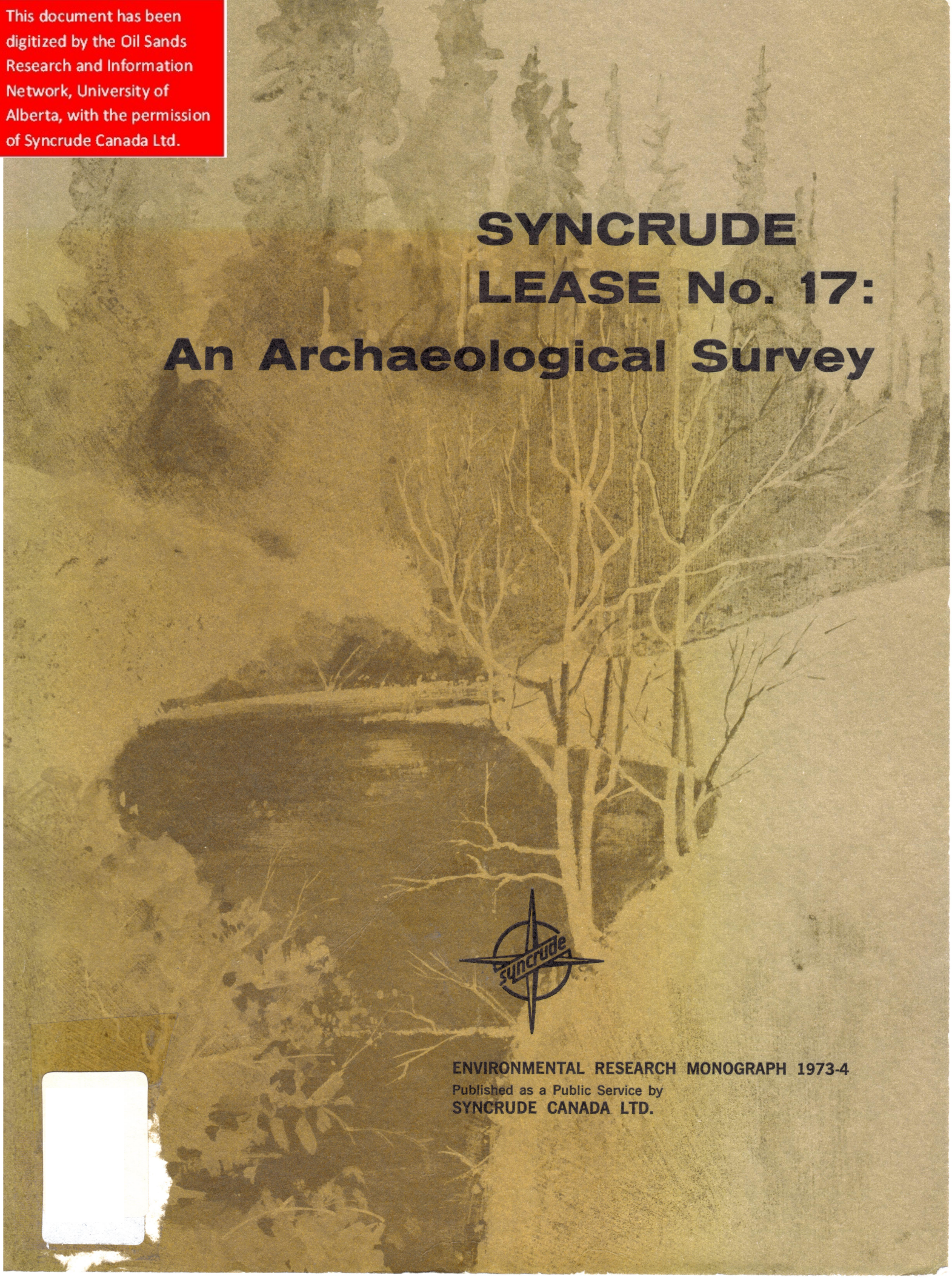
SYNCRUDE LEASE No. 17: An Archaeological Survey



ENVIRONMENTAL RESEARCH MONOGRAPH 1973-4
Published as a Public Service by
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ENVIRONMENTAL POLICY STATEMENT

Syncrude Canada Ltd. works with the conviction that human use of the environment need not be destructive. With careful planning, based upon good information, man-altered and natural ecosystems can exist in harmony. In order to accomplish this planning, Syncrude considers resource development from a total-systems point of view. This comprehensive approach corrects the frequent tendency to attempt resolution of problems on a single purpose basis. The total-systems analysis approach leads to a plan of operations using the best practicable technology, both in resource development and in environmental protection. An eco-system approach to resource development, an integral part of our approach, implies an understanding of and respect for the potential of natural systems and the use of the economy of nature, wherever possible.

Through a comprehensive program of surveillance of the effects of our technology and careful application of that tech-nology, we aim to prevent accidental damage to the environment. Total effects will be examined by professional ecologists and study results provided to public representatives.

FOREWORD

This environmental monograph is an assessment of the archaeological potential of the area of Syncrude Lease #17 in the Athabasca Tar Sands and was initiated in order to prevent the destruction of any significant archaeological sites by the construction and operation of the Syncrude Canada Ltd. plant and mine and hence, to protect Alberta's archaeological heritage.

The policy of Syncrude Canada Ltd. is to make available to the scientific community and the public at large ecological baseline information as it relates to developments in the Athabasca Tar Sands. We feel this responsibility to contribute to the body of knowledge necessary for an orderly development of the Tar Sands, in order to minimize damage and to carry out the studies required to maintain the ecological integrity of the area.

This study was commissioned by Syncrude and was carried out by Timothy Losey of the Department of Anthropology, University of Alberta and Cort Sims, Department of Anthropology, University of Manitoba.

This report includes a preliminary evaluation of the Lease #17 area as a human habitat, both for the historic and prehistoric periods, and a subsequent summary of the results of an archaeological survey of the mining lease conducted in May and June of 1973.

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INTRODUCTION

Canada was, until very recently, considered by many a vast northern frontier which was largely undeveloped and uninhabited. Except for areas along the extreme southern border and the coastal regions, this was true. As economic development in Canada has proceeded, so has resource development increased in an attempt to keep pace with accelerated demands for raw materials. For the first time in Canadian history, resource developers and, ultimately, White Canadian society have begun to penetrate the remote "frontier" regions. Industrial development on the scale observed over the past decade has caused many concerned citizens to condemn any development as a hazard to the natural environment. To others, the uncontrolled expansion of industrial development is an absolute economic necessity. The truth must lie somewhere in between.

Significant concern is now being directed toward the so-called "non-renewable resources". A non-renewable resource may be defined as a finite quantity of matter which does not of itself regenerate so as to lend itself to perpetual extraction. Once it has been extracted, or expended, a non-renewable resource becomes non-existent. Archaeological sites are unquestionably members of this non-renewable resources category.

Archaeological remains of the activities of past human societies are records of events often enacted only once. When these records are lost, they are irreplaceable. By failing to protect archaeological resources, we run the risk of never being able to fully document the historic and prehistoric heritage of the society of man. Furthermore, the bulk of the Canadian Native population's heritage is only available in an archaeological context.

A truly Canadian heritage must begin with that of its original Native inhabitants.

During project planning, Syncrude Canada Ltd. became concerned for possible archaeological resources which might be endangered by its development in Athabasca Tar Sands Lease #17. Proposals were solicited by Syncrude for assistance in conducting a survey of the Lease #17 area to determine its archaeological site potential. In line with their environmental baseline studies, Syncrude accepted a research proposal and funded a field project to that end.

The report contained herein embodies background information from the original research proposal and the subsequent findings of the archaeological survey project. Included are statements of both the method and theory employed in the research. All reported archaeological finds in the Boreal Mixedwood Ecosystem of Alberta and pertinent ethnohistorical and ethnographic literature concerning Native Groups of the general region are reviewed. In preparation for the survey, a system was formulated whereby Lease #17 could be divided into a number of priority areas according to their archaeological potential. To define these priority areas, it became necessary to first make an appraisal of the human carrying capacity of the area employing existing environmental data.

The result of the preliminary ground work was the evaluation of Lease #17 as a human habitat both for historic fur trade and prehistoric periods. It was upon this evaluation that the system of priority areas was developed and used as a general guide during the course of the survey. The sites found during the survey exhibit a marked clustering along the Beaver Creek between the 901 - 1000 foot contours. These sites are generally in Spruce/Aspen, Pine/Aspen and Pine Communities and are generally within 500 yards of 4 or more different plant communities. To summarize, the basic variables, considered to be determining factors in the location of archaeological sites, were the presence of a water source and a diverse environment.

The rationale behind choosing these variables was that the place where two different plant communities blend together (an ecotone) has a greater density and variety of life than either of the two communities alone. Thus, a river or lake while providing a convenient source of water also causes a break in the surrounding plant community thereby creating an ecotone. Such areas would be the most productive areas for prehistoric hunters and gatherers to exploit.

The results of the field work are presented within the framework of the proposed research design. The contents of 28 archaeological sites are described and analysed. These sites were confined to the eastern one-third of the lease. It was assumed that areas close to water and areas of environmental diversity would be the areas favoured by prehistoric man. As all of the eastern one-third of the lease was intensively surveyed (excluding portions of marsh and muskeg), it is very probable that the sample of sites discovered is quite representative of the actual site distribution in that particular area. The spatial relationships between sites along with a comparison of expected and observed proximity of sites to characteristics of drainage, elevation, and vegetation were explored using the chi-square (X^2) statistical test. A total of 999 stone artifacts were recovered, 27 of which constitute tools and objective pieces. An analysis of types of stone material used and the distribution of edge angles exhibited by the stone tools is presented also.

In summary, the artifact sample from Lease #17 shows that a variety of stone materials were available and were utilized. Tools were apparently roughed out at a quarry site and then transported to camp sites for finishing. The edge angles of worn artifacts indicates that the tools had a variety of uses. The scarcity of projectile points may be due to the use of perishable bone and antler for these tools.

PART I

A BASIS

FOR AN

ARCHAEOLOGICAL SURVEY

OF

ATHABASCA TAR SANDS LEASE #17

1. INTRODUCTION

Objective

To complete a preliminary appraisal of the archaeological potential of Syncrude Lease #17.

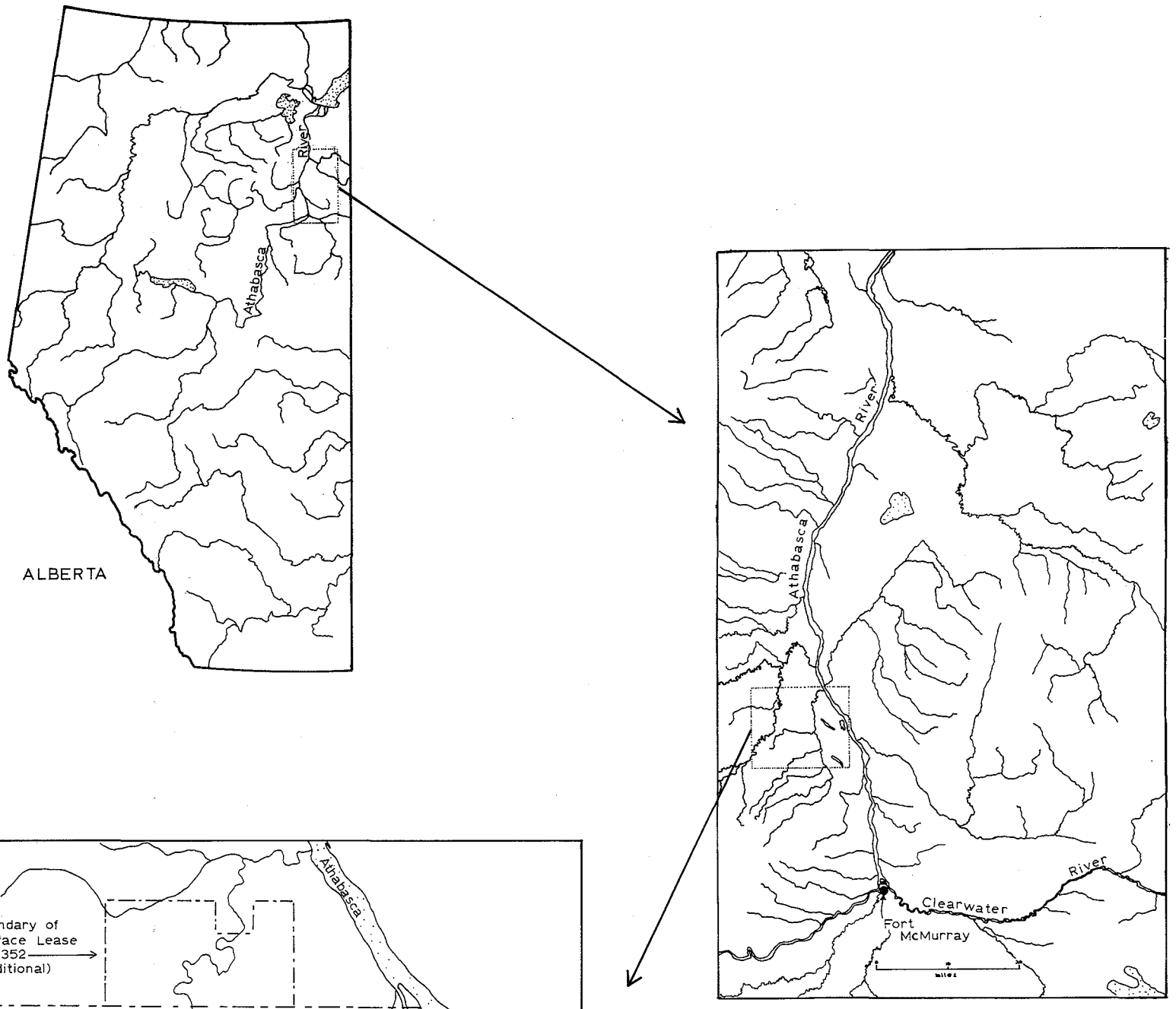
Methodology

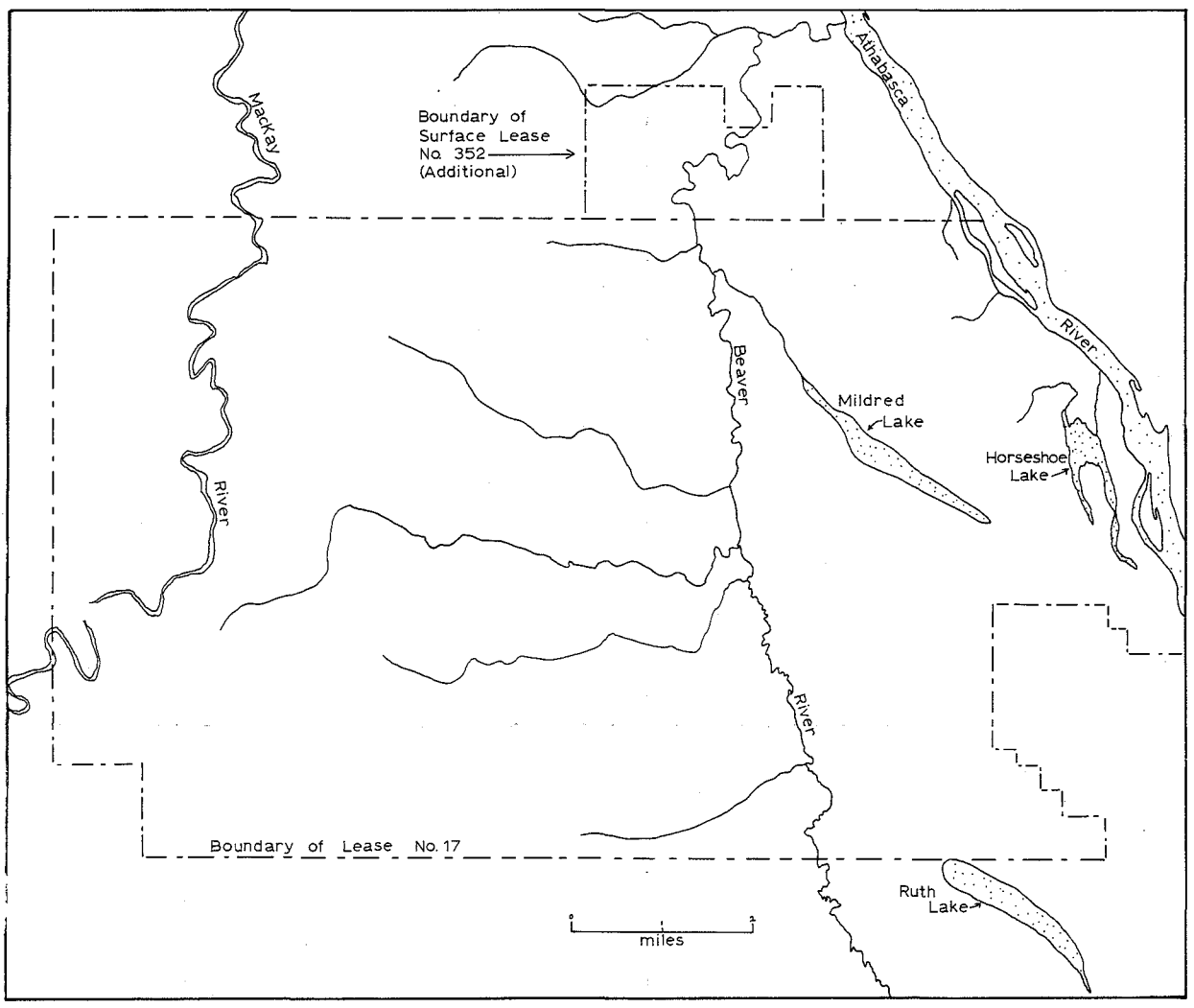
In order to accomplish this objective, it was necessary to:

1. Review the written history of the area, particularly during the Fur Trade Era;
2. Review archaeological findings in the Boreal Mixedwood Ecosystem of North-Eastern Alberta;
3. Appraise the human carrying capacity of the area, using existing environmental data;
4. Review ethnographic literature concerning known Native groups or populations which inhabit the general area.

The result was an evaluation of the Lease #17 area as a human habitat, both for the historic (Fur Trade) and prehistoric periods. A system of priorities was then established for areas within the lease regarding archaeological potential.

Following the initial appraisal, a proposal for a systematic archaeological survey was constructed in order to provide a complete inventory of sites within the Lease #17 boundary. Special attention was paid to areas of active work in the event that archaeological sites were endangered and required salvage.


Athabasca River
ALBERTA
Athabasca River
Clearwater River
Fort McMurray
miles


Mackay River
Boundary of Surface Lease No. 352 (Additional)
Athabasca River
Beaver River
Mildred Lake
Horseshoe Lake
Boundary of Lease No. 17
Ruth Lake
miles

2. PRELIMINARY EVALUATION

Canada's 1967 Centennial celebrations generated an intense interest among Canadians concerning the country's historic heritage. This renewed interest centered primarily around people and events which figured prominently in the development of Canada as a nation. Much of Canada's colorful and interesting history is embodied in the period known as the fur trade era. Indeed, it was the fur trading economy which ultimately led to the exploration and settlement of Canada.

In reality the historic fur trade period constitutes only a small portion of a comparatively long heritage which begins with the initial peopling of the New World by the North American Indian. It is both ironic and disheartening that the role of Canada's Native population in its historic past is so often overlooked. It is obvious that without the benefit of an indigenous population the Colonial Fur Trade economy could not have been developed. In fact, the very lives of the White traders were often dependent on the generosity of the Native people. Canada's true heritage can only be fully understood and appreciated through honest recognition of its Native people and their past.

History and Prehistory in Canada

The period of time beginning with the present and extending back to the first arrival of the American Indian on this continent is conveniently divided into two stages known as the *historic* and *prehistoric* periods.

The *historic* period encompasses approximately 300 years and is usually recognized by the appearance of the first written records regarding Canada, its lands and people. Since none of the

North American aboriginal groups are known to have been literate, the historic period necessarily begins with the records of the first explorers, traders, and missionaries. Some scholars have included a period called the *protohistoric* which is designed to span the transition between prehistoric and historic times during which writings are scanty and sporadic.

The *prehistoric* period embodies that block of time prior to the meeting of Europeans and the indigenous Canadian population. The prehistoric period is immense in comparison to historic times. It is important to realize that Canada's true heritage must include the prehistoric period as well as its historic counterpart and that the origin of Canadian heritage possesses great time depth which is expressed in millennia, a heritage of at least 10,000 years and perhaps as great as 30,000 years.

Archaeological Research

Knowledge of the origins and lifeways of prehistoric people is a primary goal in the science of archaeology. This goal is accomplished through the use of various techniques many of which are borrowed or were first developed in other disciplines. Archaeological techniques, however, are often used to explore, identify or add detail to poorly documented historic period sites (e.g. trading posts, military establishments, Metis settlements, etc.). The excavation, study, and interpretation of sites once inhabited by prehistoric people is the task of the archaeologist. Archaeological sites represent the basic units of investigation.

Archaeological research is usually approached in one of two ways, either as *proposed research* designed to answer or explore some specific historic or prehistoric question, or as a *salvage operation* initiated to remove antiquities from an endangered area (e.g. highway construction, urban development). Differentiation between the two approaches is not always clear-cut. For example,

given ample lead time, a project otherwise viewed as essentially a salvage operation, can be designed to yield high level problem-oriented research. Adequate lead time is a necessity regarding the development of appropriate research strategies and in gathering information regarding site density and type.

