CREATING AND DELIVERING BETTER SOLUTIONS

TAMERLANE PINE POINT PROJECT

Vegetation/Ecosystem Baseline Studies

November, 2005

Tamerlane Ventures Inc.

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VEGETATION / ECOSYSTEM BASELINE STUDIES
PINE POINT PROJECT
TAMERLANE

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EXECUTIVE SUMMARY

Ecological land classification is a mapping process that involves the integration of site, soil and vegetation information. This information is used to organize ecological data into units that respond to disturbance in a similar and predictable manner. This information can then be used for a number of purposes including environmental assessment, project planning long-term monitoring and to develop sustainable resource management plans.

The 36,153 ha study area is located on the cusp of the Boreal Plains and the Taiga Plains Ecozones and encompasses that Slave River and Hay River Lowland Ecoregions. The area is characterized by short, cool summers and long, cold winters. The ecoregion is classified as having a subhumid mid-boreal ecoclimate. Surficial deposits were influenced by the flooding and recession of Glacial Lake McConnell. Sand and gravel deposits are common (Day, 1972). Luvisols and Brunisols are the dominant upland soil, with Gleysolic and Organic soils dominant in the low-lying areas. Sporadic discontinuous permafrost is common in the organic deposits. Jack pine and trembling aspen are common seral species, while white spruce and black spruce dominate later successional stands. Poorly drained fens and bogs are covered with low, open stands of larch, black spruce and ericiaceous shrubs. (Environment Canada, 2000)

Baseline data were collected in September 2005. Thirty-eight field inspections were completed in seven ecosystem types resulting in a terrestrial ecosystem mapping sampling intensity level 4. Mapping at a 1:50,000 scale was completed using Quickbird imagery. Eleven ecosystem types were classified within the study area. Eight of these are naturally vegetated, one is classified as water, one is anthropogenic and one was cloud.

Just over 50 % of the study area is classified as lowland and 47% is classified as upland. Most of the area is forested, and shrub units tended to be present in low-lying areas that had some evidence of fire. These same shrub units made up the majority of the mixed wood units. Broadleaf and graminoid units are not common. The most common ecosite is the upland, Labrador tea – mesic ecosite (28%), with the shrubby fens and the treed fens second and third, respectively (25% and 24%). The bearberry and willow / horsetail ecosites have restricted distribution and each represent less than 1% of the study area.

Confidence in the mapping and subsequent data analysis is moderate to high for most units, with the exception of the Labrador tea – subhygric and Canada buffalo berry which are low. This is primarily due to a lack of topographical information. Confidence in mapping structural stage and stand composition is moderate to high.

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1.0 INTRODUCTION

Ecological Land Classification (ELC), an ecological mapping process that involves the integration of site, soil and vegetation information, was undertaken as part of the environmental baseline investigations conducted by EBA Engineering Consultants Ltd. (EBA) for Tamerlane Ventures Inc. (Tamerlane). Integrated and sustainable resource management requires an understanding of ecosystem dynamics and functioning. Ecosystem classification helps organize ecological data into units that respond to disturbance in a similar and predictable manner. Understanding past, present, and potential future development requires knowledge of environmental baseline conditions. This baseline report provides a basis for environmental assessment, project planning and long-term monitoring of the environment associated with future mining activities. The ELC is also a biophysical base for other resource components such as wildlife and biodiversity.

2.0 STUDY AREA

The study area is 36,153 ha and is located on the cusp of the Boreal Plains and the Taiga Plains Ecozones and encompasses that Slave River and Hay River Lowland Ecoregions. The area is characterized by short, cool summers and long, cold winters. The mean annual temperature is –17.5 °C, and annual precipitation ranges from 300 to 400 mm. The ecoregion is classified as having a subhumid mid-boreal ecoclimate. (Environment Canada, 2000)

The region consists mainly of an undulating sandy plain, with some eolian features, underlain with low relief, flay-lying Palaeozoic strata. Surficial deposits in the area were largely influenced by the recession of Glacial Lake McConnell, and sand and gravel deposits are common (Day, 1972). Luvisols and Brunisols are the dominant upland soil, with Gleysolic and Organic soils dominant in the low-lying areas. Sporadic discontinuous permafrost is common in the organic deposits. (Environment Canada, 2000)

Vegetation of the regions is characterized by medium to tall, closed stands of jack pine (*Pinus banksiana*) and trembling aspen (*Populus tremuloides*). White spruce (*Picea glauca*) and black spruce (*Picea mariana*) dominate later successional stands. Poorly drained fens and bogs in this region are covered with low, open stands of larch (*Larix laricina*), black spruce and ericiaceous shrubs. (Environment Canada, 2000)

3.0 ELC OBJECTIVES

The objectives of the ELC were to complete the following tasks:

- Define ecosystem types (ecosites) on the basis of field studies.
- Map and characterize the landscape in the study area using defined ecosystem units and satellite imagery.

4.0 METHODS

The ELC project methods employed can be divided into four phases: preliminary ecosystem classification and sampling plan, field sampling, satellite imagery preparation, and ELC mapping. The methods and approach associated with each phase are discussed below.

4.1 PRELIMINARY CLASSIFICATION AND SAMPLING PLAN

At the initiation of the project, a literature review was completed of ecosystem and vegetation classification in northern Alberta and the NWT (Day, 1972; ESWG, 1995; Rowe, 1972; Beckingham and Archibald, 1996). The ecosystem sampling plan was adapted from British Columbia's Terrestrial Ecosystem Mapping (TEM) system (Resources Inventory Committee [RIC]1998a; 1998b). The TEM standard has also been recently adopted for several other ELC mapping projects conducted as a part of environmental assessments in the Northwest Territories and Nunavut.

A TEM Level 4 survey intensity was planned for the ELC sampling of the study area. This survey intensity is considered appropriate for ecosystem representation, local resource planning and landscape management. The appropriate scale of mapping is 1:20,000 to l:50,000. This sampling intensity typically includes 15-25 % polygon visitation with a plot ratio of 5 % detailed full plots, 20 % ground inspection form (GIF) plots and 75 % visual plots.

Initial review of the satellite imagery indicated that polygons were generally large and for preliminary sampling it was estimated that there would be 450 polygons. This is based on a 1:50,000 mapping scale, with an average polygon size of 80 ha. Typical range of polygon size for that scale of mapping is 2 to 80 ha. It was estimated that 112 plots, at a 25 % sampling intensity, would be needed of the following types:

- 6 full plots,
- 22 GIF plots, and
- 84 visual plots.

The minimum number of plots required would be 68 at a 15 % sampling intensity. Prior to field sampling, potential sampling locations were identified using satellite imagery.

4.2 FIELD SAMPLING

Field data collection occurred from September 19 to 23, 2005. Collection of field data followed the standards established in British Columbia for Describing Terrestrial Ecosystems in the Field (DTEIF) (Province of British Columbia, 1998) and for TEM (RIC, 1998a). All plot position coordinates were determined using Global Positioning System (GPS), with an expected accuracy of 6-8 m. The ELC field crew consisted of a two-person team, which undertook a range of field measurements described below.

A total of 19 full plots and 19 visuals were completed for a total of 38 sample plots in 241 polgyons. A sampling ratio of 50:0:50 was achieved for full, GIF and visual plots in the

field. The 38 plots sampled within 241 polygons (not including water), resulted in a 16 % sampling intensity for the project. This meets the requirements for a TEM Level 4 survey. The final number of plots sampled was reduced from the pre-field planning target numbers (as mentioned in Section 4.1). This adjustment was due to difficulties in accessing potential sample locations. To make up for the difficulties in access, more full plots were completed to ensure sufficient information was collected to adequately describe the ecosystem types.

In each of the full plots, the following site information was collected: plot number, date, UTM coordinates, elevation, exposure, aspect, slope, macro- and meso-site position, soil moisture, drainage and nutrient regime, ecosystem unit name, successional status, structural stage, and surface substrate (bedrock, rocks, mineral soil, wood, organic matter and water). Notes describing the plot-in-context and variability within the polygon were recorded. Photographs were taken at each plot.

Due to the timing of the survey (late fall), determination of vascular and non vascular plants to genus and species level was sometimes difficult. When possible, plants were identified to species level. Vegetation cover, density and distribution estimates were recorded for each species identified. Vascular plant identification followed Porsild and Cody (1968, 1980). Bryophyte and lichen identification followed Vitt *et al.* (1988).

Visual plots involved recording brief point or area characteristics made from the ground, and were used to note the basic ecosystem unit, vegetation or other key features. The primary function of visual plots is to aid in the delineation of polygon labels and to confirm the placement of polygon boundaries during the photo interpretation and mapping phases of the work. No GIF plots were completed.

Following field sampling, GPS data associated with the plot locations were prepared for use in the project's GIS software (ESRI ArcView® 3.2 and Arc/Info® 8.1). Full plot data were digitally transcribed from field plot forms using VPRO, an ecological data entry and management tool (Province of British Columbia, 1999).

4.3 SATELLITE IMAGE PREPARATION

The imagery used for mapping was created from two satellite captures of the study area and surrounding region. The study area consists of a tasked, ortho-rectified Quickbird scene acquired between August 25, 2005 and September 02, 2005. The Quickbird satellite collects panchromatic imagery at 60-70 cm resolution and multispectral imagery at 2.4-2.8 m resolution. The acquired imagery has been shown in natural color and has been enhanced with the panchromatic high resolution band to increase visual interpretation. The surrounding region consists of archived Landsat7 ETM+ imagery acquired on July 03, 2001 from the Global Land Cover Facility. The Landsat satellite collects 8 bands of visible and near infrared regions of the spectrum. The imagery used consists of bands 7,4, and 1 and has been enhanced for visual interpretation. The Quickbird and Landsat imagery have been mosaiced for a seamless image of the study area and surrounding region.

