SUMMER FIELD RECONNAISSANCE TO DETERMINE THE GENERAL COMPOSITION OF FLORAL AND FAUNAL GROUPS PRESENT IN THE FORMER ALSANDS LEASE AND THEIR RELATION TO TRADITIONAL RESOURCES USED BY MEMBERS OF THE COMMUNITY OF FORT McKAY

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Produced for:

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1. INTRODUCTION AND BACKGROUND

Shell's former ALSANDS lease was cleared, drained and subsequently abandoned in 1982, after the inception of the National Energy Policy. The Aquatic Mammal Studies completed during the winter of 1995/96 which covered both the Syncrude Aurora Mine site, and the Suncor Steep Bank Mine site, revealed that major vegetative changes have occurred during the intervening 15 years. The drainage appears to have been instrumental in creating the basis for major changes in the immediate subsurface growth medium. This has resulted in the establishment of a vegetation community comprised of intense deciduous growth, attended by a major community of Brome grass. This grass is particularly prevalent on the levees in the formerly cleared areas, suggesting that the levees were seeded once the drainage ditches were completed. The return of the beavers to the area (about 1993/94 according to local Fish and Wildlife officers) has added some 30 kilometers of impounded water, some of it deep enough to maintain year long fish populations.

The re-establishment of the vegetation succession pattern has resulted in a major increase in both food supplies and shelter for wildlife in general. During this period of natural reclamation, the ALSANDS lease has been left unattended and unobserved. In the interests of Shell, the governments, and all of the other prospective mining operators seeking to establish in the oil sands region, the following is an attempt to document the changes to the lease. This documentation will help to identify and, hopefully, make use of the mechanisms that have produced the positive changes so that they can be incorporated into the reclamation of future mining operations in the area.

Shell Canada Limited has been involved in oil sands exploration for several decades. In the late 1970's this exploration resulted in Shell initiating a project which would have culminated in an open oil sands mine and ore handling operation (ALSANDS). By the early 1980's, the project had reached a stage where the prospective mine site had been cleared and a drainage program implemented to de-water the lease. This area was substantial, covering some 14 square kilometers of muskeg on the ALSANDS lease.

Since the abandonment of this project in 1982, the area has received little attention, receding in memory to a point where it is for all practical purposes, "out of site, out of mind." The first real notice of the positive changes which have taken place on this lease came about through casual observation of a team composed of a biologist and two local trappers who were conducting an aquatic mammals study on both the Syncrude Aurora mine site and the Suncor Steepbank Mine site. It was fortuitous that the ALSANDS lease is partially located on the Syncrude Aurora mine site, and so became the subject of some special notice.

2. OBJECTIVES

The objectives of the following study are as follows:

1. To delineate the habitat types and current successional trends in the former ALSANDS lease area.

2. To determine the variety of species of birds, mammals, and (if present) fish which have taken up residence in the lease since the commencement of plant regeneration and creation of the water bodies in the drainage ditches, since the return of beavers to the area.

3. To compare the vegetation community before the lease was cleared with vegetation currently present on the lease.

4. To compare the species of plants and animals present with those which have been determined to be the most frequently utilized by the people of Fort McKay.

5. To determine if certain of these species are accumulating trace metals and/or polycyclic aromatic hydrocarbons(PAH's), and if so, to what degree. (Note: this portion of the study was completed by Golder Associates Ltd. Fort McKay Environment Services Ltd provided field assistance to the Golder field team.) This was done to acquire information on the trace metals and PAHs which might be found in the materials which the community members still consume.

To accomplish the above, the study will occur in two phases. Fieldwork for the first phase was completed before the first frosts in the fall of 1997. This phase included vegetation sampling for trace and heavy metals, and for PAH'S. This work was supplemented by the completion of eight browse and vegetation transects which were selected so as to include a representation of the main vegetative communities on the lease. As an addendum to this work, a waterfowl survey was completed on August 28, and a series of small mammal trap transects were included along with the vegetation transects. A variety of observations were made by the study team and a pair of trappers from the Community of Fort McKay on contract to both Suncor and Syncrude to control beaver populations in the area.

An electro-fishing survey was carried out in the drainage ditches in the ALSANDS lease to determine the species and age distribution of fish populations which have become established within the waters confined by the beaver dams located in the ditches. The survey took place during mid September before freeze-up.

Phase 2, still to be completed, will consist of a series of wildlife surveys. These surveys will take place during the spring and early summer of 1998. The first will be a drumming count and dancing ground survey to establish the relative level of Ruffed grouse, Sharp-tailed grouse and Spruce grouse in the area. This will be followed (or perhaps preceded) by a waterfowl breeding

pair survey. During the summer, a brood survey will also take place to determine the level of actual production for waterfowl in the wetlands produced within the ALSANDS drainage project by the actions of the beavers in the area.

3. METHODOLOGY

The fieldwork for Phase 1, carried out during the latter part of August and mid September of 1997, was handled by a field team composed of personnel from Golder Associates Ltd., and Fort McKay Environment Services Ltd. Data was generally shared along with utilization of various pieces of equipment and vehicles in the interests of creating strong working relationships between Golder's personnel and those from Fort McKay Environment Services. Fortunately, this situation also provided a more economic operation on the whole for both companies.

3.A. Scope of Work

To compare the changes in the vegetation and attendant wildlife communities on the ALSANDS lease pre-1982 (when the lease was drained and cleared) to vegetation and wildlife which currently inhabit the area, it was necessary to review the ALSANDS Environmental Impact Assessment completed by Hardy Associates (1978) Ltd. * (See Appendix A Map Shell Lease 13, and ALSANDS, including Browse Transects, Vegetation Sample sites and Drainage Ditch Pattern).

It was then necessary to identify and describe the general vegetation community and the various species of wildlife (and fish) which have re-established in this newly regenerated area. Phase 1 fieldwork provided the bulk of the data for this portion of the study.

A review of aquatic mammal studies completed for Syncrude and Suncor on the Aurora and Steepbank mine areas respectively was also undertaken to help determine where vegetation samples and browse transects might be located so as to be able to compare new findings with those from the work completed during the winter of 1995/956 in the above mentioned studies.

Sampling techniques and survey method protocols were provided by Golder, and were adhered to closely by the joint study team. This was to ensure that the data taken during this study would be comparable to those taken by Golder during their work on the adjacent proposed Shell and Suncor mine sites. These protocols (Golder Associates Ltd: Specific Work Instructions: Shell Browse Pellet Count Survey [May 1997], Project Millennium: Vegetation Tissue Sampling Collection) can be found in Appendix B of this report.

* *"Environmental Impact Assessment Presented to Alberta Environment In Support of An Oil Sands Mining Project:"* Produced for the AlSANDS Project Group By Hardy Associates (1978) Ltd. December, 1978.

The first of the field activities completed was the helicopter survey for waterfowl and other aquatic fauna on Shell's Lease 13, and on the old ALSANDS lease. This survey occurred on August 28, and was completed during the morning hours to ensure that conditions were settled. Survey data can be found in Appendix C, and will be reviewed in the Discussion section which follows.

Once the aerial survey was completed, biologists and technicians from Fort McKay Environment Services Ltd. and Golder Associates Ltd. took to the field and completed the collection of a variety of plant species, specifically, Blueberries (*Vaccinium caespitosum*), Cattails (*Typha latifolia*) and Labrador tea (*Ledum groenlandicum*). Efforts were made to acquire samples of "rat root" (*Acorus calamus*), however the team was unable to locate this species in spite of the assistance provided by members of the community of Fort McKay. Plant samples taken in the field were handled in the manner prescribed in the attached protocols. They were divided into portions according to their ultimate destination (i.e., Metals or PAH analysis), packed, preserved and recorded to ensure continuity of sample integrity, and shipped to Golder's office in Calgary for distribution to the labs for their respective analysis.

The plants collected during this process were analyzed for trace and heavy metals, specifically Pb, Hg, Ni, Cu, Va, Al, (etc., etc.) and PAHs to determine the base levels of these materials on Shell's Lease 13 before the onset of Shell's mining activities (Collection of samples by Golder/Ft. McKay Sample analysis and statistical analysis by Golder Associates Ltd.)

Following the vegetation sampling, transects were established for small mammal trapping. Traps were set according to methods prescribed for this process and as instructed by Golder personnel. Three transects were set within the ALSANDS site, and Golder personnel ran a number of transects on Shell's Lease 13. Each transect contained 33 traps, of which 16 were museum sets, 8 were regular snap traps, 8 were live traps, and one was a pitfall. Transect number 2 on the ALSANDS lease was located almost directly on the same site as on of the winter transects completed in 1995 by the Syncrude Aquatic Mammals study team.* The trap lines were operated for three days each. The traplines operated on the ALSANDS lease Browse transects numbering 1 to 5 yielded only 9 small mammals which are discussed later in the text.

Following the small mammal trapping, browse transects were set up and browse surveys completed. The three trap line transects on the ALSANDS lease were also the sites of the first three browse transects. Five more such transects were set up on the ALSANDS lease. All Browse transect locations and survey data are presented on Appendix E Global Positioning Satellite Systems points, in the event that there is a future need to return to these exact locations. The results of the browse transect survey are reviewed in the following Discussion section.

* *"Survey of Consumptive Use of Traditional Resources By the Community of Fort McKay:"* Completed for Syncrude Canada Ltd. By Ft McKay Environment Services Ltd; Feb.1996.

Electro-shocking of the drainage structures in the ALSANDS lease was completed on September 14. The northwestern portion of the drainage system is distinct from the east half of the system which was drained very shortly before the shocking took place. Conditions for the shocking were less than optimal in the southeast portion of the drainage system as a result of the removal of a number of very large beaver dams by Syncrude contractors. A flash flood was caused by this dam removal and those ditches drained (which still maintained a relatively strong moving stream) were not shocked. Minnow traps were set however, and were successful in trapping about 85 small fish, the bulk of which were Brook Sticklebacks (Culea inconstans). Lake chubs (Couesius plumius) were also present, along with what might have been another species thought to be Northern Red-bellied Dace.

Water sampling in the drainage canals was also carried out. The sampling which took place was carried out to determine pH, Dissolved Oxygen, Conductivity (Total Dissolved Solids) and Temperature. Chemical samples were also taken for analysis. These were taken to determine Total Metals, Total Hydrocarbons, Sulfides, Total Organic Carbons, Biological Oxygen Demand, Naphthenic Acids, Microtox, Major Ions and Chlorophyll "A."

The completion of the above field activities made it possible to draw a comparison of the present day flora and fauna with that which existed previous to the establishment of the drainage project and the site clearing on the ALSANDS lease. With the pre-determination of the types of flora and fauna most preferred for consumption by the people of the Community of Fort McKay,* it was at this point possible to determine how many of these species had returned to the ALSANDS lease, and in what quantity.

This information is particularly valuable to the community of Fort McKay, and is presented in the Discussion in the following text.

4. DESCRIPTION OF ORIGINAL ALSANDS LEASE: FLORA

A review of the ALSANDS PROJECT GROUP Environmental Impact Assessment completed by Hardy Associates (1978) Ltd. in December 1978, in support of the proposed ALSANDS Oil Sands Mining Project was completed in early September of 1997. This document described the general vegetative communities found on the lease, and placed these communities into two general categories: These were "Peatland Types," and "Upland Forest Types."

* *"Survey of Consumptive Use of Traditional Resources By the Community of Fort McKay"* Completed for Syncrude Canada Ltd. By Ft. McKay Environment Services Ltd; Feb.1996.

4.A Peatland Types

Peatland types were generally described as, "Scrub Black spruce/Moss Muskeg , and "Scrub Black Spruce Tamarack Sedge Fen."

Scrub Black spruce/Moss Muskeg occurred in areas with thick accumulations of Sphagnum peat on poorly drained, low-lying terrain. These areas where hummocky and exhibited clumps of stunted Black Spruce on these hummocks along with Labrador tea, "swamp birch" and low shrubs of cloud berry, with bog cranberry the prominent ground cover. On the drier hummocks, Cladina and Cladonia were present. Moss and sedges were found in the depressions between the hummocks.

Scrub Black spruce/Tamarack/Sedge Fen dominated the study area. The water table in these areas was surficial and was slowly moving through the fens. Organic accumulations were mainly graminoid and generally shallower than bog vegetation.

Certain fens were formed into narrow bands of willow and "swamp birch" (probably Dwarf birch) along the drainages. These were bounded by open stands of stunted tamarack and scattered black spruce. An open to dense cover of swamp birch, leatherleaf and bog rosemary was also to be found in these areas.

Other fens were reticulated or ribbed with the ribs perpendicular to the direction of the near surface water flow. Mosses shrubs and tamarack were to be found on the parallel raised ridges between the troughs of sedges and moss within the reticulated fen areas

4.B. Upland Forest Types

Topographical relief has not changed due to the clearing and drainage. It was then, and is now, still subtle. This subtle relief however, was then defined by distinct changes in vegetation, the higher areas being characterized by **Poplar** (both balsam poplar and aspen) forest between ten and twenty meters in height. The understory in such areas was described as "an open shrub cover of willow and Canada buffalo berry along with ericaceous shrubs (such as Shrubby cinquefoil) while the slopes (as low as they are) contain forbs and grasses." White birch was also present.

Jack Pine Forest were not common on the original ALSANDS lease and were only located where drainage was rapid and the soil base was composed of coarse outwash and/or eolian ridges adjacent to aspen dominated forest and muskeg. Undergrowth in such areas was composed of low shrubs, mostly blueberry, bearberry, Cladina lichens, and black spruce regeneration. The latter was scattered through the area.

Aspen Poplar-Spruce Forest was found in a number of freely drained sites throughout the study area. The spruce component (black or white spruce) ranged from regeneration to large (75 cm. d.b.h.) old trees. Undergrowth was medium to tall shrub strata of older willow, dogwood and

cranberry. The forbs strata consisted of Sarsaparilla, twin flower, bunch berry, and ground pine. The ground cover was mostly feather mosses.

Aspen Poplar-Jack Pine Forest was found in association with other aspen dominated forest types. Jack pine was widely scattered among even aged aspen of smaller stature. The understory consisted largely of willow, Canada buffalo berry and blueberries. Some scattered spruce regeneration was noted.

Black spruce-Tamarack-Jack pine Forest was relegated to only a few sites characterized by poorly drained lower slopes of eolian and outwash terrain. They also occurred on low relief exposures of mineral soil in peatlands. These two areas both experienced near-surface fluctuating water tables. This vegetation type includes clumps of scattered black spruce and tamarack along with patches of jack pine, all of which average 10 meters in height. The understory was composed of willow, alder, Labrador tea and blueberry. Scattered patches of sedges and grasses were also present, accompanied by bog cranberry and patches of Cladina lichens. On the wetter sites, hummocks of sphagnum appeared along with feather moss, bog rosemary, leatherleaf, and small bog cranberry.

White spruce Forest was the climax upland vegetation in the area. Some balsam fir was interspersed with the White spruce. The forest consisted of tall white and black spruce (up to 30 meters) with scattered white birch, and aspen. Undergrowth consisted of coniferous regeneration, including balsam fir. Alder, willow, dogwood and low-bush cranberry were also distributed throughout the shrub layer. Ground cover included bunchberry, twin flower and a carpet of feather mosses.

4.C. Riparian and Aquatic Types

These vegetative types were confined to two general categories. These were:

Shrub Types, which were confined to bands of tall deciduous shrubs along the defined drainages including the Muskeg River and all of its tributaries in the area. Vegetation in the drier of these areas included in this category included willow, alders and shrubby cinquefoil. Imperfectly drained upland sites included willow, alder, cinquefoil and also included blueberry and Labrador tea.

Aquatic Types were found adjacent to the Shrub type which gave way to narrow, discontinuous bands of emergent vegetation in shallow water. These species consist of cattail, various species of rushes, and horsetail. In the deeper waters, floating mats of moss, duckweed and algae were also present, along with pond-lily. Semi-submergent and submergent plant species were located throughout the aquatic habitats and included arrowhead, several species of pond weed, and muskgrass.

5. DESCRIPTION OF THE CURRENT STUDY AREA: FLORA

The former ALSANDS lease is located in the bottom half of Sections 1 to 4 in Township 96, Range 10, and in the top half of Sections 33 and 34, and in the east half of Section 35, and the west half of Section 36, Township 95, range 10, all west of the 5th meridian.

5.A. Grasses and Forbs

As stated in item number 4 above, the current ALSANDS lease itself is almost flat, the only perceptible relief being the levees created during the excavation of the drainage ditches. On the levees, the monoecious plant community is composed of thick stands of Brome grass (*Bromus enermis*) on the levees, probably seeded to act as an impediment to erosion. The presence of Marsh reed grass (*Calamagrostis canadensis*), June grass (*Koeleria cristata*), and Rough hair grass (*Agrostis scabra*) were noted once the immediate vicinity of the levees was vacated.

Areas within the centres of the main eastern and western sections of the current lease site are relatively dry, and exhibit little in the way of top soil (probably because it was removed during the clearing). These areas are generally more open and exhibit a more xeric plant community than that which can be found in the areas adjacent to the cleared lease area. Indeed, some portions of these two locations resemble a tension zone between prairie and parkland with open grassy areas bordered by zones of scrub aspen and poplar.