Historic records including early journals and letters as well as professional ethnohistorical and ethnographic writings form an information baseline from which archaeological research proceeds backwards in time. Interpretation of individual sites is sometimes aided by observations made among Native American groups. However, the value of historic documents, in particular, regarding interpretation of sites decreases since the location and practices of various indigenous groups recorded in the eighteenth century are not necessarily the same as their antecedants. At the same time, Native groups were undergoing rapid change through the process of acculturation following the period of European contact.

Beyond the use of ethnohistorical and ethnographic records, a thorough assessment of local or regional ecological character is essential to an appraisal of an area's archaeological potential. Using historic documents, an inventory of important Native material and subsistence commodities can be compiled and the prerequisites for an area's human carrying capacity may be tabulated. Since a pre-agricultural or hunting and gathering society is regarded as being in much closer articulation with the environment than most modern societies, an assessment in terms of human carrying capacity is a valid approach. Prehistoric population density may then be viewed as a function of the amount of energy available for human consumption in a particular ecosystem. A potential home range or territory may then be defined.

The level of human technology or capability is an essential factor in how efficiently an area can be exploited. It follows that if the energy requirements of any human group exceeds the energy

available, either change or extinction must occur. Both change within and extinction of various human cultures have long attracted the attention of archaeologists in a search for cause and effect relationships. The eventual goal lies in the ultimate hope of formulating general "laws" regarding culture change.

Habitat Areas and Human Resources

Every living plant and animal including man has a definite habitat which it characteristically exploits for the purpose of survival, growth and reproduction. In some cases the habitats of various organisms overlap while others may be exclusive to one another. Since man's habitat includes nearly the entire planet, he is able to exploit the habitats of several other species simultaneously. But man does not utilize every available resource. His choices about which is appropriate to eat or wear are conditioned, sometimes demanded, by the culture or society of which he is a member.

Culturally-defined material and subsistence commodities will limit to a large extent the areas man will seek to exploit. Thus an area which offers these commodities in close proximity will receive more intense exploitation and habitation than one in which the desired resources are widely scattered. The rationale here may be considered in terms of energy expenditure; that is, the latter area would require greater amounts of energy to successfully exploit than would the former.

Archaeological sites in forested and semi-forested areas of Alberta are very often (but not exclusively) located near water bodies such as lakes, rivers, or tributary streams. An easy explanation for these occurrences is that habitations were so located for convenient access to water. However, in view of the

the discussion presented thus far, the availability of water may be only a minor consideration. Another explanation might be that these locations provided other, perhaps more important, resources.

It is a well-established ecological principal that the juncture of two or more ecozones (called an ecotone) possesses a greater density and variety of life forms than the zones lying to either side (Odum, 1965). A lakeshore or river break, for example, produces a relatively rapid succession of plant and animal communities which may potentially yield more energy (in terms of subsistence items) than either the water body or the ecosystem flanking it. Furthermore, such sites may have been occupied repeatedly throughout the annual cycle as various plants and animals became available seasonally. In many areas, lakeshore and river break localities offer an abundance of firewood and some measure of shelter from cold winds and severe winter storms. Many Native groups are known to have moved into river bottom areas during periods of severe winter weather.

A final appraisal of the archaeological potential of any given area can only be accomplished through a thorough on-the-ground archaeological survey. However, an area need not receive total coverage by the survey team. Using historical, ecological and other data as discussed above, certain parts of an area may be eliminated as being either un-inhabitable or of very low potential. The remainder may then by systematically surveyed and sites recorded at whatever intensity is deemed necessary to provide adequate coverage. The archaeological survey is considered *Phase I* of any archaeological endeavor and is a prerequisite in the normal evaluation of an area's potential.

Prehistory in Northern Alberta

Archaeological sites in Alberta are as varied and complex as the people who once inhabited them. They are at best only a partial

record of human events which occurred in the past. Generally speaking the prehistory of southern Alberta is much better known than in the north, this being a product of greater population density and consequently more intense research activity. Sites in northern Alberta are often small suggesting a very sparse Native population. These sites are usually shallow and very fragile. Unfortunately many are destroyed by industrial and urban development each year. Alberta's archaeological sites fall, unquestionably, into the category of non-renewable resources.

A brief look at *An Introduction to the Archaeology of Alberta, Canada* (Wormington & Forbis, 1965) provides an appropriate point of departure concerning the state of archaeological knowledge in the province. In short, as of 1965 the vast northeast region of Alberta represented a complete void archaeologically. In more recent years researchers have begun to move into areas of northern Alberta but relatively few sites have yet been reported north of the 55th parallel. Brief mention of those located in the north-eastern sector of Alberta may be of value in the preliminary evaluation of the Fort McMurray/Athabasca Oil Sands area.

Calling Lake Area:

Calling Lake is situated approximately 150 miles south of Fort McMurray at a point where the Athabasca River swings north toward Lake Athabasca. Seven sites were located on an extinct raised beach along the east shore of Calling Lake as a result of a survey conducted in 1966 (Gruhn, 1966). Three of these were subsequently excavated and reported during 1966-67. The lake lies within the Boreal Mixedwood Forest ecosystem of Alberta.

The first site (GhPh 103)* excavated in 1966 yielded some 350 stone tool artifacts and a collection of fish and mammal bone

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* This is a national site designation scheme known as the "Borden Designation". It is merely a shorthand code form for giving lattitude and longitude.

remains. The stone tool assemblage was interpreted as having affinities with the so-called small tool tradition of Sub-Arctic Canada (Gruhn, 1966:4). Although all of the material was contained in a single undifferentiated deposit it was concluded on the basis of differences in projectile point forms that more than one cultural assemblage was represented. Recent disturbance at the site made radio-carbon dating impossible.

Two additional sites (GhPh 106 and GhPh 107) were excavated the following year (Gruhn, 1967). These sites are situated *ca.*¼ mile apart and occupy similar positions on a former beach 4 - 5 meters above the present lake level. Unlike the previous site, GhPh 106-107 were deposited in two separate levels. The upper level at GhPh 107 contained evidence of pottery and projectile style which suggested influence from the south. In the lower level, a point type of considerably earlier origin was recovered.

Site GhPh 106 yielded no culturally assignable artifacts in the upper levels but two distinctive projectile points were recovered from the bottom of the deposit (Ibid: 2). Strangely enough, micro-blades (a tool typical of the Sub-Arctic small tool tradition mentioned earlier) were associated throughout all levels. A radio-carbon sample was collected from the upper level of GhPh 107.

Bonnyville Area:

Further east near Bonnyville, Alberta is located the Caribou Island Site (GbOs 100) situated some 20 feet above the present level of nearby Moose Lake. Excavations conducted in 1965 revealed a very crude assemblage of simple pebble tools in a former beach deposit which was buried beneath several feet of eolian sand dune deposits (Bryan, 1965: 1). Artifacts subsequently deposited atop the dune sands were estimated at 5,000 - 6,000 years old (Bonnichsen & Bryan, n.d.). Following examination of the site in 1968 by L. A. Bayrock, then of the Alberta Research Council, it was

suggested that ice fracturing may have been responsible for the crude "tool" assemblage. However, the age and origin of the simple water-worn stone tools at the Caribou Island site are still being disputed.

Lake Athabasca Area:

More recently the Archaeology Section, National Museum of Man, in Ottawa conducted a shoreline survey of Lake Athabasca in an attempt to summarize the archaeological content of this central region of the province (Wright, n.d.). Following two season's work, Wright concluded that nearly a continuous record was present in the area beginning as early as 5,000 to 6,000 B.C. with the so-called Acasta Lake Complex. The record continues through to the Reliance Complex, thought to be of historic Yellowknife Indian origin (Noble, 1971: 115).

Summary of Known Sites:

Although the roster of prehistoric sites in Northern Alberta is small, the contention regarding the occurrence of archaeological sites in proximity to water bodies is maintained. It is clear that a record of considerable time depth does exist which spans a period of at least 7,000 years. The northern region, because of its position in relation to the final retreat of the Wisconsin Age continental ice sheet, may be expected to yield sites 10,000 years old or older.

Historic Sites in Northern Alberta

Fur trade in Western Canada was dominated for the first 200 years of its existence by the British Trading Company established in the Hudson Bay. The St. Lawrence Valley trading system established by the French fell into the hands of British traders after 1760 (Nicks & Nicks, 1972: X). This new regime expanded trade relations into the Northwest and the area known today as Northern Alberta. By 1787 the regime emerged as the well-known Northwest Company which monopolized the fur trade in Western Canada for over 30 years.

By the mid-1800's numerous major and minor trading posts had been established over much of the Northwest and the newly-formed Hudson's Bay Company was extending trade well into Mackenzie River drainage. A relatively rich storehouse of information regarding various Native groups and their social and political relationships both to one another and to the White traders had accumulated by this time. Unfortunately, however, serious data gaps do exist since many events of anthropological interest were often overlooked or simply mentioned in passing. Careful archaeological research coupled with the investigation of historic records is necessary in order to correct and add detail to these omissions.

Several historic trading establishments were founded early in the development of trade in the Athabasca District. The Lake Athabasca area was for many years considered the hub of fur trading activity in the Canadian West. The presence of White traders in the district profoundly affected the lives of Natives within hundreds of miles of the centre.

Peter Pond, an independent trader and major historic figure of the fur trade era, established the first post some 40 miles south of Lake Athabasca in 1778. During his first winter, Pond retrieved furs valued at nearly 8,400 pounds sterling! The post continued to operate well into the 1780's.

Fort Chipewyan, the most important post in the Old Northwest, was established by Roderick Mackenzie (cousin of explorer Alexander) in 1778. It enjoys the status of being the oldest continuously-occupied settlement in the province. Originally a Northwest Company post, Fort Chipewyan was founded as an effort to head off Hudson Bay Company trade with the Chipewyan Indians. Slightly later, a rival post was situated a few miles west of Fort Chipewyan on the shores of Lac Claire. In 1788, Alexander Mackenzie established a fort on Lake Athabasca to serve as a basis for his trading and exploring expeditions.

Further up the Athabasca River approximately midway between Lake Athabasca and Fort McMurray, Pierre au Calumet post was erected for the sole purpose of trade in rum with the Cree (Parker, 1972: 51). The Native traders at Fort Chipewyan were apparently indifferent to the use of spiritous liquors. The Chipewyan's disinterest in barter for rum eventually led to the removal of that item of trade from the Athabasca District (Ibid.). This flurry of activity in the area involving several Native groups (i.e. Cree, Chipewyan, Slave, Beaver, etc.) has undoubtedly produced both variety and enrichment of archaeological resources in the Fort McMurray area.

The Slave, Beaver, Chipewyan and Cree had many similarities in their cultural make-up. Their subsistence at the time of the coming of the White man can be characterized as being a generalized hunting and gathering economy. This economy varied with the environmental opportunities of any particular locality. In some areas fishing was of primary importance whereas in others hare or caribou were the most important food supply (Oswald 1966: 19ff, Spencer and Jennings, et. al. 1965: 156ff).

The Cree, Slave, Beaver and Chipewyan groups were typically composed of highly mobile independent bands. These scattered bands only occasionally came together into larger units (Skinner 1911: 57, Goddard 1916: 221).

With the advent of European culture the native populations of the Boreal Forest changed their economy to one based on trapping beaver, bear, lynx and otter for their fur. The social interaction between bands itensified and gatherings became more frequent with the introduction of the fur trade. The focal point of this interaction was usually the nearest trading post (Skinner 1911: 57).

One thing is certain regarding the Native population engaged in the business of trading furs. The introduction of superior items of technology (i.e. trade muskets and steel axes) provided a degree of independance and mobility heretofore unknown to

indigenous Native groups. For example, the Historic Cree Indians were rapidly moving westward, pushing a number of tribes, including the Beaver and Slave Indians, further westward (Goddard 1916: 209, Mackenzie 1911: 195), in an attempt to expand their role as middlemen in the fur trade enterprise. In addition, the spread of contagious European-borne diseases caused serious decimation of several groups and consequent turmoil in the social and political affairs of the Natives.

3. ARCHAEOLOGICAL POTENTIAL OF SYNCRUDE LEASE #17

From the standpoint of historic site potential it seems clear that the general lower Athabasca River region was intensely involved early in the development of the fur trade economy of Athabasca District by both the Northwest Fur Company and the Hudson's Bay Company. The Athabasca River was part of a network of river routes stretching from the Peace River to the west to Hudson's Bay to the east. In particular, the Clearwater River which empties into the Athabasca River at Fort McMurray was a major artery for east-west travel for early fur trappers (Hitchon 1967: 296).

The Beaver Creek has long been an area utilized by trappers and a well established trappers' trail was noted on the Beaver Creek near the beginning of this century (Ells 1926: 36). Until very recently, trapping was still carried out on Lease #17. Two trappers' cabins were located on the lease. One was on the bank of the Athabasca River just east of Horseshoe Lake and the other was located on the Beaver Creek between two tributary streams just north of the 24th base line. The cabin on the Beaver Creek was destroyed before the beginning of the survey by exploratory mining excavations.

The fact that the Pierre au Calumet post was especially maintained for trade in rum with the powerful Cree middlemen presents the possibility of distinguishing Cree from indigenous Indian settlements (e.g. on the presence or absence of discarded rum bottles or casks). Other diagnostic culture traits might then be followed backwards in time to trace the beginnings of the westward Cree expansion. Sites ranging from short stopover camps to semi-permanent Native settlements peripheral to nearby trading establishments present a high potential for discovery in the area.

Ecologically the area encompassed by Lease #17 may have

been a productive fur trapping zone during the fur trade era. Beaver are reported in the upper drainage of the Beaver River (R.R.C.S., 1972). Beaver pelts prepared for trade represented the currency during much of the period. It is difficult to establish how numerous the animal may have been in the past. Since Canada's waterways fast became its first highways during the early historic period, trappers camps, Native habitations or the remains of an undocumented trader's post may be expected to occur almost at any point with easy access to the river.

The potential for the occurrence of prehistoric sites requires closer scrutiny of the regional ecology. The regional ecological regime of the area may be considered highly variable representing no less than a dozen important habitat types (R.R.C.S. 1972. Map 1). Among the most important of these are the moose habitats which constitute both the summer and winter range. The river break zone is an especially critical area in terms of the latter period. Moose are known to have been the primary food resource for indigenous pre-contact Northern Native groups much as the buffalo was for the southern Plains groups.

Secondary food resources of the Native Albertans include woodland caribou, rabbit (hare), fish, muskrat, beaver, porcupine and various avian species such as waterfowl and grouse. Nearly all of these are currently present in the Lease #17 area or were in the recent past. Various wild berries such as those reported in the Mildred Lake area were also utilized particularly in the production of pemmican. Fishing may be regarded as the most important summer occupation by nearly all northern Natives. Both the Athabasca and Beaver Rivers and perhaps also Mildred Lake could have supplied the Natives with an ample quantity of fish.

Areas of Priority

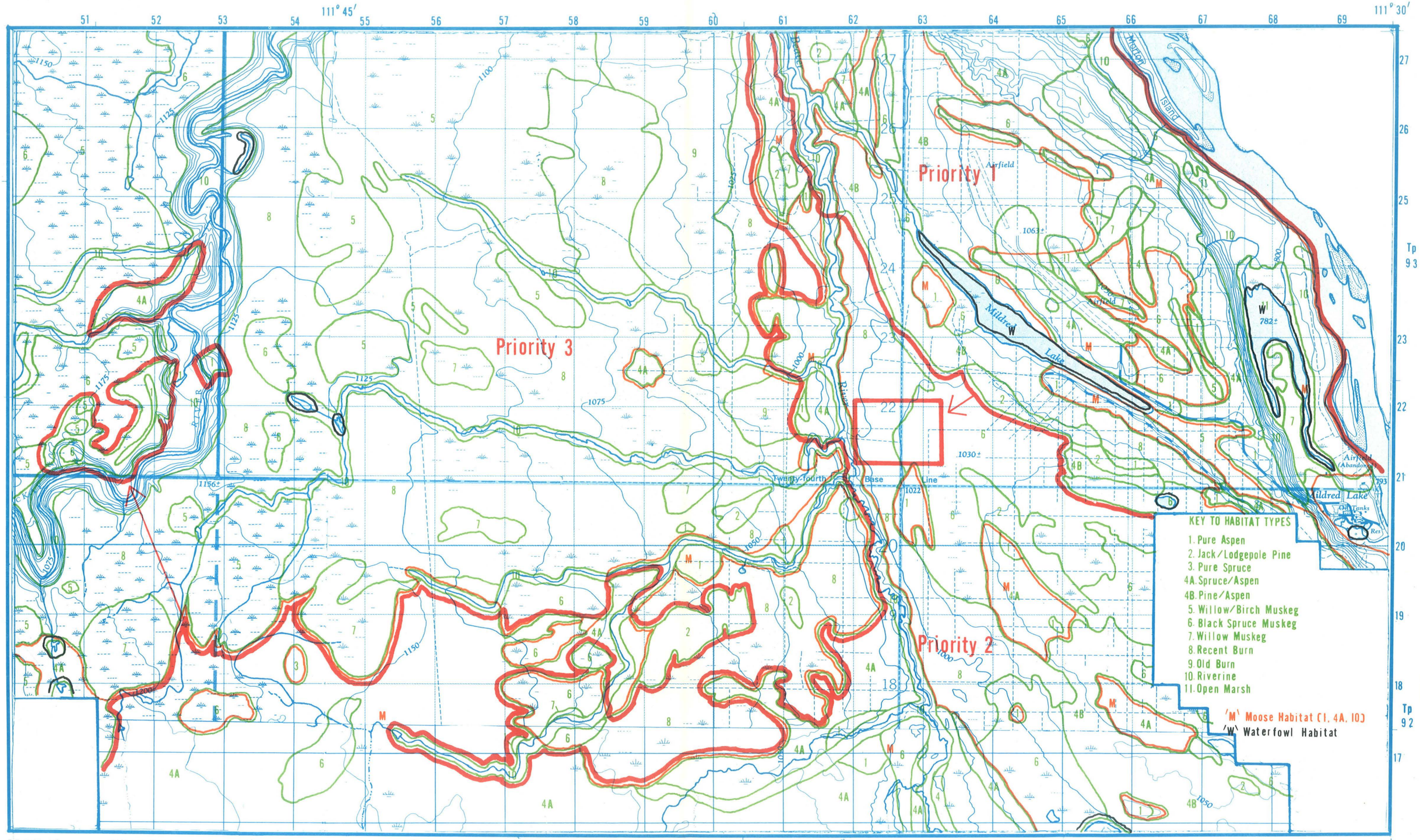
Overall, the greatest habitat variability occurs in the

eastern half of Lease #17. Of particular interest is the area separating Mildred Lake and the Athabasca River and designated Zone 5, Travel Influence Zone (R.R.C.S. 1972, Map 1). The relatively high relief of this area forms a natural causeway which extends from the Athabasca River near Horseshoe Lake northwest toward Mildred Lake and beyond through an otherwise impassable muskeg zone. It has been noted elsewhere (Losey, 1973) that extensive ridges of this nature not only influence human travel but that of other animals as well. Frequently, aboriginal hunting camps are located in these areas to take advantage of animal movements.

The importance of wild berries collected seasonally has already been mentioned. The possibility that Mildred Lake in prehistoric times was endowed with an exploitable fish population cannot be discounted. Waterfowl are reported to frequent the lake during spring and fall migrations. Thus in this limited area of less than 25 square miles nearly all of the known primary and secondary Native food sources are available during some part of the annual cycle. Consequently, this area should be rated *Priority 1* regarding its archaeological potential (see Map 1).

The remainder of the eastern portion of Lease #17 (excluding the area described above) is less varied but important primarily as moose habitat. Since much of this zone is surrounded by muskeg, hunting forays penetrating west from Mildred Lake would necessarily be undertaken only in winter. For various reasons, aboriginal winter camps of short duration are very rarely preserved in the archaeological record. The area between the Beaver and Athabasca Rivers south of Mildred Lake is considered of less importance archaeologically and may be given a *Priority 2* designation (Map 1).

The entire area west of the Beaver Creek except for isolated areas along its banks because of its extreme low relief and poor drainage may be considered least important of the entire area. The small stretch of the MacKay River which traverses the northwestern section of Lease #17 is also deemed an area of rather low potential



MAP 1 — PRIORITY AREAS 1, 2 and 3 on LEASE 17

SCALE 1:50.000

except perhaps as a travel route through the country. The river was apparently an important secondary waterway during the fur trade period. The area encompassing approximately 35 square miles west of the Beaver Creek may be rated *Priority 3* in archaeological potential.

Assuming that the proposed "retention pond area" would be the first to be affected by development of Lease #17, the area peripheral to Mildred Lake between the Beaver and Athabasca Rivers retains its *Priority 1* rating. Especially critical would be the travel influence zone (Zone 5) which has already been partially disturbed by road and airfield construction. This area should receive immediate attention in order to salvage any sites which may have been damaged.

The area rated *Priority 2* will be largely unaffected initially with the exception of the "Plant Site" itself and its construction. This area (*ca.* 4 sq. mi.) should be moved into the *Priority 1* classification.

The large tract of muskeg extending west from the Beaver Creek to the western boundary of Lease #17 except for the isolated areas along the banks of the creek may retain its *Priority 3* rating (see Map 1). The areas designated as habitat types 1, 2, 4A and 4B (R.R.C.S. 1972) may be moved into the *Priority 2* category because of their importance concerning the availability of Native food resources.

