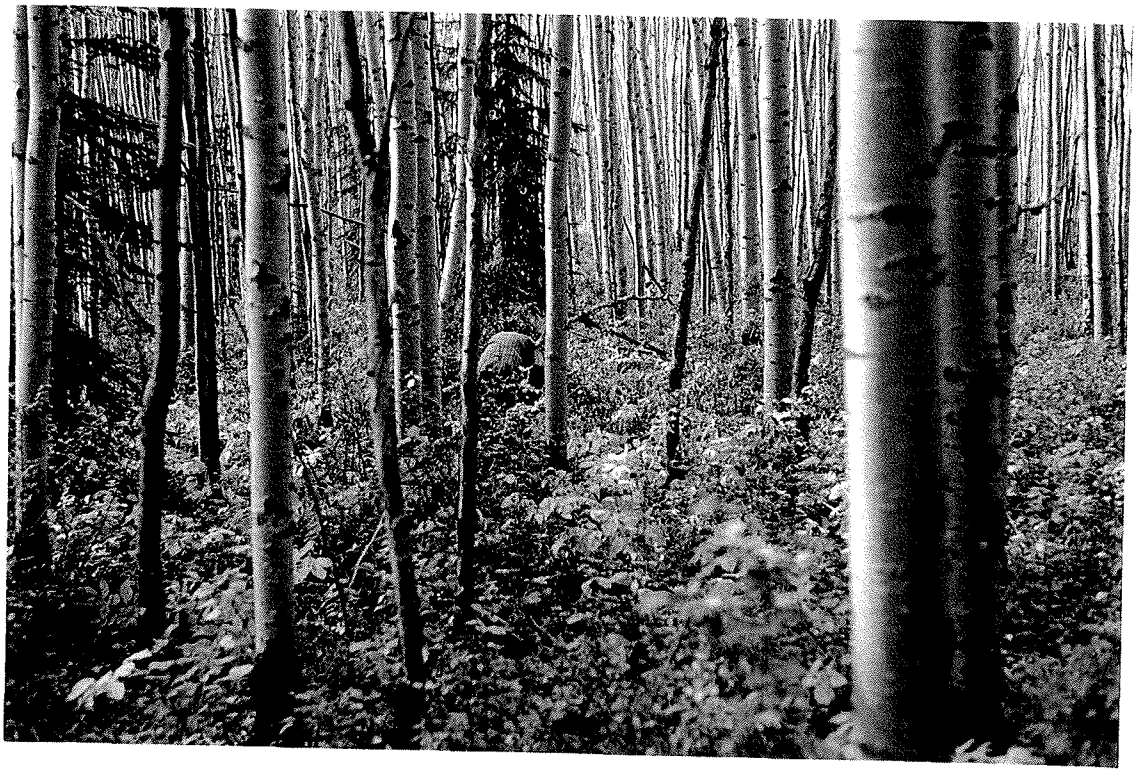
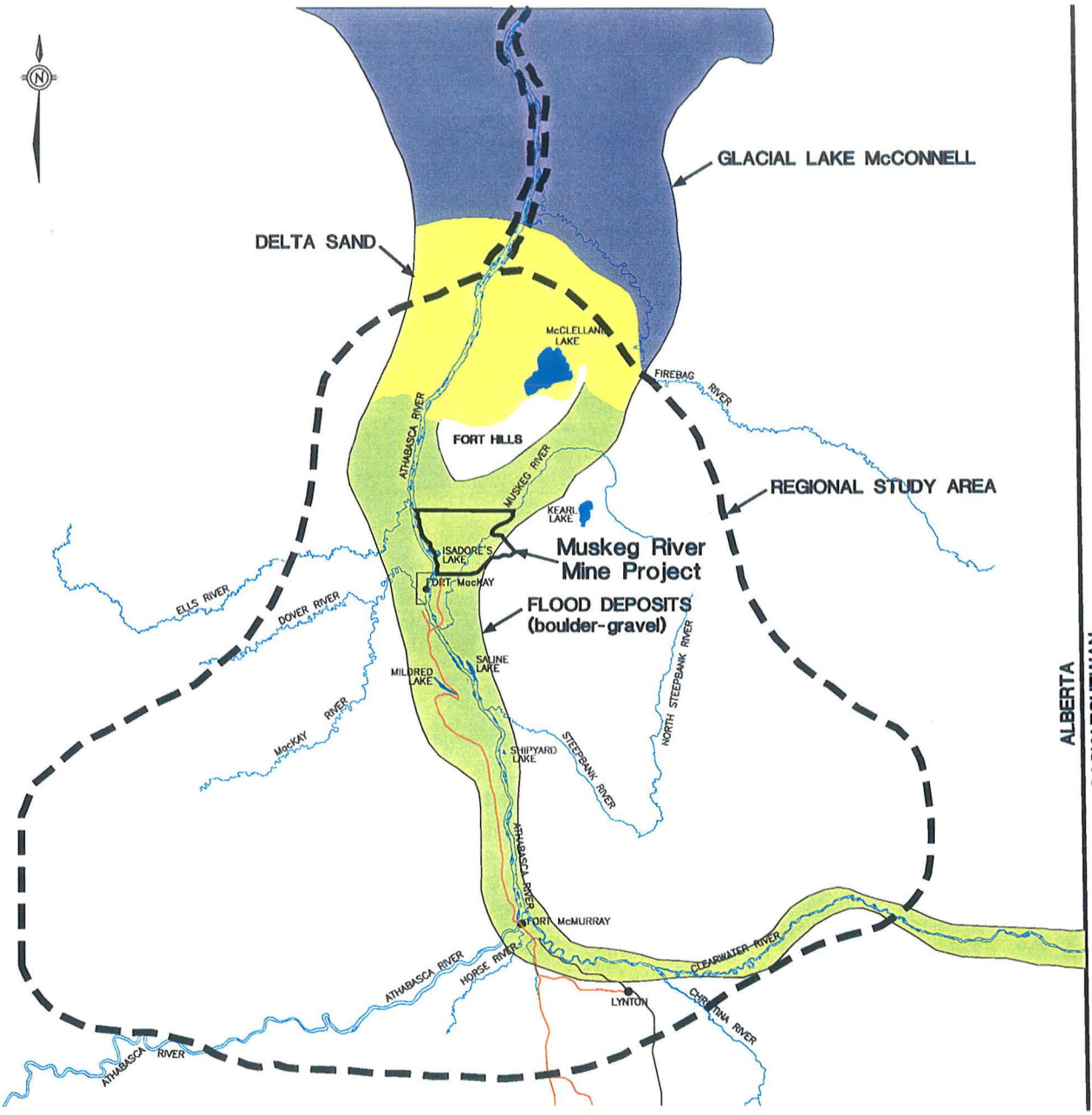


Plate 4: Aspen related forest community associated with well drained landscape features.

J:\1997\2237\8450\BASELINE\GLACLAKE.dwg



0 10 20 30 40 50km

SCALE 1:1,000,000

REFERENCE

DIGITAL DATA SETS 74D, 74E, 74I
84A AND 84H FROM RESOURCE DATA DIVISION
ALBERTA ENVIRONMENTAL PROTECTION, 1997.

AFTER FISHER AND SMITH 1993.

Golder Associates

SHELL CANADA LIMITED

GLACIAL LAKE AGASSIZ PALEOFLOOD SPILLWAY

12 JAN 98	Figure 8	DRAWN BY: RFM

6 350 000 N

6 345 000 N

6 340 000 N

460 000 E

465 000 E

470 000 E

475 000 E

480 000 E

HhOv 61
HhOv 62
HhOv 126
HhOv 127
HhOv 125
HhOv 63
HhOv 29
HhOv 64
HhOv 28
HhOv 27
HhOv 94
HhOv 38
HhOv 6
HhOv 49
HhOv 50
HhOv 51
HhOv 52
HhOv 56
HhOv 54
HhOv 55
HhOv 111
HhOv 3
HhOv 128
HhOv 123
HhOv 146
HhOv 5
HhOv 119
HhOv 53
HhOv 118
HhOv 115
HhOv 117
HhOv 12
HhOv 122
HhOv 121
HhOv 120
HhOv 116
HhOv 114
HhOv 113
HhOv 90
HhOv 89
HhOv 91
HhOv 88
HhOv 87
HhOv 36
HhOv 11
HhOv 93
HhOv 37
HhOv 85
HhOv 84
HhOv 83
HhOv 10
HhOv 16
HhOv 78
HhOv 82
HhOv 81
HhOv 86
HhOv 124
HhOv 80
HhOv 79
HhOv 137
HhOv 71
HhOv 132
HhOv 130
HhOv 133
HhOv 70
HhOv 134
HhOv 129
HhOv 128
HhOv 96
HhOv 135
HhOu 16
HhOu 31
HhOv 75
HhOv 139
HhOv 73
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HhOv 77
HhOv 76
HhOv 33
HhOv 32
HhOu 21
HhOu 7
HhOu 20
HhOu 19
HhOu 26
HhOu 25
HhOu 27
HhOu 28
HhOu 6
HhOu 24
HhOu 32
HhOu 29
HhOu 30
HhOu 23
HhOu 22
HhOu 16
HhOu 17
HhOu 4
HhOu 2
HhOu 8
HhOu 1
HhOv 31
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HhOv 34
HhOv 19
HhOv 40
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HhOv 18
HhOv 107
HhOv 22
HhOv 106
HhOv 105
HhOv 17
HhOv 68
HhOv 67
HhOv 69
HhOu 9
HhOu 10
HhOu 34
HhOu 11
HhOu 12
HhOu 13
HhOu 15
HhOu 14
HhOt 1

LEGEND

- Local Terrestrial Study Area
- Lease 13
- Proposed 1997 HRIA Boundary
- Existing Archaeological Sites
- Open Water

Rating
- Low
- Medium
- High

SOURCE: Golder Associates Ltd., Alberta Environmental Protection (1997)

500 0 500 1000 1500 2000 2500 3000
Metres

MAP PROJECTION: Universal Transverse Mercator Zone 12 DATUM: NAD 83

Golder Associates

SHELL CANADA LIMITED

MUSKEG RIVER MINE PROJECT HISTORICAL RESOURCE SITE POTENTIAL RATINGS

12 Jan. 1998	Figure 9	PRODUCED BY: J. Shaw REVIEWED BY:

/data8/oilsands/972-2237/9840/working/arcview/archy11x17.apr

boundaries as a basis for structuring field investigations. Subsequently, communities ranked as having high and moderate potential were transferred to 1:20,000 air photographs to plan access routes for field studies.

4.6 Procedures

Design of an appropriate mitigation program to offset project impacts is best based on an effective comparison of the significance of resources involved. Consequently, the strategy of inventory and assessment comparable to the highly successful 1980 Alsands HRIA was employed in areas of new impact in 1997 (see Figure 6). This strategy involved intensive investigations of raised terrain features. Use of a similar approach provides an equivalent level of assessment of terrain potential in these areas and an analogous level of site assessment, so that comparative site evaluation is possible.

Features selected for examination were chosen on the basis of a GIS sensitivity analysis as discussed above. Sample selection was weighted toward the highest ranked features but also provided coverage of a reasonable number of moderately ranked features. Investigations in many cases extended beyond the break in slope on the features selected and, thus, provided at least some coverage of areas considered to have lower potential. Considering the results of previous studies, however, no detailed investigations took place in areas known to have little or no potential for archaeological sites. However, numerous low potential areas were traversed in accessing test locations. Cutline disturbances provided subsurface visibility in many of these instances. The absence of cultural materials in any of these circumstances confirmed the results of previous studies and the utility of the model.

Techniques used in the 1980 study were used for assessment in this study. Features were covered on foot by walking linear transects oriented according to the shape of feature, usually along its long axis. Transects were placed 10-20 m apart depending on the size of the feature. Any natural or man-made exposure on features (tree throws, cutlines, etc.) were closely examined. Tests measuring 40-50 cm on a side were excavated at 10-20 m intervals along each transect, again depending on the size of the feature. Notes were kept regarding the distribution and number of tests conducted on each feature. Tests were excavated into the C horizon or until glacial deposits were encountered. Since, with one exception, all sites recorded in this region have been limited to the

upper soil horizons, this program is considered more than adequate to identify all significant archaeological sites in the areas examined.

Shovel tests that produced artifacts were expanded to 1 x 1 m in size to obtain information on the depth and density of cultural materials present. Site size was estimated by placement of shovel tests on the four cardinal directions outward from the find until cultural materials were no longer encountered. Transect shovel tests fulfilled most of the objectives in this regard.

Five previously recorded sites exist in the 1997 assessment area. Three were identified in the initial 1973 survey (Sims and Losey 1975) and two were recorded in the 1980 Alsands HRIA (Ronaghan 1981b). Attempts were made to relocate these sites in the 1997 program.

Site locations were fixed by GPS readings and were plotted on Project aerial photo and contour maps. Standard recording procedures were followed and resulted in completion of sketch maps and Archaeological Survey site forms (see Appendix I). Materials were curated according to standards outlined in the Guidelines for Archaeological Permit Holders in Alberta.

Analysis has been conducted according to Guideline standards but considers previous studies with a view toward recording attributes that will facilitate effective comparison with existing collections. Perhaps the most systematic study in this regard has been the surface collection of artifacts from the Cree Burn Lake site along the SR 963 highway alignment (HhOv 16) conducted in 1981 (Ronaghan 1982b). In that study, a simple classification scheme was adopted to segregate an assemblage that consists of 7,325 lithic artifacts that are almost exclusively Beaver River Sandstone. Although other more detailed schemes, involving reduction stages, could be adopted, it was decided to use the same approach for the materials recovered in the 1997 Muskeg River Mine HRIA, primarily to permit comparison with that large sample. Details relating to the attributes considered and the categories created are provided in the lithic analysis appended to this report (Appendix II).

5.0 RESULTS

This section presents the results of the four major studies that constitute HRIA level studies within the proposed Muskeg River Mine development area. These include the 1980 Alsands Project Area assessment (Ronaghan 1981b), those portions of the 1980 Alsands Transportation and Utility Corridor study (Ronaghan 1981a) that fall within the Project development area, the 1979 Alsands Mine and Plant site study areas (Conaty 1979) that were subsequently examined after forest clearance by the Archaeological Survey of Alberta (Ives 1982a, 1988) and the 1997 Muskeg River Mine HRIA study area. Because the individual studies completed for the Alsands Project provide the detail relevant for the historical resources identified and assessed, their results will be summarized. The reader is advised to refer to the reports cited for detail relating to the sites identified and the specific recommendations made to offset impacts to individual sites. However, the following discussion indicates the level of coverage each of those studies provided in relation to the developments proposed for the Project.

Detailed results of the 1997 studies are provided in Section 5.3. This section provides detailed descriptions of the sites identified and presents recommendations for mitigation of impacts should they be affected by Project-related construction activities. Archaeological Survey site inventory forms for these sites are provided in Appendix I of this report and include sketch maps of each, showing test locations and indicating which produced cultural materials. A summary evaluation of all known resources within the Project is provided in Section 7.0 of this report. Tabular information in that section provides site evaluations from previous studies, recommendations from those studies and any outstanding requirements established by Alberta Community Development. Also provided is a ranking of the significance of each site within potential development zones and a description of the mitigation program considered appropriate for offsetting the effects of the Project.

5.1 Survey Coverage

5.1.1 1973 Lease 13 Pilot Survey

The survey by Sims (1975) for the initial proposal to develop an oil sands extraction facility on Lease 13, was conducted in an "opportunistic fashion" by two people over an 8-10 day period focused on existing exposures (river cutbanks, road cuts and seismic cutlines); subsurface testing

was not included in the program. The 47 sites found are clustered along the Muskeg River and Jackpine Creek in eroding banks. The degree of coverage of the lease area was not discussed in detail, nor were maps provided in this study sufficiently informative to gain an accurate impression of areas covered.

5.1.2 1979 Alsands HRIA

This study examined four specific proposed development component areas of the formerly proposed Alsands Project (Conaty 1979, Figure 6). Two types of archaeological sampling strategies were conducted during this program: a probabilistic survey and a judgmental survey. The intent of the probabilistic survey was to obtain an unbiased sample that might allow statistically valid predictions of archaeological site densities to be generated for the whole lease area. Examination areas were chosen after each development area was divided into 1/8 by 1/8 mile quadrants and a 30% sample randomly derived. Subsequently, within each selected quadrant varying numbers of 3 x 3 ft. excavation units were excavated on the basis of a randomized selection of test intervals. The judgmental survey component selected generalized areas for investigation on the basis of a perceived likelihood of the presence of archaeological sites. Test units of the same size were excavated within these areas "wherever it was thought artifacts were likely to occur" (Conaty 1979).

Only two of the areas examined correspond with those proposed for development in the Muskeg River Mine Project. A narrow strip along the southern boundary of the proposed Alsands plant and campsite area falls within Lease 13 and would be developed for the Muskeg River Mine Project. Conaty (1979) reports examination of five 1/8 x1/8 mile randomly selected quadrats within this area, with a total of 67, 3 x 3 ft. units excavated. A single archaeological site was recorded on a slightly raised feature in this largely saturated terrain. No judgmental examination took place in this area during the 1979 program.

About 60% of the first five-year mine area proposed for the Alsands project falls within the Muskeg River Mine development. Conaty (1979) reports examining 26 quadrats in this area and excavation of 412, 3 x 3 ft. tests. No archaeological sites were encountered in any of this work, nor were any discovered in the judgmental component of the program, which focused on areas surrounding a small lake in the middle of this area. The number of tests excavated in this portion of the program was not included in the report, however, it is assumed that many were.

Based on the identification of one site in two of the four areas examined in the probabilistic component of the program, estimates of site density throughout the study area were provided. It was considered probable that between zero and 81 additional sites might be present in areas not directly sampled. Conaty suggested that there may be no sites in the five-year mine area, most of which lies in the currently Project development area. Because one site was identified in the plant and campsite area, he considered it likely that up to 40 sites might be present there. However, only a very small portion of that area is included in the Muskeg River Mine. This study was considered to have produced results that were not totally compatible with the goals of an HRIA.

In terms of coverage of the areas investigated, it can be effectively argued that, although a 30% sampling fraction was adopted in terms of the quadrats selected, because of the dense vegetation cover in this region, the actual sample fraction is more effectively represented by the square area that comprised the tests that were excavated. Because some inconsistencies are apparent between the areas reported to have been covered and maps showing quadrats investigated, illustrations of the results of this program have not been included in this report.

5.1.3 1980 Alsands HRIA

This study examined eight development areas for the then-proposed Alsands Project. A mine area and portions of the tailings pond and gravel resource mining localities included in that program fall within areas scheduled for development by the Project. However, with minor exceptions (two proposed water intake areas on the Athabasca River), most of the examination took place in the Project development area. This study adopted a different approach from previous work, making use of existing topographic variation, by focusing investigations on the discrete elevated landforms within the development area. An intensive testing program was implemented on a sample of these features, while low, saturated areas were generally avoided. This program employed small shovel tests (measuring 0.4-0.5 m on a side) distributed along 10-20 m wide transects at 10-20 m distances. Elevated features selected for testing were identified on the basis of air photo analysis, and helicopter support was used to deploy survey crews.

As a check against bias, a random selection of test areas was also included in the test program. Forty test plots (quadrats) 70 x 70 m in size were chosen within four major soil types mapped for the project area. These were examined by placing 1 x 1 m test excavations on a 10 m grid, yielding a total of 49 tests for each plot.

Within areas proposed for development by the Project, examination was conducted on 20 non-linear elevated features, 51 linear elevated features and 26 soil test plots. This resulted in the excavation of 1,274 1 x 1 m tests in soil plots and 2,048 0.4-0.5 m shovel tests on features (Ronaghan 1981b). This information has been consolidated with the results of the 1997 Muskeg River Mine HRIA and is provided as Figure 10 in this report. Thirty-eight archaeological sites and one historic period site were identified and assessed during this program. These sites exhibited a strong correlation with the elevated landforms throughout the hinterlands of the lease that were the focus of the investigations. These results contrast with the results of the 1979 studies, but because of the non-probabilistic nature of the sampling strategy employed, no quantified predictions were possible for the areas not examined in the study. Nevertheless, the success of the program argues effectively for the presence of a site distribution pattern focused on the types of features examined.

To gain a quantified impression of the overall coverage involved in this investigation, and a prediction of the actual site density throughout the study area, a GIS-assisted calculation has been applied to this area during the analysis for the 1997 Muskeg River Mine HRIA. Because there is a demonstrated correlation between elevation and vegetation communities, the distribution of jack pine and aspen-dominated communities accurately reflects the distribution of well-drained elevated landforms. Consequently, the distribution of these forest communities was taken as a reflection of the area of the lease that has potential to contain archaeological sites. Comparison of the total area these communities encompass with areas investigated in 1980 provides a quantifiable impression of the sample of all areas of potential the 1980 studies actually amount to. The methods used to accomplish comparison and their results are presented below.

During this study, Alsands requested an examination of their road from the barge landing on the Athabasca River to the then-existing camp, which is situated in an area currently proposed for the plant site for the Muskeg River Mine Project. This road also generally follows the alignment that will be developed for the access corridor into the Muskeg River Mine Project from Highway 63, except for its initial 2.3 km. A judgmental survey was conducted along this road, with examination of existing exposures and shovel testing of undisturbed elevated features undertaken. Eighteen potential borrow sources, most of which had already been tested, were also examined. Seventeen prehistoric sites, four of which had been identified in Sims' earlier reconnaissance, were identified and assessed. Two systematic surface collections of stone artifacts were completed as a result of this study and recommendations for further study tendered. Figure 11 is a reproduction of the map

6 350 000 N

6 345 000 N

6 340 000 N

460 000 E

465 000 E

470 000 E

475 000 E

/data/b/oilsands/972-2237/9700/9840/working/arcview/archy_20.apr

LEGEND:

- Cree Burn Lake Archaeological Site
- Historic Resource Study Area
- Lease 13
- Alsands Study Area
- Northwest Utilities Pipeline Survey Areas (1980)

1-90	1997 Golder Shell Lease 13 Survey
A1 - A57	1980 Alsands Project Survey
A1' - A20'	1980 Alsands Project Survey
S1 - S36	Archaeology Survey of Alberta
B1 - B19	Ft. McMurray Energy Corridor (1981)
B1' - B5'	Ft. McMurray Energy Corridor (1981)

Archaeology Sites

- Muskeg River Mine HRIA
- Alsands HRIA
- Alberta Culture (post-construction survey)

DATE OF PHOTOGRAPHY: 97-06-11

SOURCE: Alberta Community Development, Golder Associates Ltd., Lifeways of Canada Ltd., The Orthoshop

Based on August 1997 Survey

1 0 1 2

Kilometers

MAP PROJECTION: Universal Transverse Mercator Zone 12

DATUM: NAD 83

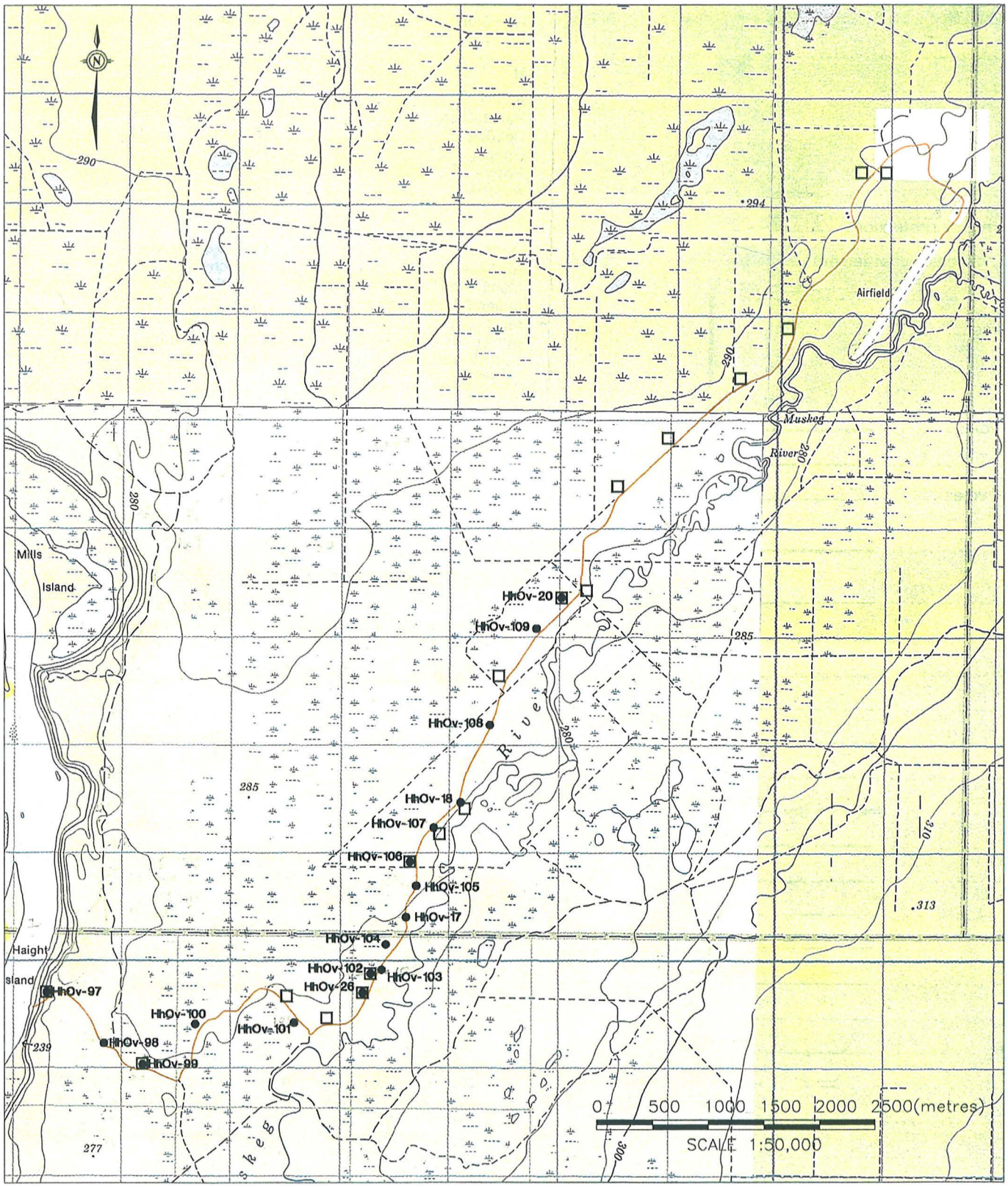
Golder Associates

SHELL CANADA LIMITED

MUSKEG RIVER MINE PROJECT ARCHAEOLOGICAL SURVER COVERAGE (1979-1997)

23 Jan. 1998	Figure 10	PRODUCED BY: J.S./R.P. REVIEWED BY:

J:\1997\2237\8450\ROADHRIA.dwg



LEGEND

- ROAD
- ● ARCHAEOLOGICAL SITE
- □ BORROW PIT

REFERENCE

SCANNED NTS MAPSHEETS 74E/3, 74E/4
74E/5 AND 74E/6
AFTER RHONAGHAN 1981b

Golder Associates

SHELL CANADA LIMITED

ALSANDS ROAD HRIA

11 JAN 98	Figure 11	DRAWN BY: RFM

provided in the Alsands report illustrating the alignment examined and the sites identified during this portion of the Alsands study.

5.1.4 Alsands Energy Corridor HRIA

This study employed the same methods described for the Alsands project area, and focused on examination of a 695 m wide corridor, 90 m of which had been cleared in advance of approval for construction of highway construction in support of the Alsands project and others proposed farther north (Ronaghan 1981a). Other facilities proposed for eventual emplacement within the corridor included a railroad, several powerlines, an access road and several pipelines. Areas selected for examination were chosen on the basis of prefield study of contour maps provided by Alberta Transportation and available air photographs. Linear and non-linear elevated features were selected for field examination. Only a small portion of the corridor study area intersects areas proposed for development in the Project.

Attempts to illustrate the relationship between areas examined in the Corridor study and the Project were frustrated by the absence of the original air photographs used to identify areas of potential features for field examination in the archived records for the Project. Nevertheless, the air photo mosaic provided in the final report provided an adequate basis for estimating the coverage provided by this study and the site locations recorded. Figure 10 displays the features examined during this program. However, notes on the numbers of tests excavated on these features were missing from the archived records (these data are available for other portions of the corridor) and are not included in the report. It can be assumed that a similar frequency of testing was undertaken, but numbers cannot be provided.

The areas that these tested features encompass within the Project development area have been included in the calculations to estimate areas with archaeological potential. Techniques used to derive at these figures, results obtained and implications for design of a mitigation program for the Project are discussed below.

5.1.5 Northwest Utilities Pipeline Right of Way

This project involved an HRIA conducted along a proposed alignment of a natural gas pipeline intended to link the Texaco and CDC Tar sands Pilot Plants east of the Muskeg River and the

Syncrude Mildred Lake facility (Ronaghan 1981c). It entailed examination of a 30 m wide right of way adjacent to the Township 94/95 boundary along the southern margin of the Project development area. In this area, the alignment corresponds with the proposed access road into the Project area, and correspondingly provides historical resources coverage for that portion of the proposed road.

Examination techniques corresponded with those used in the 1980 studies for the Alsands Project HRIA and the Energy Corridor HRIA discussed above. Air photo analysis identified elevated features intersected by the proposed alignment and shovel testing was conducted in the same fashion as the earlier studies at 10-20 m intervals within and extending just beyond proposed disturbance zones. An air photo mosaic in the final report provided an adequate basis for estimating the coverage provided by this study. Figure 10 includes an illustration of the areas and features covered within the Project development area.

Within the area that corresponds with the proposed Project access road, a considerable portion of the alignment is situated in relatively low, saturated terrain. However, six elevated features were examined, one new archaeological site (HhOv 128) and one previously recorded site (HhOv 104) were identified and assessed. Fifty-seven shovel tests were excavated in these areas. Because this study was limited in scope, its results have not been included in the sample size calculations on the Alsands data. Regardless of its limitations, this study did provide archaeological coverage of the area that will be used for a portion of the Project site access road.

5.1.6 Archaeological Survey of Alberta Post-Clearance Examination

In the winter of 1979/80, the Alsands project group completed preliminary development within their proposed plantsite and initial five-year mine area by clearing the forest and excavating drainage ditches. Because forest clearance had been conducted under frozen ground conditions, surface disturbance was limited to those areas where the cutter bar scraped the surface, which generally took place on elevated ridges where archaeological sites are known to occur. This afforded an excellent opportunity to verify the results of Conaty's earlier Survey of these areas where only one new archaeological site had been discovered. J. W. Ives of the Archaeological survey of Alberta did a surface inspection of these cleared areas and was able to identify large numbers of archaeological sites on elevated features that had been examined previously with no returns (Ives 1982a, 1988). Controlled surface collections of selected sites were also completed. In

this process, Ives (1988) recorded a total of 33 prehistoric sites, of which 25 are situated in the Project development area (Figures 6 and 10). That study provided an extremely thorough examination of this area and its results served as a basis for making predictions about the number of sites that might actually be present throughout the Project development area.

5.1.7 1997 Muskeg River Mine HRIA

This study focused its activities on those areas of the Project development area that had not been examined during previous HRIA studies (Figures 6 and 10). It employed the investigation strategy used in the two previously completed Alsands projects, not only because of the success of that strategy, but to also provide a comparable assessment. Elevated landforms were targeted for examination on the basis of GIS identification of vegetation communities that signify the appropriate features, and based on air photo analysis. During the course of the program, 90 elevated landforms were examined with varying numbers of transects depending on the shape of the landform and its size (Table 5). The results of two previous studies (Conaty 1979, Ronaghan 1981b) provided adequate indications of the utility of the model employed in the 1997 program. These indications were further supported by fortuitous examination of exposures (cutlines, drainage ditches, etc.) in areas considered to have low potential. Further testing of this model was judged unwarranted.

This program resulted in excavation of 4,578 shovel tests and in identification of 16 prehistoric archaeological sites and one historic, perhaps relatively recent, hunting camp. Detailed descriptions of these sites are provided below. The areas investigated during this program are illustrated in Figure 10 and have been included in the calculations completed to gain an impression of the proportion of all areas of archaeological potential that have been investigated within the Project development area. The numbers associated with the 1997 test areas shown in Figure 10 correspond with the numbers in Table 5. The numbers associated with Alsands Project test areas correspond with Table 2 and 3 in the Alsands HRIA (Ronaghan 1981b) and with field records available for the 1980 Alsands Corridor Study (Ronaghan 1981a).

The 1997 program was completed in several different areas within proposed development zones and revealed topographic variation that may have relevance for interpreting site distribution patterns. The program was structured on the basis of a GIS identification of upland vegetation communities associated with elevated features. These identifications appeared to correspond quite

well with landforms recognized in previous study as having potential for the presence of archaeological sites. Only in a few instances was it necessary to eliminate areas of predicted potential from the investigation sample because of the absence of elevated topographic characteristics despite the presence of vegetation communities suggestive of well-drained conditions.

This was especially true for the narrow strip of land along the northern margin of the Project area, where the activities initiated for the formerly proposed Alsands project had cleared the forest and excavated drainage ditches in 1979/80. Pre-clearance air photos show that this area was formerly relatively level low-lying, saturated terrain, supporting bog-and muskeg and bog-associated shrub communities. However, after 17 years of artificial drainage, the vegetation communities favoured for regeneration in this area reflect the improved drainage conditions. For this reason, the entire area was predicted to have moderate potential for archaeological sites. When examined in 1997, its flat, low-lying character was abundantly evident. Because there was no reason to select any one area over another for examination, this area was omitted from the program in favour of locations elsewhere that exhibited greater potential.

The northeastern portion of the Project area, where a dump is proposed to be situated, exhibited the kind of topographic variation that allowed for inclusion of several landforms in the 1997 investigation program. In conducting this work however, a significant difference in the immediately subsurface mineral sediments was noted from other areas investigated in the program. Instead of the blanket of aeolian sands that characterize the uppermost deposits in areas farther south, a dense fine-grained silt deposit is present over the rocky substrate. Review of the palaeocurrent map (Smith and Fisher 1993; see Figure 8) illustrating the extent of deposits associated with the 9,900 year old Glacial Lake Aggasiz catastrophic flood, indicates that this area corresponds with widening of the flood channel as it was deflected around the Fort Hills and began to slow to form a delta at the foreshore of Glacial Lake McConnell. Although detailed mapping was not available for areas farther north, air photos suggest that topographic variation is even more subdued as one approaches the deltaic landscape that characterizes the terrain along the east and north flanks of the Fort Hills. These sediments proved more difficult to excavate but still produced the occasional archaeological site.

Table 5 1997 Muskeg River Mine HRIA Survey Areas

Survey Area	Transects	Shovel Tests	Results	Survey Area	Transects	Shovel Tests	Results
1	0	0	HhOv 71	46	3	54	
2	6	141		47	3	18	
3	3	6		48	3	9	
4	3	54		49	3	18	
5	3	60		50	5	250	HhOv 181
6	4	46		51	?	12	
7	2	11		52	?	36	
8	2	18	HhOu 41	53	?	30	
9	3	20		54	?	39	
10	4	86		55	?	50	
11	4	68		56	?	30	
12	4	72	HhOu 42	57	?	35	
13	3	72	HhOu 43	58	?	60	
14	5	10		59	3	30	HhOv 182
15	5	100		60	3	3	
16	5	260		61	3	48	
17	5	32		62	3	16	
18	8	80		63	3	9	
19	4	80		64	3	30	
20	2	20		65	3	75	
21	4	68		66	5	104	HhOv 186
22	5	35		67	5	36	
23	4	19		68	5	100	
24	5	90		69	?	115	
25	3	30	HhOv 179	70	3	120	
26	3	18		71	3	15	
27	4	96		72	3	126	
28	4	88		73	3	80	HhOv 185
29	3	36		74	3	60	
30	?	8		75	3	98	
31	4	48		76	4	228	
32	4	80		77	4	48	
33	4	20		78	4	33	
34	3	24		79	4	40	
35	6	36		80	3	15?	HhOv 184
36	3	30		81	4	42	HhOu 42
37	3	30		82	3	10	
38	1	15		83	6	35	HhOv 187
39	3	6	HhOv 180	84	3	23	
40	3	45		85	6	40	
41	3	30		86	3	10	
42	3	75		87	3	6	
43	3	60		88	3	12	
44	1	35	HhOv 183	89	3	8	
45	?	24		90	3	40	HhOv 188 HhOv 189 HhOv 190
				Total		**4,578**	

Within the main portion of the study area, east of the Muskeg River, where the bulk of the facilities associated with the Project are proposed, landforms analogous to those encountered in the Alsands project studies were present. Discrete, well-drained features of varying shapes occur between intervening areas of muskeg. Here a blanket of aeolian sands of varying depths up to 50 cm is present immediately below the forest litter. The vegetation communities selected by GIS analysis corresponded relatively accurately with elevated landforms considered to have archaeological potential. Many of these were tested in the 1997 program and several produced archaeological sites (Figure 10).

A similar situation prevailed for the area south of the Muskeg River/Jackpine Creek junction, which is the proposed area for an overburden disposal area and a reclamation material storage location. Here, an extensive bog with standing water is flanked by a large, linear elevated ridge along the east side of the current channel of the Muskeg River. This ridge probably represents a remnant feature of the braided outwash channel formed by the paleoflood 9,900 years ago. It may be one of the controlling features for the current Muskeg River and Jackpine Creek channels. Its size, coupled with the typical limited extent of archaeological sites in this area, militates against site discovery. Although its northerly portion was extensively tested, no archaeological sites were encountered. The critical placement of the dump areas was modified during the field portion of the 1997 program, resulting in examination areas no longer proposed for development. The results obtained in examining this feature are comparable to those obtained in 1980 during examination of a similar but larger feature situated along the western margin of the Project area, which is now the site of the Susan Lake Gravel Pit. However several sites were encountered at the northern extremity near the junction of the Muskeg River and Jackpine Creek.

A small area along the northwest margin of the Project area was included in the 1997 sampling program because it lies outside areas examined during the Alsands Project HRIA and was initially to be developed as part of the proposed Mine pits. Here the topography is extremely rugged with high narrow ridges separating irregular drainage channels. This area lies more centrally to the main channel of the presumed 9,900 year old paleoflood and these ridges are interpreted as representing remnants of deeply incised braided outwash deposits, created under faster flow regimes than those toward the interior of the Project area. A linked series of ridges in this small area were tested during the 1997 program but no archaeological sites were identified. This area is no longer proposed for development.

The 1997 sampling program was successful in identifying intact archaeological sites and is considered sufficient in its execution to meet the requirements of an HRIA for the areas investigated. It should be noted, however, that although a large proportion of landforms with archaeological potential were tested, not all such areas could be examined. It is also necessary to consider that the test program could have and, probably did miss, sites on landforms examined. This is an unavoidable outcome of archaeological studies in forested environments, especially in areas where small, widely distributed sites are known to occur. The mitigation program recommended for the Project, discussed in a subsequent section, has been designed to address this problem.

5.2 Previously Recorded Sites

During the course of the 1997 Project historical resources program, attempts were made to relocate several previously recorded sites within or adjacent to the study area. Fourteen prehistoric sites and one historic period site were thought to occur in these areas. Table 6 provides summary data on these sites, and circumstances surrounding each are discussed in the following paragraphs. Figures 7 and 10 illustrate their reported locations. In general, however, it was not possible to relocate any of the sites identified in Sims' 1973 Lease 13 survey. Attempts to relocate these were frustrated by the lack of accurate detail about their locations, their small size and perhaps, most significantly, the considerable amount of forest regrowth in the intervening 24 years since they were first recorded. The following descriptions of previously recorded sites that fall within the 1997 HRIA study area present the results of the 1997 program. Recommendations are based on those results and the potential impacts of development, as currently proposed. However, evaluations of each have been included in the tabular summary in Section 7.0 of this report to accommodate possible changes in the eventual development configuration and the possibility that they might be encountered in monitoring of forest clearance activities.

Table 6 Previously Recorded Sites Within 1997 Study Area

Site	Previous. Permit	Type	Condition	Potential Impacts	Recommendations	1997 Program
HhOu 6	74-31	ss/cs	disturbed	none	test excavate	unable to relocate
HhOu 7	74-31	ss/cs	disturbed	mine	none made	unable to relocate
HhOu 16	80-91	cs	impacts mitigated	mine	no further study	revisited - no further study
HhOu 17	80-91	cabin	collapsed	mine	no further study	revisited - no further study
HhOv 21	74-31	cs/ss	destroyed	tailings	none made	unable to relocate
HhOv 31	74-31	if	destroyed	plant	no further study	unable to relocate
HhOv 32	74-31	if	destroyed	mine	none made	unable to relocate
HhOv 33	74-31	if	destroyed	mine	no further study	unable to relocate
HhOv 71	80-91	cs	impacts mitigated	mine	no further study	revisited - no further study
HhOv 112	80-91	if	undisturbed	tailings	None.	assessed adequately -not visited
HhOv 113	80-91	cs/ws	undisturbed	tailings	Excavate.	assessed adequately -not visited
HhOv 114	80-91	cs/ws	undisturbed	tailings	Excavate.	assessed adequately -not visited
HhOv 115	80-91	ws	undisturbed	tailings	Test excavate.	assessed adequately -not visited
HhOv 116	80-91	if	undisturbed	tailings	None.	assessed adequately -not visited
HhOv 139	81-64		disturbed	mine	Test excavate.	assessed adequately -not visited

if = isolated find, ss = surface scatter, cs = campsite, ws = workshop

1. **HhOu 6:** This site was originally recorded by Sims and Losey (1975) as a campsite/workshop consisting of eight Beaver River Sandstone artifacts situated on a ridge intersected by exploration cutlines in a hinterlands situation somewhat removed from the Muskeg River in the northern portion of the development area. During helicopter overflights in 1997, it was determined that the site location in Sims (Sims and Losey 1975) actually fell in the centre of a very large bog and no potential cutlines were identified that may have existed in 1973. Ground examination of raised features considered to have potential in the vicinity of the plotted site location (see Figure 10) failed to identify any archaeological materials that might represent this site. This situation is disappointing since it is the only site of those recorded in 1973 within the 1997 Project area that had been considered sufficiently significant to warrant additional study. The reported site location is adjacent to but outside the southern boundary of the NE storage area. It may not be affected by construction associated with the Project.

   Recommendations: Because this site could not be relocated, no additional studies are recommended at this time.