4.4 ELC MAPPING

Ecosystems were interpreted, mapped and labelled on-screen using ArcView® 3.2. Interpretation and labelling followed approaches defined by the RIC (1998a). To maintain a high level of consistency, the staff that completed the field sampling also attributed the polygons. Ecosystems were mapped at a nominal scale of 1:50,000. A quality assurance/quality control (QA/QC) review of the mapping was conducted concurrently with the line work. At the beginning of each day, 10 % of the polygons that were previously mapped were revisited to ensure consistency from day to day. At the end of the mapping process, 10 % of the polygons were audited for accuracy. Final ELC documents include this baseline report and vegetation maps of the study area.

5.0 RESULTS OF FIELD SAMPLING AND MAPPING

Data collected in the field were used for ecosystem classification and mapping. Classification and mapping results for soils and vegetation are presented below.

5.1 SOILS

The general area is described in the Soils of the Slave River Lowland as low-lying flat land with numerous lakes and abandoned stream channels. The soil climate is subarctic (humid), with discontinuous permafrost. In much of the area, soil development has been influenced by the presence of water for much of the year. The dominant soils are Humic Gleysols and Gleysols and Regosols (Day, 1972). There is little relief, and changes in vegetation communities are not followed with a characteristic change in surface elevation, but rather, a change in the depth to mineral soil.

In the study area, soils are primarily Eluviated Eutric Brunisols in upland areas and Terric Organics and Gleysols in lowland areas. Cumulo Organics were encountered, most likely a result of the formation and flooding regimes of Glacial Lake McConnell. The cumulo layers are remnants of the past glaciation and with the passage of time, these soils will become Terric and Typic organics. Mineral soils vary in texture from gravel to clay, however sand was most common.

Soil data collected as part of the ecosystem classification are provided in Appendix A.

5.2 VEGETATION

Detailed vegetation data were collected in the field and used to determine ecosystem classification. Below is a description of how the ecosystem units were classified, what units were found and how they are distributed in the study area.

5.2.1 Defining Ecosystem Units

The ecosystem units were defined in broad terms for zone, landform, structural stage, and stand composition. These components are further divided as indicated in Table 1. Building on the broad classifications, the ecosystem units were further defined into ecosites using soils and vegetation data collected during field surveys. The Field Guide to Ecosites of

Northern Alberta (Beckingham and Archibald, 1996) was used to classify the ecosites (Table 2). Due to the scale of mapping and the type of imagery, it was not possible to distinguish between rich and poor fens so these ecosites were combined when mapping.

TABLE 1: ECOSYSTEM COMPONENTS

Zone	Landform	Structural Stage	Stand
Canadian Shield	Upland Lowland Riparian	Forest Shrub Graminoid	Broadleaf Coniferous Mixed

TABLE 2: ECOSITES IN THE STUDY AREA

Ecosite	Description
Upland	
a	bearberry Pj
b	Canada buffalo-berry – green alder
c	Labrador tea – mesic
d	Labrador tea – subhygric
Lowland	
h1	treed fen
h2	shrubby fen
h3	graminoid fen
Riparian	
e	willow / horsetail
Other	
w	Open water, no differentiation of depth
ds	Previous mining activity
cld	Cloud

5.2.2 Ecosystem Descriptions in the Study Area

The following section provides descriptive information on landscape units, canopy type, stand composition and ecosystem types within the study area.

5.2.2.1 Landscape Units

Four landscape units were identified, upland, lowland, riparian and water (Table 3). To visualize the abundance and distribution of the broad ecosystem types, the study area was mapped according to each type (Figure 1). Lowland units were the most abundant. It was difficult to distinguish the transition zones between lowland and upland from the satellite imagery, with the lowland, primarily treed fens being somewhat indistinguishable from the

adjacent upland Labrador tea – subhygric ecosite. It is possible that lowlands are slightly over-represented in the study area. This issue is discussed in more detail in Section 5.3.2.

TABLE 3: LANDSCAPE UNITS WITHIN THE STUDY AREA

Landscape Unit	Total Area (ha)	No. of Polygons	Area as % Total Area
Upland	16,949	107	46.9
Lowland	18,201	96	50.3
Riparian	112	13	0.3
Water	483	22	1.3
Cloud	408	3	1.1
TOTAL	**36,153**	**241**	**100**

5.2.2.2 Structural Stage

The study area was divided into structural stage based on height of vegetation with forest being greater than 10 m and shrub less than 10 m. Structural stage can be a useful in interpreting wildlife habitat values. The majority of the study area is forested (Table 4, Figure 2). Shrubs tended to be located in lowland areas that had been burnt and within riparian zones. Graminoid areas were often interspersed with shrubs and may be under-represented in the study area if they did not constitute a majority of the polygon.

TABLE 4: STRUCTURAL STAGE WITHIN THE STUDY AREA

Structural Stage	Total Area (ha)	No. of Polygons	Area as % Total Area
Forest	25,171	135	69.6
Shrub	8,993	58	24.9
Graminoid	388	8	1.1
Not Applicable[1]	1,601	40	4.4
TOTAL	**36,153**	**241**	**100**

[1] includes non vegetated, water and cloud

5.2.2.3 Stand Composition

Stand Composition data are provided in Table 5 and are visually presented in Figure 3. Conifer-dominated stands are the most common stand composition category and cover approximately 69 % of the study area. These cover both upland and lowland units, such as pine forests, the white and black spruce forests along the Buffalo River, and treed fens. Mixed stands cover approximately 25 %. The mixed stands are predominately bog birch (*Betula nana*) and regeneration of larch and black spruce in lowland areas, a result of historical fire disturbances. There are a few white spruce (*Picea glauca*) – balsam poplar (*Populus balsamifera*), aspen or paper birch (*Betula papyrifera*) forests that were observed during the field surveys, but these were generally too small to map.

TABLE 5: STAND COMPOSITION WITHIN THE STUDY AREA			
Stand Composition	Total Area (ha)	No. of Polygons	Area as % Total Area
Broadleaf	126	13	0.3
Coniferous	24,998	132	69.1
Mixed	9,040	48	25.0
Graminoid	388	8	1.1
Not applicable[1]	1,601	40	4.4
TOTAL			
[1] includes non vegetated, water and cloud			

5.2.2.4 Ecosites

Each field site was classified into an ecosite based on the classification scheme outlined in Beckingham and Archibald (1996). In total, eight naturally vegetated ecosites, one water, one anthropogenic (disturbed) and one classified as cloud (Table 6) were identified and mapped in 241 polygons within the study area. Visual distribution of the ecosystem types is provided in Figure 4. Summaries of the polygon mapping and these ecosites are provided below. Detailed vegetation data are located in Appendix B.

TABLE 6: ECOSITE DISTRIBUTION WITHIN THE STUDY AREA				
Ecosytem Type	Total Area (ha)	No. of Polygons	Average Polygon Size (ha)	Area as % Total Area
Upland				
a	126	1	126	0.3
b	531	8	66	1.5
c	10,249	45	228	28.3
d	5,456	40	136	15.1
Riparian				
e	112	13	9	0.3
Lowland				
h1	8,795	40	220	24.3
h2	8,895	46	193	24.6
h3	388	8	49	1.1
Other				
water	483	22	22	1.3
disturbed	710	15	47	2.0
cloud	408	3	136	1.1
Total	**36,153**	**241**	**150**	**100**

A total of 241 polygons were mapped in the 36,153 ha study area. The average polygon size is approximately 150 ha, with a range from a 2 ha willow horsetail (a shrubby riparian area within the flood plain of the Buffalo river) to a 3,056 ha treed fen. While the average polygon size was 150 ha, the mode polygon size was 84 ha which indicates over half of the polygons mapped were less than 84 ha in size. Ecosites that have less than one % cover are considered ecosystems of restricted distribution. A brief description of each ecosite is provided below.

Upland Units

The upland ecosystems are dominated by jack pine, aspen and paper birch in seral communities, and black and white spruce in climax communities. Immediately after fire, these communities are dominated by fast growing deciduous seral species, such as paper birch and alder (*Alnus* species). The slower growing jack pine becomes the dominant species a few years after fire. In the study area, there are numerous successional stages observed in areas due to fire. Approximately 47 % of the study area is covered by upland units.

a) bearberry Pj

This ecosite was not sampled during the field program and the description is based on Beckingham and Archibald (1996). This ecosite is typical of dry sites, with rapidly drained soils on coarse textured glaciofluvial parent material. It has a poor to very poor nutrient regime. Jack pine is the common tree species while bearberry (*Arctostaphylos uva ursi*) is the common shrub. Cushion mosses (*Dicranum* spp.) and haircap mosses (*Polytrichum* spp.) are common, as well as numerous reindeer lichens (*Cladina* species). During the mapping, there was only one polygon that was identified as having a significant amount of pine and lichen. It appeared to be associated with an esker complex so was classified as bearberry Pj. This ecosite covers less than one % of the study area.

b) Canada buffalo-berry – green alder

This is the most productive forest ecosite of the study area and is generally found on lower slopes or toe positions in the landscape and along the Buffalo River. This ecosystem has a moderate nutrient regime with a submesic to subhygric moisture regime. White spruce is the climatic climax species, but seral communities will contain varying amounts pine, aspen and paper birch. Canada buffalo berry (*Shepherdia canadensis*), common juniper (*Juniperus communis*), saskatoon (*Amelanchier alnifolia*), and rose are common shrubs. Bearberry (*Arctostaphylos uva-ursi*), false toadflax (*Geocaulum lividum*), twinflower (*Linnaea borealis*) and northern bedstraw (*Galium boreale*) are common in the herb layer. This ecosite accounts for less than two % of the study area.

c) Labrador tea - mesic

This ecosite is the most commonly occurring ecosystem and covers approximately 28 % of the study area. It is found on upland sites that have shallow organic deposits. It has a very poor to medium nutrient regime with a mesic to submesic moisture regime. Black spruce is

common in mature stands and jack pine dominates mature seral communities. Common juniper, rose (*Rosa acicularis*) and bog cranberry (*Vaccinium vitis idaea*) are common shrubs.

d) Labrador tea - subhygric

This ecosite covers 15 % of the study area and occurs in transition zones between treed fens and upland Labrador tea – mesic sites. Soils tend to be moist, leading to a well-developed moss layer. Nutrient regime is poor to medium. Black spruce and jack pine are common tree species, while Labrador tea (*Ledum groenlandicum*), black spruce, and creeping juniper (*Juniperus horizontalis*) are found in the shrub layer. Stair-step moss (*Hylocomium splendens*) and red-stemmed feather moss (*Pleurozium schreberi*) are common mosses. Reindeer lichens are a common ground cover.