Species identification of the monocots in the Hardy study did not appear to be present. "Sedges" (*Carex spp.*) were noted to be present in most of the poorly drained areas of the lease before it was drained and cleared, but species were not identified. At the time of the present field study, the area was relatively dry, and sedges were only common in the emergent and riparian sites.

A number of forbs were identified during the field work for this study, among which were two species of Aster (*Aster sibericus* and probably *Aster nova anglia*), anemone (*Anemone canadensis*), and Golden rod (*Solidago canadensis*.). Also found in profusion were Strawberry (*Frageria virginiana*.), Bunchberry (*Cornus canadensis*) and Grass of parnassus (*Parnassia palustris*). These were probably present during the original Hardy study, but were not identified to species.

5.B. Shrubs

During the process of clearing the ALSANDS lease, it appears that the A horizon was for all practical purposes, removed along with the vegetative communities which covered the area. The cleared lease was then burned. This action, combined with the drainage of the lease has resulted in the creation of growth sites which appear to exhibit more seasonal extremes in growth conditions than before the clearing and drainage occurred. For example, there are fairly large areas within the lease where nutritional levels and moisture conditions produce good growth in the more dominant species such as poplar, aspen and willow until they reach a certain size (about

3 to 4 meters). At this height, they begin to exhibit stress resulting in high levels of mortality. The exact reasons for this are not known at this time. In other areas, a certain level of moisture still remains, but with the massive amount of regrowth, there is a tendency for one or two species to dominate. The regrowth in such areas is intense, and is heavily dominated by such species as Dwarf birch, with virtually no understory. Stem densities are high, creating excellent cover for prey species such as hares and grouse. Ground cover is almost nonexistent This is undoubtedly due to the lack of light penetration.

In general, the regrowth of shrubby vegetation has been confined to date, to a small number of woody plants. These include Dwarf birch (*Betula pumila*) and several species of willow (*Salix spp.*). Shrubby cinquefoil (*Potentilla fruiticosa*), and Canada buffalo berry (*Shepherdia canadensis)*, were found in large quantities on several of the drier vegetation transects. Labrador tea (*Ledum groenlandicum)* was also present, but in much lower quantities than in the uncleared Jack pine and Black spruce areas adjacent to the former ALSANDS lease.

Along the levees, the willows, aspen and poplar were severely pruned by beavers, and it is clear that the over use of willow, aspen and poplar will ultimately limit the beaver in the area. The Dwarf birch remained untouched by beavers at the time of this field reconnaissance. Blue berries (*Vaccinium caespitosum)*, Rose (*Rosa acicularis*), and Snowberry (*Symphoricarpos occidentalis*), were present in most of the transects in significant quantities, with the exception of transects numbers 7 and 8, which were almost 100% Dwarf birch with virtually no understory. Horse tail (*Equisetum spp.*) was also prevalent throughout the study area. Less common, but also found throughout the area were blueberries, leather leaf (*Chamaedphne calyculata)*, and Labrador tea. Saskatoon, *(Amalachier alnifolia*), low bush cranberries (*Viburnum edule ssp. trilobum*), and goose berries (*Ribes oxacanthoides*) were also found but were relatively less abundant than the other shrubby species noted above.

5.C. Deciduous and Coniferous Trees

The deciduous tree species in the area are currently limited to Aspen (*Populus tremuloides*), and Balsam poplar (*Populus balsamifera*). Once again, on the levees, none of these trees can be found above the grass height any closer than 25 metres from the water. There were signs that poplar and/or aspen trees formerly existed within this area, but beavers have cropped them to such an extent that most of them have died back, and are now just stumps hidden in the very dense Brome grass established on the levees above high water.

Coniferous tree species were confined to Tamarack (*Larix laricina*) and Black spruce (*Picea mariana*), the bulk of which were tamarack. Many of the tamarack are between 4 and 6 metres tall, indicating that they established themselves almost immediately after the occurrence of the site clearing.

Discussions with District Fish and Wildlife officers regarding the ALSANDS lease (during the aquatic mammals studies in the winter of 1995/96) revealed that the beavers re-established

themselves in the drainage ditches on the lease only after the poplar, aspen and willows had reached a size which could adequately provide both food and good building materials. This occurred about 12 years after the initial site clearing in 1982. It is therefore apparent that the birch and tamarack currently located at the water's edge, were at least a meter or more above the bottom of the dried out drainage ditches until the beavers returned to dam the run-off.

5.D. Emergents and Aquatic

Sedge (*Carex spp.*) were present along the ditch banks. Emergents included Cattails (*Typha latifolia*) and a number of different rushes. Common great bulrush (*Scirpus validus*) was present, but not in quantity, the shallower stretches of water being dominated by cattail. Also present were spike rush (*Eleocharis palustris*), and baltic rush (*Juncus balticus*).

Several pond weeds (*Potomageton spp.*) were seen and masses of Coontail *(Ceratophyllum demersum*) and Spiked water-milfoil (*Myriophyllum exalbescens*) were located in several of the beaver dams. Duckweed (*Lemna minor* and *L. triscula*) was also present but not in quantity.

6. DESCRIPTION OF STUDY AREA: FAUNA

The terrestrial fauna of the general area have been observed and documented in relative detail over the past thirty or forty years. The Hardy (1978) Ltd. ALSANDS Project Group Environmental Impact Assessment Report (December, 1978), provides a detailed list of the fauna of the area. The species observed in the area over time are identified in the following list. It must be stated at this point, however, that many of the species listed were not observed during the 1997 late summer field reconnaissance. Also, one or two species which were observed during this field reconnaissance, are not listed in the Hardy 1978 Report.

The list of species known to live in, or to frequent the area during part or all of the year is as follows:

6.A. Reptiles and Amphibians

Boreal chorus frog	*Pseudacris triscriata*
Canadian toad	*Bufo hemiophrys*
Red-sided garter snake	*Thamnophis sirtalis*
Wood frog	*Rana sylvatica*

The only one of the above species observed during the recent 1997 field reconnaissance program was the wood frog, and they were observed with relative frequency.

6.B. Avifauna

The number and variety of avifauna inhabiting the area both seasonally and throughout the year

is impressive. A list (from Hardy, 1978 ALSANDS Project Group Environmental Impact Assessment) is provided below. It should be noted at this point, that not all of the birds on the list below were observed during this study. Those that were are discussed in the text following the list.

6.B.1. Aquatic Birds

Common loon	*Gavia immer*
American bittern	*Botaurus lentiginosus*
*Canada goose	*Branta canadensis*
*Mallard	*Anas platyrhynchos*
*Green-winged teal	*Anas crecca*
American widgeon	*Anas clypeata*
Ring-necked duck	*Aythya collaris*
Common goldeneye	*Bucephala clangula*
*Bufflehead	*Bucephala albeola*
*Sandhill crane	*Grus canadensis*
*American coot	*Fulica americana*
*Killdeer	*Charadrius vociferus*
Spotted sandpiper	*Actitis macularia*
Solitary sandpiper	*Tringa solitaria*
*Greater yellowlegs	*Tringa melanoleucus*
Lesser yellowlegs	*Tringa flavipes*
*Red winged blackbird	*Agelaius phoeniceus*

* Observed during this study

A waterfowl survey covering the Shell lease and the former ALSANDS lease was carried out by helicopter on August 28. Several species of shorebirds and several Sandhill cranes (*Grus canadensis*) were also identified during this survey (See Appendix C, August 28, 1997 Waterfowl Survey Covering Shell Lease 13 and ALSANDS). The area covered included a number of small lakes and sloughs as well as all of the drainage ditches in the ALSANDS lease, and Kearl lake. Waterfowl were limited in numbers, but this was because they were in the midst of staging on the lakes further south for the annual fall migration. The limited number of birds seen leaned heavily toward broods which had not yet reached a point in physical development which would allow them to safely fly south.

In the days following the survey during the vegetation sampling in the area, large numbers of migrating Sandhill cranes, Canada geese (*Branta canadensis*), and White-fronted geese (*Anser albifrons*) were observed as they passed over the study area heading south. Also observed during this study were Swans (*Olor spp.*), White-fronted geese (*Anser albifrons),* and Snow Geese *(Chen hyperboria*).

A more thorough determination of the use of this area by waterfowl will be derived from the breeding pair surveys and brood surveys that will be conducted during the spring and summer of 1998.

6.B.2. Terrestrial Birds

*Red-tailed hawk	*Buteo jamaicensis*
*Marsh hawk	*Circus cyaneus*
*Spruce grouse	*Canachites canadensis*
Ruffed grouse	*Bonasa umbellus*
*Gray jay	*Perisoreus canadensis*
*Common raven	*Corvus corax*
*Common flicker	*Colaptes auratus*
Yellow-bellied sapsucker	*Sphyrapicus varius*
*American robin	*Turdus migratorius*
Yellow-rumped warbler	*Dendrioca coronata*
Evening gros-beak	*Hesperiphona vespertina*
*Common grackle	*Quiscalus quiscula*
Dark-eyed junco	*Junco hyemalis*
*Chipping sparrow	*Spizella passerina*
*White throated sparrow	*Zonotrichia albicollis*
Fox sparrow	*Passerella iliaca*
Song sparrow	*Melospiza melodia*

*Observed during the 1997 ALSANDS lease field reconnaissance

Also observed were Sharp-shinned hawk (*Accipiter striatus*), Sharp-tailed grouse (*Pediocetes phasianellus*), and Kestrel (*Falco sparverius*). Observed in the same area in 1995 during the autumn were two Bald eagles (Haliaeetus leucocephalus).

6.B.3 Upland Game Birds

The old ALSANDS lease area is known to the local people for its numbers of "chicken." This is local vernacular for grouse in general, but in this area the term specifically applies to Sharp-tailed grouse (*Pediocetes phasianellus*). During the completion of the vegetation sampling and the browse transects, Sharp-tailed grouse were seen on a daily basis. As high as 12 were observed in a single group on at least one occasion while travelling along the north side of the lease.

It was noted that Sharp-tailed grouse were not observed in the study area during the 1978 Hardy Wildlife surveys.

The Authors state (ALSANDS Project Group Environmental Impact Assessment Report, December, 1978; Page 1960) that; "Sharp-tailed grouse were not observed in the oil sands region

during the winter months of 1977, nor have they been recorded for the study area. Open bogs may be important habitat* though the species prefers bushy parklands and edges of forest clearings throughout its range.** The drier conditions caused by the drainage on the ALSANDS lease, resulting in more grassy and open areas, appears to have created a habitat more in tune to the Sharp-tail's needs.

Willow ptarmigan (*Lagopus lagopus*) are known to move into the area during the winter months. It was therefore, not surprising that they were not observed in the area during the latter part of August and early September of 1997.

Spruce grouse (*Canachites canadensis*) were observed at the south end of Shell Lease 13 during the vegetation sampling.

Ruffed grouse (*Bonasa umbellus*) are also present, but were not observed during the late summer field studies.

6.B.4 Song Birds

The time of day during which this particular survey occurred ensured that those species which are crepuscular in nature would be at their lowest point of activity. It was therefore not surprising that song birds were conspicuous by their lack of presence. White-throated sparrows (*Zonotrichia albicollis*) and Vesper sparrows (*Pooecetes gramineus*) were observed during the fieldwork, along with a variety of unidentified sparrows. Red-winged black birds (*Agelaius phoenicius*), Brewer's blackbirds (*Euphagus cyanocephalus*) and Grey jays (*Perisoreus canadensis*) were observed during the field activities as well. A survey will be conducted in the spring of 1998 to provide an inventory of breeding song birds and upland game birds. This will be accomplished through bird song identification and enumeration, and drumming and dancing ground counts.

6.B.5 Corvids and Other Predatory Birds

Predatory birds observed during this survey were Red-tailed hawk, (*Buteo jamaicensis*), Ravens (*Corvus corax*), Northern harriers (*Circus cyaneus*), Sharps-shinned hawk (*Accipiter striatus*), and Kestrels (*Falco sparverius*). The region, however, is known to harbour a variety of avian predators including hawks, owls, ravens and crows. Bald eagles (*Haliaeetus leucocephalus*) were observed at Kearl lake within a few kilometers of Shell's Lease 13. Also known to inhabit the area are several species of owl such as the Great horned owl (*Bubo virginiana*), and the Great grey owl (*Strix nebulosa*), but these were not observed during the vegetation sampling and the browse survey.

* "Avifauna Baseline Studies, Volume 11, Report for Terrestrial Fauna Research Committee, Aoserp Project TF2.1 : Francis, J. and K. Lumbis 1978.

** "Birds of Alberta" revised by W.R. Salt, Alberta Dept of Indst. & Dev. 1966

6.C. Mammals

The following list of mammals has been taken in tact from Hardy Associates (1978) Ltd. report. It must be stated that a number of these mammals were not included in the observations made during the 1997 ALSANDS Lease Field Reconnaissance conducted by Fort McKay environment Services Ltd and Golder Associates personnel.

6.C.1 Small Mammals

*Cinereus shrew	*Sorex cinereus*
*Deer mouse	*Peromyscus maniculatus*
Least chipmunk	*Eutamius minimus*
Mackenzie vole	*Phenacomys mackenziei*
*Meadow vole	*Microtus pennsylvanicus*
Northern flying squirrel	*Glaucomys sabrinus*
*Pigmy shrew	*Microsorex hoyi*
Porcupine	*Erethizon dorsatum*
*Red-backed vole	*Clethrionomys gapperi*
*Red Squirrel	*Tamiasciurus hudsonicus*
Saddle-backed shrew	*Sorex arcticus*
*Snowshoe hare	*Lepus americanus*
Water shrew	*Sorex palustris*

* Observed during the 1997 ALSANDS lease field reconnaissance study

Small mammal trap transects were set up throughout the ALSANDS lease and to the southeast of this area on the current Shell Lease 13 proposed mine area. A number of small mammals were taken during this trapping exercise, including one meadow vole which appeared to be carrying a large warble fly larva as a parasite.

The cover in the area is ideal for microtenes and a variety of species were caught including Red backed voles (*Clethrionomys gapperi*), White-footed deer mouse (*Peromyscus maniculatus*), Masked shrew (*Sorex cinereus*) and one specimen tentatively identified as a Meadow vole (*Microtus pennsylvanicus*). Red squirrels (*Tamiasciurus hudsonicus*) were observed on a casual basis from time to time crossing the road in the Black spruce and Jack pine site near the ALSANDS lease area.

Numerous active snowshoe hare (*Lepus americanus*) runs in the grass and through the birch and tamarack were also observed. Also during this 1997 ALSANDS lease field reconnaissance, the beaver control team from Fort McKay was frequently successful in snaring hares which they used to supplement their camp diet. It must once again, be state that the impenetrable nature of the regenerated Dwarf birch stands in the cleared ALSANDS lease area must be regarded as an Eden for Hares (Appendix D, Photos 1, 2, and 3). The spacing of the stems are so dense as to

make the area all but impenetrable to anything but the smallest of mammal predators, and thus represents a high level of security for most species preyed upon by coyotes, fisher, foxes, lynx and wolves.

On the levees, there were numerous mounds, similar to those made by Pocket gophers in areas to the south. These mounds were present in numbers within the dense stands of brome. No Pocket gophers were either trapped or observed during the study, however.

6.C.2 Semi-Aquatic Furbearers

*Beaver	*Castor canadensis*
Mink	*Mustela vison*
*Muskrat	*Ondatra zibethicus*
*River otter	*Lutra canadensis*

* Observed during the 1997 ALSANDS lease field reconnaissance study.

The presence of the current water regime in the lease is due exclusively to the presence of beavers (*Castor canadensis*) and their innate abilities to capitalize on the presence of small amounts of running water and, of course, willows, poplar and aspen. All of these items are used as building materials for their dams. The habitat for beavers in the area is ideal from the perspective of both water supply (as well as the security of deep ditches within which to store it) and food. The food situation however, is already being stressed, and will undoubtedly limit beaver numbers in in the foreseeable future in a natural manner.

Muskrats (*Ondatra zibethicus*) are present in the drainage ditches, as evidenced by the dislodged cattail and rushes in and around the colonies of these emergents in the shallower areas of the canals. This was corroborated by observations of muskrat in the area by the beaver control personnel operating in the area.

Winter studies in the area identified the presence of both mink (*Mustela vison*) and river otters (*Lutra canadensis*) both of which must feed on the fish in the beaver dams. A river otter was accidentally caught by the beaver control personnel during the beaver trapping operation on the old ALSANDS lease in late August, 1997.

6.C.3 Carnivorous Furbearers

*Black Bear	*Ursus americanus*
*Coyote	*Canis latrans*
Ermine	*Mustela erminea*
Fisher	*Martes pennanti*
Long-tailed weasel	*Mustela frenata*
Lynx	*Lynx lynx* (*ssp canadensis*)

Marten	*Martes americana*
*Red fox	*Vulpes vulpes*
Timber wolf	*Canis lupus*
Weasel	*Mustela nivalis*
Wolverine	*Gulo gulo (ssp. lusus)*

* Observed during the 1997 ALSANDS lease field reconnaissance study

During the winter studies completed by Fort McKay Environment Service during the winter of 1995/967, tracks and other signs of Canada lynx (*Lynx canadensis*), fox (*Vulpes vulpes*), coyote (*Canis latrans*), fisher (*Martes pennanti*) and Long-tailed weasels (*Mustela frenata*) were observed during track transect counts conducted for Syncrude and Suncor on the Aurora and Steepbank mine sites, respectively.