2. **HhOu 7:** This site was originally designated as a small partially disturbed campsite/surface scatter consisting of 13 Beaver River Sandstone specimens, situated on raised terrain along a cutline in the vicinity of, but not directly adjacent to, a small lake near the northern boundary of the lease area (Sims and Losey 1975). The plotted site location occurred on a linear, well-drained landform on the edge of the cleared former Alsands Mine area. A more southerly

portion of this feature contains HhOu 26 recorded during the archaeological Survey of Alberta post-clearance inspection (Ives 1982a, 1988). The portion of the feature that extends into the 1997 study area was included in the sampling program described above. Numerous cutlines cross this feature, some of which are much younger that the 24-year-old cutline examined by Sims and may represent upgrades of that line. Because of the uncertainty regarding the precise location of this site, all the cutlines that intersect the feature were examined and 141 shovel tests were excavated in undisturbed areas of this feature. No evidence of this site was encountered during this examination. It is assumed that either the entire site contents were recovered by Sims or that what remains is too restricted to be identified with standard procedures. Given the initial low value placed on this site, this outcome is not viewed as a significant loss. The reported site falls within the currently proposed mine area and will be removed by mining activities.

Recommendations: Because this site could not be relocated, no additional studies are recommended at this time.

3. **HhOu 16:** This site was initially recorded as a small campsite/workshop during the 1980 Alsands Mine and Tailings pond HRIA (Ronaghan 1981b). It is situated on a west-facing spur of a ridge near the Alsands camp area, overlooking a low boggy area that now contains the main leg of Alsands Mine drainage ditch. It was assessed as warranting immediate excavation because of scheduled gravel mining activities in 1980. Approval was given for recovery of a 16 m^2 excavation sample from the most productive site area; 599 artifacts were recovered, 98% of which were Beaver River Sandstone. This sample was considered adequate to offset potential impacts and it was recommended that the site be released for development.

   This area was revisited during the 1997 Project HRIA. It had, indeed, been developed as a gravel source (Plate 5). The site of the excavations conducted in 1980 could not be relocated. It is assumed that it has been removed during pre-excavation stripping of the gravel pit. The exposed intact soil horizons along the western margin of the pit were examined but no additional archaeological materials were observed. This site is considered to have been destroyed by gravel pit development. Its location within the currently proposed mining area will be removed during development.

   Recommendations: No further studies are recommended for this site.

4. **HhOu 17:** This site is a trapper's cabin that was initially recorded during the 1980 Alsands Mine and Tailings Pond HRIA (Ronaghan 1981b). At that time the site area was searched, photographs were taken and notes were made regarding mode of construction and types of artifacts present. The remains suggested that the cabin postdated World War II. A local informant indicated that the cabin was owned by the late Fred Boucher. At the time, the cabin was considered to be of low historic value and no further studies were recommended.

   This site was revisited during the 1997 program. The cabin was still present but its collapse had significantly accelerated in the intervening 17 years (Plate 6). The vegetation had effectively reclaimed the surrounding area and no additional artifacts were observed. Its value measured in traditional historic terms has degraded significantly. However, its value in traditional Aboriginal terms remains to be established. This site lies within the currently proposed mining area and will be removed during development.

   Recommendations: A program of interviews and archaeological examinations is recommended to offset development impacts to this site (See Section 7.3).

5. **HhOv 21:** This site was originally recorded as a small campsite/workshop consisting of 58 specimens of non-diagnostic Beaver River Sandstone recovered along a cutline on a raised sandy feature west of the road to the Shell lease camp during Sims' 1973 sample survey of the lease area (Sims and Losey 1974). It was considered to be of limited value because of the previous level of disturbance entailed in the exploration work that exposed it. Location information for this site placed it in a large boggy area northwest of a raised feature that was included in the 1997 program and conformed to the descriptive information provided by Sims for this site: a low sandy ridge surrounded by muskeg, with a northwest/southeast trending cutline on its surface. It was concluded that this feature represented the most likely location for this site.

   The entire feature was thoroughly examined in the 1997 program. The single cutline was still in use and provided good exposure of the sandy subsoil. These exposures were examined and 80 shovel tests were excavated. A prehistoric site, here designated as HhOv 185 (discussed below), was recorded in undisturbed context 60 m south of the existing cutline, but no artifacts were observed in the bulldozed cutline exposures and none were recovered in shovel tests adjacent to it. Consequently, it is believed that the site has been destroyed by subsequent use of the cutline

Plate 5: Crew standing on the revegitated surface of the developed gravel pit in the former location of HhOu 16, view south direction.

Plate 6: The collapsed cabin of the late Fred Boucher at HhOu 17, view south direction.

and is no longer present in any discoverable form. HhOv 185 is considered to represent an independent occurrence similar to the series of small sites identified by Ives on single features within the cleared Alsands Mine area (1982a 1988). This location falls within the proposed tailings area and will be destroyed by development activities.

Recommendations: Because this site could not be relocated, no additional studies are recommended.

6. **HhOv 31:** This site was originally recorded as an isolated find consisting of a single specimen of non-diagnostic Beaver River Sandstone recovered along a cutline on a raised sandy feature near the road to the Shell lease camp during Sims' 1973 sample survey of the lease area (Sims and Losey 1975). Because no additional materials were observed it was considered to be of no further archaeological value. Location information for this site placed it on a raised feature adjacent to the road, which had been severely disturbed by gravel extraction activities along a north-trending bulldozed cutline. This feature had been selected for examination during the 1997 field program. A thorough search of the cutline exposures present failed to recover any evidence of this site. In addition 35 tests excavated in treed areas of the feature failed to recover any archaeological specimens that would be considered representative of this site. A newly recorded site, HhOv 183, was identified in an undisturbed context over 200 m north of the road but on this same feature, is considered to be a separate occurrence. Because no evidence of HhOv 31 could be identified, it is considered to have been destroyed and to be of no additional concern. This location falls within the proposed plant site and will be destroyed during development.

   Recommendations: Because this site is considered to have been destroyed, no additional recommendations are made.

7. **HhOv 32:** This site was originally recorded as an isolated find consisting of a single specimen of non-diagnostic Beaver River Sandstone recovered around drill hole #489 during Sims' 1973 sample survey of the lease area (Sims and Losey 1975). Because no additional materials were observed, it was considered to be of no further archaeological value. Location information for this site placed it adjacent to the road to the cleared Alsands plant site area and Syncrude's Aurora Project. While it could not be determined what the number of the drill test might have been, a heavily disturbed areas, that may have been a former drill site location subsequently used

as a borrow source, was present east of the plot of the location data provided by Sims. This area was thoroughly examined in 1997. The terrain levelling was such that no mineral soil remained on the well-drained portion of the small ridge on which this activity had taken place. No evidence of HhOv 32 was identified and no areas suitable for shovel testing remained. A raised feature west of the presumed site location was included in the 1997 program and 88 shovel tests were excavated. No archaeological materials were discovered as a result of these investigations. This site is considered to have been destroyed by excavations and road construction activities. Its location falls within the proposed mining area and will be destroyed during development activities.

Recommendations: Because this site is considered to have been destroyed, no additional recommendations are made.

8. **HhOv 33:** This site was originally recorded as an isolated find consisting of a single specimen of non-diagnostic Beaver River Sandstone recovered along a cutline "200-250 ft south of a shallow lake in the middle of Lease 13" during Sims' 1973 sample survey of the lease area (Sims and Losey 1975). Because no additional materials were observed it was considered to be of no further archaeological value. Location information for this site placed it along one of several cutlines in the general area of the northward bend in the road to the cleared Alsands plant site area and Syncrude's Aurora Project. All existing cutlines were walked in this area and two features of archaeological potential tested in the general vicinity of this reported find, through farther south and west. No evidence of HhOv 32 was identified and no areas suitable for shovel testing were present in the reported site location. A newly recorded site, HhOv 179 was identified in a partially disturbed context over 300 m southwest of the road. The reported site location is considered to be a separate occurrence. Because no evidence of HhOv 33 could be identified, it is believed to have been destroyed by road construction and to be of no additional concern. This location is situated in the proposed mining area and will be destroyed during development.

Recommendations: Because this site is considered to have been destroyed, no additional recommendations are made.

9. **HhOv 71:** This site was recorded during the first stages of historical resources study in the proposed Alsands plant site area (Conaty, 1979: p108). Archaeological study of the site was

recommended before plant site developments were to take place and it was left as an uncleared island in the plant site area. During the 1980 Alsands Project HRIA archaeologists revisited the site and made recommendations for sample excavations, which were accepted. A 16 m^2 sample was extracted from this site under permit 80-91, which included 666 Beaver River Sandstone specimens, only one of which could be classified as a tool fragment. These activities were considered to be adequate mitigation of proposed impacts; recommendations to release this site for development were made. These recommendations were agreed with in a December 2, 1981 letter from W. J. Byrne to the Alsands Project Group. During the 1997 program, the site was revisited and several photographs taken (Plate 7). The former excavation area was identified and no additional disturbance observed. This location falls within the currently proposed mining area and will be destroyed during development.

Recommendations: This site has been released for development by Alberta Community Development; no additional recommendations are made.

10. **HhOv 112-116:** Although these sites occur within the Tailings Area and would be directly affected by development, they were identified and assessed during the 1980 studies done within the Energy Corridor proposed for the Alsands Project (Ronaghan 1981a). These sites were not revisited during the 1997 program because concerns are considered to have been adequately addressed in 1980. The requirements established by Alberta Community Development in review of the recommendations arising from that study are considered still to be in effect. These sites have been included in the overall evaluations for the Project development area; the reader should consult the recommendations section of this report for additional detail. Sites HhOv 112 and 116 were considered to be of no further value; no further studies were recommended in the event that impacts were to occur. However, HhOv 113, 114 and 115 were considered to be of sufficient significance that mitigative excavations were recommended if development was proposed in these locations. The character of these recommended studies was not specified because impact was uncertain. Alberta Culture agreed with the evaluations and indicated that these sites would "require additional work should they be threatened by impact" (W. J. Byrne to D. L. Dabbs, December 1, 1981). However, the exact nature of these studies was not outlined. These requirements are considered to be still in effect.

Plate 7: The location of the 1980 excavation block at HhOv 71, view east.

Recommendations: If the tailings development proceeds as proposed, HhOv 113, 114 and 115 should be included in the Predevelopment Information Recovery component of the mitigation program recommended for the Project, discussed in Section 7.3 of this report. It is suggested that a preliminary test program involving ten 15 m^2 of dispersed 50 x 50 cm or 1 x 1 m tests be employed to define productive site areas. This should be followed by sample recovery, through excavation of sixteen 20 m^2 blocks placed in the most productive site areas, if significant concentrations or unique materials are identified.

11. **HhOv 139:** This site happens to occur within the 1997 study area but was part of the 1981 post-clearance studies conducted by the Archaeological Survey of Alberta (Ives 1982a, 1988). Concerns for this site are considered to have been adequately addressed in 1981. This site was not revisited during the 1997 program. Recommendations tendered on the original inventory form for this site indicate that test excavations would be warranted if impacts were to take place. Alberta Community Development has not officially reviewed these recommendations or made determinations as to whether additional studies would be necessary. For the purposes of this report, this site has been evaluated as being of moderate value in representing the typical site distribution pattern throughout the Project area, along with a series of other sites of similar character (see Section 6.0). As such, it would be considered eligible for inclusion in a sampling program that would recover archaeological material in a staged excavation program from a proportion of these sites before they are consumed in development of the Project (see Section 7.3).

5.3 New Sites

As with the 1980 Alsands Project studies, the 1997 Project was successful in identifying prehistoric archaeological sites. Sixteen new sites were recorded and assessed. Almost invariably these occur in undisturbed situations. Detailed descriptions of each, along with recommendations for future management, are provided below. Table 7 below provides summary information on these sites. Figure 12 displays the location with relation to current development plans. In addition, Figure 11 displays their location with respect to other areas examined and Table 5 provides information on the number of transects and shovel tests excavated on the landforms on which they occur. Finally, Appendix I provides the site inventory forms for each and includes sketch maps illustrating the locations of assessment tests within each general site area.

The recommendations for each of these sites assume that developments will proceed as currently planned. However, each of these sites have been included, along with all others in the general Project area, in the tabular summary in Section 6.4 and could be included in the overall mitigation program recommended for the Project on the basis of their ranking if development plans change.

Table 7 New Sites Identified in the 1997 Program

Site	Site Type	Site size	Artifacts	Positive	Material
HhOu 41	Buried scatter	1 sq. m	11 debitage	One	BRS
HhOu 42	Buried scatter	1 sq. m	36 debitage	One	BRS
HhOu 43	Buried scatter	1 sq. m	10 debitage	One	BRS
HhOu 44	Buried scatter	1 sq. m	1 debitage	One	BRS
HhOu 45	Buried scatter	5 sq. m	100 debitage	Two	BRS
HhOu 46	Buried scatter	5 sq. m	33 debitage	One	BRS
HhOv 178	Buried scatter	1 sq. m	6 debitage	One	BRS
HhOv 179	Buried scatter	1 sq. m	7 debitage	One	BRS
HhOv 180	Buried scatter	1 sq. m	7 debitage	One	BRS
HhOv 181	Buried scatter	1 sq. m	210 debitage	One	BRS
HhOv 182	Buried scatter	1 sq. m	51 debitage	One	BRS
HhOv 183	Buried scatter	1 sq. m	2 flake tools	One	BRS
HhOv 184	Buried scatter	10 sq. m	378 debitage	Six	BRS
HhOv 185	Buried scatter	1 sq. m	33 debitage	One	BRS
HhOv 186	Buried scatter	1500 sq. m	24 debitage	Six	BRS
HhOv 187	Buried scatter	150 sq. m	69 debitage	Three	BRS

1. **HhOu 41 (12-30-95-9-W4 - 12VVU 726 476; Plates 8 and 9):** This site is a buried artifact scatter recorded during the 1997 field season. The site was identified on a small jack pine covered knoll, approximately 100 m west of the Muskeg River. The knoll is situated on the first terrace back from the river and measures 33 m north/south by 58 m east/west. A total of 29 tests were completed on the landform; one was positive. This test was expanded into a 1 x 1 m unit and produced one core fragment, 35 pieces of debitage and the lateral edge of a biface fragment at approximately 15 cm below ground surface within sand/silt sediments. All material recovered was of Beaver River Sandstone. Though undisturbed, the site is limited in areal extent and therefore considered to be of limited archaeological potential. It will not be impacted by any proposed development plans for the Project.

   Recommendations: Because this site has limited value and would not be affected by proposed developments, no further studies are warranted at this time. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) if its impact status changes.

J:\1997\2237\8450\BASELINE.DWG

Muskeg River Mine Project

MINE AREA

WEST STORAGE AREA

NE STORAGE AREA

SOUTH STORAGE AREA AND CLEARING

RMS

RMS

PROPOSED TAILINGS LOCATION

Fred Boucher

Raymond Boucher

Isadore Lacorde

Louis Tourangeau

Mile 49

ISADORE'S LAKE

MILLS CREEK

ATHABASCA RIVER

MUSKEG RIVER

SHELLEY CREEK

JACKPINE CREEK

MUSKEG

HhOv-61 HhOv-137 HhOv-71 HhOv-62 HhOv-126 HhOv-127 HhOv-125 HhOv-63 HhOv-29 HhOv-64 HhOv-28 HhOv-27 HhOv-94 HhOv-38 HhOv-91 HhOv-90 HhOv-89 HhOv-88 HhOv-87 HhOv-36 HhOv-11 HhOv-93 HhOv-37 HhOv-85 HhOv-84 HhOv-83 HhOv-77 HhOv-76 HhOv-10 HhOv-16 HhOv-78 HhOv-79 HhOv-82 HhOv-86 HhOv-81 HhOv-124 HhOv-80 HhOv-186 HhOv-182 HhOv-184 HhOv-21 HhOv-185 HhOv-19 HhOv-187 HhOv-18 HhOv-107 HhOv-106 HhOv-105 HhOv-17 HhOv-68 HhOv-69 HhOv-67 HhOv-22 HhOv-20 HhOv-109 HhOv-34 HhOv-40 HhOv-108 HhOv-181 HhOv-39 HhOv-180 HhOv-179 HhOv-33 HhOv-74 HhOv-178 HhOv-72 HhOv-73 HhOv-139 HhOv-32 HhOv-135 HhOv-138 HhOv-96 HhOv-134 HhOv-133 HhOv-70 HhOv-130 HhOv-131 HhOv-132 HhOv-129 HhOv-20 HhOv-7 HhOv-19 HhOv-21 HhOv-18 HhOv-31 HhOv-183 HhOv-1 HhOv-44 HhOv-45 HhOv-46 HhOv-4 HhOv-3 HhOv-2 HhOv-8 HhOv-16 HhOv-17 HhOv-6 HhOv-42 HhOv-43 HhOv-41 HhOv-23 HhOv-22 HhOv-24 HhOv-30 HhOv-28 HhOv-29 HhOv-25 HhOv-27 HhOv-31 HhOv-26 HhOv-14 HhOv-9 HhOv-10 HhOv-34 HhOv-11 HhOv-12 HhOv-13 HhOv-15 HhOv-49 HhOv-6 HhOv-50 HhOv-146 HhOv-51 HhOv-120 HhOv-5 HhOv-52 HhOv-19 HhOv-56 HhOv-53 HhOv-4 HhOv-118 HhOv-54 HhOv-55 HhOv-116 HhOv-117 HhOv-115 HhOv-114 HhOv-112 HhOv-113 HhOv-111 HhOv-3 HhOv-128 HhOv-123 HhOv-122 HhOv-121

0 500 1000 1500 2000 2500(metres)

SCALE 1:50,000

REFERENCE

DIGITAL DATA SETS 74D, 74E, 74I
84A AND 84H FROM RESOURCE DATA DIVISION
ALBERTA ENVIRONMENTAL PROTECTION, 1997.

LEGEND

- Trapper's Cabin – Collapsed
- Trapper's Cabin
- 29 Borden Identification Number
- (40) Gravesite\Number of Graves
- Boiler and Rig Debris

Golder Associates

SHELL CANADA LIMITED

RELATIONSHIP BETWEEN HISTORICAL RESOURCES AND PROPOSED IMPACT ZONES

22 JAN 1998	Figure 12	DRAWN BY: CG/VS

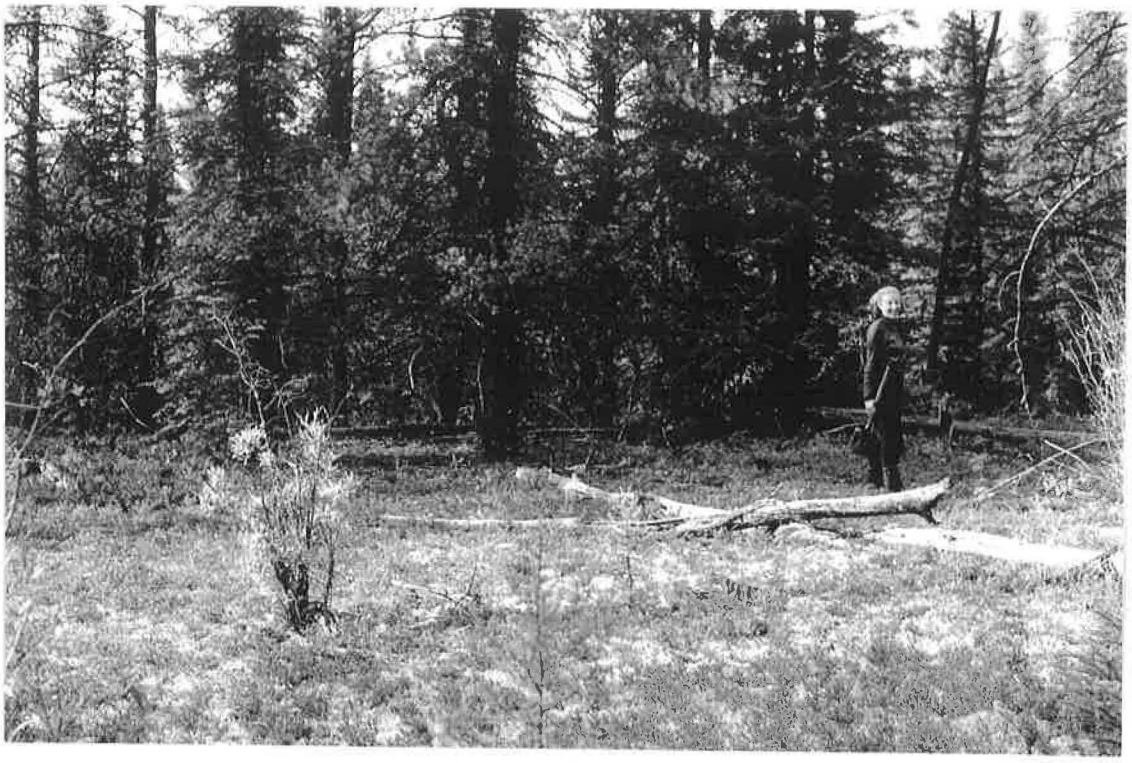


Plate 8: HhOu 41 site area view north.

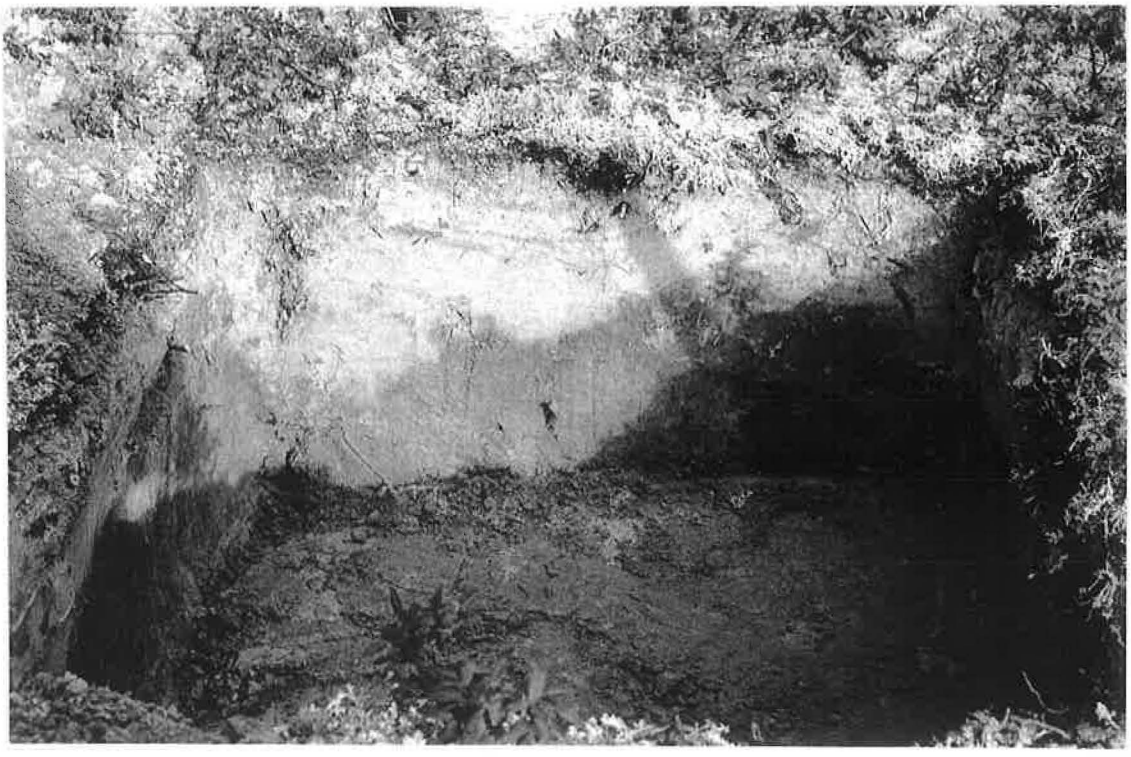


Plate 9: One by one metre test at HhOu 41 view north.

2. **HhOu 42 (15-30-95-9-W4 - 12VVU 730 483; Plate 10):** This site was identified during the 1997 field program and was recorded as a buried artifact scatter. The site is situated on a north/south trending ridgetop, approximately 500 m northwest of the Muskeg River and 200 m south of an existing east/west cutline. The ridge measures 400 m north/south by 100 m east/west. A total of 150 shovel tests were placed on the landform but only one was positive, producing three Beaver River Sandstone secondary flakes. This test was expanded into 1 x 1 m in size and resulted in the recovery of 33 additional Beaver River Sandstone debitage specimens. All artifacts were recovered at approximately 15 cm below surface within a sand/silt matrix. Though undisturbed, the site is limited in areal extent and, is therefore, considered to be of limited archaeological potential. It will not be impacted by any proposed development plans for the Project.

   Recommendations: Because of its limited significance and the fact that it will not be affected by the Project, no further studies are warranted. However, it may quantify for inclusion in a proportional sampling program (see Section 7.3) if its impact status changes.

3. **HhOu 43 (4-32-95-9-W4 - 12VVU 735 484; Plate 11):** This site was identified during the 1997 field program and was recorded as a buried artifact scatter. The site is situated on a north/south trending ridgetop approximately 250 m north of the Muskeg River and 100 m south of an existing east/west cutline. The ridge measures 500 m north/south by 150 m east/west. A total of 140 shovel tests were placed on the landform, only one of which was positive. The initial test produced one Beaver River Sandstone secondary flake. The test was expanded into a 1 x 1 m test resulting in the recovery of eight additional Beaver River Sandstone debitage specimens and one quartzite retouch flake. All artifacts were recovered at approximately 15 cm below surface within a sand/silt matrix. Though undisturbed, the site is limited in areal extent and therefore considered to be of limited archaeological potential. It will not be impacted by any proposed development plans for the Project.

   Recommendations: Because of its limited significance and the fact that it will not be affected by the Project, no further studies are warranted. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) if its impact status changes.

4. **HhOu 44 (10-24-95-10-W4 - 12VVU 712 458; Plates 12 and 13):** This site was identified during the 1997 program and is classified as a buried artifact scatter. It is situated on the

Plate 10: HhOu 42, general view south.

Plate 11: HhOu 43, general view north.

Plate 12: HhOu 44, general view southeast.

Plate 13: One by one metre test at HhOu 44.

highest terrace edge on the east side of the Muskeg River. The landform parallels the entire east side of the Muskeg River, trending northeast to southwest. The terrace edge is well-formed and extends east back from the river for approximately 100 to 150 m at its widest point. One of seven shovel tests excavated over the extent of the site area produced positive results. The positive test, which was subsequently expanded into a 1 x 1 m unit, produced one Beaver River Sandstone secondary flake and one pebble chert end scraper. Six tests in the immediate vicinity of the productive unit failed to recover any additional archaeological materials. In all tests, artifacts were recovered in sandy sediments approximately 15 cm below the existing surface. This site is completely undisturbed but is considered to be of limited archaeological potential. At present it lies west of the proposed muskeg storage area and therefore outside of any proposed impact zone.

Recommendations: Because of its limited significance and the fact that it will not be affected by development, no further studies are warranted. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) if its impact status changes.

5. **HhOu 45 (10-24-95-10-W4 - 12VVU 711 457; Plates 14 and 15):** This site is classified as a buried artifact scatter identified during the 1997 field program. It is situated on the same high terrace edge as HhOu 44, on the east side of the Muskeg River. The terrace edge at this juncture, though still paralleling the east side of the Muskeg River, now trends east to west. The terrace edge is still very discernible at this point. Two of seven shovel tests excavated over the extent of the site area produced positive results. The first positive test, which was subsequently expanded into a 1 x 1 m unit, produced 99 pieces of lithic debitage. One test immediately west of the productive unit produced a single secondary flake. All material was of Beaver River Sandstone. In all tests, artifacts were recovered in sandy sediments approximately 15 cm below the existing surface. This site is completely undisturbed but is considered to be of limited archaeological potential. At present, it lies west of the proposed muskeg storage area and therefore outside of any proposed impact zone.

   Recommendations: Because of its limited significance and the fact that it will not be affected by development, no further studies are warranted. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) if its impact status changes.

Plate 14: HhOu 45, general view north.

Plate 15: One by one metre test at HhOu 45.

6. **HhOu 46 (10-24-95-10-W4 - 12VVU 709 456; Plates 16 and 17):** This site was identified during the 1997 program and is classified as a buried artifact scatter. It is situated along a terrace on the south side of the Muskeg River. At this point the landform parallels the east/west-trending Muskeg River. The terrace edge is not well-formed and gently slopes downward to the river as opposed to being incised. One of six shovel tests excavated over the extent of the site area produced positive results. The positive test, which was subsequently expanded into a 1 x 1 m unit, produced 33 pieces of Beaver River Sandstone debitage. Five tests in the immediate vicinity of the productive unit failed to recover any additional archaeological materials. In the positive test, artifacts were recovered in sandy sediments approximately 15 cm below the existing surface. This site is completely undisturbed but is considered to be of limited archaeological potential. At present it lies west of the proposed muskeg storage area and, therefore, lies outside of any proposed impact zone.

   Recommendations: Because of its limited significance and the fact that it will not be affected by development, no further studies are warranted.

7. **HhOv 178 (3-26-95-10-W4 - 12VVU 692 469; Plate 18):** This site was identified during the 1997 program and is classified as a buried artifact scatter. It is situated on a teardrop-shaped knoll 50 m east of a small lake, west of the former Alsands camp and 160 m north of the road to the former Alsands plant site. The landform is approximately 160 m on a north/south axis and 22 m on an east/west axis at its widest point. One of 42 shovel tests excavated over the extent of the feature produced a single Beaver River Sandstone core from the sandy sediments approximately 20 cm below the existing surface. This test was expanded into a 1 x 1 m unit and an additional five specimens of Beaver River Sandstone were recovered in a similar stratigraphic context. Tests in the immediate vicinity of the productive unit failed to recover

Plate 16: HhOu 46, general view south.

Plate 17: One by one metre test at HhOu 46.

Plate 18: HhOv 178 general view north and one by one metre test.

any additional archaeological materials. This site is completely undisturbed but is considered to be of limited archaeological potential. It will be removed during the early stages of stripping for the Project.

Recommendations: On the basis of its physical characteristics, this site warrants no specific mitigation study. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) because of its representative nature.

8. **HhOv 179 (3-26-95-10-W4 - 12VVU 684 466, Plates 19 and 20):** This site is located on a small well-drained knoll approximately 200 m south of an existing major road and 25 m south of an existing cut-line. The site, discovered in 1997, has been recorded as a buried artifact scatter consisting of seven pieces of debitage and one lateral edge of a biface fragment. All artifact material consists of Beaver River Sandstone. In addition to these artifacts, one piece of red ochre was also recovered. All artifacts were recovered from a single shovel test that was expanded into a 1 x 1 m unit. Artifacts were recorded at a depth of 15 cm below surface within a sand/silt matrix. The landform on which the site is situated measures 40 m north/south by 160 m east/west. A total of 30 shovel tests were done on this feature. Though undisturbed, the site is limited in areal extent and therefore considered to be of limited archaeological potential. It will be removed during the early stages of stripping for the Project.

   Recommendations: On the basis of its limited physical characteristics, this site warrants no specific mitigation study. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) because of its representative nature.

9. **HhOv 180 (3-22-95-10-W4 - 12VVU 674 454, Plates 21 and 22):** This buried scatter is located on a very small well-drained knoll approximately 6 m south of an existing cut-line and was recorded during the 1997 field program. The knoll measures 8 m north/south by 12 m east/west and is the only visible point of dry ground within the immediate area. A total of four negative shovel tests and one positive test was completed on the landform. The positive test was subsequently expanded into a 1 x 1 m unit and produced six pieces of debitage and one core fragment, all of Beaver River Sandstone. Artifacts came from within a sand/silt matrix approximately 15 cm below surface. Though undisturbed, the site is limited in areal extent and therefore considered to be of limited archaeological potential. It will be removed during the early stages of stripping for the Project west overburden disposal area.

Plate 19: HhOv 179, general view south.

Plate 20: One by one metre test at HhOv 179.

Plate 21: HhOv 180, general view north.

Plate 22: One by one metre test at HhOv 180.

Recommendations: On the basis of its limited physical characteristics, this site warrants no specific mitigation study. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) because of its representative nature.

10. **HhOv 181 (11-14-95-10-W4 - 12VVU 690 445, Plates 23 and 24):** This buried scatter is situated on a large, well-drained open meadow with a bog to the south and east. It lies 250 m east of an existing major road and was recorded during the 1997 program. A total of 13 tests were excavated at the south end of the landform, one of which was positive. Three core fragments and 207 pieces of lithic debitage were recovered from this shovel test and its subsequent expansion into a 1 x 1 m unit. All material was Beaver River Sandstone and was noted at 15 cm below surface in a sand matrix. Though the site is limited in areal extent, the sheer number of artifacts recovered suggests activity beyond that of an isolated occurrence. It will not be impacted by any proposed development plans for the Project.

    Recommendations: Because this site can be avoided, no further work is recommended on the site. However, a preliminary limited number of 1 x 1 m units (n = 8) should be placed near the positive test if impact status should change and it qualifies for inclusion in a proportional sampling program (see Section 7.3) because of its moderate value in representing the typical site distribution pattern in the Project area.

11. **HhOv 182 (1-16-95-10-4 - 12VVU 668 438, Plates 25 and 26):** This site was found during the 1997 program and is classified as a buried artifact scatter. It is situated on a large north/south-trending knoll 350 m west of cutline and 11.4 km west of the road to the former Alsands plant site. The landform is approximately 150 m on a north/south axis and 22 m on an east/west axis at its widest point. One of 30 shovel tests excavated over the extent of the feature was positive. When expanded into a 1 x 1 m unit, this test produced 51 pieces of lithic debitage. All the material was Beaver River Sandstone. Artifacts were recovered from the sandy sediments approximately 15 cm below the existing surface. This site is completely undisturbed but is considered to be of limited archaeological potential. It will be removed during the early stages of stripping for the Project tailings settling pond area.

    Recommendations: On the basis of its limited physical characteristics, this site warrants no specific mitigation study. However, it may qualify for inclusion in a proportional sampling program (See Section 7.3) because of its representative nature.

Plate 23: Shovel testing at HhOv 181, general view south.

Plate 24: One by one metre test at HhOv 181.

Plate 25: Shovel testing at HhOv 182, general view north.

Plate 26: One be one metre test at HhOv 182.

12. **HhOv 183 (7-23-95-10-W4 - 12VVU 694 465, Plates 27 and 28):** This site is a buried artifact scatter recorded during the 1997 field season. The site was recovered on a very small, well-drained knoll, approximately 35 m east and south of two cutlines. The knoll measures 70 m north/south by 40 m east/west. A total of 17 tests were completed on the landform; one was positive. The test was expanded into a 1 x 1 m unit and produced two secondary flakes approximately 15 cm below ground surface within sand/silt sediments. All material recovered was of Beaver River Sandstone. Though undisturbed, this site is limited in areal extent and, therefore, considered to be of limited archaeological potential. It will be removed during the early stages of stripping for the Project plant site.

    Recommendations: On the basis of its limited physical characteristics, this site warrants no specific mitigation study. However, it may qualify for inclusion in a proportional sampling program (See Section 7.3) because of its representative nature.

13. **HhOv 184 (15-10-95-10-W4 - 12VVU 679 433, Plates 29 and 30):** This site is located on a large north/south-trending knoll that lies immediately west of the existing road to the former Alsands plant site. The site, discovered in 1997, has been recorded as a buried artifact scatter consisting of 378 pieces of debitage. All artifact material consists of Beaver River Sandstone. Artifacts were recovered from six of 6 shovel tests on the site. The site area is approximately 15 m north/south by 30 m east/west. The first positive test and subsequent expansion into a 1 x 1 m unit produced 71 pieces of lithic debitage. The remaining five positive tests produced an additional 299 pieces of lithic debitage. Artifacts were recorded up to a depth of 20 cm below surface within a sand/silt matrix. The landform on which the site is situated measures 200 m north/south by 120 m east/west. The site is undisturbed and quite large in areal extent and is therefore considered to be of moderate archaeological potential. At present, it lies east of the proposed tailings area and west of an existing access road and therefore may be outside of any proposed impact zone.

    Because of its size and the density of cultural material present, this site is considered to have greater archaeological potential than others typically recorded in the Project area. The density of remains suggests that tool manufacture may have been one of the major on-site activities. A full range of technological types may be present, suggesting it may be possible to define a typical sequence of tool production involving Beaver River Sandstone source material.

Plate 27: Shovel testing at HhOv 183, general view east.

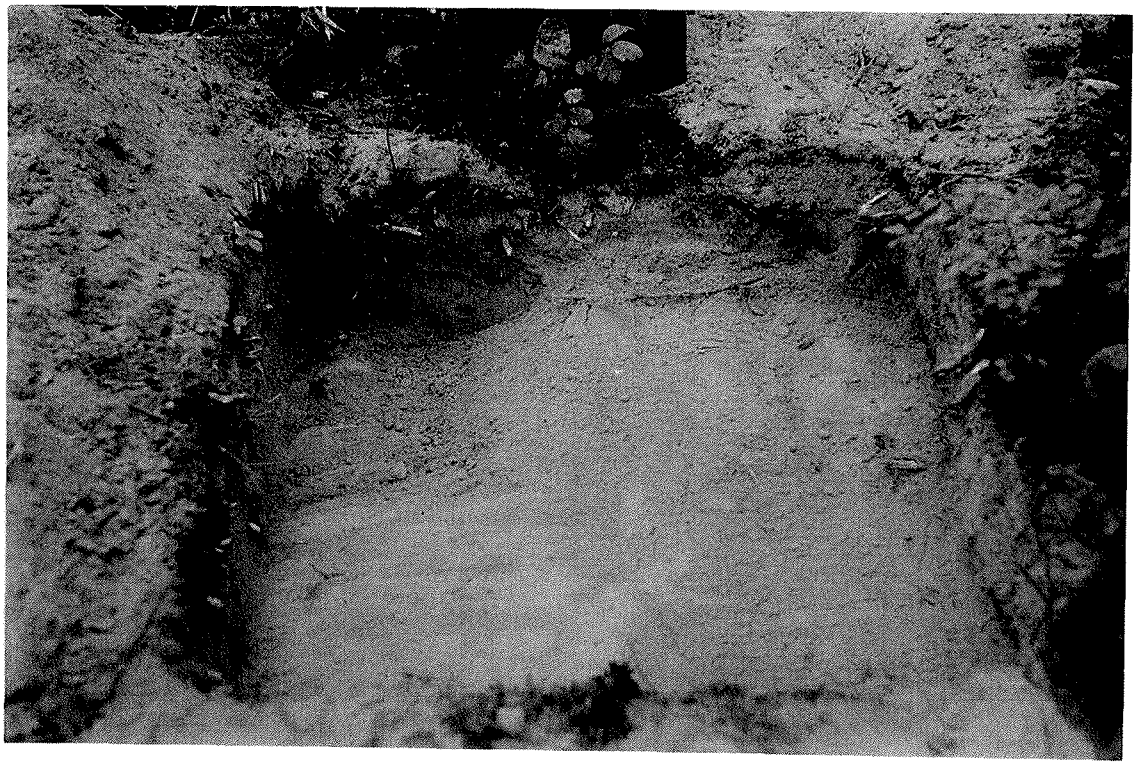


Plate 28: One by one metre test at HhOv 183.

Plate 29: HhOv 184, general view north.

Plate 30: One by one metre test at HhOv 184.

Recommendations: An additional 30 m^2 of dispersed excavation is recommended as a preliminary sample before the need for additional work is determined, if proposed development should encroach on the site.

14. **HhOv 185 (5-10-95-10-W4 - 12VVU 672 428, Plates 31 and 32):** This site was identified during the 1997 field program and was recorded as a buried artifact scatter. The site is situated on a large east/west-trending ridgetop approximately 50 m southwest of a northwest/ southeast cutline. The ridge measures 75 m north/south by 200 m east/west. A total of 65 shovel tests were excavated on the landform, one of which was positive. The initial test produced eight Beaver River Sandstone secondary flakes. It was expanded into 1 x 1 m in size, which resulted in the recovery of 25 additional Beaver River Sandstone debitage specimens. All artifacts were recovered at approximately 15 cm below surface within a sand/silt matrix. Though undisturbed, the site is limited in areal extent and therefore considered to be of limited archaeological significance. It will be removed during the early stages of stripping for the proposed Project tailings settling pond area.

    Recommendations: On the basis of its limited physical characteristics, this site warrants no specific mitigation study. However, it may qualify for inclusion in a proportional sampling program (see Section 7.3) because of its representative nature.

15. **HhOv 186 (14-9-95-10-W4 - 12VVU 658 433, Plates 33 and 34):** This site was identified during the 1997 program and is classified as a buried artifact scatter. It is situated on a large northwest/southeast-trending ridge 250 m south of an existing cutline and 2 km west of the road to the former Alsands plant site. The landform is approximately 75 m on a north/south axis and 30 m on an east/west axis at its widest point. Six of 21 shovel tests excavated over the extent of the feature produced positive results. The first positive test, expanded into a 1 x 1 m unit, produced three pieces of lithic debitage. The remaining five positive tests produced an additional 20 secondary flakes and one core. All material was of Beaver River Sandstone. In all tests, artifacts were recovered in sandy sediments approximately 20 cm below the existing surface. The site is undisturbed and quite large in areal extent and is therefore considered to be of considerable comparative archaeological value. It will be removed during the early stages of stripping for the Project tailings settling pond area.

Plate 31: HhOv 185, general view west.

Plate 32: One by one metre test at HhOv 185.

Plate 33: HhOv 186, general view south.

Plate 34: One by one metre test at HhOv 186.

Recommendations: Although the amounts of cultural material recovered in the test program at this site were relatively modest, its considerable size suggests that several episodes of tool production and/or use are represented. Experience suggests that dense material concentrations may exist in areas of this site not tested. For these reasons, this site is considered to be atypical of the sites recorded within the Project area and to have greater interpretive potential. Mitigation studies are considered to be warranted before it is destroyed by development activities. The program recommended would consist of placement of an initial ten 1 x 1 m tests dispersed throughout the site to identify concentrations. This should be followed by fifteen 30 m^2 of block excavations as warranted.

16. **HhOv 187 (16-4-95-10-W4 - 12VVU 665 419, Plates 35 and 36):** This buried scatter is situated on a level, slightly raised knoll overlooking a bog to the west. The site lies 500 m west of a cutline and was recorded during the 1997 program. A total of eight tests were excavated at the west end of the landform, of which three were positive. Fifty-seven pieces of lithic debitage were recovered from the shovel test and its subsequent expansion into a 1 x 1 m unit. Two secondary flakes were recovered from the northern positive test and 10 pieces of lithic debitage from the northwest test. All material was Beaver River Sandstone and was recovered at 15 cm below surface in a sand matrix. The site will be removed during the early stages of stripping for the Project tailings settling pond area.

Recommendations: Although this site is relatively small in its size, the recovery of one dense concentration of artifacts and two other occurrences suggests that several activity areas may be present. In this respect, it is considered to exhibit more variety than many of the sites typically recorded within the Project area and to have greater interpretive potential. The character of the materials recovered, which include larger sized specimens, some of which exhibit cortex, suggests that activities may represent the early stages of tool production. This is unexpected given the site's distance form any predicted material sources. For these reasons, a sampling program is recommended before decisions are made about further study in advance of development. It is recommended that mitigation proceed by excavation of five 1 x 1 m dispersed test units to be followed by ten 15 m^2 of block excavations, as warranted.

Plate 35: HhOv 187, general view west.