Riparian

One riparian ecosite was identified in the study area. This ecosite occurs adjacent to streams and rivers and riparian succession results in a broad range of structural stages from young seral to mature climatic climax.

e) willow / horsetail

The willow / horsetail ecosite covers less than one % of the study area. It has poor drainage and frequently floods. It has a rich nutrient regime. Common species are willow (Salix species), river alder (*Alnus incana*), balsam poplar and red-osier dogwood (*Cornus stolonifera*). The herb layer is dominated by horsetail *(Equisetum* species), reed grass (*Calamagrostis canadensis*) and sedges (*Carex* species). The riparian ecosystem is likely more common than the mapping indicates. Within fens, there is usually a drainage network that directs water into channels that drains the area. In air photo or satellite interpretation, it is often difficult to identify these channels if they are narrow unless the vegetation along the channel varies significantly from the surrounding vegetation.

Lowland

Wetland ecosystems include graminoid, shrubby, and treed fens. The fens are generally restricted to areas of poorly drained organic soils. Soils tend to be rich in nutrients. Stand composition varies due to the fire regime; early successional stands are dominated by an open canopy of bog birch, while mature stands have a closed canopy of black spruce and larch. Wetland ecosystems represent less than 50 % of the study area.

hi: treed fen

This ecosite occurs in areas with some water movement. It has a rich to very rich nutrient regime and a subhydric to hydric moisture regime. Black spruce and tamarack form an open canopy with willow, bog birch, sweet gale (*Myrica gale*) and shrubby cinquefoil (*Pentaphylloides floribunda*) common in the shrub layer. The herb layer is diverse, with sedges, three leaved false Solomon's seal (*Maianthemum trifolium*), small bedstraw (*Galium tridifum*) and bog cranberry being most common. This ecosite is the second most common wetland type behind shrubby fen, covering approximately 24 % of the study area.

h2: shrubby fen

Shrubby fens are found throughout the study area and common distribution is near open water, within larger fen complexes or drainage areas where there is some water movement. They have a medium to rich nutrient regime and a subhydric to hydric moisture regime. The shrubby fens are often mixed wood, with a canopy of bog birch or willow with an understory of larch or black spruce. This is a result of fires in the area. Sweet gale and sedges are common. This ecosite accounts for approximately 25 % of the study area.

h3: graminoid fen

Graminoid fens account for one % of the study area. They are poorly drained with a hydric moist regime and a medium nutrient regime. Sedges, reed grass and bulrushes (*Scirpus* species) are common. The graminoid fens are often associated with shallow open water and shrubby fens. Within the study area, there were a number of polygons that contained both graminoid and shrubby fen ecosites. Generally, the shrubby fen was dominant, so it is likely that the graminoid fen is under-represented in the study area.

Other Units

Previous mined areas are identified as disturbed, non-vegetated units. Other anthropogenic areas, such as roads, gravel pits, were not identified as part of this baseline report. Previously mined areas account for approximately two % of the study area. All open water is classified as water. It was not possible to distinguish shallow open water from lakes. Water accounts for approximately one % of the study area. A portion of the study area (one %) was covered by cloud during the time the satellite imagery was acquired and could not be mapped.

5.3 DISCUSSION OF FIELD SAMPLING AND MAPPING RESULTS

There were two objectives outlined for the ecosystem classification: define ecosites on the basis of field studies, and map and characterize the landscape in the study area using defined ecosystem units and satellite imagery. Meeting these objectives is discussed below.

5.3.1 Defining Ecosites

Seven of the eight ecosites were quantitatively sampled in the field. The three most common ecosites had three or more plots sampled to describe them. Four of the eight ecosites sampled had only one quantitative plot (Labrador tea – subhygric, willow / horsetail and graminoid fen ecosites) or none at all (bearberry Pj ecosite). The descriptions of the ecosites are sufficient for this level of mapping. For future development, it is recommended to focus efforts on those ecosites that had low sampling intensity and that will be directly or indirectly affected.

5.3.2 Mapping and Characterizing the Landscape

Landscape patterns and features associated with terrain and vegetation were mapped in the study area, using the defined ecosites and satellite imagery. Confidence in mapping the

ecosites ranged from high to low, with high confidence for the shrubby and graminoid fens and willow horsetail ecosites, moderate confidence for the bearberry, Labrador tea – mesic and treed fen ecosites and low confidence for the Labrador tea – subhygric and Canada buffalo berry ecosites.

Confidence was moderate in the bearberry, Labrador tea – mesic and treed fen ecosites, and low in the Labrador tea – subhygric due to a lack of detailed topographical information. The Labrador tea – mesic were often situated on higher ground, while the Labrador tea – subhygric was transitional between the upland jack pine forest and the lowland fens. Without contours, it was difficult to distinguish this transition zone. Coloration of the Labrador tea – mesic and the treed fens was somewhat distinguishable from the transitional zone of the Labrador tea – subhygric, but it was not sufficient to be used as an accurate tool to distinguish the ecosites.

Confidence in mapping of the Canada buffalo berry ecosite is low for two reasons: lack of topographical information and scale of mapping. These units tended to be on slopes and in seepage areas. Units along the river were easy to distinguish and map, however, small pockets were observed throughout Labrador tea – mesic and subhygric units, but were indistinguishable on the satellite image due to similarities in color and the scale of mapping. It is likely that this unit is under represented in the study area.

Canopy type and stand composition was also attributed to each polygon. Confidence in mapping the structural stage is high in areas surrounding full and visual plots. Where possible, plot photos were taken of the landscape and used to attribute polygons. In the satellite imagery, there was little difference between shrub regeneration of jack pine and forested jack pine or black spruce. Both tended to be a dark green. There are slight differences in the imagery color among deciduous, mixed and coniferous. Confidence in mapping canopy type and stand composition in the absence of field data was moderate.

6.0 SUMMARY

Ecological land classification mapping was carried out for the Pine Point study area. Baseline data was collected in September 2005, and 11 ecosites were classified within the 36,153 ha study area. Eight of these were naturally vegetated, one was classified as water, one was anthropogenic and one was cloud.

Confidence in the mapping and subsequent data analysis is moderate to high for most units, with the exception of the Labrador tea – subhygric and Canada buffalo berry which are low. This is primarily due to a lack of topographical information. Confidence in mapping canopy type and stand composition is moderate to high.

7.0 CLOSURE

EBA is pleased to present Tamerlane with this Vegetation/Ecosystem Baseline Study Report for the Pine Point Project. We hope everything is found to be satisfactory. If there are any questions, please do not hesitate to contact us.

Respectfully submitted,

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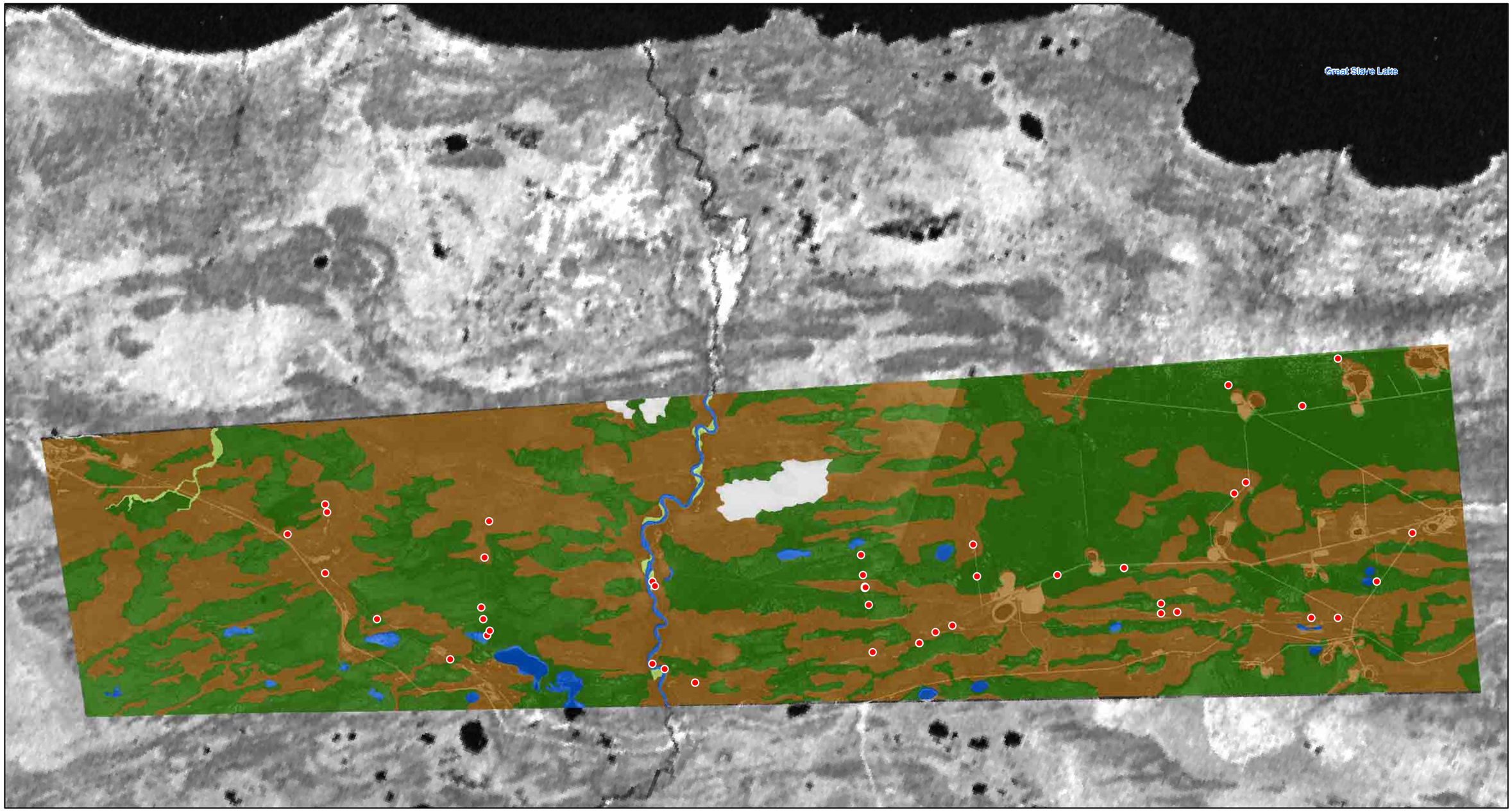
FIGURES