During the 1997 ALSANDS lease field reconnaissance, fisher tracks were observed along the drainage on the south end of the lease area. Coyotes were heard while taking water samples at the large beaver lodge on the far west end of the lease, and fresh wolf scat was located immediately adjacent to this location during the same water sampling episode.

Black bear *(Ursus americanus)* sign was prevalent in the area. Bears were occasionally observed by campers and the Fort McKay beaver control personnel working in the area during this study.

6.C.4 Ungulates

Barren ground caribou	*Rangifer arcticus*
*Moose	*Alces alces*
Mule deer	*Odocoileus hemionus*
Plains bison	*Bison bison bison*
White-tailed deer	*Odocoileus virginianus*
Wood bison	*Bison bison athabascae*
Woodland caribou	*Rangifer caribou*

*observed during the field study

Deer, likely white tailed deer *(Odocoelius virginiana),* and moose (*Alces alces)* beds were frequently found in the deep grass on the levees. Moose were observed several times on the lease area itself from both the ground and the air. The remains of a wolf-killed moose were located in the grass near a beaver dam located on the extreme south end of the drainage complex for the lease, indicating the presence of both wolves (*Canis lupus*) and moose in the area.

Woodland caribou (*Rangifer caribou*) and Barren ground caribou (*Rangifer arcticus*) are only occasional visitors to the area. Woodland caribou were observed on the ALSANDS lease area during the winter of 1972/73 (Shell, 1975). In 1959, R. Webb, a biologist with Alberta Fish and

Wildlife Division reported that in 1957,* a migrating herd of approximately 1500 Barren ground caribou actually moved south through the area past Fort McMurray before returning to the NWT. This type of Barren ground caribou movement has not been recorded since that point in time.

7. Fish

The drainage pattern set out on the lease was parted in the centre by the road to the Syncrude camp, with the east half draining through the south eastern ditches into the Muskeg River. Fish were only observed in the drainage ditche in the eastern portion of the lease. An electro-shocking expedition in the northern and western portion of the lease corroborated the initial determination that fish were not present in this area.

Minnow traps set in the southern-most drainage ditch immediately after the forcible removal of about eight beaver dams were successful in capturing over 80 fish. These were identified as Lake chubs (*Couesius plumius*),and Brook stickleback (*Culea inconstans*). The variety in the size distribution of the two species, indicated the presence of both adults and juvniles.

The presence of fish in these waters was undoubtedly attributable, first, to the creation of these water impoundments by the beavers; and second, to the water depth, which in most cases was greater than two meters, and appeared to average between 3 and 5 meter (See Appendix D Photo Number 4). Water temperatures, oxygen content, conductivity, and clarity were apparently within optimum parameters for fish. This suggests that a stocking program might be worthy of consideration with the idea of establishing a "put and take" fishery in these beaver created water impoundments.

Questions requiring more research in this light might be:

- If such drainage projects were designed to facilitate both drainage and fish use, what changes could be made to increase the benefits provided by these canals to breeding, rearing and wintering fish?

- Would mining companies entertain the concept of allowing such de-watering projects to be used for the production of a "put and take" domestic or commercial fishery while the company fulfills its drainage objectives.

* R. Webb: Personal Communication, Oct. 1997

8. SMALL MAMMAL TRAPPING RESULTS

During the last week in August, 1997, a series of transects were established within the cleared and drained area of the former ALSANDS lease. These transects to determine the levels of browse use by ungulates in the area, and to locate a systematic small mammal trapping program for the purposes of determining the species composition and relative abundance of small mammals which have re-established themselves on the lease since it was cleared and drained in 1982.

Eight transects were set up, of which the first five served as both browse and small mammal transects. All 8 of these transects are positioned on the ALSANDS lease map (Appendix A). To insure that the exact location of each transect can be re-established in the future, their locations have been recorded using Ground Positioning Satellite data (see Appendices A and E for GPS file numbers and UTM E. and N. numbers at the start and end of each transect location).

The small mammal trap configurations for each transect were identical, and followed protocols established by Golder Associates Ltd. for the purposes of ensuring that human error in trapping and analysis are minimized if not eliminated.

Each transect included 6 main site locations, and each site location was 13 meters from the previous site. At each site, five traps were set. Two of these were Museum sets, two were snap traps, and one was a live trap. At the third site on each transect, a pit fall trap was set by burying a four litre ice cream bucket, the top of which was level with the ground surface, and filling the container with about two inches of water. The traps, with the exception of the pit fall, were baited with a mixture of oatmeal and peanut butter.

It was noted that this bait was also capable of attracting much larger prey, and on several occasions, traps disappeared, the signs indicating that there was probably a black bear somewhere with a trap stuck to its nose.

Appendix E includes the data sheets which describe the vegetation communities on each of the transects involved. Transect number 1 (see map location) was the only transect of the five transects which were trapped that was relatively wet. Transects 2 to 5 inclusive were xeric, and exhibited a dearth of top soil. The vegetation on transect 2, 4 and 5 were almost characteristic of badlands, or dry land prairie. Transect 3 contained more of a soil base, and a more diversified and lush understory. Transect 5 was divided because of its location (i.e., too close to the a drainage ditch running north/south on the east side of the transect). On this transect, ground cover was virtually absent because the Dwarf birch, which was two to three meters high, was so dense that sunlight rarely reached the ground. Birch stems up to an inch in diameter, with densities that reached as high as two hundred per square meter, provide a paradise for prey species such as hares and grouse, and a virtually impenetrable wall for the larger predators both avian and terrestrial, explaining to some extent, the presence of these prey species in their current numbers.

Trapping Results

While the other Golder small mammal trapping crew operating in Shell's Lease 13 was quite successful in trapping and collecting a large number of small mammals, the McKay/Golder study team trapping the 5 transects on the old ALSANDS lease experienced only marginal success.

Many traps on these transects,were sprung without catching anything and had to be reset during this period. At least one trap was carried off by something much larger than a vole. Only 9 small mammals were trapped during the three days that these five trap transects were in operation. A shrew (probably *Sorex sinurius*) was caught in a live trap and set free after being marked for future reference (a small strip of its fur shaved from its back).. Of the 8 others captured in the museum sets and snap traps, four were shrews, three were red backed voles (*Clethrionomys gapperi*) and the last was an unidentified vole (probably a meadow vole [*Microtus pennsylvanicus*]).

9. BROWSE SURVEY RESULTS:

Browse surveys were conducted on the five transects established for small mammal trapping. An additional three transects were established for the purposes of conducting browse surveys on areas which were more difficult to access, and which exhibited vegetation communities sufficiently different from those within which the first five transects were located.

Browse identification and recording methods were provided in study protocols developed by Golder Associates Ltd., and were closely adhered to. Each transect was established, identified and sited in using the GPS file methods to ensure easy future relocation for resampling purposes. Five sampling sites were located on each transect. These sites were situated 25 meters apart with each site having a central location on the transect itself, and encompassing an area 5 meters in diameter, the radius being 2.5 meters from the central point on the transect.

Within the area defined, overstorey, understory and ground cover vegetation are all identified, and an estimate of the percentage of the sample area that each of these classifications cover was made. A detailed examination of the species making up the overstorey, understory, and ground cover is then completed to determine, a) if each (or any) species has been browsed, b) was it browsed recently, or is it old browse, and c) what animal species did the browsing (i.e. Hare, moose, deer, etc.).

The above are recorded on standard data sheets (Appendix E) for further review and analysis.

Transect 6 was located the furthest north of all of the vegetation transects (see map). This transect was comprised of a relatively rich and lush regeneration understory composed of grasses, forbs and shrubs, such as fireweed and saskatoon respectively. Aspen and willow made up the bulk of the overstorey which covered about 30% of the transect. The area exhibited a considerable amount of black bear sign, but from a browse perspective, virtually all signs of

browse use were from previous years.

Transects number 7 and 8 are located on the north side of the main east/west drainage ditch on the south west portion of the ALSANDS lease area. These transects are about 1.5 kilometers apart, and both areas have been subjected to drainage. Plant communities now present are characterized by dense regeneration comprised of Dwarf Birch (*Betula pumila*), tamarack (*Larix larcinia*), a small amount of willow (*Salix spp.*), and an occasional black spruce (*Picea mariana*). Where open areas exist, and they are relatively few, at least one species of grass (probably *Calamagrostis spp.*) is present, along with a small amount of snowberry (*Symphorycarpos spp.*).

Once again, ground cover was almost non existent within the Dwarf birch stands due to the incredible stem densities at ground level, and the virtual absence of sunlight below the birch canopy some two to three meters above the ground (Photos, Appendix D) .

Within both of these transects, there was an absence of current browse. However, Snowshoe hare browse from previous winters was noted. In some cases this browse was located a meter above ground level, indicating snow depth which would discourage movement of most other mammalian species, particularly deer. This might also explain the lack of browse sign in the area by species other than hares.

To conclude, no statistical analyses were undertaken on the data from the browse transects, because there was an almost complete absence of current browse on any of these transects. This may lead one to conclude that there are no ungulates using the area. It may also lead one to conclude that because of the easy access to the area, and the fact that hunters, both native and non-native frequent the area for the entire year, that the ungulates, especially moose, (because they are so obvious in this newly regenerating area), are not given the opportunity to make use of the newly produced and abundant food supply because they are harvested before they can do so.

Hares and Sharp-tailed grouse, on the other hand, appear to thrive in the area. Grouse in particular were frequently observed by the study team, and the Fort McKay animal control group (beaver trappers) snared Snowshoe hares with regularity to supplement their camp fare.

10. RESULTS OF PAH AND METAL ANALYSIS OF PLANT SAMPLES:

Little baseline information has been gathered on the amount of trace metals and polycyclic aromatic hydrocarbons (PAHs) which might be found in various plants and animals which are consumed on a regular basis by the people from the community of Fort McKay. Shell decided, therefore, to collect and analyse a selection of plants which they believe are regularly consumed by the members of this community. Their selection was solely confined to the following plants, and to the immediate substrates within which these plants were rooted.

Ten sites were selected. Five of these sites were flooded, and five were on higher ground. From the flooded sites, it was decided that cattail root (*Typha latifolia*), and rat root (Sweet flag or

Acorus calamus) would be sampled along with the substrate within which they were rooted. The sites located on higher ground would be selected for their ability to produce blueberries (*Vaccinium myrtilloides*) and Labrador tea (*Ledum groenlandicum*). The Labrador tea and the blueberries would be sampled along with the substrate within which these plants were rooted.

The sampling programs were successful with the exception of the fact that the study team were not able to locate rat root. Samples of this species will therefore have to be acquired when and wherever the opportunity arises.

Sample sites where the above species were located and acquired are provided on the map included (Appendix A) at the end of this report. All sites were delineated and recorded with GPS file numbers to ensure that they can be relocated precisely in the future for resampling purposes.

The protocol used to collect, preserve, record, and analyse the vegetation samples was provided by Golder Associates Ltd.. This protocol was followed to the letter by the study team which was lead by a Mr. Tony Calverley, a senior field technician with Golder. This protocol is also provided in the Appendices following the text of the report The interpretation of the sample analyses will be found in the Golder Report on Shell lease 13. The data from the sample analysis can be found in Appendix F and clearly indicates the presence of a number opf trace metals, which include heavy meatals, ferrous metals, and the alkaline metals. The interpretation of the values derived from the chemical analysis of the vegetation samples is outside the area of capability of the Fort McKay Group however, and will be provided by Golder Associates in their report which will include these subjects.

11. DISCUSSION

One of the original reasons for the initiation of this field investigation was to determine, in accordance with the Fort McKay Community Food habits study completed earlier this year, what species have re-invaded the ALSANDS site since it was cleared and drained in 1982, the relative abundance of these species, and what part they play in the daily diet of the people of Fort McKay. The Food Habits Study* identified a number of species of mammals, birds, fish and plants that the people of this community consume, and the relative levels of consumption of these species in the diets of the community members. The top ten of these species consumed by the community members can be listed as follows:

1. Moose -- Everyone in the community eats moose, and they eat it almost every day.

* "A Survey of The Consumptive Use of Traditional Resources In The Community Of Fort McKay:" For Syncrude Canada Ltd. By Fort McKay Environment Services Ltd. May, 1997.

2. Snowshoe hares -- Every one in the community eats hare, whenever they can catch them. The people spend as much time in the bush as they can hunting and trapping. They take hares on an opportunistic basis whenever and wherever they can during all seasons.

3. Grouse: All three species: (Sharp-tailed, Ruffed, and Spruce) -- these birds occupy roughly the same level of consumption as hares. That is, they are also taken in an opportunistic fashion whenever and wherever possible, during all seasons. They are also eaten by all community members.

4. Lake Whitefish are eaten by virtually all members of the community, and are taken during all seasons of the year. The supply of Lake whitefish are almost all derived from Namur and Moose Lakes to the north and west of the community.

5. Great Northern Pike -- are also taken and eaten by virtually everyone in the community. This species is taken simultaneously with whitefish and are equally preferred as a food species. Once again, the supply is derived from Moose and Namur Lakes, by and large.

6. Blueberries -- are eaten by all members of the community. They are consumed raw, cooked, frozen, and as jams and jellies as long as they are available. The size and density of the annual crop determines to a large extent, the volume picked, and hence, how far the supply lasts into the following year.

7. Cranberries -- are also eaten by all members of the community, and are picked and processed similar to the blueberries. Less of them are eaten raw, but they are canned and frozen, to be used in sauces and pastries during the following year. Once again, the amount eaten during the off seasons depends heavily upon the size and density of the berry crop for any particular year.

8. Ratroot -- This plant is used as a medicinal. It is chewed, or prepared as an infusion, like tea, and used to alleviate stomach disorders, headaches, tooth aches, etc. It is also utilized by the entire community at all times of the year. It should be noted at this point, that this root is relatively potent, and an individual who consumes much more than a cup full of the actual root itself over a year is indeed a major consumer of this plant.

The species metioned above by no means comprise the complete list of those species taken from the wild for consumption by the community. A number of the older members of the community will occasionally consume a beaver or muskrat, and most will take ducks, geese and caribou when and if the opportunity arises. (Caribou meat is occasionally provided to members of the community by friends from Fort Chip, Fort Smith, or Yellowknife in the NWT.and thus should not be regarded as local fare).

The drainage pattern currently present on the ALSANDS lease has given rise to an interesting situation regarding both aquatic mammals and migratory water birds. The refilling of these

ditches with water due to the activities of the beaver returning to the area has created a new and very attractive area for the nesting and rearing of a variety of aquatic birds including ducks, geese and other migratory species. This habitat cohort is new and has not yet been surveyed from the production and rearing perspective. This will occur in the spring and summer of 1998.

It is safe to say, however, that the number of waterfowl which will be raised on the ALSANDS lease in this newly created series of water-filled ditches will be considerably more than had been raised on an annual basis previous to the creation of these ditches. This will provide the members of the community of Fort McKay with a nutritious food source which, heretofore, was not an option to be found on the ALSANDS lease.

Most of the other species listed above were available in various numbers on the ALSANDS site before it was cleared in 1982. However, during the Winter Aquatic Mammal surveys conducted on the Proposed Aurora mine site in the winter of 95/96, numbers of hares, and Sharp-tailed grouse were noted to be orders of magnitude higher in the newly regenerated ALSANDS site. Beavers were roughly 6 times as numerous per Sq. Km. on the lease, as they were in the adjacent areas. Hares, up to 30 times as high. Sharp-tailed grouse were at least as numerous as hares, and all were being pursued by a number of smaller furbearing predators such as mink, weasels, foxes, etc.. The intense growth and density of the Dwarf birch in the area actually precludes penetration by lynx, coyotes and wolves.

Trappers whose lines were formerly located on the ALSANDS Lease before it was cleared, and who accompanied the survey biologist onto the area during the winter of 95/96 expressed astonishment at the densities of beaver, hare and grouse on the area.

It has been subsequently learned through anecdotal discourse with the trappers and other members of the community that moose will frequently move into the area. It was also learned in this fashion that these moose are easy to locate because of their size in comparison to the height of growth of the regenerating deciduous vegetation on the lease, and they are taken with regularity as a food item. Hence, because of easy access and, therefore, the animal's vulnerability, moose may never actually be able to take advantage of the new and massive food source currently being produced on the site.

It can thus be stated that, from the perspective of production of species of animals most frequently sought by the community members as essential dietary items, the regenerated ALSANDS lease, is probably as productive as it has ever been. From the perspective of berry production, it will be some time before this area re-establishes a ground cover which is sufficient in depth and diversity to actually allow it to produce much in the way of high grade berry crops.

The drainage and the actual removal and burning of duff and peat from the ground during the lease clearing, appears to have had a serious influence on the level of nutrient availability, and the ability of the surface layer to maintain a sufficient amount water during the growing season. In a number of areas, particularly adjacent to browse transect numbers 2, 3, 4, and 5, Aspen and

balsam poplar achieve heights of about 3 to 4 meters, and then appear to die in large numbers. The actual reasons for this die-off have not been determined, but the ground cover to bare mineral soil is extremely shallow, and the area exhibits characteristics of xeric parkland sites which can occasionally be encountered in areas east of Castor in the County of Paintearth (east of Stettler).