Plate 36: One by one metre test at HhOv 187.

5.4 Historic Period Resources

One potential historic site, a hunting camp, was identified during the 1997 program. It does not appear to exceed 50 years in age and, consequently, is not considered an historical resource under the provisions of the Alberta Historical Resources Act. It is not discussed in detail here.

5.5 Palaeontological Resources

No specific palaeontological studies were required by Alberta Community Development in their preliminary review of the development information for the Muskeg River Mine Project. This reflects the fact that bedrock exposures are non-existent in the Project area and the area is rated as having unknown potential in this regard. No palaeontological resources were encountered in any of the investigations conducted for the 1997 program and none have been identified in any previous study within the Project area. Given the modest potential for significant palaeontological remains in the McMurray Formation, which is the target zone for mining activities, it is not expected that significant fossils will be unearthed during the various stages of Project development. Nevertheless, should any significant fossils be uncovered during development, it is recommended that the Tyrrell Museum of Palaeontology be contacted.

6.0 SUMMARY

This section summarizes the results of previous and current historical resource studies in the Project development area as a basis for estimating the direct impacts of the proposed Project. A mitigation program designed to offset the proposed impacts of the Project is discussed in Section 7.0

6.1 Coverage

Historical resources studies to date have provided inventory level information for most of the areas proposed for development during the life of the Project. Several related developments, such as water intake facilities and pipelines remain in the initial planning stages and have not been considered in the current historical resources program. Nevertheless, for the majority of the Project development area, an assessment of the proportional coverage of areas of archaeological potential entailed in these investigations can be provided. For the purposes of this assessment, GIS technology was employed.

Maps and air photos provided in the records for 1980 Alsands studies, the 1981 and 1982 Alsand post-clearance studies and the 1997 Project program identified the elevated features examined within proposed development zones. These features were plotted on clear plastic overlays fitted to the main Project area air photo mosaic. These areas were subsequently digitized and incorporated in the main Project database, which contains layers at the same scale for vegetation communities, soil types and other relevant environmental variables. To obtain an impression of the sample this comprises of all elevated landforms with the Project area, the areas tested were compared with all areas classified as supporting jack pine and aspen-related vegetation communities.

For the purposes of this exercise, three different areas were compared. An "historical resources study area" was established that consists of the Project Local Study Area (LSA), but exempts areas west of the Highway 63 alignment and the Susan Lake gravel ridge. This excludes the landforms and site distributions along the rim of the Athabasca River valley, which reflect a different a topography and land use pattern from that observed throughout the interior of the Project area. The Muskeg River "Mine footprint" was also included in this comparison, as it reflects both the physical impact zone and a representative portion of the distinctive historical resource site distribution recorded in the area. The third area included in this comparison is that portion of the Project area that was cleared of forest during the initial preparation stages for the Alsands Project's

first five-year mine site, which was subsequently examined by the Archaeological Survey of Alberta (Ives 1982a, 1988). Figure 10 shows these three areas.

Table 8 shows the overall size in hectares these areas encompass, the total amount of elevated areas of potential within each area and how many of these areas have been examined during the 1980 and 1997 HRIA programs. It is evident from Table 8 that landforms with potential for archaeological sites comprise between 12 and 20% of the total area within each of these zones. In the overall study area, 26% of these landforms have been examined, while the coverage within the mine footprint development zone rises to 34%. For this comparison, it has been assumed that all of the elevated landforms within the cleared Alsands mine area were examined by the Archaeological Survey.

Table 8 Historical Resources Survey Coverage, Areas of Potential and Site Density Predictions

	Historical Resources Study Area	**Mine Footprint**	**Archaeological Survey Post-Clearance Study**
Total area	10,000.1 ha	4,316.6 ha	331.7 ha
Areas of potential	2,028 ha (20% of total area)	759.5 ha (17.5% of total area)	38.5. ha (11.6% of total area)
Areas investigated	524 ha (25.8% of potential)	260.7 ha (34.3% of potential)	38.5 ha (100% of potential)
numbers of sites	111	81	25
sites per hectare			0.649
Predicted site numbers	1,317	492	25

6.2 Overall Site Prediction

The above analysis provides an indication of the landforms that may contain archaeological sites within the Project development area. This calculation can serve as a basis for predicting the actual numbers of archaeological sites that might be present in development zones, but requires an extrapolation of site density in these areas if dense vegetation cover did not obscure their presence. Only one previous study provides data that could indicate actual site densities on these landforms.

For the Alsands Project, Dr. J. W. Ives of the Archaeological Survey of Alberta inspected areas cleared of forest for in 1981 and 1982 (Ives 1982a, 1988) and identified of large numbers of archaeological sites on elevated features that had been examined previously with no returns. Ives inspected 28 elevated features, examining exposures created during clearance (Ives 1982a).

According to his observations, subsurface visibility varied between 5 and 100%, for a mean of 35%. Thirty-five archaeological sites were recorded and surface collections made. Ives suggests that, given the proportion of exposures available for examination, perhaps 65% more sites remain to be discovered in this area and projects a density of 30 sites/ km^2 throughout his study area.

The results of this study were used to predict the potential number of sites throughout the Project area. A perhaps tenuous assumption necessary in this regard, is that site distributions in Ives' study area are sufficiently representative of the potential of landforms in adjacent areas to provide reliable estimates. For this reason, the following estimates should be considered preliminary. Ives' simple per kilometre estimates have been modified to account for the number of elevated features throughout the Project area and the area they encompass. Existing field records, maps and air photographs, were used to calculate the area encompassed by the elevated features examined by Ives. The recovery of 25 sites within the Project area has been used to calculate a projection of 0.649 sites/ha of elevated area.

Table 8 shows the total area encompassed by elevated features calculated for two distinct areas. The "Historical Resources Study Area" includes the entire LSA with the exception of the Susan Lake gravel ridge and Athabasca River valley rim, and the "Mine Footprint" represents the actual proposed impact zones of the Project. Simple extrapolation of the density estimates derived from the post-clearance studies completed in the Alsands mine site area yields estimates that 1,317 historical resource sites may occur in the general Historical Resources Study Area and 492 historical resource sites may be present within the Mine Footprint area. On this basis, it is possible to conclude that numbers of sites in the range of the latter estimate might be discovered on elevated landforms throughout the development area, if forest removal techniques similar to those applied in 1980 for the Alsands Project were used during the phased development schedule for the Project, and similar post-construction inspection techniques were employed.

Using Ives' estimate that an additional 65% might be present under conditions of 100% subsurface visibility, the total number of historical resource sites present within the proposed development area may approach 811. These figures imply that large numbers of historical resource sites are present in the area and that only a few of these are actually known. Whether or not these estimates are considered reliable, a similar range in site values to that encountered in the Alsands post-clearance studies is expected to occur. That is, most of these will be of relatively low value or would be considered representative of site occupation patterns that have already been defined for the area.

None of the sites identified in the Alsands mine area was considered sufficiently significant to warrant large-scale sample recovery before their removal.

Only one highly significant site ("Bezya", HhOv 73) has so far been identified among the 99 recorded in the LSA east of the Highway 963 corridor and, in its case, archaeological sample recovery procedures were considered sufficient to offset proposed development impacts. If a similar ratio of site values could be assumed for other development areas, it could be expected that either no highly significant sites would be encountered, or those that were would not require permanent avoidance. Between four and eight significant sites might be anticipated on purely numerical grounds. However, it must be appreciated that sites of this character are comparatively extensive and situated on distinctive landforms of obvious potential. All such landforms have been investigated and the intensive inspection procedures employed are considered to have been adequate to uncover sites of this nature. It is, therefore, expected that identification of a significant site in post-construction inspection would be unlikely. A more likely scenario would be identification of large numbers of low to moderate value sites, all of which would be considered representative of known occupation patterns.

Ives' interpretation of the significance of the sites recorded in post-clearance survey is partially revealed in the separate recommendations made on site forms completed for this not fully reported project. Despite the fact that fewer than 30 artifacts were recovered at 64% of the sites recorded in this study, 35% were recommended for further study at least at a preliminary level. With the large predicted sample available within the Project area, the issue of redundancy of information requires more close consideration.

6. 3 Site Distribution

Previous archaeological studies in the Project area and adjacent lands have identified a unique and important distribution of archaeological sites that appears to stand in significant contrast to similar areas within the Lower Athabasca River basin. To appreciate the implications this site distribution has on regional prehistory, it is necessary to consider its variation on both spatial and temporal dimensions. The following section considers this variation by focusing on gaining a better understanding of the Holocene landscape and vegetation changes that may have affected prehistoric land use.

6. 3.1 Site Age

Establishing a chronology for the prehistoric occupations identified within the Project area is frustrated by the problems that characterize archaeology throughout the Boreal Forest region. Organic materials associated with the remains of prehistoric occupation, that could be used to obtain radiometric dates for the occupations they represent, are invariably removed by the destructive chemical processes inherent in the acid soils of the region. In addition, stylistically distinct artifact types that can be used to provide rough estimates of occupation dates are rarely recovered in the sites in the area. Thus, for the vast majority of archaeological sites recorded in the area, even approximate ages cannot be provided.

If the 9,900 year date provided for the Glacial Lake Agassiz outwash flood is accepted, it provides an earliest possible date of prehistoric occupation of the floodplain area, which encompasses and extends beyond the Project area. Chronologically sensitive artifacts have been obtained from two sites adjacent to the Project area, suggesting that the area was in use during the Early Prehistoric Period, between 9,000 and 7,500 years ago. Sims (1975) reports recovery of a specimen identified as Hell Gap from a site along the Muskeg River near the proposed plant site. This style of point is thought to date between 9,950 and 9,450 years on the southern Plains and probably occurs considerably later in forested regions. Recent studies in the Syncrude Aurora North project area have recovered several spear point specimens initially classified as Scottsbluff (Mack Shortt personal communication), which date to a period 9,450 and 8,350 years ago on the southern Plains. Other specimens relating to occupations thought to date from a similar period have been recovered from the east side of the Athabasca River and the Birch Hills area (Ives 1993).

While this evidence of early occupation is limited, it may be augmented by Ives' recovery of a quantity of large flakes (8-10 cm in length) from a small site (HhOu 27) in the Project area north of the Muskeg River (Ives 1982b 1993). Use of bifacial cores for the production of large flakes is frequently considered characteristic of material use strategies employed in the Early Prehistoric Period. However, such patterns cannot be considered to be limited to that time range.

Although populations are generally thought to be larger during the Middle Prehistoric Period, and sites more widely distributed and easily encountered, evidence of occupations dating between 7,500 and 1,200 years ago is surprisingly limited. A single point recovered from within the Muskeg River Mine development area has been tentatively assigned a Shield Archaic affiliation (Ronaghan

1981b) and may date from between 3,500 and 1,750 years ago. More tangible evidence of Middle Prehistoric use of the area has been recovered from the Bezya Site within the Muskeg River Mine Project area (LeBlanc and Ives 1986). Excavations at this site produced a large collection of microcores, ridge flakes, core tablets and microblades that are thought to relate to an occupation by group(s) affiliated with an archaeological entity referred to as the Northwest Microblade tradition (Millar 1981, Workman 1978). A date of 3,990 years ago was obtained from charcoal believed to be associated with this assemblage of stone artifacts. Elsewhere, a series of points from the Birch Hills have been assigned to this period (Ives 1993) and one point recovered from the Cree Burn Lake Site has been assigned to the Oxbow type, which dates 4,500-3,500 years ago on the Plains (Vickers 1986)

Although evidence of Late Prehistoric occupation within the region after 2,500 years appears to increase (Reeves 1997), most of the support for this contention comes from the Birch Hills and other areas north and west of the development area. Two relatively undiagnostic points have been recovered from sites within and adjacent to the Project area. Ives has argued that most of these small notched arrow points are best considered to represent late Taltheilei Tradition occupation of the region by groups speaking Athapaskan (Ives 1993) but other linkages are possible. Reeves (1997) suggests that the most intensive development and use of the Beaver River Sandstone sources, some of which may be in or near the Project area, took place during the Taltheilei occupation between 2,500 and 1,200 years ago. At present there is no way to assess this suggestion.

In summary, the ages of the sites situated within the proposed Project development area remain largely unknown. Indications within the development area suggest that several occupations took place between 9,000 and 4,000 B.P. Later occupations are more well-defined along the Athabasca River and in the Birch Hills to the west, but occur in the Project area as well. Although this pattern may be more suggestive than real, given the lack of information, it may be important to note that the period between 9,000 and 4,000 B.P. corresponds with the Hypsithermal climatic maximum, when significantly different climatic regimes and vegetational mosaics are predicted to have been in effect.

6.3.2 Early Landscapes

Terrain Variation

Prehistoric hunting groups developed economies that were intimately linked with the landscapes in which they subsisted. Three major factors may have contributed to a considerably different landscape being present in the Project area during the periods described above than can be observed today. The first of these is the original landforms left in the wake of the Glacial Lake Aggasiz outwash flood. Within the Project area, the studies conducted by Smith and Fisher (1993) indicate that the landforms consisted of braided outwash channel features along the floodway approaches to a large deltaic sand deposit north of the Fort Hills. These abandoned channels are currently filled by wetland organic deposits that have reduced the terrain variation significantly from its original form.

In order to obtain a better understanding of the reduction in landscape variation entailed in the accumulation of organic deposits, geotechnical data obtained in soil studies conducted for the Muskeg River Mine EIA were incorporated into the GIS data base for the project. This information was placed in a temporal context by reviewing modeling studies, relating to the timing and character of peat formation in western Canada, recently completed by researchers from the University of Alberta (Halsey et al. in press). The implications of these data for the distribution of archaeological sites were then considered.

It is apparent that peatlands began forming at high elevations after the Early Holocene climatic maximum of 9,000 years ago had passed. Forming first in the highlands of the Foothills and in major uplands such as the Birch Mountains at approximately 8,000 years ago, peat development expanded eastward and downslope during the period 8,000 to 6,000 years ago, but was delayed in certain lowland areas, such as the Peace/Wapiti basins until 5,000-4,000 years ago. The youngest peat deposits in Alberta are situated in the Parklands south of the project area and appear to have started forming in the period between 4,000 and 3,000 years ago (see Halsey et al. for detail). Consequently, for the landscape surrounding the Muskeg River Mine Project area, it would appear reasonable to suggest that peat deposits began forming between 6,000 and 4,000 years ago.

No data are currently available to suggest the rates of peat formation in specific locations such as the project area, because specific drainage characteristics and accurate predictions of moisture input

during a wide range of time periods would have to be taken into account. However, general climatic predictions for the mid-Holocene interval suggest that modern climatic conditions were reached between 7,500 (Vance 1985) and 5,000 (Schweger et al. 1981) years ago. Given the present lack of data, it may be reasonable to assume that peat formation began slowly, accelerated as modern moisture regimes were achieved and that rates may have stabilized during the latter part of the Holocene.

For the project area itself, muskeg (peat) depths have been estimated to range between less than 60 cm in depth through to a maximum of greater than 1.8 metres in depth. Figure 13 displays the locations of muskeg deposits at three depth intervals throughout the Local Study Area and compares these to the locations of archaeological sites. It is evident that the deepest muskeg deposits are situated east of the Muskeg River, within the proposed mine locality and north along the Muskeg River. Many archaeological sites are situated along the margins of these deposits and on islands of raised terrain surrounded by these, especially in the mine and tailings areas, where archaeological studies have focused.

Considering the fact that the elevated terrain features, on which the archaeological sites are situated, rise between less than one to greater than three metres above the surrounding terrain, this variation may have been increased to between 1.5 and 5 metres prior to muskeg formation. This variation, coupled with the aligned, sometimes sinuous form these features take, may have created topographic situations that would have been highly conducive to big game hunting by prehistoric groups.

It may be useful to conceive of the landscape as consisting of relatively deeply incised linear channels with numerous end points and breaches. These channels may have been vegetated with herbaceous communities in the earliest post glacial periods, by marshy plant communities the period between 8,000 and 6,000 years ago and by forming peat deposits in the period between 6,000 years and the present. Capture of grazing ungulates, probably most commonly bison, may have been facilitated in these channels by blocking exit points, followed by simple surround techniques. Later, during periods of peat formation, these potential advantages of the landscape may have been augmented by the possibility of driving animals into moisture-saturated channel deposits where their movement and escape possibilities would have been restricted. These suggestions are highly speculative at this time, given the lack of any chronological framework for the archaeological sites

6 350 000 N

6 345 000 N

6 340 000 N

460 000 E

465 000 E

470 000 E

475 000 E

LEGEND:

Historic Resource Study Area

Muskeg Depths

- 60 cm
- 70 cm
- 180 cm

Archaeology Sites

- Muskeg River Mine HRIA
- Alsands HRIA
- Alberta Culture (post-construction survey)

SOURCE: Alberta Community Development, CanAg Enterprises Ltd., Golder Associates Ltd., Lifeways of Canada Ltd., The Forestry Corp.

1 0 1 2

Kilometers

MAP PROJECTION: Universal Transverse Mercator Zone 12

DATUM: NAD 83

Golder Associates

SHELL CANADA LIMITED

MUSKEG RIVER MINE PROJECT
MUSKEG DEPTHS SHOWING MINE PLAN AND ARCHAEOLOGICAL SITE LOCATIONS

29 Jan. 1998 | Figure 13 | PRODUCED BY: J.S./B.P. REVIEWED BY:

/data8/oilsands/972-2237/9840/working/arcview/hrsa_20.apr

in the sample within the Project area and the lack of any evidence of hunting. However, this type of scenario could be examined in future mitigative study.

If landscape variation played an important part in prehistoric hunting activities associated with the sites identified, it may be useful to consider what the remains of these activities may comprise in archaeological terms. After a kill, carcasses would have been dismembered for transport to a processing area, especially if water saturated conditions made such work difficult. Low value segments would be discarded at the kill. Elements left in the channel bottoms may have been preserved by the anaerobic conditions of the marshland soils or subsequent peat deposits. Channel margins may have some potential for the preservation of processing remains, especially if faunal elements became rapidly incorporated into expanding peat deposits. Any bone that would have been transported to exposed feature-tops would have remained on surface and entirely consumed by taphonomic processes. The most suitable locations to examine these propositions are the channels bottoms and margins, which are currently inaccessible to archaeological techniques. The mitigation program recommended in Section 7.0 of this report accounts for these possibilities while recognizing some of the practical difficulties associated.

Vegetation Communities

The second major factor responsible for differences in the present landscape is the climatic conditions that prevailed during the Hypsithermal interval. During the period between 9,000 and 4,000 years ago, substantially warmer and drier conditions than experienced today characterized North America's climatic patterns. The effects of these conditions on the distribution of vegetation communities are not precisely understood but some of the general findings of research into this question can provide helpful insights on possible Hypsithermal landscapes in the region.

Pollen spectra from layered lake sediments provide the most detailed information available for forecasting past vegetation regimes but have inherent problems that must be understood before accurate reconstructions can be made. Pollen records in western Canada tend to be dominated by a few prolific pollen-producing species, particularly conifers, which are capable of drowning out minor constituents and masking subtle vegetation changes (Vance et al. 1995). Also, important species, such as poplar, are almost absent from many profiles because their pollen preserves poorly or is easily damaged. In addition, species with very limited dispersal ranges, like many grasses, often do not register in profiles, even if large communities are relatively close to the collection

locale. Consequently, pollen records produce broad indications of trends and collection sites on ecotonal boundaries tend to provide better indications of change.

A single pollen profile, obtained from Eaglenest Lake (Vance 1986), is available for the immediate study area. It shows that a peak in warm dry postglacial climatic conditions was reached just before 9,000 years ago. A forest canopy dominated by spruce and birch prevailed through most of the period through till 7,500 years, with alder migrating into the region around 8,450 years ago and pine arriving at the end of the period. No major vegetative changes were apparent in the subsequent sequence, suggesting that modern climatic conditions were established by 7,500 years ago.

These results were obtained in an upland in the middle of the Mixedwood forest and tend to downplay some of the more dramatic fluctuations observed in ecotonal locations. Although the mean annual temperature was only 1.5°C warmer than today, at a site in the lower Athabasca basin south of the study region (Litchi-Fedrovitch 1970), other more dramatic conditions have been suggested. Growing degree days appear to have been considerably higher, by between 6 and 20%, precipitation values were lower than present, by about 13%, and aridity increased by about 18% (Zoltai and Vitt 1990). These conditions, without doubt, had significant effects on the vegetational regimes in the area that probably would not be evident in the pollen profile recovered from the Birch Hills site analyzed by Vance, but can only be postulated at present. It can be assumed that the forest present on upland sites would have been more open than it is today, with less understory and higher proportions of herbaceous elements. These communities would have higher proportions of birch, alder and jack pine than are present today. Lowland sites probably contained far lower water tables and probably supported much higher proportions of grasses and herbaceous plants than are present today. Pollen cores extracted from some of the standing lakes, such as the one just west of the proposed plant site, if obtained, may provide a source of detailed information about vegetation sequences in this area that could help provide firm data to assess these predictions.

Lake level data are also useful in assessing some of the effects of this prolonged period of aridity. Schweger et al. (1981) have reported findings from lakes in the central portion of Alberta suggesting that significantly lower lake levels were experienced during the period from 9,000 to 6,000 years ago, with a return to today's levels beginning around 5,000 B.P. and completed by 2,000 years ago (see also Ritchie and Harrison 1993). During the early portion of this period, most shallow basins were completely dry and water levels in deeper lakes may have dropped as much as

15 m. Consequently, it may not be improbable to suggest that the standing water in the Project area may not have existed in the 9,000 to 4,000 year period and that water tables in general would have been much reduced.

Occasionally, evidence comes to light that serves to confirm some of these predictions and provides indication of the former productivity of the regional landscape, about which additional information is provided below. Recently, reclamation work conducted at the Suncor project south of the Project area unearthed a set of elk antlers at the base of muskeg deposits in grey sands (J. Burns, pers. comm., Canadian Press, Calgary Herald, November 11, 1997). These antlers were radiocarbon dated at 5,500 years ago suggesting a possible initiation date for muskeg formation in that particular deposit. Elk are a grazing species that flourishes in parkland ecozones that support grasslands as a significant component of the vegetation regimes, and have not been observed in the Fort McMurray region for centuries (Canadian Press 1997). While this find represents only a single data point, it tends to support the case for a formerly more grassland-oriented vegetation mix in this region during the middle of the Holocene climatic interval than exists today.

In summary, while much of the above is highly speculative, it is likely that environmental conditions during the early part of the prehistoric period were substantially different than during its final stages, reflecting lower water levels, more open forests and higher proportions of herbaceous elements present.

Landscape Productivity

The third major factor that may have influenced landscapes throughout much of prehistory in northern regions, the cultural use of fire as a habitat enhancement technique, is even less well understood. Nevertheless, consideration of the possible effects of the use of fire by prehistoric hunting groups is warranted as a means of understanding the environmental context for prehistoric occupation. The most relevant research into this practice has been anthropological studies by Henry Lewis (Lewis 1977, 1980) some of which is summarized here.

Generally, northern native populations made regular use of fire for a variety of reasons, most of which relate to promotion of a diversity of habitat and to increasing "edge effect," which resulted in greater resource productivity and offered greater lifestyle stability. Aboriginal peoples use fire for various reasons, including: burning of large areas to divert big game into small unburned areas to

facilitate their capture or to provide open prairies and meadows that would be better grazing for big game; use of fire as a mechanism to assist in driving game for communal hunting; use of fire to protect certain vegetation communities, particularly medicinal plants, from encroachment by trees or to provide a fire break buffer around them; use of fire as a pest management device; use of fire to keep travel corridors clear; and use of fire to clear brush from riparian habitats to promote the growth of new grasses and tree sprouts to benefit beaver, muskrats, moose and waterfowl.

These cultural fires differed from natural fires in several important respects: the seasonality of their use, the frequency of burnings and the intensity of the fire. Aboriginal groups tended to start fires in the spring or in fall after hunting and berrying season. Because trees would be lacking, leaves and moisture levels would be reduced. This timing would allow better control over the areas burned and would reduce the possibility of wildfires. Aboriginal people burned certain areas annually, while in other circumstances, alternate years or even intervals as long as five years were used. The frequency and seasonality of these fires would tend to reduce the accumulation of brush and deadfall characteristic of old-growth forests, and would result in a higher frequency of low-intensity fires. The cumulative effect of these practices could have been a general replacement of forested land with grassland or an opening of existing forests by reduction of underbrush. The fact that many accounts of early explorers in this region mention large burned-over areas with dead trees littering the landscape may be unrecognized testimony to the widespread application of these techniques.

Perhaps the most important outcome of these practices would be an increase in the productivity of the landscape for game and other types of resources. Evidence of increased productivity in the landscape surrounding the Project area is provided by the results of Traditional Land use studies for Syncrude's Aurora Project (Fort McKay Environment Services 1996) and for the Muskeg River Mine Project (Fort McKay Environment Services 1997). During these studies, transects for estimating relative abundance of wildlife were conducted in various areas within the Project development area. The results indicate that the area previously cleared of forest for the formerly proposed Alsands project were far more productive, on the order of between 4.3 to 30 times, than equivalent areas that had not been cleared (Fort McKay Environment Services 1996). The clearance had a similar effect to a controlled fire in that only the arboreal and higher shrub component of the vegetation regime was removed, with little surface damage. This allowed regeneration of willow/alder shrub and aspen communities favoured by beaver and big game as

food resources. This, in turn, encouraged larger populations of furbearing carnivores and other species.

The emplacement of drainage canals in this area has augmented the effects of forest clearance and is probably an important factor in explaining the increased wildlife productivity of these areas. Nevertheless, it may be useful to consider these effects as partially analogous to the reduced water levels that would have prevailed during the Hypsithermal interval. While figures of 5 to 30% greater productivity may not be readily transferable to a prediction of prehistoric conditions, they are suggestive of a situation substantially different from modern circumstances.

6.4 Significance

Site significance is perhaps the most important element in development of an effective mitigation program. Before the advent of protective legislation, site significance was generally evaluated intuitively. Establishing the significance of archaeological sites in potential conflict with development activities, however, requires that evaluation be made on the basis of explicit systematic criteria to facilitate scrutiny and concurrence by regulatory agencies. In addition to consideration of the physical site attributes that contribute to an assessment of the scientific value of a particular resource, these evaluations need to consider project-related impacts to provide a basis for developing a comprehensive program that successfully mitigates impact and meets the management needs outlined in protective legislation. A wide variety of schemes for evaluating the significance of archaeological resources is available in the archaeological literature, however, none has received universal acceptance.

In a discussion of archaeological site significance, Ives (Archaeological Survey of Alberta 1985) has recognized several dimensions of variability in the physical attributes that are expected to occur in the Slave River region, and which may have applicability to the sites recorded in studies in the vicinity of the Project. These are grouped in three categories: chronological variation, technological variation and other factors, which include the presence of rarer forms of archaeological evidence. While it may be possible to rank sites within a framework that employs these criteria, previously obtained samples from the region show limited variability in most of these areas, with the possible exception of technological variability. In fact, redundancy of information in the sites in the Project area is a significant issue of concern that requires consideration. In his review of the information recovered from post-clearance examination of the Alsands plant and

initial mine sites, Ives (1982a, 1988) suggests that site size, material density, technological variation and functional variation may be useful measures against which to judge redundancy.

For the purposes of this report, it was intended that a combination of these factors be employed to rank the significance of the sites identified. It was also intended that sites identified in previous archaeological studies within the Project area be incorporated in this evaluation so that all resources could be compared. The focus of this evaluation would be an attempt to recognize those sites that represent unusual information sources and hold potential to provide important new information not already available in the archaeological samples from the Project area, archived by Alberta Community Development.

Achievement of these goals has been frustrated by the degree of variability in the specific information available for sites recorded during the different programs conducted in the Project area. For instance, no uniform basis has been adopted for assignment of sites to a classification of functional types. Description of sites identified in the 1973 survey (Sims and Losey 1975) did not include basic physical characteristics such as site size or assemblage variability. The Alsands data did not include site size but provided other useful criteria. The data collected by the Archaeological Survey of Alberta have not yet been fully reported and it was not possible to obtain figures on site size, assemblage variability or the numbers of artifacts in their collections. These shortcomings restricted the capability of this program to incorporate all of the sites in a rigorous assessment of significance. Nevertheless sufficient information was obtained from reports, site forms and other types of data to provide evaluations in a series of categories.

Table 9 shows the archaeological sites (by their registry number in the Borden system) that fall within proposed impact zones, and the evaluation criteria chosen to reflect the range in variation in physical site characteristics within these sites. It also provides entries for each site, where sufficient information was available. However, it was not possible to provide an evaluation for all sites in all criteria and should development plans change, the sites included in the table would also change.

Table 9 Significance of Sites Within and Adjacent to Development Zones

Borden Number [a]	Type[b]	Impact Area	Integrity	Size [c]	Chronological indicators	Collection	Material Diversity	Assemble Diversity	Original Assessment	Existing Recommend	H.R. Act Status/ Outstanding Requirements.	1997 Evaluation
HhOu 1[d]	cs	Musk. R. set back	disturbed	n/a	Hell Gap point	26	no	yes	not assessed	None given.		significant
HhOu 6[d]	ss	NE dump	disturbed	n/a	n/a	8	n/a	n/a	significant	Test excavate.		mod. value representative
HhOu 7[d]	cs	Mine	disturbed	n/a	n/a	13	n/a	n/a	not assessed	None given.		low value representative
HhOu 16[d]	cs/ws	Plant Site	destroyed	n/a	n/a	398	no	n/a	Significant	nfw	clearance given	destroyed
HhOu 17[d]	hist	Plant Site	collapsed	n/a	modern	n/a	n/a	n/a	low value	nfw	clearance given	low value representative
HhOu 18[d]	cs/ws	Mine	part.dist.	n/a	n/a	?	?	?	not assessed	No further work.		mod. value representative
HhOu 19[d]	ss	Mine	part.dist.	n/a	no	n/a	no	yes	not assessed	No further work.		low value representative
HhOu 20[d]	ss	Mine	part.dist.	n/a	no	n/a	n/a	yes	not assessed	No further work.		low value representative
HhOu 21[d]	bur/ ss	Mine	part.dist.	n/a	no	n/a	yes	yes	not assessed	No further work.		mod. value representative
HhOu 22[d]	if	Mine	part.dist.	n/a	no	1	no	no	not assessed	No further work.		low value representative
HhOu 23[d]	ss	Mine	part.dist.	n/a	no	3	no	no	not assessed	No further work.		low value
HhOu 24[d]	bur/ ss	Mine	part.dist.	n/a	no	n/a	no	n/a	not assessed	Test excavate.		mod. value representative
HhOu 25[d]	ss	Mine	part.dist.	n/a	no	n/a	no	n/a	not assessed	No further work.		low value representative
HhOu 26[d]	bur/ ss	Mine	part.dist.	n/a	no	n/a	no	n/a	not assessed	No further work.		low value representative
HhOu 27[d]	bur/ ss	Mine	part.dist.	n/a	no	n/a	no	yes	not assessed	Test excavate.		mod. value representative
HhOu 28[d]	bur/ ss	Mine	part.dist.	n/a	no	3	no	n/a	not assessed	No further work.		low value representative
HhOu 29[d]	bur/ ss	Mine	part.dist.	n/a	no	1	yes	n/a	not assessed	No further work.		low value representative
HhOu-30[d]	bur/ ss	Mine	part.dist.	n/a	no	1	no	n/a	not assessed	No further work.		low value representative
HhOu-31[d]	if	Mine	part.dist.	n/a	no	1	no	no	not assessed	No further work.		low value
HhOu-32[d]	bur/ ss	Mine	part.dist.	n/a	no	n/a	n/a	n/a	not assessed	Test excavate.		mod value representative
HhOu 41[d]	bur/ ss	Mine	undist.	1 m^2	no	12	n/a	yes	low value	No further work		low value

Borden Number [a]	Type[b]	Impact Area	Integrity	Size [c]	Chronological indicators	Collection	Material Diversity	Assemble Diversity	Original Assessment	Existing Recommend	H.R. Act Status/ Outstanding Requirements.	1997 Evaluation
												representative
HhOu 42	bur/ ss		undist..	1 m^2	no	36	n/a	n/a	low value	No further work		low value representative
HhOu 43	bur/ ss		undist.	1 m^2	no	10	yes	n/a	low value	No further work		low value representative
HhOu 44 [d]	bur/ ss	RMS	undist.	1 m^2	no	2	yes	yes	low value	No further work		low value representative
HhOu 45 [d]	bur/ ss	RMS	undist.	5 m^2	no	100	n/a	n/a	mod. value	No further work		mod. value representative
HhOu 46 [d]	bur/ ss	RMS	undist.	5 m^2	no	33	n/a	n/a	mod. value	No further work		mod. value representative
HhOv 6	ss	intake facility road	part. dist.	n/a	no	13	?	yes	significant	Relocate.		mod. value representative
HhOv 10	ss		disturbed	n/a	no	12	?	yes	?			low value representative
HhOv 11	ss		disturbed	n/a	no	58	?	yes	?	Revisit.		low value representative
HhOv 16	cs/ws		part.dist.	n/a	Oxbow point	1000+	yes	yes	high	Avoid.	Avoid (Dec 2/81) Mit. unspecified (Dec 1/81)	significant
HhOv 17 [d]	ss	access road utility corridor	disturbed	n/a	no	5	?		unknown	Avoid.	Avoid (Dec 2/81) NC (Dec 1/81)	low value representative
HhOv 18 [d]	ss	access road utility corridor	disturbed	n/a	Shield Archaic & LMP dart points	1660	yes	yes	significant	Surface collection.	Avoid (Dec 2/81) NC (Dec 1/81)	mod. value representative
HhOv 19 [d]	ss	access road utility corridor	disturbed	n/a	no	?	?	?	?	?		low value representative
HhOv 20 [d]	ss	access road utility corridor	destroyed	n/a	no	10	?	?	none	No further work.	No Concern Released (NC)	destroyed
HhOv 21 [d]	ss	Mine	destroyed	n/a	no	57	n/a	yes	not assessed	Relocate.		destroyed
HhOv 31 [d]	if	Plant site	destroyed	n/a	no	1	no	no	none	None.		destroyed
HhOv 32 [d]	ss	Plant site	destroyed	n/a	no	2	n/a	no	none	None.		destroyed
HhOv 33 [d]	if	Mine	destroyed	n/a	no	1	no	no	none	None.		destroyed
HhOv 34 [d]	if	Access road utility corridor	destroyed	n/a	no	?	no	no	none	None.		destroyed
HhOv 36	if		destroyed	n/a	no	?	no	no	none	None.		destroyed
HhOv 37	if		destroyed	n/a	no	1	no	no	none	None.		destroyed

Borden Number [a]	Type[b]	Impact Area	Integrity	Size [c]	Chronological indicators	Collection	Material Diversity	Assemble Diversity	Original Assessment	Existing Recommend	H.R. Act Status/ Outstanding Requirements.	1997 Evaluation
HhOv 39	if		destroyed	n/a	no	1	no	no	none	None		destroyed
HhOv 40	if		destroyed	n/a	no	1	no	no	none	None.		destroyed
HhOv 71[d]	bur	Mine	undist.	n/a	no	666	no	yes	none	Mitigated.	mit. complete - NC	low remaining value
HhOv 73[d]	bur	Mine	undist.	n/a	no	1000+	yes	yes	high significance	Excavate.	significant mit. unspecified	significant
HhOv 74[d]	cs	Mine	undist.	n/a	no	6	yes	yes	significant	Excavate.	3 2x2m units	mod. value
HhOv 75[d]	if	Mine	undist.	n/a	no	1	no	no	none	No further work.	NC	low value
HhOv 76[d]	if	West dump	part.dist.	n/a	no	0	no	no	none	No further work.	NC	low value
HhOv 77[d]	if	West dump	part.dist.	n/a	no	0	no	no	none	No further work.	NC	low value
HhOv 78[d]	if	Tailings location	undist.	n/a	no	12	no	no	none	No further work.	NC	low value
HhOv 79[d]	if	Tailings location	undist.	n/a	no	1	no	no	none	No further work.	NC	low value
HhOv 80[d]	if	Tailings location	undist.	n/a	no	2	no	no	none	No further work.	NC	low value
HhOv 81[d]	ws	Tailings location	undist.	n/a	no	1000+	no	yes	significant	Excavate.	2x2m test	mod. value
HhOv 82[d]	cs/ws	Tailings location	unknown	n/a	no	5	yes	no		Test excavate.	2 2x2m units	mod. value
HhOv 83	ss		destroyed	n/a	no	1	no	no	none	No further work.	NC	destroyed
HhOv 84	cs/ws		disturbed	n/a	no	3	no	yes	unknown	Test excavate.	Surface collection, 2x2m unit	mod. value
HhOv 85[d]	if	West dump	undist.	n/a	no	2	no	no	none	No further work.	NC	low value
HhOv 86[d]	cs/ws	West dump	undist.	n/a	no	479	yes	yes	significant	Excavate.	4 3x3m units	mod. value
HhOv 87	cs		undist.	n/a	no	8	no	no	significant	Test Excavate.	5x5m excavation	mod. value
HhOv 88	ss		part.dist.	n/a	no	3	no	yes	unknown	Test Excavate.	Surface collection, 2x2m test	mod. value
HhOv 89	ss		disturbed	n/a	no	11	no	yes	none	No further work.	NC	low value representative
HhOv 90	cs/ws		undist.	n/a	no	2	no	no	unknown	Test excavate.	2x2m test	mod. value
HhOv 91	cs/ws		undist.	n/a	no	12	no	yes	unknown	Test excavate.	2x2m test	mod. value
HhOv 96[d]	if	Mine	disturbed	n/a	no	1	no	no	none	No further work.	NC	low value
HhOv-105[d]	if	Access road utility corridor	destroyed	n/a	no	11	no	no	none	No further work.	NC	destroyed
HhOv 106[d]	if	Access road utility corridor	destroyed	n/a	no	1			none	No further work.	NC	destroyed
HhOv 107[d]	cs/ws	Access road	destroyed	n/a	no	15	no	no	none	No further work.	NC	destroyed

Borden Number [a]	Type [b]	Impact Area	Integrity	Size [c]	Chronological indicators	Collection	Material Diversity	Assemble Diversity	Original Assessment	Existing Recommend	H.R. Act Status/ Outstanding Requirements.	1997 Evaluation
		utility corridor										
HhOv 108 [d]	if	Access road utility corridor	destroyed	n/a	no	1	no	no	none	No further work.	NC	destroyed
HhOv 109 [d]	cs/ws	Access road utility corridor	disturbed	n/a	no	648	yes	yes	significant	Avoid.	Avoid	mod. value
HhOv 112 [d]	if	Tailings location	undist.	n/a	no	1	no	no	none	None.	NC	low value
HhOv 113 [d]	cs/ws	Tailings location	undist.	n/a	no	5	no	no	significant	Excavate.	mit. unspecified	mod. value
HhOv 114 [d]	cs/ws	Tailings location	undist.	n/a	no	>95	no	n/a	significant	Excavate.	mit. unspecified	mod. value
HhOv 115 [d]	ws	Tailings location	undist.	n/a	no	15	no	no	unknown	Test excavate.	mit. unspecified	mod. value
HhOv 116 [d]	if	Tailings location	undist.	n/a	no	2	no	no	none	None.	NC	low value
HhOv 121 [d]	if	Tailings location	undist.	n/a	no	3	no	no	none	None	NC	low value
HhOv 122 [d]	if	Tailings location	undist.	n/a	no	2	no	no	none	None	NC	low value
HhOv 123 [d]	if	Tailings location	undist.	n/a	no	4	no	no	none	None	NC	low value
HhOv 124	cs/ws		undist.	n/a	no	98	no	yes	significant	Excavate.	mit. unspecified	mod. value
HhOv 128 [d]	cs/ws	Access road utility corridor	undist.	n/a	no	115	no	yes	significant	Avoid.		mod. value
HhOv 129 [d]	?	Mine	disturbed	?	?	?	?	?	not assessed	No further work.		low value
HhOv 130 [d]	bur/ ss	Mine	disturbed	n/a	no	n/a	no	n/a	not assessed			low value representative
HhOv 131 [d]	?	Mine	disturbed	?	?	?	?	?	not assessed	Test excavate.		mod. value representative
HhOv 132 [d]	bur/ ss	Mine	disturbed	n/a	yes	n/a	yes	yes	not assessed	Test excavate.		mod. value representative
HhOv 133 [d]	ss	Mine	disturbed	n/a	no	4	no	no	not assessed	No further work.		low value representative
HhOv 134 [d]	if	Mine	disturbed	n/a	no	1	no	n/a	not assessed	No further work.		low value representative
HhOv 135 [d]	ss	Mine	disturbed	n/a	no	n/a	yes	n/a	not assessed	Test excavate.		mod. value representative

Borden Number [a]	Type [b]	Impact Area	Integrity	Size [c]	Chronological indicators	Collection	Material Diversity	Assemble Diversity	Original Assessment	Existing Recommend	H.R. Act Status/ Outstanding Requirements.	1997 Evaluation
HhOv 137 [d]	bur/ scat	Mine	disturbed	n/a	no	n/a	yes	n/a	not assessed	No further work.		low value representative
HhOv 138 [d]	bur/ scat	Mine	disturbed	n/a	no	n/a	yes	n/a	not assessed	Test excavate.		mod. value representative
HhOv 139 [d]	bur/ scat	Mine	disturbed	n/a	no	5	no	n/a	not assessed	Test excavate.		mod. value representative
HhOv 178 [d]	bur/ scat	Mine	undist.	1 m^2	no	6	no	no	low value	No further work		low value representative
HhOv 179 [d]	bur/ scat	Mine	undist.	1 m^2	no	8	no	yes		No further work		low value representative
HhOv 180 [d]	bur/ scat	Mine	undist.	1 m^2	no	7	no	no	low value	No further work		low value representative
HhOv 181 [d]	bur/ scat	Access road utility corridor	undist.	1 m^2	no	210	no	no	significant	Test excavate if impacted 8m^2 prelim. sample		mod. value representative
HhOv 182 [d]	bur/ scat	Tailings location	undist.	1 m^2	no	51	no	no	low value	No further work		low value representative
HhOv 183 [d]	bur/ scat	Mine	undist.	1 m^2	no	2	no	yes		No further work		low value representative
HhOv 184 [d]	bur/ scat	Access road utility corridor	undist.	10 m^2	no	378	yes	no	significant	excavate if impacted 30m^2 prelim. sample		mod. value representative
HhOv 185 [d]	bur/ scat	Tailings location	undist.	1 m^2	no	33	no	no	low value	No further work		low value representative
HhOv 186 [d]	bur/ scat	Tailings location	undist.	1500 m^2	no	24	no		significant	If impacted, 10m^2 dispersed tests. 15-30m^2 excavations if warranted		mod. value
HhOv 187 [d]	bur/ scat	Tailings location	undist.	150 m^2	no	69	no		significant	If impacted, 5m2 dispersed tests. 10-15m2 excavations if warranted		mod. value

(a) site registry number using the Borden system.
(b) cs=campsite, ss=surface scatter, ws=workshop, hist.=historic, bur=buried, scat=scatter, if=insolated finds, hist=historical designation, nc=no concern.
(c) size only for sites surveyed in 1997.
(d) in or adjacent to proposed development zone.