Summary

The area enclosed by the boundary of Syncrude Lease #17 was divided into three segments according to their archaeological potential. Archaeological potential was based on a consideration of (1) the possible occurrence of historic period sites resulting from the increased human activity in the Athabasca District and (2) the availability of required Native subsistence resources known for the area. Priority ratings were assigned with reference to the

above with the additional consideration of proposed development within the Lease #17 area. The priority ratings are summarized as follows:

Priority 1

The northeast segment of Lease #17 bounded on the east by the Athabasca River, on the west by Beaver Creek, and on the south by a large musket tract. The "plant site" (see Map 1) was included due to damage which will occur as a result of construction activity.

Priority 2

The southeast segment of Lease #17, east of Beaver Creek, primarily muskeg zone but includes some potential human habitat and resource areas. This area also includes isolated habitat west of Beaver Creek with some potential.

Priority 3

The remainder of the Lease #17 area consists primarily of muskeg zone and was probably accessible aboriginally only in winter due to low relief and poor drainage. This segment lies west of Beaver Creek and is bounded on three sides by the limits of the lease.

PART II

ARCHAEOLOGICAL SURVEY

OF

ATHABASCA TAR SANDS LEASE #17

1. INTRODUCTION

For the purpose of this report, an archaeological site may be defined as a collection of one or more discrete areas which represent differing kinds of activity originating from past human behavior. Simple sites may be characterized by the occurrence of houses, pits, and work areas whereas more complex sites may possess the remains of palaces, temples, aqueducts, etc. (Hole & Heizer, 1969: 314). Archaeological remains attributed to the prehistoric period in Northeastern Alberta often consist of only stone and bone tools, chipping detritus and other bi-products of tool manufacture, and the remains of animals utilized for subsistence. Evidence of cooking in the absence of pottery or other vessels is usually indirect. Such evidence may consist merely of fragments of fire-cracked-rock or boiling stones, burned animal bone, or occasionally, charcoal.

The archaeological survey for sites on Syncrude Lease #17 entailed a search for remains such as those mentioned above. However, since the area in question constitutes an archaeological "unknown", the recovery of even a single artifact represents evidence of past human activity and, therefore, also of a *potential* archaeological site. A single artifact has no value in itself but is a clue to the possible presence of archaeological remains. It is the relationships *between* artifacts found exactly as they were abandoned hundreds or even thousands of years ago which have archaeological value.

Exploratory excavation or "testing" as it is sometimes called, of a presumed archaeological site is designed to assess the potential of the remains with reference to the criteria stated above. Obviously, a site disturbed by grazing, erosion, or construction has less value in terms of recoverable information than an

undisturbed deposit. Archaeological testing, then, is conducted with the intention of discovering additional material in an undisturbed context so that areas of activity, e.g. cooking, tool making, or butchering, can be recognized and their relationships to one another may be assessed.

The Setting

Tar Sands Lease #17 is located between the MacKay and Athabasca Rivers approximately 20 miles north of the town of Fort McMurray in northeastern Alberta. The lease is roughly rectangular in outline, being nearly 7 miles from the south to north boundary and 12 miles from its eastern to its western extremities. An additional piece of land which adjoins the northern boundary of Lease #17 is included in the development plan of Lease #17. This area has been designated the addition to Surface Lease #352. This piece of land is rectangular, about 2.5 miles long and 1.5 miles wide.

The major geographic features on the lease are the west bank of the Athabasca River, a small portion of the MacKay River, a fairly large section of the Beaver Creek, Horseshoe Lake and Mildred Lake. The Beaver River flows south to north, somewhat east of the center of the lease. Mildred Lake lies between the Beaver River and the Athabasca River. Mildred Lake is about 3 miles long and .5 miles wide at its widest point. Horseshoe Lake lies next to the Athabasca River and is about 2 miles long and as its name implies, is shaped like a horseshoe. The very northernmost tip of Ruth Lake also extends over the southern boundary of Lease #17, although the major part of this Lake lies south of the lease.

The exposed geological deposits on the lease are dominated by the massive outcrop of Cretaceous tar sand referred to as the McMurray Formation. This deposit has exposed thicknesses of up to

150 feet. These sediments are often overlain by Cretaceous shales and thin interbedded sandstones (Ells 1926: 18-19, 39).

Beneath the tar sand are shales and limestones of Devonian age. Near the mouth of the Beaver Creek and along the Athabasca River, these limestones are exposed and usually of "hard massive bands alternating with rubbly and highly argillaceous strata" (Ells 1926: 18).

Lease #17 lies in the boreal mixed wood forest. On the lease itself there are nearly a dozen different plant community types including Aspen, Jack Pine, Spruce, Willow Birch Muskeg, Spruce/Aspen, Jack Pine/Aspen, Black Spruce Muskeg, Willow Muskeg and Open Marsh.

The variety of habitats on the lease provides food and cover for a large variety of wildlife. Moose, deer, black bear, wolf, coyote, hare, lynx, grouse, ducks, beaver, buffalo, and muskrats were or now are abundant on some parts of the lease.

Procedure

In the preliminary analysis of Lease #17 it was found that the greatest variability in habitat occurs in the northeastern half of the lease, between the Beaver Creek and the Athabasca River. For this reason it was given a Priority 1 classification. The southeastern portion of the lease has somewhat less varied habitat and was therefore given a Priority 2 classification. The remainder of the lease mainly consists of muskeg and lies west of the Beaver Creek. This area was given a Priority 3 classification because it would only be accessible aboriginally in the winter and because such winter sites would likely not be preserved.

The archaeological survey was conducted using the above priorities as a guide for scheduling work to be done. The survey schedule included the Mildred Lake shore, the Beaver Creek, the area

between Mildred Lake and the Beaver River, the west bank of the Athabasca River, the area between the Athabasca River and Mildred Lake, and finally the remaining localities with some potential human habitat or resource.

The addition to Surface Lease #352 was also surveyed. This area covered a northern portion of the Beaver Creek. It was surveyed because it will be disturbed by the northern portion of a proposed retention pond to be built on Lease #17.

2. THE SITES

METHOD OF SITE DESIGNATION

Archaeological sites found on Lease #17 were numbered beginning with the number one. The coordinates of each site are given with the use of the one thousand meter "Universal Transverse Mercator Grid". In all cases the sites on the lease are given coordinates from the Fort MacKay 1:50,000 topographic map designated 74E/4E.

A total of 28 sites were found on Lease #17 and the addition to Surface Lease #352. Of these 13 were thought to be sufficiently important to warrant the careful excavation of test pits in them. Subsequently 49 test pits were excavated into these 13 sites. In addition a large number of test pits were excavated in other areas thought to have some archaeological potential.

Generally two types of soil conditions confronted the excavators (Photograph #1 and #2). The first was a thin layer of medium sand overlying a layer of course sand and gravel or tar sand. The second was thick, many times somewhat duned, medium sand layer of unknown depth. A third soil type was found at only one site (site No. 7). This consisted of a thick top layer of sand with a very high content of silt. This site owes its uniqueness to the fact that it is the only site found on the primary flood plain of the Beaver Creek.

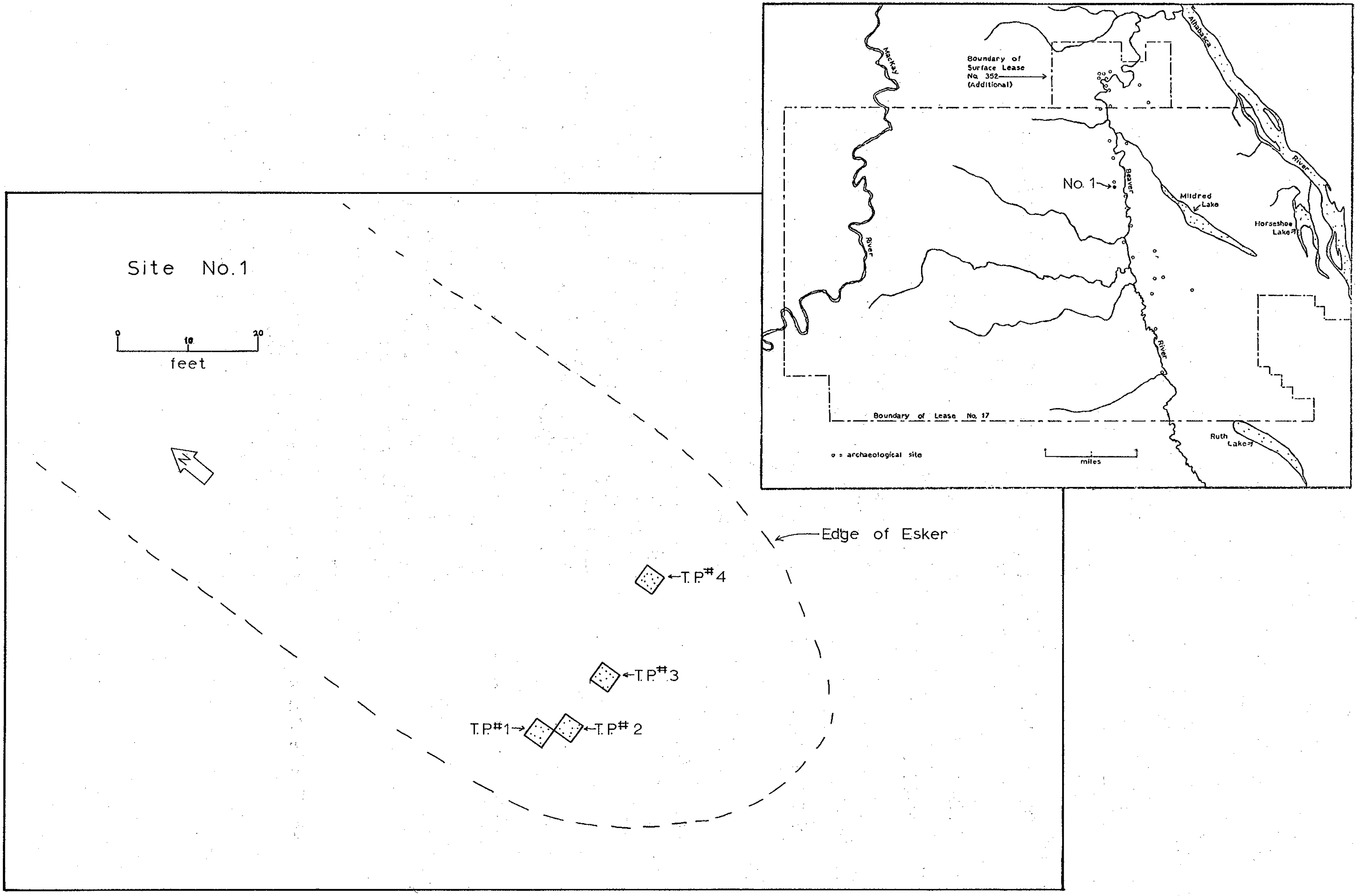
Photograph of soil profile of Site #8. This profile shows a thin medium sand layer covering a coarse sand and gravel layer.

Photograph of soil profile of Site #26. This profile shows a thick duned layer of medium sand.

SITES TESTED

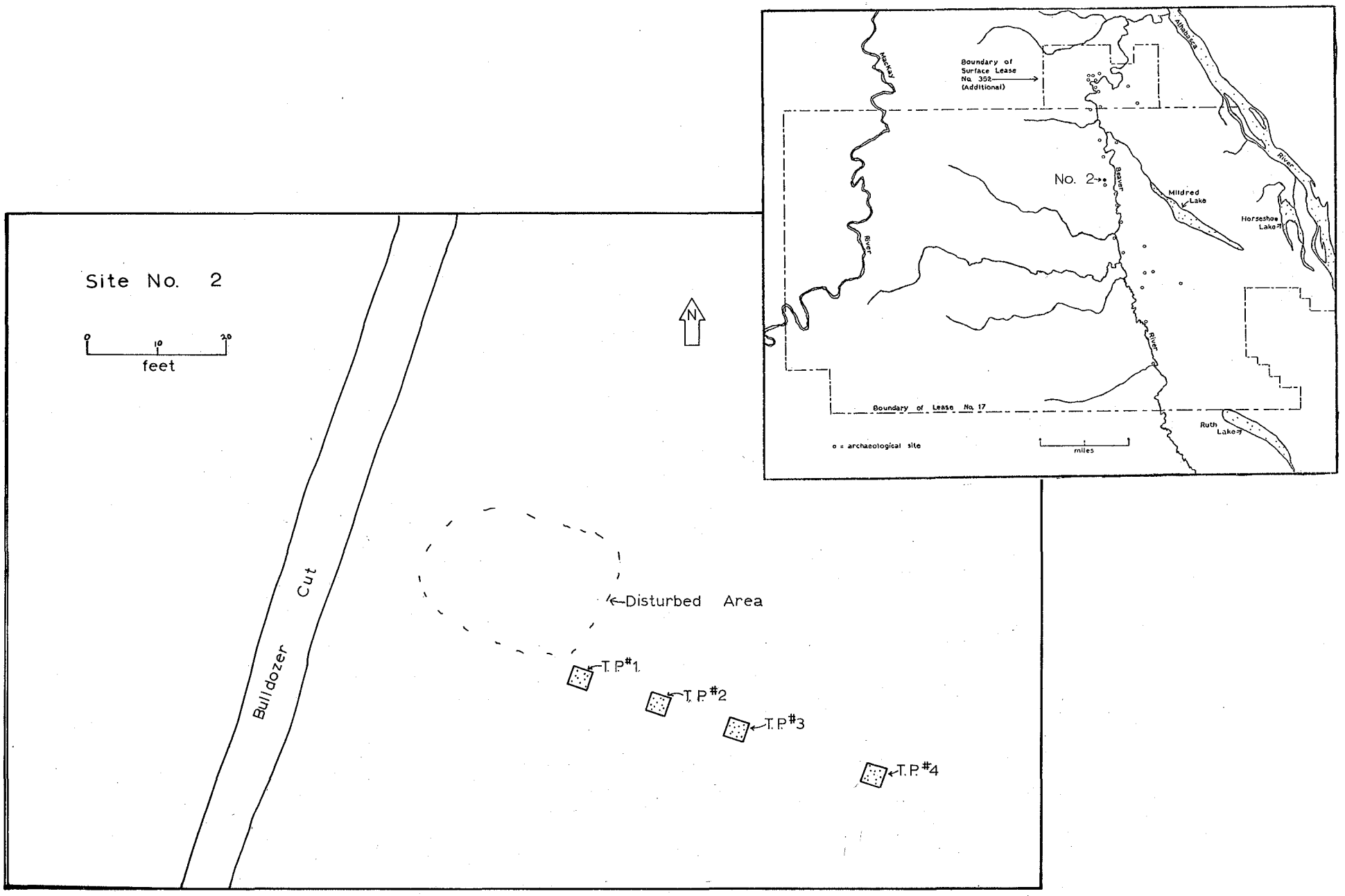
SITE NO. 1

SITE COORDINATES:	613E 245N in the NE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	The site is situated on an esker .4 miles south of a gravel pit on the west side of the Beaver Creek and 2.85 miles from (south) the Fort MacKay Road.
HABITAT TYPE:	A Spruce/Aspen community covers the esker while a Willow/Muskeg is directly adjacent to the esker to the west.
DESCRIPTION:	This is an open site of limited content, suggesting that it was a camp site of short duration. The soil consists of a shallow sandy layer covering the poorly sorted alluvium of the esker. The artifact came from the top of the sandy soil.
WORK DONE AT SITE:	Four 3 x 3 foot test pits were excavated in the south end of the esker to a depth of 6 inches. The test pits were arranged in an east/west transect across the esker. An examination of the surface of the site was made and the site was mapped and photographed.
ARTIFACTS RECOVERED:	One gray chert artifact was found that was bifacially worked on one edge and flaked unifacially over one entire surface. This artifact was found in test pit #1 at a depth of 4 inches.


Site No.1
0
10
20
feet
N
Edge of Esker
T.P.#4
T.P.#3
T.P.#1
T.P.# 2
Boundary of Surface Lease No. 352 (Additional)
Mackay
River
Athabasca
River
No. 1
Beaver
River
Mildred Lake
Horseshoe Lake
Boundary of Lease No. 17
Ruth Lake
o = archaeological site
miles

SITE NO. 2

SITE COORDINATES:	613E 247N in the NE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	The site is located in a flat clearing with the only topographic feature of any significance in the vicinity being the esker on which site #1 is situated, to the south.
HABITAT TYPE:	The site is covered by scattered Aspens and is very close to the edge of the Willow Muskeg to the west. The site is within the boundaries of a Spruce/Aspen community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp of short duration. The soil consisted of a shallow medium sand covering a very coarse gravel. The artifact was found in the upper medium sand. The site was disturbed slightly by a bulldozer running over its surface.
WORK DONE AT SITE:	Four 3 x 3 foot test pits were excavated to the top of the coarse gravel (about 6 to 8 inches). The test pits were arranged in a transect running in an east/west direction just south of the disturbed area where the artifact was found. An examination of the surface of the site was made and the site was mapped and photographed.
ARTIFACTS RECOVERED:	A chi-thos was discovered in the disturbed area at this site. This artifact was made of a relatively thin piece of metamorphic rock which was shaped by having its edges trimmed.

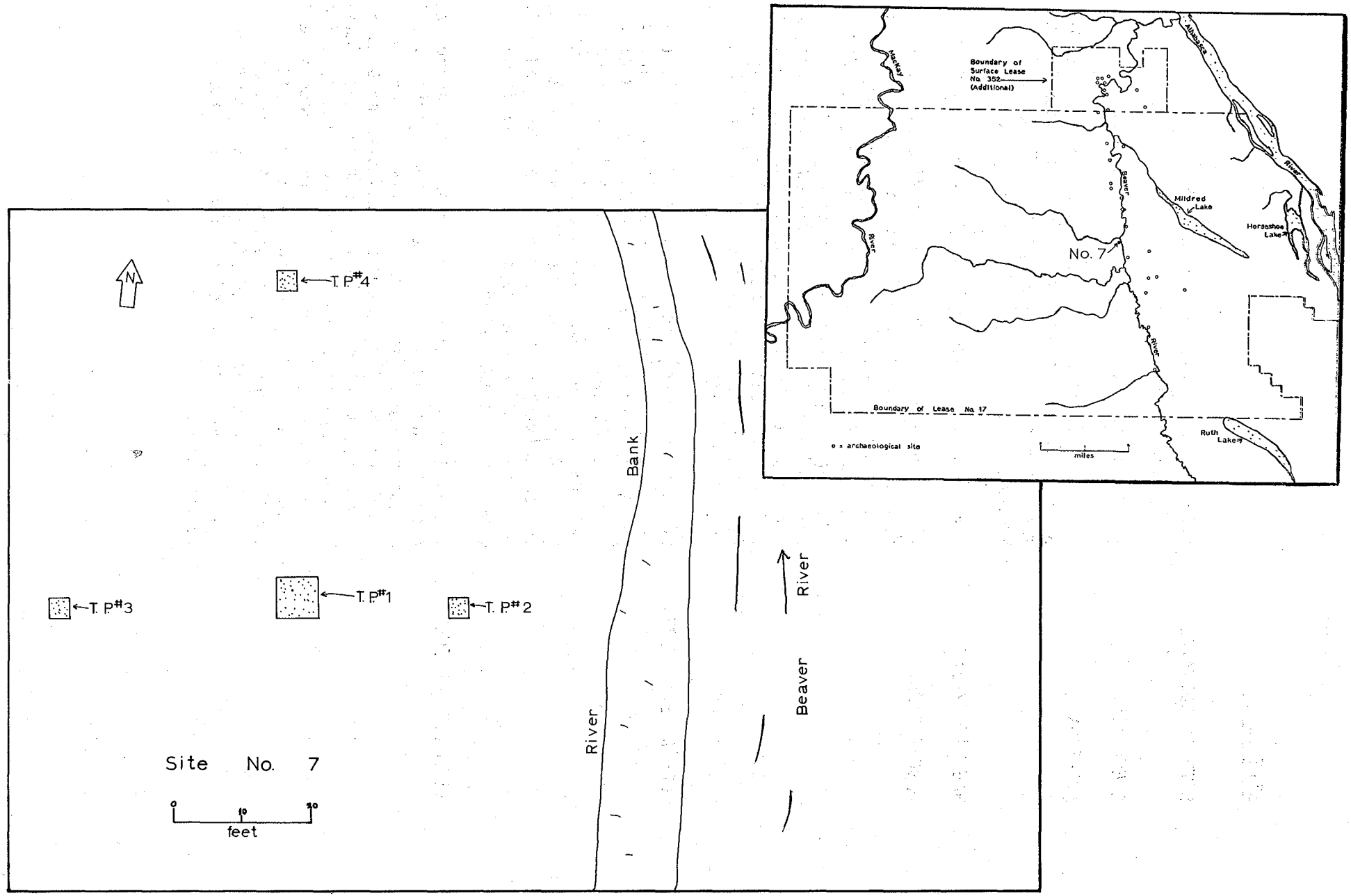

Site No. 2
0
10
20
feet
N
Bulldozer Cut
←Disturbed Area
←T. P. #1
←T. P. #2
←T. P. #3
←T. P. #4
Boundary of Surface Lease No. 352 (Additional)
Mackay River
Athabasca River
Beaver River
Mildred Lake
Horseshoe Lake
Ruth Lake
No. 2
Boundary of Lease No. 17
o = archaeological site
miles

Photograph of Site #1 looking west.