12. CONCLUSIONS AND RECOMMENDATIONS

At this point certain tentative conclusions can indeed be drawn, and reconmmendations made regarding the planning and action which might be focused on such a site under similar conditions.

1. It can be concluded that in the regeneration of vegetation over the 15 years since the lease was cleared and drained has produced a number of species highly sought after by the members of the community of Fort McKay for food. Among these, are Snowshoe hare, and Sharp-tailed grouse.

2. It can be concluded that wherever there is destined to be deciduous growth and running water, beavers are soon to appear. They can be regarded as either an asset or a liability depending on the point of view of the observer. When the deciduous vegetation reaches and optimum size (apparently in this country this takes about 12 to 15 years) The beavers do a remarkable job of damming up the drainage, and thereby creating long, deep bodies of water. These deep ditches would be ideal for the creation of a "Put and Take fisherey" if natural introductions of local fish have not taken place.

   It is therefore recommended: that at least one of the remaining ditches (some have already been drained) be tested out as a pilot project using rainbow trout as a test fish. This species could be placed in the water shortly after the ice is out, and harvested in the late fall or early winter from under the ice. They might also be used as a sport fishery during the summer months. Some losses would undoubtedly occur to predators such as otter, mink, and herons and possibly mergansers, but such a project should be tested.

3. It can be concluded that there will be a whole new, and relatively large cohort of waterfowl raised in these drainage ditches where formerly there were none.

   It is therefore recommended: That, if such a drainage project becomes necessary in the future, the alignment and configuration of the ditches should be planned to maximize or optimize both waterfowl and fish production. The beavers have done well, but with some help from the human engineers, they could have done much better.

   It can be concluded that the production of prey species such as Sharp-tailed grouse and Snowshoe hares on the ALSANDS lease has been highly successful because the regeneration of the vegetative species used as food and shelter by these prey species has been maximized.

It is therefore recommended: That the natural phenomena which produce such regeneration after the clearing, drainage and burning of the cleared vegetation be more closely examined to try to learn how this patttern of regeneration came about, and perhaps how to help nature repeat it.

5. It can be concluded that the access to the area provided by the many trails throughout, and by the waterways provided by the beaver filled ditches themselves, has not been to the advantage of the larger prey species like moose, caribou, and deer. The new food source attracts them, but their size makes them all too obvious to local hunters, thus rendering these animals incapable of responding to this food source.

   It is thererfore recommended: That in the event of such a project occurring again, access to such a site should be restricted until the vegetation is high enough and covers enough area to provide these animals with adequate security.

13. LITERATURE CITED

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4. "Avifauna Baseline Studies - Volume 11" Report for the Terrestrial Research Committee, AOSERP Project TF2:1 Francis, J. and K. Lumbis, 1978.

5. "Birds of Alberta" Revised by W.R. Salt, Alberta Department of Industry and Development, 1996.

6. R. Webb. Personal Communication Re: 1958 barren ground caribou sitings in the Fort McMurray Area. October, 1997.

14. APPENDICES

Appendix A: **MAP: Shell Lease 13, and Former ALSANDS lease**

Appendix B: **GOLDER Associates Ltd Working Protocols - Designed For the Millennium Project:**

1. **Vegetation Collection For Metals And PAHs**
2. **Browse Sampling**

Appendix C: **Joint Golder/Fort McKay Waterfowl Survey Data August 28, 1997**

Appendix D: **Photographs Taken on ALSANDS Site**

Appendix E: **Browse Transect Data Sheets For Transects 1 to 8 Inclusive**

Appendix F: **Data for Metal Lab Sample Analyses**

APPENDIX 1

AREA MAP OF SHELL LEASE 13 AND FORMER ALSANDS LEASE

- BROWSE TRANSECT SITES

-VEGETATION SAMPLE SITES

-DRAINAGE DITCH PATTERN ON ALSANDS LEASE

Former ALSANDS Lease
See map on following page.

Lease 12

Lease 34

Lease 36

Shell
Lease 13
West

Shell
Lease 13
East

Lease 13

Lease 7

Lease 31

Lease 30

Lease 90

MUSKEG

MUSKEG RIVER

SHELLEY CREEK

JACKPINE CREEK

KEARL LAKE

KHAHAGO CREEK

WESUSKEMINA CREEK

MILLS CREEK

ISADORE'S LAKE

PEMMICAN CREEK

STOCKINGS CREEK

BLACKFLY CREEK

FORT McKAY

2
3
4
5
6
7
8
10

0 1000 2000 3000 40000 5000m

SCALE 1:75,000

REFERENCE

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

LEGEND

- LABRADOR TEA LEAVES
- BLUEBERRIES
- CATTAIL ROOTS

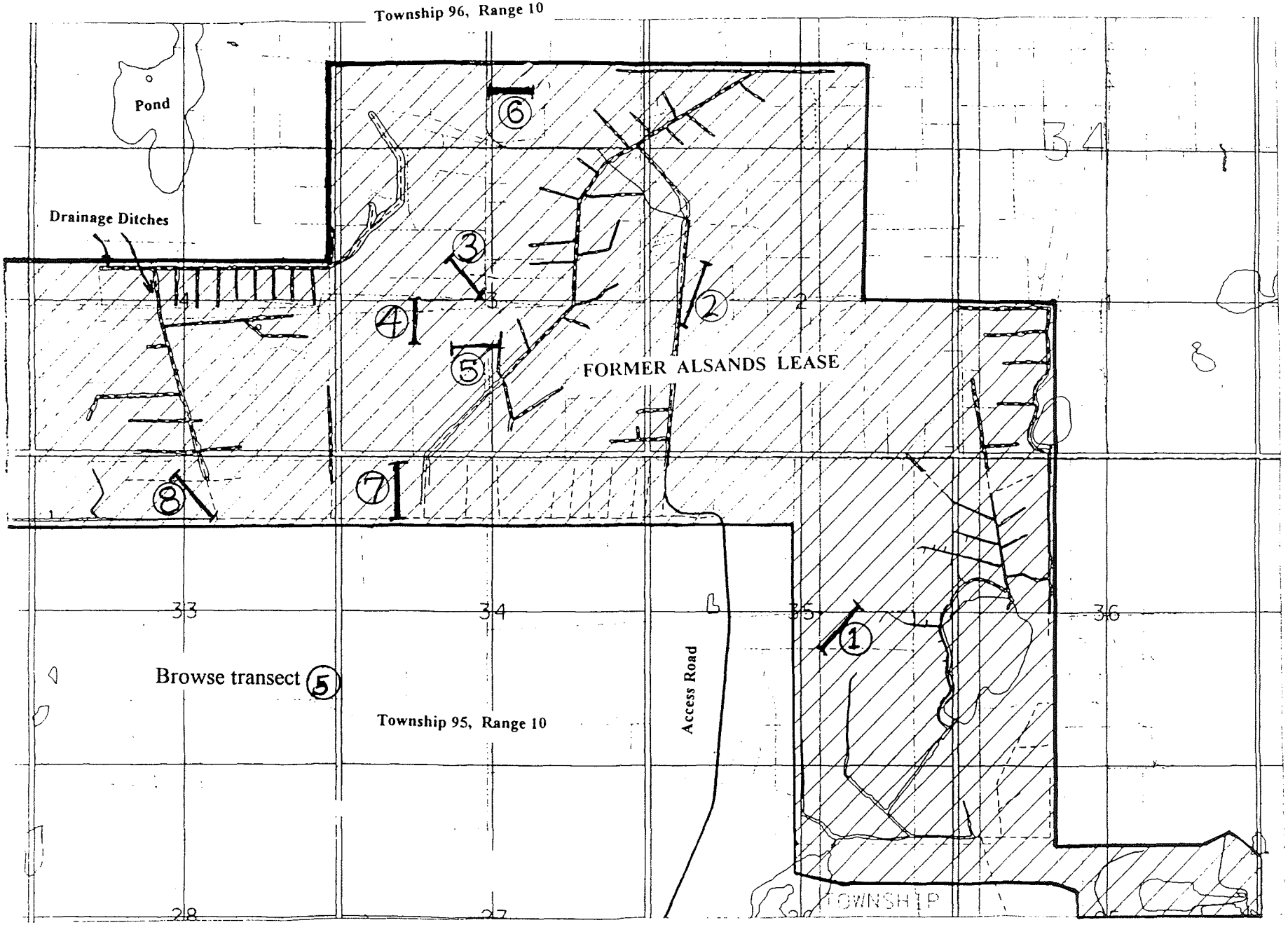
FORT McKAY ENVIRONMENTAL SERVICES

Golder Associates

SHELL CANADA LIMITED

VEGETATION SAMPLING LOCATIONS

23 OCT 1997	FIG. No. 1	DRAWN BY: CG


Township 96, Range 10
Pond
Drainage Ditches
FORMER ALSANDS LEASE
Browse transect 5
Township 95, Range 10
Access Road
33
34
35
36
28
27
TOWNSHIP

APPENDIX B

GOLDER WORKING PROTOCOLS FOR MILLENIUM PROJECT

-FOR VEGETATION COLLECTION FOR METAL AND PAH SAMPLING

-FOR CURENT BROWSE SAMPLING

GOLDER ASSOCIATES LTD.
SPECIFIC WORK INSTRUCTIONS

SPECIFIC WORK INSTRUCTIONS SWI No: 1

Project: SHELL BROWSE/PELLET COUNT SURVEYS (MAY 1997)

Date: May 30, 1997

Author: M. Raine

To: Jason Sharp, Sheldon Kowlachuk

cc: Derek Melton **File No.:** 972-2237

Team Leader: Michael Raine

Subject: Ungulate Surveys **Job/Task No.:** 7740

Scope of Work/Specific Instructions:
Objectives: The study objectives are to describe ungulate distribution, abundance, and habitat use within the various plant community types in the Shell Study Area. Also, it will be important to determine relative ungulate abundance in relation to potential travel corridors. Data from the browse and pellet count surveys may also be used to verify habitat models (HSI models). In addition, any wildlife sightings of interest (in particular, VECs), including all sightings of threatened and/or endangered wildlife species (for all taxa), should be recorded.

Study Area: The Study Area is delineated on the topo maps and the aerial photos. Transects should occur in all of the plant community types delineated on the air photos and listed in Beckingham and Archibald (1996). The preferred method for accessing the study area is by truck and foot. Plant community types to sample have been predetermined on the aerial photos. Access by truck, quad & foot.

Study Teams: The study team will consist of two people. The team will visit each plant community type together. The team will work together on each transect, separated by a distance of 10 m. Teams will carry a cell phone and a radio for safety purposes, and there will be a designated contact to check in with at the end of the day (see Health and Safety Plan).

Sampling Design: Within the study area, as many replicates of each plant community type will be sampled. A replicate will consist of one pair of 100 m transects within an individual plant community type.

Sampling Methodology: Browse and pellet count surveys will be initiated in early May prior to leaf flush. Prior to commencing the field work, the study area will be stratified into survey units based on plant community types. The field guide to Ecosites of Northern Alberta (Beckingham and Archibald 1996) will be used to classify vegetation types. A riparian shrub vegetation community type (willow - red osier dogwood) will also be sampled.

Pellet counts and browse surveys will occur along the same transects. Within each plant community type, randomly select transect starting points. Each transect should be located a minimum of 50 m from traveled roads or trails. Transects should also be a minimum of 10 m from habitat edge to avoid potential edge effects. Transects may be placed end to end if the community type polygon is sufficiently large and if the transects are separated by at lease 25 m.

Sample in the vicinity of the winter snow track survey locations initially, then choose other areas to ensure

that adequate representation of the vegetation communities has been achieved. Also, ensure that riparian communities along the Muskeg River and Jackpine Creek are sampled.

Determine the start of the transect using air photos and a differential GPS unit. Select a vegetation community to sample ~~that~~ that is a minimum of 120 m wide (i.e., 100 m transect plus 10 m on either side). At the start point, fill out the site description data sheet and any relevant information on the browse/pellet data sheet. Do not fill in the vegetation community description at this point. This will be completed by both study team members at the end of the transect. Make sure to collect a GPS file and waypoint. Measure transect distance by using a hip chain. Use a compass bearing to ensure that you stay along the chosen transect. Record the compass bearing on the data sheet.

Each transect should be 100 m in length. Each transect should consist of 5 sampling stations located every 25 m. Each station will consist of a 5 m diameter circular plot. A stake and 2.5 m rope can be used to judge distances. For each plot, record the following information as per the data sheet, for all shrub species:

- species;
- % cover;
- height;
- average % browsed to the nearest 10%, for current browse only (defined as browse activity from the past winter).

Only record shrub species that are from 0.5 to 5.0 m in height.

Browse species may include:

- alder (*Alnus* spp.);
- balsam poplar (*Populus balsamifera*);
- beaked hazel (*Corylus cornuta*);
- bog birch (*Betula glandulosa, B. pumila*);
- buckbrush or western snowberry (*Symphoricarpos occidentalis*);
- chokecherry (*Prunus virginiana*);
- common snowberry (*Symphoricarpos albus*);
- low-bush cranberry (*Viburnum edule*);
- paper birch (*B. papyrifera*);
- pin cherry (*P. pennsylvanica*);
- red-osier dogwood (*Cornus stolonifera*);
- rose (*Rosa* spp.)
- saskatoon (*Amelanchier alnifolia*);
- trembling aspen (*P. tremuloides*);
- willow (*Salix* sp.);

Labrador tea is not considered to be a shrub for the purposes of this study.

As a team will be working a transect together, the transect should be twinned, such that each observer walks 10 m apart. Each observer then collects data on his/her own transect. Only one GPS unit is required, however, each observer should have a hip chain.

Pellet group counts should be conducted within the continuous transect, 1 m on each side of the transect. For a 100 m transect, this will give a total sample of 200 m^2 per 100 m segment/person. Count only those pellets on top of last year's leaf litter. Use a meter stick to determine if the pellet groups are within the transect. Greater than 50 % of the pellets in the group must be within the plot to be counted. Pellet groups within the plot should be identified to species (i.e., elk, moose, deer, hare, coyote, etc.).

A pellet group is defined as 6 or more pellets touching one another. Do not count less than 6 pellets, which may be the case of the animal was moving while defecating (i.e., leaving a single pellets or a trail of

pellets).

At the end of the transect, the two study team members should meet and complete the vegetation community type description: record the average % cover of the 2 dominant tree, shrub, herb and moss/lichen species that were encountered over the transect. For the case of trees, the ratio of each species should be recorded rather than the % cover, as per AVI specifications. For example, black spruce 1 and jack pine 9 would represent a 1:9 ratio. Also record the average density (crown closure) class (A,B,C or D) for each tree species. Assign a vegetation community type as per Beckingham and Archibald (1996). If the transect crosses a mosaic of 2 or more types, record both types, with the most common type listed first.

All incidental sightings of wildlife, including tracks, nests, roosting sites, feeding sites, etc. should be recorded. In particular, sightings of threatened and/or endangered wildlife species should be recorded. Important sightings should include a GPS location.

At the end of each day, update a running tally of the number of ecosite phases sampled in order to plan the work for subsequent days. Also keep track of the completed transect locations on a topographic map or an air photo.

Required equipment will include 1 GPS unit, 2 hip chains, extra string, compass, binoculars, camera, film, field notebook, plant identification book, clipboard, pencils, datasheets, topo maps, aerial photos, cell phone and radio, first aid kit, survival kit, and bear spray.

Work Product(s) Due by: Field work to be conducted in May, 1997.

Allocated Personnel Hours: 10 hours a day for 6 days for 2 people

Subcontractor (as applicable): N/A

Special Handling Requirements:

None.