6.4.1 Evaluation Criteria

Evaluation criteria chosen include:

Site type: represents the functional classifications applied to sites by the individual researchers in reports or on site forms. The categories used are generally impressions, but reflect variation observed in the field or after assemblage analysis. The campsite designation (cs) usually represents an impression that the site represents more than the remains of a brief stop by a small hunting party, and may include materials that reflect the use of tools for domestic activities. The workshop designation (ws) generally applies to an assemblage that appears to represent the remains of tool production. A surface scatter (ss) represents the remains of a brief stop by a small party, and involves tool production/maintenance debris as part of a brief episode of resource processing, and which is exposed in some type of surface disturbance. If such a site exhibits intact portions in the sediments buried below forest litter, a buried (bur) indication has been appended to the designation provided. An isolated find (if) represents the recovery of a single artifact either from a surface exposure or in a subsurface context. The historic designation (hist.) applies to structural features generally found on surface, and which represent activities such as hunting or trapping that took place in recent periods.

Impact area: various designations applied in this category were derived by overlaying the current mine plans on the site distribution map. Figure 12 shows this relationship. The various components of the Project are identified when a site falls within or adjacent to one of these areas.

Integrity: relates to the degree of existing disturbance observed at the site during the field inspection. Some of these designations are now 17 years-old and some changes may have occurred. However, the exploration activities that represent the most likely source of additional impact were largely completed for the Alsands Project, and it is believed that, for the most part, the conditions identified at the time of original recording probably still apply. Evaluations in this category include: undisturbed, partially disturbed and destroyed. These evaluations require little explanation except to say that it did not seem reasonable to break down the disturbed category further in the absence of full information on the actual extent of most sites. The designation "collapsed" has been used for the single historic period cabin that is present in the sample.

Site Size: values could be included only for the sites recorded in the 1997 program. None of the previous studies provided detailed information in this regard.

Chronological indicators: refers to the presence of artifact types that provide some indication of the period during which the site occupation occurred; generally these are projectile point types, the styles of which are known to exhibit limited temporal time spans. Only a very few entries could be made in this category. However, because establishment of a prehistoric culture history remains a major question in this region, and so few archaeological sites provide any evidence that could be used to place their occupation in time, any indications in this regard are worthy of note.

Collection: represents actual counts or the number of archaeological specimens recovered at each of the sites. In many cases, it was not possible to include these numbers for all sites because the information was not available in the records from previous projects.

Material diversity: assignment of values in this category was difficult given the state of the records available for each site included in the table. A "yes/no" evaluation has been provided based on the presence or absence of materials other than Beaver River Sandstone. Even one specimen of different material present in a collection resulted in a "yes" entry in the table. Although it may appear to be a relatively minor distinction, the existence of different material types within an assemblage provides some indication of the extent of the seasonal round of a group's activities or participation in exchange networks.

Assemblage diversity: identifies variation in a series of categories that suggest that activities other than stone tool production took place at the site, or that tool production activities exhibit a range of variation suggesting more than one technique was applied. For example, if a formed tool is present, suggesting resource processing may have taken place, or providing an indication of what the final product of tool manufacture was, a yes evaluation was included in the table. If a specimen was present that exhibited use wear, reflecting resource processing as well as tool production, a yes evaluation was tabulated. If during analysis, significant variation was noted in the types of specimens present (e.g., a bimodal distribution of specimen size), a yes evaluation was included in the table, reflecting the possibility that two or more types of stone tool products were being produced during site occupation. It was not possible to include an evaluation in this category for all sites evaluated because of the limitations of the data available in the records for previous projects.

Nevertheless, all the sites evaluated for the Alsands Project and those identified in 1997 could be evaluated in this category.

Also included in this table are three categories of information that may provide additional information on the relative significant of the sites evaluated. "Original assessment" is the impression of the original investigator and was obtained either from reports or site forms. These evaluations may incorporate data that have not been included elsewhere and may represent a reason for altering an individual site evaluation, based on the results of other considerations, or of providing an evaluation for sites that are not fully described in the available records. The "existing recommendations" category provides the recommendations made by the researcher who originally recorded the site. In both these categories, it was not possible to provide information for all sites included in this evaluation because of the character of the site records. The final category included in this evaluation is the "Historical Resources Act Status" of any site that has been evaluated by Alberta Community Development. The entries in this column represent outstanding requirements that would have to be met before a site could be released for development. It must be recognized that some requirements have not yet been completely defined and others may require modification if preliminary results suggest changes would be appropriate.

Summary

Tabular entries have been made for 98 prehistoric archaeological sites and one historic period cabin within or near proposed development zones associated with the Project. This total includes sites near proposed development zones and encompasses all of the historical resource sites present in an area large enough to accommodate minor changes in the plans for locations of specific development activities. Some are situated in the setback zone along the Muskeg River and would not be affected in any event. However, they have been included in the table in recognition of their existence. Although planned impacts are not anticipated at these sites, accidental damage may occur if, for example, fisheries or water quality enhancement projects in the Muskeg River become necessary and affect river bank areas. Knowledge of the locations of these sites may assist planning for these or other currently unplanned activities.

Of this total, 27 have been classified as isolated finds of single artifacts, 19 have been classified as disturbed surface scatters of stone artifacts, 14 have been classified as surface scatters that contain portions that are buried and still intact, 18 have been identified as buried scatters or buried sites

(one of these is the Bezya site, HhOv 73, which is currently on Alberta Community Development's significant site list), four have been classified as campsites, 14 have been classified as campsite/workshops and two have been classified as workshops.

Evaluations for these sites provided in the final column of Table 9. These represent a combination of the factors shown in the Table 9. All sites that have been destroyed (n = 16) are not rated as they are considered to no longer exist. Isolated finds (n = 17) are rated as having low value. Surface scatters with or without buried portions and buried scatters have generally low value, but are considered to be representative of an occupation pattern that is well-represented throughout the Project area (n = 29). If, however, the original investigator recommended additional study, such sites have been included in a classification termed "moderate value representative" (n = 17). This indicates that although the site represents typical prehistoric occupation patterns, one or more of its physical characteristics were viewed as having enough significance to warrant sample recovery. Sites classified as campsites and workshops were generally rated as having higher value. Any site with outstanding mitigation requirements was rated as having moderate value (n = 17).

Finally, three significant sites that stand in contrast to the typical pattern in the development area are included in the table. Cree Burn Lake (HhOv 16) has been nominated as a Provincial Historical resource and, although it technically lies outside any zones scheduled for development during the Project, it is sufficiently close that its inclusion was considered warranted. Bezya (HhOv 73) is currently on Alberta Community Development's significant site list and although major excavations have taken place at this site, additional value is considered to be present and will require consideration before its destruction during development. HhOu 1 has also been included in this category because it is one of the very few sites in the region that has produced evidence that would allow an estimate of time of occupation (ca. 9,000 years). This site is situated within a setback area along the Muskeg River and would likely not be affected.

With the exception of the single historic period cabin, the prehistoric archaeological sites found in this area are small in size and represent use of the resources of the area by small groups over short durations. Many may reflect only single episodes of activity. The remains present at these sites are limited to stone tools and the debris resulting from their production and use. The archaeological sites in this region exhibit almost exclusive use of a distinctive material for stone tool manufacture, Beaver River Sandstone.

However, in their numbers and distribution, the prehistoric sites in this area represent the densest known concentration yet identified in Alberta's forested regions. This pattern extends up the Muskeg River drainage and around the Fort Hills to the north and east. It appears to be unique, involving an intensive and long-term use of both a specific local source material and a particular landscape.

It is evident that there is a limited degree of variation in the character of the physical remains contained within these sites. Consequently, there is considerable potential for redundant information. In recognition of this fact, the evaluations tabulated above for archaeological sites have classified most of the sites in the Project area as being "representative" of a typical pattern of exploitation. Within this category, a range of low and moderate values have been assigned to reflect variation in the quantities or qualities of information available at each. The recommended mitigation program discussed in Section 7.0 accounts for redundant information and the range of variation identified in this sample.

7.0 RECOMMENDED MITIGATION STRATEGY

7.1 Introduction

The mitigation program recommended to offset the negative physical effects on historical resources of the Muskeg River Mine Project would take places in stages. The objectives of such a program would be:

- to identify any highly significant resources that would require special procedures such as permanent avoidance or major sample recovery;

- to recover, conserve and analyze samples from sites that represent non-typical historical behavior patterns;

- to recover, conserve and analyze sample information from sites that represent typical or representative components of the recognized historical land use patterns resident throughout the Project area;

- to recover in the course of these activities palaeoenvironmental information that would provide important contextual data that would help elucidate prehistoric land use patterns within the Project area; and

- to correlate and interpret this information in a cohesive study that makes a major contribution to understanding of the prehistory of the region.

This program would be accomplished in stages that correspond to the various stages of the development process. To explore how historical resources mitigation studies can be articulated with development schedules, it will be necessary to appreciate the effects of a key preliminary phase in this process: forest clearance. The discussion in Section 6.2 indicates that there will be stages in development of the Project that will likely expose additional historical resources; principally during forest clearance and possibly during muskeg removal. This discussion suggests that it would be possible to design a series of historical resource studies that could be implemented and would be appropriate to identify, record and recover information from any resources that might be exposed during these construction activities. The following discussion

outlines a comprehensive program of studies intended to offset the negative effects on historical resources of development of the Project. Aside from the possibility that additional sites may be uncovered during pre-development forest clearance, several other factors are important in appreciating the mitigation program presented below. First, many sites recorded in previous studies lie within or adjacent to proposed development zones and were not investigated in the 1997 studies. It will be necessary to incorporate these sites in the program to ensure that all known resources that might be affected by development are considered. Furthermore, it is necessary to accommodate the possibility that areas subject to disturbance may be altered as developments plans are finalized. In addition, auxiliary developments such as powerlines, pipelines and roads are not yet fully defined. It will be necessary to accommodate these types of unanticipated impacts. Consequently, a flexible program will be required that will account for these needs.

Finally, the potential for increasing levels of information redundancy must be considered to ensure that mitigation studies augment the existing historical resources information base in a productive fashion and that scarce resources are allocated to maximize the benefits of the program. In considering these issues and the program recommended, the reader is advised to refer to Table 9 as it identifies the known sites that would be included in the program.

7.2 Permanent Avoidance

With the single exception of the Cree Burn Lake site, none of the sites recorded during the historical resources studies associated with the Project would be considered of such significance that they would warrant permanent avoidance. It would appear that an appropriate mitigation program could effectively offset impacts to all the other individual resources to be affected by the Project and that portions of the patterns they represent will remain outside development zones.

7.3 Pre-Development Mitigation Studies - Information Recovery

The first step in mitigation studies would be to complete the study requirements already established by Alberta Community Development during their review of previous studies in the study area. Some of these requirements have been specifically identified, at least at a preliminary level; others remain to be specified. The detailed descriptions of the 1997 sites in Section 5.2 outline recommended mitigation procedures for these sites. After review of these recommendations, and

those presented for previously recorded sites (Table 9), by Alberta Community Development, final requirements can be established for each of these sites.

The most significant site so far identified within the project area is the Bezya Site (HhOv 73). This site contains evidence of the use of unusual technology for this region of the province and is the only site that has been radiocarbon dated within the Project area. Excavations conducted by the Archaeological Survey of Alberta in 1982 and 1983 (LeBlanc 1986) recovered a detailed sample of material relating to the use of small black chert pebbles in the production of microcores and microblades. Microblades are small, finely edged objects that can be embedded in wood or bone handle to fulfill a variety of cutting and penetrating tasks. This technology represents the ultimate conservation of stone source material, and is extremely portable, but is more commonly known in the archaeological assemblages of the Northwest Territories. A radiocarbon date of 3,900 years has been obtained from this site.

Although a large sample of this material has been obtained from this site, additional significant remains may yet be present and current Project development plans will completely consume this site. A final recovery program is recommended for this site before it is destroyed during construction. This program would begin with additional testing in an attempt to identify any additional concentrations of microcore/blade materials or other significant information. Perhaps 20 m^2 of dispersed testing may be needed to identify additional concentrations. This would be followed by conservation excavations distributed en-bloc to recover these materials. The size of this excavation, if warranted, would be determined in consultation with Alberta Community Development. Subsequent analysis would compare the results obtained with those of previous studies and would result in permanent conservation of these materials for future study.

In all other instances, information recovery procedures would involve excavation of small-scale tests, the size and distribution of which reflect individual site characteristics. The intent of these procedures would be recovery of a sample of material from the most productive or most representative areas of these sites to enable effective characterization of activities at each, and radiocarbon dating of the occupation represented, if any suitable materials are present. Based on results of these preliminary studies, additional information recovery may be warranted.

These types of studies are recommended for sites that contain information that is unique or exceptional and would be tailored to the specific nature of that information. For sites that represent

a land use pattern that is already recognized within the project area, a sampling approach will be adopted. Sites considered to be representative of typical land use patterns have been evaluated above as being of low or moderate value in this regard, reflecting variation in their physical characteristics.

Sites exhibiting a moderate value in representing the typical land use pattern are those that may be more productive or more varied in their expressions. It is recommended that these be sampled at a higher proportion than lower value sites. It is recommended that archaeological material recovery procedures be implemented at 20% of this site type. The procedures recommended will focus on recovery of sample information from intact areas of the site and would proceed by implementing a shovel testing program to identify and characterize areas of concentrated archaeological information. Perhaps 5 m^2 would be required to achieve this goal. If no concentrations are identified, studies could be terminated, otherwise a sample recovery program would be implemented that would be targeted at obtaining samples that could address outstanding information needs relating to definition of the character of the land use pattern these sites represent. For example, sites containing artifacts that could help identify a period of use would be subject to additional study. If warranted, block excavations needed to recover this information would probably range between 4 and 20 m^2 and would be determined in consultation with Alberta Community Development.

Sites considered to be of lower value in representing the typical land use pattern would be sampled using the same procedures, but at a lower proportion. It is recommended that only 10% of these sites be included in the study program. A similar program to that recommended above would be instituted for these sites.

One historic period cabin site has been recorded within the Project area and would be destroyed by construction. Although this site may be less than 50 years old and technically may not be considered to be an historical resource, it represents some of the earliest evidence of traditional use patterns of the Project area by members of the Boucher family, who still retain trapping rights in this area. Use patterns associated with this site may exhibit continuity with those currently in effect and delineation of these patterns may provide insights into changes in traditional use that may have accompanied industrial development of the Fort McMurray region in the last few decades. This site has deteriorated considerably since it was first recorded in 1980, archaeological materials may still be associated with the collapsed structure.

A program of information recovery is recommended for this site. It would entail both archaeological studies and oral interviews. Interviews would be conducted with the surviving relations and acquaintances of Mr. Fred Boucher, the trapper who built the cabin, in an effort to define the activities that may have taken place here, the archaeological remains that might be present and how use of this site reflected Mr. Boucher's activities in the area. With this information, a small-scale archaeological program can be implemented to recover materials associated with the cabin that might confirm, expand on or modify the information obtained in interviews. With this information Mr. Boucher's traditional land use activities throughout the Project area can then be summarized. This information would, then, be contrasted with current land use patterns revealed through interviews with the Boucher family to better understand land use changes that may have taken place since oil sands development commenced in the region.

7.4 Information Recovery in Conjunction with Construction - Monitoring

Discussions in Section 6.0 indicate that studies of various landforms within the Project area, while intense, have probably not identified a large number of sites that may be present. This situation presents a possibility that highly significant or unique archaeological sites may not have been recognized and may require management. Alternatively, this situation presents the possibility that information redundancy will reach relatively high levels. Both of these eventualities can be accounted for in an efficient fashion with application of monitoring procedures. Such procedures would ensure that highly valuable sites are recognized and sampled before they are destroyed by development and would allow recognition of redundant information so that future studies can be modified to make them more efficient and avoid unnecessary duplication of effort. Consequently, a monitoring component would be included in the mitigation program recommended for the Project. This component of the study would take place after forest clearance has created exposures on the landforms known to have high potential for archaeological sites. The procedures entailed in such a program have been discussed above. Its objectives would be to record and evaluate sites not discovered in the initial HRIA. Focus would be placed on identification of sites that represent sources of unique information that might help define the nature of the prehistoric use of the landscape. Sites would be classified using the 1997 HRIA categories and would rank their significance accordingly.

On this basis, additional information recovery would be implemented at sites of unique character in areas where adequate representative sample information is available. Sites of representative value would be sampled only if limited information is available from the area in question.

7.5 Palaeoenvironmental Sampling

Understanding the role that past environments may have played in structuring the nature of the unique site distribution pattern recognized within the Project area is an important information gap in the studies conducted to date. The acidic soils of the region have literally removed almost all of the organic materials that typically accompany archaeological sites in other regions of the province. This has resulted in a situation whereby it is very difficult to provide any complementary interpretation for the material recovered that would help establish the environmental context for the occupations identified. Information has been presented that hints at some of the possible environmental conditions that may have led to the intensive use of the Project area landscape, but no concrete data are available to refute or confirm these possibilities.

In addition, most of the sites have not produced the kinds of materials that would place them in any kind of chronological framework. This information need severely limits construction of a firmly based culture history for this region of the province. In the course of information recovery programs at historical resource sites throughout the Project area, specimens may be recovered that enable provision of a radiocarbon date for the assemblages with which such material is associated. Provisions are required to obtain these dates when suitable materials are recovered.

In addition, muskeg removal may uncover bone and other materials that might enable more detailed estimates of environmental conditions in prehistoric times. These may relate to issues surrounding the onset of muskeg accumulation within the Project area and its rate of accumulation as well as other environmental conditions in the past. Because recovery of information along these lines remains unknown and is likely to be rare, mitigation procedures recommended in this regard would be to make contractors aware of the possibility that such remains could be unearthed and to establish provisions about whether such material could be collected, along with some indication of its original position within deposits, and submission to relevant agencies for analysis.

7.6 Articulation With Proposed Development Schedules

The recommended mitigation program can be integrated with the various stages of Project development. In fact, the incremental stages of development proposed for this Project provide an excellent opportunity to use information feedback to modify the mitigation program so that it becomes more effective at offsetting Project impacts.

Pre-development studies would be initially targeted at areas scheduled for forest clearance in 1999. These areas include the plant site area and access roads.

In 1999, pre-development mitigation programming can be implemented in the areas proposed for forest clearance in the year 2000 (oil sands stockpile area, tailings settling pond, south overburden disposal area and reclamation material storage area) and, at the same time, monitoring can be conducted in the areas cleared in the winter of 1999/2000 in advance of muskeg and overburden removal.

This type of sequence would be repeated as development proceeds. For example, in the year 2000 pre-development mitigation would take place in the initial mine area that would be scheduled for forest clearance that winter, while monitoring studies would take place in recently cleared and drained areas.

Effective implementation of this type of program requires effective communication between the proponent and their contractors and the organization conducting the historical resources program. It will be necessary to be quickly apprised of any schedule changes or modifications in development plans. The information provided in this report should be sufficient to allow inclusion or removal of any sites from the annual study program.

Because of the extended schedule, it will be necessary to implement a program of study that collects information that can be effectively compared with information obtained in previous study. The reports available for the Alsands project, the series of studies completed at the Cree Burn Lake Site (HhOv 16), and the 1997 Muskeg River Mine Project HRIA all provide a basis for design of comparable analyses. These should be consulted when preparing final mitigation plans for the Project.

7.7 Summary

Previously presented information indicates that only one historical resource site within the vicinity of the Project area would require permanent avoidance: the Cree Burn Lake site (HhOv 16). This site lies outside proposed development zones and will not be directly affected by the Project. Previous sections discussed the type of mitigation program that would be considered sufficient to offset the proposed impacts to the remaining historical resources associated with the Muskeg River Mine Project. As well, this discussion provides an indication of how the recommended mitigation program can be integrated with development schedules. It is believed that implementation of an effective program of historical resource mitigation studies can offset the proposed impacts of the Project.

8.0 CLOSURE

We trust this report presents the information you require. Should any portion of the report require clarification, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

Report prepared by:

Brian M. Ronaghan, M.A.
Senior Archaeologist

Report reviewed by:

for Rebecca J. Balcom
Principal

John R. Gulley, M.Sc., P.Biol.
Oil Sands Project Director

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APPENDIX I

SITE FORMS

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOu 41
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 2

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/6 Kearl Lake

5. U.T.M. Grid Zone: 12VVU Easting: 722 Northing: 476 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 12 Section 30 Township 95 Range 9 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 15km. At this point one will be just entering a fenced tailings pond area. Proceed north along cut line for 1km then east for 1km then back south along cut line for 1km. Site lies 150 m west of this point.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on terrace edge, west side of Muskeg River. Douglas fir, and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type

☐ isolated find	☐ quarry	☐ ranch	☐ school
☐ scatter (<10)	☐ rock art	☐ dwelling	☐ urban
☒ scatter (>10)	☐ burial	☐ trading post	☐ ceremonial/religious
☐ campsite	☐ palaeoenvironmental	☐ police post	☐ industrial
☐ stone feature	☐ settlement	☐ mine	☐ transportation
☐ killsite	☐ homestead	☐ trail	☐ Other... _____
☐ workshop	☐ farm	☐ mission	

13. Features (Frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure
..... cairn	..... effigy	..... mound	..... foundation .....
..... stone arc	..... pictograph	..... depression	..... cellar
..... stone line	..... petroglyph	..... cabin	..... dump
..... drive lane	..... hearth	..... house	..... fence

Borden No. HhOu 41
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a single positive 1 x 1 m shovel test containing one core fragment, eight secondary flakes, one large piece of block shatter, one flake shatter and a lateral edge of a biface fragment from the SW quad. Four secondary flakes and two flake shatter from the NW quad, thirteen secondary flakes and two flake shatter from the NE quad and three secondary flakes and one block shatter from the SE quad. All material Beaver River sandstone. Additional seven 50 x 50 cm tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
1	1	lithic tool(s)			human remains			metal
36	36	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

One core fragment, eight secondary flakes, one large piece of block shatter, one flake shatter and a lateral edge of a biface fragment from the SW quad. Four secondary flakes and two flake shatter from the NW quad, thirteen secondary flakes and two flake shatter from the NE quad and three secondary flakes and one block shatter from the SE quad. All material Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOu 41
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 8 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder: Brian Ronaghan — Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. — Date (Y/M/D): 97/09/02

28. Surface collected by: — Date (Y/M/D):

29. Tested/assessed by: Golder Associates — Date (Y/M/D): 97/09/02

30. Excavated/mitigated by: — Date (Y/M/D):

31. Form completed by: Tom Hoffert — Date (Y/M/D): 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify): ☐ additional investigation required (specify):

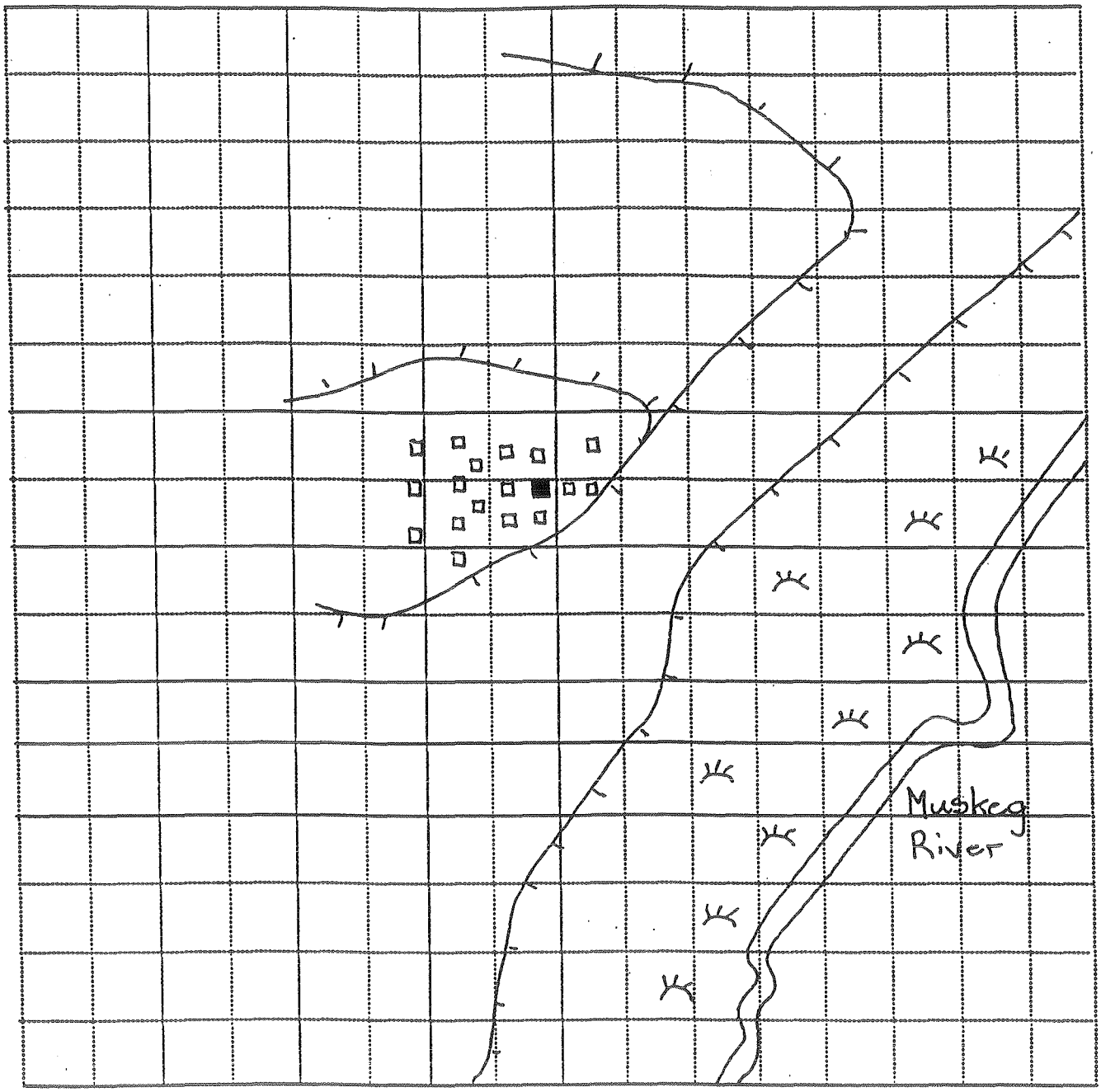
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOu-41

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

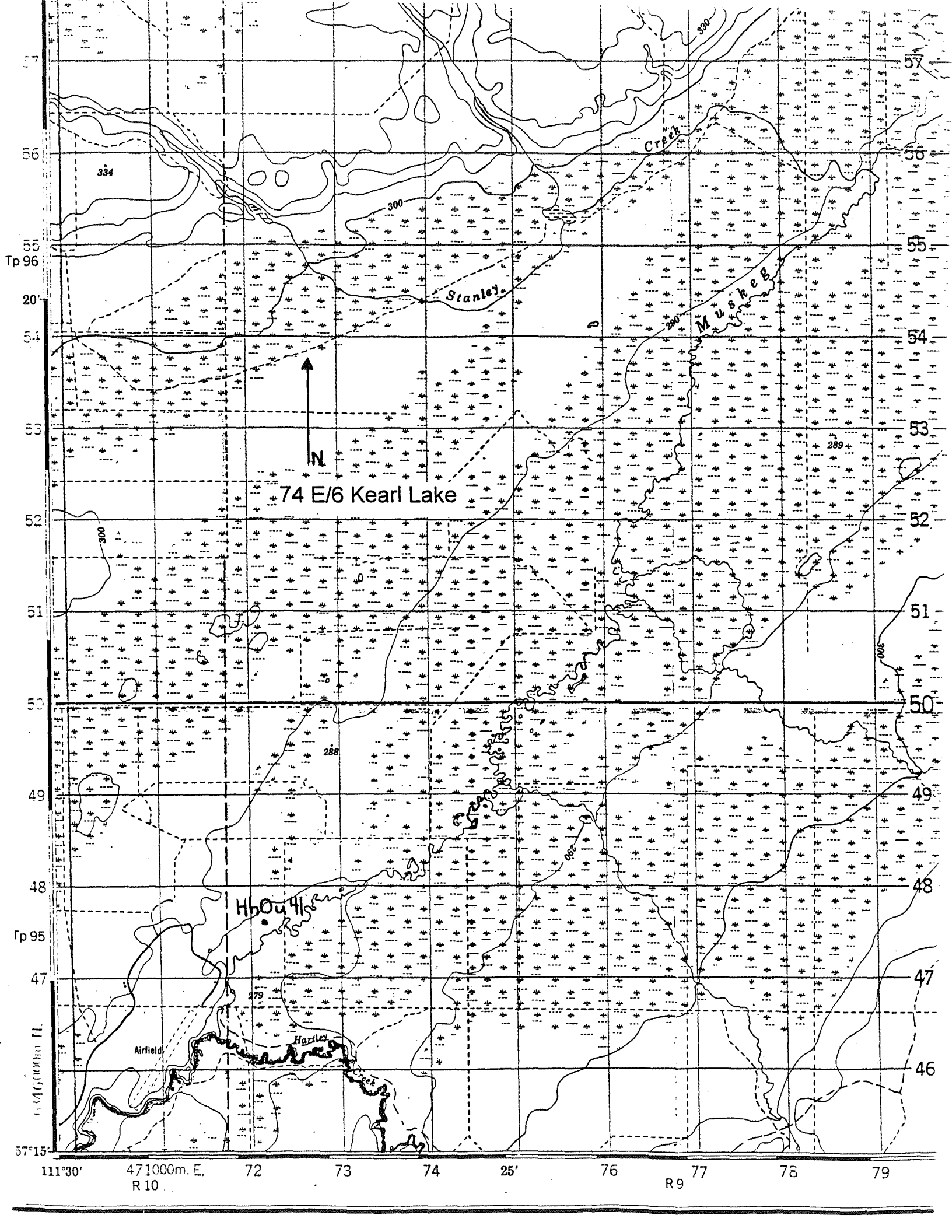
■ Shovel test positive

□ Shovel test negative

N

Scale : 1 cm = 20 m

0


74 E/6 Kearl Lake
N
Stanley Creek
Muskeg
Harlan Creek
Airfield
334
289
288
279
300
330
290
Tp 96
Tp 95
111°30'
471000m. E.
72
73
74
25'
76
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R 10
R 9
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Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOu 42
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 3

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/6 Kearl Lake

5. U.T.M. Grid Zone: 12VVU Easting: 730 Northing: 483 ☒ NAD 27 ☐ NAD 83

GPS ☒ yes ☐ no

6. Legal Description: LSD 15 Section 30 Township 95 Range 9 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 15km. At this point one will be just entering a fenced tailings pond area. Proceed north along cut line for 1km then east for 1.7km. Site lies 150 m south of this point.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on north - south trending ridge top, west of Muskeg River. Douglas fir, and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOu 42
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a single positive 1 x 1 m shovel test containing thirty-one secondary flakes and five flake shatter fragments. All material Beaver River sandstone. Additional six 50 x 50 cm tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
36	36	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Thirty-one secondary flakes and five flake shatter all of Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOu 42
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 7 No. of shovel tests
☐ erosion exposure No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/09/02

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/09/02

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify):
☐ additional investigation required (specify):

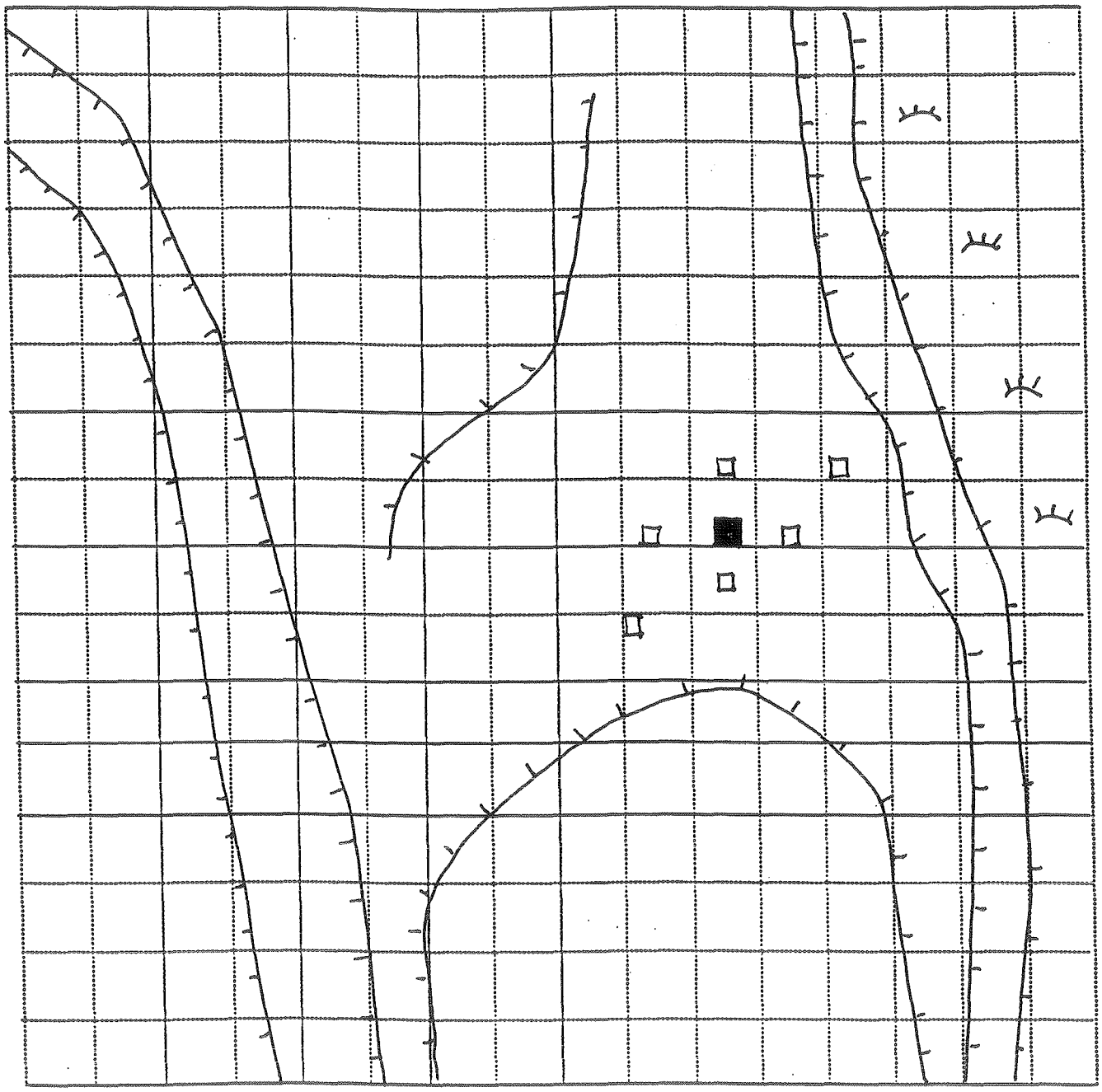
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOu 42

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

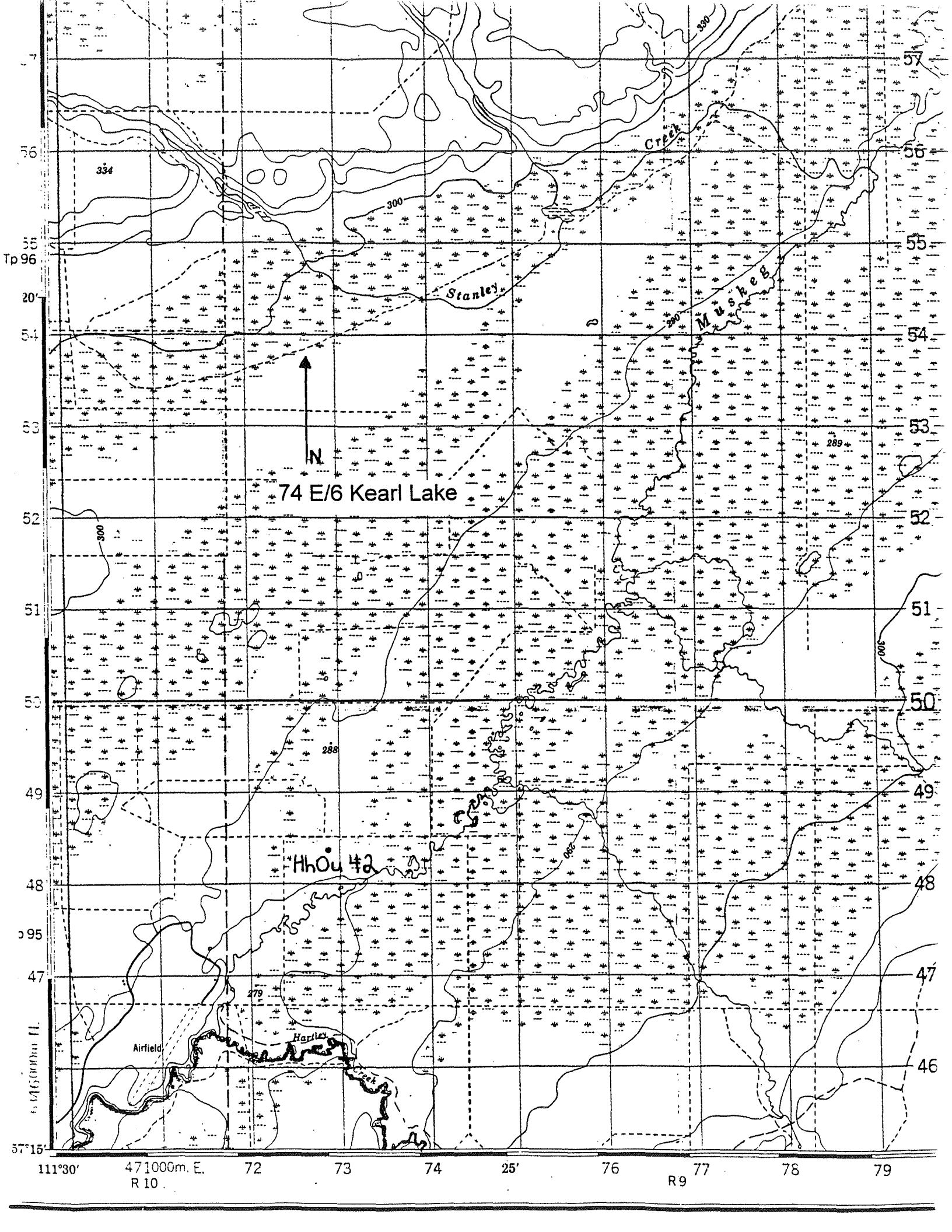
■ Shovel test positive

□ Shovel test negative

N

Scale : 1 cm = 5 m

0


74 E/6 Kearl Lake
N
Stanley
Creek
Muskeg
Hartley
Creek
Airfield
HhOu 42
334
288
289
279
300
330
290
Tp 96
111°30'
471000m. E.
R 10
R9
72
73
74
25'
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Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOu 43
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 4

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/6 Kearl Lake

5. U.T.M. Grid Zone: 12VVU Easting: 735 Northing: 484 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 4 Section 32 Township 95 Range 9 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 15km. At this point one will be just entering a fenced tailings pond area. Proceed north along cut line for 1km then east for 2.2km. Site lies 100 m south of this point.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on north - south trending ridge top, west of Muskeg River. Douglas fir, and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☒ scatter (<10)
- ☐ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOu 43
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a single positive 1 x 1 m shovel test containing seven secondary flakes and two block shatter fragments of Beaver River sandstone. One additional quartzite retouch flake was recovered. Four 50 x 50 cm tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
10	10	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Seven secondary flakes and two block shatter fragments of Beaver River sandstone. One additional quartzite retouch flake was recovered.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOu 43
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 5 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder: Brian Ronaghan Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D): 97/09/03

28. Surface collected by: Date (Y/M/D):

29. Tested/assessed by: Golder Associates Date (Y/M/D): 97/09/03

30. Excavated/mitigated by: Date (Y/M/D):

31. Form completed by: Tom Hoffert Date (Y/M/D): 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify): ☐ additional investigation required (specify):

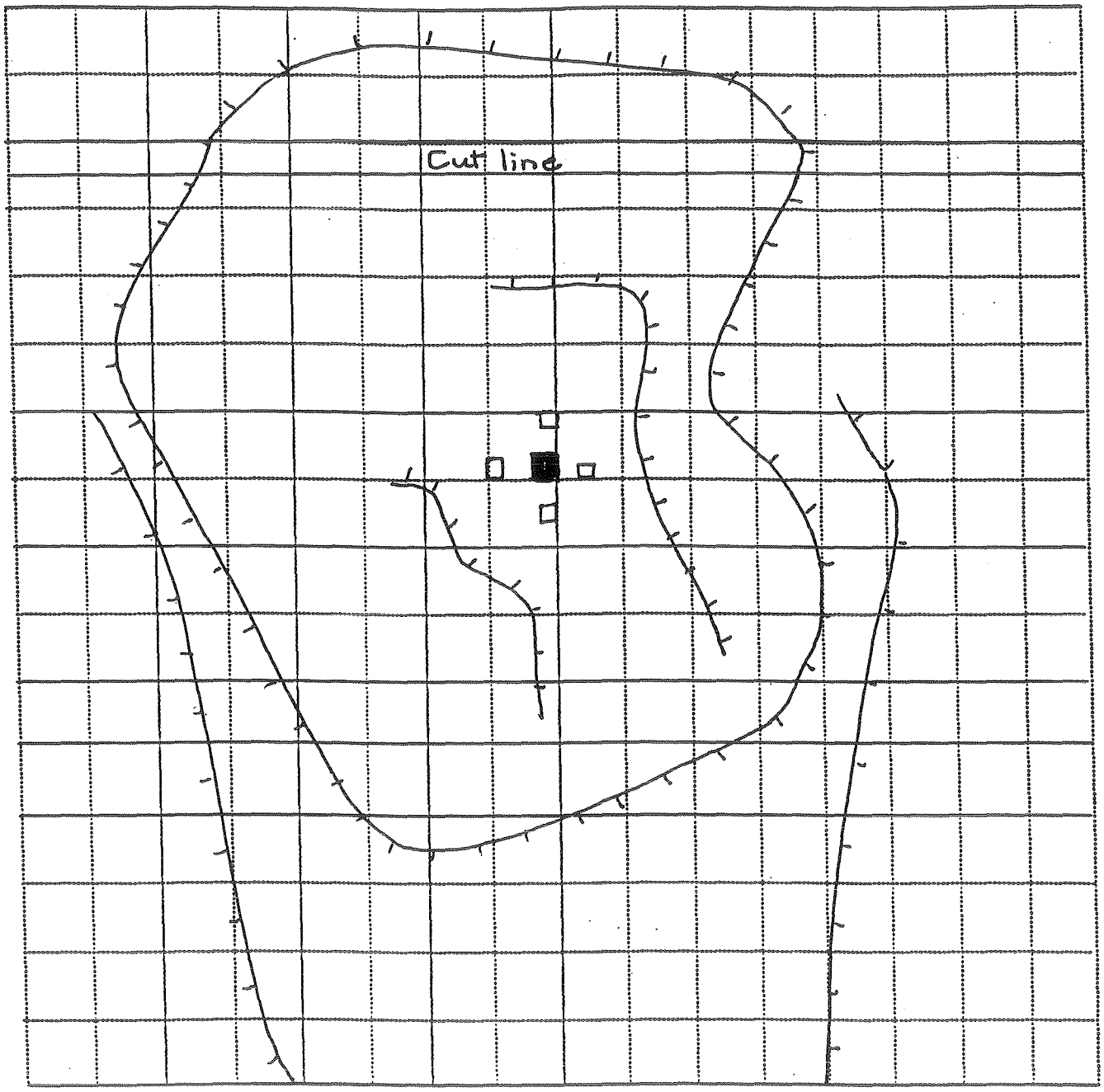
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOu 43