Photograph of Site #2 looking east.

SITE NO. 7

SITE COORDINATES:	616E 225N in the SE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on the west bank of the Beaver Creek, 50 to 100 yards south of the confluence of a small stream with the Beaver Creek. The site is situated on the primary creek terrace within 30 yards of the creek and about 10 feet above the normal water level.
HABITAT TYPE:	The site was covered by a Spruce/Aspen community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp site of short duration. The soil is a very silty sand with apparently considerable depth. As near as can be determined, the artifacts came from the upper 6 inches of the soil. The site has been disturbed over its entire surface by bulldozing.
WORK DONE AT SITE:	Three 3 x 3 foot test pits and one 6 x 6 foot test pit were excavated from 6 to 12 inches below surface. The test pits were arranged with the large pit in the center and the 3 smaller pits located east, north and south of it. A surface collection was made and the site was mapped and photographed.
ARTIFACTS RECOVERED:	One black chalcedony scraper, 1 gray limestone flake scraper, 3 quartzite flakes, 5 quartzite flake fragments and 4 chert flake fragments were found on the surface of this site.


N
T. P.#4
T. P.#3
T. P.#1
T. P.#2
Site No. 7
0
10
20
feet
Bank
River
Beaver
River
Boundary of Surface Lease No. 352 (Additional)
Mackay
River
Athabasca
River
Beaver
River
Mildred Lake
Horseshoe Lake
No. 7
River
Boundary of Lease No. 17
Ruth Lake
o = archaeological site
miles

SITE NO. 8

SITE COORDINATES: 612E 262N in the SW 1/4 of the NW 1/4 of Township 93, Range 11.

ELEVATION: Approximately 950 feet above sea level.

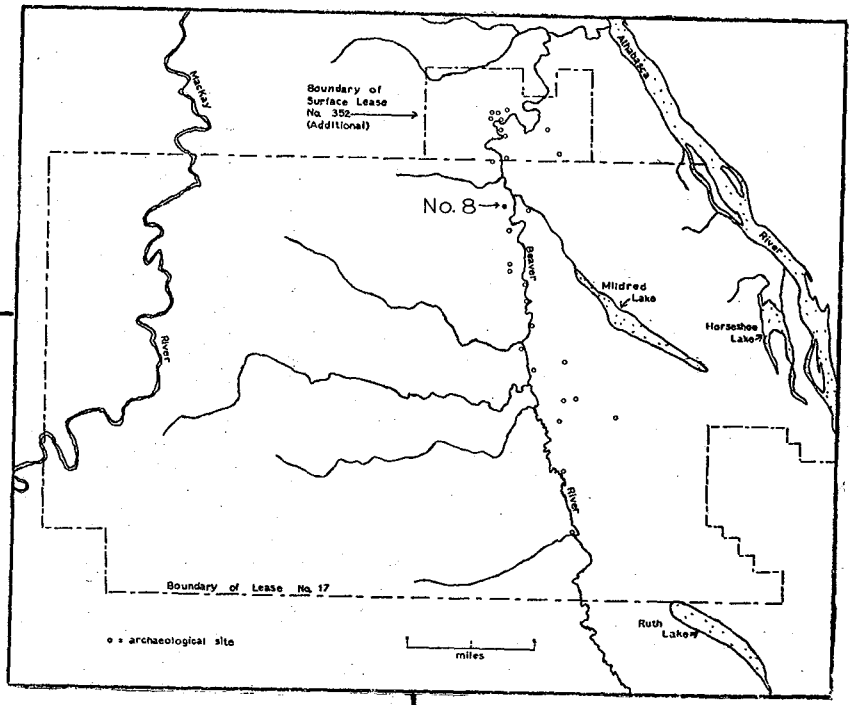
LOCATION: This site is located about 300 yards west of the Beaver Creek on the south side of a small stream where a road crosses the stream. The site is exactly 2 miles south of the Fort MacKay Road.

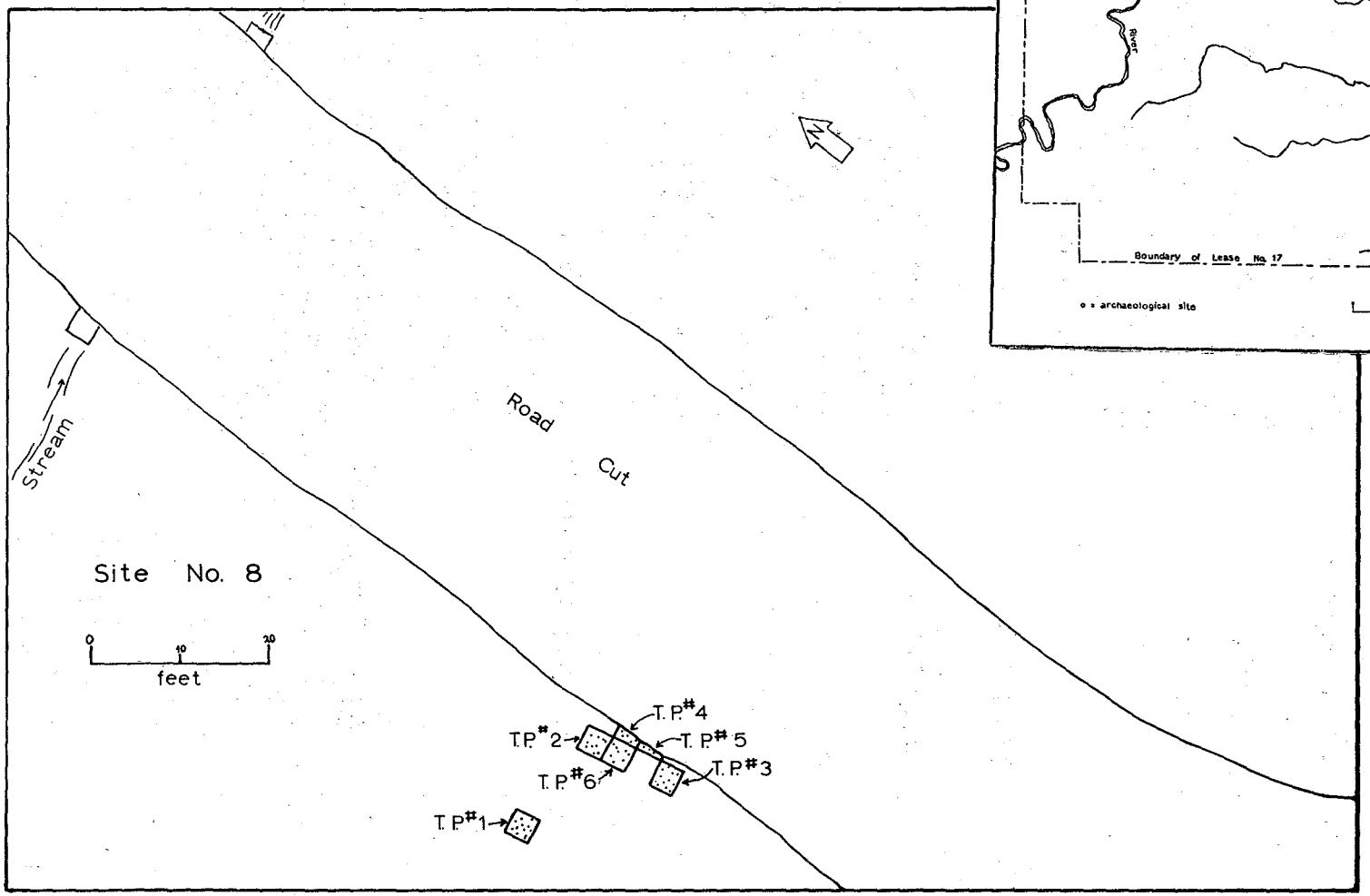
HABITAT TYPE: The site is covered with a Spruce/Aspen community.

DESCRIPTION: This site contained large quantities of flaking debris of the same type of material which suggests that it was a workshop where implements were fashioned from raw material. The soil consists of a layer of medium sand overlying a coarse sand and gravel bed. The artifacts were concentrated in the area 6 to 8 inches below the surface of the ground. The site has been almost completely destroyed by the construction of the road that runs through it.

WORK DONE AT SITE: Six squares were excavated to a depth of 12 inches below surface. Test pits #4 and #5 were excavated on the edge of the road cut so they were 3 feet long and varying from 6 inches to 2 feet wide. The rest of the test pits were 3 feet square. The test pits were all arranged around the area where cultural material was coming out of the road cut. A surface collection was made and the site was mapped and photographed.

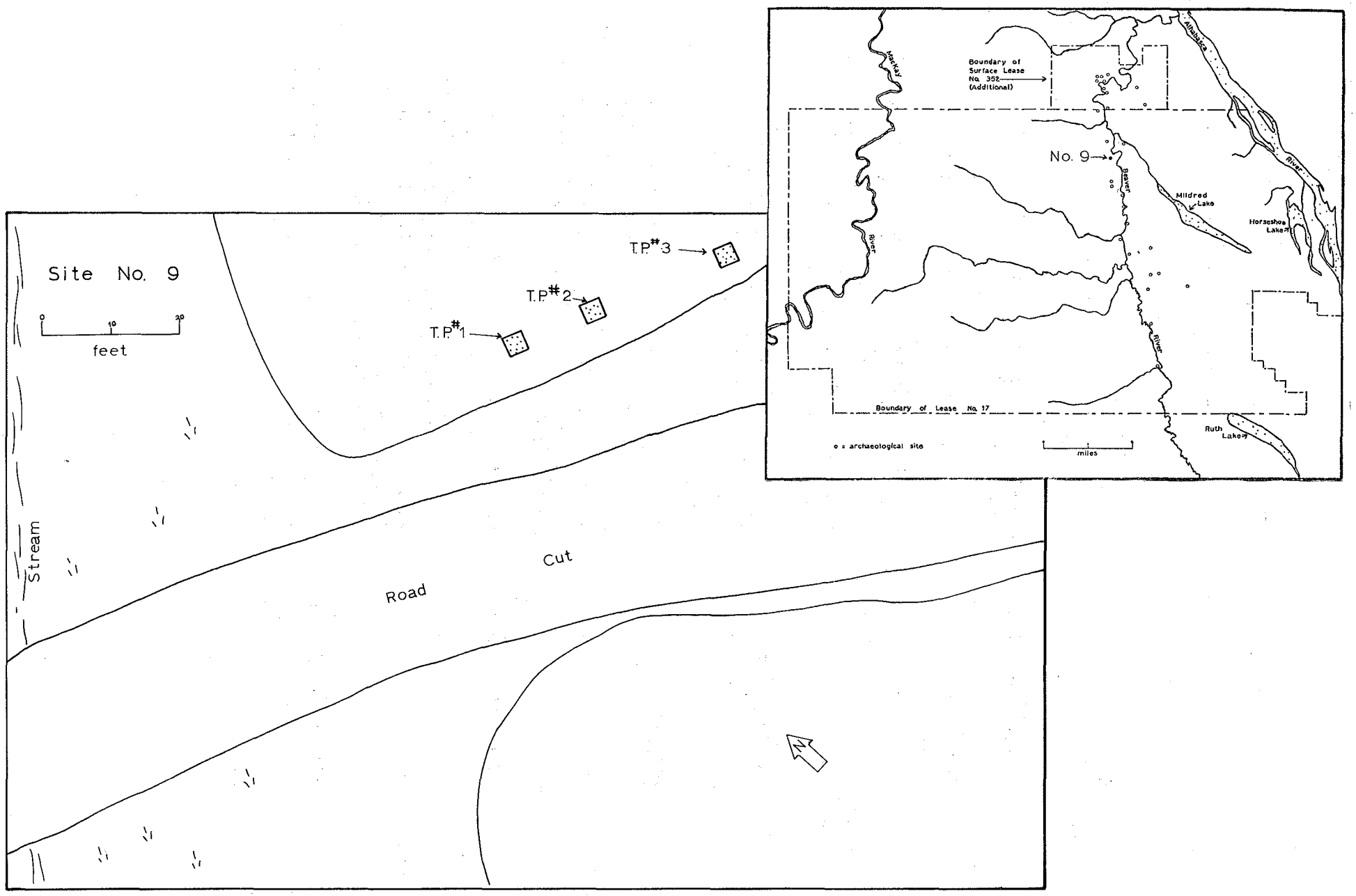
ARTIFACTS RECOVERED: The surface collection yielded one chalcedony flake, 6 chert flake fragments, 5 limestone flakes and 10 limestone flake fragments. In test pit #3 one limestone core fragment was found between 0 to 6 inches below surface. In test pit #5 seven flakes, 2 flake fragments, and 3 pieces of shatter, all of limestone, were found between 0 to 12 inches below surface. In test pit #4 one piece of chert shatter, 46 flakes of limestone, 6 pieces of shatter of limestone and 360 flake fragments of limestone were found between 0 and 12 inches below surface.


Mackay River
Boundary of Surface Lease No. 352 (Additional)
No. 8
Beaver River
Athabasca River
Mildred Lake
Horseshoe Lake
Boundary of Lease No. 17
Ruth Lake
o = archaeological site
miles


Stream
Road Cut
Site No. 8
0
10
20
feet
T. P. #4
T. P. #2
T. P. #5
T. P. #3
T. P. #6
T. P. #1

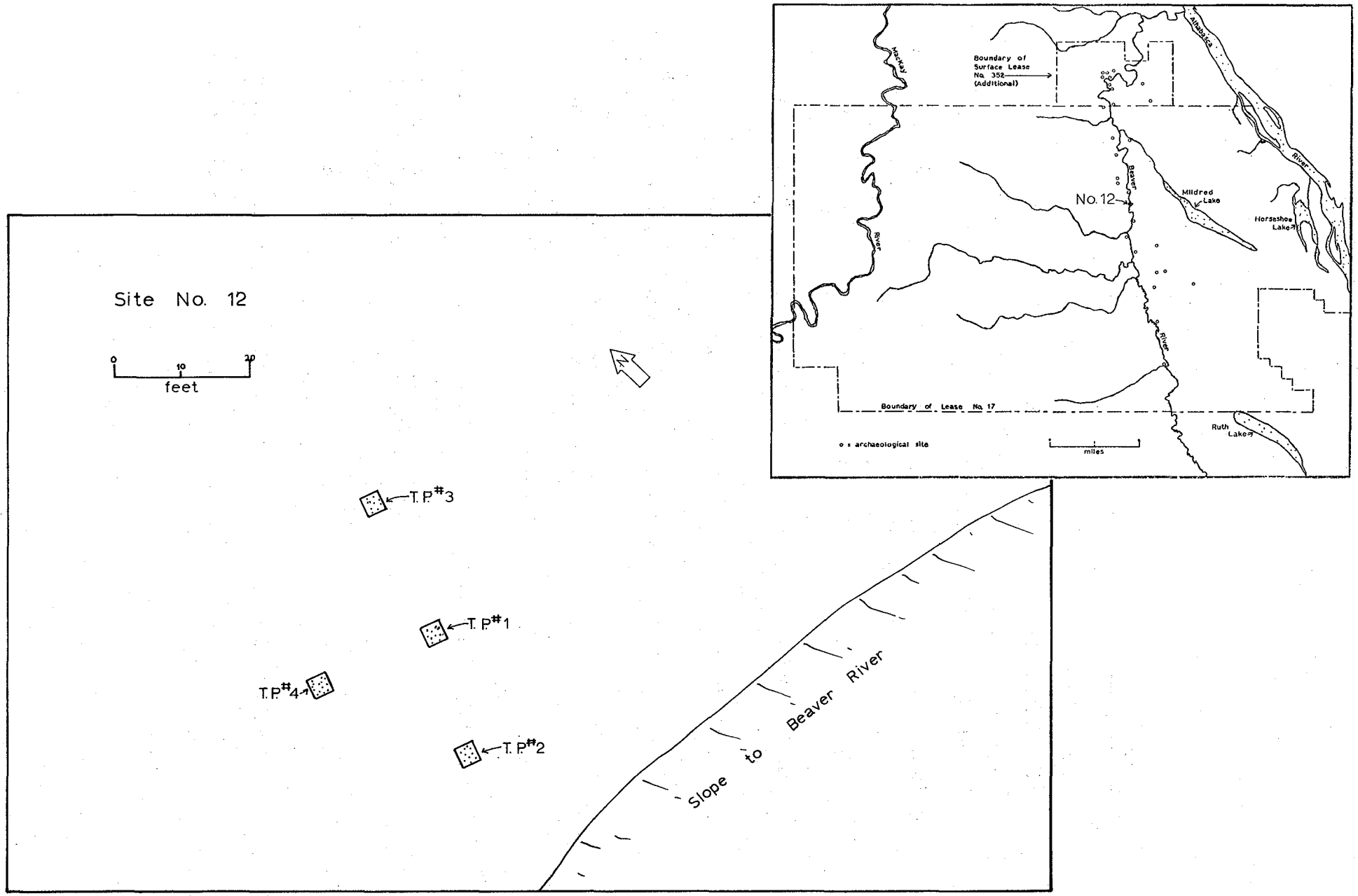
SITE NO. 9

SITE COORDINATES:	613E 255N in the SW 1/4 of the NW 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located about 300 yards west of Beaver Creek on the south side of a small stream where the road crosses the stream. The site is exactly 2.45 miles south of the Fort MacKay Road.
HABITAT TYPE:	The site is covered with a Spruce/Aspen community.
DESCRIPTION:	This site contained a quantity of flaking debris of the same type of material which suggests that it was a workshop where implements were fashioned from raw material. The soil consists of a layer of medium sand overlying a coarse sand and gravel bed. The artifacts were, as near as can be determined, in the upper portion of the sand layer. The site has been almost completely destroyed by the construction of the road that runs through it.
WORK DONE AT SITE:	Three 3 x 3 foot test pits were excavated on the east side of the road just south of the small stream. The test pits were arranged in a line parallel to the road cut. A surface collection was made and the site was mapped and photographed.
ARTIFACTS RECOVERED:	Four gray quartzite flakes and 4 gray quartzite flake fragments were found on the surface of this site.


Site No. 9
0
10
20
feet
T.P.#3
T.P.#2
T.P.#1
Stream
Road
Cut
N
Boundary of Surface Lease No. 352 (Additional)
No. 9
Mackay River
Athabasca River
Beaver River
Mildred Lake
Horseshoe Lake
Ruth Lake
Boundary of Lease No. 17
o = archaeological site
miles

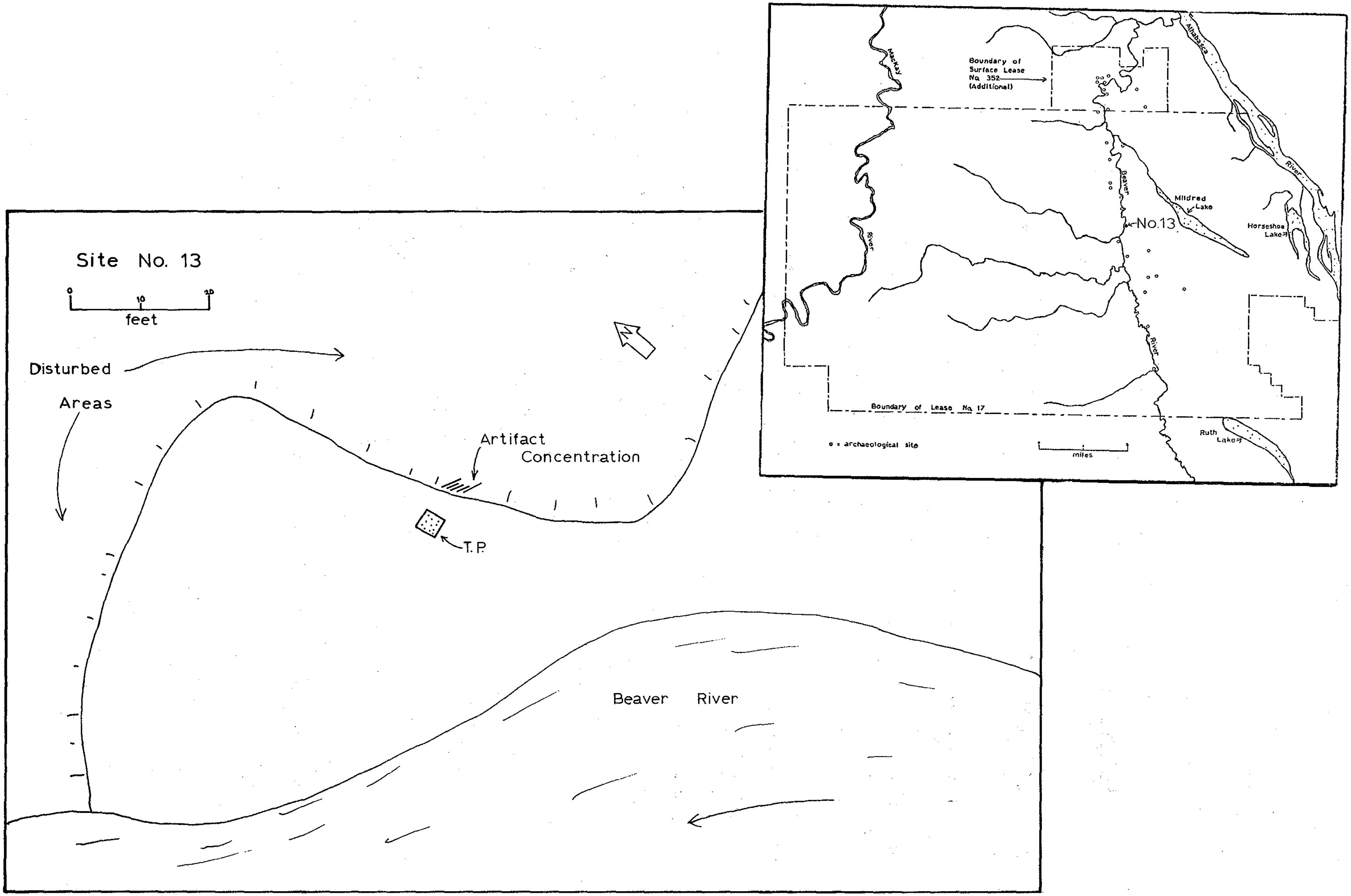
SITE NO. 12

SITE COORDINATES:	618E 237N in the NE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	The site is located on the west side of the Beaver Creek at a point where there is a sharp bend in the creek. The site is situated on top of a 25 foot bank which has a steep slope to the water's edge.
HABITAT TYPE:	The top of the bank where the site is located is covered with Jack Pine and the site is situated within the limits of a Jack Pine/ Aspen community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp of short duration. The soil is a medium sand overlying an outcrop of Cretaceous tar sand. The artifact came from the upper portion of the medium sand.
WORK DONE AT SITE:	Four 3 x 3 foot test pits were excavated to a depth of one foot. Three of the test pits were arranged in a line perpendicular to the creek while the fourth test pit was excavated to the west of the other three. A surface collection was also made and the site was mapped and photographed.
ARTIFACTS RECOVERED:	One quartzite flake was found at this site in test pit #1 at a depth of approximately 6 inches.