Applicable Specs. and Procedures: N/A

Project Manager Approval/Date: **QA Manager/Date:**

Figure 1 Plant Tissue Sampling

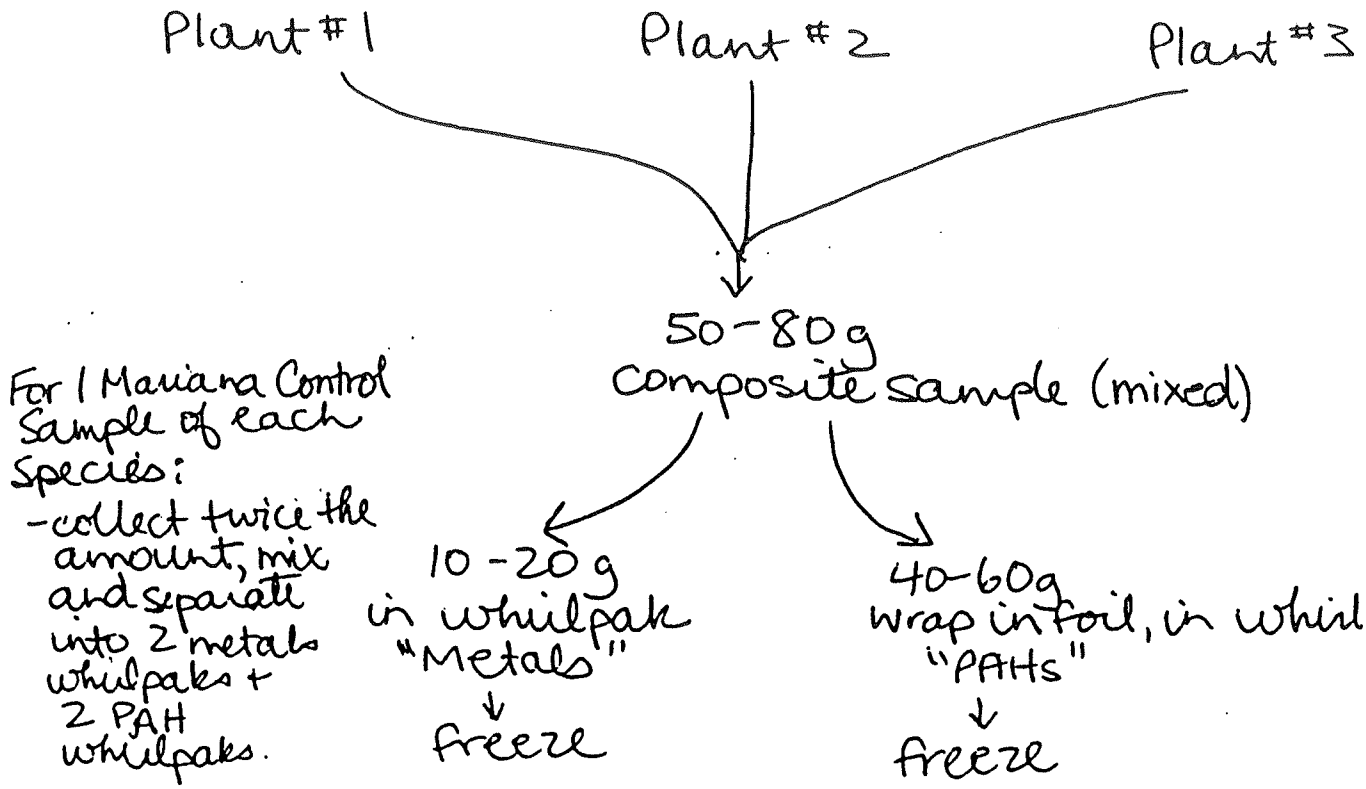
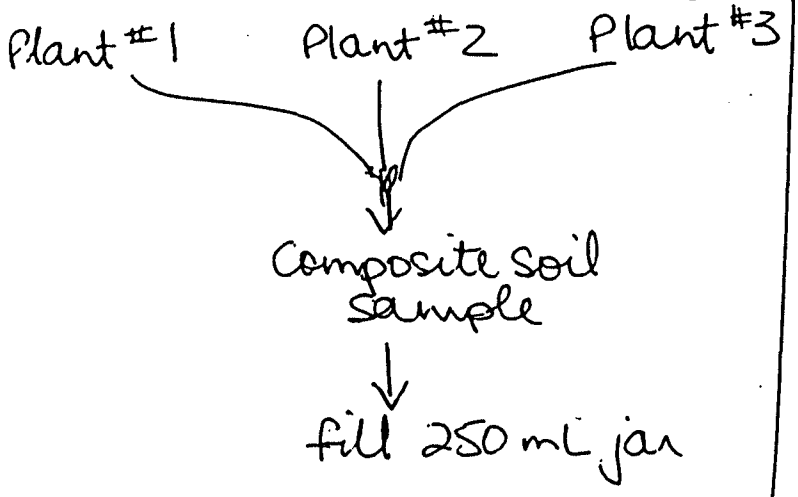
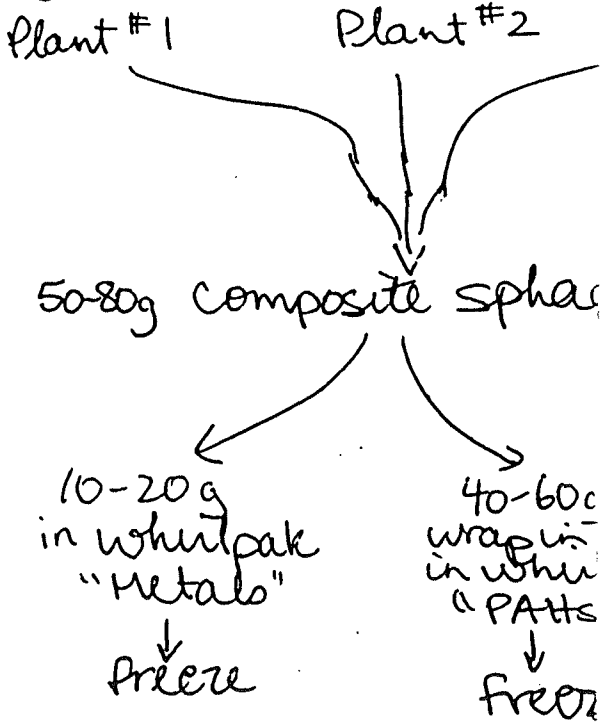


Figure 2 Soil Sampling



For 1 Mariana Control Sample:
- collect twice the amount, mix and fill two 250 mL jars

Figure 3 Sphagnum Sa



For 1 Mariana Control San
- collect twice the amo mix and separate 2 metals whilpaks + 2 PAH whilpaks

GOLDER ASSOCIATES LTD.
SPECIFIC WORK
INSTRUCTIONS

SWI No: 1.0
Project: Project Millenium
Date: August 7, 1997 revised version

Author: Farida Bishay/Laura Mucklow
To: Greg Suter
cc: file
Project Manager: Shawn McKeown

Subject: Vegetation Tissue Sample Collection

Job/Task No: 972-2205-8836

Scope of Work/Specific Instructions:

General:

Sample Material Designated for Collection:
(i) Native Plant Tissues (test and control samples)
(ii) Soil Samples (test and control samples according to location of plant samples)

Samples of plant tissues are to be collected from a variety of terrestrial and aquatic habitats in the oil sands region. The tissues will be analyzed for metals, sulphur and polycyclic aromatic hydrocarbons (PAH). The purpose of this sampling is to address concerns for potential contamination of foods used by aboriginal people. Vegetation samples will be collected in 1) the Suncor study area (i.e., test samples), and 2) in areas outside the plume of particulate emission deposition (i.e., control samples),

Four species will be collected: labrador tea (leaves), blueberry (fruit), ratroot (root) and cattail (root). Ratroot may not be available at all locations, but it should be collected wherever it is found. All ratroot samples should be marked ARCHIVE on the chain of custody sheets submitted with the samples.

Soil samples will be collected at each site where plant materials are collected. The collection of soil samples will assist in determining if there are any significant accumulations of metals or PAH in soils, a condition that may lead to bioaccumulation into vegetation.

Plant Samples (refer to Figure 1):

(1) Test Samples

- five suitable test locations within the Suncor lease property for blueberries, laborador tea and cattail (and ratroot, if found)
- three of these sites have been established for each species and two additional sites are discretionary upon discussion with Fort McKay band members
- where possible, blueberries and labrador tea may be sampled from the same locations; similarly, cattail and ratroot may be sampled from the same locations
- for each sample, only the relevant parts (i.e, fruit (blueberries), leaves (labrador tea) and roots (cattail and ratroot)) from three different plants of the same species should be placed into one sample container
- use a new pair of latex gloves to collect each sample
- collect approximately 50 to 80 g, mix up the material thoroughly and place approximately 10 to 20 g in one whirlpak, labelled "metals"; the remaining 40 to 60 g should be wrapped in foil and then placed in another whirlpak, labelled "PAHs"; Label each whirlpak with the date and sample location

(2) Control Samples: NA

- two control locations near Mariana, south of Suncor lease, taken at least 1 km from any roads for blueberries, laborador tea and cattail (and ratroot, if found)
- two control locations immediately west of the Syncrude lease for blueberries, laborador tea and cattail (and ratroot, if found)
- for 3 of the samples, collect in same manner as test samples
- for the fourth sample (a Mariana sample is easiest), collect twice the required amount of plant material, mix up the material thoroughly and divide into two metal whirlpaks (about 10-20 g in each) and two PAH sample whirlpaks (about 40-60 g in each); label as "Metals A", "Metals B", "PAHs A" and "PAHs B" (these will become "split" samples for Q.C. purposes)

Storage and Shipment:

- place all plant samples in a cooler while in the field
- place in freezer at the end of the day
- for shipment, pack plant samples in cooler with dry ice

Soil/Sphagnum Samples (refer to figures 2 and 3):

The rooting media of the plants must also be sampled. In some cases, this may be soil, while in other cases, it may be sphagnum.

(1) Test Samples

IF THE PLANTS ARE ROOTED IN SOIL:

- collect a soil sample from every test location where plant samples are collected (ie. 5 samples for blueberry, 5 for laborador tea, 5 for cattail and up to 5 for ratroot, if found)
- sample should be collected using a stainless steel scoop; the sample should be taken from the surface (top 2-3 cm) and should be collected at the base of each of the three plants sampled in that location
- wipe scoop with clean cloth, rinse with distilled water and then alcohol; use new set of gloves for each sample
- for cattail/ratroot, an Ekman grab sampler may have to be used to collect soil/sediment samples; the grab sampler should be cleaned between samples using the same method as for the scoop
- for each sample, soil from the base of the three plants sampled in that location should be placed into one 250 mL glass jar; fill the glass jar completely with soil
- label each jar with the date, sample location and species of plant it was collected from the base of (ie. blueberries, labrador tea, cattail, ratroot)

IF THE PLANTS ARE ROOTED IN SPHAGNUM:

- collect a sphagnum sample from every test location where plant samples are collected
- samples may be collected using a stainless steel scoop or other similar device; the sample should be taken from the surface (top 2-3 cm) and should be collected at the base of each of the three plants sampled in that location
- wipe scoop with clean cloth, rinse with distilled water and then alcohol; use new set of gloves for each sample
- collect approximately 50 to 80 g of sphagnum, mix up the material thoroughly and place approximately 10 to 20 g in one whirlpak, labelled "metals"; the remaining 40 to 60 g should be wrapped in foil and then placed in another whirlpak, labelled "PAHs"; also label each whirlpak with the date, sample location and species of plant it was collected from the base of

(2) Control Samples:

IF PLANT IS ROOTED IN SOIL:

- for 3 of the samples, collect in same manner as test samples
- for the fourth sample (a Mariana sample is easiest), collect twice the required amount of soil, mix up the material thoroughly and divide into two glass jars; label with "A" and "B" (these will become "split" samples for Q.C. purposes)

IF PLANT IS ROOTED IN SPHAGNUM:

- for 3 of the samples, collect in same manner as test samples
- for the fourth sample (a Mariana sample is easiest), collect twice the required amount of sphagnum, mix up the material thoroughly and divide into two metal whirlpaks (about 10-20 g in each) and two PAH sample whirlpaks (about 40-60 g in each); label with "Metals A", "Metals B", "PAHs A" and "PAHs B" (these will become "split" samples for Q.C. purposes)

Storage and Shipment:

SOIL SAMPLES:

- place all soil samples in a cooler while in field
- place in fridge at end of the day
- for shipment, pack soil samples in cooler with ice packs

SPHAGNUM SAMPLES:

- place all sphagnum samples in cooler while in field
- place in freezer with plant samples at end of day
- for shipment, pack with plant samples in cooler with dry ice

Work Product(s) Due By: August 28, 1997
Allocated Manhours: 2 people - 36 hours each
Subcontractor (as applicable): N/A
Special Handling Requirements: Avoid cross contamination, use sterile, powderless gloves
Applicable Specifications and Procedures: TP Plant Tissue Sampling Methods; TP Soil Sampling Methods; TP8.2-2 Sediment Sampling Methods
Technical Review Process:
Project Manager Approval: Date: August 7, 1997
QA Manager Approval: Date: August 7, 1997

Golder Associates

SUBJECT | Job No. | Ref. | Made by | Checked | Reviewed | Date | Sheet | of

TEST Samples	Sample Locations	Singles/Plants	Composites	Split Sample
Blue Berries	5 (3 discretion + 2 recons)	NA	5 (soil)	N/A
Lab. Tea	5 " "		5 (sphagnum?)	
Cattail	5 " "	NA	5 (sediment/sphagnum)	N/A
Rat root (archive)	(5) " "		(5) (" ")	
	Σ Samples = 20 Σ Analyses = 15		Σ Samples = 20 Σ Analyses = 15	

CONTROL Samples				
Blue Berries	4 (2 Mariana, 2 West Spruce)	1	4	1
Lab Tea	4 (" ")	1	4	1
Cattail	4 (" ")	1	4	1
Rat root	(4) (" ")	(1)	(4)	(1)
	Σ Samples = 16 Σ Analyses = 12	Σ Samples = 4 Σ Analyses = 3	Σ Samples = 16 Σ Analyses = 12	Σ Samples = 4 Σ Analyses = 3

Notes: 1) parentheses indicate archived samples.
2) Split sampling for control area only.
3) Soil composites should reflect plant composite locations

APPENDIX C

JOINT GOLDER/FORT McKAY WATERFOWL SURVEY:

AUGUST 28, 1997

August 28, 1997 - Fall Waterfowl Survey - Shell Lease #13
1010 hours to 1205 hours.
Observers - Carl Surrendi, Debbie Mahoney, Bertha Ganter, Tony Calverley

Species	Number of Individuals	UTM Coordinates	Other Observations
- Mallard	25 - 30	463690E/6341490N	
- Mallard	2	Isadore's Lake 463700E/6343250N	
- None	-0-	Daphne Island (East channel 460650E/6348390N	
- Bufflehead	20 - (2 broods) { 1 with 4 / 1 with 3	464790E/6346460N	1 new beaver lodge
Yellowlegs	3		
Mallard	3		
Mallard	7	468450E/6346290N	1 beaver lodge
Western Grebe	1	468550E/6346800N	
Blue-winged Teal	6	468920E/6347140N	
Mallard	6 (1 hen + 5 brood)		
Mallard	8 (1 hen + 7 brood)		
Sandhill Crane	4	(East Ditch System) 465300E/6350190N	Moose tracks, beave dams
Blue-winged Teal	5	(West Ditch System) 465830E/6350190N	Beaver dams and runs
Mallard	6		
Common Snipe	2		
Red-tailed Hawk	1		
Mallard	6 (1 hen + 5 brood)	(East Ditch System) 469700E/6348060N	
Blue-winged Teal	4		
Mallard	1		
Mallard	3 (1 hen + 2 brood)		
Bufflehead	5	484000E/6347100E	
Yellowlegs	2		
Horned Grebe	2	Kearl Lake 485640E/6349480N	9 - beaver lodges
Bufflehead	5 (1 hen + 4 brood)		
common Loon	3		
unknown Divers	2		
Common Merganser	2		
Lesser Scaup	5		
American Coot	1		
Unknown Teal	2		
Blue-winged Teal	2		
Mallard	1		
Mallard	6 (1 hen + 5 brood)	469000E/6341680N	
Blue-winged Teal	7 (1 hen + 6 brood)		
Mallard	10 (2 hens + 8 brood)		
Mallard	2		
Unknown Teal	2		
	30 ducks total		

August 28, 1997 - Fall Waterfowl Survey - Shell Lease #13

Species	Number of Individuals	UTM Coordinates	Other Observations
		Unnamed Lake	
Redhead	2	468600 E/6341200 N	1 Beaver lodge
Unknown dabblers	4		
Blue-winged Teal	1	469125 E/6341045 N	
Mallard	1 (hen)	477750 E/6342480 N	

Survey end at 1145, ferry back to Ft. McMurray

APPENDIX D

ALSANDS LEASE SITE PHOTOGRAPHS

Extent of Beaver Work in East-West drainage on the South Side of the Old Cleared ALSANDS Lease

Browse Transect 6. Vegetation was relatively diverse in its Regeneration. Current Browse was, nevertheless, almost Completely Absent.

Browse Transects 7 and 8. Dwarf Birch was extremely dense. Ground Cover under the Birch was absent, indicating the lack of sunlight penetration and the extreme stem density.

Photographs Of ALSANDS Lease

Photo No.1 Bertha Ganter (Ft. McKay) and Michael Raines (Golder.) Background is East West Drainage ditch on the south side of ALSANDS lease. Dam is 10 ft. deep and backs water up for 2 kilometres.

Photo No.2 : Debbie Mahoney , Browse Transect No.6, vegetation of willow and aspen. Ground cover is rose, snow berry, and fireweed. Black bear sign was prevalent, but signs of browse were lacking.

Photo. No. 3: Browse transect No 7 illustrates the incredible stem density of the Dwarf Birch which covers a significant portion of the ALSANDS lease. Hares can penetrate easily, but predators cannot.

Photo No. 4: Browse Transect No. 8 . A combination of Dwarf Birch and tamarack, with a smattering of willow and Native grasses. Stem densities favor hares and grouse.