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

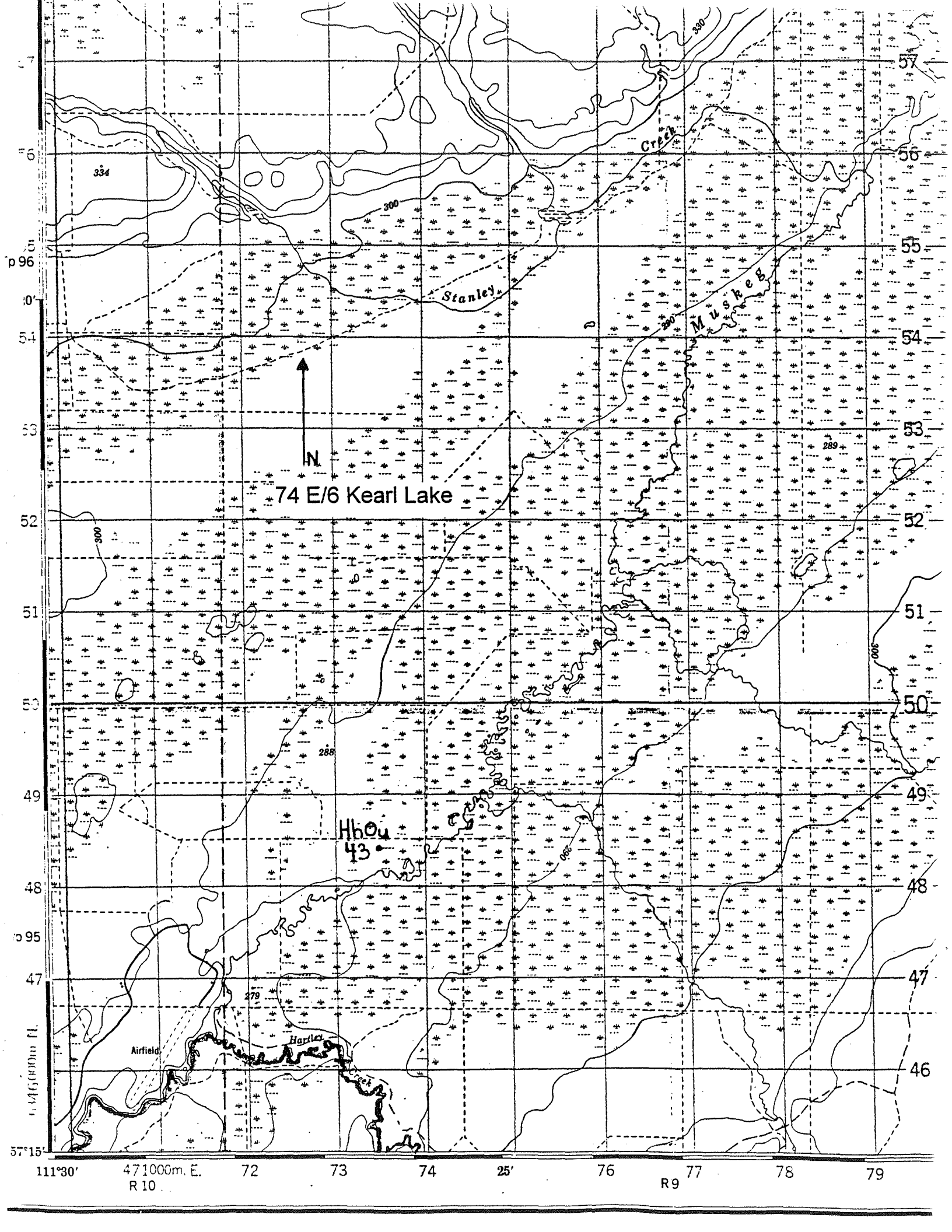
Additional Legend

■ Shovel test positive
□ Shovel test negative

N

Scale : 1 cm = 20 m

0


74 E/6 Kearl Lake
N
Stanley Creek
Muskeg
Harley Creek
Airfield
HbOu
43
334
300
288
289
279
290
330
57
56
55
54
53
52
51
50
49
48
47
46
111°30'
471000m. E.
72
73
74
25'
76
77
78
79
R 10
R 9
57°15'

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOu 44
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 14

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/6 Kearl Lake

5. U.T.M. Grid Zone: 12VVU Easting: 712 Northing: 458 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 10 Section 24 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 16km. At this point one will be at northern end of abandoned airstrip. Proceed south along airstrip for 1 km then east across Muskeg River. Site lies 30 m east of river and 50 w of two track running north - south through bush.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on highest terrace edge, east side of Muskeg River. Douglas fir, and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☒ scatter (<10)
- ☐ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)

.....	stone circle	.....	medicine wheel	.....	pit	.....	structure
.....	cairn	.....	effigy	.....	mound	.....	foundation
.....	stone arc	.....	pictograph	.....	depression	.....	cellar
.....	stone line	.....	petroglyph	.....	cabin	.....	dump
.....	drive lane	.....	hearth	.....	house	.....	fence

Borden No. HhOu 44
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a single positive 1 x 1 m shovel test containing one chert end scraper and one Beaver River sandstone secondary flake. Additional six 50 x 50 cm tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
1	1	lithic tool(s)			human remains			metal
1	1	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

One chert end scraper and one Beaver River sandstone secondary flake.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOu 44
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 7 No. of shovel tests
☐ erosion exposure ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder: Brian Ronaghan Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D): 97/10/19

28. Surface collected by: Date (Y/M/D):

29. Tested/assessed by: Golder Associates Date (Y/M/D): 97/10/19

30. Excavated/mitigated by: Date (Y/M/D):

31. Form completed by: Tom Hoffert Date (Y/M/D): 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify):
☐ additional investigation required (specify):

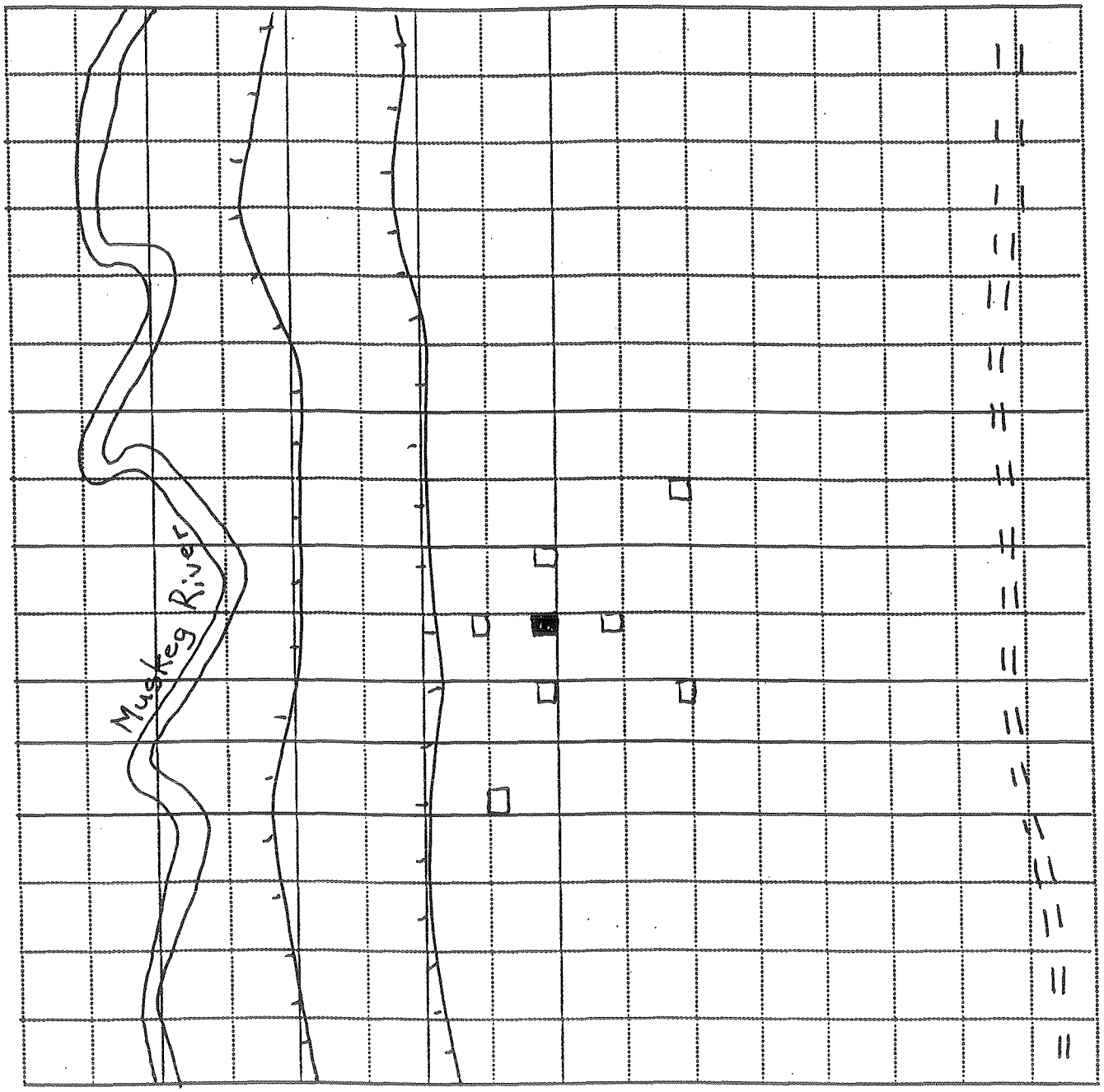
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOu 44

Permit No. 97·107



N.T.S. 1:50,000MAP INSET Map No.:

LEGEND

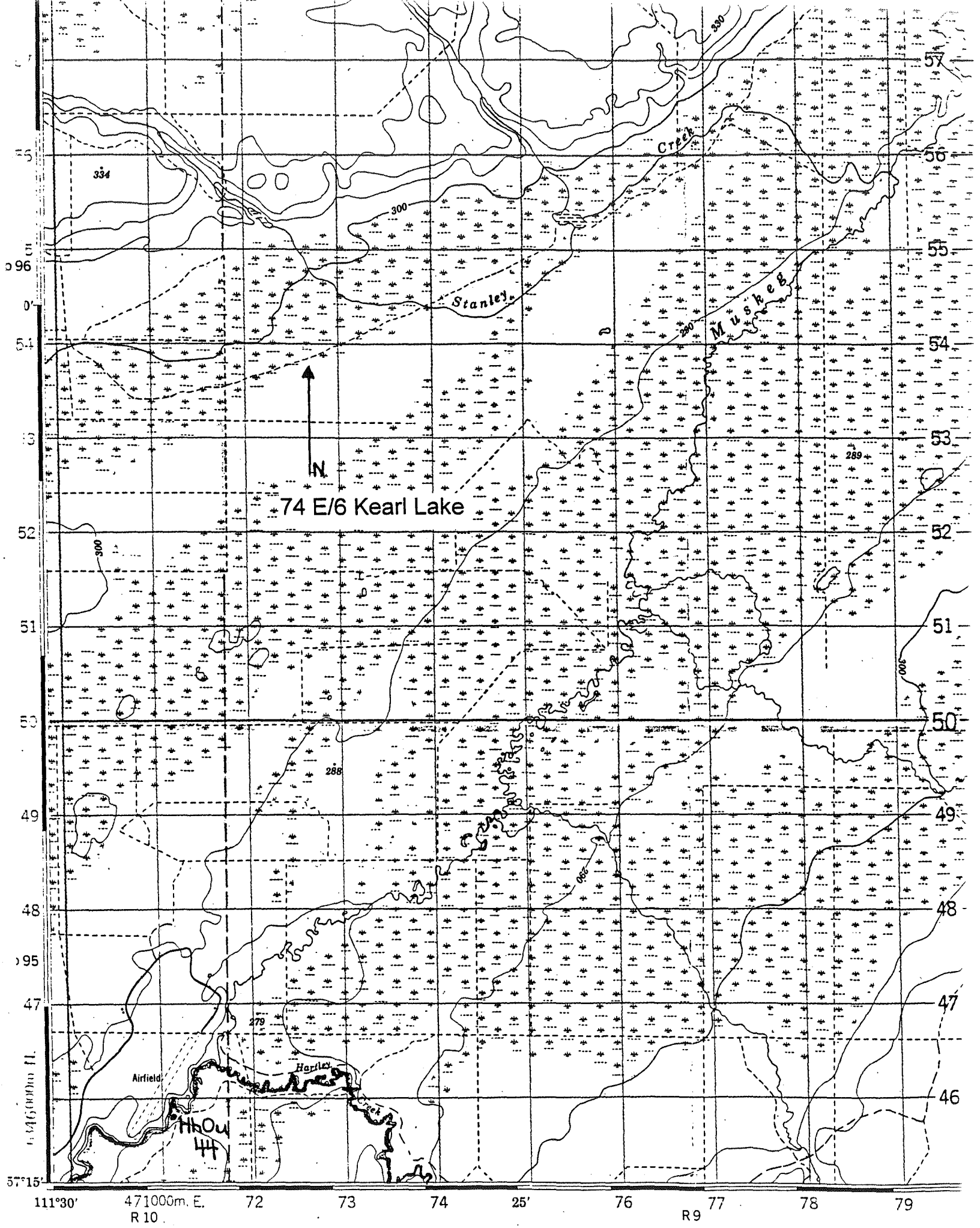
Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend
Shovel test positive
Shovel test negative
Two track

Scale : 1 cm = 10 m

N

0


74 E/6 Kearl Lake
N
Stanley
Creek
Muskeg
Harley
Creek
Airfield
334
289
288
279
300
111°30'
47
1000m. E.
72
73
74
25'
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R 10
R 9
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Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOu 45
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 15

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/6 Kearl Lake

5. U.T.M. Grid Zone: 12VVU Easting: 711 Northing: 457 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 10 Section 24 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 16km. At this point one will be at northern end of abandoned airstrip. Proceed south along airstrip for 1.1 km then east across Muskeg River. Site lies 50 m east of river and 50 m w of two track running north - south through bush.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on highest terrace edge, east side of Muskeg River. Douglas fir, and Jack pine prominent overstory.

10. Site Class
☒ prehistoric
☐ indiginous historic
☐ historic
☐ contemporary
☐ undetermined

11. Sub Type
☐ surface
☒ subsurface
☐ underwater
☐ stratified
☐ undetermined

☒ single component
☐ multi component
☐ undetermined
1 # components

12. Site Type
☐ isolated find
☐ scatter (<10)
☒ scatter (>10)
☐ campsite
☐ stone feature
☐ killsite
☐ workshop
☐ quarry
☐ rock art
☐ burial
☐ palaeoenvironmental
☐ settlement
☐ homestead
☐ farm
☐ ranch
☐ dwelling
☐ trading post
☐ police post
☐ mine
☐ trail
☐ mission
☐ school
☐ urban
☐ ceremonial/religious
☐ industrial
☐ transportation
☐ Other... _____

13. Features (Frequencies if possible)
..... stone circle
..... cairn
..... stone arc
..... stone line
..... drive lane
..... medicine wheel
..... effigy
..... pictograph
..... petroglyph
..... hearth
..... pit
..... mound
..... depression
..... cabin
..... house
..... structure
..... foundation
..... cellar
..... dump
..... fence

Borden No. HhOu 45
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of: ST 1 fourteen core fragments, sixty-two secondary flakes, three primary decortication flakes, two secondary decortication flakes, four retouch flakes, two flake shatter and ten block shatter. ST 2 one secondary flake. All material Beaver River Sandstone. Three additional tests were sterile.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
100	100	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

ST 1 fourteen core fragments, sixty-two secondary flakes, three primary decortication flakes, two secondary decortication flakes, four retouch flakes, two flake shatter and ten block shatter. ST 2 one secondary flake. All material Beaver River Sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOu 45
Permit No. 97-107

22. Estimated Dimensions N-S: 5 m E-W: 5 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 7 No. of shovel tests
☐ erosion exposure ____ No. of backhoe tests

24. Estimated Portion Intact 95 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/10/19

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/10/19

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

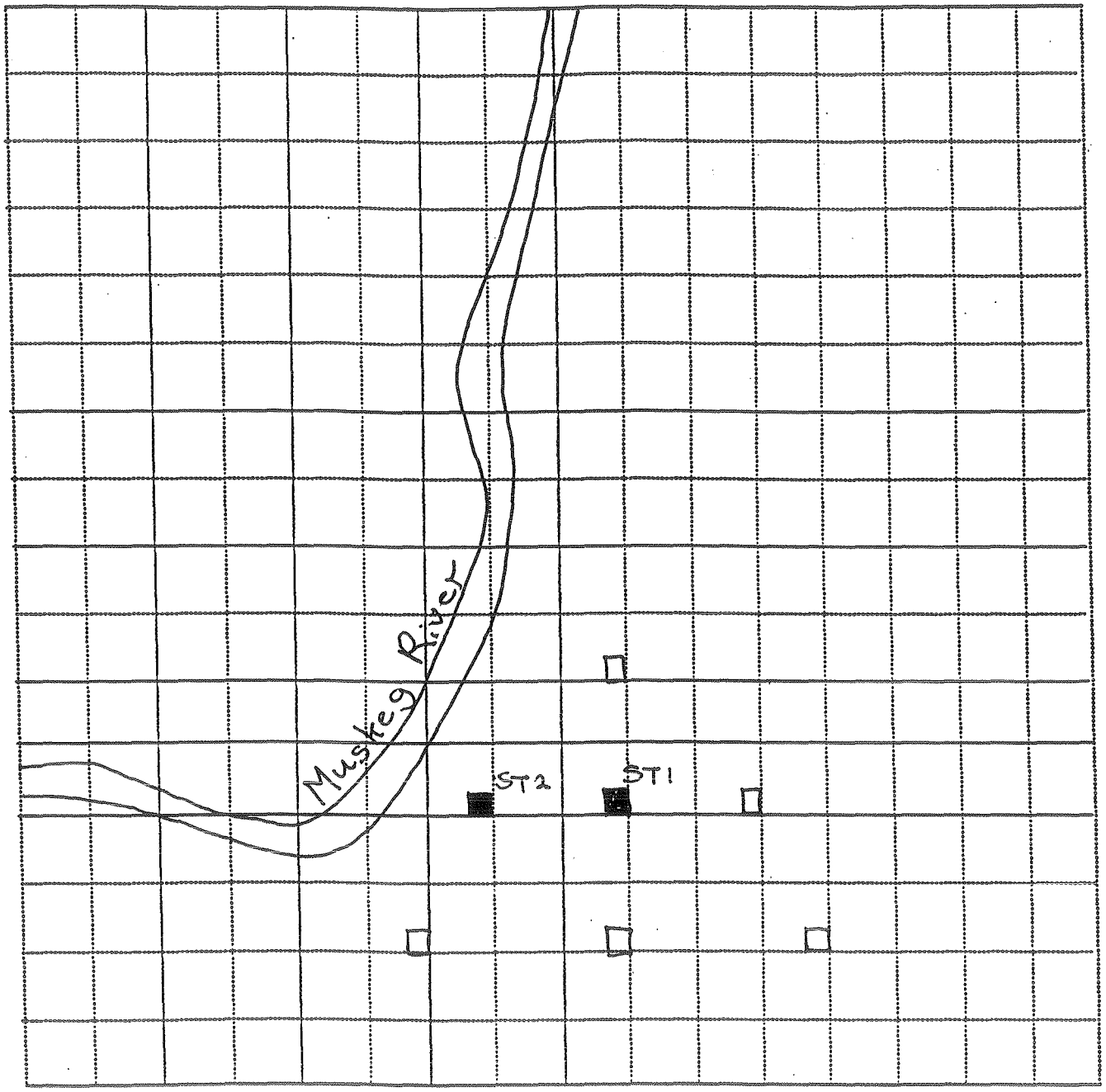
33. Recommendations ☐ no additional investigation required (specify):
☐ additional investigation required (specify):

35. Additional Remarks

36. Site Map

Borden No. HhOu 45

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

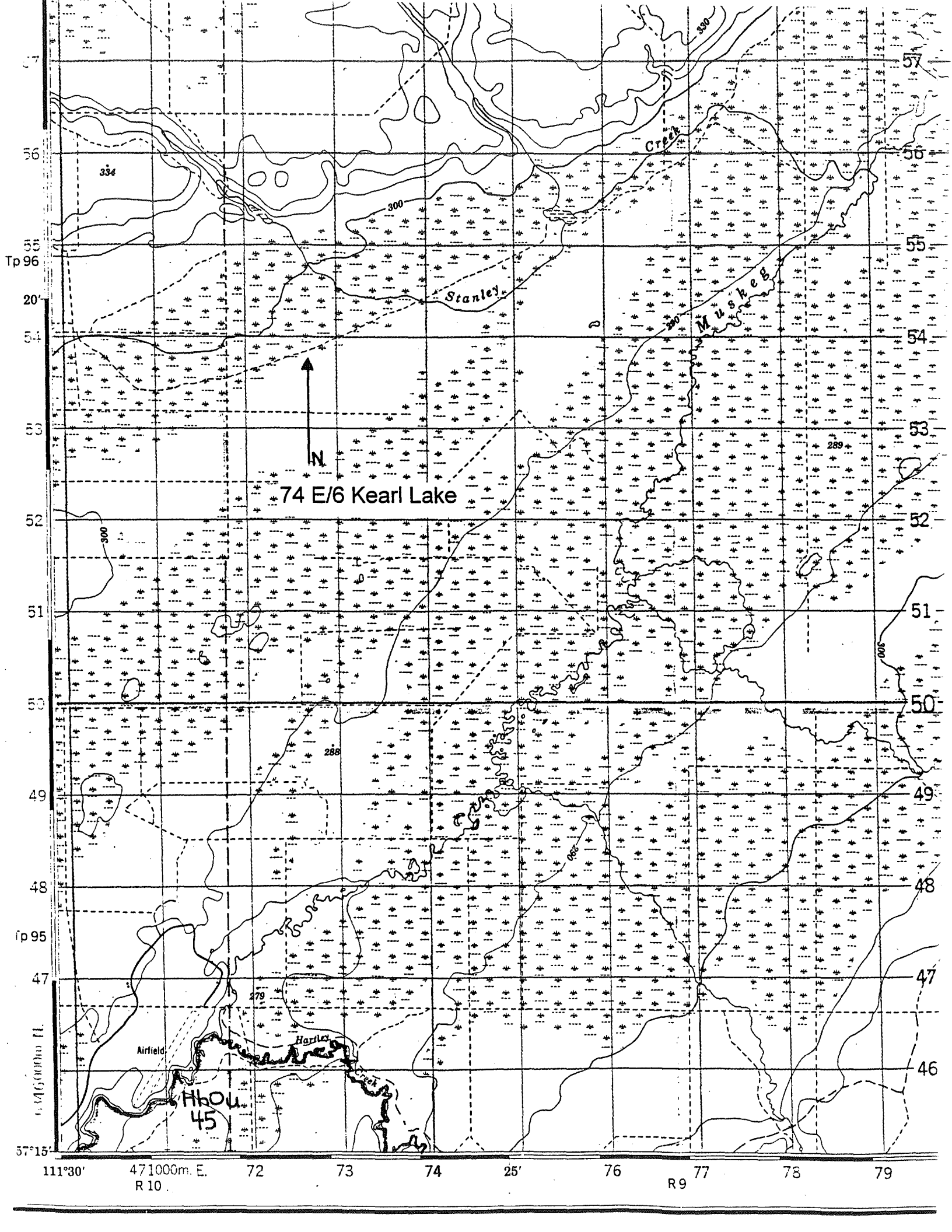
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 5 m

0


74 E/6 Kearl Lake
N
Stanley
Creek
Musk eg
Harley
Creek
Airfield
334
300
330
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Tp 96
Tp 95
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R 10
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Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOu 46
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 16

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/6 Kearl Lake

5. U.T.M. Grid Zone: 12VVU Easting: 709 Northing: 456 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 10 Section 24 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 16km. At this point one will be at northern end of abandoned airstrip. Proceed south along airstrip for 1.2 km then southeast across Muskeg River. Site lies 50 m south of river and 100 m w of two track running north - south through bush.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on highest terrace edge, south side of Muskeg River. Douglas fir, and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOu 46
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of : ST 1 onecore, three core fragments, two block shatter, one retouch flake, twenty-four secondary flakes, one primary decortication flake and two secondary decortication flakes. All material Beaver River Sandstone. Four additional tests were sterile.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
33	33	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

ST 1 onecore, three core fragments, two block shatter, one retouch flake, twenty-four secondary flakes, one primary decortication flake and two secondary decortication flakes. All material Beaver River Sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOu 46
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 6 No. of shovel tests
☐ erosion exposure ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/10/19

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/10/19

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

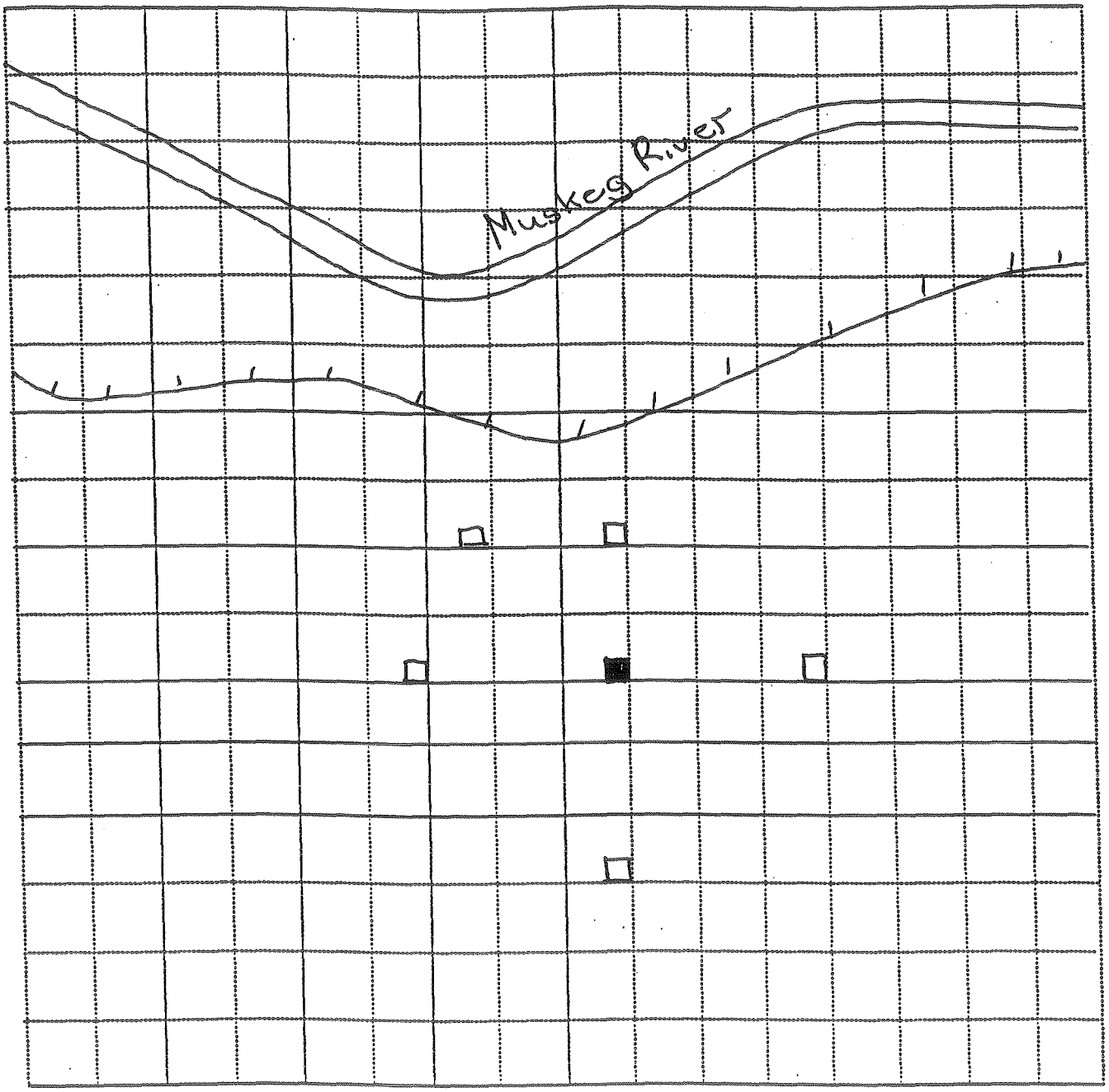
33. Recommendations ☐ no additional investigation required (specify):
☐ additional investigation required (specify):

35. Additional Remarks

36. Site Map

Borden No. HhOu 46

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

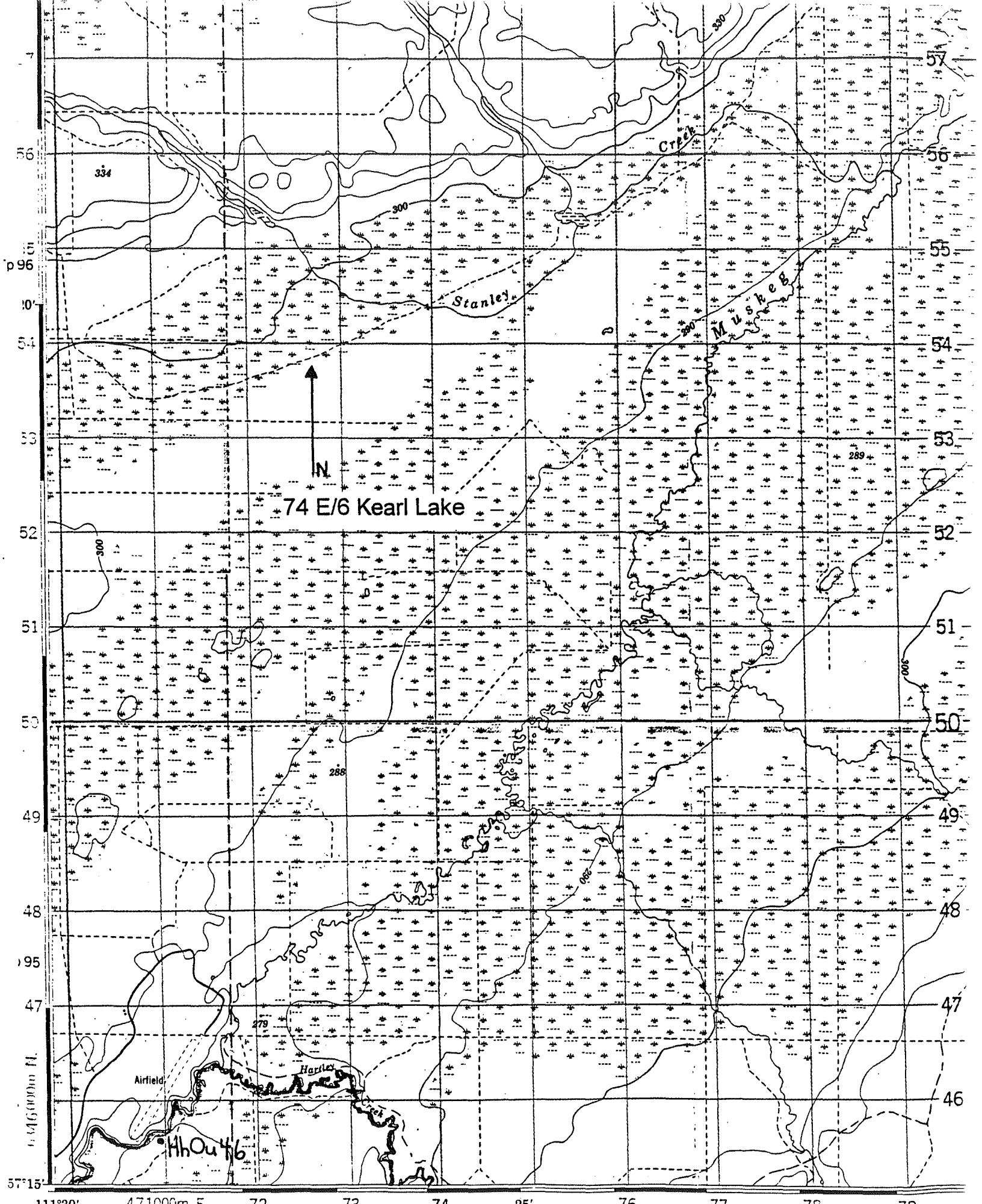
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 2 m

0


74 E/6 Kearl Lake
N
Stanley
Creek
Muskeg
Airfield
Harley
Creek
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HhOu46
111°30'
471000m. E.
72
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COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 178
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 1

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/5 Bitumount

5. U.T.M. Grid Zone: 12VVU Easting: 692 Northing: 469 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 3 Section 26 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 12 km. Site lies 1.75 km magnetic north from this point of road.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on lower bench of prominent knoll approximately 200 m east of large unnamed lake. Douglas fir, and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☒ scatter (<10)
- ☐ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence
- .....

Borden No. HhOv 178
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists a single positive shovel test containing two core fragments, one secondary flake and three large pieces of block shatter. All material Beaver River sandstone. Additional eleven tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
6	6	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Two core fragments, one secondary flake and three block shatter all of Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 178
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 12 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/08/31

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/08/31

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify):
☐ additional investigation required (specify):

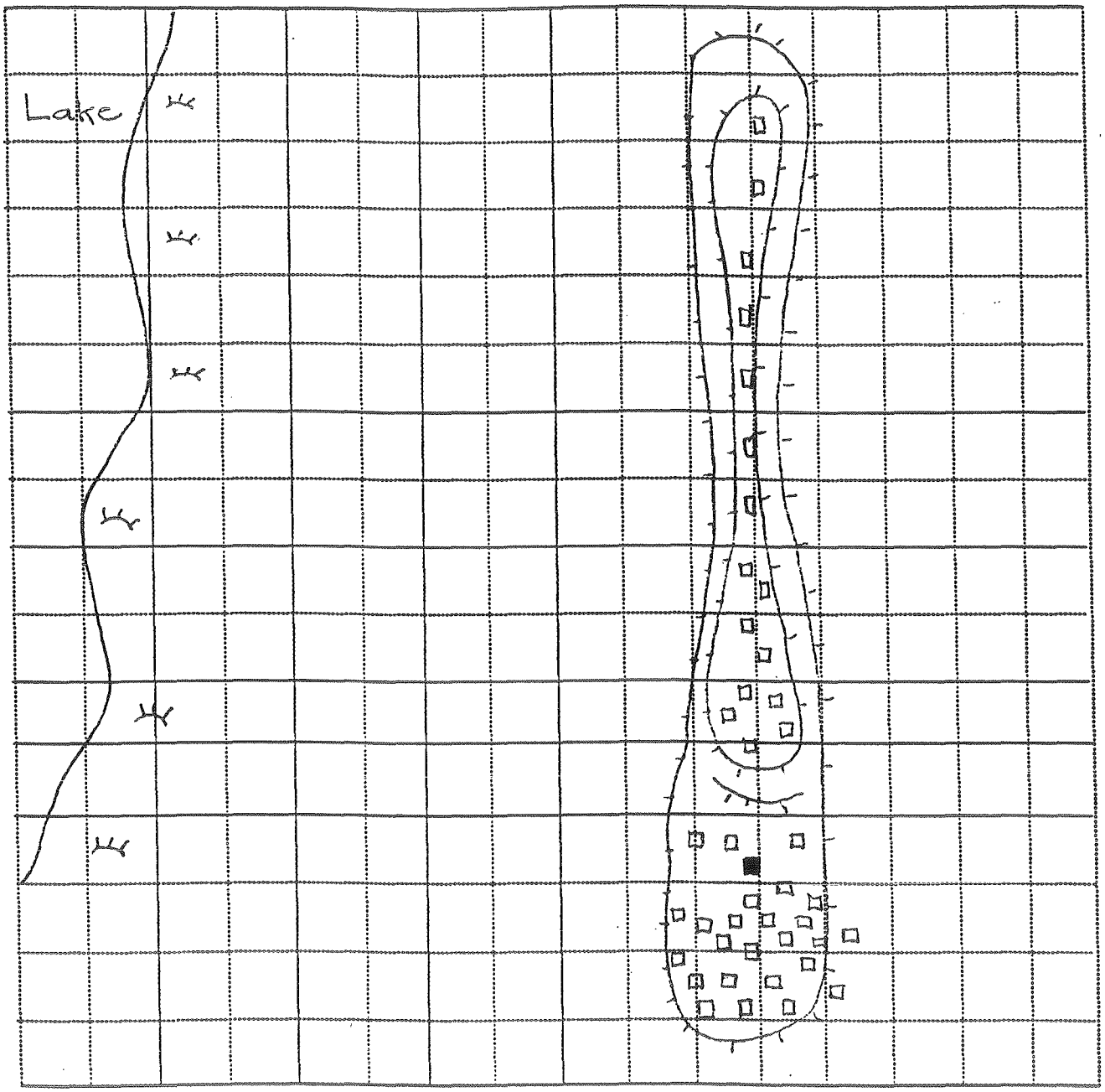
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOv 178

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

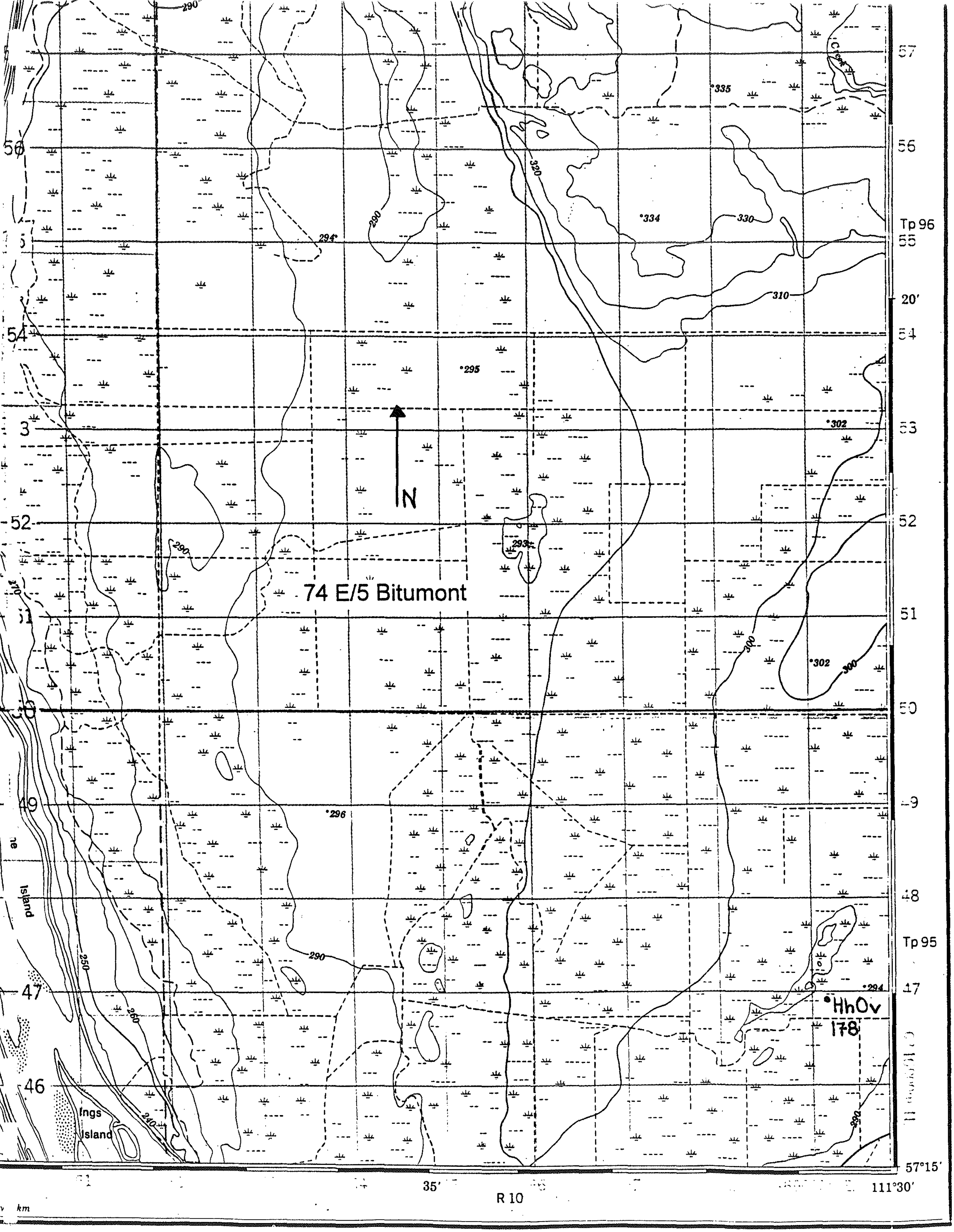
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 10 m

0



74 E/5 Bitumont
N
HhOv
178
Tp 96
Tp 95
57
56
55
20′
54
53
52
51
50
49
48
47
46
57°15′
35′
R 10
111°30′
km
Creek
Ings
Island
335
334
330
320
310
300
302
295
294
293
296
290
260
250
240

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 179
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 5

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/5 Bitumount

5. U.T.M. Grid Zone: 12VVU Easting: 684 Northing: 466 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 3 Section 26 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 11.25 km. Site lies 250 m magnetic north from this point of road.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on small well drained knoll approximately 200 m north of existing road. Douglas fir, and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type

☐ isolated find	☐ quarry	☐ ranch	☐ school
☒ scatter (<10)	☐ rock art	☐ dwelling	☐ urban
☐ scatter (>10)	☐ burial	☐ trading post	☐ ceremonial/religious
☐ campsite	☐ palaeoenvironmental	☐ police post	☐ industrial
☐ stone feature	☐ settlement	☐ mine	☐ transportation
☐ killsite	☐ homestead	☐ trail	☐ Other... _____
☐ workshop	☐ farm	☐ mission	