Site No. 12
0
10
20
feet
T.P.#3
T.P.#1
T.P.#4
T.P.#2
Slope to Beaver River
Boundary of Surface Lease No. 352 (Additional)
Hockay
River
Athabasca
River
Beaver
River
No. 12
Mildred Lake
Horseshoe Lake
Ruth Lake
Boundary of Lease No. 17
o = archaeological site
miles

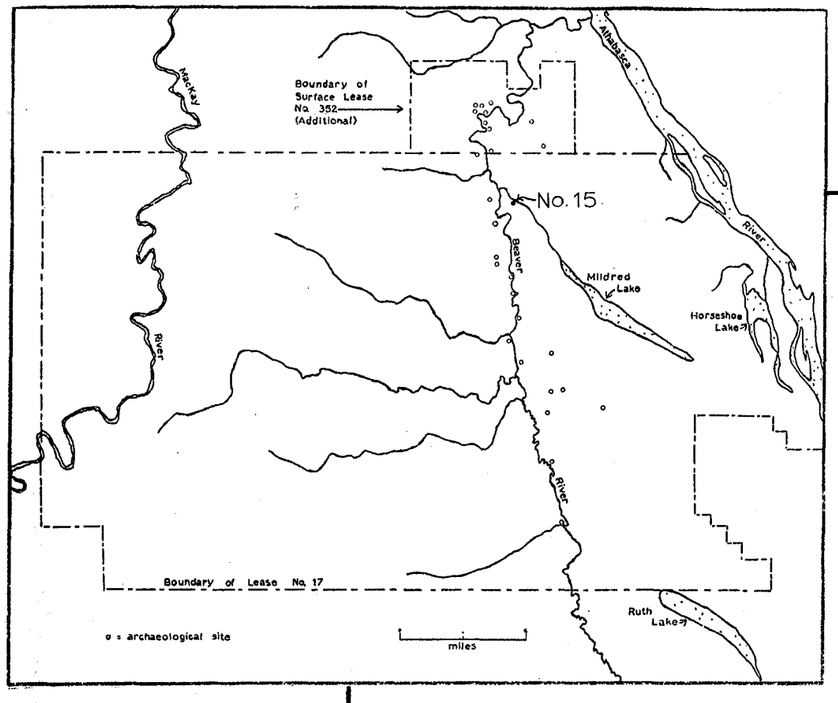
SITE NO. 13

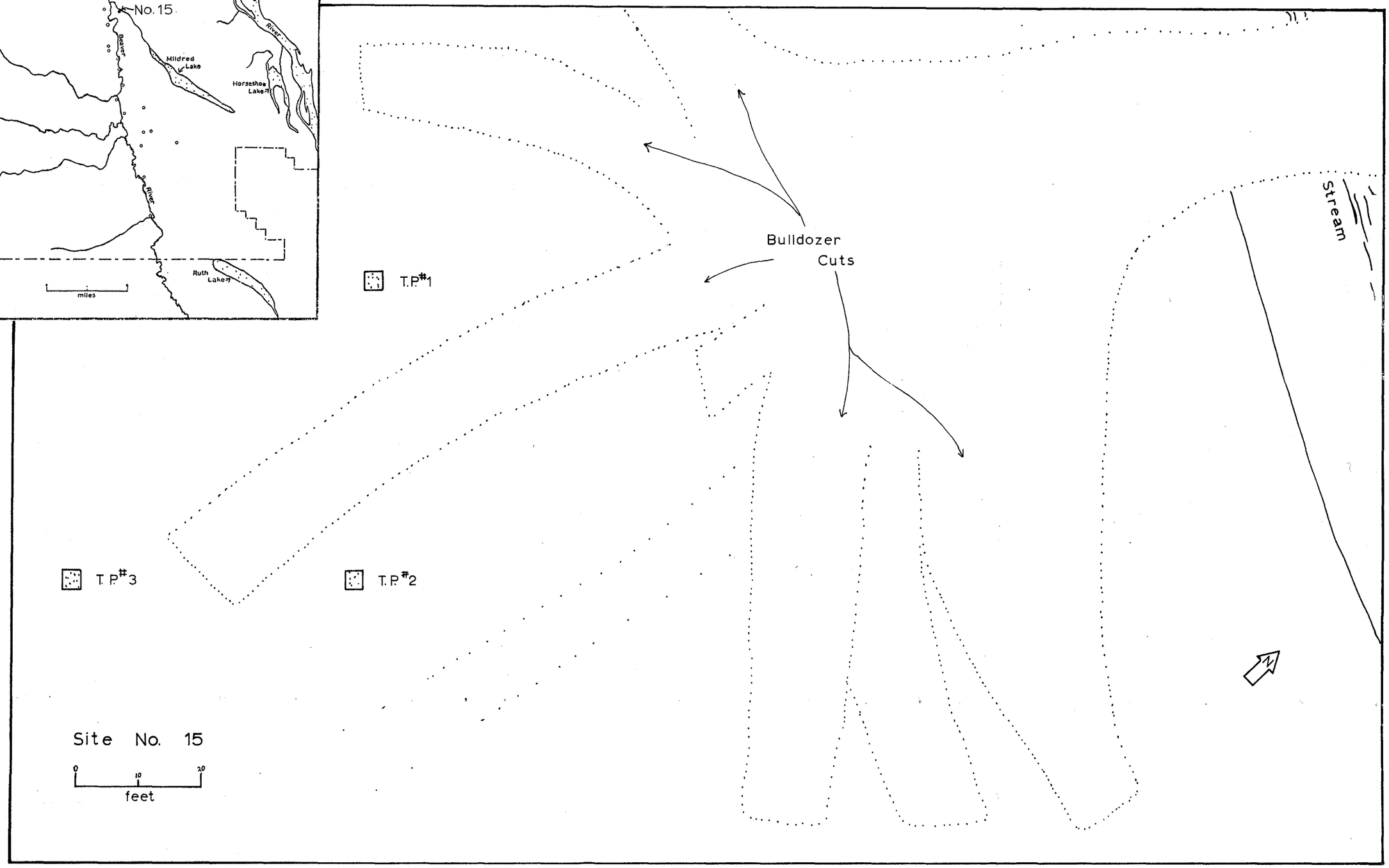
SITE COORDINATES:	618E 231N in the SE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on a piece of high ground on the east side of the Beaver Creek. The site is approximately 15 feet above the normal water level in the creek and approximately 27 feet from the water's edge.
HABITAT TYPE:	The site was covered by Jack Pine in an area which has been recently burned.
DESCRIPTION:	This site contained a large quantity of flaking debris of the same type of material which suggests that it was a workshop where implements were fashioned from raw material. The soil consists of a thin layer of medium sand overlying an outcrop of shale. The artifacts are believed to have come from the upper portion of the sandy soil. The site has been completely destroyed by bull-dozing.
WORK DONE AT SITE:	One 3 x 3 foot test pit was excavated to the top of the shale (about 6 inches). The test pit was excavated between the river and the disturbed area where the cultural material was found. A portion of the disturbed area was also excavated and put through a screen. A surface collection was made and the site was photographed and mapped.
ARTIFACTS RECOVERED:	Two gray chert biface fragments, 35 flakes, 47 flake fragments, and 10 pieces of shatter, all of the chert, were found in the disturbed area of this site.


Site No. 13
0
10
20
feet
Disturbed
Areas
Artifact
Concentration
T.P.
Beaver River
Boundary of
Surface Lease
No. 352
(Additional)
Mackay
River
Athabasca
River
Beaver
River
Mildred
Lake
No.13
Horseshoe
Lake
Boundary of Lease No. 17
Ruth
Lake
o = archaeological site
miles

SITE NO. 15

SITE COORDINATES:	618E 261N in the SE 1/4 of the NW 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located along the south side of the creek that flows out of Mildred Lake and into the Beaver Creek. The site is approximately 500 yards upstream from the point where Mildred Creek joins the Beaver Creek. The site is located at a bulldozer crossing and has been greatly disturbed.
HABITAT TYPE:	The site is covered by a Pine/Aspen community.
DESCRIPTION:	This site contained a large quantity of flaking debris of the same type of material which suggests that it was a workshop where implements were fashioned from raw material. The soil consists of a thick layer of medium sand. The artifacts came from the top 6 inches of this sand layer. The site has been greatly disturbed by bulldozing.
WORK DONE AT SITE:	Three 3 x 3 foot test pits were excavated to a depth of 12 inches below the surface. The test pits were excavated south of the disturbed area and in strips of undisturbed soil near the area where the cultural material was found. A surface collection was made and the site was photographed and mapped.
ARTIFACTS RECOVERED:	One core, one flake scraper, 28 flakes, 104 flake fragments and 10 pieces of shatter, all of limestone, were recovered from the surface of this site.


Hackett
Athabasca
River
Boundary of
Surface Lease
No. 352
(Additional)
No. 15
Beaver
River
Mildred
Lake
Horseshoe
Lake
River
Boundary of Lease No. 17
Ruth
Lake
o = archaeological site
miles

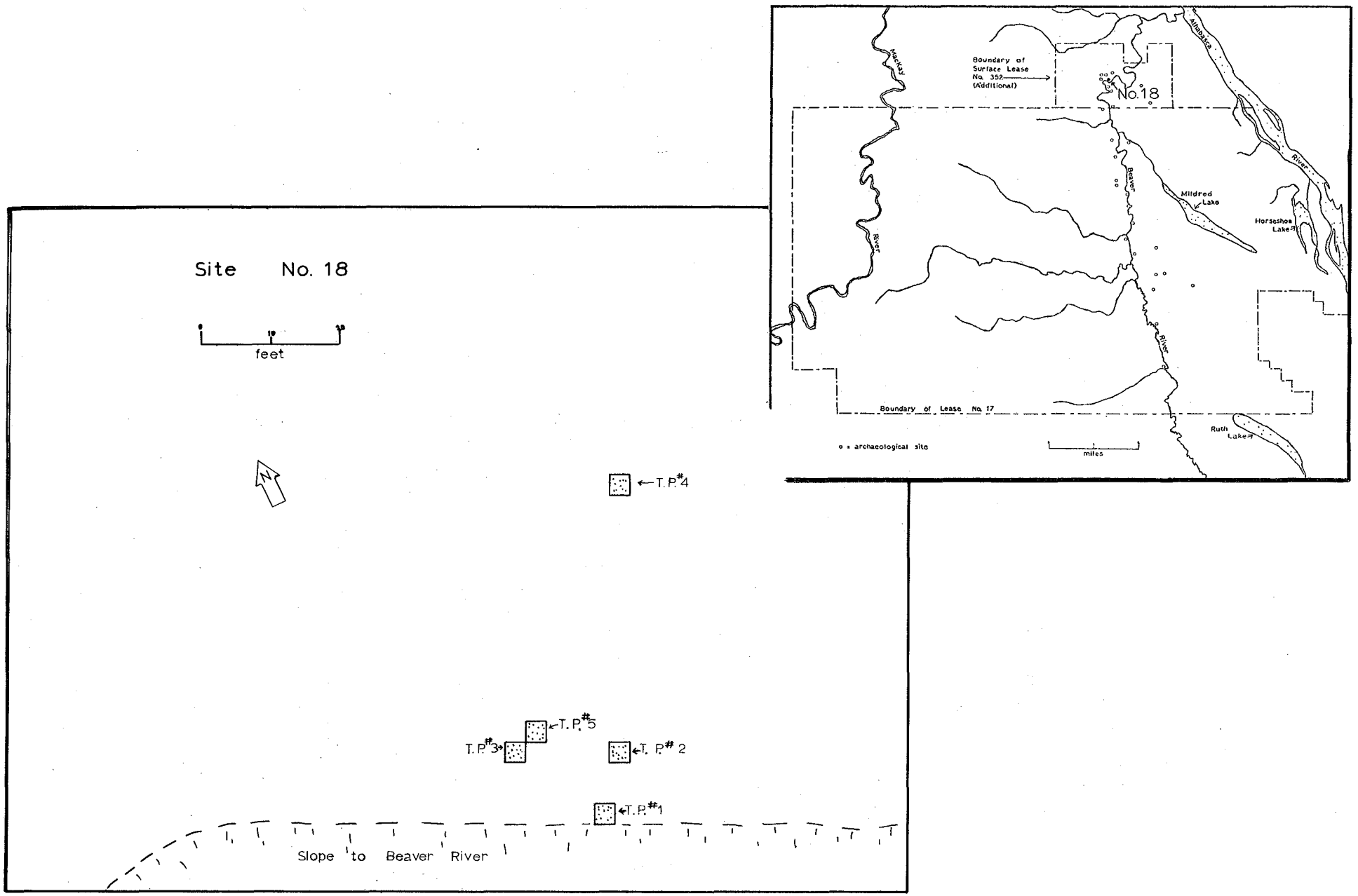

Bulldozer
Cuts
Stream
T.P.#1
T.P.#2
T.P.#3
Site No. 15
0
10
20
feet

Photograph of Site #7 looking west.

Photograph of Site No. 26 looking west.

SITE NO. 18

SITE COORDINATES:	610E 284N in the NE 1/4 of the NE 1/4 of Township 92, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on top of the bank on the north side of the Beaver Creek. The bank is very steep and slopes to the water's edge. The top of the bank is approximately 100 feet above the normal water level. The site is about 300 yards downstream from the Fort MacKay Road.
HATITAT TYPE:	This site is covered with pine and is within the boundaries of a Pine/Aspen community.
DESCRIPTION:	This site contained a large quantity of flaking debris of the same type of material which suggests that it was a workshop where implements were fashioned from raw material. The soil consists of a thick layer of medium sand. The artifacts came from the top 6 inches of this sand layer.
WORK DONE AT SITE:	Five 3 x 3 foot test pits were excavated to a depth of 12 to 18 inches below surface. The test pits were arranged around the areas where cultural material was found and in a line perpendicular to the creek. A surface collection was made and the site was photographed and mapped.
ARTIFACTS RECOVERED:	The surface collection included 11 flake fragments, 2 flakes and a piece of shatter, all of which were of limestone. In test pit #1, five flakes, 25 flake fragments and 3 pieces of shatter, all of limestone, were found between 0 and 6 inches below surface. In test pit #3 one gray chalcedony flake was found between 6 to 12 inches below surface. In test pit #4 one black chalcedony piece of shatter was found between 0 and 6 inches below surface. In test pit #5 one limestone flake scraper and 14 limestone flake fragments were found.


Site No. 18
feet
T.P.#4
T.P.#5
T.P.#3
T.P.#2
T.P.#1
Slope to Beaver River
Boundary of Surface Lease No. 352 (Additional)
No. 18
Hackett River
Athabasca River
Beaver River
Mildred Lake
Horseshoe Lake
Ruth Lake
Boundary of Lease No. 17
o = archaeological site
miles

SITE NO. 21

SITE COORDINATES:	628E 194N in the NW 1/4 of the NW 1/4 of Township 92, Range 10.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	The site is situated on the east side of the Beaver Creek next to a drill hole. The site is located between a small gully which intermittently contains running water and a small ridge running east/west away from the creek.
HABITAT TYPE:	The site is covered with Aspen and is adjacent a Black Spruce Muskeg to the north. It is within an area that has recently been burned.
DESCRIPTION:	This is an open site of limited content which suggests a camp site of short duration. The soil is a layer of medium sand covering an outcrop of tar sand. The artifacts came from the upper 6 to 8 inches of the sandy soil. The site has been disturbed by drilling operations and by bulldozing.
WORK DONE AT SITE:	Six 3 x 3 foot test pits were excavated at this site to a depth of 12 inches. Four test pits were excavated north of the gully and two test pits were excavated south of the gully. A surface collection was made and the site was photographed and mapped.
ARTIFACTS RECOVERED:	One quartzite end scraper, one gray chert flake scraper, 31 gray chert flake fragments, 2 pieces of gray chert shatter, one gray chert flake, 6 quartzite flakes, and 3 limestone flakes were found on the surface of this site.