APPENDIX E

BROWSE TRANSECT DATA SHEETS

TRANSECTS 1 TO 8 INCLUSIVE

11:38 AM

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect #1 Plot #: 4 Linked to: AL-1

Observer: CS, DM, TC Date(dd/mon/yy): 31/08/97 Time: 1045

GPS file #: Mo8 3116A UTM: E: 469334.3 N: 6348569.2

Air Photo #: 94-111; LN-94B, #47 Ground Photo Roll #: #1 Photo #s: 31 (End of trans)

Description of Location: Moist Regen. Willow Dwarf Birch with spruce clumps cover site

Plant Community Type: - Compass bearing 61°

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	Aspen	10	Poplar	5
Understorey - shrub and/or trees (shrub < 2m)	Willow	40	D. Birch	30
Herb	Crowfoot + Equisetum	40	Carex	60
Lichen/Moss	sphagnum	60		
Crown Coverage: A(low) - D(high)	A		A	

Point	Species	% Cover	Height	Current Br.
0	Willow	5	2.5	0
	Poplar	10	4m	0 *
	Cush Buffalo Berry	5	2.5	0
	Snow Berry	1	.5	0
	Rose	2	.75	0
	Ribes	1	.75	0
	Aspen	2	3.5	0
	Open	74		
25	Willow	30	3.5	0
	Poplar	2	2	0 *
	Dwarf Birch	15	2.5	0
	White Spruce	3	1.5	0
	Ribes	2	.75	0
	Rose	1	.75	5
	Snow Berry	1	.5	0
	Potentilla	1	.75	0
	Open	45		
50	Dwarf Birch	15	2.5	0
	Willow	20	2.5	0 *
	Spruce	1	.75	0 *
	Potentilla	2	1m	0
	Rose	1	.75	0
	Ribes	1	.5	0
	Open	60		
75	Willow	45	3.5	0
	D. Birch	20	2.0	0
	Spruce	1	1.5	0
	Ribes	1	.75	0
	Potentilla	1	.5	0
	Open	32		
100	D. Birch	30	2.5	1 *
	Willow	40	3.5	6
	Snow berry	5	.75	0
	Rose	2	.75	1
	Spruce	1	.5	0
	Ribes	5	.75	0
	Open	17		

Pellets	Number
Moose	
Deer	
Wolf	
Coyote	
Fox	
Bear	1 large

* Pop. BA - lightly browsed in previous year

- 1 No. Flicker
- Flock of migrating 100+ Brandt Canadenses

* willow browsed in previous years Hare

Hare browse in past years

End of Transect
E 469389.5
N 6348649.1
File M083117A

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect # 2 Plot #: 5 Linked to: AL-2
Observer: ES, DM, TC Date(dd/mon/yy): 31/08/97 Time: 1345 - 1435
GPS file #: M082917B UTM: E: 468728.8 N: 6350405.4
Air Photo # 94-111, LN-94B, #47 Ground Photo Roll # 1 Photo #s: 34 End Tradale
Description of Location: Rengen aspen/Balsam poplar
Plant Community Type: dry regen site Compass 37°

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	Aspen	25	Poplar	5
Understorey - shrub and/or trees (shrub < 2m)	~~Aspen~~ Potentilla	~~25~~ 25	Buffalo berry	10
Herb	Bear Berry	35	Strawberry	25
Lichen/Moss	Reindeer lichen	30	detritus	60
Crown Coverage: A(low) - D(high)	A		A	

Point	Species	% Cover	Height	Current Br.
0	aspen	15	2.5	0
	Rose	2	.5	5
	J. pine	4	.75	0 ×
	Open	79		
25	D. Birch	5	2m	0
	Aspen	25	3.0m	0 *
	Potentilla	10	1.5	0
	Rose	5	.75	0
	Poplar	30	4	0
	Lonicera	1	1	0
	Willow	5	2.5	0
	Snow berry	1	.5	0
	Open	18		
50	Potentilla	~~40~~	1.0m	0 *
	Can Buf berry	10	.75	0 *
	Snow berry	3	.75	0 *
	Aspen	25	2.5	0 *
	Saskatoon	1	.75	0
	Rose	2	.5	0
	~~Willow~~	~~7~~		
	Open	18		
75	aspen	30	3.5	0 *
	Paper Birch	2	2.0	0
	Can Buf Berry	10	1.0	0
	Willow	3	1.0	5
	Rose	2	.5	0 *
	Open	55		
100	Aspen	35	4	0
	Willow	5	2	0
	Can buf Berry	10	1	0
	Poplar	10	3.0	0
	Potentilla	5	1	0
	Saskatoon	1	.75	0
	J. Pine	1	.5	0 *
	Rose	~~2~~	1	1
	Open	31		

Pellets	Number
Moose	
Deer	
Wolf	
Coyote	
Fox	
Bear	
Hare	1

Northern Hansen

* Hare browse early years
* light browse in previous years
— aspen ~~[illegible]~~ in past
* Hare browse (light) old

* browsed in previous years

* Browsed in previous years

* - old hare browse

End
M083120A
E468743.4
N6350528.2

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect 3 Plot # 3 Linked to: AL-3
Observer: TC, CS, DM Date(dd/mon/yy): 30/08/97 Time: 1510 -1600
GPS file #: M0830821A UTM: E: ~~467673.4~~ N: 6350831.3
Air Photo # 94-11; LN-94 13; #47 Ground Photo Roll # 1 Photo #s: 28 (end of Trans
Description of Location: Region trembling aspen
Plant Community Type: Compass bearing 32°

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	Aspen	25	—	—
Understorey - shrub and/or trees (shrub < 2m)	Aspen/.	15	Potentilla	30
Herb	Bear berry	75	Strawberry x pinegrass	15
Lichen/Moss	Reindeer lichen	15	moss xx	5
Crown Coverage: A(low) - D(high)	A	—	A	—

Point	Species	% Cover	Height	Current Br.
0	Aspen (P.tr.)	25	3.5	0
	Saskatoon	20	1.5M	1%
	Rubes	2	.75M	0
	Willow	2	1.5M	0
	Rose	2	.5M	1%
	Can Buf berry	4	.75M	0
	Open	45		
25	Willow	10	2.5M	0
	Rose	3	.75M	1%
	Viburnum	5	.75	0
	Aspen	40	4M	0
	Can Bf Berry	15	.75	0
	Saskatoon	5	2.5M	0
	Strawberry	1	.5M	0
80	Willow	20	2.5M	0
	Can leaf berry	45	1M	0
	Aspen	10	.3M	0
	Potentilla	2	.5M	0
	Rose	1	.75M	0
	Viburnum	1	.5M	0
	Aspen	2	2M	0
	Open	19%		
75				
125				
100	Potentilla	75	.75	0
	aspen	1	1.5M	0
	Willow	21	.75	0
125	Willow	15	2M	0
	Aspen	1	1.5	0
	Potentilla	55	.75	0
	Snow berry	15	.25	0
	Spruce (Probably marinna)	1	.25	0
	Open	13		

Pellets	Number
Moose	0
Deer	0
Wolf	0
Coyote	0
Fox	0
Bear	0

Trail complete 1600

Grouse 1

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect #4 Plot #: 1 Linked to:
Observer: CS, DM, TC Date(dd/mon/yy): 30/08/97 Time: 1245 – 1355
GPS file #: M083018A UTM: E: 467328.7 N: 6350849.2
Air Photo # 94-111, LN-94B, #47 Ground Photo Roll #: 1 Photo #s: 23-25
Description of Location: Disturbed regen aspen/balsam poplar
Plant Community Type: Compass Bearing 180°

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	Aspen (Po TR)	35	Poplar (Po. ba	5
Understorey - shrub and/or trees (shrub < 2m)	Aspen	35	Saskatoon	20
Herb	Grasses	80	Fireweed	10
Lichen/Moss	—	—	—	—
Crown Coverage: A(low) - D(high)	A		A	

60% open; 10% [illegible]

Point	Species	% Cover	Height	Current Br.
0	Rhododendron Canadensis	35	1M	0
	Rose	15	1M	<1
	Willow	10	2M	0
	Ribes	5	.75M	0
	Viburnum	5	.75	0
	Amelanchier alnifolia	5	1.2M	5
	Aspen (Po Tr)	20	4m	0
	Poplar (P. ba)	5	3-4M	0
25	Potr	20	3-4	0
	Sxxx	10	2	0
	roac	5	0.5	0
	Viburnum	5	0.5	0
	Aspen	70	4 M	0
50	Rose	15	.7 M	75
	Canada Buffalo Berry	5	.6M	0
	Saskatoon	5	1.5M	0
	Snowberry (Symp)	>2	.5	0
	Viburnum	>2	.75M	0
	Poplar (P. ba	1	2M	0
75	Aspen	50	4M	0
	Saskatoon	30	2M	10
	Buffalo berry	4	.75M	0
	Snow Berry	10	.5M	0
	Rosa C.	5	.75M	0
	Viburnum	>1		0
100				
	Aspen	10	4M	0
	Willow	5	2M	0
	Can-Buffalo Berry	5	1M	0
	Rose	2	.5M	0
	Snow Berry	2	.5M	0
	Open	76		

Pellets	Number
Moose	0
Deer	0
Wolf	0
Coyote	0
Fox	0
Bear	0

~~fragaria~~ Vicia A; aspen; Lathyrus; Epilobium; Gallium
Grasses - Calamagrostis sp

* hit harder in previous year
* last year browse [illegible]

GPS END
M083019A
UTM E 467337.7
N 6350679.8

-Evidence of bear tracks through grass
-2 flocks of cranes (4 + 10)

r:\1997\2237\7700\datasheets\browse2.doc Golder Associates photo 25

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect #5 Plot # 2 Linked to: —

Observer: CS, DM, TC Date(dd/mon/yy): 30/08/97 Time: 1405 - 1500

GPS file #: M083017A UTM: E: 467679.1 N: 6350596.3

Air Photo # 94-111, LN-94B, #47 Ground Photo Roll # 1 Photo #s: 26(S) (27(N)

Description of Location: willow / dwarf birch regen.

Plant Community Type: - Compass bearing 90°

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	None		—	
Understorey - shrub and/or trees (shrub < 2m)	Willow sp	60	Betula (B. pu	10
Herb	—	—	—	—
Lichen/Moss	— Leaf litter Light	100	—	—
Crown Coverage: A(low) - D(high)	A		A	—

Point	Species	% Cover	Height	Current Br.
	Dwarf Birch (Bpu	60	3m	5
	Willow	20	3m	1
	Open	20	—	—
0	East End of Transect 75 metres in			
	Willow	70	2m	6
	open deep snow	60	.5m	
25	Dwarf Birch (Bpu	60	3m	5
	Willow	20	3m	0
	Open	20		
50	Willow	90	3.5	>5
	Open	10		
75	Betula (Bpu	15	2m	0
	Willow	55	3.5m	0
	Ribes sp	5	.75	0
	Open	25		
100	Willow	15	2.5	0
	Aspen	25	4.5	0
	Birch (B. pu	10	2	0
	Potentilla fr.	3	1.5	0
	Ribes	2	1	0
	Snow Berry	1	.5	0
	Open	45		

Pellets	Number
Moose	0
Deer	0
Wolf	0
Coyote	0
Fox	0
Bear	0

END GPS
File M083020A
E 467761.2
N 6350619

W. End
GPS M083020B.
E 467609.4
N 6350569.6

60 sandhill cranes overhead

Most Browse on site 1 — Hare in previous year

old Hare browse previous year

Not Hare browse last year

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect #6 Plot #: Linked to:
Observer: Date(dd/mon/yy): 31/08/97 Time:
GPS file #: M083120B. UTM: E: 467695.6 N: 6351887.6
Air Photo #: Ground Photo Roll #: Photo #s:
Description of Location: Aspen willow Region: grass + Fireweed lower storey. Saskatoon Rose
Plant Community Type: Alin density High. Compass 90 11:05 AM

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	Aspen	30	willow	10
Understorey - shrub and/or trees (shrub < 2m)	saskatoon	30	Rose	35
Herb	Grasses + Aster	50	Strawberry. Fireweed	20
Lichen/Moss	—	0	—	0
Crown Coverage: A(low) - D(high)	A		A	

Point	Species	% Cover	Height	Current Br.
0	Aspen	35	4.	0
	Willow	10	2.5	0
	Saskatoon	25	2.	0 X
	Rose	10	.75	5 X
	Snow Berry	1	.5	0
	Open	19		
25	Aspen	25	4	0 X
	Rose	45	1.5	10 + last year
	Saskatoon	10.	1.	0 X
	Ribes	2.	.75	0
	Snowberry	2.	.5	0
	Open	16		
50	Aspen	15	3.5	0 X
	Saskatoon	20.	1.	0 X
	Rose	2.	.5	0 X
	Willow	5.	2.	0 X
	Snowberry	2	.5	0
	Ribes	2	1	0
	Open	54		
75	Aspen	70	5	0 X
	Saskatoon	15	2.	0 X
	Snowberry	3	.75	0
	Rose	5	1.	0 X
	Willow	2	3.5	0
	Ribes	1.	.75	0
	Open	4		
~~100~~				
100	Rose	~~45~~ 50	1.0	0 X
	Willow	10.	2.	2 X
	Snowberry	1.	.5	0
	Ribes	1.	.75	0
	Saskatoon	15	1	0 X
	Honeysuckle (Lonicera spp.)	1	1.5	0
	Open	32		
	Buffalo berry	2		

Pellets	Number
Moose	
Deer	
Wolf	
Coyote	
Fox	
Bear	

3 sharp tailed grouse
4 sharp Tailed grouse sit. 1

X station 1 saskatoons heavy browse last year. also rose Moose + ungulates

X station 2 - aspen Browsed last year saskatoons (Hard last year

station 3 Aspen browsed last year. willow. last year Rose. X

station 4 saskatoons rose } heavy browse last year.

End TRANSECT
FILE M083121A
E467954.1
N6351797.9

X rose X saskatoon X willow } heavy browse last year

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect #7 Plot #: ______ Linked to: ______

Observer: ______ Date(dd/mon/yy): 31/08/97 Time: 3:27 PM

GPS file #: M083121B UTM: E: 468065.4 N: 6349637.7

Air Photo #: ______ Ground Photo Roll #: ~~THICK~~ Photo #s: ______

Description of Location: BIRCH/WILLOW/TAMARACK/SPRUCE REGEN-; DENSE STEM

Plant Community Type: -

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	BIRCH	25	TAMARACK	10
Understorey - shrub and/or trees (shrub < 2m)	BIRCH	25	WILLOW.	15
Herb	Grasses, ~~Strawberries~~ Hairgrass.	10	Strawberries.	20.
Lichen/Moss	Reindeer+Other ~~Sphagnum Moss~~	5	Spaghum	5
Crown Coverage: A(low) - D(high)				

Point	Species	% Cover	Height	Current Br.
0	Tamarack	2	3.0 m	Ø
	Willow	40.	3.5 m.	Ø **
	Birch	8	3.0 m	Ø *
	Open.	50		
25	Tamarack	15.	4 m.	Ø
	Dwarf Birch.	~~4~~0.	2.5 m.	Ø
	Ribes	1.0	0.5 m	Ø
	Willow.	1.0	0.5 m.	Ø
	Open	43.		
50.	Willow	75	3.0 m	Ø *
	Dwarf Birch	15	2.0 m.	Ø *
	Tamarack.	2	2.0 m.	Ø
	Open.	8		
75.	Dwarf Birch	20.	2 m.	trace **
	Willow	15	2.5 m.	Ø
	Spruce (Black)	8	3 m.	Ø
	~~Tamarack~~			
	Snowberry	1	0.25 m.	Ø
	Open.	56		
100	Tamarack	38.	4.0 m.	Ø
	Dwarf Birch	30	2.5 m.	Ø *
	Willow	10.	2.5 m	5% **
	Snowberry	10	1.0 m.	Ø
	Open	12		

Pellets	Number
Moose	
Deer	
Wolf	
Coyote	
Fox	
Bear	

* OLD HARE BROWSE

** OLD UNGULATE BROWSE

END TRANSECT

GPS File # M083121C

UTM. E: 468081.0

UTM. N: 6349792.0

DATA SHEET FOR BROWSE/PELLET SURVEY -- Shell 13 972-2237 TASK 7740

Transect #: Browse Transect #8 Plot #: _____ Linked to: _____

Observer: _____ Date(dd/mon/yy): 31/06/97 Time: 3:55pm

GPS file #: M08312ID. UTM: E: 466195.7 N: 6349737.1

Air Photo # _____ Ground Photo Roll # _____ Photo #s: _____

Description of Location: Dwarf Birch - Willow Regen. ; small Tamarack no understory ; Stem density intense 12.5m

Plant Community Type: Compass 320°

	Species 1	% Cover	Species 2	% Cover
Overstorey - trees	Birch	80	Willow	10
Understorey - shrub and/or trees (shrub < 2m)	ø		ø	
Herb	Leaf Litter.	100		
Lichen/Moss				
Crown Coverage: A(low) - D(high)	D		A.	