Legend

- Upland
- Lowland
- Riparian
- Water
- Unknown (cloud cover)
- Sample Point Location

Sources:
Landsat TM bands 7,4,1 (GLFC)
QuickBird-Pacific GeoAnalytic

Scale: 1:110,000

0 1 2 4 Kilometers

Pine Point Project

Pine Point Landscape Units

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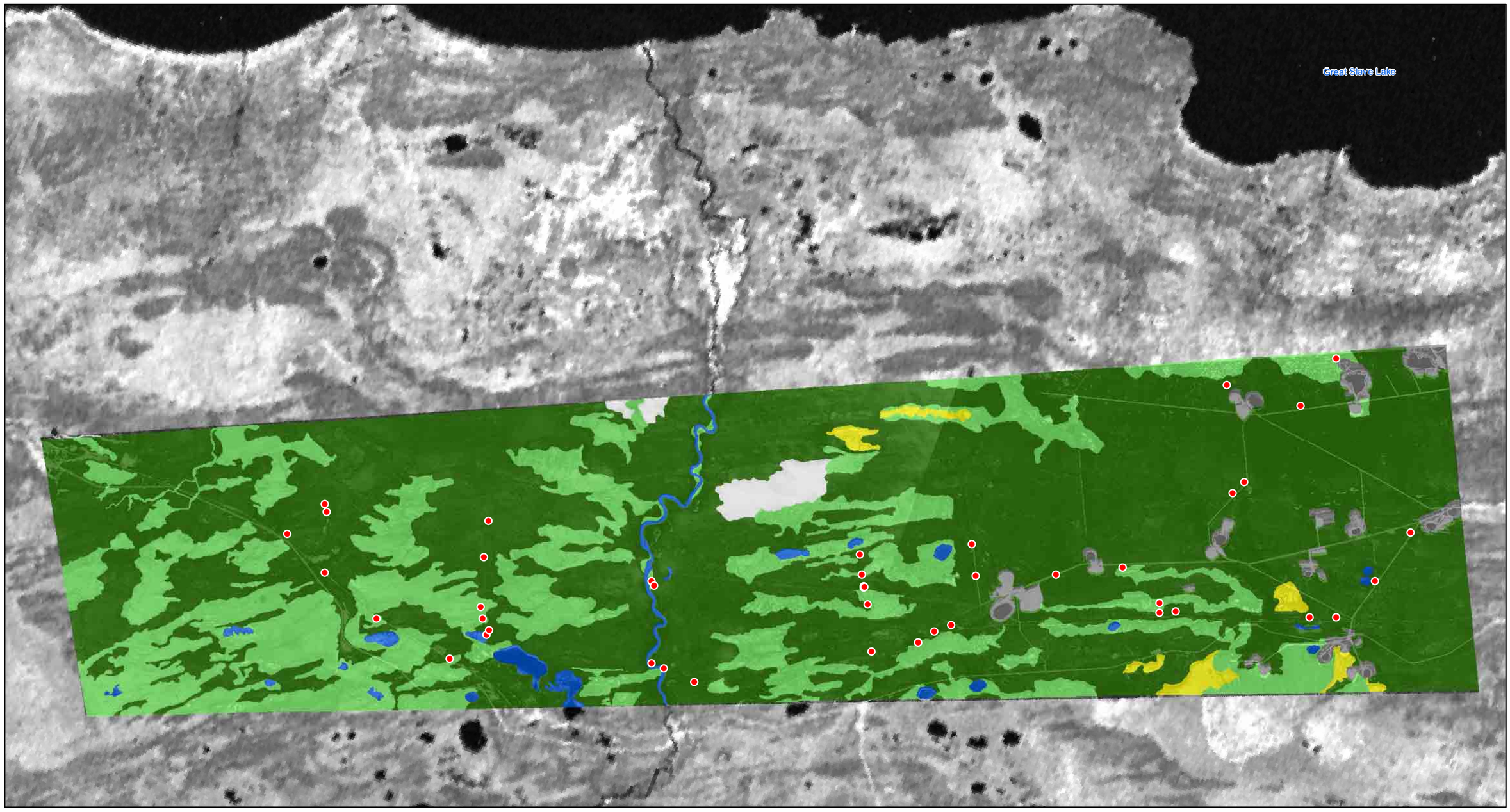
Figure 1

1740089_Figure3_vegetation_landform.mxd



Legend

- Forest
- Shrub
- Graminoid
- Water
- Disturbed
- Unknown (cloud cover)
- Sample Point Location

Sources:
Landsat TM bands 7,4,1 (GLFC)
QuickBird-Pacific GeoAnalytic

Scale: 1:110,000

0 1.25 2.5 5
Kilometers

Pine Point Project

Pine Point Structural Stage

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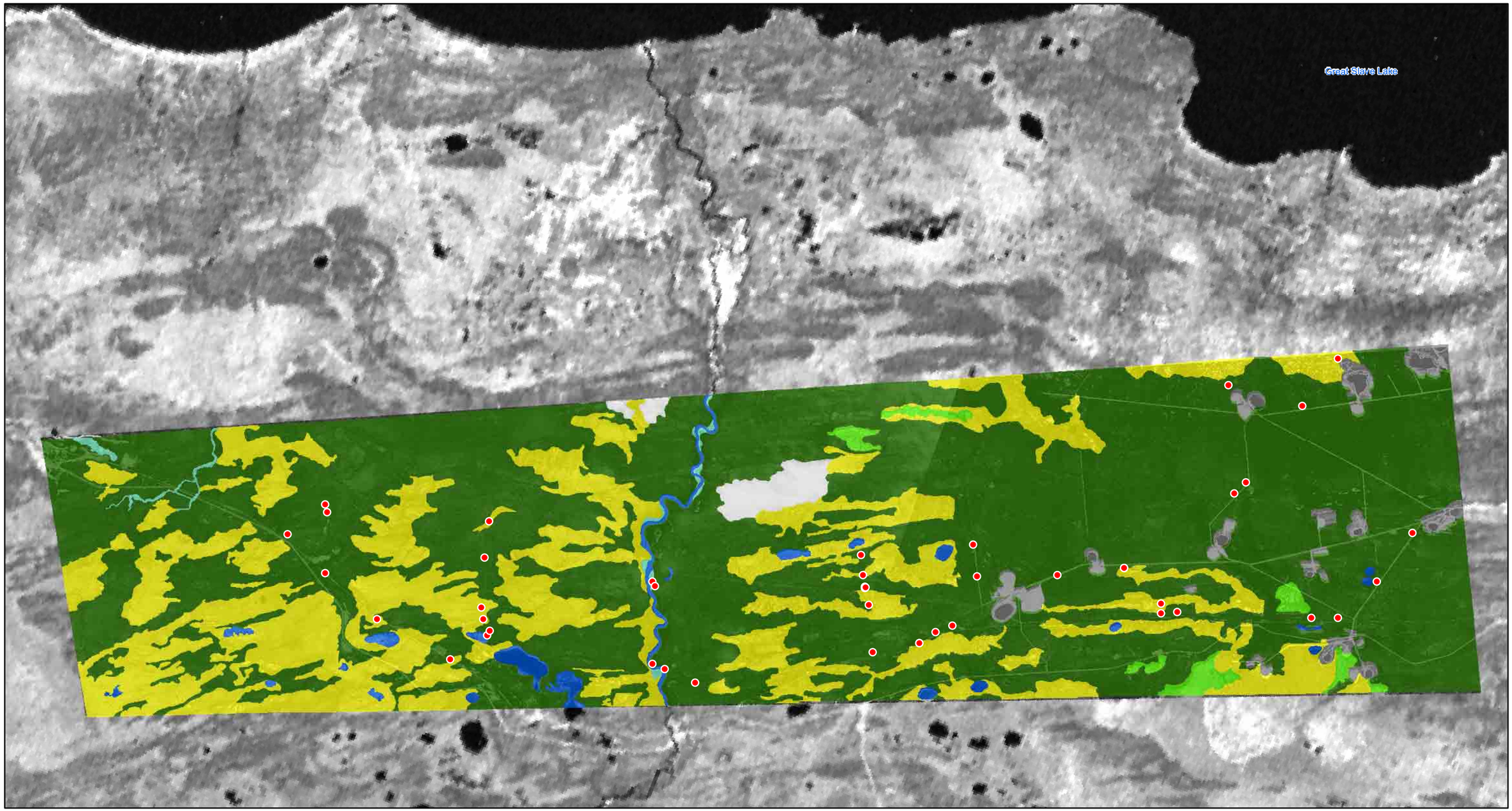
Figure 2

1740089_Figure2_vegetation_veg1.mxd



Legend

- Coniferous
- Broadleaf
- Mixed
- Graminoid
- Water
- Disturbed
- Unknown (cloud cover)
- Sample Point Location