Site No. 21

0 10 20
feet

T.P.#4

T.P.#5

T.P.#6

T.P.#3

T.P.#1

T.P.#2

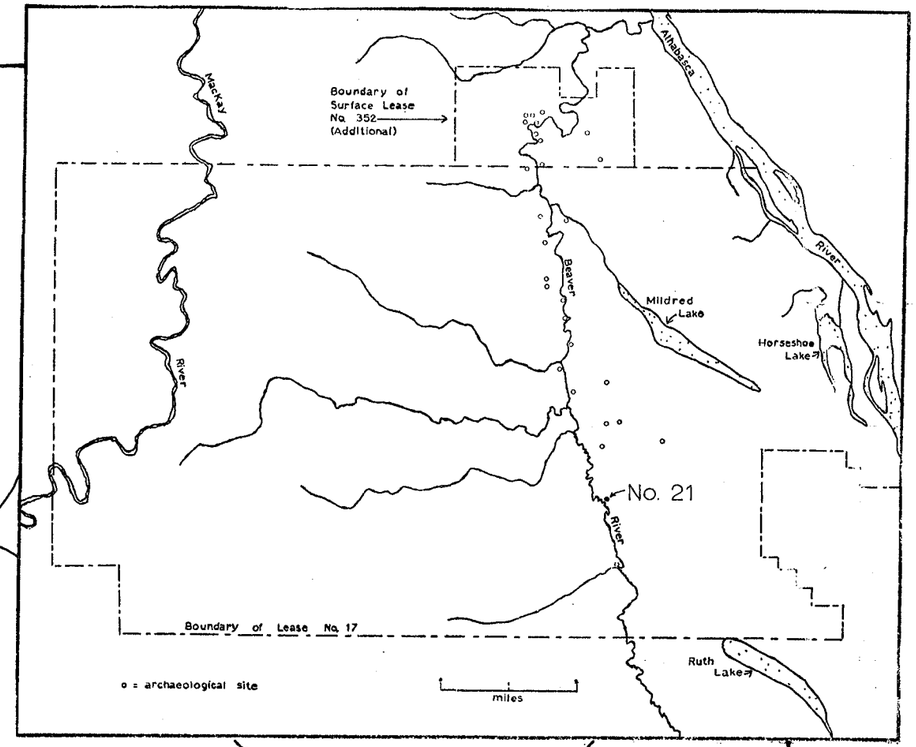
Bulldozer

Gully

Cut

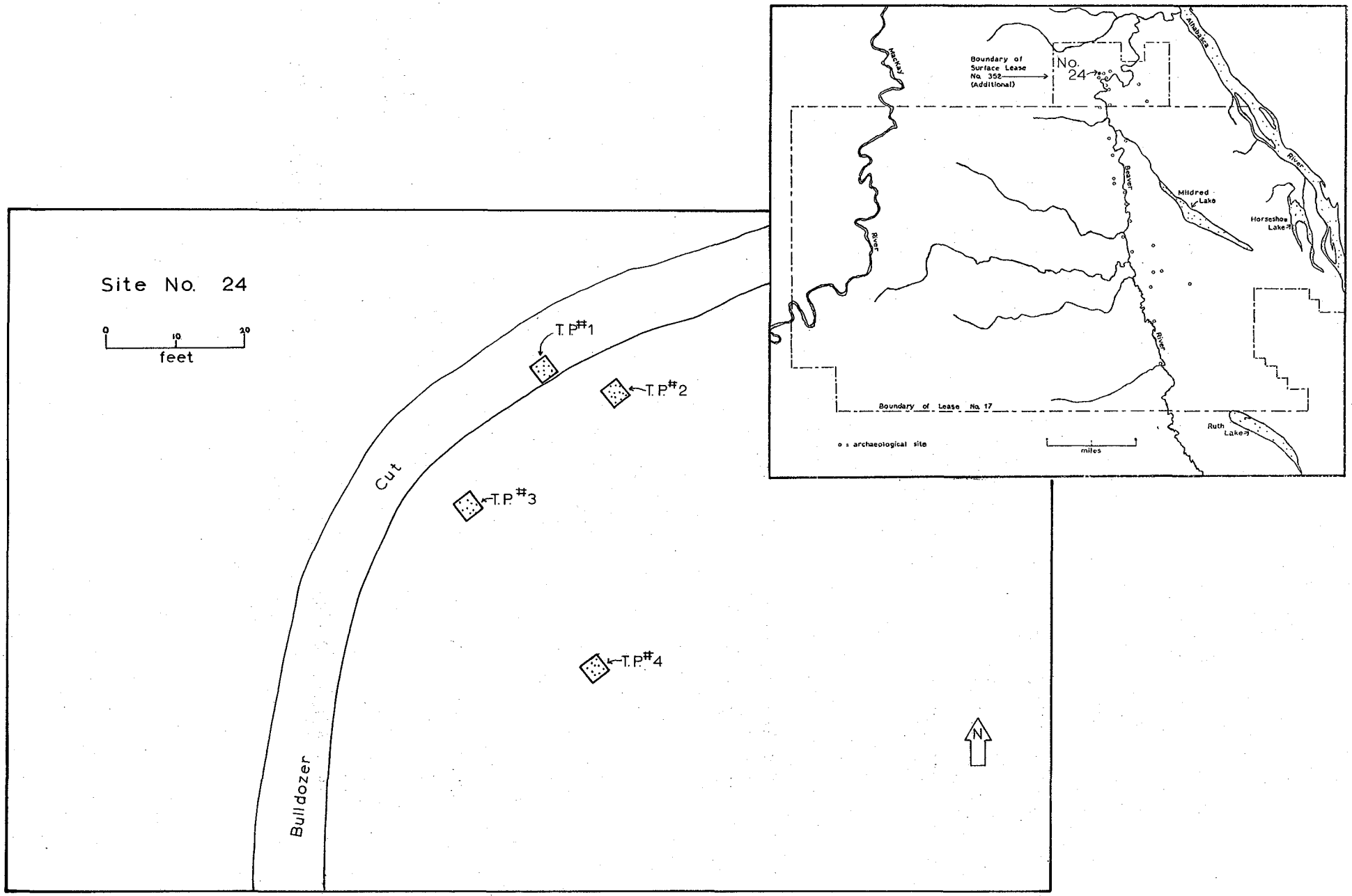
Beaver River

N



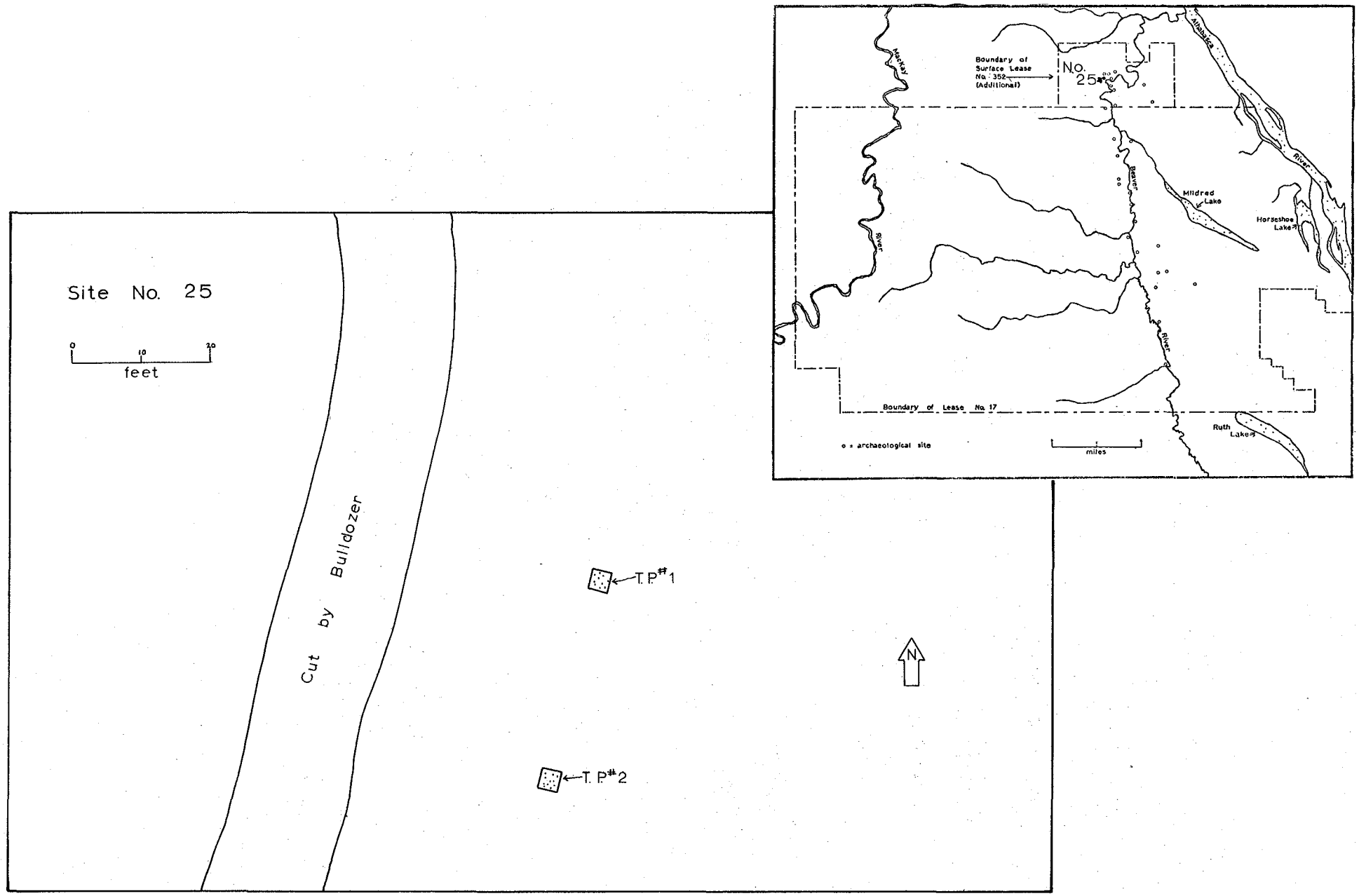
SITE NO. 24

SITE COORDINATES:	608E 286N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located near a cutline which runs from the Fort MacKay Road east to the cutline outlining a proposed sludge pond. The site is on the north side of the Beaver Creek and about 100 to 150 yards from the water's edge. The site is on the edge of a stabilized sand dune.
HABITAT TYPE:	The site is covered by a Spruce/Aspen community.
DESCRIPTION:	This site contained a quantity of flaking debris of the same type of material which suggests that it was a workshop where implements were fashioned from raw material. The soil consisted of duned medium sand of considerable depth. The artifacts came from the upper 6 inches of this sandy soil.
WORK DONE AT SITE:	Five test pits were excavated along the cutline at this site. The test pits were 3 x 3 foot squares excavated to a depth of 12 inches. A surface collection was made and the site was photographed and mapped.
ARTIFACTS RECOVERED:	The surface collection included 1 core, one flake scraper, 11 flakes, 31 flake fragments, 3 pieces of shatter, all made from gray chert. In test pit #1 seven flakes, 13 flake fragments and 2 pieces of shatter, all of which were of chert, were found between 0 to 6 inches below surface.


Site No. 24
0
10
20
feet
T.P.#1
T.P.#2
T.P.#3
T.P.#4
Cut
Bulldozer
N
Boundary of Surface Lease No. 352 (Additional)
No. 24
Hackett
River
Beaver
River
Athabasca
River
Mildred Lake
Horseshoe Lake
Boundary of Lease No. 17
Ruth Lake
o = archaeological site
miles

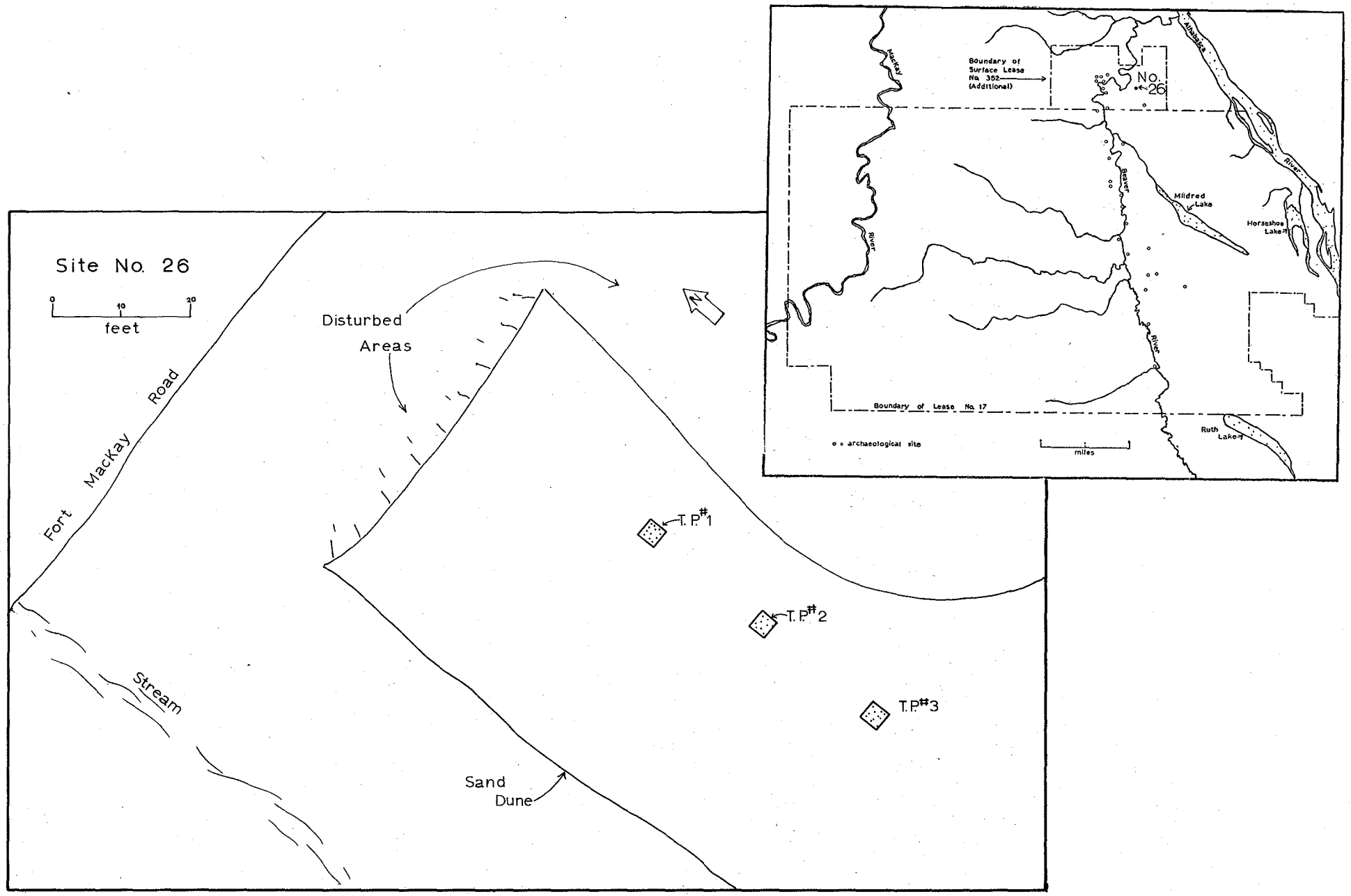
SITE NO. 25

SITE COORDINATES:	607E 285N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is approximately 100 yards southwest of Site 24 on the same cutline and on the edge of the same duned sand. The site is on the north side of the Beaver Creek and east of the MacKay Road. It is between 100 to 150 yards northwest of the Beaver Creek.
HABITAT TYPE:	The site is covered by a Spruce/Aspen community.
DESCRIPTION:	This site is very likely related to site No. 24 due to its proximity to that site and the fact that it contains the same type of flaked stone material. It is here considered a separate site because it has a discernable concentration of cultural material separated from the concentration at site No. 24. The soil is duned medium sand of considerable depth. The artifacts are believed to have come from the upper portion of this sandy soil.
WORK DONE AT SITE:	Two 3 x 3 foot test pits were excavated at this site parallel to the cutline. The test pits were excavated to a depth of 12 inches. A surface collection was made and the site was photographed and mapped.
ARTIFACTS RECOVERED:	One chert flake, 3 quartzite flakes and 5 quartzite flake fragments were found on the surface of this site.


Site No. 25
0
10
20
feet
Cut by Bulldozer
T.P.#1
T.P.#2
N
Hackay
Athabasca
River
Boundary of Surface Lease No. 352 (Additional)
No. 25
Beaver
River
Mildred Lake
Horseshoe Lake
River
Boundary of Lease No. 17
Ruth Lake
o = archaeological site
miles

SITE NO. 26

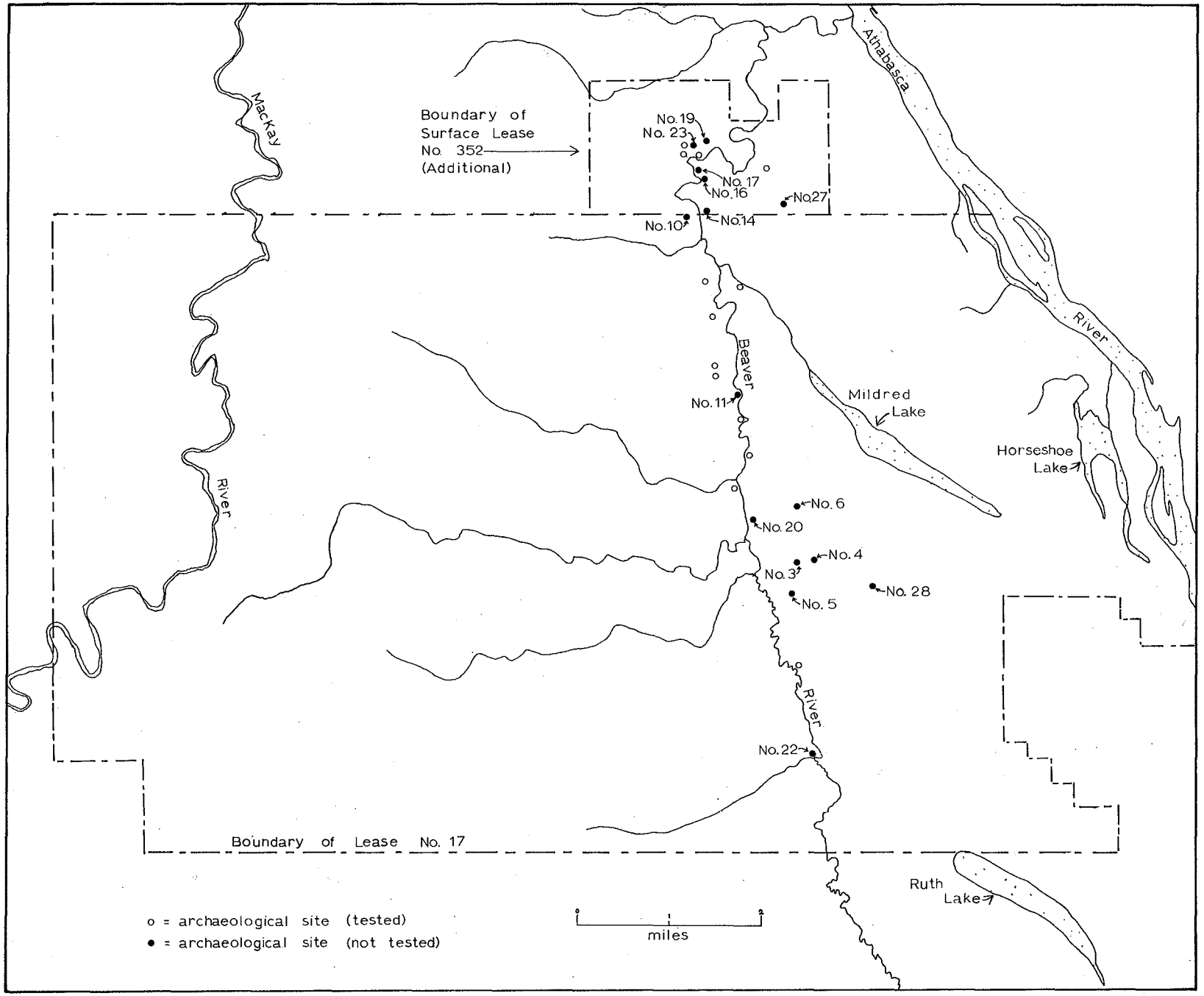
SITE COORDINATES:	623E 281N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on some duned sand which has been bisected by the MacKay Road. The site consists of two low parallel sand dunes separated by a small stream, which runs in a north/south direction.
HABITAT TYPE:	The site is covered by a Spruce/Aspen community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp site of short duration. The soil consists of duned medium sand of considerable depth. The artifacts are believed to have come from the upper portion of this sand layer.
WORK DONE AT SITE:	Three 3 x 3 foot test pits were excavated at this site to a depth of 6 inches. The test pits were excavated in a line parallel to the small stream. A surface collection was also made, and the area tested was mapped and photographed.
ARTIFACTS RECOVERED:	One chalcedony flake scraper, 1 quartzite flake. 2 chert flakes, 5 chert flake fragments, and 3 chert pieces of shatter were found on the surface of this site.


Site No. 26
0
10
20
feet
Fort MacKay Road
Disturbed Areas
T. P.# 1
T. P.# 2
T.P.# 3
Stream
Sand Dune
Boundary of Surface Lease No. 352 (Additional)
No. 26
MacKay River
Athabasca River
Beaver River
Mildred Lake
Horseshoe Lake
Ruth Lake
Boundary of Lease No. 17
o = archaeological site
miles

SITES NOT TESTED

SITE NO. 3

SITE COORDINATES:	627E 211N in the SE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 1025 feet above sea level.
LOCATION:	The site is located on the western edge of a sandy ridge east of the Beaver Creek. This ridge parallels the river to a large extent. The site is slightly less than .5 miles east of the Beaver Creek and just north of the 24th base line. The site straddles a small gully which empties into the muskeg a few feet to the west.
HABITAT TYPE:	This site is located on the edge of a Spruce/ Aspen community adjacent a Black Spruce Muskeg to the west.
DESCRIPTION:	This is an open site of limited content, suggesting that it was a camp site of short duration. The soil is a fairly deep medium sand. The artifacts came from the top six inches of the sandy soil. The site has been disturbed by bulldozing over its entire surface.
WORK DONE AT SITE:	Surface collection was made. The site was photographed and a sketch map was drawn.
ARTIFACTS RECOVERED:	A gneiss chi-thos, 9 gray chert flakes and 5 gray chert flake fragments were found on the surface of this site.


Mackay River
Athabasca River
Boundary of Surface Lease No. 352 (Additional)
No. 19
No. 23
No. 17
No. 16
No. 27
No. 10
No. 14
Beaver River
No. 11
Mildred Lake
Horseshoe Lake
No. 6
No. 20
No. 4
No. 3
No. 28
No. 5
River
No. 22
Boundary of Lease No. 17
Ruth Lake
o = archaeological site (tested)
• = archaeological site (not tested)
miles

SITE NO. 4

SITE COORDINATES:	630E 212N in the SW 1/4 of the SW 1/4 of Township 93, Range 10.
ELEVATION:	Approximately 1025 feet above sea level.
LOCATION:	The site is located around a drill hole on a sandy ridge east of the Beaver Creek. The ridge parallels the creek to some extent. The site is a little over .5 miles east of the Beaver Creek and is on the eastern edge of the ridge. It is situated just north of the 24th base line.
HABITAT TYPE:	The site was situated on the edge of the Spruce/Aspen community next to the Black Spruce Muskeg to the east.
DESCRIPTION:	This is an open site of limited content which suggests that it was a camp site of short duration. The soil is a fairly deep, medium sand. As near as can be determined the artifacts came from the top six inches of sand. The site has been disturbed over its entire surface by bulldozing.
WORK DONE AT SITE:	A surface collection was made. The site was photographed and a sketch map was drawn.
ARTIFACTS RECOVERED:	The surface collection included two chalcedony flake scrapers, a quartzite end scraper, a gray chert pebble scraper, a gray chert biface, 5 quartzite flake fragments, 2 chert flake fragments and a limestone flake fragment.

SITE NO. 5

SITE COORDINATES:	627E 207N in the NE 1/4 of the NE 1/4 of Township 92, Range 11.
ELEVATION:	Approximately 1025 feet above sea level.
LOCATION:	This site is located on the west side of a sandy ridge about 400 yards east of the Beaver Creek. This high ground is the same sandy ridge on which sites No. 3 and 4 are located. This ridge runs somewhat parallel to the Beaver Creek. The site is located about 300 yards south of the 24th base line.
HABITAT TYPE:	The site is situated on the edge of the Spruce/Aspen community next to the Black Spruce Muskeg.
DESCRIPTION:	This is an open site of limited content which suggests that it was a camp site of short duration. The soil is a fairly deep, medium sand. As near as can be determined the artifacts came from the top six inches of the sandy soil. The site has been disturbed over its entire surface by bulldozing.
WORK DONE AT SITE:	A surface collection was made and the soil was screened in several areas. The site was photographed and a sketch map was drawn.
ARTIFACTS RECOVERED:	One small black chalcedony flake end scraper, 7 quartzite flakes, 6 quartzite flake fragments and a flake fragment of chert were found on the surface of this site.