13. Features (Frequencies if possible)

..... stone circle	..... medicine wheel	..... pit	..... structure
..... cairn	..... effigy	..... mound	..... foundation .....
..... stone arc	..... pictograph	..... depression	..... cellar
..... stone line	..... petroglyph	..... cabin	..... dump
..... drive lane	..... hearth	..... house	..... fence

Borden No. HhOv 179
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists a single positive shovel test containing three secondary flakes from the SW quad, one secondary flake from the NW quad, three secondary flakes and one piece of red ochre from the SE quad and one lateral edge of a biface fragment from the NE quad. All material Beaver River sandstone. Additional seven tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
1	1	lithic tool(s)			human remains			metal
7	7	lithic debitage			floral remains			glass
		bone tools			tephra	1	1	other, specify
		ceramics			soil samples			ochre
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Seven Beaver River sandstone secondary flakes, one Beaver River sandstone biface fragment and one piece of red ochre.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 179
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 8 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder: Brian Ronaghan Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D): 97/09/05

28. Surface collected by: Date (Y/M/D):

29. Tested/assessed by: Golder Associates Date (Y/M/D): 97/09/05

30. Excavated/mitigated by: Date (Y/M/D):

31. Form completed by: Tom Hoffert Date (Y/M/D): 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify): ☐ additional investigation required (specify):

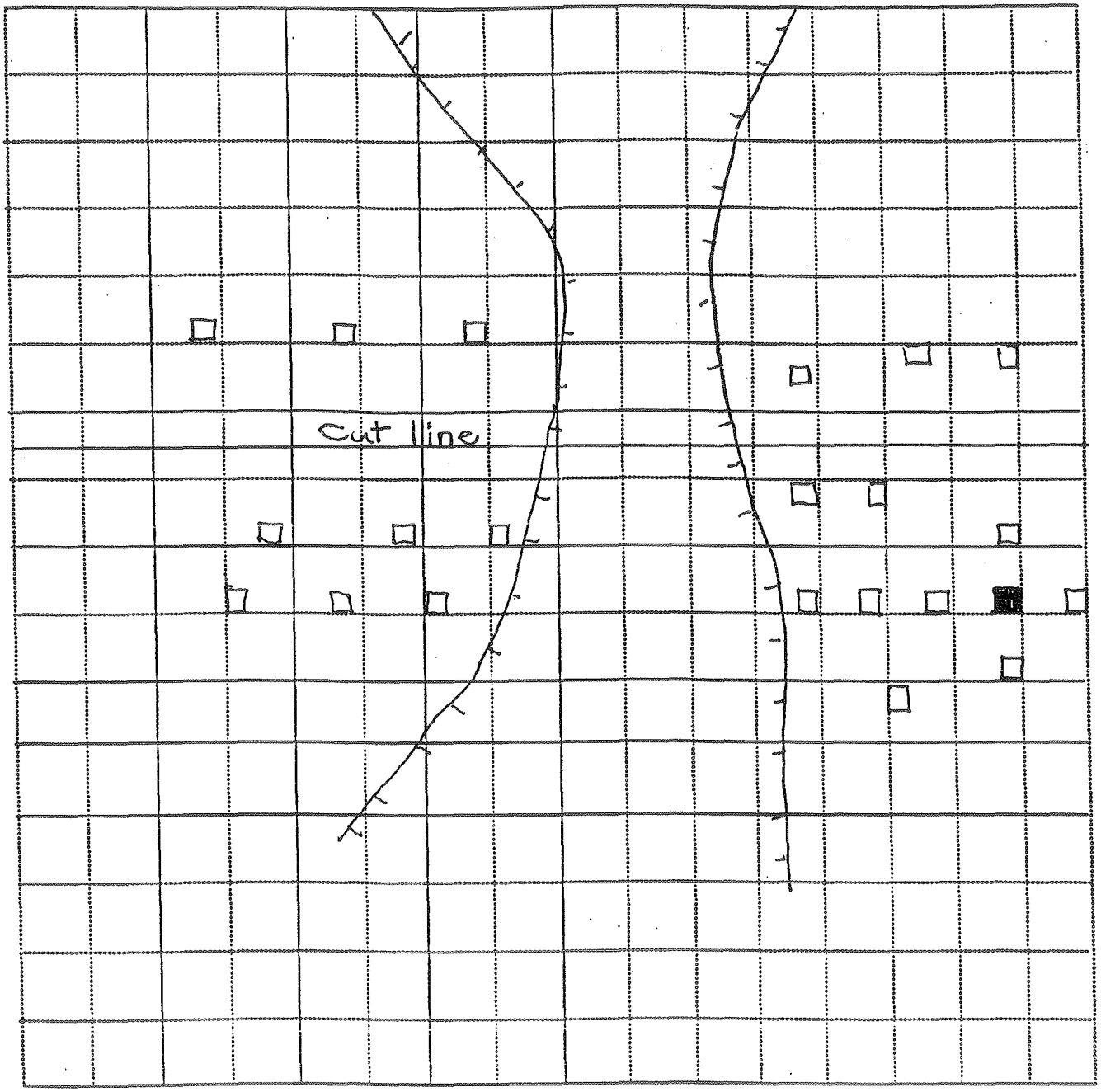
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOv 179

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

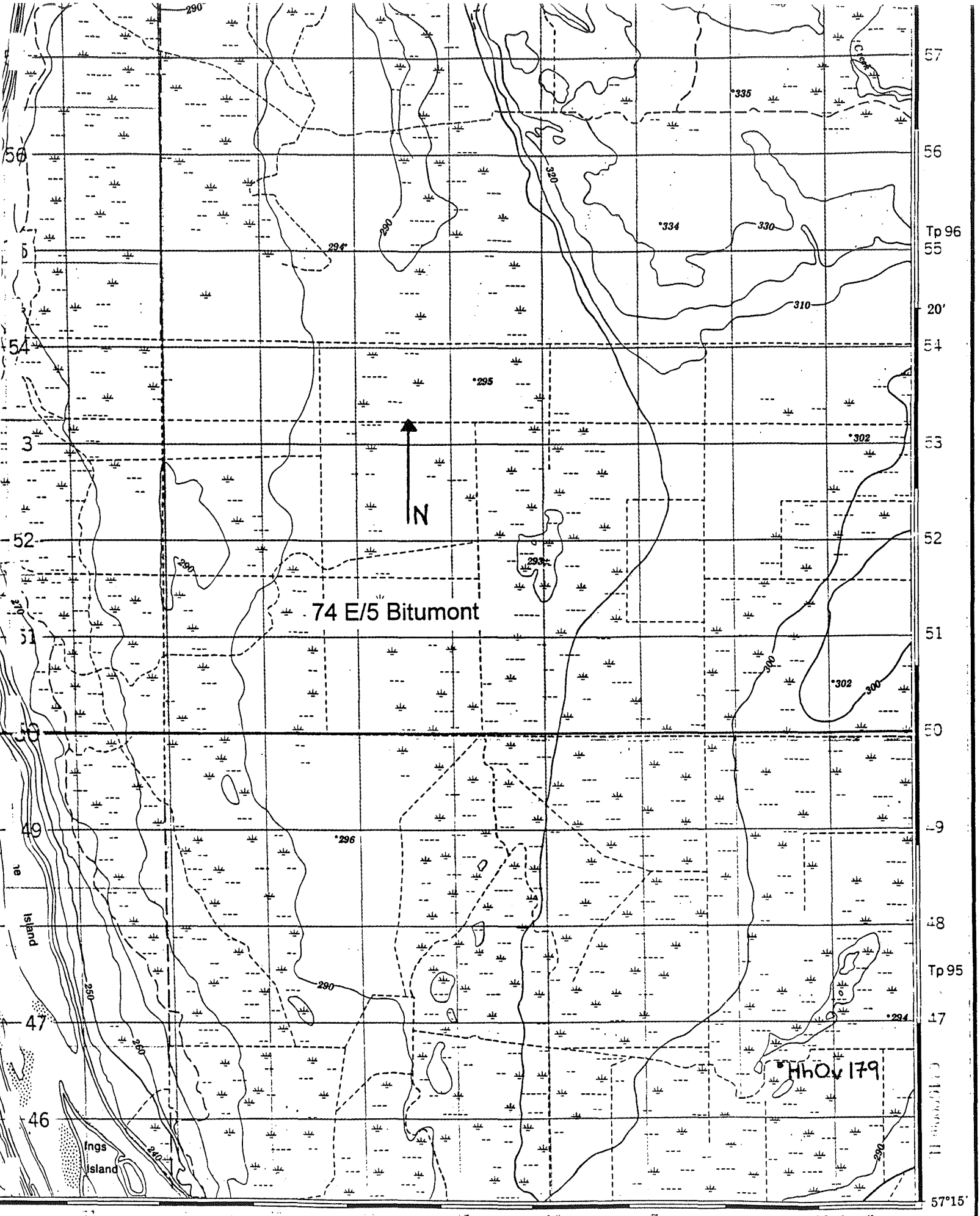
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 5 m

0


74 E/5 Bitumont
N
HhQv 179
Island
Islands
Tp 96
Tp 95
35'
R 10
111°30'
57°15'
km

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 180
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 6

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/5 Bitumount

5. U.T.M. Grid Zone: 12VVU Easting: 674 Northing: 454 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 3 Section 22 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 12 km. Site lies 2 km magnetic west from this point of road.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on very small well drained knoll approximately 6 m south of existing cut line. Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☒ scatter (<10)
- ☐ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence
- .....

Borden No. HhOv 180
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists a single positive 1 x 1 m test containing three secondary flakes, one core fragment and three pieces of block shatter. All material Beaver River sandstone. Additional four 50 x 50 cm tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
7	7	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Three secondary flakes, one core fragment and three pieces of block shatter. All material Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 180
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 5 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder: Brian Ronaghan Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D): 97/09/04

28. Surface collected by: Date (Y/M/D):

29. Tested/assessed by: Golder Associates Date (Y/M/D): 97/09/04

30. Excavated/mitigated by: Date (Y/M/D):

31. Form completed by: Tom Hoffert Date (Y/M/D): 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify): ☐ additional investigation required (specify):

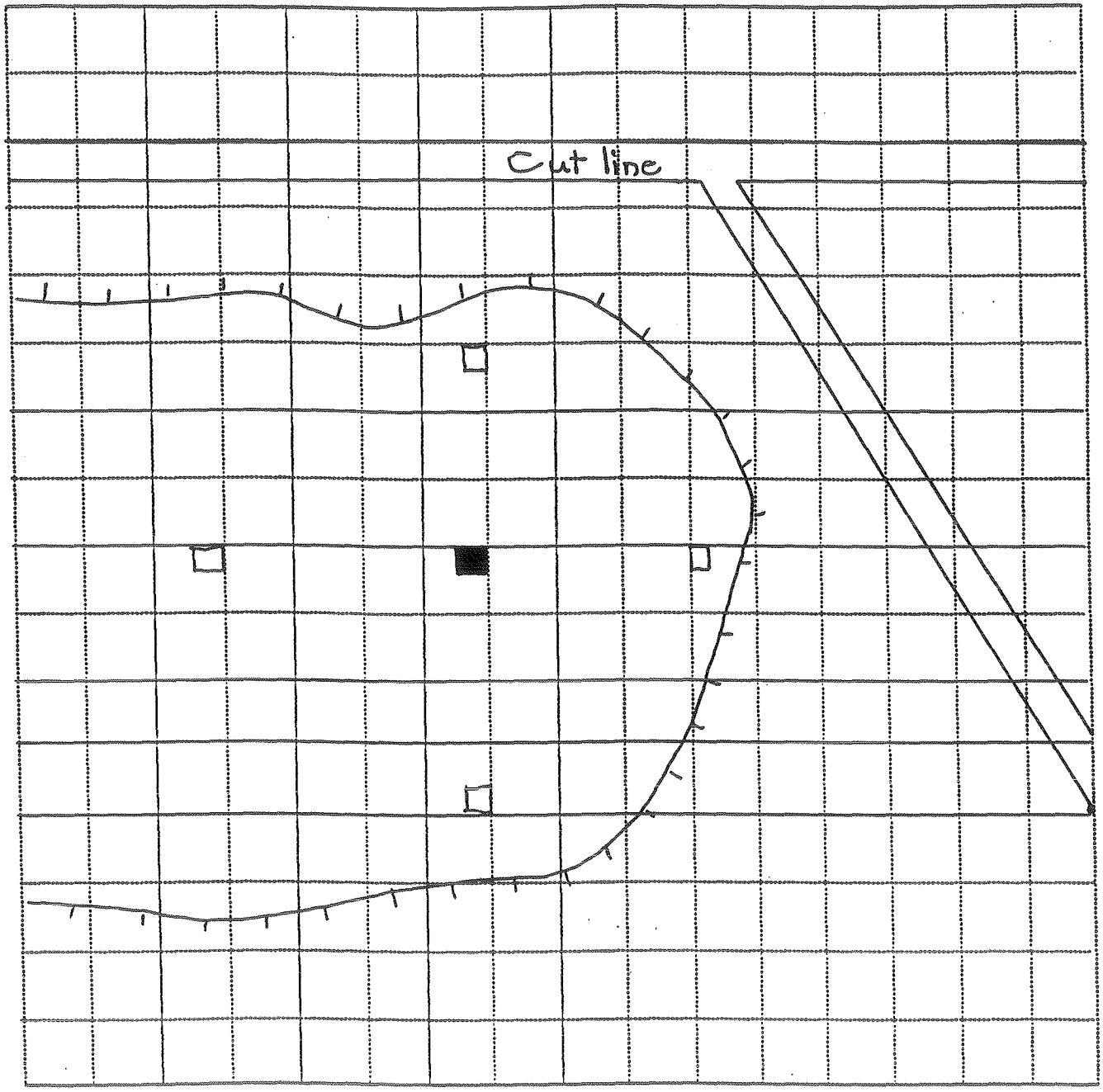
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOv 180

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

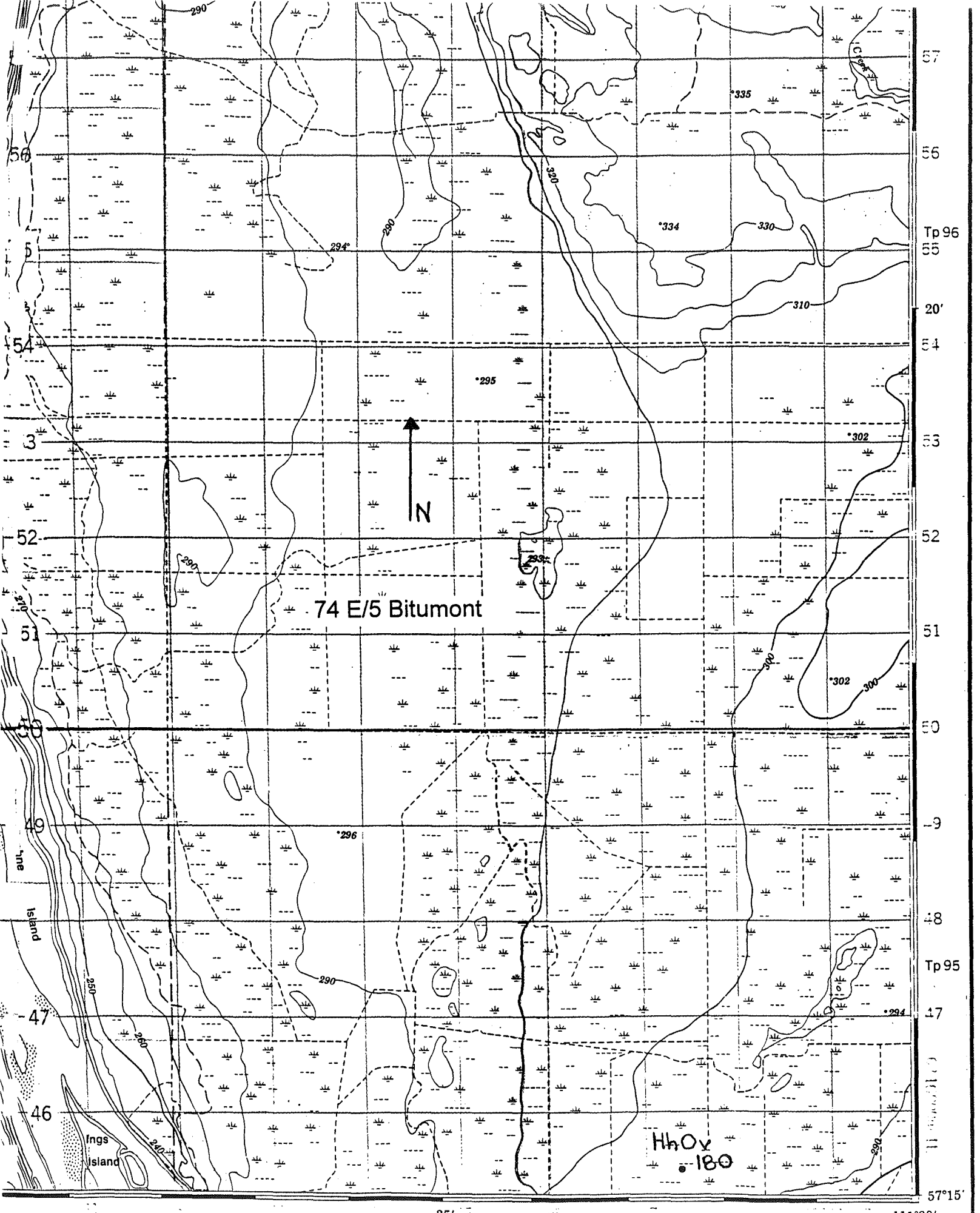
■ Shovel test positive

□ Shovel test neg

N

Scale : 1 cm = 1 m

0


74 E/5 Bitumont
N
Tp 96
Tp 95
R 10
35'
111°30'
57°15'
20'
Island
Ings
Island
HhOx
180

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 181
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 7

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/5 Bitumount

5. U.T.M. Grid Zone: 12VVU Easting: 690 Northing: 445 ☒ NAD 27 ☐ NAD 83

GPS ☒ yes ☐ no

6. Legal Description: LSD 11 Section 14 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 10 km. Site lies 250 m magnetic east from this point of road.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located in large open meadow, well drained with swamp to the south and east. Douglas fir and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOv 181
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists a single positive 1 x 1 m test containing one hundred and thirty-eight secondary flakes, thirteen retouch flakes, twenty-four pieces of block shatter, thirty-two pieces of flake shatter and three core fragments. All material Beaver River sandstone. Additional twelve 50 x 50 cm tests around positive test proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
210	210	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

One hundred and thirty-eight secondary flakes, thirteen retouch flakes, twenty-four block shatter and thirty-two flake shatter, three core fragments. All material Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 181
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 13 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder: Brian Ronaghan Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D): 97/09/05

28. Surface collected by: Date (Y/M/D):

29. Tested/assessed by: Golder Associates Date (Y/M/D): 97/09/05

30. Excavated/mitigated by: Date (Y/M/D):

31. Form completed by: Tom Hoffert Date (Y/M/D): 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify): ☐ additional investigation required (specify):

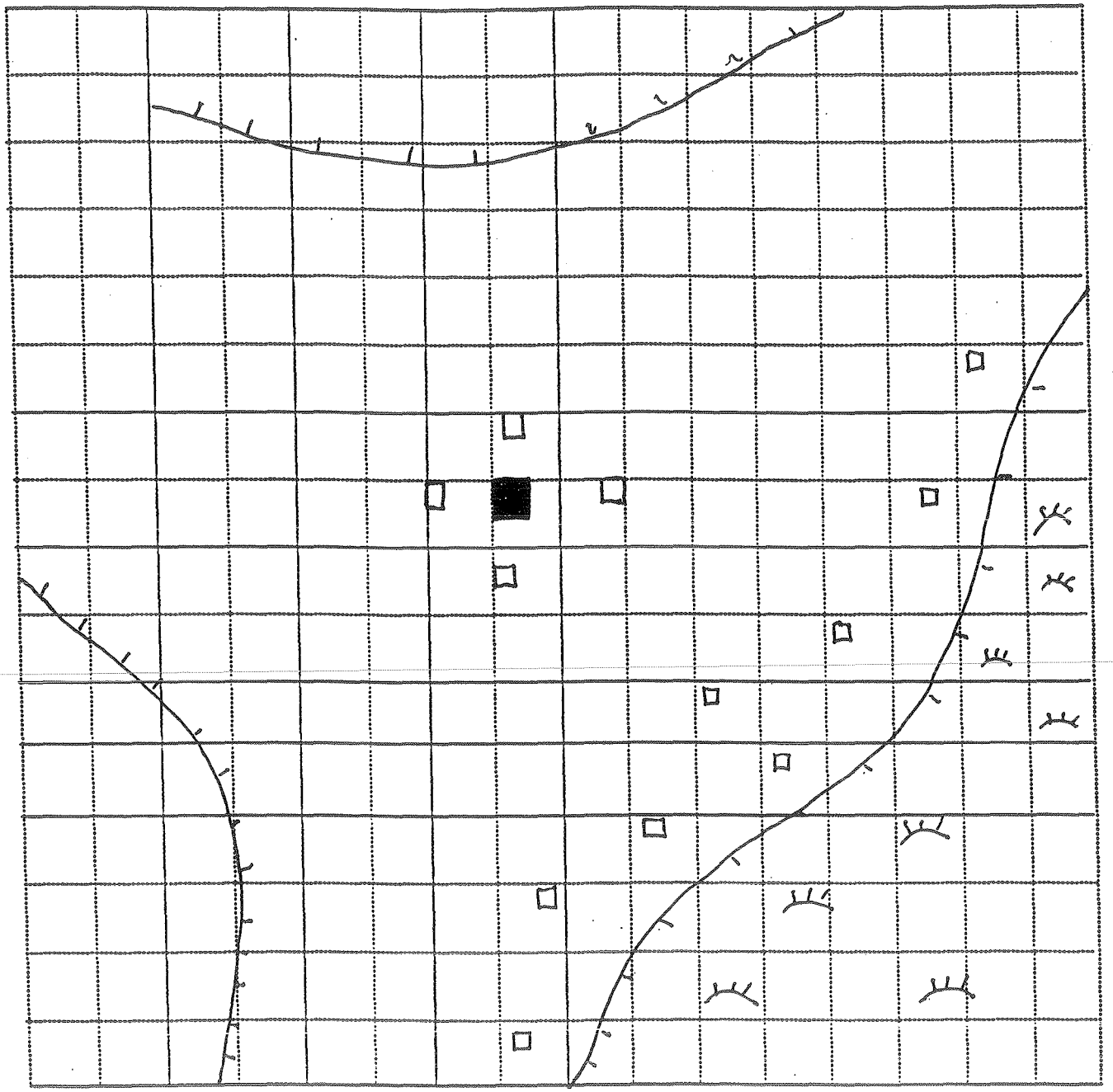
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOv 181

Permit No. 97-107



N.T.S. 1:50,000MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

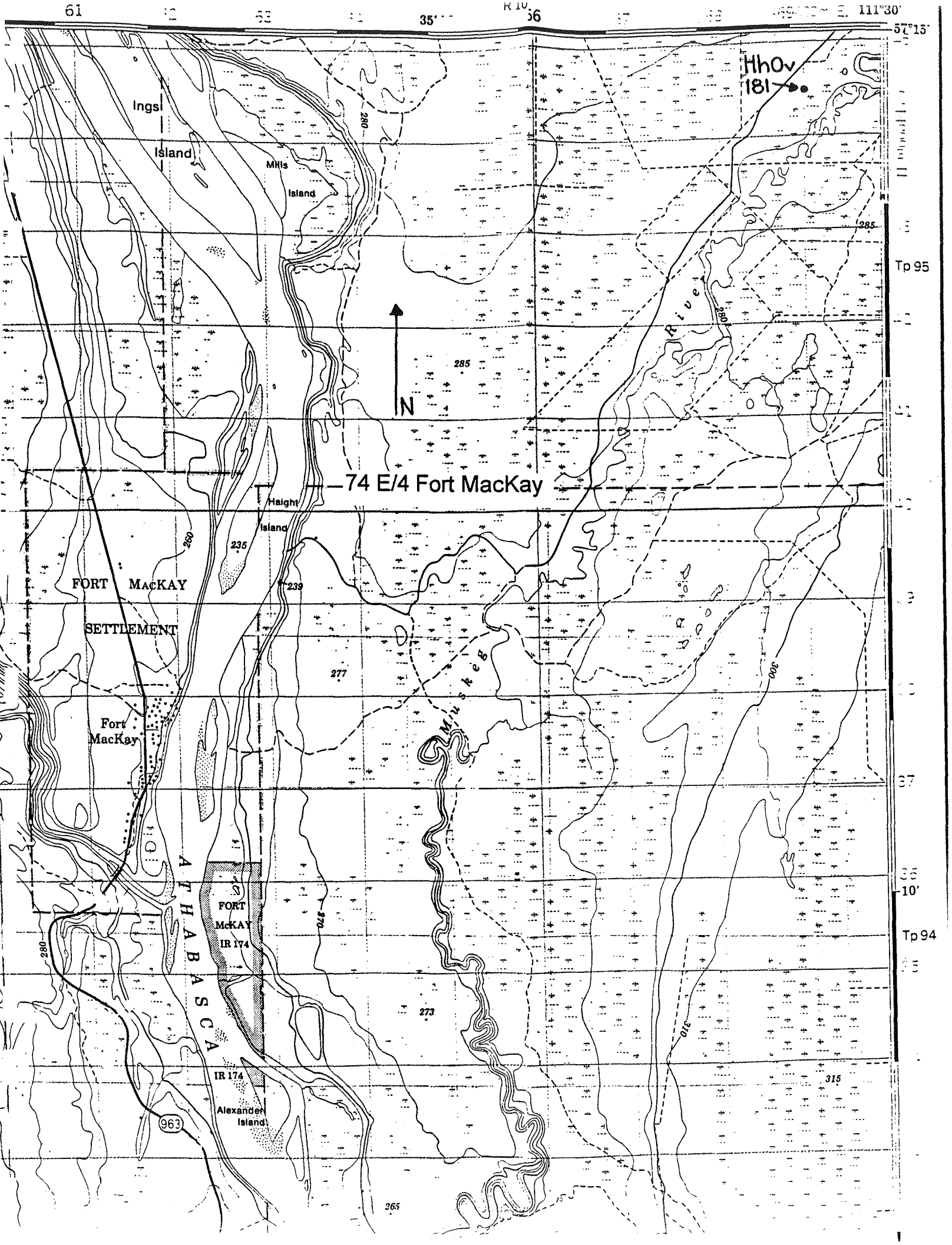
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 5 m

0


Ingsl
Island
MHls
Island
Hhov
181
N
74 E/4 Fort MacKay
Haight
Island
FORT MACKAY
SETTLEMENT
Fort
MacKay
FORT
McKAY
IR 174
IR 174
Alexander
Island
963
ATHABASCA
Tp 95
Tp 94
285
280
260
235
239
277
300
273
310
315
265

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 182
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 8

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/4 Fort MacKay

5. U.T.M. Grid Zone: 12VVU Easting: 668 Northing: 438 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 1 Section 16 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 9 km. Site lies 1.4 km magnetic west from this point of road.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on large north - south trending ridge. Douglas fir and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOv 182
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a single positive 1 x 1 m test containing NE quad: two flake shatter, twenty-one secondary flakes and three retouch flakes. NW quad: six secondary flakes and five retouch flakes. SW quad: one secondary flake. All material Beaver River sandstone. Additional six 50 x 50 cm tests around positive test proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
51	51	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

NE quad: two flake shatter, twenty-one secondary flakes and three retouch flakes. NW quad: six secondary flakes and five retouch flakes. SW quad: one secondary flake. All material Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No.

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other...
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates

Borden No. HhOv 182
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 7 No. of shovel tests
☐ erosion exposure ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/09/06

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/09/06

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify):
☐ additional investigation required (specify):

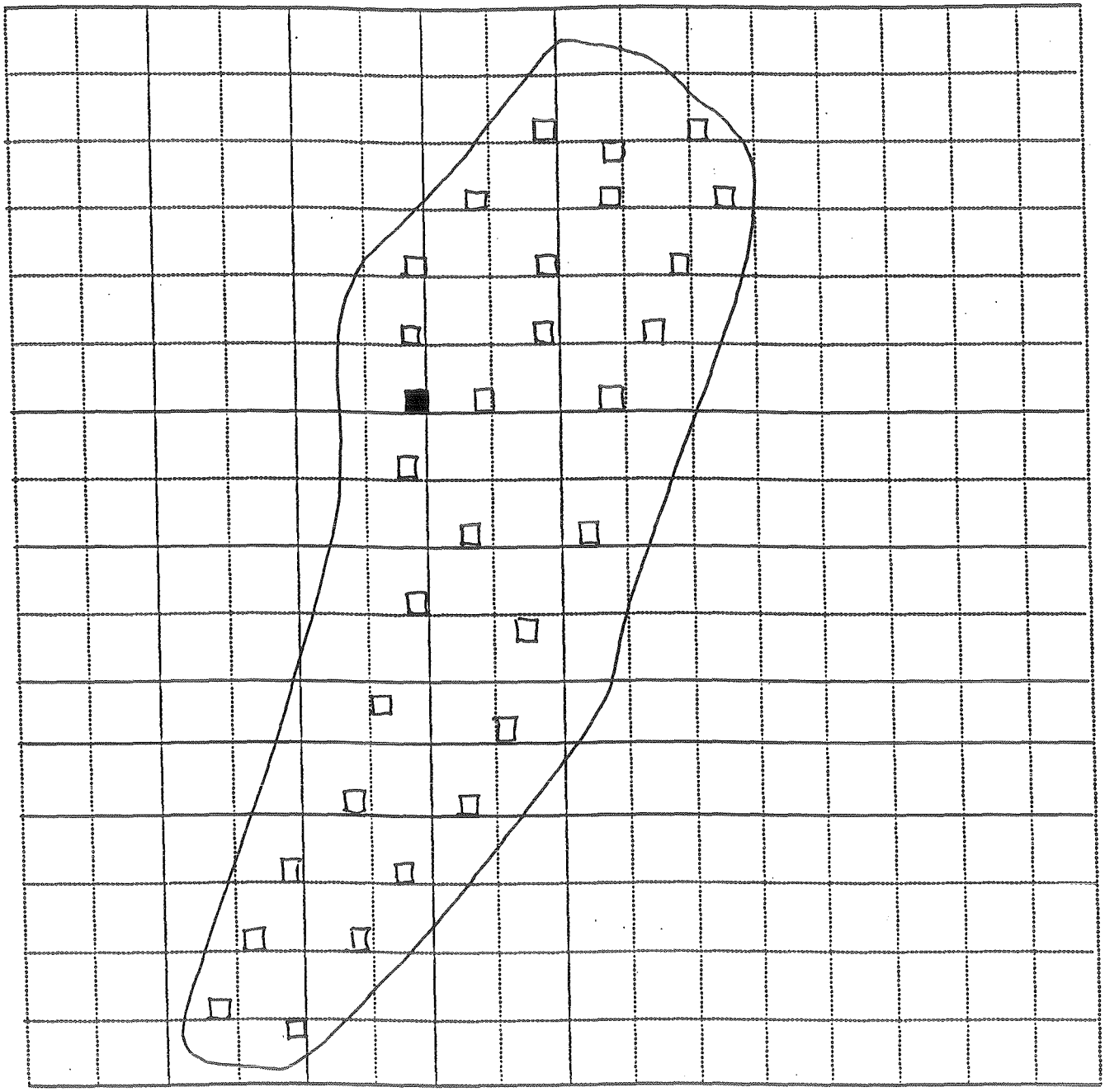
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOv 182

Permit No. 97-107



N.T.S. 1:50,000MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

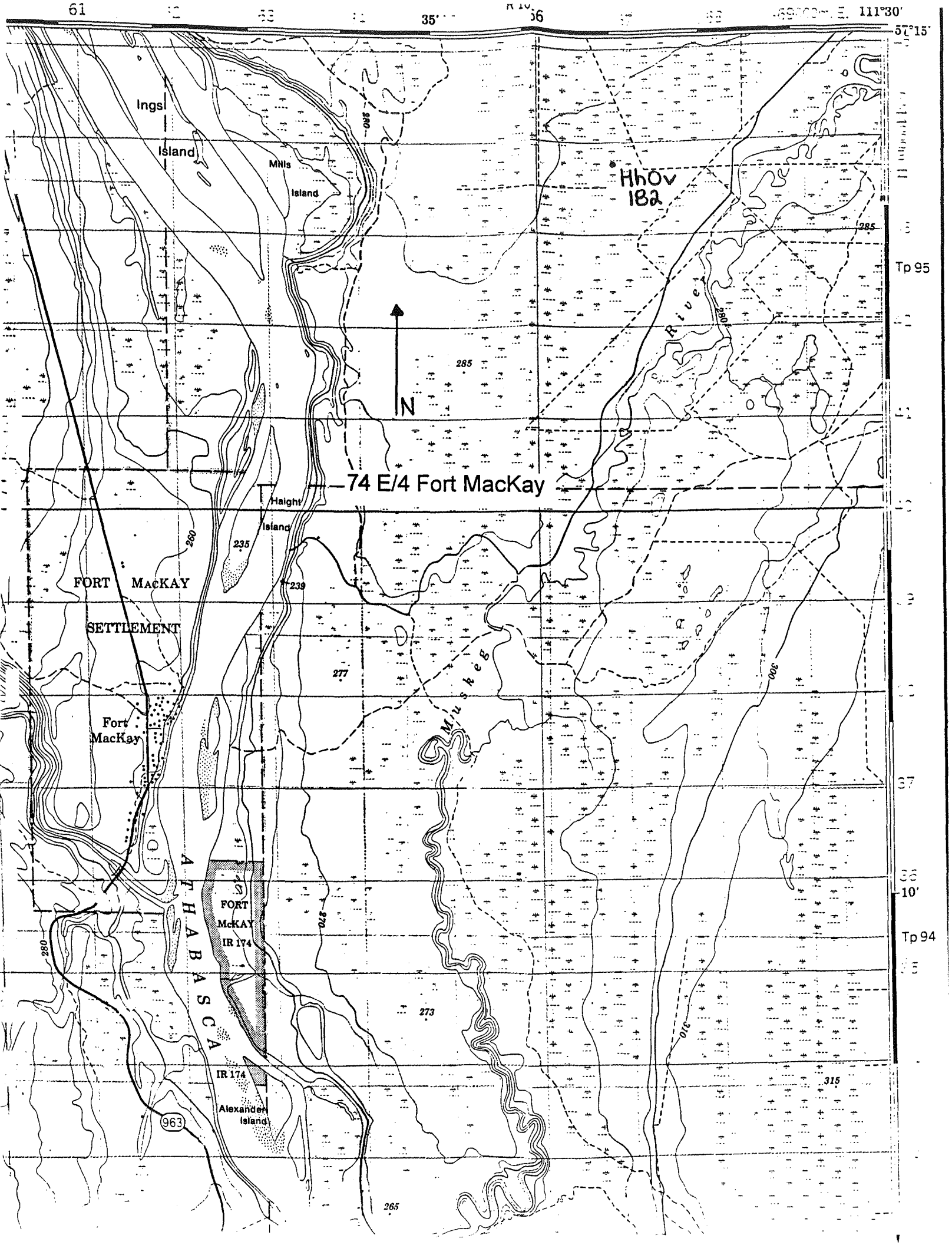
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 10 m

0


Ings
Island
Mills
Island
HhOv
182
N
74 E/4 Fort MacKay
Haight
Island
FORT MACKAY
SETTLEMENT
Fort
MacKay
FORT
McKAY
IR 174
IR 174
Alexander
Island
963
ATHABASCA
Muskeg
River
Tp 95
Tp 94
280
285
235
239
277
273
265
270
300
310
315
111°30'

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 183
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 9

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/5 Bitumount

5. U.T.M. Grid Zone: 12VVU Easting: 694 Northing: 465 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 7 Section 23 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 12 km. Site lies 500 m magnetic east from this point of road.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on very small well drained knoll bordered by existing cut line and lease road. Jack pine and alder prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined
- 1 # components

12. Site Type
- ☐ isolated find
- ☒ scatter (<10)
- ☐ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence
- .....

Borden No. HhOv 183
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a single positive 1 x 1 m test containing two secondary flakes which have marginal retouch along a lateral edge. All material Beaver River sandstone. Additional seven 50 x 50 cm tests proved negative.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
2	2	lithic tool(s)			human remains			metal
		lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Two secondary flakes with marginal retouch, all of Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No.

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other...
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates

Borden No. HhOv 183
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 7 No. of shovel tests
☐ erosion exposure ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/09/07

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/09/07

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

33. Recommendations ☒ no additional investigation required (specify):
☐ additional investigation required (specify):

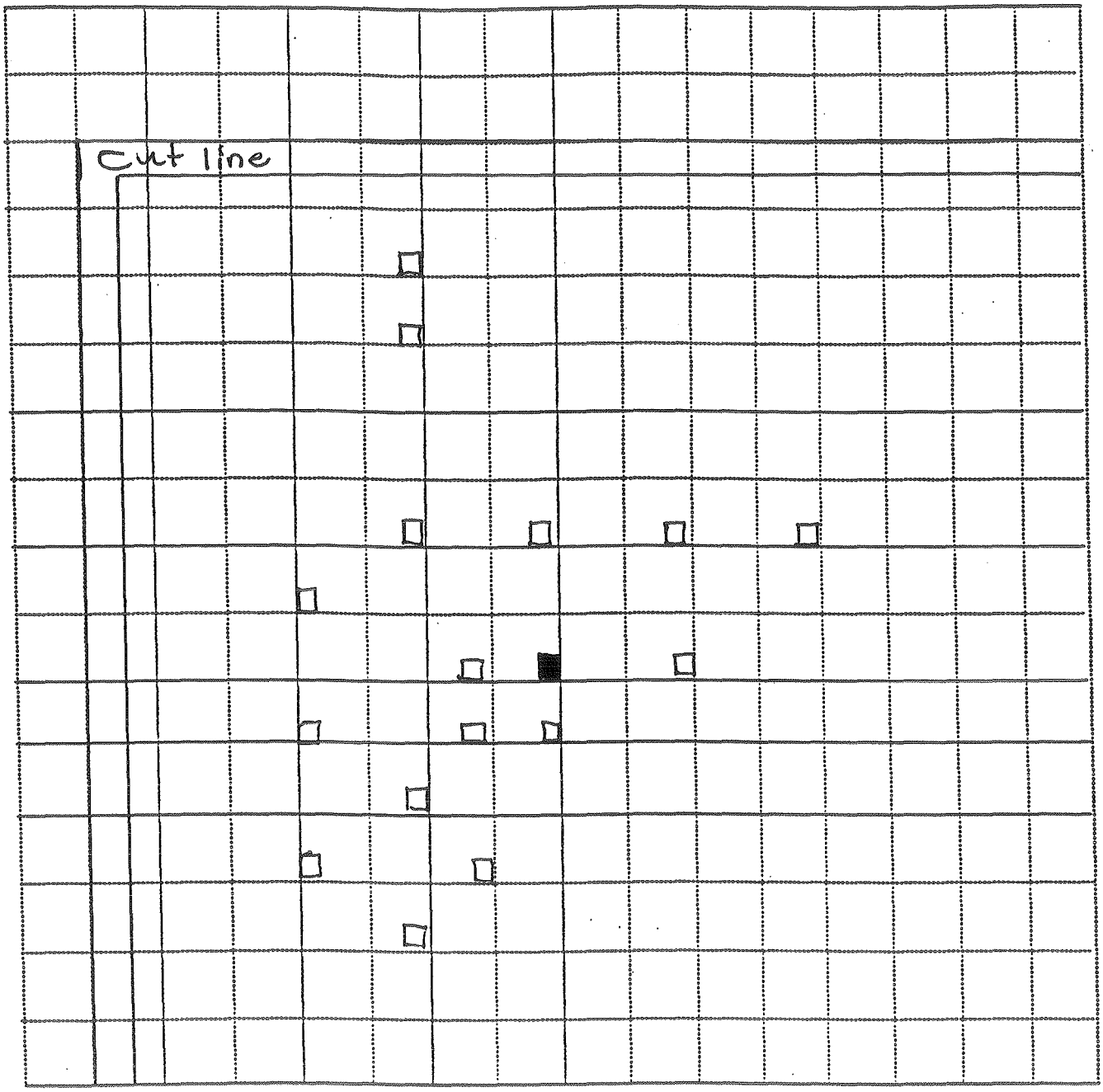
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOv 183

Permit No. 97 - 107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

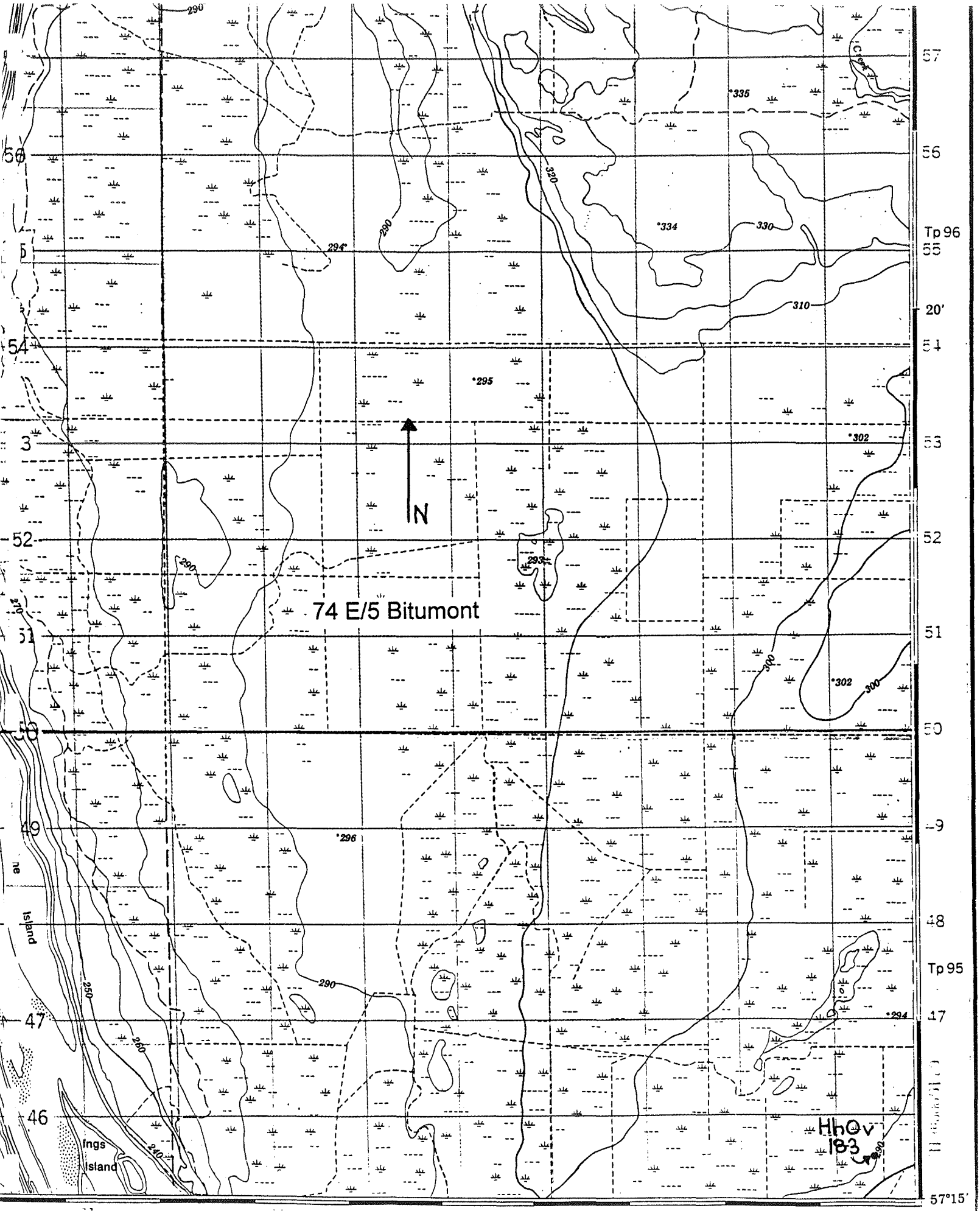
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 5 m

0


74 E/5 Bitumont
N
Tp 96
Tp 95
20'
35'
R 10
111°30'
57°15'
km
Island
Islands
HhQv
183

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 184
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 10

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/4 Fort MacKay

5. U.T.M. Grid Zone: 12VVU Easting: 679 Northing: 433 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 15 Section 10 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 8 km. Site lies adjacent to road, west side.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on large north - south trending knoll. Douglas fir and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOv 184
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a six positive 50 x 50 cm tests containing: ST 1 (1 x 1 m unit) - sixty-two secondary flakes, nine primary decortication flakes, four secondary decortication flakes, two retouch flakes, three flake shatter and four block shatter. ST 4 - twenty-eight secondary flakes, two retouch flakes, one thinning flake, two block shatter and one flake shatter. ST 6 - two secondary flakes and three block shatter. ST 7 - forty-three secondary flakes, three flake shatter, one block shatter and one primary decortication flake. ST 11 - one hundred and sixty secondary flakes, ten retouch flakes, three primary decortication flakes, two secondary decortication flakes, eleven flake shatter, one quartzite flake shatter, one chert secondary flake. St 12 - seven secondary flakes. All material Beaver River sandstone except where noted. Additional nine 50 x 50 cm tests were sterile.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
378	378	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

ST 1 (1 x 1 m unit) - sixty-two secondary flakes, nine primary decortication flakes, four secondary decortication flakes, two retouch flakes, three flake shatter and four block shatter. ST 4 - twenty-eight secondary flakes, two retouch flakes, one thinning flake, two block shatter and one flake shatter. ST 6 - two secondary flakes and three block shatter. ST 7 - forty-three secondary flakes, three flake shatter, one block shatter and one primary decortication flake. ST 11 - one hundred and sixty secondary flakes, ten retouch flakes, three primary decortication flakes, two secondary decortication flakes, eleven flake shatter, one quartzite flake shatter, one chert secondary flake. St 12 - seven secondary flakes. All material Beaver River sandstone except where noted.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 184
Permit No. 97-107

22. Estimated Dimensions N-S: 10 m E-W: 10 m Depth: .20 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 16 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 95 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will not be impacted by oilsands construction.