Sources:
Landsat TM bands 7,4,1 (GLFC)
QuickBird-Pacific GeoAnalytic

Scale: 1:110,000

0 1.25 2.5 5 Kilometers

Pine Point Project

Pine Point Stand Composition

EBA ENGINEERING CONSULTANTS LTD. eba

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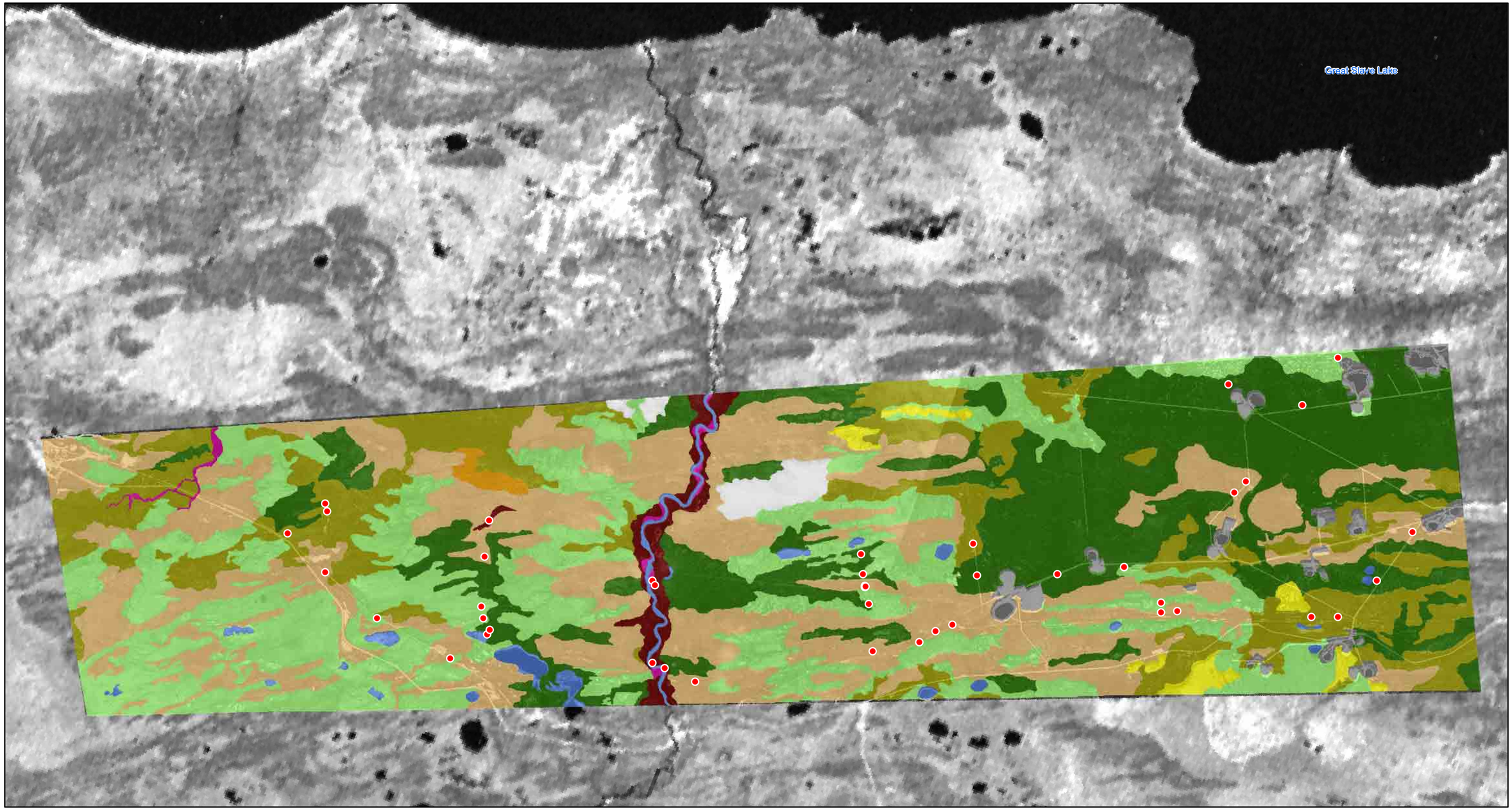
Figure 3

1740089_Figure3_vegetation_type1.mxd



Legend

UPLAND
- Bearberry Pj
- Canada Buffalo-Berry-Green Alder
- Labrador Tea- Mesic
- Labrador Tea-Subhygric

LOWLAND
- Treed Fen
- Shrubby Fen
- Graminoid Fen

RIPARIAN
- Willow/Horsetail

OTHER
- Water
- Disturbed
- Unknown (cloud cover)

- Sample Point Location

Sources:
Landsat TM bands 7,4,1 (GLFC)
QuickBird-Pacific GeoAnalytic

Scale: 1:110,000

0 1.25 2.5 5 Kilometers

Pine Point Project

Pine Point Ecosite Classification

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November, 2005

Figure 4

1740089_Figure4_vegetation_unit.mxd

APPENDIX

APPENDIX A SOIL DATA

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E1	**Humic Gleysol**	organic	very poor	0	level	1	toe	n/a	15 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	8-0	-	-	-	-	-
Of	0-34	-	fibric	-	-	7.0
Cg1	34-50	brown	medium sand	strong, granular	not sticky	7.0
Om	50-58	black	mesic	-	-	7.0
Cg2	50+	light brown	sandy clay loam	massive	slightly sticky	7.0

Vegetation / Comments
see vegetation/site sheet; Om layer almost Oh, may have some minerals

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E2	**Humic Regosol**	glacio-fluvial	very poor	0	level	1	n/a	n/a	10 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	2-0	-	-	-	-	-
Of	0-15	-	fibric	-	-	7.0
Cg1	15-28	-	course sand	strong, granular	non-sticky	7.5
Oh	28-35	-	humic	-	-	7.5
Cg2	35-58	-	course sand	strong, granular	non-sticky	8.0
Cg3	58-90	-	clay	massive	firm	8.0

Vegetation / Comments
sand layer has pebbles

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E3	**Eutric Brunisol**	till	imperfect	5	undulating	3	mid	north east	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	8-5	-	-	-	-	-
LFH	5-0	-	-	-	-	-
Of	0-15	-	fibric	-	-	-
B	15-32	brown	loam	weak, subangular blocky	friable	8.0
C	32+	pale brown	silty clay loam	massive	slightly sticky	8.0

Vegetation / Comments
lots of rocks on surface and with depth, varying shapes and sizes (mostly >10 cm- not diggable with shovel)

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E4	**Terric Mesisol**	glacio-lacustrine	very poor	0	level	1	n/a	n/a	0 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	5-0	-	-	-	-	-
Of	0-45	-	-	-	-	7.0
Om	45-110	-	-	-	-	7.0
Cg	110+	gleyed	clay	massive	sticky	8.0

Vegetation / Comments
snail shells in Om layer not wet and very light brown but could not tell orgin of Om-almost like vermiculite structure and consistence

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E5	**Eluviated Eutric Brunisol**	till	well	5	very gently rolling	3	mid	north east	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	3-0	-	-	-	-	-
Ae	0-6	grey	sandy loam	granular	friable	7.5
Bm	6-23	brown	sandy loam	granular	friable	7.5

Vegetation / Comments
shovel refusal at 23cm; 50% rocks >10cm angular

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E6	**Eluviated Eutric Brunisol**	glacio-fluvial	very well	0	level	1	n/a	n/a	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	3-0	-	-	-	-	-
Ae	0-5	-	sand	single grained	loose	-
Bm	5-40	-	sand	single grained	loose	7.0
C1	40-53	-	course sand	single grained	loose	-
C2	53+	-	sand	single grained	loose	7.0

Vegetation / Comments
small gravel, pebbles in C1; moved north about 100 m and was in Sb (some Lt) but soils did not change - more pebbles to 75 cm then fine sand.

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E7	**Eluviate Eutric Brunisol**	fluvial	rapid	3	gently rolling	1	upper	west	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	7-0	-	-	-	-	-
Ae	0-2	-	sandy loam	granular	friable	6.0
Bm	2-16	-	sandy loam	granular	friable	6.0

Vegetation / Comments
shovel refusal at 16 cm- big rocks; 30% course fragments, 4-10 cm angular, some small pebbles, larger rocks at depth

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E8	**Typic Fibrisol**	organic	very poor	0	level	1	n/a	n/a	0 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	8-0	-	-	-	-	-
Of	0-120	brown	fibric	-	-	7.0

Vegetation / Comments

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E9	**Eluviated Dystric Brunisol**	fluvial/ moraine	rapid	0	gently rolling	1	upper	north	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	3-0	-	-	-	-	-
Ae	0-6	pale brown	sand	single grained	loose	4.5
Bm	6-24	brown	sand	single grained	loose	5.0

Vegetation / Comments
hit rocks at 24 cm, course fragments approximately 20% to 25 cm and then 50% (very few rocks to 20 cm)

Site	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
E10	**Terric Fibrisol**	organic/ glacio lacustrine	very poor	0	level	1	n/a	n/a	0 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
carex/ moss	8-0	-	-	-	-	-
Of	0-80	-	fibric	-	-	-
Cg	80+	grey	sandy clay	massive	friable	7.5

Vegetation / Comments
some sulfur smell at depth

Site E11	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Terric Mesisol	organic/ glacio lacustrine	very poor	0	level	1	n/a	n/a	10 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	-	-	-	-	-	-
Of	0-40	brown	fibric	-	-	-
Om	40-95	dark brown	mesic-humic	-	-	7.5
Cg	95+	blue grey	silty clay	massive	very sticky	7.5

Vegetation / Comments
mineral material has small pebbles in it, very strong sulfur smell