SITE NO. 6

SITE COORDINATES:	627E 221N in the SE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 1025 feet above sea level.
LOCATION:	This site is located on a sandy ridge about .5 miles east of the Beaver Creek and approximately .5 miles north of Site No. 3.
HABITAT TYPE:	This site is within a Spruce/Aspen community and adjacent a Black Spruce Muskeg to the south and west.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp site of short duration. The soil is a fairly deep, medium sand. As near as can be determined the artifacts came from the top six inches of the sand. The site has been disturbed over its entire surface by bulldozing.
WORK DONE AT SITE:	A surface collection was made and the soil was screened in several areas. The site was photographed and a sketch map was drawn.
ARTIFACTS RECOVERED:	One quartzite uniface with a scraping edge on one side was found on the surface of this site.

SITE NO. 10

SITE COORDINATES:	608E 274N in the SE 1/4 of the NW 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	The site is located in a flat clearing on the west side of the Beaver Creek along a road. This site is 2.45 miles south of where this road meets the Fort MacKay Road.
HABITAT TYPE:	The site is situated in a community of widely dispersed Jack Pine.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp site of short duration. The soil is a medium sand overlying a coarse sand and gravel. The artifacts are believed to have come from very near the surface of the sandy soil.
WORK DONE AT SITE:	A surface collection was made, photographs taken and a sketch map drawn.
ARTIFACTS RECOVERED:	Two gray chert flake fragments were found on the surface of this site.

SITE NO. 11

SITE COORDINATES:	616E 241N in the NE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on the west side of the Beaver Creek at the top of the river bank. The bank is approximately 25 feet above the normal level of the Beaver Creek. The bank drops sharply into the creek to form a high steep incline.
HABITAT TYPE:	The site is located on top of the ridge which is covered with Jack Pines and Aspen.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp site of short duration. The soil is a medium sand overlying an outcrop of Cretaceous tar sand. The artifact is believed to have come from the upper portion of the medium sand.
WORK DONE AT SITE:	An examination of the river bank and the surface of the ridge was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	One artifact bifacially flaked on one edge and made of limestone was found on the surface of this site.

SITE NO. 14

SITE COORDINATES:	612E 274N in the SE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 950 feet above sea level.
LOCATION:	This site is located on top of a bank on the east side of the Beaver Creek very near the northern boundary of lease #17. The top of the bank is approximately 80 feet above the present water level and has a steep slope to the water's edge.
HABITAT TYPE:	The site is covered by a Jack Pine community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a campsite of short duration. The soil is a thick layer of medium sand. The artifact is thought to have come from the upper portion of this sandy soil.
WORK DONE AT SITE:	An examination of the creek bank and the surface of the ridge was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	One black chalcedony flake was found on the surface of this site.

SITE NO. 16

SITE COORDINATES:	612E 279N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 950 feet above sea level.
LOCATION:	This site is located on the east side of the Beaver Creek on top of a bank which is approximately 100 feet above the normal water level. The bank has a very steep slope to the water's edge. The site is approximately 250 yards upstream from where the Fort MacKay Road crosses the Beaver Creek.
HABITAT TYPE:	The site is covered by a Spruce/Aspen community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a campsite of short duration. The soil is a thick layer of medium sand. The artifacts are thought to have come from the upper portion of this sandy layer.
WORK DONE AT SITE:	An examination of the creek bank and the surface of the site was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	Two pieces of limestone shatter were found on the surface of this site.

SITE NO. 17

SITE COORDINATES:	611E 281N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 900 feet above sea level.
LOCATION:	This site is located on the east side of the Beaver Creek on top of a 60 foot high bank which has a steep slope to the water's edge. The site is approximately 200 yards upstream from the Fort MacKay Road.
HABITAT TYPE:	This site is covered by a Spruce/Aspen community.
DESCRPTION:	This is an open site of limited content suggesting it was a campsite of short duration. The soil is a thick layer of medium sand. The artifacts are thought to have come from the upper portion of this sandy layer.
WORK DONE AT SITE:	An examination of the creek bank and the surface of the site was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	One chalcedony backed knife was found on the surface of this site.

SITE NO. 19

SITE COORDINATES:	613E 287N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on top of a bank on the north side of the Beaver Creek. The site is about 700 yards upstream from the Fort MacKay Road and is situated adjacent an oxbow lake. The bank on which the site is located drops in a steep slope to the edge of the oxbow lake. The site is about 250 yards north of the Beaver Creek.
HABITAT TYPE:	This site is covered with a Jack Pine community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp of short duration. The soil is a thick layer of medium sand. The artifact is thought to have come from the upper portion of the sandy layer.
WORK DONE AT SITE:	An examination of the creek bank and the surface of the ridge was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	One core fragment of limestone was found on the surface of this site.

SITE NO. 20

SITE COORDINATES:	619E 219N in the SE 1/4 of the SE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is on the east side of the Beaver Creek about 100 yards from the creek. The site is situated on a low ridge which runs parallel to the Beaver creek and is on the eastern edge of this ridge.
HABITAT TYPE:	The site is covered by Jack Pine and is directly adjacent a Black Spruce Muskeg to the east. The site is within a recently burned area.
DESCRIPTION:	This site contained a quantity of flaking debris of the same type of material which suggests that it was a workshop where implements were fashioned from raw material. The soil consists of a thick layer of medium sand. The artifacts came from the top 6 inches of this sand layer. This site has been cut through by a road and has been destroyed by bulldozing.
WORK DONE AT SITE:	An examination of the surface of the site was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	The surface collection included 6 flakes and 14 flake fragments of gray limestone.

SITE NO. 22

SITE COORDINATES:	629E 177N in the NW 1/4 of the NW 1/4 of Township 92, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on the west side of the Beaver Creek on the north side of a small creek, adjacent the point where the creek and the Beaver Creek join. The site is situated on top of a 25 foot bank. A cutline runs through the center of the site.
HABITAT TYPE:	The site is situated in a Spruce/Aspen community.
DESCRIPTION:	This is an open site of limited content which suggests that it was a camp site of short duration. The soil consists of a medium sand. The artifacts are believed to come from the upper 6 inches of the sandy soil. The site has been disturbed by bull-dozing.
WORK DONE AT SITE:	An examination of the surface of the site was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	One quartzite side-notched projectile point and 2 pieces of limestone shatter were found on the surface of this site.

SITE NO. 23

SITE COORDINATES:	610E 287N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	The site is on a cutline approximately 100 to 150 feet north of the Beaver Creek. The site is on a cutline on which a proposed sludge pond dyke will be constructed. The site is between site No. 19 and the Fort MacKay Road.
HABITAT TYPE:	The site is covered with a Pine/Aspen community.
DESCRIPTION:	This is an open site of limited content which suggests that it was a camp site of short duration. The soil consists of a medium sand. The artifacts are believed to come from the upper 6 inches of the sandy soil.
WORK DONE AT SITE:	An examination of the surface of the site was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	Two quartzite flake fragments, 1 gray chert flake, 4 chert flake fragments and 2 pieces of chert shatter were found at this site.

SITE NO. 27

SITE COORDINATES:	626E 275N in the SE 1/4 of the NE 1/4 of Township 93, Range 11.
ELEVATION:	Approximately 975 feet above sea level.
LOCATION:	This site is located on an east/west cutline between the Fort MacKay Road to the north and an area cleared for the construction of a proposed sludge pond dyke to the south. The site is situated on some low duned sand which has been stabilized by vegetation.
HABITAT TYPE:	This site is in a Pine/Aspen community.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp site of short duration. The soil consists of duned medium sand of considerable depth. The artifacts are believed to have come from the upper portion of this sandy soil.
WORK DONE AT SITE:	An examination of the surface of the site was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	Two gray chert flake fragments were found on the surface of this site.

SITE NO. 28

SITE COORDINATES:	640E 207N in the NW 1/4 of the NW 1/4 of Township 93, Range 10.
ELEVATION:	Approximately 1050 feet above sea level.
LOCATION:	This site is situated on the edge of a large sandy ridge a little over a mile east of the Beaver Creek. A cutline, which runs north/south, crosses over the site. The site is just below the 24th base line.
HABITAT TYPE:	The site is situated in a Jack Pine community directly adjacent a Black Spruce Muskeg to the north.
DESCRIPTION:	This is an open site of limited content suggesting that it was a camp site of short duration. The soil consists of duned medium sand of considerable depth. The artifacts are believed to have come from the upper portion of this sandy soil.
WORK DONE AT SITE:	An examination of the surface of the site was conducted. The site was photographed and a sketch map was drawn of it.
ARTIFACTS RECOVERED:	One quartzite flake and two chert flake fragments were found on the surface of this site.

3. DISCUSSION

The Site Distribution

Twenty-eight archaeological sites were located on Lease #17 and Surface Lease #352. These sites were confined to the eastern one-third of the lease. The distribution of these sites offers the opportunity to test the original assumptions made at the outset of the survey. It was assumed that areas close to water and areas of environmental diversity would be the areas favored by prehistoric man.

As all of the eastern one-third of the lease was intensively surveyed (excluding portions of marsh and muskeg), it is very probable that the sample of sites discovered is quite representative of the actual site distribution in that particular area. This being the case, any nonrandomness in the distribution of the sites found would reveal factors which influenced the settlement patterns of prehistoric peoples in this area.

To determine whether or not there is a nonrandom distribution of sites, we plotted 28 random localities in the eastern one-third of the lease (from just west of the Beaver Creek east to the Athabasca River). The distribution of these random localities was determined with the use of a table of random numbers (See Gumerman 1971). The distribution of the random localities and the 28 sites that were found on the lease were then compared.

It was noted that there was a wider dispersion of random localities than of sites over the area we had intensively surveyed. It was also noted that 53.57% (15) of the sites were less than 500 yards from another site, while 89.28% (25) were within 1000 yards of one another. On the other hand, it was found that only 32.14% (9) of the

random localities were within 500 yards of another random locality and only 49.99% (14) were within 1000 yards of another random locality.

To show the significance of these differences the chi-square (X^2) statistical test was applied. Briefly the chi-square test shows whether an observed frequency differs significantly from the expected frequency (Moroney 1951: 246-70). In this case the observed frequencies are the actual sites found and the expected frequencies are the random localities which were plotted.

The chi-square value obtained from the test can show that a distribution either could or could not have occurred by chance. Chi-square values at or greater than the .01 level of probability are here considered to represent a significant nonrandom distribution. That is, a chi-square value which could be expected by chance alone to occur only one chance in one hundred cases or less is thought to be high enough to permit its acceptance as a significant nonrandom distribution.

In Table 1 the expected and observed distances between sites are given. The chi-square test yielded a value which exceeded the .01 level of probability. In other words, it is unlikely that the observed distances between the 28 sites found on Lease #17 and the additional portion of Lease #352 were due to chance alone.

TABLE I

DISTANCE BETWEEN SITES

Observed and Expected Distance Frequencies Between Sites with the Chi-square Test on these Values

	DISTANCES IN YARDS					
	1-500	501-1000	1001-1500	1501-2000	2001-2500	2501-3000
Expected	9	5	6	3	4	1
Observed	15	10	2	1	0	0

$X^2 = 17.999$
$df = 5$
$p. > .01$

The clustering exhibited by the sites found during the survey can be seen as the result of a number of factors. The most obvious factor is the proximity of the sites to the Beaver Creek. A total of 96.42% (27) of the sites are within 1000 yards of the creek. An equal number of randomly distributed localities (28) in the eastern one-third of the lease exhibits a far greater dispersion with reference to the Beaver Creek. Only 25% (7) of the random localities are within 1000 yards of the Beaver River.

In Table II the expected and observed distances between sites and the Beaver Creek are given. The chi-square test of these figures yielded a value which greatly exceeds the .001 level of probability. This means that there is far less than one chance in 1000 that the sites found could be clustered along the Beaver Creek simply by chance alone.

TABLE II

DISTANCES FROM SITES TO THE BEAVER RIVER

Observed and Expected Distance Frequencies between Sites and the Beaver Creek with the Chi-square Test on these Values

	DISTANCE IN YARDS					
	1-1000	1001-2000	2001-3000	3001-4000	4001-5000	5000 and above
Expected	7	3	5	8	3	2
Observed	27	1	0	0	0	0

$X^2 = 76.476$
$df = 5$
$p. > .001$

This supports the original contention that the supply of water would affect site distribution. However, the Beaver Creek is not the only source of water on the lease. There are two lakes and the west bank of the Athabasca River within the limits of the eastern one-third of the lease. It might well be asked why there were no sites found along these water sources. Obviously some additional variables were acting on the settlement pattern of the prehistoric inhabitants of the area under study.

One of these variables seems to have been the elevation of the land. It was noted that 78.57% (22) of the sites were between the 901 to 1000 foot contours. Random points plotted over the eastern one-third of the lease produced only 35.71% (10) localities of that elevation. On the other hand, 64.28% (17) of the random localities fell between the 1001 to 1100 foot contours, while only 17.85% (5) of the sites were of that elevation.

In Table III the expected and observed elevations of sites are given. The chi-square test of these figures yields a value which greatly exceeds the .001 level of probability. In other words

there is far less than one chance in 1000 that the sites clustered between the 901 and 1000 foot contours simply by chance alone.

Admittedly the elevation of the sites is a dependent variable. That is, any group of sites located near the Beaver River will automatically have similar elevations. However, elevation does affect drainage patterns and vegetation and may therefore have had some effect on prehistoric man's preference for camping areas.

In this respect it was observed that 42.75% (12) of the sites found during the survey were within 500 feet of the small tributary streams. Only 14.28% (4) of the randomly selected localities were near tributary streams. A total of 42.75% (13) of the sites were located on the banks of the Beaver Creek, while only 3.57% (1) of the random localities were located there. It, therefore, appears that the tendency to camp at lower elevations was in part due to a preference to camp either near a tributary stream or near the Beaver Creek or both.

TABLE III

ELEVATIONS OF SITES

Observed and Expected Elevation Frequencies of Sites with the Chi-Square Test of these Values

	ELEVATIONS IN FEET		
	801-900	901-1000	1001-1100
Expected	1	10	17
Observed	1	22	5

$X^2 = 22.870$
$df = 2$
$p. > .001$

In the formulation of this survey's methodology, habitat and environmental diversity were hypothesized as being major determining factors in the site location. During the survey it was noted that 53.57% (15) of the sites were in Spruce/Aspen communities, 21.42% (6) were in Pine/Aspen communities, 14.28% (4) were in Pine communities and 10.71% (3) were in burned areas. Due to the large areas that have been burned recently, it is difficult to accurately judge the structure of the plant community on the lease. However, certain trends in site location within plant communities are perceptible.

It was observed that among the random localities plotted on the eastern one-third of the lease, fewer points were located in Spruce/Aspen and Pine communities than was found to be the case with real sites. We also found that 14.28% (4) of the random localities fell within a Pure Aspen community, whereas no actual sites did.

In Table IV the expected and observed frequencies of habitat location are given. The chi-square test of these figures yields a value which exceeds the .01 level of probability. This means that it is unlikely due to chance alone that this distribution of sites within plant communities would occur.

Another facet of the location of the sites is the proximity of the sites to other habitats besides the one they occupy (i.e. the environmental diversity which is close to the site). It was observed that there were a greater number of habitats within a 500 yard radius of a site than would be expected under random circumstances. It was also found that 68.71% (17) of the sites were within 500 yards of four different plant communities, 7.14% (2) were within 500 yards of five different plant communities and 10.71% (3) were within 500 yards of six plant communities. Only 21.42% (6) of the sites had less than four within 500 yards of their locations. On the other hand, it was noted that 71.42% (20) of the randomly placed points on the eastern one-third of the lease had fewer than four plant communities within 500 yards of their locations.

TABLE IV

SITE LOCATION WITHIN PLANT COMMUNITIES

Observed and Expected Frequencies of Sites within Plant Communities with the Chi-square Test on these Values

	Spruce/ Aspen	Pine/ Aspen	Pine	Recent Burn	Aspen
Expected	11	6	1	6	4
Observed	15	6	4	3	0

$X^2 = 15.954$
$df = 4$
$p. > .01$

In Table V the expected and observed frequencies of numbers of plant communities within 500 yards of the sites are given. The chi-square test on these frequencies yields a value which exceeds the .001 level of probability. This indicated that it is very unlikely that the location of sites within environmentally diverse areas happen merely by chance alone. The selection of such areas probably resulted from the fact that these areas offer the greatest economic opportunities for hunting and gathering peoples.

It is suspected that there is also a correlation between soil types and site location. Unfortunately the data on the distribution of soil types on the lease is not readily available, and we cannot therefore demonstrate such a correlation. Suffice it to say that 64.28% of the sites (18) had soil composed of thick often slightly duned, medium sand layers covering them.

TABLE V

NUMBER OF PLANT COMMUNITIES WITHIN 500 YARDS OF SITES

Observed and Expected Frequencies of Plant Communities within 500 Yards of Sites with the Chi-square Test on these Values

	NUMBER OF PLANT COMMUNITIES					
	1	2	3	4	5	6
Expected	6	5	9	6	1	1
Observed	0	1	5	17	2	3

$X^2 = 36.144$
$df = 5$
$p. > .001$

The Artifact Distribution

The survey crew collected 999 artifacts from the 28 sites on Lease #17 and the additional portion of Surface Lease #352. Of these artifacts, 972 were flakes, flake fragments or detritus which are by-products of the manufacture of stone implements. Twenty-seven tools and objects left in the process of being manufactured into tools (objective pieces) were found on the lease. The tools and objective pieces are described in Appendix B.

The number of tools and objective pieces is too low to show any significant clustering in their distribution. However there are some aspects of the collection of artifacts as a whole that are worth examining. Table VI shows that limestone made up 67.66% of the sample, while chert made up 25.42%, quartzite 5.71%, chalcedony 1.00%, and gneiss and metamorphosed sandstone .21%. These figures give the impression that limestone was the favored material for making artifacts. A closer look shows that while the majority of flakes are of limestone, only 22.22% (6) of the tools and objective pieces were of that material.

Chalcedony which makes up only 1% of the total sample, also makes up 22.22% (6) of the tools and objective pieces. This indicates that there was probably not as great a preference for limestone as the percentage for the total sample implies.

TABLE VI

ARTIFACT MATERIAL TYPE

	Chert	*Chalcedony*	*Quartzite*	*Limestone*	*Other*
Flakes, Flake fragments, and shatter	245	4	53	670	0
Tools and Objective Pieces	9	6	4	6	2

Simple numbers of flakes, flake fragments and detritus are not an indication of the popularity of one type of stone material over another. This is the case because the manufacture of one stone tool can produce hundreds of flakes and other debris. In this light, the sample at hand shows that only six different types of material were used in the manufacture of stone tools. The identification of material preferences must await the collection of a larger tool sample.

Quartzite is available in large quantities in the local gravels while the hard limestone found in the sites, outcrops on the lower part of the Beaver Creek near its mouth. A prehistoric quarry, where limestone was obtained, has been located just north of the lease along the Beaver Creek (See Appendix A). The quarry shows that not only was a great deal of raw material available but that also it was rather intensively utilized.

Scrapers are the most abundant tool type in the collection, making up 60.74% (17) of the total tool sample. Only one knife and one projectile point were found. The second most numerous tool types were bifaces. These artifacts made up 25.92% (7) of the sample.

It was noted that the artifacts with a scraping or cutting edge (scrapers, chi-thos, knife and uniface) all had worn edges. The bifaces and cores on the other hand exhibited no wear on any of their edges. This suggests, as was already suspected, that the bifaces and cores are not finished tools but rather artifacts left before being finished into tools. It is not surprising therefore, to find that three similar bifaces were collected at the quarry site north of the lease. It is probable that tools were roughed out at quarrying sites and transported to camp sites to be finished.

It has been claimed by a number of authors (C.F. Wilmsen 1970: 71) that the angle of the working edge on scrapers and knives varies with the use for which they were intended. Angles 26^{o} to 35^{o} are said to have been used for cutting, while angles of 46^{o} to 55^{o} were used for skinning, hide scraping, shredding, wood cutting and bone or antler cutting. Larger angles of 66^{o} to 75^{o} are seen as appropriate for bone working, wood working and heavy shredding (Wilmsen 1970: 60-71). According to Wilmsen the most useful tool edge angles lie between 46^{o} and 55^{o}. That is, tools with working edges in this range can be used for the greatest number of different jobs.

It was observed that 70.58% (12) of the artifacts with a used working edge (scrapers, chi-thos, uniface, knife) had edge angles between 46^{o} and 55^{o}. It was also observed that 29.41% (4) of the artifacts with a used working edge had edge angles between 26^{o} and 35^{o} and 5.88% (1) had an edge angle between 66^{o} and 75^{o}.

In order to determine if the above percentage represented a significant nonrandom distribution of edge angles the distribution was tested with the use of chi-square. To do this it was assumed that a perfectly random distribution would be one in which equal numbers of artifacts would fall into each edge angle division. In Table VII the expected and observed edge angle frequencies are given. The chi-square test of these frequencies yielded a value which greatly exceeds the .001 level of probability. This means that there is far less than one chance in one thousand that the distribution of edge angles is due to chance alone.