26. Researcher/Permit Holder: Brian Ronaghan Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D): 97/09/06

28. Surface collected by: Date (Y/M/D):

29. Tested/assessed by: Golder Associates Date (Y/M/D): 97/09/06

30. Excavated/mitigated by: Date (Y/M/D):

31. Form completed by: Tom Hoffert Date (Y/M/D): 97/11/05

32. Project name/Report Title

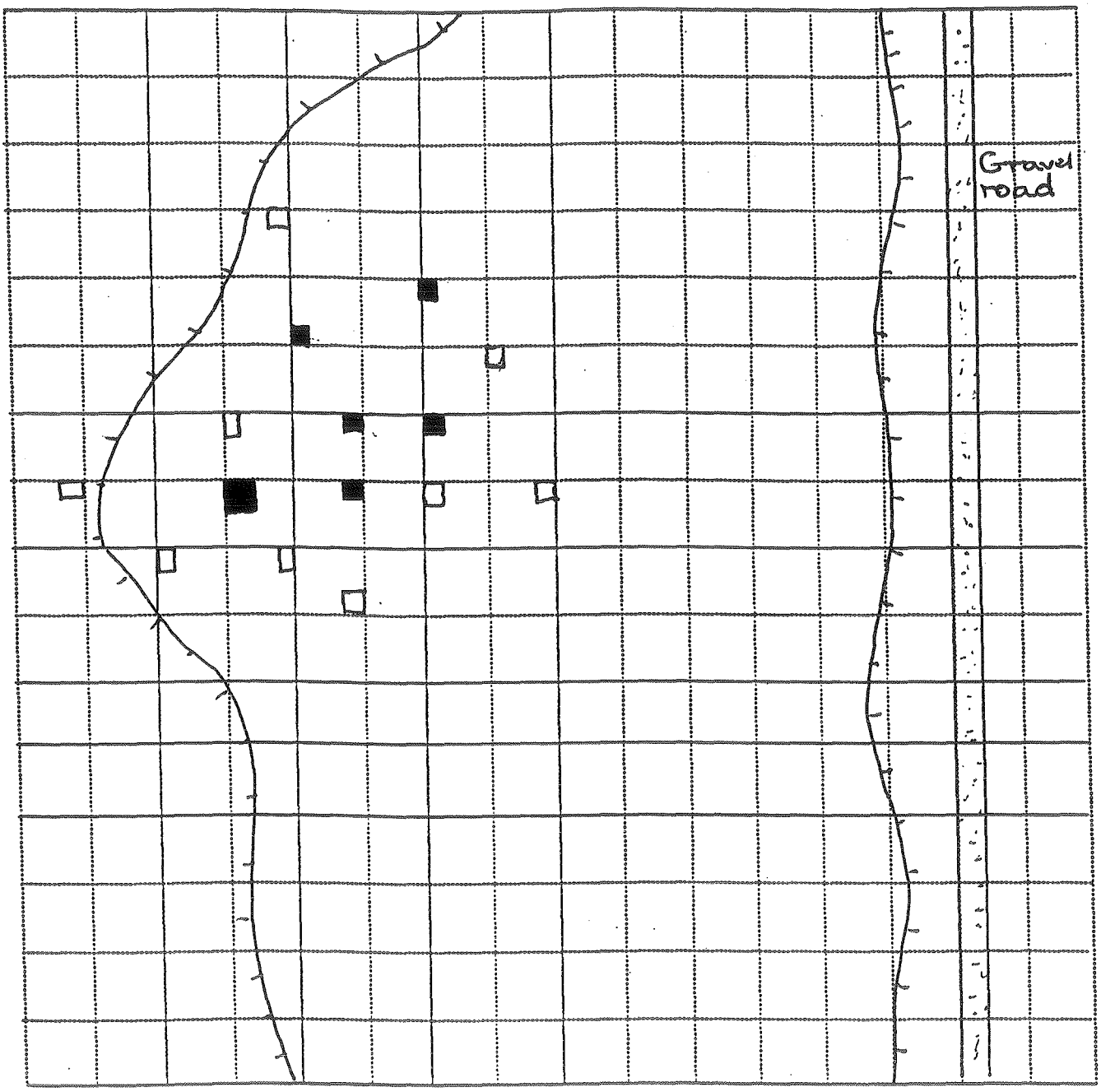
33. Recommendations ☐ no additional investigation required (specify): ☐ additional investigation required (specify):

35. Additional Remarks

36. Site Map

Borden No. HhOv 184

Permit No. 97-107



N.T.S. 1:50,000 MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

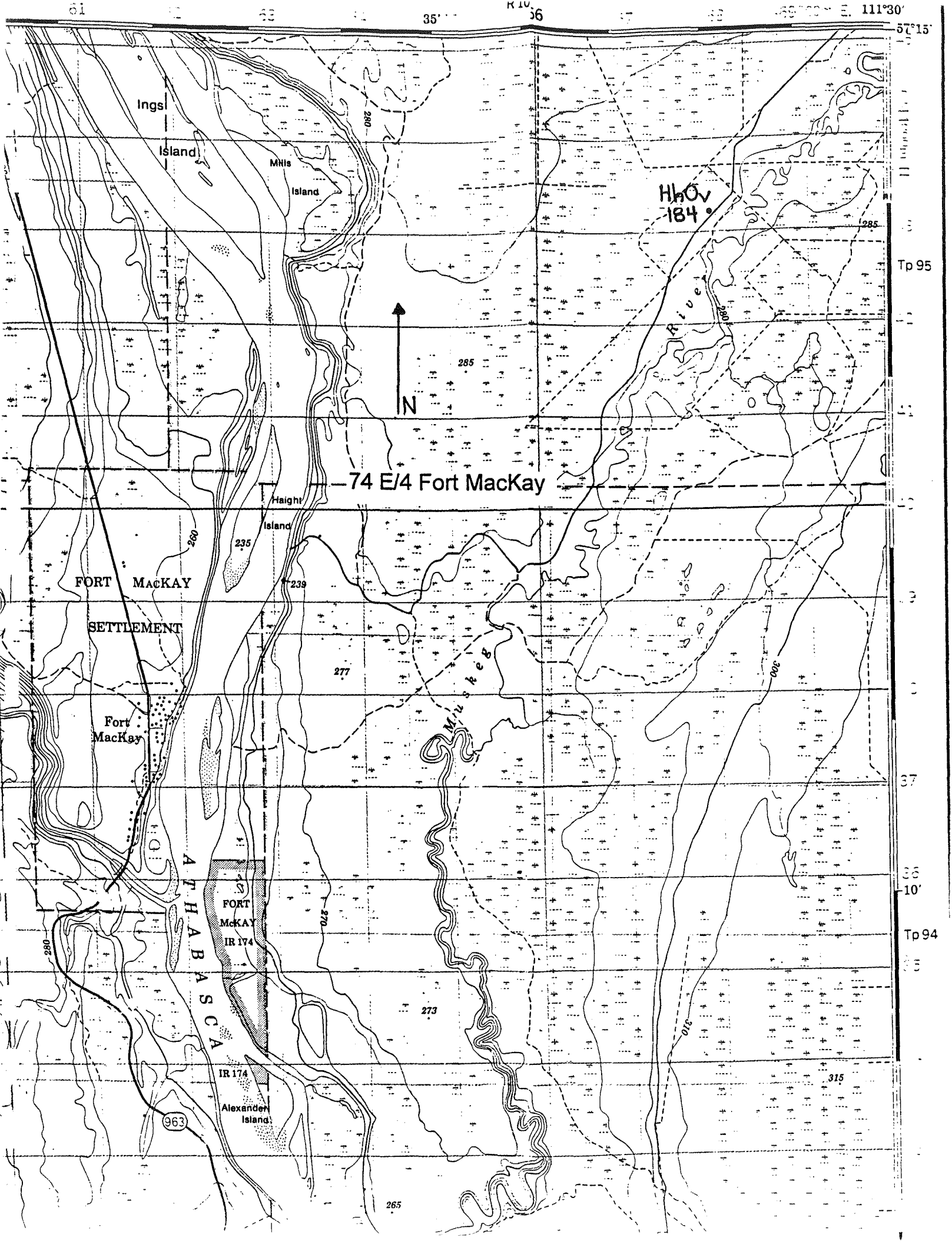
Additional Legend

■ Shovel test positive
□ Shovel test negative

N

Scale : 1 cm = 10 m

0


R 10
35'
56
E. 111°30'
57°15'
Ings
Island
Mills
Island
280
HhOv
184
285
Tp 95
River
260
285
N
74 E/4 Fort MacKay
Haight
Island
260
235
239
FORT MACKAY
SETTLEMENT
277
Muskeg
300
Fort
MacKay
ATHABASCA
FORT
McKAY
IR 174
270
280
273
310
315
IR 174
Alexander
Island
963
265
10'
Tp 94

Alberta
COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

ARCHAEOLOGICAL SITE INVENTORY DATA

Borden No. HhOv 185
Permit No. 97-107

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 11

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/4 Fort MacKay

5. U.T.M. Grid Zone: 12VVU Easting: 672 Northing: 428 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 5 Section 10 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 7 km. Site lies 400 m magnetic west of road at this point.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on large east - west trending ridge. Douglas fir and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence
- .....

Borden No. HhOv 185
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a one positive 1 x 1 m test containing twenty-five secondary flakes, four retouch flakes, three flake shatter and one core fragment. All material Beaver River sandstone. Additional four 50 x 50 cm tests were sterile.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
33	33	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Twenty-five secondary flakes, four retouch flakes, three flake shatter and one core fragment. All material Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 185
Permit No. 97-107

22. Estimated Dimensions N-S: 1 m E-W: 1 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ erosion exposure ☐ Other... 5 No. of shovel tests ____ No. of backhoe tests

24. Estimated Portion Intact 0 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction. Collection of artifacts effectively mitigates site. No further work.

26. Researcher/Permit Holder: Brian Ronaghan Date (Y/M/D): 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D): 97/09/08

28. Surface collected by: Date (Y/M/D):

29. Tested/assessed by: Golder Associates Date (Y/M/D): 97/09/08

30. Excavated/mitigated by: Date (Y/M/D):

31. Form completed by: Tom Hoffert Date (Y/M/D): 97/11/05

32. Project name/Report Title

33. Recommendations ☐ no additional investigation required (specify):
☒ additional investigation required (specify):

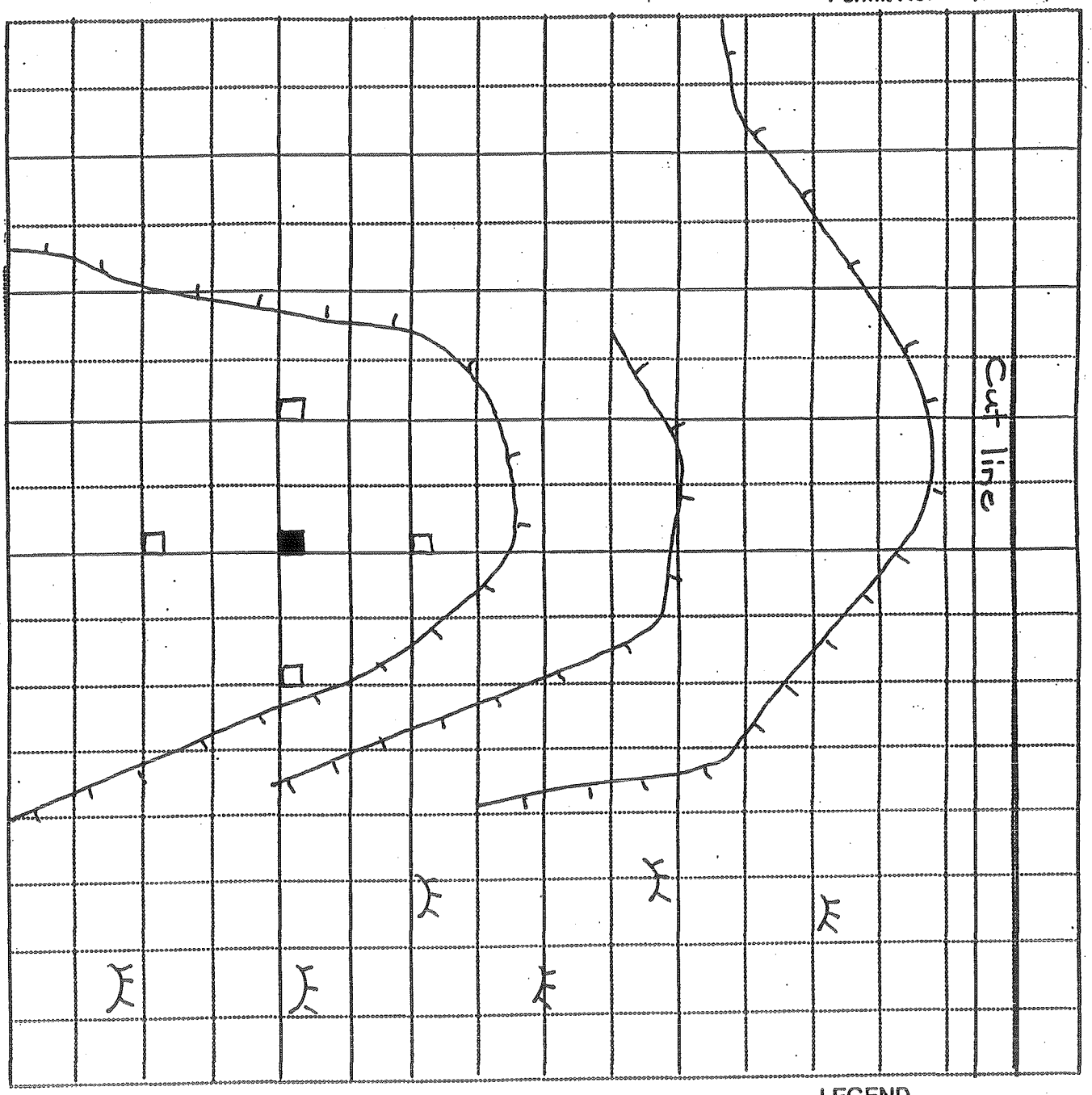
No further work.

35. Additional Remarks

36. Site Map

Borden No. HhOv 185

Permit No. 97-107



N.T.S. 1:50,00 MAP INSET Map No.:

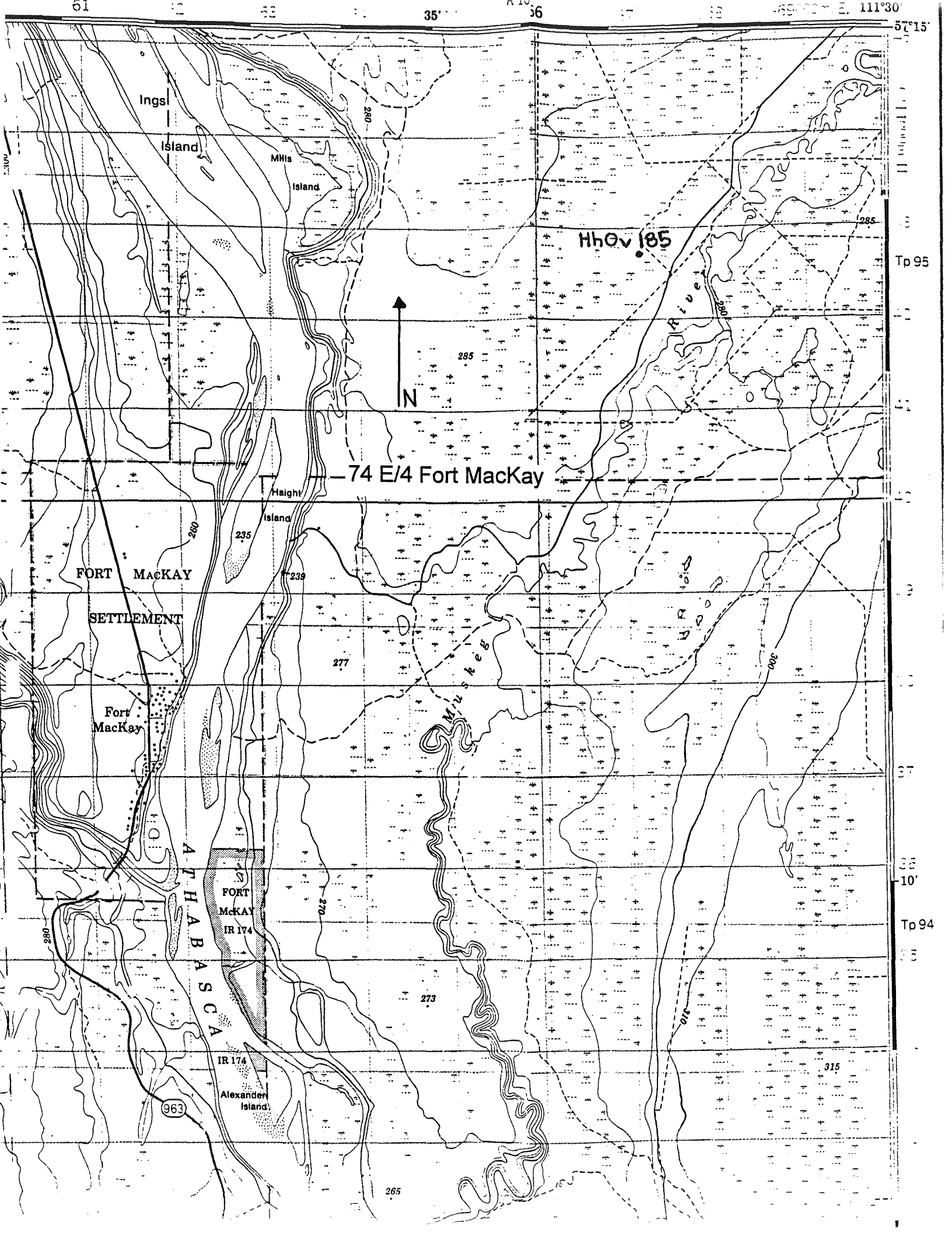
LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise
Additional Legend

N

Scale : 1 cm = 5 m

0


Ingsl
Island
Mills
Island
HhOv 185
N
74 E/4 Fort MacKay
Haight
Island
FORT MACKAY
SETTLEMENT
Fort
MacKay
FORT
McKAY
IR 174
IR 174
Alexander
Island
963
ATHABASCA
Muskeg
River
Tp 95
Tp 94
280
285
235
239
277
270
273
265
300
310
315

COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

Borden No. HhOv 186
Permit No. 97-107

ARCHAEOLOGICAL SITE INVENTORY DATA

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 12

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/4 Fort MacKay

5. U.T.M. Grid Zone: 12VVU Easting: 658 Northing: 433 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 14 Section 9 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 8 km. Site lies 2 km magnetic west from this point on road.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on large northwest - southeast trending ridge. Douglas fir and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOv 186
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of a six positive 50 x 50 cm tests containing: ST 1 - one secondary flake. ST 2 - seven secondary flakes and one block shatter. ST 12 - one core and six block shatter. ST 16 - two secondary flakes and one primary decortication flake. St 17 - two secondary flakes. 1 x 1 m unit - three secondary flakes. All material Beaver River sandstone. Additional twelve 50 x 50 cm tests were sterile.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
24	24	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

ST 1 - one secondary flake. ST 2 - seven secondary flakes and one block shatter. ST 12 - one core and six block shatter. ST 16 - two secondary flakes and one primary decortication flake. St 17 - two secondary flakes. 1 x 1 m unit - three secondary flakes. All material Beaver River sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 186
Permit No. 97-107

22. Estimated Dimensions N-S: 50 m E-W: 30 m Depth: .20 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 18 No. of shovel tests
☐ erosion exposure ____ No. of backhoe tests

24. Estimated Portion Intact 85 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/09/09

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/09/09

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

33. Recommendations ☐ no additional investigation required (specify):
☒ additional investigation required (specify):

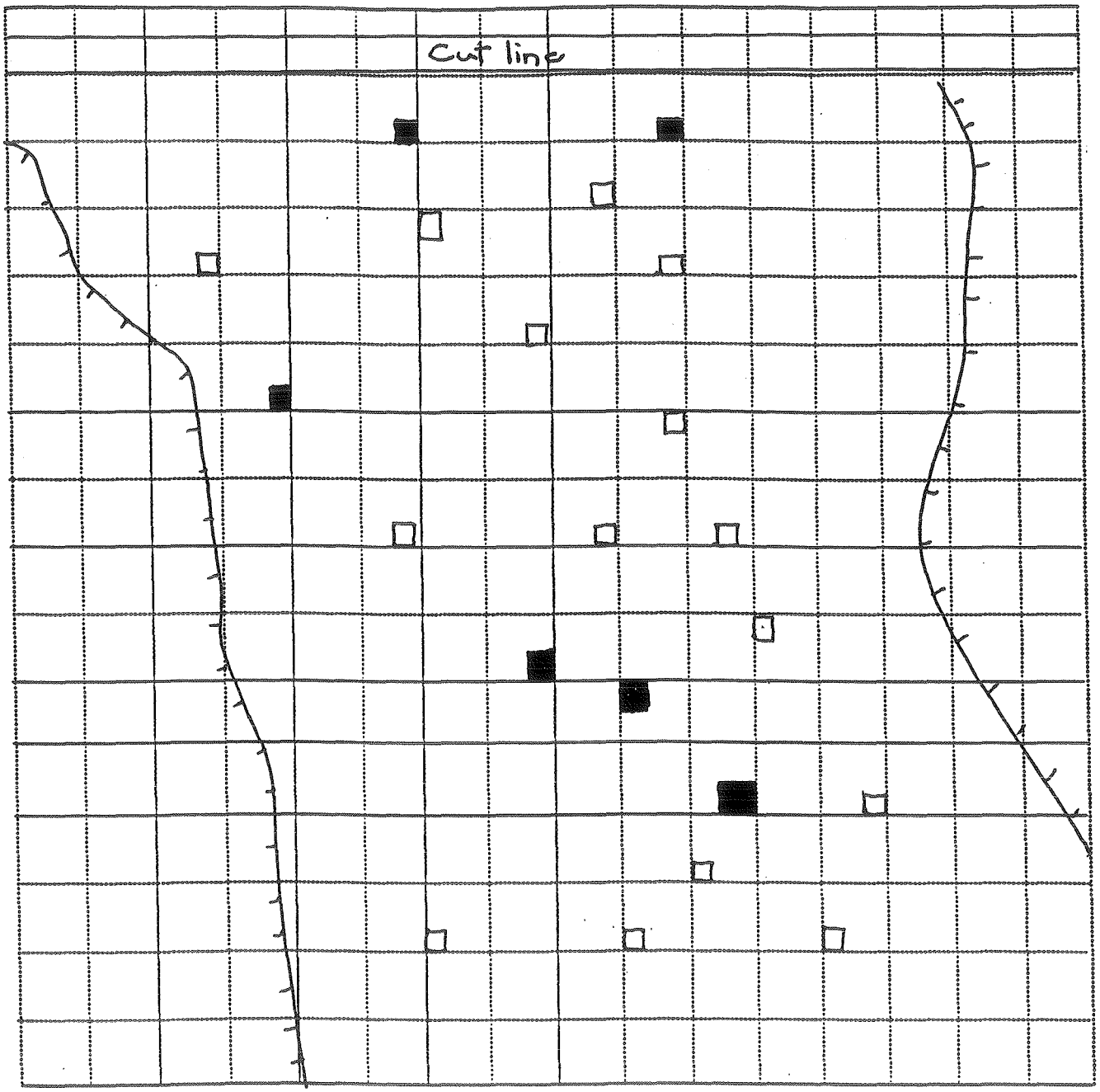
??

35. Additional Remarks

36. Site Map

Borden No. HhOv 186

Permit No. 97-107



N.T.S. 1:50,000MAP INSET Map No.:

LEGEND

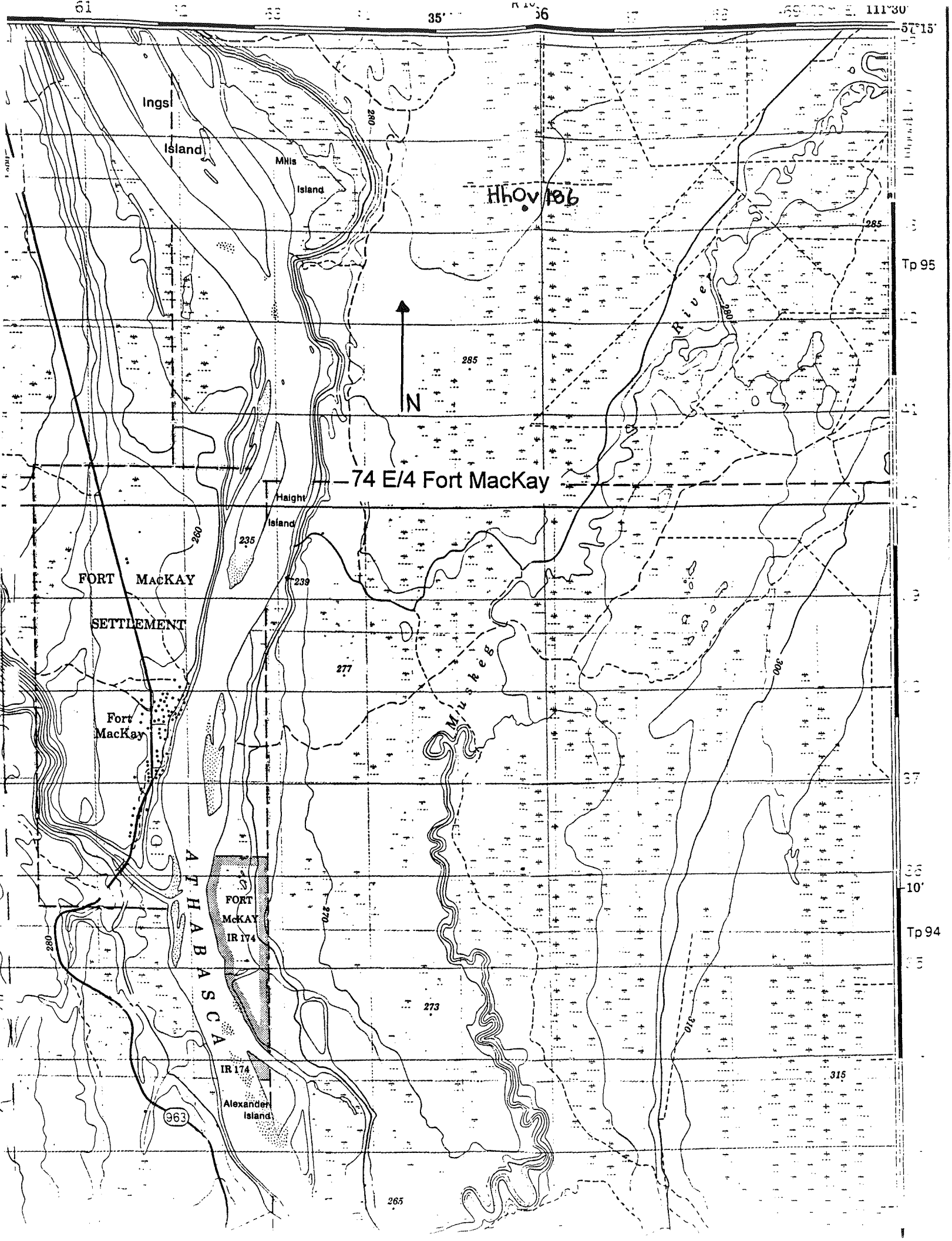
Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend
Shovel test positive
Shovel test negative

N

Scale : 1 cm = 2 m

0


74 E/4 Fort MacKay
N
Ingsl
Island
Mhls
Island
Haight
Island
FORT MACKAY
SETTLEMENT
Fort
MacKay
FORT
McKAY
IR 174
IR 174
Alexander
Island
963
ATHABASCA
Muskeg
Tp 95
Tp 94
10'
280
285
260
235
239
277
270
273
265
300
310
315

COMMUNITY DEVELOPMENT

Archaeological Survey
Provincial Museum of Alberta

ARCHAEOLOGICAL SITE INVENTORY DATA

Borden No. HhOv 187
Permit No. 97-107

Return to: Archaeological Inventory and Permit Coordinator
Archaeological Survey, 8820 - 112 St.
Edmonton, Alberta T6G 2P8

Update/Revisit Date:

1. Site Name: ..... 2. Field No. GAL 13

3. Elevation 290 4. N.T.S. 1:50,000 Map No. & Name 74 E/4 Fort MacKay

5. U.T.M. Grid Zone: 12VVU Easting: 665 Northing: 419 ☒ NAD 27 ☐ NAD 83

GPS ☐ yes ☒ no

6. Legal Description: LSD 16 Section 4 Township 95 Range 10 W of 4 M

7. Land Owner ☐ Government of Canada ☐ Government of Alberta ☐ Municipal Government ☒ Freehold

Land Owner Name/Address

8. Access (refer to highway, road number, trail, cardinal direction, landmarks, nearest settlement, distances)

Proceed north along highway 963 past the turn off for the Town of Fort MacKay. Highway crosses the Athabasca River and heads north. Proceed for approximately 7 km. Turn east and drive for 6 km. Site lies 600 m magnetic west of road at this point.

9. Site Environment/Setting (describe in terms of drainage, slope, aspect, vegetation, soil type, landforms)

Site is located on flat slightly raised knoll. Douglas fir and Jack pine prominent overstory.

10. Site Class
- ☒ prehistoric
- ☐ indiginous historic
- ☐ historic
- ☐ contemporary
- ☐ undetermined

11. Sub Type
- ☐ surface
- ☒ subsurface
- ☐ underwater
- ☐ stratified
- ☐ undetermined

- ☒ single component
- ☐ multi component
- ☐ undetermined

1 # components

12. Site Type
- ☐ isolated find
- ☐ scatter (<10)
- ☒ scatter (>10)
- ☐ campsite
- ☐ stone feature
- ☐ killsite
- ☐ workshop
- ☐ quarry
- ☐ rock art
- ☐ burial
- ☐ palaeoenvironmental
- ☐ settlement
- ☐ homestead
- ☐ farm
- ☐ ranch
- ☐ dwelling
- ☐ trading post
- ☐ police post
- ☐ mine
- ☐ trail
- ☐ mission
- ☐ school
- ☐ urban
- ☐ ceremonial/religious
- ☐ industrial
- ☐ transportation
- ☐ Other... _____

13. Features (Frequencies if possible)
- ..... stone circle
- ..... cairn
- ..... stone arc
- ..... stone line
- ..... drive lane
- ..... medicine wheel
- ..... effigy
- ..... pictograph
- ..... petroglyph
- ..... hearth
- ..... pit
- ..... mound
- ..... depression
- ..... cabin
- ..... house
- ..... structure
- ..... foundation
- ..... cellar
- ..... dump
- ..... fence

Borden No. HhOv 187
Permit No. 97-107

14. Description (spatial extent, patterning and variety of remains, diagnostics and exotic material, for historic archaeological sites provide details regarding site ownership, origins, function and context)

Site consists of : ST 1 (1 x 1 M) forty-one secondary flakes, one core fragment, one core, two retouch flakes, one thinning flake, nine flake shatter and two block shatter. ST 2 two secondary flakes. ST 3 six secondary flakes and four flake shatter. All material Beaver River Sandstone. Five additional shovel tests were sterile.

15. Materials observed/collected (frequencies if possible)

observed	collected		observed	collected		observed	collected	
		projectile point(s)			faunal remains			shell
		lithic tool(s)			human remains			metal
69	69	lithic debitage			floral remains			glass
		bone tools			tephra			other, specify
		ceramics			soil samples			
		fire cracked rock			macrofossils			
		charcoal			wood			

16. Collection Remarks (formed tools, raw materials)

Site consists of : ST 1 (1 x 1 M) forty-one secondary flakes, one core fragment, one core, two retouch flakes, one thinning flake, nine flake shatter and two block shatter. ST 2 two secondary flakes. ST 3 six secondary flakes and four flake shatter. All material Beaver River Sandstone.

17. Collection Repository ☒ Provincial Museum of Alberta, Archaeological Survey ☐ Private collection ☐ Other...

Dispositions File No. .....

18. Photo/Images ☒ yes ☐ no Repository GAL

19. Culture ☐ Early Prehistoric ☐ Late Prehistoric ☐ Historic ☐ Other... .....
☐ Middle Prehistoric ☐ Fur Trade/Contact ☒ Undetermined

Cultural Affiliation (Complexes, phases, traditions, projectile point types, ethnopraphic & ethnic groups)

Unknown.

20. Calendar Date (A.D./B.C.) Unknown

21. Radiocarbon Dates .....

Borden No. HhOv 187
Permit No. 97-107

22. Estimated Dimensions N-S: 10 m E-W: 15 m Depth: .15 m

23. Means of Estimating Dimensions ☒ surface inspection ☐ Other... 8 No. of shovel tests
☐ erosion exposure ____ No. of backhoe tests

24. Estimated Portion Intact 95 %

25. Disturbance Factors (natural, human, current, potential)

Will current development impact site ☒ yes ☐ no ☐ unknown

Type of Disturbance

☐ agriculture	☐ road/highway	☐ coal mine	☐ transmission line	☐ industrial area	☐ other...
☐ pipeline	☐ gravel/sand pit	☒ oil sands	☐ reservoir	☐ vandalism	
☐ wellsite	☐ residential area	☐ forestry	☐ recreation area	☐ erosion	

Disturbance Factors Remarks

Site will be impacted by oilsands construction.