Site E12	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Rego Gleysol	fluvial	very poor	0	level	1	n/a	n/a	5 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	2-0	-	-	-	-	-
Of	0-5	-	fibric	-	-	-
C	5-20	-	silty clay	massive	very sticky	7.0

Vegetation / Comments

Site E13	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Peaty Regosol	organic/ moraine	moderately well	0	level	1	mid	north east	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
moss	20-0	-	-	-	-	-
Of	0-55	dark brown	fibric	-	-	-
C	55-90	dark greyish brown	silty clay loam	massive	slightly sticky	7.5

Vegetation / Comments
auger refusal at 90 cm- big rocks

Site E14	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Terric Mesisol	organic / glacio-lacustrine	very poor	0	level	1	n/a	n/a	0 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
graminoid next to water						
moss	-	-	-	-	-	-
marl	0-35	grey	-	-	-	8.5
Om	35-90	dark brown	-	-	-	8.0
C	90+	brown	sandy clay loam-sand	massive	slightly sticky	8.0
treed fen						
moss	15-0	-	-	-	-	-
Of	0-100	-	fibric- some mesic material	-	-	-
C	100+	grey-green	sandy loam	massive	slightly sticky	-

Vegetation / Comments
pebbles at depth, some larger rocks- could npt auger; lots of shells (whole and broken) in top layer

Site E15	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Terric Mesisol	organic/ glacio lacustrine	very poor	0	level	1	n/a	n/a	5 cm

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
sedges	8-0	-	-	-	-	-
Om	0-95	very dark brown	mesic-some fibric	-	-	-
Cg	95+	blue grey	silty clay	massive	sticky	8.0

Vegetation / Comments
C has strong effervescence, anaerobic smell

Site E16	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Eutric Brunisol	glacio-lacustrine	well	5	level	1	n/a	n/a	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	6-0	-	-	-	-	-
Bm	0-13	brown	silty clay loam	granular	friable	6.0

Vegetation / Comments
very rocky, 70% course fragments 2-16 cm angular to rounded, some broken; esker material to the west, esker is mostly sand and gravel, some rocks (10% >4 cm)

Site E17	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Brunisol	-	-	-	-	-	-	-	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	-	-	-	-	-	-
Bm	0-13	dark brown	sandy loam	granular	friable	6.5

Vegetation / Comments
too rocky to auger past 13 cm, course fragments 70%, 3-26 cm, angular and rounded

Site E18	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Eluvated Eutric Brunisol	glacio-fluvial	rapid	4	undulating	2	upper	north	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	8-0	-	-	-	-	-
Ae	0-4	gray brown	sand	single grained	loose	-
Bm	4-65	brown	sand	single grained	loose	-

Vegetation / Comments
course fragments 30%, 5% >5cm, coarse sand, pockets of gravel throughout area

Site E19	Subgroup	Parent Material	Drainage	Stoniness	Surface Expression	Slope Class	Slope Position	Aspect	Depth to Water Table
	Eluvated Eutric Brunisol	glacio-fluvial	very rapid	0	level	1	level	n/a	-

Horizon	Depth (cm)	Colour	Texture	Structure	Consistence	pH
LFH	4-0	-	-	-	-	-
Ae	0-13	pale brown	sand	single grained	loose	-
Bm	13-50	brown	sand	single grained	loose	8.0
C	50+	grey brown	sand	single grained	loose	-

Vegetation / Comments
rocks at 55 cm

APPENDIX

APPENDIX B VEGETATION DATA

Pine Point Vegetation Data: Species Composition
Site Unit - b
Canada buffalo berry

Strata	Scientific Name	Common Name	Frequency	Average % Cover	Plot #		
					5	7	8
A	Betula papyrifera	paper birch	30.0%	0.2			0.5
A	Picea glauca	white spruce	30.0%	1.0		3.0	
A	Picea sp.	spruce	70.0%	4.3	11.0		2.0
A	Pinus banksiana	jack pine	30.0%	0.3			1.0
A	Populus tremuloides	trembling aspen	70.0%	3.8		11.0	0.5
B	Amelanchier alnifolia	saskatoon	70.0%	7.0		20.0	1.0
B	Cornus stolonifera	red-osier dogwood	30.0%	0.2	0.5		
B	Juniperus communis	common juniper	100.0%	8.0	1.0	3.0	20.0
B	Juniperus horizontalis	creeping juniper	100.0%	1.3	2.0	1.0	1.0
B	Larix laricina	tamarack	30.0%	0.2	0.5		
B	Ledum groenlandicum	Labrador tea	30.0%	20.0	60.0		
B	Lonicera dioica	glaucous-leaved honeysuckle	30.0%	0.7		2.0	
B	Myrica gale	sweet gale	30.0%	0.2	0.5		
B	Pentaphylloides floribunda	shrubby cinquefoil	30.0%	0.2	0.5		
B	Picea glauca	white spruce	30.0%	0.8		2.5	
B	Picea sp.	spruce	70.0%	7.7	18.0		5.0
B	Pinus banksiana	jack pine	30.0%	0.3			1.0
B	Populus balsamifera	balsam poplar	30.0%	0.2			0.5
B	Populus tremuloides	trembling aspen	70.0%	2.3		6.0	1.0
B	Ribes lacustre	black gooseberry	30.0%	0.3		1.0	
B	Rosa acicularis	prickly rose	100.0%	3.8	1.0	10.0	0.5
B	Salix sp.	willow	70.0%	1	2.0		0.5
B	Shepherdia canadensis	Canada buffalo berry	100.0%	2.0	0.5	5.0	0.5
B	Viburnum edule	highbush-cranberry	30.0%	5.0		15.0	
C	Achillea millefolium	yarrow	30.0%	0.2		0.5	
C	Arctostaphylos alpina var. rubra	alpine bearberry	30.0%	0.3	1.0		
C	Arctostaphylos uva-ursi	kinnikinnick	70.0%	2.3		2.0	5.0
C	Aster ciliolatus	Lindley's aster	30.0%	0.2		0.5	
C	Astragalus americanus	American milk-vetch	30.0%	0.2			0.5
C	Calamagrostis canadensis	bluejoint reedgrass	30.0%	0.7	2.0		
C	Cornus canadensis	bunchberry	30.0%	0.2		0.5	
C	Empetrum nigrum	crowberry	30.0%	0.3	1.0		
C	Epilobium angustifolium	fireweed	30.0%	0.2		0.5	
C	Equisetum arvense	common horsetail	30.0%	6.7	20.0		
C	Equisetum scirpoides	dwarf scouring-rush	30.0%	1.0	3.0		
C	Festuca sp.	fescue	30.0%	0.2			0.5
C	Fragaria virginiana	wild strawberry	30.0%	0.2		0.5	
C	Galium boreale	northern bedstraw	70.0%	0.3		0.5	0.5
C	Geocaulon lividum	false toad-flax	100.0%	0.5	0.5	0.5	0.5
C	Grass sp.	grass	30.0%	0.7			2.0
C	Lathyrus ochroleucus	creamy peavine	30.0%	0.3		1.0	
C	Linnaea borealis	twinflower	70.0%	0.3	0.5	0.5	
C	Mitella nuda	common mitrewort	30.0%	0.2	0.5		
C	Orthilia secunda	one-sided wintergreen	30.0%	0.2		0.5	
C	Pyrola asarifolia	pink wintergreen	30.0%	0.2		0.5	
C	Triantha glutinosa	sticky false asphodel	30.0%	0.2			0.5
C	Vaccinium vitis-idaea	bog cranberry	70.0%	2.7	7.0		1.0

Pine Point Vegetation Data: Species Composition
Site Unit - b
Canada buffalo berry

				Average %	Plot #		
C	Viola sp.	violet	30.0%	0.2	0.5		
D	Cladina mitis	lesser green reindeer	100.0%	3.8	1.0	0.5	10.0
D	Cladina rangiferina	grey reindeer	70.0%	2.8	0.5		8.0
D	Cladina stellaris	star-tipped reindeer	70.0%	5.3	1.0		15.0
D	Cladonia sp.	clad lichens	30.0%	0.3		1.0	
D	Dicranum undulatum	wavy heron's-bill moss	30.0%	0.2			0.5
D	Hylocomium splendens	step moss	100.0%	28.0	75.0	1.0	8.0
D	Leymus innovatus	fuzzy-spiked wildrye	30.0%	1.7		5.0	
D	Moss sp.	moss	30.0%	3.3	10.0		
D	Peltigera aphthosa	freckle pelt	100.0%	0.7	1.0	0.5	0.5
D	Peltigera neopolydactyla	greater frog pelt	30.0%	0.2			0.5
D	Pleurozium schreberi	red-stemmed feathermoss	100.0%	6.7	15.0	1.0	4.0
D	Usnea sp.	beard lichens	70.0%	6.8	20.0	0.5	