Point	Species	% Cover	Height	Current Br.
0	Dwarf Birch	50	3 m.	ø
	Willow	~~43~~	3.5 m.	ø
	Tamarack	5	3. m.	ø
	Balsam Poplar	2	4. m.	ø
	~~Aspen~~.			
25	Dwarf Birch.	~~35~~ 25	2.5m.	ø *
	Aspen	1	3m.	ø *
	Tamarack.	~~5~~	3m.	ø
	Willow.	8	1m.	ø *
	Open.	61		
50	Dwarf Birch	75	2.25m.	ø *
	Willow	5	2.5m.	ø
	Open	20.		
~~75~~	Dwarf Birch	~~80~~	3.5m	ø
	Willow	1	0.5m	ø
	Open	19		
100	Dwarf Birch	35	3. m.	ø *.
	Willow.	5	2.5 m.	~~5~~ 5 %.
	Tamarack	1	2.0 m.	ø
	Open	59		

Pellets	Number
Moose	
Deer	
Wolf	
Coyote	
Fox	
Bear	

* OLD BROWSE (Hare)

End Transect

GPS File M08312F

E466086.0

N6349748.8

APPENDIX F

METAL LAB ANALYSIS DATA

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

Detection Limit

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709023-01	SITE #1 BLUEBERRY							
Sample Type:BLUEBERRY								
Collected:08/26/97 10:30								
		Mercury (Hg)	0.02	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	.638	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	9.12	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	7	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	945	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	4.15	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	12	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	488	2	mg/kg		09/30/97	RG
		Manganese (Mn)	194	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	0.27	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	851	2	mg/kg		10/01/97	CC
		Potassium (K)	4550	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	17	2	mg/kg		10/01/97	CC
		Strontium (Sr)	1.48	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	<0.2	0.2	mg/kg		10/01/97	CC
E709023-02	SITE #1 LABRADOR TEA							
Sample Type:TEA								
Collected:08/26/97 10:30								
		Mercury (Hg)	0.03	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	915	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		09/30/97	RG
		Antimony (Sb)	<0.4	0.4	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	71.8	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	21	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	4948	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		09/30/97	RG
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	3.33	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	36	2	mg/kg		09/30/97	RG
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	1020	2	mg/kg		09/30/97	RG
		Manganese (Mn)	229	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	2.26	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	992	2	mg/kg		09/30/97	RG
		Potassium (K)	4680	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	12	2	mg/kg		09/30/97	RG
		Strontium (Sr)	8.58	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	15.7	0.2	mg/kg		09/30/97	RG
E709023-03	SITE #1 SOIL							
Sample Type:SOIL								
Collected:08/26/97 10:30								
		Mercury (Hg)	0.05	0.01	mg/kg		09/13/97	RG

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709023-03	SITE #1 SOIL							
Sample Type:SOIL								
Collected:08/26/97 10:30								
		Metals (Strong Acid Rec.)						
		Barium (Ba)	129	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	3720	100	mg/kg		09/13/97	RG
		Chromium (Cr)	4.2	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	<1	1	mg/kg		09/13/97	RG
		Copper (Cu)	7	1	mg/kg		09/13/97	RG
		Iron (Fe)	4730	1	mg/kg		09/13/97	RG
		Lead (Pb)	<5	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	542	10	mg/kg		09/13/97	RG
		Manganese (Mn)	138	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	3	2	mg/kg		09/13/97	RG
		Potassium (K)	627	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	<100	100	mg/kg		09/13/97	RG
		Strontium (Sr)	22	1	mg/kg		09/13/97	RG
		Sulphur (S)	401	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	45	5	mg/kg		09/13/97	RG
		Vanadium (V)	9	1	mg/kg		09/13/97	RG
		Zinc (Zn)	19.1	0.5	mg/kg		09/13/97	RG
E709023-04	SITE #2 CATTAIL ROOT							
Sample Type:CATTAIL ROOT								
Collected:08/26/97 11:20								
		Mercury (Hg)	0.02	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	1460	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	39.6	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	0.7	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	14.5	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	6	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	5160	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	0.25	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	1.63	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	2290	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	861	2	mg/kg		09/30/97	RG
		Manganese (Mn)	225	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	0.98	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	893	2	mg/kg		10/01/97	CC
		Potassium (K)	15600	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	641	2	mg/kg		10/01/97	CC
		Strontium (Sr)	10.4	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	0.85	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	0.6	0.2	mg/kg		10/01/97	CC
E709023-05	SITE #2 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/26/97 11:20								
		Mercury (Hg)	0.07	0.01	mg/kg		09/13/97	RG
		Metals (Strong Acid Rec.)						
		Barium (Ba)	97.1	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	27300	100	mg/kg		09/13/97	RG
		Chromium (Cr)	35.0	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	6	1	mg/kg		09/13/97	RG
		Copper (Cu)	15	1	mg/kg		09/13/97	RG

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LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709023-05	SITE #2 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/26/97 11:20								
		Metals (Strong Acid Rec.)						
		Iron (Fe)	32500	1	mg/kg		09/13/97	RG
		Lead (Pb)	11	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	5070	10	mg/kg		09/13/97	RG
		Manganese (Mn)	609	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	24	2	mg/kg		09/13/97	RG
		Potassium (K)	1990	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	182	100	mg/kg		09/13/97	RG
		Strontium (Sr)	53	1	mg/kg		09/13/97	RG
		Sulphur (S)	5810	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	57	5	mg/kg		09/13/97	RG
		Vanadium (V)	30	1	mg/kg		09/13/97	RG
		Zinc (Zn)	51.8	0.5	mg/kg		09/13/97	RG
E709023-08	SITE #3 CATTAIL ROOT							
Sample Type:CATTAIL ROOT								
Collected:08/26/97 13:45								
		Mercury (Hg)	0.02	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	797	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	12.9	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	6	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	2410	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	0.16	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	1.79	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	2110	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	849	2	mg/kg		09/30/97	RG
		Manganese (Mn)	67.8	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	0.63	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	793	2	mg/kg		10/01/97	CC
		Potassium (K)	11800	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	1330	2	mg/kg		10/01/97	CC
		Strontium (Sr)	8.81	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	0.18	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	<0.2	0.2	mg/kg		10/01/97	CC
E709023-07	SITE #3 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/26/97 13:45								
		Mercury (Hg)	0.06	0.01	mg/kg		09/13/97	RG
		Metals (Strong Acid Rec.)						
		Barium (Ba)	82.1	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	20600	100	mg/kg		09/13/97	RG
		Chromium (Cr)	20.8	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	13	1	mg/kg		09/13/97	RG
		Copper (Cu)	28	1	mg/kg		09/13/97	RG
		Iron (Fe)	58000	1	mg/kg		09/13/97	RG
		Lead (Pb)	7	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	11400	10	mg/kg		09/13/97	RG
		Manganese (Mn)	708	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	26	2	mg/kg		09/13/97	RG
		Potassium (K)	1310	20	mg/kg		09/13/97	RG

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LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709023-07	SITE #3 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/26/97 13:45								
		Metals (Strong Acid Rec.)						
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	117	100	mg/kg		09/13/97	RG
		Strontium (Sr)	45	1	mg/kg		09/13/97	RG
		Sulphur (S)	2780	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	58	5	mg/kg		09/13/97	RG
		Vanadium (V)	37	1	mg/kg		09/13/97	RG
		Zinc (Zn)	35.5	0.5	mg/kg		09/13/97	RG
E709023-08	SITE #4 BLUEBERRY							
Sample Type:BLUEBERRY								
Collected:08/26/97 14:10								
		Mercury (Hg)	0.02	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	452	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	6.39	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	3	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	770	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	3.14	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	14	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	321	2	mg/kg		09/30/97	RG
		Manganese (Mn)	315	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	0.41	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	827	2	mg/kg		10/01/97	CC
		Potassium (K)	3150	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	6	2	mg/kg		10/01/97	CC
		Strontium (Sr)	1.46	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	<0.2	0.2	mg/kg		10/01/97	CC
E709023-09	SITE #4 LABRADOR TEA							
Sample Type:TEA								
Collected:08/26/97 14:10								
		Mercury (Hg)	0.03	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	985	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	0.5	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	73.6	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	17	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	4860	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	5.66	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	79	2	mg/kg		10/01/97	CC
		Lead (Pb)	0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	1250	2	mg/kg		09/30/97	RG
		Manganese (Mn)	895	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	2.55	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	994	2	mg/kg		10/01/97	CC
		Potassium (K)	4310	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG

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LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709023-09	SITE #4 LABRADOR TEA							
Sample Type:TEA								
Collected:08/26/97 14:10								
		Metals in Tissue						
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	11	2	mg/kg		10/01/97	CC
		Strontium (Sr)	7.00	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	11.7	0.2	mg/kg		10/01/97	CC
E709023-10	SITE #6 SOIL							
Sample Type:SOIL								
Collected:08/26/97 14:10								
		Mercury (Hg)	0.04	0.01	mg/kg		09/15/97	RG
		Metals (Strong Acid Rec.)						
		Barium (Ba)	116	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	1310	100	mg/kg		09/13/97	RG
		Chromium (Cr)	5.9	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	2	1	mg/kg		09/13/97	RG
		Copper (Cu)	8	1	mg/kg		09/13/97	RG
		Iron (Fe)	13200	1	mg/kg		09/13/97	RG
		Lead (Pb)	<5	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	541	10	mg/kg		09/13/97	RG
		Manganese (Mn)	495	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	4	2	mg/kg		09/13/97	RG
		Potassium (K)	557	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	<100	100	mg/kg		09/13/97	RG
		Strontium (Sr)	14	1	mg/kg		09/13/97	RG
		Sulphur (S)	144	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	50	5	mg/kg		09/13/97	RG
		Vanadium (V)	14	1	mg/kg		09/13/97	RG
		Zinc (Zn)	17.1	0.5	mg/kg		09/13/97	RG
E709023-11	SITE #5 BLUEBERRY							
Sample Type:BLUEBERRY								
Collected:08/26/97 14:45								
		Mercury (Hg)	<0.01	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	654	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	8.46	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	4	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	899	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	4.18	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	13	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	343	2	mg/kg		09/30/97	RG
		Manganese (Mn)	576	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	0.75	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	807	2	mg/kg		10/01/97	CC
		Potassium (K)	4690	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	<2	2	mg/kg		10/01/97	CC
		Strontium (Sr)	1.36	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	<0.2	0.2	mg/kg		10/01/97	CC

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LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709023-11	SITE #5 BLUEBERRY							
Sample Type: BLUEBERRY								
Collected: 08/26/97 14:45								
		Metals in Tissue						
E709023-12	SITE #5 LABRADOR TEA							
Sample Type: TEA								
Collected: 08/26/97 14:45								
		Mercury (Hg)	0.02	0.01	mg/kg		09/30/97	RG
		Sulphur (S)	1020	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	120	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	17	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	5020	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	0.31	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	X 4.36	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	38	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	960	2	mg/kg		09/30/97	RG
		Manganese (Mn)	848	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	1.32	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	1060	2	mg/kg		10/01/97	CC
		Potassium (K)	5401	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	8	2	mg/kg		10/01/97	CC
		Strontium (Sr)	7.45	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	12.7	0.2	mg/kg		10/01/97	CC
E709023-13	SITE #5 SOIL							
Sample Type: SOIL								
Collected: 08/26/97 14:45								
		Mercury (Hg)	0.04	0.01	mg/kg		09/13/97	RG
		Metals (Strong Acid Rec.)						
		Barium (Ba)	99.8	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	1060	100	mg/kg		09/13/97	RG
		Chromium (Cr)	5.9	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	3	1	mg/kg		09/13/97	RG
		Copper (Cu)	✗ 10	1	mg/kg		09/13/97	RG
		Iron (Fe)	2770	1	mg/kg		09/13/97	RG
		Lead (Pb)	5	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	✗ 434	10	mg/kg		09/13/97	RG
		Manganese (Mn)	660	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	4	2	mg/kg		09/13/97	RG
		Potassium (K)	628	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	<100	100	mg/kg		09/13/97	RG
		Strontium (Sr)	12	1	mg/kg		09/13/97	RG
		Sulphur (S)	137	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	✗ 51	5	mg/kg		09/13/97	RG
		Vanadium (V)	✗ 10	1	mg/kg		09/13/97	RG
		Zinc (Zn)	20.4	0.5	mg/kg		09/13/97	RG

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E708023-13	SITE #5 SOIL							
Sample Type:SOIL								
Collected:08/26/97	14:45							
		Metals (Strong Acid Rec.)						
		N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT						
		THIS IS THE FINAL PAGE OF THE REPORT						

Appendix A Test Methodologies

Acid Digestion

Preparation: Microwave digestion of sample in a closed vessel with concentrated nitric acid on a wet or dry soil/solids
Reference: E.P.A. SW 846 Method 3051

Acid Digestion

Mercury (Hg)

Instrumentation: Continuous cold vapour atomic absorption spectrometry
Reference: US EPA SW 846; APHA 3112B

Mercury (Hg)

ICP Method Descriptions

Metals by Inductively Coupled Plasma in digests of soils/solids
METHOD REFERENCE: E.P.A. SW846 Method 6010
NOTE: Wavelengths selected for analysis are the determination of the laboratory

METAL		WAVELENGTH	*DETECTION LIMIT mg/Kg
Barium	(Ba)	455.403	0.5
Beryllium	(Be)	313.042	1
Cadmium	(Cd)	228.802	0.5
Calcium	(Ca)	317.933	5
Chromium	(Cr)	283.563	0.5
Cobalt	(Co)	238.892	1
Copper	(Cu)	324.754	1
Iron	(Fe)	259.940	1
Lead	(Pb)	220.353	5
Lithium	(Li)	670.781	20
Magnesium	(Mg)	285.213	5
Manganese	(Mn)	257.610	1
Molybdenum	(Mo)	281.615	1
Nickel	(Ni)	231.604	1
Sodium	(Na)	588.995	5
Potassium	(K)	769.896	5
Tin	(Sn)	189.926	5
Thallium	(Tl)	351.924	1
Vanadium	(V)	290.882	1
Zinc	(Zn)	213.856	0.5
Silver	(Ag)	328.068	1
Strontium	(Sr)	421.552	1

*The actual detection limits reported will vary with the digestion extraction ratio.
NOTE: Wavelenghts and detection limits may vary with matrix and sample composition.

Sulphur (S)

Preparation Methods: Microwave digestion in a closed vessel with nitric acid.
Instrumental: ICP spectometry at 180.7 nm

Appendix A Test Methodologies

Reference: Methods Manual for Forest Soil & Plant Analysis, 1991, Forestry Canada.

PAH in Solid Samples

Preparation Method:	Soxhlet extraction with DCM or by accelerated solvent extraction with DCM/Acetone
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3540 (modified) or EPA 3545 (modified) Analytical Method: EPA 8270 (modified)

PAH in Various Matrices

Preparation Method:	Solvent extraction with DCM
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3550 (modified) Analytical Method: EPA 8270 (modified)

Mercury Cold Vapor Prep.

Preparation: Digestion with permanganate, nitric, and sulphuric acids.
Reference: US EPA SW 846 / APHA 3112B

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709028-01	SITE #6 BLUEBERRY							
Sample Type:BLUEBERRY								
Collected:08/26/97 11:47								
		Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
		Sulphur (S)	544	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	15.5	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	6	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	1140	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	2.91	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	8	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	353	2	mg/kg		09/30/97	RG
		Manganese (Mn)	204	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	0.99	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	691	2	mg/kg		10/01/97	CC
		Potassium (K)	4020	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	<2	2	mg/kg		10/01/97	CC
		Strontium (Sr)	1.24	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	<0.2	0.2	mg/kg		10/01/97	CC
E709028-02	SITE #6 LABRADOR TEA							
Sample Type:TEA								
Collected:08/26/97 11:47								
		Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
		Sulphur (S)	927	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	14.7	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	100	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	16	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	5200	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	0.09	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	3.36	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	38	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	1070	2	mg/kg		09/30/97	RG
		Manganese (Mn)	468	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	6.92	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	898	2	mg/kg		10/01/97	CC
		Potassium (K)	4230	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	2	2	mg/kg		10/01/97	CC
		Strontium (Sr)	8.53	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	13.5	0.2	mg/kg		10/01/97	CC
E709028-03	SITE #6 SOIL							
Sample Type:SOIL								
Collected:08/26/97 11:47								
		Mercury (Hg)	0.03	0.01	mg/kg		09/13/97	RG

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709028-03	SITE #6 SOIL							
Sample Type:SOIL								
Collected:08/26/97 11:47								
		Metals (Strong Acid Rec.)						
		Barium (Ba)	25.7	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	360	100	mg/kg		09/13/97	RG
		Chromium (Cr)	7.9	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	1	1	mg/kg		09/13/97	RG
		Copper (Cu)	7	1	mg/kg		09/13/97	RG
		Iron (Fe)	8230	1	mg/kg		09/13/97	RG
		Lead (Pb)	<5	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	322	10	mg/kg		09/13/97	RG
		Manganese (Mn)	41.5	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	3	2	mg/kg		09/13/97	RG
		Potassium (K)	815	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	<100	100	mg/kg		09/13/97	RG
		Strontium (Sr)	7	1	mg/kg		09/13/97	RG
		Sulphur (S)	369	100	mg/kg		09/13/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	38	5	mg/kg		09/13/97	RG
		Vanadium (V)	20	1	mg/kg		09/13/97	RG
		Zinc (Zn)	14.6	0.5	mg/kg		09/13/97	RG
E709028-04	SITE #7 BLUEBERRY							
Sample Type:BLUEBERRY								
Collected:08/27/97 14:10								
		Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
		Sulphur (S)	668	100	mg/kg		10/01/97	CC
		Metals In Tissue						
		Aluminum (Al)	<0.2	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	9.13	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	4	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	959	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	3.45	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	20	2	mg/kg		10/01/97	CC
		Lead (Pb)	<0.4	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	361	2	mg/kg		09/30/97	RG
		Manganese (Mn)	364	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	0.40	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	707	2	mg/kg		10/01/97	CC
		Potassium (K)	4500	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	<2	2	mg/kg		10/01/97	CC
		Strontium (Sr)	1.11	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	1.0	0.2	mg/kg		10/01/97	CC
E709028-05	SITE #7 LABRADOR TEA							
Sample Type:TEA								
Collected:08/27/97 14:10								
		Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
		Sulphur (S)	1090	100	mg/kg		10/01/97	CC
		Metals In Tissue						
		Aluminum (Al)	1.3	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	83.6	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	13	2	mg/kg		09/30/97	RG