26. Researcher/Permit Holder Brian Ronaghan Date (Y/M/D) 97/08/31

27. Observed by: Golder Associates Ltd. Date (Y/M/D) 97/10/18

28. Surface collected by: Date (Y/M/D)

29. Tested/assessed by: Golder Associates Date (Y/M/D) 97/10/18

30. Excavated/mitigated by: Date (Y/M/D)

31. Form completed by: Tom Hoffert Date (Y/M/D) 97/11/05

32. Project name/Report Title

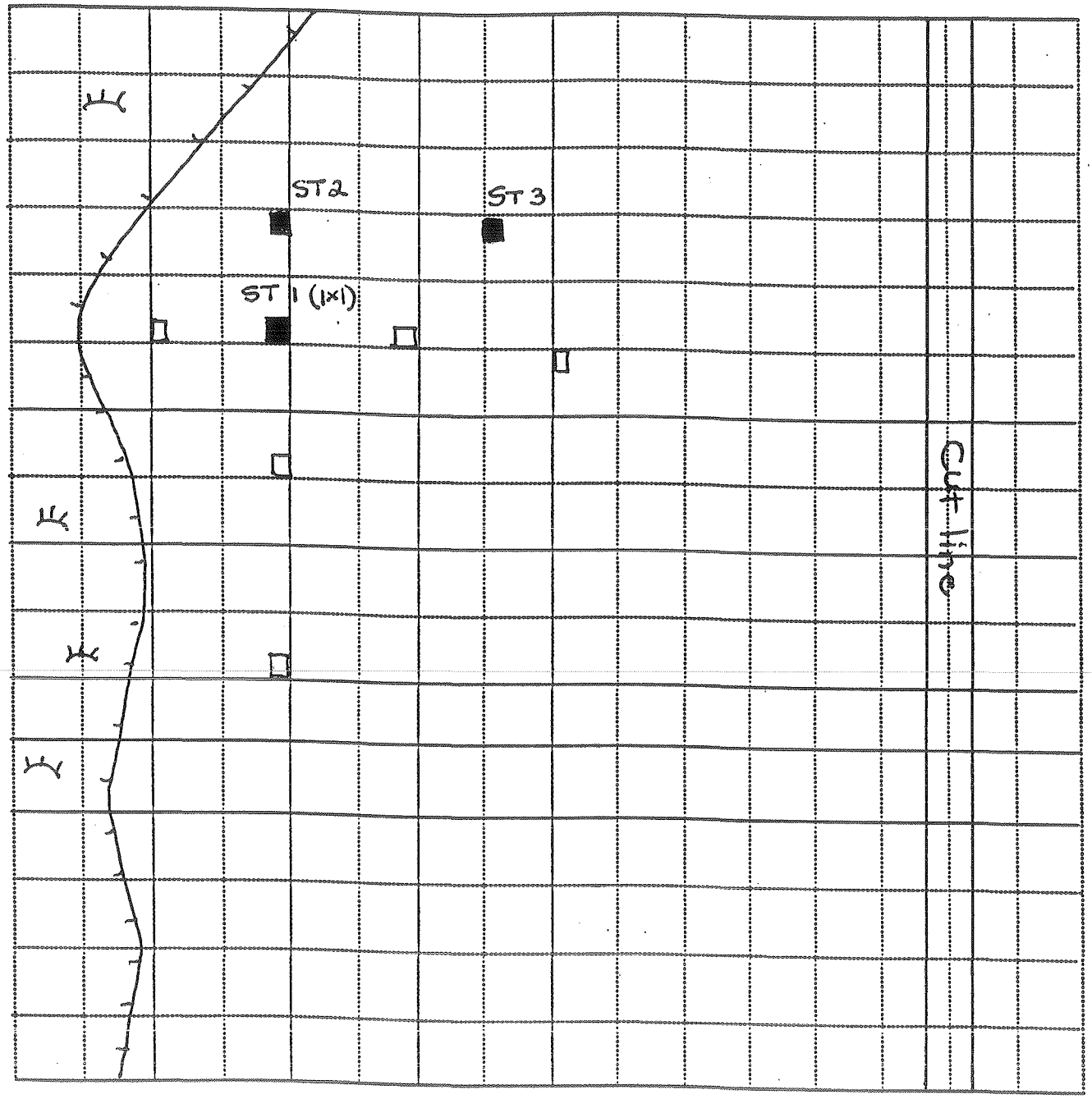
33. Recommendations ☐ no additional investigation required (specify):
☒ additional investigation required (specify):

35. Additional Remarks

36. Site Map

Borden No. HhOv 187

Permit No. 97-107



N.T.S. 1:50,000MAP INSET Map No.:

LEGEND

Extent of Site
Building
Foundation
Road
Trail
Fence
Railway
River
Steep Rise

Additional Legend

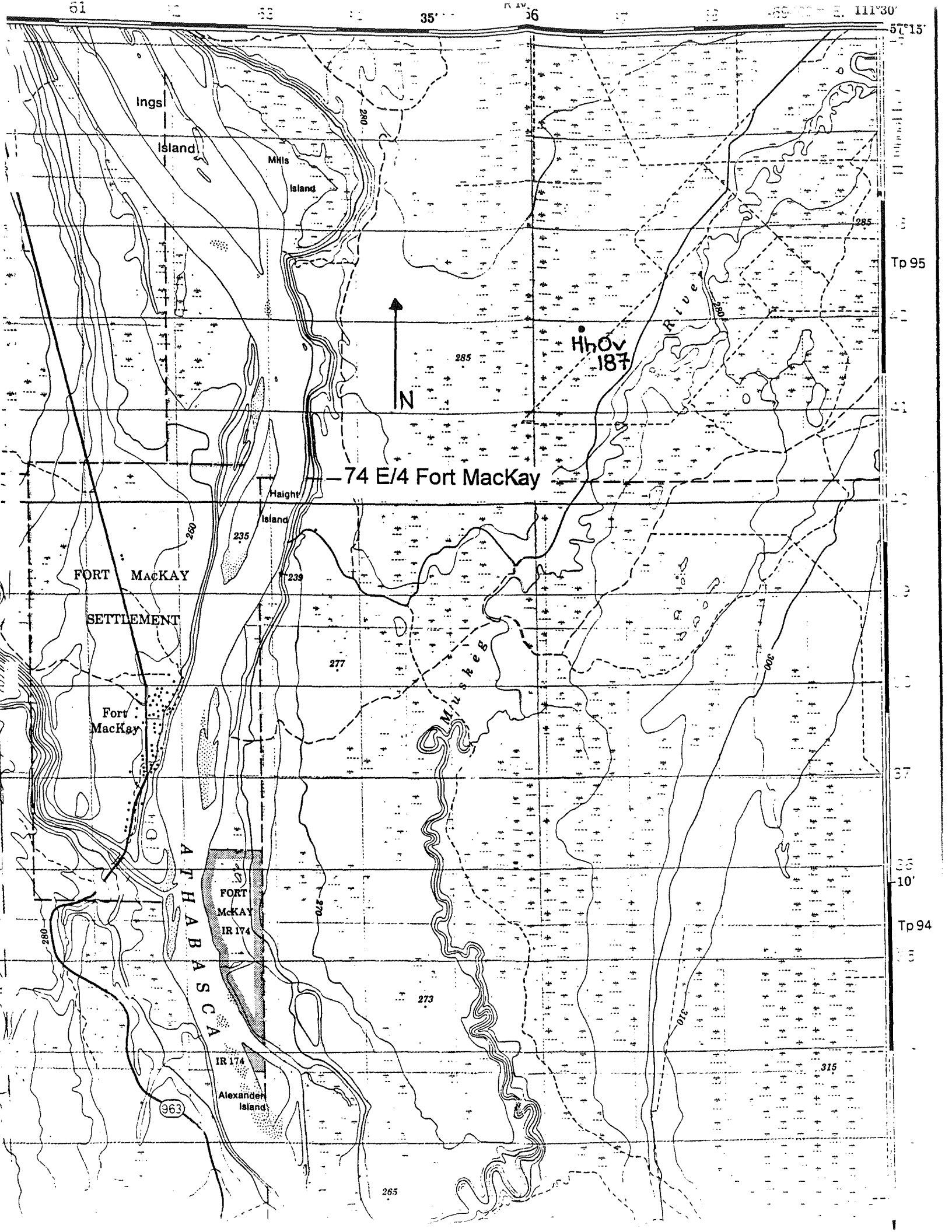
Shovel test positive

Shovel test negative

N

Scale : 1 cm = 10 m

0


74 E/4 Fort MacKay
HhOv 187
N
Ings Island
Mills Island
Haight Island
FORT MacKAY SETTLEMENT
Fort MacKay
FORT McKAY IR 174
IR 174
Alexander Island
963
ATHABASCA
Muskeg
Tp 95
Tp 94
111°30'
51°15'
10'

APPENDIX II

LITHIC ANALYSIS

Lithic Analysis

1.0 Methods

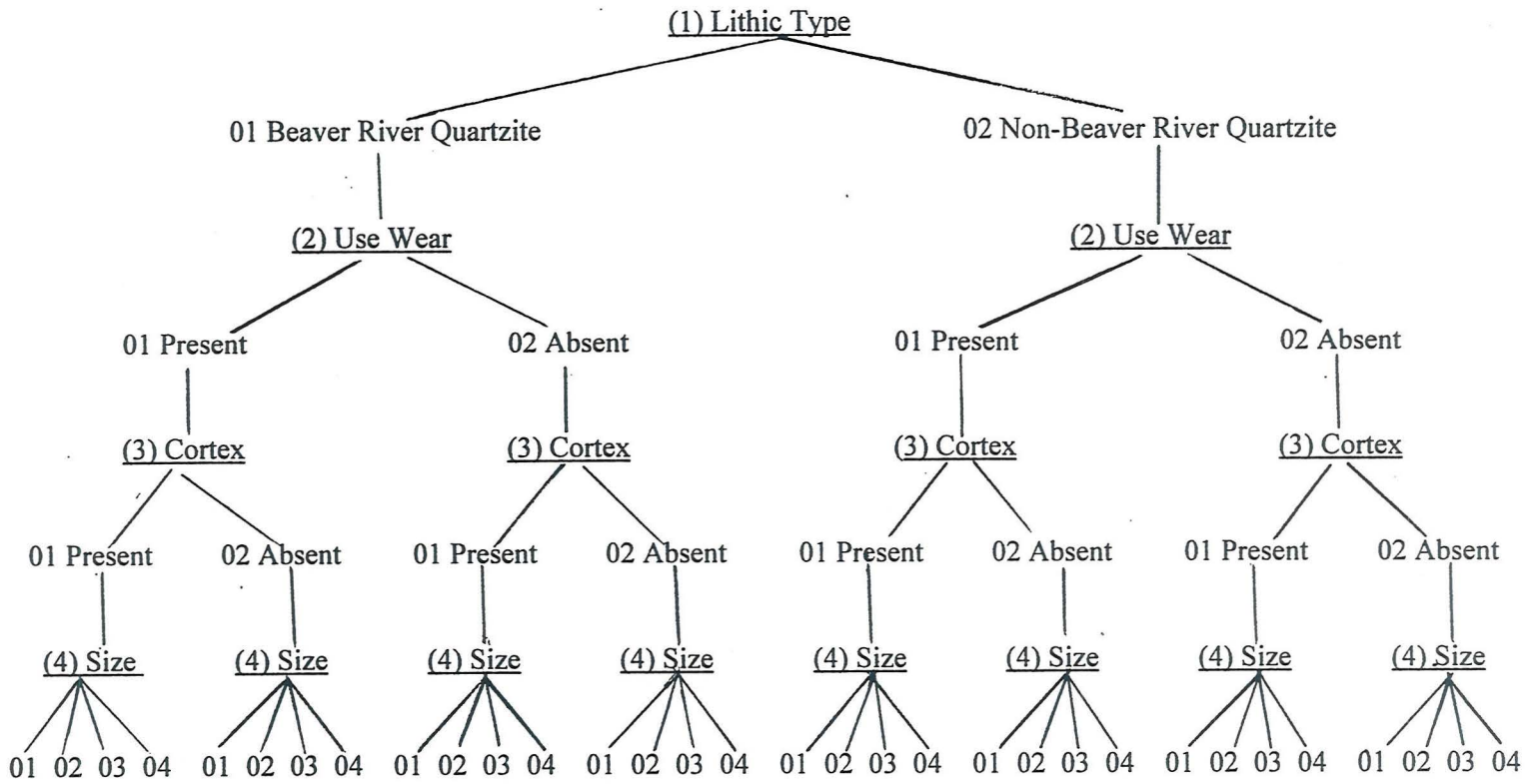
The 1997 field program, conducted at the Muskeg River Mine project, produced a total of 983 lithic artifacts. The debitage consisted of cores and core fragments (n = 29), block shatter (n = 57) and flakes (n = 892). The tools include an endscraper (n = 1), retouched flakes (n = 2) and biface fragments (n = 2). Before the commencement of this study numerous other oil sands related projects have been carried out in the area. In 1981 Lifeways of Canada completed a controlled surface collection at HhOv 16, also known as the Cree Burn Lake Site (Ronaghan 1981). This site is situated on a high terrace edge along the eastern side of the Athabasca River. In relation to sites recorded within the scope of this report, site HhOv 16 lies along the immediate western edge of the 1997 study area (Figure 6, Section 4.2).

Analysis of material recovered in the Lifeways of Canada study was limited. It tended to concentrate more on providing a specific data set suitable for later comparative analysis than in trying to reach any definitive conclusions about the artifact assemblage.

Each of the Cree Burn Lake artifacts was categorized within a structured, hierarchical classification system similar to that applied by Schiffer to his Joint site collection (Schiffer 1976). This system can best be visualized in a "Tree" shape in which each artifact trait is a link from which further attributes branch (Fig II-1). The initial sort of material separates all tools, cores and core fragments from flakes and flake fragments within the assemblage. Further separation between the flake categories was done on the basis of lithic type (Beaver River Sandstone and others), use wear (presence or absence), cortex (presence or absence) and size (small, medium, large or fragment).

The advantages of using this system are threefold. Firstly, the resultant 32 possible artifact types within each category of flakes and cores are all firmly defined hierarchically and as such can be manipulated in a number of ways. Secondly, the original provenience is retained within the collection so that subsequent analysis utilizing different attributes can be conducted. Thirdly,

J:\1997\2237\8400\FLAKE.DWG



Types: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

Size:

01 - Large = > 16cm^2

02 - Medium = > 4cm^2 < 16cm^2

03 - Small = < 4cm^2

04 - Fragment

Golder Associates

SHELL CANADA LIMITED

FLAKE AND FLAKE FRAGMENTS

10 FEB 1998	II-1	DRAWN BY: VS

when confronted with a large assemblage the method is extremely time effective for cataloguing purposes.

Stanley Ahler has examined a number of Northern Plains sites using similar techniques in artifact classification (Ahler 1989). His paper presents the various ways in which data from this system can be manipulated to reflect results in both functional and settlement diversity within a specific site. The analysis presented here is an attempt at using the resultant data to show similarities and diversities between various sites and their assemblages.

Artifacts recovered from the 1997 field program were first washed then quickly examined so as to separate tools, cores and core fragments from flakes and flake fragments. All of the artifacts were then passed through a nested grid to determine size. The only provenience retained during this initial sort was that of site locale. Table II-1 provides a general summary of the artifacts recovered by the sites recorded in the 1997 program.

Table II-1: Lithic Material Recovered

Site/Artifact	Biface	End Scraper	Secondary Flake (Retouched)	Core/Core Fragments	Debitage	Decortication Flake	Shatter	Total
HhOu 41	1			1	28		7	37
HhOu 42					31		5	36
HhOu 43					8		2	10
HhOu 44		1[1]			1			2
HhOu 45				14	67	5	12	98
HhOu 46				4	25	3	2	34
HhOv 178				2	1		3	6
HhOv 179	1				7			8
HhOv 180				1	3		3	7
HhOv 181				3	141		56	200
HhOv 182					36		2	38
HhOv 183			2					2
HhOv 184					318[2]	19	29[3]	366
HhOv 185				1	29		3	33
HhOv 186				1	15	1	7	24
HhOv 187				2	52		15	69
Total	2	1	2	29	762	28	146	970

All material Beaver Sandstone except:

[1]: Chert

[2]: One chert

[3]: One quartzite

2.0 Formed Tools

2.1 Bifaces:

Bifaces are represented by two fragments recovered from two separate sites; HhOu 41 and HhOv 179. Both fragments are of Beaver River Sandstone.

The fragment from HhOu 41 consists of the medial section of a laterel working edge (Figure II-2). The edge is convex and slightly sinuous. Bifacial retouch is complete and multiple step fractures along the working edge suggest utilization. The fragment is too small to determine overall shape or cross-section.

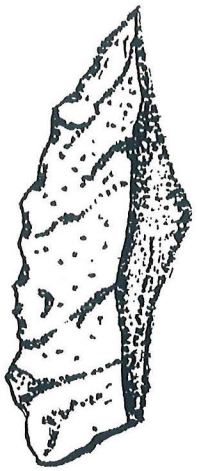
The fragment from HhOv 179 consists of the nearly complete right lateral edge, the proximal end, and the proximal left lateral edge (Figure II-2). The biface is plano-convex in cross section and almost lanceolate in shape. The right lateral edge is straight with complete bifacial retouch. Flake scars range from 5mm to 10mm resulting in a highly sinuous edge. Use wear is evident near the proximal end. The proximal end itself appears stemmed with the proximal left lateral edge flaked and ground creating a shoulder that would facilitate hafting. The material appears to be somewhat brittle, with several of the thinning and retouch flake scars terminating in step fractures.

2.2 Scrapers:

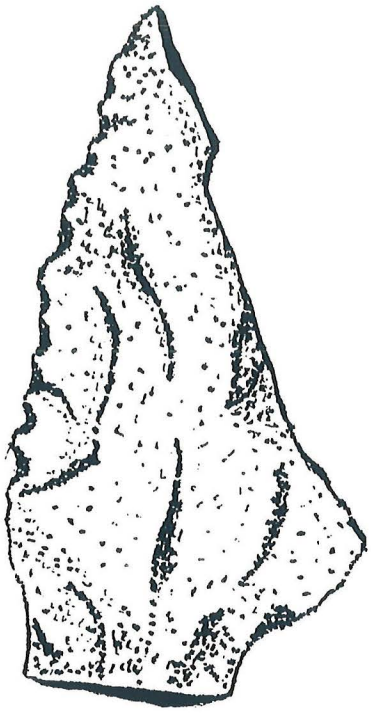
The only complete tool, and one of only a few examples of non-Beaver River Sandstone in the collection, is a chert split-pebble end scraper recovered from site HhOu 44 (Figure II-2). The scraper is discoid in shape with unifacial retouch along the distal and right lateral edges forming a steep working edge. Flake scars range from 1mm to 5mm in width. Use-wear, in the form of crushing, is evident along the length of the right lateral edge. Use-wear along the distal edge is less obvious.

Metrics:
Distal edge angle = 65°
Lateral edge angle = 60°
Length = 23.6mm
Width = 23.0mm
Weight = 6.2g

J:\1997\2237\8400\TOOLS.DWG



HhOu 41: 12



HhOv 179: 9

HhOu 44: 1

Golder Associates

SHELL CANADA LIMITED

FORMED TOOLS

10 FEB 1998	Figure II-2	DRAWN BY: VS

2.3 Retouched/Utilized Flakes

Only two retouched/utilized flakes, both of Beaver River Sandstone, were identified during the course of this study. Both flakes are from site HhOv 183, and constitute the entire assemblage for that site. One flake, a large secondary reduction flake, exhibits retouch on the dorsal surface along the distal end of the left lateral edge (Figure II-2). Use-wear is visible along three-quarters of both lateral edges, with the right lateral edge exhibiting a polished or glossy finish. The other utilized flake, a secondary reduction flake fragment, exhibits use-wear along one lateral edge (Figure II-2). The use-wear is only visible dorsally and terminates distally in a snap. While the large reduction flake was probably used for cutting, the smaller reduction flake fragment appears to have been used in a scraping fashion.

3.0 Cores

Cores and core fragments make up approximately three percent (n = 29) of the lithic assemblage, and were recovered from nine of the sixteen sites. All cores and core fragments are of Beaver River Sandstone. None of the artifacts exhibit cortex, which is consistent with material being quarried from exposed bedrock as opposed to glacial till or fluvial deposits (see below). Three cores were identified in the assemblage, each from one of three sites; HhOu 46, HhOv 186, and HhOv 187. All three exhibit multi-directional flake removal and are amorphous in shape. Iron staining is also present on all three, as a reddish discolouration that appears to be confined to areas of weakness, such as joint fractures or bedding planes. Numerous step and hinge fractures cover the cores suggesting a lesser quality of Beaver River Sandstone than has been seen at other sites.

4.0 Materials

Of the 983 artifacts collected during the course of the current investigation, only 5 are non-Beaver River Sandstone. This includes 2 quartzite, 2 pebble chert and 1 chert.

Until recently, Beaver River Sandstone was mislabelled as a quartzite. It is now known that Beaver River Sandstone is a sedimentary, rather than metamorphic rock. It is described as a light gray, bimodal, silica-cemented sandstone which contains 3 to 15 percent medium to fine-grained sand in a very fine-grained to silt-sized matrix (Fenton and Ives 1990). The silica cement is strong enough that fractures pass through, instead of around, the individual grains, making for a good flaking

material. Quality varies, however, with some artifacts exhibiting a waxy chert like appearance, while others appear dull and more course and produce flakes that often end in step or hinge fractures.

Determining a source for Beaver River Sandstone has proved difficult. Examples of unmodified Beaver River Sandstone in till or fluvial deposits is extremely rare, and it is unlikely that prehistoric peoples would have utilized such a source. According to Fenton and Ives (1990), a more likely scenario is the exclusive quarrying of natural outcrops like that at the Beaver River Quarry site (HgOv 29). In terms of geological formation, it has been determined that Beaver River Sandstone is located near the top of the lower member of the McMurray Formation, and is generally present where the McMurray Formation is more than 60 meters thick (Fenton, Ives 1990). Maps produced by McPherson and Kathol (1977), based on overburden thicknesses, predict that outcrops of such formations would be confined to a corridor of less than 25 kilometers from the Athabasca River in the Fort MacKay region.

More recently, however it has been suggested (Reeves 1995) that large quariable blocks of this material may have been displaced and deposited over the landscape affected by the 9,900 year Glacial Lake Agassiz outwash flood (Smith and Fisher 1993). This suggestion remains to be verified.

5.0 Debitage

Table II-2 shows the flake classifications found within the sites. There are 12 different categories represented within the 16 sites recorded. The two most heavily represented are categories 14 and 15, being small to medium sized Beaver River Sandstone flakes absent of cortex. The combined two categories account for 80% of the artifact assemblage. In relation to artifact size, a little less than half the assemblage (46%) is comprised of flakes less than two centimetres in size. These types are represented by types 11, 15 and 31. The remaining artifacts are either large, medium or fragmented. There are four instances of non-Beaver River Sandstone material occurring in the collection. These lithic types are quartzite (n = 2) and chert (n = 2) and are represented at sites HhOu 43 and HhOv 184.

Table II-2: Flake Classifications for Sites Recovered.

	Debitage Types												
Site #	5	9	10	11	12	13	14	15	16	26	31	32	
HhOu 41	0	0	4	1	1	2	16	4	7	0	0	0	35
HhOu 42	0	0	0	0	0	0	15	16	5	0	0	0	36
HhOu 43	0	0	1	0	0	1	5	2	0	0	1	0	10
HhOu 44	0	0	0	0	0	0	1	0	0	0	0	0	1
HhOu 45	0	0	4	1	0	2	35	30	2	0	0	0	74
HhOu 46	0	0	0	3	0	0	10	15	0	0	0	0	28
HhOv 178	0	0	0	0	0	3	0	0	1	0	0	0	4
HhOv 179	0	0	0	0	0	1	6	0	0	0	0	0	7
HhOv 180	0	0	0	0	0	0	2	1	3	0	0	0	6
HhOv 181	0	0	0	0	0	2	52	98	32	0	0	0	184
HhOv 182	0	0	0	0	0	0	8	27	3	0	0	0	38
HhOv 183	2	0	0	0	0	0	0	0	0	0	0	0	2
HhOv 184	0	3	15	1	0	1	113	166	45	1	1	1	356
HhOv 185	0	0	0	0	0	0	5	24	3	0	0	0	32
HhOv 186	0	1	0	0	0	0	11	4	0	0	0	0	16
HhOv 187	0	1	1	0	0	0	32	18	13	0	0	0	65
Total	2	5	25	6	1	21	311	405	114	1	2	1	894
% of Total	0%	1%	3%	1%	0%	2%	35%	45%	13%	0%	0%	0%	100%

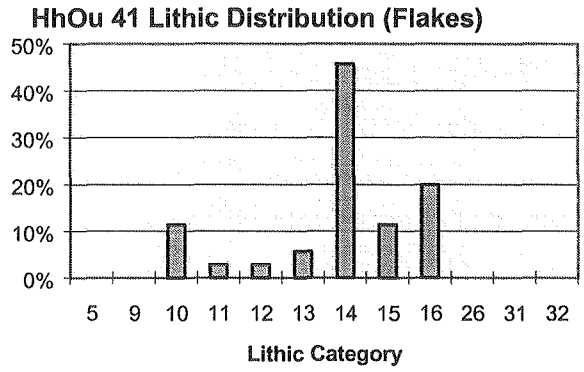
Before an intrasite comparison was attempted each specific site was examined in an attempt to determine any patterning evident at each specific locale.

Ahler (1991) has theorized that site activity can be directly linked to flake size. Since flintknapping is a reductive process, no flake produced in the knapping process can be larger than the parent core. The maximum size of the flaking debris can be indirectly used to calculate the size of the parent raw material, the mode of manufacture as well as the position in the manufacturing process. Flakes produced early in the reduction process should have relatively greater numbers in the large size classes with relatively fewer numbers in the smaller size classes. The inverse of this would also hold true. Large amounts of flakes in the small size classes and relatively fewer large size flakes would mean these flakes were produced at a later stage of the reduction process.

The presence or absence of cortex within the assemblage is another good indicator of what reduction stage artifacts may be assigned. In general, the frequency of cortical flakes will be higher in the initial manufacturing process and will be lowest in the latter stages.

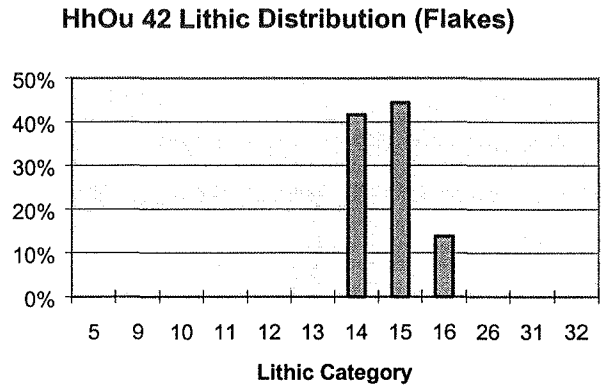
As for the mode of manufacture, percussion flaking, on the whole, is capable of producing flakes much larger in size than any produced by pressure flaking. Size grade distribution data should then provide a fairly good measure of load application variation.

Site HhOu 41 contained a total of 35 artifacts represented by seven different artifact types. The majority of flakes represented here fall within the medium size class (n = 20). When combined with those within the small (n = 5) and fragmented (n = 8) classes 94% of the assemblage is contained within these categories.

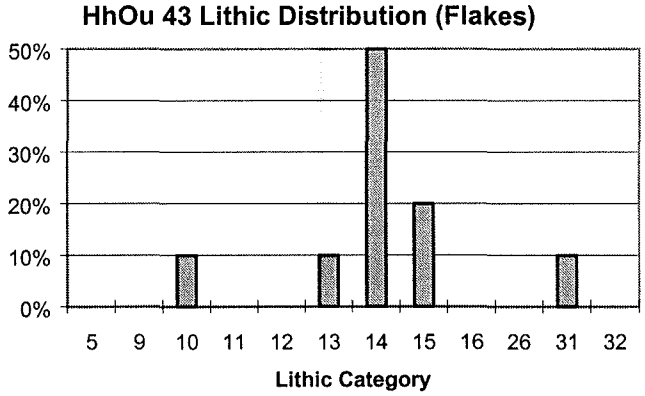


It would appear that activity at this site falls within the earlier stages of reduction. Medium size flakes dominate and most likely were removed by percussion techniques. If the number of decortication flakes (n=6) is also taken into account, a good case can be made suggesting that the early stages of flake reduction were a large component of the flint knapping procedures that were carried out on this site.

Site HhOu 42 has a total of 36 artifacts broken down into three categories. There is almost an even split between medium sized flakes (n = 15) and small sized flakes (n = 16). There are no decortication flakes within the assemblage. The site can be theorized, then, to lie within the later stages of flake reduction, with perhaps both percussion and pressure techniques being employed.



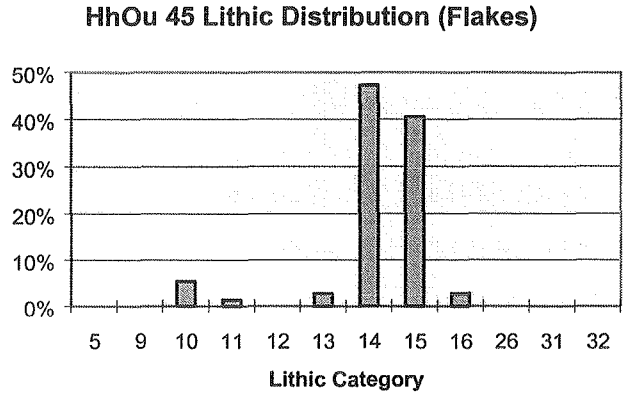
Site HhOu 43 contains one large flake, one medium decortication flake, five medium sized flakes and three small flakes. With the presence of the decortication flake and five medium sized flakes one may assume that the primary activity at the site centered around the earlier stages of flake reduction. The three small flakes in the assemblage may point to some tool production so in essence this may have been a tool expediency site, one in which a specific tool was fashioned to suit a particular need. The samples from this site is too small, however, to allow confident conclusions in this regard.



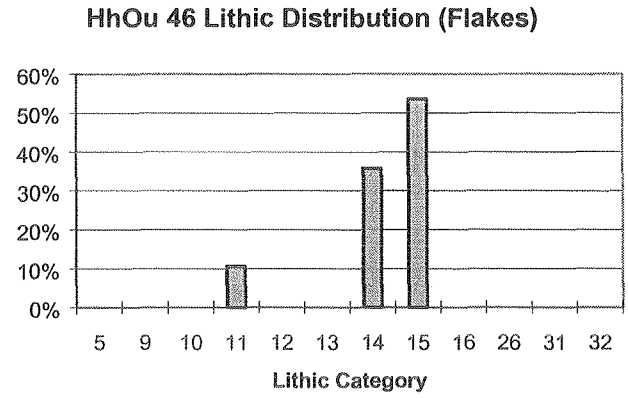
Site HhOu 44 has one medium sized flake. With such a limited assemblage no generalizations can be formulated.

Site HhOu 45 contains two large sized flakes, four medium sized decortication flakes, 35 medium sized flakes, 31 small sized flakes and two fragments. All artifacts are of Beaver River Sandstone. Similar to site HhOu 42, there is an equal distribution of medium and small sized flakes. The

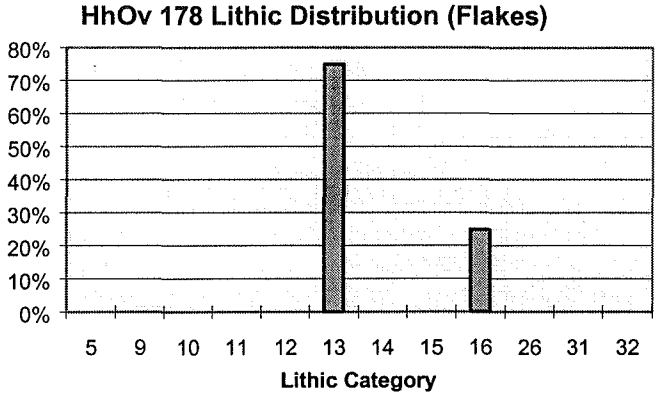
presence of decortication and medium sized flakes suggests earlier stages of flake reduction. Tool manufacturing may also have taken place, as evidenced by the large amount of small sized flakes. The total number of flakes recovered (n = 74) and the presence of both early and late stages of manufacturing suggests that this could be a campsite locale. It is probable that additional material is present at the site, beyond those recovered from the testing program.



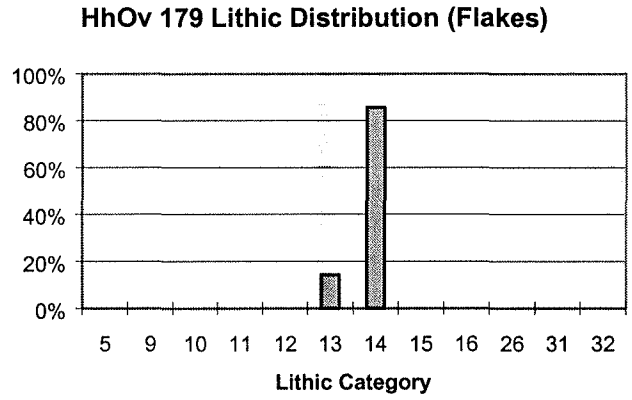
Site HhOu 46 has artifacts represented in three categories. There are 10 medium sized flakes, three small decortication flakes and 15 small flakes. Flake size points towards the later stages of core reduction. The presence of decortication could represent early stages of reduction. However, the small size of the flakes may suggest final tool shaping, perhaps the removal of cortex from the finished product.



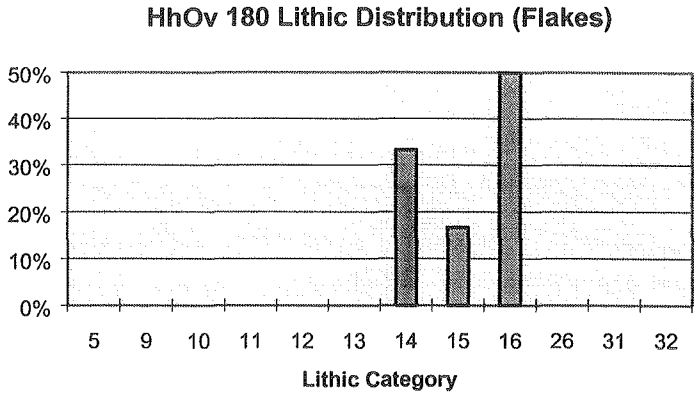
HhOv 178 has four flakes in the assemblage: three large flakes and one fragmented flake. Though the assemblage is limited, it tends to suggest a small scale site within the early stages of manufacturing.



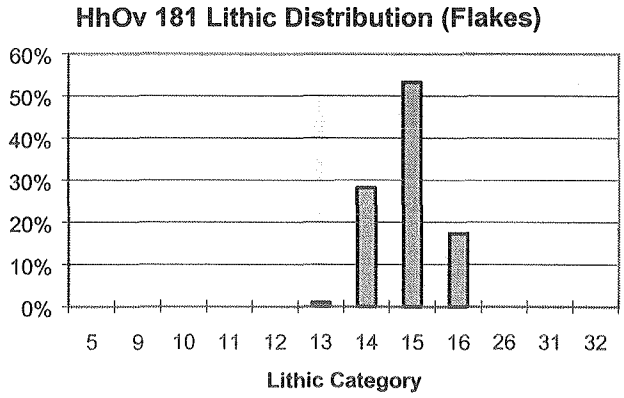
HhOv 179 has seven flakes in the assemblage; one large sized flake and six medium sized flakes. Like HhOv 178 the site can be assumed to lie within the early stages of flake reduction.



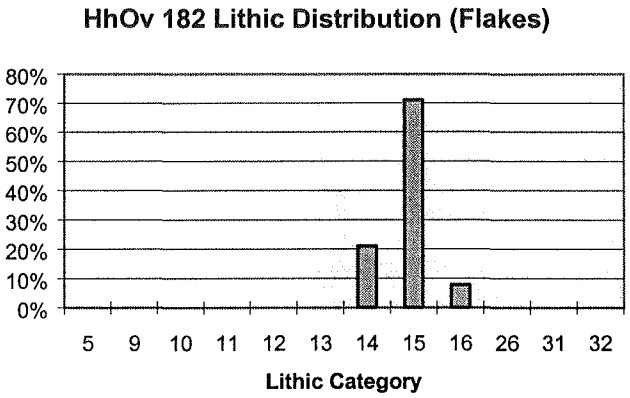
HhOv 180 contains two medium sized flakes, one small sized flake and three fragmented flakes. This site may have been a locale where a tool was quickly fashioned to suit a particular need.



HhOv 181 contains 184 total artifacts. There are two large flakes, 52 medium sized flakes, 98 small sized flakes and 32 fragmented flakes. No decortication flakes were recovered and all the material is of Beaver River Sandstone. The high frequency of small sized flakes suggests that pressure techniques were utilized and, as such, it appears that this is a tool manufacturing locale. The large amount of flakes within the total assemblage also suggests that this may be a much larger site than is reflected by just the artifacts recovered in the testing program.

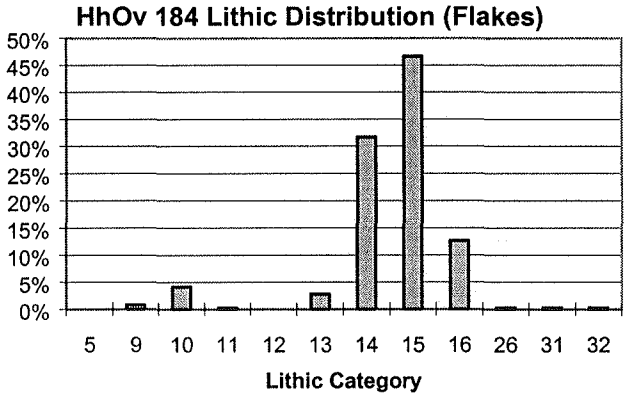


Site HhOv 182 has a total of 38 artifacts within the assemblage. There are eight medium sized flakes, 27 small flakes and three fragmented flakes. Flake size points towards the later stages of the manufacturing process, involving pressure flake removal. As such, this site would be considered a tool manufacturing locale.

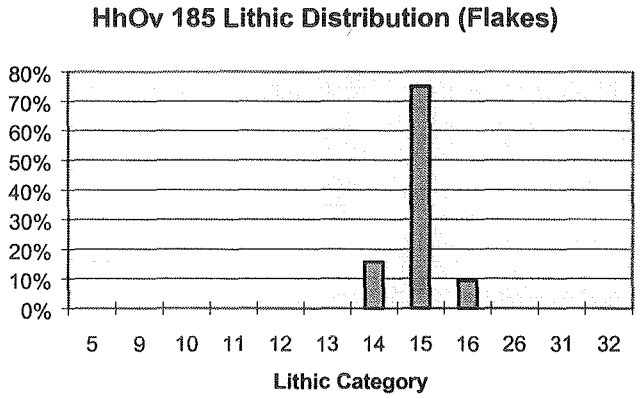


Site HhOv 183 contains two large sized flakes which have been retouched/utilized along each of their lateral edges. The site is considered to be a small scale expediency site.

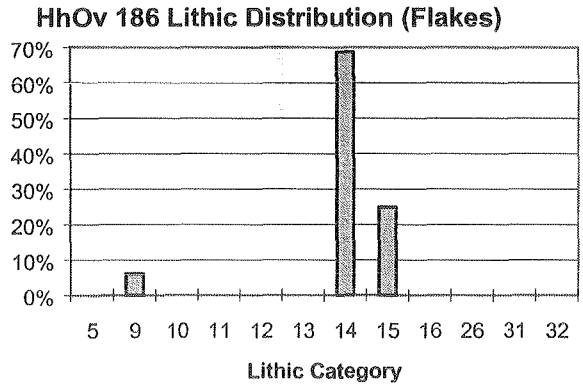
Site HhOv 184 contains the largest numbers of artifacts recovered at any of the sites recorded in 1997 (n = 356). There are three large decortication flakes, 15 medium decortication flakes and one small decortication flake, 10 large flakes, 113 medium flakes, 166 small flakes and 45 fragmented flakes. Three non-Beaver River Sandstone flakes occur within the assemblage, consisting of one medium, one small and one fragmented flake. The apparent size mixing or production stages within the assemblage suggests that both the early and late stages of the manufacturing process were carried out here. The large number of artifacts shows that this may have been a campsite of some duration and that additional material may exist beyond those recovered during the testing program.



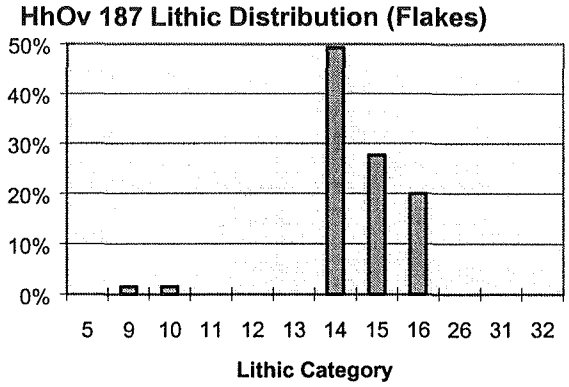
Site HhOv 185 is thought to be a site exhibiting the later stages of flake reduction, possibly with tool production being the primary focus. There are five medium sized flakes, 24 small flakes and three fragmented flakes.



Site HhOv 186 contains one large sized decortication flake, 11 medium flakes and four small flakes. The presence of a decortication flake and the relatively high frequency of medium sized flakes, in proportion to small, suggests an early manufacturing process was carried out at the site.



Site HhOv 187 has one large sized decortication flake, one medium sized decortication flake, 32 medium flakes, 18 small flakes and 13 fragmented flakes. The presence of decortication flakes along with the relatively high proportion of medium sized flakes as opposed to small tends to suggest an early manufacturing stage. The meagre flake count may show that some tool production was carried out on site. The relatively high frequency of artifacts could mean that there is additional material yet to be recovered from this locale.



Comparing these sites indicates that there are five sites which fall within the early stages of the manufacturing process (HhOu 41, HhOv 178, 179, 186 and 187), five sites which fall within the later stages of the manufacturing process (HhOu 42 and 46, HhOv 181, 182 and 185), two sites which exhibited both stages (HhOu 45 and HhOv 184), three sites considered to be expediency sites (HhOu 43 and HhOv 180 and 183) and one site with too limited an assemblage to classify (HhOu 44).

To allow an examination of the combined influence that the flake types carry upon the archaeological sites involved, the data was first summarized using Principal Component Analysis (PCA Gauch 1982). This ordination technique can be used to summarize the changes from site to site in a number of different variables concurrently and to gain insight into the relationship between those variables. PCA extracts a new set of uncorrelated variables from the original data, referred to as factors or ordination axes. Each new ordination axis represents a combination of some of the original variables, thereby, reducing the number of variables necessary to describe the overall variation in the data. For example, if small sized Beaver River Sandstone flakes without cortex and small sized non-Beaver River Sandstone flakes without cortex are intercorrelated, PCA will extract a single axis representing both these variables.

For each variable within Table 1 to be equally represented, all data were divided by the largest number within each category so that no one variable would skew the results. The results are shown in Table II-2. The site numbers were not used in the analysis but were retained in order to keep track of the variance between sites.

Table II-2: Standardized Data for Flakes.

	Variables											
Site #	5	9	10	11	12	13	14	15	16	26	31	32
HhOu 41	0	0	.27	.33	1	0.2	.14	.02	.15	0	0	0
HhOu 42	0	0	0	0	0	0	.13	.10	.11	0	0	0
HhOu 43	0	0	1	0	0	.1	.04	.01	0	0	1	0
HhOu 44	0	0	0	0	0	0	.008	0	0	0	0	0
HhOu 45	0	0	.27	.33	0	.2	.31	.18	.04	0	0	0
HhOu 46	0	0	0	1	0	0	.09	.09	0	0	0	0
HhOv 178	0	0	0	0	0	.3	0	0	.02	0	0	0
HhOv 179	0	0	0	0	0	.1	.05	0	0	0	0	0
HhOv 180	0	0	0	0	0	0	.02	.006	.07	0	0	0
HhOv 181	0	0	0	0	0	.2	.46	.59	.71	0	0	0
HhOv 182	0	0	0	0	0	0	.07	.16	.07	0	0	0
HhOv 183	1	0	0	0	0	0	0	0	0	0	0	0
HhOv 184	0	1	1	.33	0	1	1	1	1	1	1	1
HhOv 185	0	0	0	0	0	0	.04	.14	.07	0	0	0
HhOv 186	0	0.3	0	0	0	0	.10	.02	0	0	0	0
HhOv 187	0	0.3	0.07	0	0	0	0.28	0.12	0.30	0	0	0

A total of 12 variables were first entered into the principle component analysis producing factor scores, an eigenvalue (sum total of the matrix) and variance account output as shown in Table II-3.

Table II-3: Eigenvalues and Variance Accounted for by Principle Components Within Sites.

COMPONENT	EIGENVALUE	PERCENTAGE VARIANCE
1	7.123	59.359
2	1.283	10.690
3	1.134	9.450
4	0.959	7.991
5	0.813	6.774
6	0.381	3.172
7	0.181	1.510
8	0.074	0.620
9	0.037	0.311
10	0.013	0.110
11	0.002	0.014
12	0.000	0

As seen from Table II-3 there are 12 variables in the analysis but when combined into components, only a few account for the majority of the variance. Component 1 accounts for the majority of the variance at 59%. The next step was to determine which variables within component 1 are involved in the variation. This was accomplished by observing the loading of the variables on the components. These results are shown in Table II-4.

Table II-4: Loadings on Variables of Principal Component 1.

	26	32	13	14	15	9	16	10	31	12	11	5
Component 1	0.962	0.962	0.938	0.938	0.904	0.878	0.870	0.740	0.738	-0.006	0.213	-0.162

To distinguish the relevance between individual loadings, the component was sorted so that a relevant break could be observed. Within component 1, the first nine variables all show a high positive correlation, while the remaining three variables (12, 11 and 5) show either a low positive correlation or a high negative correlation. The three variables which separate from the others consist of:

1. variable 5, large sized Beaver River Sandstone flakes with no cortex but with marginal retouch;

2. variable 11, small sized Beaver River Sandstone decortication flakes and

3. variable 12, fragmented Beaver River Sandstone decortication flakes.

It appears, then, that variation between sites exists on two levels. The first is the presence of retouch (HhOv 183) and the second is size of decortication flakes. Small sized decortication flakes exist at sites HhOu 41, 45 and 46 and at HhOv 184. Fragmented decortication flakes were recovered from site HhOu 41.

It is easy to see how site HhOv 183 separates from the other sites as it is the only one which contains marginally retouched flakes. The remaining four sites separate from the others on the basis of the presence of small decortication flakes found within their assemblage. As stated previously, decortication flakes should point towards sites containing an early manufacturing reduction process. However only one site, HhOu 41 was determined to fall within that stage, with sites HhOu 45 and HhOv 184 containing both early and late stages. Site HhOu 46 exhibits only late

stage reduction processes. Actual physical examination of these artifacts shows that none of these flakes are pressure flakes, hence not tool manufacture related. They are consistent with early stage flake reduction. What they may show is size of parent material. The smaller the decortication flake the smaller the parent material, which in turn may be related to distance from a quarry source. The larger the parent, pieces material the closer it is expected one would be to the source. On the other hand, the smaller the objective piece the farther away from the source. The validity of this assumption could only be proven by further sample recovery. It is interesting to note, however, that all four of the sites are in close proximity to each other. If a straight line was to be drawn from the most southerly site (HhOv 184) to the most northerly site (HhOu 41) it would be six kilometres long. The remaining two sites (HhOu 45 and 46) lie 500 m east of this line.

During the course of the analysis a number of observations were made pertaining to the utility of this classification system. On the plus side the system is fast in terms of quickly placing artifacts into their respective types. Another advantage is that anyone can conduct the work. Discrepancies as to what constitutes the characteristics of a specific flake type is eliminated. Perhaps the greatest advantage of the system is that large amounts of information can be assimilated into a few categories so that manipulation of the data is more readily facilitated without the aid of computer assisted statistical programs. A disadvantage of the system is that sample size should be as large as possible before any valid generalizations can be made. In the case of this study, where analysis was based on artifacts recovered from a testing program, generalizations made about the sites could very well prove erroneous once more data are collected. The other inherent problem with this classification system is that flake size is often a result of the lithic material utilized. Coarse-grained crypto-crystalline material will produce much larger flakes throughout the reduction process as opposed to fine-grained crypto-crystallines. To surmize that all small sized flakes are pressure removed is too sweeping a generalization. In our sample set less than 1% of the assemblage was non-Beaver River Sandstone. To better understand the flaking properties of Beaver River Sandstone one could conduct replicative studies to determine the materials limitations and characteristics. However, this would virtually negate any time saving advantages the system has.