Pine Point Vegetation Data: Species Composition
Site Unit - c
labrador tea mesic

Strata	Scientific Name	Common Name	Frequency	Average % Cover	Plot #					
					1	2	3	4	5	6
A	Betula papyrifera	paper birch	20.0%	0.1					0.5	
A	Larix laricina	tamarack	20.0%	0.1				0.5		
A	Picea mariana	black spruce	80.0%	3.6	10.5	9.0	0.5	0.5		1.0
A	Picea sp.	spruce	20.0%	1.0					6.0	
A	Pinus banksiana	jack pine	100.0%	9.9	6.5	7.0	20.0	2.0	11.0	13.0
A	Populus tremuloides	trembling aspen	20.0%	0.1				0.5		
B	Amelanchier alnifolia	saskatoon	50.0%	0.4	0.5		1.0	1.0		
B	Betula nana	scrub birch	30.0%	0.2	0.5	0.5				
B	Betula papyrifera	paper birch	30.0%	0.2		0.5			0.5	
B	Juniperus communis	common juniper	100.0%	10.2	15.0	5.0	8.0	10.0	3.0	20.0
B	Juniperus horizontalis	creeping juniper	80.0%	1.9	2.0		1.0	1.0	0.5	7.0
B	Larix laricina	tamarack	70.0%	0.4	0.5	0.5		1.0		0.5
B	Ledum groenlandicum	Labrador tea	20.0%	2.5	15.0					
B	Lonicera dioica	glaucous-leaved honeysuckle	30.0%	0.2			0.5			0.5
B	Pentaphylloides floribunda	shrubby cinquefoil	80.0%	1.3	5.0	0.5	1.0	0.5		1.0
B	Picea mariana	black spruce	80.0%	5.9	16.0	3.5	13.0	2.0		1.0
B	Picea sp.	spruce	20.0%	0.4					2.5	
B	Pinus banksiana	jack pine	50.0%	1.8		0.5		9.0		1.0
B	Populus balsamifera	balsam poplar	30.0%	0.3		1.0			0.5	
B	Populus tremuloides	trembling aspen	30.0%	0.3				0.5	1.0	
B	Ribes lacustre	black gooseberry	20.0%	0.1		0.5				
B	Rosa acicularis	prickly rose	100.0%	0.8	0.5	1.0	1.0	0.5	0.5	1.0
B	Salix sp.	willow	70.0%	2.1	0.5	2.0			0.5	0.5
B	Shepherdia canadensis	Canada buffalo berry	100.0%	4.7	4.0	3.0	1.0	5.0	7.0	8.0
B	Vaccinium myrtilloides	velvet-leaved blueberry	20.0%	0.2				1.0		
B	Viburnum edule	highbush-cranberry	80.0%	0.5		1.0	0.5	0.5	0.5	0.5
C	Achillea millefolium	yarrow	30.0%	0.2	0.5	0.5				
C	Anemone multifida	cut-leaved anemone	20.0%	0.1						0.5
C	Anemone sp.	anemone	20.0%	0.1	0.5					
C	Arctostaphylos alpina var. rubra	alpine bearberry	80.0%	2.4	2.0	10.0	1.0	0.5		1.0
C	Arctostaphylos uva-ursi	kinnikinnick	50.0%	1.3	2.0	3.0	3.0			
C	Aster ciliolatus	Lindley's aster	30.0%	0.2			0.5			0.5
C	Aster sp.	Aster	50.0%	0.3	0.5	0.5			0.5	
C	Astragalus americanus	American milk-vetch	50.0%	0.3	1.0	0.5				0.5
C	Botrychium lunaria	common moonwort	20.0%	0.1		0.5				
C	Campanula rotundifolia	common harebell	70.0%	0.3	0.5	0.5			0.5	0.5
C	Carex sp.	sedge	100.0%	1.1	3.0	1.0	1.0	0.5	0.5	0.5
C	Cornus canadensis	bunchberry	30.0%	0.2	0.5	0.5				
C	Empetrum nigrum	crowberry	30.0%	0.2				0.5		0.5
C	Epilobium angustifolium	fireweed	30.0%	0.2				0.5	0.5	
C	Equisetum arvense	common horsetail	20.0%	0.5	3.0					
C	Fragaria virginiana	wild strawberry	20.0%	0.1		0.5				
C	Galium boreale	northern bedstraw	100.0%	0.7	0.5	1.0	1.0	0.5	0.5	0.5
C	Geocaulon lividum	false toad-flax	50.0%	0.3	0.5				0.5	0.5
C	Grass sp.	grass	20.0%	0.1						0.5
C	Leymus innovatus	fuzzy-spiked wildrye	100.0%	3.3	5.0	3.0	2.0	2.0	5.0	3.0
C	Linnaea borealis	twinflower	70.0%	0.6	0.5		2.0	0.5		0.5

Pine Point Vegetation Data: Species Composition
Site Unit - c
labrador tea mesic

				Average %	Plot #					
C	Pyrola asarifolia	pink wintergreen	70.0%	0.3		0.5		0.5	0.5	0.5
C	Senecio triangularis	arrow-leaved groundsel	20.0%	0.1			0.5			
C	Tofieldia pusilla	common false asphodel	20.0%	0.1		0.5				
C	Trisetum spicatum	spike trisetum	20.0%	0.1						0.5
C	Vaccinium vitis-idaea	bog cranberry	80.0%	3.9	0.5		1.0	2.0	10.0	10.0
C	Zigadenus elegans	mountain death-camas	50.0%	0.3		0.5			0.5	0.5
D	Cetraria nivalis	ragged paperdoll	30.0%	0.9			5.0	0.5		
D	Cladina mitis	lesser green reindeer	100.0%	11.4	10.0	20.0	20.0	0.5	8.0	10.0
D	Cladina rangiferina	grey reindeer	70.0%	3.1	10.0			0.5	3.0	5.0
D	Cladina sp.	reindeer lichens	20.0%	1.7						10.0
D	Cladina stellaris	star-tipped reindeer	70.0%	15.8	40.0	15.0			10.0	30.0
D	Cladonia sp.	clad lichens	30.0%	0.3	1.0					1.0
D	Dicranum sp.	heron's-bill moss	20.0%	0.1	0.5					
D	Hylocomium splendens	step moss	70.0%	7.0	2.0	25.0			10.0	5.0
D	Liverwort sp.	liverwort	20.0%	0.1	0.5					
D	Moss sp.	moss	20.0%	0.1		0.5				
D	Peltigera aphthosa	freckle pelt	50.0%	0.3	1.0				0.5	0.5
D	Peltigera neopolydactyla	greater frog pelt	30.0%	0.2		0.5		0.5		
D	Pleurozium schreberi	red-stemmed feathermoss	70.0%	11.3	1.0	30.0			7.0	30.0
D	Ptilium crista-castrensis	knight's plume	20.0%	0.1		0.5				
D	Stereocaulon tomentosum	eyed foam	20.0%	0.1	0.5					
D	Tomentypnum nitens	golden fuzzy fen moss	30.0%	0.2	0.5	0.5				
D	Usnea sp.	beard lichens	30.0%	0.2					0.5	0.5

Pine Point Vegetation Data: Species Composition
Site Unit - d
labrador tea subhygric

Strata	Scientific Name	Common Name	Frequency	Average % Cover	Plot # 8
A	Larix laricina	tamarack	100.0%	1.0	1.0
A	Picea mariana	black spruce	100.0%	2.5	2.5
A	Pinus banksiana	jack pine	100.0%	1.5	1.5
B	Betula nana	scrub birch	100.0%	5.0	5.0
B	Juniperus horizontalis	creeping juniper	100.0%	10.0	10.0
B	Larix laricina	tamarack	100.0%	1.0	1.0
B	Ledum groenlandicum	Labrador tea	100.0%	40.0	40.0
B	Pentaphylloides floribunda	shrubby cinquefoil	100.0%	0.5	0.5
B	Picea mariana	black spruce	100.0%	8.0	8.0
B	Pinus banksiana	jack pine	100.0%	0.5	0.5
B	Salix sp.	willow	100.0%	1.0	1.0
C	Andromeda polifolia	bog-rosemary	100.0%	0.5	0.5
C	Antennaria sp.	pussytoes	100.0%	0.5	0.5
C	Arctostaphylos alpina var. rubra	alpine bearberry	100.0%	1.0	1.0
C	Arctostaphylos uva-ursi	kinnikinnick	100.0%	2.0	2.0
C	Astragalus americanus	American milk-vetch	100.0%	0.5	0.5
C	Carex sp.	sedge	100.0%	1.0	1.0
C	Empetrum nigrum	crowberry	100.0%	0.5	0.5
C	Linnaea borealis	twinflower	100.0%	0.5	0.5
C	Maianthemum trifolium	three-leaved false Solomon's-seal	100.0%	0.5	0.5
C	Vaccinium vitis-idaea	bog cranberry	100.0%	0.5	0.5
D	Cladina mitis	lesser green reindeer	100.0%	25.0	25.0
D	Cladina rangiferina	grey reindeer	100.0%	2.0	2.0
D	Cladina stellaris	star-tipped reindeer	100.0%	0.5	0.5
D	Cladonia sp.	clad lichens	100.0%	0.5	0.5
D	Hylocomium splendens	step moss	100.0%	30.0	30.0
D	Pleurozium schreberi	red-stemmed feathermoss	100.0%	0.5	0.5
D	Tomentypnum nitens	golden fuzzy fen moss	100.0%	0.5	0.5

Pine Point Vegetation Data: Species Composition
Site Unit - e
willow / horsetail

Strata	Scientific Name	Common Name	Frequency	Average % Cover	Plot # 2
B	Alnus incana	river alder	100.0%	20.0	20.0
B	Cornus stolonifera	red-osier dogwood	100.0%	5.0	5.0
B	Picea mariana	black spruce	100.0%	0.5	0.5
B	Populus balsamifera	balsam poplar	100.0%	2.0	2.0
B	Ribes hudsonianum	northern blackcurrant	100.0%	1.0	1.0
B	Rosa acicularis	prickly rose	100.0%	0.5	0.5
B	Salix sp.	willow	100.0%	50.0	50.0
C	Calamagrostis canadensis	bluejoint reedgrass	100.0%	20.0	20.0
C	Carex sp.	sedge	100.0%	10.0	10.0
C	Equisetum hyemale	scouring-rush	100.0%	25.0	25.0
C	Galium trifidum	small bedstraw	100.0%	0.5	0.5
C	Lilium sp.	lily	100.0%	0.5	0.5
C	Pyrola asarifolia	pink wintergreen	100.0%	0.5	0.5
C	Rorippa palustris	marsh yellow cress	100.0%	0.5	0.5
C	Rubus arcticus ssp. acaulis	nagoonberry	100.0%	0.5	0.5
C	Sium suave	hemlock water-parsnip	100.0%	0.5	0.5
C	Stachys palustris	swamp hedge-nettle	100.0%	0.5	0.5
C	Thalictrum venulosum	veiny meadowrue	100.0%	1.0	1.0
C	Typha latifolia	common cattail	100.0%	0.5	0.5
D	Liverwort sp.	liverwort	100.0%	0.5	0.5
D	Moss sp.	moss	100.0%	3.0	3.0