TABLE VII

EDGE ANGLE FREQUENCIES

Observed and Expected Frequencies of Edge Angles of the Scrapers, Chi-thos, Knife and Uniface with the Chi-square Test on these Values

	EDGE ANGLES				
	26^{o}-35^{o}	36^{o}-45^{o}	46^{o}-55^{o}	56^{o}-65^{o}	66^{o}-75^{o}
Expected	3.4	3.4	3.4	3.4	3.4
Observed	4	0	12	0	1

$X^2 = 30.352$
$df = 4$
$p.>.001$

The concentration of edge angles between 46^{o} to 55^{o} can be interpreted as indicating that the tools recovered during the survey had a variety of uses. This is supported by the fact that this is the most popular range of edge angles in other areas of North America (Wilmsen 1970: 60-71).

There is a definite scarcity of projectile points in the archaeological sites on Lease #17. Only a single quartzite side-notched projectile point was found during the survey. Ethnographically we know that aboriginal groups in the northern Boreal Forest of Alberta and the Northwest Territories used antler and bone to make projectile points (Goddard 1916: 219, Spencer and Jennings et. al. 1965: 159). Such artifacts are only rarely preserved in archaeological sites. If bone and antler projectile points were present in sites on Lease #17, they would not have been preserved. This is the case because bone in general was absent at most of the sites and only as badly decayed fragments in a few sites.

There is some independent evidence which suggests the use of antler and bone projectile points in the area of Lease #17. Such a projectile point was found in a muskrat push-up north of Lease #17 near Moose Lake by Henry Boucher of Fort MacKay, Alberta. Unfortunately, Mr. Boucher is now deceased, and the present whereabouts of this artifact is not known. However, we were able to obtain a tracing of the projectile point made by the finder and this is presented in Appendix B. Mr. Boucher claimed in a letter to the Department of Anthropology at the University of Alberta dated March 26, 1969, that the projectile point was made from the foreleg of a moose and that his 84 year old father recognized it as being used for moose hunting when he was a boy.

In summary, the artifact sample from Lease #17 shows that a variety of stone materials were available and were utilized. Tools were apparently roughed out at quarrying sites and then transported to camp sites for finishing. The edge angles of worn artifacts indicates that the tools had a variety of uses. Finally, the scarcity of projectile points may be due to the use of perishable bone and antler projectile points by the prehistoric inhabitants of Lease #17.

Chronological and Spacial Relationships

The survey did not produce a collection of artifacts sufficient to discern any of the chronological or spacial relationships of the sites on the lease. Due to frequent fires over the lease a good carbon sample for C^{14} dating purposes could not be obtained. Bone, as already mentioned, was only poorly preserved at only a few sites. For these reasons the age and relationships of the sites and artifacts found on Lease #17 and Surface Lease #352 cannot be determined at this time.

Side-notched projectile points similar to the one found at

site No. 22 are known to have appeared in the Boreal Forest about 8000 years ago and persisted to the historic period. Bifaces and scrapers similar to the specimens in the collection also occur over a very long period in the Boreal Forest (MacNeish 1964, Campbell 1962, Harp 1962). The collection of artifacts from the lease may therefore represent a long sequence of occupation of the Beaver River drainage. It is, in fact, conceivable that sites as old or older than 10,000 years could be found in this area. The limiting factor on the age of any archaeological find in northern Alberta is the presence of a continental ice sheet over the entire area during the Wisconsin Ice Age. The time at which this ice sheet melted is not accurately known, but may be anywhere from 10,000 to 15,000 years ago (Bryan 1969, Haynes 1969).

4. CONCLUSION

The significance of the archaeological remains located on Syncrude Lease #17 is difficult to assess at the present time. As research into the prehistory of Northeastern Alberta proceeds, and more archaeological data is accumulated, the results of this initial work may be evaluated in terms of its overall contribution to the understanding of the region for this early period. The prehistoric remains located on Lease #17 may be characteristic of the entire northeastern Boreal Mixedwood ecosystem. On the other hand, areas far richer in material remains and data recoverability may be discovered, but this can only be determined by future research. Nor can the significance of archaeological remains of one region be assessed with reference to those of another. For example, we cannot say that Pueblo remains in Arizona are more important than remains of a buffalo kill-site on the Plains of Northern Montana or Alberta. For the present, suffice to say that *any* information recovered from the area is important and will ultimately form a portion of the data used to evaluate the relative significance of any area within the region.

The survey of Lease #17 and the addition to Surface Lease #352 has demonstrated that the Athabasca Tar Sands have archaeological potential. It is hoped that continued interest will be shown in realizing this potential.

Syncrude's archaeological consultants recommend that the area south of Lease #17 be surveyed in order to allow salvage of any archaeological sites which might otherwise be destroyed by the planned diversion of Beaver Creek. Sites in this area can be expected based on the distribution of sites in Lease #17.

The discovery of the large site north of Lease #17 (see Appendix A) suggests that it would be worthwhile to survey the section of Beaver Creek between the northern boundary of the lease and the Athabasca River. Salvage of the area prior to flooding by the retention pond is anticipated.

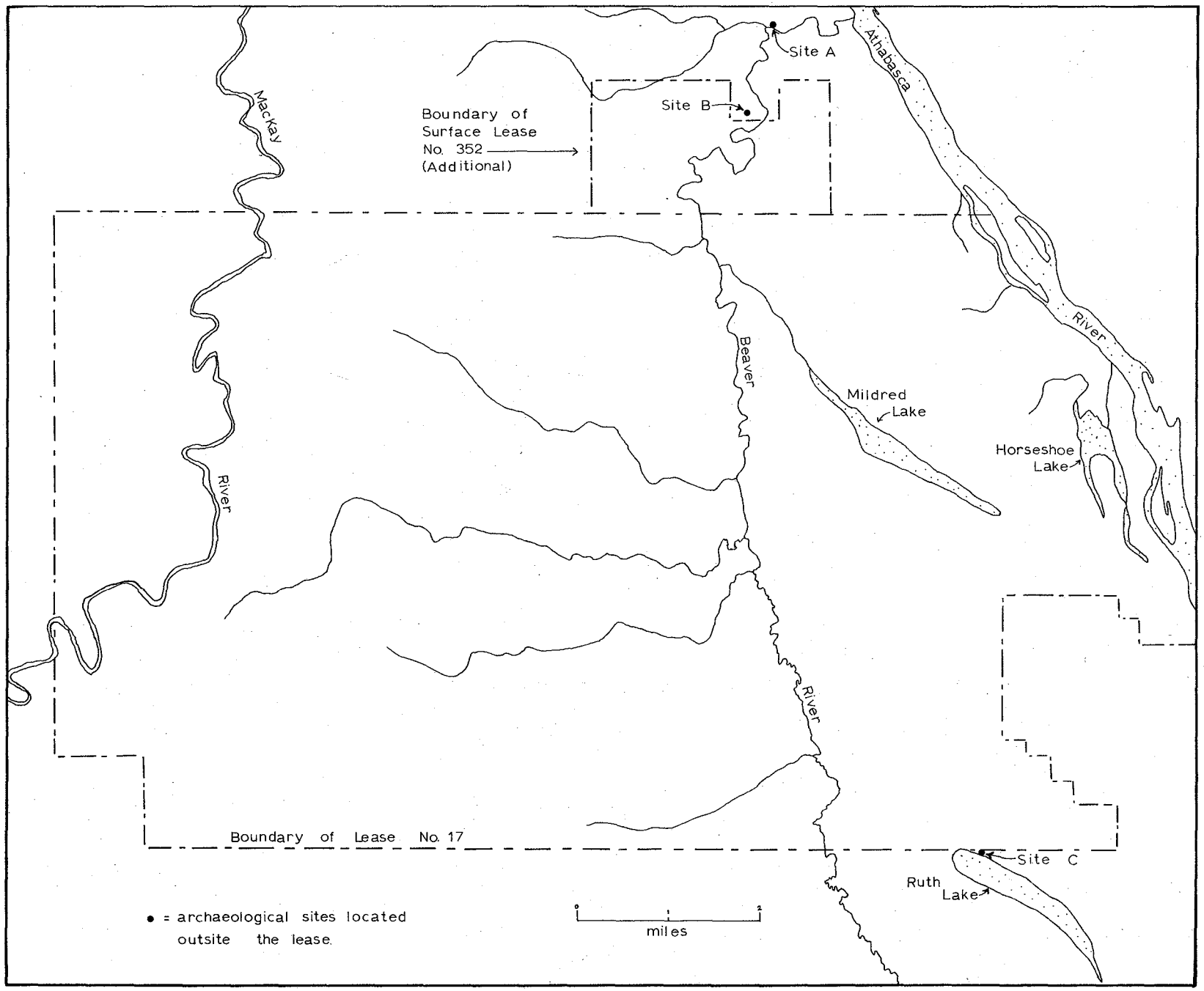
5. APPENDICES

APPENDIX A
RELATED SITES

Three sites were found adjacent to Lease #17 and Surface Lease #352. These sites are included here because they put the finds on the lease in a better perspective. The first two sites (A and B) are located on the lower part of Beaver Creek north of Lease #17. The last Site (C) is located on the shore of Ruth Lake just south of Lease #17. Site A is the most extensive site yet discovered in this area, and site C is the only site which we have been able to locate on a lake shore to date in this area. The sites were designated alphabetically to distinguish them from sites found on the lease.

SITE A

SITE COORDINATES:	*625E 306N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.*
ELEVATION:	*Approximately 850 feet above sea level.*
LOCATION:	*This site is situated north of the Beaver Creek and east of a large stream. The site stretches east from near the stream's mouth approximately 300 to 400 yards. The site parallels a bank which was formerly that of the stream. However, the Beaver Creek has cut into the stream channel and has diverted the creek upstream from the site. This has created a slough out of the lower section of the stream channel which the site now parallels. The top of the bank on which the site is located is approximately 75 feet above the present water level.*
HABITAT TYPE:	*The site is covered with a Jack Pine community.*
DESCRIPTION:	*This site appears to be a large aboriginal quarry and workshop based on the very large quantity of*


Site A
Site B
Athabasca
Mackay
River
Boundary of
Surface Lease
No. 352
(Additional)
Beaver
River
Mildred
Lake
Horseshoe
Lake
River
River
Boundary of Lease No. 17
Site C
Ruth
Lake
• = archaeological sites located
outsite the lease.
miles

flaking debris and an outcrop of the raw stone material (limestone) at the site. The exact extent and content of the site cannot be determined without further investigations. The soil consists of a thin layer of medium sand overlying a bedrock formation of limestone. The artifacts are concentrated in the upper portion of the sandy soil. A thick layer of moss covers the surface of the ground. Due to the shallowness of the soil a large number of overturned trees are present in the area. The root masses of these overturned trees contain a large quantity of cultural material.

WORK DONE AT SITE: An examination of the root masses of overturned trees was conducted. The area was photographed and a sketch map was drawn of the site.

ARTIFACTS RECOVERED: One quartzite biface, 1 quartz biface, 1 quartzite hammerstone, 2 limestone bifaces, 2 limestone cores, 12 limestone flakes, 30 limestone flake fragments, 1 limestone core fragment and 1 limestone biface fragment were found in the root masses of overturned trees.

SITE B

SITE COORDINATES: 618E 291N in the NE 1/4 of the NE 1/4 of Township 93, Range 11.

ELEVATION: Approximately 975 feet above sea level.

LOCATION: This site is located on the north side of the Beaver Creek on top of a 75 foot bank that slopes off to the water's edge. The site is just beyond the boundary of Surface Lease #352.

HABITAT TYPE: The site is located in a Pine/Aspen community.

DESCRIPTION: This site contained a quantity of debris of the same type of material which suggests that it was a workshop where raw material was finished into tools. The soil is a medium sand. The artifacts appear to have come from the upper portion of this sandy soil.

WORK DONE AT SITE: A surface collection was made. The site was photographed and a sketch map of the site was drawn.

ARTIFACTS RECOVERED: One biface fragment, 3 flake fragments and 3 pieces of shatter, all of limestone, were found on the surface of this site.

SITE C

SITE COORDINATES: 660E 157N in the NE 1/4 of the SE 1/4 of Township 92, Range 10.

ELEVATION: Approximately 1025 feet above sea level.

LOCATION: This site is situated on the shore of Ruth Lake on the northeast side of the lake, just below the boundary of Lease #17. The site is located on a north/south cutline near the northern tip of the lake.

HABITAT TYPE: The site is covered with a Pine/Aspen community.

DESCRIPTION: This is an open site of limited content suggesting a camp site of short duration. The soil is a medium sand. The artifacts are believed to have come from the top portion of the sandy soil. The site has been partially disturbed by bulldozer activity.

WORK DONE AT SITE: A surface collection was made. The area was photographed and a sketch map of the site was drawn.

ARTIFACTS RECOVERED: Six quartzite flake fragments were found on the surface of this site.

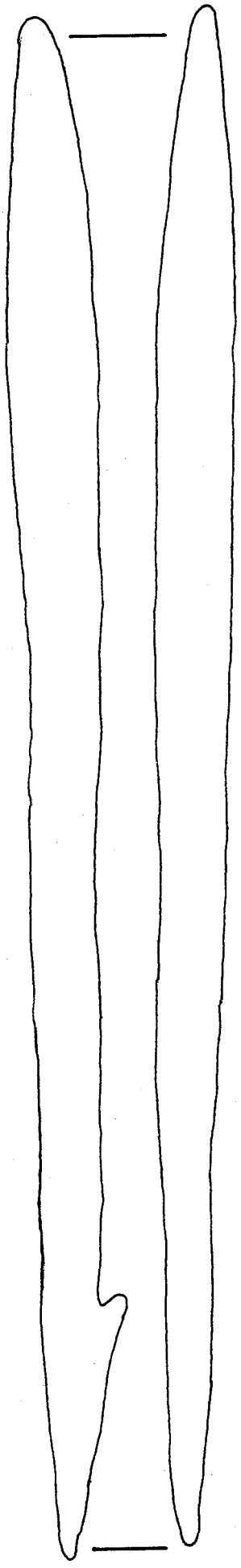
APPENDIX B

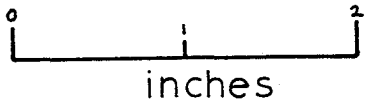
THE TOOLS AND OBJECTIVE PIECES

In all, 27 tools and unfinished tools (objective pieces) were found on Lease #17 and the addition to Surface Lease #352. Nine tools and objective pieces were found in two sites north of the lease. The following is a description of these artifacts.

TYPE:	*Side-notched projectile point.*
NUMBER OF SPECIMENS:	*One.*
SIZE RANGE:	*Length 3.3 cm., width 2.2 cm., thickness 0.7 cm.*
DESCRIPTION:	*This projectile point is triangular in outline and lenticular in transverse section. It has rounded shoulders, a straight base and slightly excurvate edges on the blade. The edges of the shallow notches in each side are ground as well as the edge of the base. The flaking is moderately well patterned and could have been produced by either the pressure or percussion techniques.*
MATERIAL:	*Quartzite 1.*
DISTRIBUTIONS:	*One in Site #22, surface.*

TYPE:	*Flake end scraper.*
NUMBER OF SPECIMENS:	*Six*
SIZE RANGE:	*Length* *Mean 3.65 cm.* *Standard Deviation 1.54 cm.* *Width* *Mean 2.78 cm.* *Standard Deviation .84 cm.*





TRACING OF BONE PROJECTILE POINT

Thickness

Mean .88 cm.
Standard Deviation .24 cm.

DESCRIPTION: These scrapers are made on flakes which have been altered on one end. They have had a series of small beveling flakes removed from one end to form a working edge. The flaking is moderately well patterned and was probably produced by the percussion technique. All of the working edges exhibit polishing and fracturing resulting from use.

MATERIAL: Quartzite 2, Chert 1, Chalcedony 2, Limestone 1.

DISTRIBUTION: 2 in Site #4, surface.
1 in Site #5, surface.
1 in Site #7, surface.
1 in Site #18, 0 to 6 inches below surface.

TYPE: Flake side scraper

NUMBER OF SPECIMENS: Seven

SIZE RANGE: Length

Mean 3.81 cm.
Standard Deviation 1.10 cm.

Width

Mean 2.57 cm.
Standard Deviation .50 cm.

Thickness

Mean .97 cm.
Standard Deviation .41 cm.

DESCRIPTION: These scrapers are made on variously shaped flakes which have had one edge retouched to strengthen and sharpen it. The flaking is poorly to moderately well patterned and was probably produced by the percussion technique. All the working edges show signs of wear.

MATERIAL: Limestone 1, Quartzite 1, Chert 4, Chalcedony 1.

DISTRIBUTION:
1 in Site #6, surface.
1 in Site #7, surface.
1 in Site #4, surface.
1 in Site #15, surface.
1 in Site #21, surface.
1 in Site #24, surface.
1 in Site # 26, surface.

TYPE: Pebble scraper.

NUMBER OF SPECIMENS: One

SIZE RANGE: Length 4.3 cm., Width 3.3 cm., Thickness 1.3 cm.

DESCRIPTION: This scraper is made from a split waterworn pebble which has been retouched along one edge to produce a strong sharp edge. The edge is somewhat polished due to wear.

MATERIAL: Chert 1.

DISTRIBUTION: 1 in Site #4, surface.

TYPE: Small biface

NUMBER OF SPECIMENS: One broken.

SIZE RANGE: Length undeterminable, Width 3.4 cm., Thickness 1.2 cm.

DESCRIPTION: This small biface is lenticular in outline and in transverse section. The tip has been broken off probably during manufacture. The flaking is well patterned and some of it was possibly produced by the pressure flaking technique.

MATERIAL: Limestone 1.

DISTRIBUTION: 1 in Site B, surface.

TYPE: Backed knife.

NUMBER OF SPECIMENS: One.

DESCRIPTION: This knife is made from a small waterworn pebble with the use of the bi-polar technique. Three flakes were driven off the pebble by a single blow which struck one end of the pebble while the other was supported on a hard surface. The removal of the three flakes produced a sharp longitudinal edge and a rounded waterworn surface on the edge opposite and 90° opposed to the sharp edge. The sharp edge shows signs of fracturing and polishing as a result of use.

MATERIAL: Chalcedony 1.

DISTRIBUTION: 1 in Site #17, surface.

TYPE: Chi-thos.

NUMBER OF SPECIMENS: Two.

SIZE RANGE: Length 12.6 cm. to 7.0 cm., Width 8.8 cm. to 4.3 cm., Thickness 1.5 cm. to 0.7 cm.

DESCRIPTION: Chi-thos have been described elsewhere as "tabular pieces of stone which are battered around the edge" (Johnson and Raup 1964: 139). These artifacts are known to have been used by Indians in recent times in tanning hides.

MATERIAL: Metamorphosed sandstone 1, Gneiss 1.

DISTRIBUTION: 1 in Site #2, surface.
1 in Site #3, surface.

TYPE: Large biface.

NUMBER OF SPECIMENS: 5 complete, 5 broken.

SIZE RANGE: Length

Mean 10.92 cm.
Standard Deviation 3.31 cm.

Width

Mean 6.90 cm.
Standard Deviation 2.43 cm.

Thickness
Mean 3.22 cm.
Standard Deviation .74 cm.

DESCRIPTION: These bifaces are roughly lenticular in outline and lenticular to plano convex in transverse section. The flaking is poorly patterned and was probably produced by the percussion flaking technique. One specimen exhibits a small polished area on one side, but otherwise there are no visible signs of wear on these artifacts.

MATERIAL: Quartz 1, Quartzite 1, Chert 4, Limestone 4.

DISTRIBUTION:
1 in Site #1, 0 to 6 inches below surface.
1 in Site #4, surface.
1 in Site #11, surface.
2 in Site #13, surface.
1 in Site #24, surface.

TYPE: Core.

NUMBER OF SPECIMENS: 4 complete, 2 broken.

SIZE RANGE: Length

Mean 9.50 cm.
Standard Deviation 1.89 cm.

Width

Mean 8.00 cm.
Standard Deviation 1.50 cm.

Thickness

Mean 5.18 cm.
Standard Deviation 1.25 cm.

DESCRIPTION: Irregularly shaped multidirectional flake cores. No platform preparation is evident. Probably produced by the percussion flaking technique.

MATERIAL: Limestone 6, Chert 1.

DISTRIBUTION: 1 in Site #15, surface.
1 in Site #19, surface.
1 in Site #24, surface.
3 in Site A, surface.

TYPE: Hammerstone.

NUMBER OF SPECIMENS: One.

SIZE RANGE: Length 7.1 cm., Width 6.7 cm., Thickness 5.3 cm.

DESCRIPTION: A rounded waterworn cobble with two battered ends. One side of the cobble has been broken away, possibly during use of it as a hammer.

MATERIAL: Quartzite 1.

DISTRIBUTION: 1 in Site A, surface.

Artifacts found during survey. TOP ROW: side notched projectile point, small biface, backed knife, three end scrapers. SECOND ROW: three end scrapers, pebble scraper, flake scraper. THIRD ROW: flake scrapers. (Note: projectile point is 3.3 cm. long.)

Artifacts found during survey. TOP ROW: hammerstone, chi-thos. BOTTOM ROW: large biface, core. (Note: chi-thos is 8.8 cm. long.)

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