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LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L	UNITS	EXTRACTED	ANALYZED	BY
E709028-05	SITE #7 LABRADOR TEA							
Sample Type:TEA								
Collected:08/27/97 14:10								
		Metals in Tissue						
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	5710	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	<0.08	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	74.0	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	104	2	mg/kg		10/01/97	CC
		Lead (Pb)	2.9	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	1010	2	mg/kg		09/30/97	RG
		Manganese (Mn)	1070	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	5.61	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	1000	2	mg/kg		10/01/97	CC
		Potassium (K)	4500	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	<2	2	mg/kg		10/01/97	CC
		Strontium (Sr)	7.41	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	0.18	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	<0.08	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	54.5	0.2	mg/kg		10/01/97	CC
E709028-06	SITE #7 SOIL							
Sample Type:SOIL								
Collected:08/27/97 14:10								
		Mercury (Hg)	0.05	0.01	mg/kg		09/13/97	RG
		Metals (Strong Acid Rec.)						
		Barium (Ba)	133	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	2360	100	mg/kg		09/13/97	RG
		Chromium (Cr)	6.7	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	3	1	mg/kg		09/13/97	RG
		Copper (Cu)	7	1	mg/kg		09/13/97	RG
		Iron (Fe)	6740	1	mg/kg		09/13/97	RG
		Lead (Pb)	7	3	mg/kg		09/13/97	RG
		Magnesium (Mg)	517	10	mg/kg		09/13/97	RG
		Manganese (Mn)	1200	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	4	2	mg/kg		09/13/97	RG
		Potassium (K)	783	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	<100	100	mg/kg		09/13/97	RG
		Strontium (Sr)	14	1	mg/kg		09/13/97	RG
		Sulphur (S)	279	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	114	5	mg/kg		09/13/97	RG
		Vanadium (V)	13	1	mg/kg		09/13/97	RG
		Zinc (Zn)	18.6	0.5	mg/kg		09/13/97	RG
E709028-07	SITE #7 SPHAGNUM MOSS							
Sample Type:MOSS								
Collected:08/27/97 14:10								
		Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
		Sulphur (S)	741	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	108	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	0.06	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	<0.2	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	28.3	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	3	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	4700	10	mg/kg		09/30/97	RG
		Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	0.21	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	2.82	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	835	2	mg/kg		10/01/97	CC
		Lead (Pb)	0.9	0.4	mg/kg		09/30/97	RG

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LAB ID / SAMPLE ID / TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709028-07 SITE #7 SPHAGNUM MOSS Sample Type:MOSS Collected:08/27/97 14:10						
Metals in Tissue						
Magnesium (Mg)	805	2	mg/kg		09/30/97	RG
Manganese (Mn)	450	0.04	mg/kg		09/30/97	RG
Molybdenum (Mo)	<0.4	0.	mg/kg		09/30/97	RG
Nickel (Ni)	3.19	0.08	mg/kg		09/30/97	RG
Phosphorus (P)	1210	2	mg/kg		10/01/97	CC
Potassium (K)	2490	2	mg/kg		09/30/97	RG
Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
Sodium (Na)	12	2	mg/kg		10/01/97	CC
Strontium (Sr)	8.32	0.04	mg/kg		09/30/97	RG
Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
Vanadium (V)	1.23	0.08	mg/kg		09/30/97	RG
Zinc (Zn)	18.0	0.2	mg/kg		10/01/97	CC
E709028-08 SITE #8 CATTAIL ROOT Sample Type:CATTAIL ROOT Collected:08/29/97 15:30						
Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
Sulphur (S)	4100	100	mg/kg		10/01/97	CC
Metals in Tissue						
Aluminum (Al)	207	0.2	mg/kg		10/01/97	CC
Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
Arsenic (As)	0.2	0.2	mg/kg		09/30/97	RG
Barium (Ba)	46.9	0.08	mg/kg		09/30/97	RG
Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
Boron (B)	29	2	mg/kg		09/30/97	RG
Cadmium (Cd)	0.17	0.08	mg/kg		09/30/97	RG
Calcium (Ca)	16500	10	mg/kg		09/30/97	RG
Chromium (Cr)	<0.5	0.5	mg/kg		10/01/97	CC
Cobalt (Co)	0.74	0.08	mg/kg		09/30/97	RG
Copper (Cu)	1.90	0.08	mg/kg		09/30/97	RG
Iron (Fe)	3270	2	mg/kg		10/01/97	CC
Lead (Pb)	1.4	0.4	mg/kg		09/30/97	RG
Magnesium (Mg)	1100	2	mg/kg		09/30/97	RG
Manganese (Mn)	162	0.04	mg/kg		09/30/97	RG
Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
Nickel (Ni)	3.13	0.08	mg/kg		09/30/97	RG
Phosphorus (P)	502	2	mg/kg		10/01/97	CC
Potassium (K)	1000	2	mg/kg		09/30/97	RG
Selenium (Se)	0.2	0.2	mg/kg		09/30/97	RG
Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
Sodium (Na)	1130	2	mg/kg		10/01/97	CC
Strontium (Sr)	33.7	0.04	mg/kg		09/30/97	RG
Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
Vanadium (V)	2.48	0.08	mg/kg		09/30/97	RG
Zinc (Zn)	59.2	0.2	mg/kg		10/01/97	CC
E709028-09 SITE #8 SEDIMENT Sample Type:SEDIMENT Collected:08/29/97 15:30						
Mercury (Hg)	0.11	0.01	mg/kg		09/13/97	RG
Metals (Strong Acid Rec.)						
Barium (Ba)	110	0.5	mg/kg		09/13/97	RG
Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
Calcium (Ca)	31000	100	mg/kg		09/13/97	RG
Chromium (Cr)	6.3	0.5	mg/kg		09/13/97	RG
Cobalt (Co)	3	1	mg/kg		09/13/97	RG
Copper (Cu)	15	1	mg/kg		09/13/97	RG
Iron (Fe)	6640	1	mg/kg		09/13/97	RG
Lead (Pb)	19	5	mg/kg		09/13/97	RG
Magnesium (Mg)	2240	10	mg/kg		09/13/97	RG
Manganese (Mn)	295	0.1	mg/kg		09/13/97	RG
Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
Nickel (Ni)	8	2	mg/kg		09/13/97	RG
Potassium (K)	1310	20	mg/kg		09/13/97	RG
Silver (Ag)	<1	1	mg/kg		09/13/97	RG
Sodium (Na)	671	100	mg/kg		09/13/97	RG

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709028-09	SITE #8 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/29/97 15:30								
		Metals (Strong Acid Rec.)						
		Strontium (Sr)	82	1	mg/kg		09/13/97	RG
		Sulphur (S)	8150	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	55	5	mg/kg		09/13/97	RG
		Vanadium (V)	14	1	mg/kg		09/13/97	RG
		Zinc (Zn)	197	0.5	mg/kg		09/13/97	RG
E709028-10	SITE #9 CATTAIL ROOT							
Sample Type:CATTAIL ROOT								
Collected:08/30/97 16:20								
		Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
		Sulphur (S)	1970	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	693	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	0.9	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	35.8	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	3	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	0.09	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	40000	10	mg/kg		09/30/97	RG
		Chromium (Cr)	1.0	0.	mg/kg		10/01/97	CC
		Cobalt (Co)	1.34	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	3.36	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	8340	2	mg/kg		10/01/97	CC
		Lead (Pb)	1.0	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	4060	2	mg/kg		09/30/97	RG
		Manganese (Mn)	133	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	3.34	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	324	2	mg/kg		10/01/97	CC
		Potassium (K)	888	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	386	2	mg/kg		10/01/97	CC
		Strontium (Sr)	36.4	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	4.00	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	2.6	0.2	mg/kg		10/01/97	CC
E709028-11	SITE #9 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/30/97 16:20								
		Mercury (Hg)	0.06	0.01	mg/kg		09/13/97	RG
		Metals (Strong Acid Rec.)						
		Barium (Ba)	102	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	97300	100	mg/kg		09/13/97	RG
		Chromium (Cr)	14.2	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	6	1	mg/kg		09/13/97	RG
		Copper (Cu)	13	1	mg/kg		09/13/97	RG
		Iron (Fe)	38100	1	mg/kg		09/13/97	RG
		Lead (Pb)	7	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	10300	10	mg/kg		09/13/97	RG
		Manganese (Mn)	782	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	12	2	mg/kg		09/13/97	RG
		Potassium (K)	1340	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	160	100	mg/kg		09/13/97	RG
		Strontium (Sr)	83	1	mg/kg		09/13/97	RG
		Sulphur (S)	2200	100	mg/kg		09/15/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	151	5	mg/kg		09/13/97	RG
		Vanadium (V)	16	1	mg/kg		09/13/97	RG
		Zinc (Zn)	31.3	0.5	mg/kg		09/13/97	RG

ENVIRO-TEST CHEMICAL ANALYSIS REPORT

LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709028-11	SITE #9 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/30/97 16:20								
		Metals (Strong Acid Rec.)						
E709028-12	SITE #10 CATTAIL ROOT							
Sample Type:CATTAIL ROOT								
Collected:08/30/97 16:50								
		Mercury (Hg)	<0.1	0.1	mg/kg		09/30/97	RG
		Sulphur (S)	874	100	mg/kg		10/01/97	CC
		Metals in Tissue						
		Aluminum (Al)	322	0.2	mg/kg		10/01/97	CC
		Antimony (Sb)	<0.04	0.04	mg/kg		09/30/97	RG
		Arsenic (As)	0.9	0.2	mg/kg		09/30/97	RG
		Barium (Ba)	18.3	0.08	mg/kg		09/30/97	RG
		Beryllium (Be)	<0.2	0.2	mg/kg		09/30/97	RG
		Boron (B)	<2	2	mg/kg		09/30/97	RG
		Cadmium (Cd)	<0.08	0.08	mg/kg		09/30/97	RG
		Calcium (Ca)	1670	10	mg/kg		09/30/97	RG
		Chromium (Cr)	0.5	0.5	mg/kg		10/01/97	CC
		Cobalt (Co)	5.24	0.08	mg/kg		09/30/97	RG
		Copper (Cu)	3.04	0.08	mg/kg		09/30/97	RG
		Iron (Fe)	4880	2	mg/kg		10/01/97	CC
		Lead (Pb)	1.2	0.4	mg/kg		09/30/97	RG
		Magnesium (Mg)	490	2	mg/kg		09/30/97	RG
		Manganese (Mn)	130	0.04	mg/kg		09/30/97	RG
		Molybdenum (Mo)	<0.4	0.4	mg/kg		09/30/97	RG
		Nickel (Ni)	6.43	0.08	mg/kg		09/30/97	RG
		Phosphorus (P)	153	2	mg/kg		10/01/97	CC
		Potassium (K)	1480	2	mg/kg		09/30/97	RG
		Selenium (Se)	<0.2	0.2	mg/kg		09/30/97	RG
		Silver (Ag)	<0.08	0.08	mg/kg		09/30/97	RG
		Sodium (Na)	345	2	mg/kg		10/01/97	CC
		Strontium (Sr)	7.57	0.04	mg/kg		09/30/97	RG
		Thallium (Tl)	<0.04	0.04	mg/kg		09/30/97	RG
		Tin (Sn)	<0.08	0.08	mg/kg		09/30/97	RG
		Vanadium (V)	7.16	0.08	mg/kg		09/30/97	RG
		Zinc (Zn)	6.6	0.2	mg/kg		10/01/97	CC
E709028-13	SITE #10 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/30/97 16:50								
		Mercury (Hg)	0.05	0.01	mg/kg		09/13/97	RG
		Metals (Strong Acid Rec.)						
		Barium (Ba)	36.1	0.5	mg/kg		09/13/97	RG
		Beryllium (Be)	<1	1	mg/kg		09/13/97	RG
		Cadmium (Cd)	<0.5	0.5	mg/kg		09/13/97	RG
		Calcium (Ca)	1080	100	mg/kg		09/13/97	RG
		Chromium (Cr)	19.7	0.5	mg/kg		09/13/97	RG
		Cobalt (Co)	4	1	mg/kg		09/13/97	RG
		Copper (Cu)	10	1	mg/kg		09/13/97	RG
		Iron (Fe)	5640	1	mg/kg		09/13/97	RG
		Lead (Pb)	5	5	mg/kg		09/13/97	RG
		Magnesium (Mg)	614	10	mg/kg		09/13/97	RG
		Manganese (Mn)	60.6	0.1	mg/kg		09/13/97	RG
		Molybdenum (Mo)	<1	1	mg/kg		09/13/97	RG
		Nickel (Ni)	14	2	mg/kg		09/13/97	RG
		Potassium (K)	1050	20	mg/kg		09/13/97	RG
		Silver (Ag)	<1	1	mg/kg		09/13/97	RG
		Sodium (Na)	<100	100	mg/kg		09/13/97	RG
		Strontium (Sr)	13	1	mg/kg		09/13/97	RG
		Sulphur (S)	2060	100	mg/kg		09/13/97	CC
		Thallium (Tl)	<1	1	mg/kg		09/13/97	RG
		Tin (Sn)	<5	5	mg/kg		09/13/97	RG
		Titanium (Ti)	63	5	mg/kg		09/13/97	RG
		Vanadium (V)	21	1	mg/kg		09/13/97	RG
		Zinc (Zn)	21.3	0.5	mg/kg		09/13/97	RG

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LAB ID	SAMPLE ID	TEST DESCRIPTION	RESULT	D.L.	UNITS	EXTRACTED	ANALYZED	BY
E709028-13	SITE #16 SEDIMENT							
Sample Type:SEDIMENT								
Collected:08/30/97 16:50								
		Metals (Strong Acid Rec.)						
		N.D. - NOT DETECTED, LESS THAN THE DETECTION LIMIT						
		THIS IS THE FINAL PAGE OF THE REPORT						

Appendix A Test Methodologies

Acid Digestion

Preparation: Microwave digestion of sample in a closed vessel with concentrated nitric acid on a wet or dry soil/solids
Reference: E.P.A. SW 846 Method 3051

Acid Digestion

Mercury (Hg)

Instrumentation: Continuous cold vapour atomic absorption spectrometry
Reference: US EPA SW 846; APHA 3112B

Mercury (Hg)

ICP Method Descriptions

Metals by Inductively Coupled Plasma in digests of soils/solids
METHOD REFERENCE: E.P.A. SW846 Method 6010
NOTE: Wavelengths selected for analysis are the determination of the laboratory

METAL		WAVELENGTH	*DETECTION LIMIT ug/Kg
Barium	(Ba)	455.403	0.5
Beryllium	(Be)	313.042	1
Cadmium	(Cd)	228.802	0.5
Calcium	(Ca)	317.933	5
Chromium	(Cr)	283.563	0.5
Cobalt	(Co)	238.892	1
Copper	(Cu)	324.754	1
Iron	(Fe)	259.940	1
Lead	(Pb)	220.353	5
Lithium	(Li)	670.781	20
Magnesium	(Mg)	285.213	5
Manganese	(Mn)	257.610	1
Molybdenum	(Mo)	281.615	1
Nickel	(Ni)	231.604	1
Sodium	(Na)	588.995	5
Potassium	(K)	769.896	5
Tin	(Sn)	189.926	5
Thallium	(Tl)	351.924	1
Vanadium	(V)	290.882	1
Zinc	(Zn)	213.856	0.5
Silver	(Ag)	328.068	1
Strontium	(Sr)	421.552	1

*The actual detection limits reported will vary with the digestion extraction ratio.
NOTE: Wavelenghts and detection limits may vary with matrix and sample composition.

Sulphur (S)

Preparation Methods: Microwave digestion in a closed vessel with nitric acid.
Instrumental: ICP spectometry at 180.7 nm

Appendix A Test Methodologies

Reference: Methods Manual for Forest Soil & Plant Analysis, 1991, Forestry Canada.

PAH in Solid Samples

Preparation Method:	Soxhlet extraction with DCM or by accelerated solvent extraction with DCM/Acetone
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3540 (modified) or EPA 3545 (modified) Analytical Method: EPA 8270 (modified)

PAH in Various Matrices

Preparation Method:	Solvent extraction with DCM
Instrument Method:	GC/MSD analysis
Method Reference:	Extraction Method: EPA 3550 (modified) Analytical Method: EPA 8270 (modified)

Mercury Cold Vapor Prep.

Preparation: Digestion with permanganate, nitric, and sulphuric acids.
Reference: US EPA SW 846 / APHA 3112B

THIS IS THE LAST PAGE OF THE METHODOLOGY APPENDIX.