Pine Point Vegetation Data: Species Composition
Site Unit - hf
treed fen

Strata	Scientific Name	Common Name	Frequency	Average % Cover	Plot #				
					1	10	11	14a	8
A	Picea mariana	black spruce	80.0%	3.8	15.0		2.0	1.5	0.5
B	Betula nana	scrub birch	100.0%	12.0	8.0	30.0	2.0	5.0	15.0
B	Juniperus horizontalis	creeping juniper	80.0%	2.7	0.5		1.0	2.0	10.0
B	Larix laricina	tamarack	100.0%	6.6	5.0	9.0	5.5	6.5	7.0
B	Ledum groenlandicum	Labrador tea	60.0%	13.1			35.0	30.0	0.5
B	Myrica gale	sweet gale	80.0%	4.5		10.0	0.5	2.0	10.0
B	Pentaphylloides floribunda	shrubby cinquefoil	60.0%	2.6	1.0			2.0	10.0
B	Picea mariana	black spruce	100.0%	6.7	9.0	0.5	15.0	8.0	1.0
B	Rosa acicularis	prickly rose	20.0%	0.1				0.5	
B	Salix sp.	willow	80.0%	2.1	1.0	2.0	0.5	7.0	
B	Shepherdia canadensis	Canada buffalo berry	20.0%	0.1	0.5				
C	Andromeda polifolia	bog-rosemary	20.0%	0.4					2.0
C	Arctostaphylos alpina var. rubra	alpine bearberry	60.0%	1.1	3.0		2.0	0.5	
C	Carex sp.	sedge	100.0%	40.4	2.0	75.0	5.0	40.0	80.0
C	Comarum palustre	marsh cinquefoil	20.0%	0.2		1.0			
C	Cornus canadensis	bunchberry	20.0%	0.1				0.5	
C	Elymus sp.	wildrye	20.0%	0.1					0.5
C	Empetrum nigrum	crowberry	40.0%	0.3			1.0	0.5	
C	Epilobium angustifolium	fireweed	20.0%	0.1				0.5	
C	Equisetum arvense	common horsetail	60.0%	2.3	1.0		0.5	10.0	
C	Equisetum scirpoides	dwarf scouring-rush	60.0%	0.3	0.5		0.5	0.5	
C	Eriophorum chamissonis	Chamisso's cotton-grass	20.0%	0.1		0.5			
C	Galium boreale	northern bedstraw	20.0%	0.1				0.5	
C	Galium trifidum	small bedstraw	60.0%	0.3		0.5		0.5	0.5
C	Grass sp.	grass	20.0%	0.1				0.5	
C	Linnaea borealis	twinflower	40.0%	0.2			0.5		0.5
C	Maianthemum trifolium	three-leaved false Solomon's-seal	100.0%	0.9	0.5	1.0	0.5	0.5	2.0
C	Mitella nuda	common mitrewort	20.0%	0.1	0.5				
C	Oxycoccus oxycoccos	bog cranberry	20.0%	0.1			0.5		
C	Petasites frigidus var. palmatus	palmate coltsfoot	20.0%	0.1			0.5		
C	Petasites sagittatus	arrow-leaved coltsfoot	20.0%	0.1	0.5				
C	Rubus arcticus ssp. acaulis	nagoonberry	60.0%	0.4		0.5	0.5		1.0
C	Triantha glutinosa	sticky false asphodel	20.0%	0.1			0.5		
C	Trichophorum cespitosum	tufted clubrush	40.0%	0.3		1.0		0.5	
C	Triglochin maritima	seaside arrow-grass	60.0%	0.3		0.5	0.5		0.5
C	Vaccinium vitis-idaea	bog cranberry	60.0%	5.3	0.5		1.0	25.0	
C	Viola sp.	violet	20.0%	0.1					0.5
C	Zigadenus elegans	mountain death-camas	20.0%	0.1			0.5		
D	Cladina mitis	lesser green reindeer	80.0%	2.6	0.5		10.0	2.0	0.5
D	Cladina stellaris	star-tipped reindeer	20.0%	0.2				1.0	
D	Dicranum sp.	heron's-bill moss	20.0%	8.0				40.0	
D	Drepanocladus sp.	hook-moss	20.0%	0.1		0.5			
D	Hylocomium splendens	step moss	60.0%	23.0	60.0		15.0	40.0	
D	Moss sp.	moss	60.0%	7.1			30.0	5.0	0.5
D	Peltigera aphthosa	freckle pelt	60.0%	0.3	0.5		0.5	0.5	
D	Pleurozium schreberi	red-stemmed feathermoss	20.0%	1.6					8.0

Pine Point Vegetation Data: Species Composition
Site Unit - hf
treed fen

				Average %	Plot #				
D	Polytrichum strictum	bog haircap moss	20.0%	0.1	0.5				
D	Sphagnum capillifolium	common red peat-moss	20.0%	0.1			0.5		
D	Sphagnum fuscum	common brown peat-moss	20.0%	0.2			1.0		
D	Tomentypnum nitens	golden fuzzy fen moss	80.0%	22.0	30.0	15.0	40.0	25.0	
D	Usnea sp.	beard lichens	40.0%	1.8	1.0			8.0	

Pine Point Vegetation Data: Species Composition
Site Unit - hg
graminoid fen

Strata	Scientific Name	Common Name	Frequency	Average % Cover	Plot # 14
B	Betula nana	scrub birch	100.0%	5.0	5.0
B	Chamaedaphne calyculata	leatherleaf	100.0%	0.5	0.5
B	Myrica gale	sweet gale	100.0%	10.0	10.0
B	Salix sp.	willow	100.0%	7.0	7.0
C	Carex sp.	sedge	100.0%	40.0	40.0
C	Comarum palustre	marsh cinquefoil	100.0%	10.0	10.0
C	Scirpus sp.	bulrush	100.0%	35.0	35.0
C	Triglochin maritima	seaside arrow-grass	100.0%	2.0	2.0
D	Calliergon sp.	water-moss	100.0%	10.0	10.0
D	Moss sp.	moss	100.0%	5.0	5.0

Pine Point Vegetation Data: Species Composition
Site Unit - hs
shrubby fen

Strata	Scientific Name	Common Name	Frequency	Average % Cover	Plot #		
					15	2	3
B	Betula nana	scrub birch	70.0%	21.7	40.0		25.0
B	Betula papyrifera	paper birch	30.0%	0.2			0.5
B	Cornus stolonifera	red-osier dogwood	30.0%	0.7			2.0
B	Juniperus horizontalis	creeping juniper	70.0%	0.5		1.0	0.5
B	Larix laricina	tamarack	100.0%	1.2	0.5	1.0	2.0
B	Ledum groenlandicum	Labrador tea	100.0%	1.2	2.0	1.0	0.5
B	Myrica gale	sweet gale	100.0%	10.3	1.0	25.0	5.0
B	Pentaphylloides floribunda	shrubby cinquefoil	70.0%	4.3	8.0	5.0	
B	Picea mariana	black spruce	100.0%	3.7	3.0	1.0	7.0
B	Ribes lacustre	black gooseberry	30.0%	0.2			0.5
B	Rosa acicularis	prickly rose	70.0%	0.7		1.0	1.0
B	Salix sp.	willow	100.0%	2.7	5.0	1.0	2.0
B	Viburnum edule	highbush-cranberry	30.0%	0.2			0.5
C	Arctostaphylos alpina var. rubra	alpine bearberry	30.0%	0.2	0.5		
C	Aster ciliolatus	Lindley's aster	30.0%	0.2	0.5		
C	Calamagrostis canadensis	bluejoint reedgrass	30.0%	6.7			20.0
C	Calamagrostis sp.	reedgrass	30.0%	0.7		2.0	
C	Carex concinna	low northern sedge	30.0%	0.7		2.0	
C	Carex sp.	sedge	100.0%	66.7	80.0	80.0	40.0
C	Comarum palustre	marsh cinquefoil	70.0%	0.5	0.5		1.0
C	Cornus canadensis	bunchberry	30.0%	0.3			1.0
C	Epilobium angustifolium	fireweed	30.0%	0.2			0.5
C	Equisetum arvense	common horsetail	30.0%	0.2			0.5
C	Eriophorum angustifolium	narrow-leaved cotton-grass	30.0%	0.2		0.5	
C	Maianthemum trifolium	three-leaved false Solomon's-seal	30.0%	0.2		0.5	
C	Petasites sagittatus	arrow-leaved coltsfoot	70.0%	0.7	1.0		1.0
C	Pyrola asarifolia	pink wintergreen	30.0%	0.2	0.5		
C	Rubus arcticus ssp. acaulis	nagoonberry	30.0%	0.3			1.0
C	Stuckenia filiformis	slender-leaved pondweed	30.0%	0.2			0.5
C	Stuckenia pectinata	fennel-leaved pondweed	30.0%	0.2			0.5
C	Triglochin maritima	seaside arrow-grass	70.0%	0.5		1.0	0.5
C	Trimorpha acris var. asteroides	bitter fleabane	30.0%	0.2			0.5
C	Typha latifolia	common cattail	30.0%	0.2			0.5
C	Vaccinium vitis-idaea	bog cranberry	70.0%	0.3		0.5	0.5
C	Viola sp.	violet	30.0%	0.2		0.5	
D	Aulacomnium palustre	glow moss	30.0%	0.3		1.0	
D	Cladonia sp.	clad lichens	30.0%	0.2	0.5		
D	Drepanocladus sp.	hook-moss	30.0%	1.0		3.0	
D	Moss sp.	moss	70.0%	2.3	2.0		5.0
D	Tomentypnum nitens	golden fuzzy fen moss	70.0%	3.7	1.0	10.0	