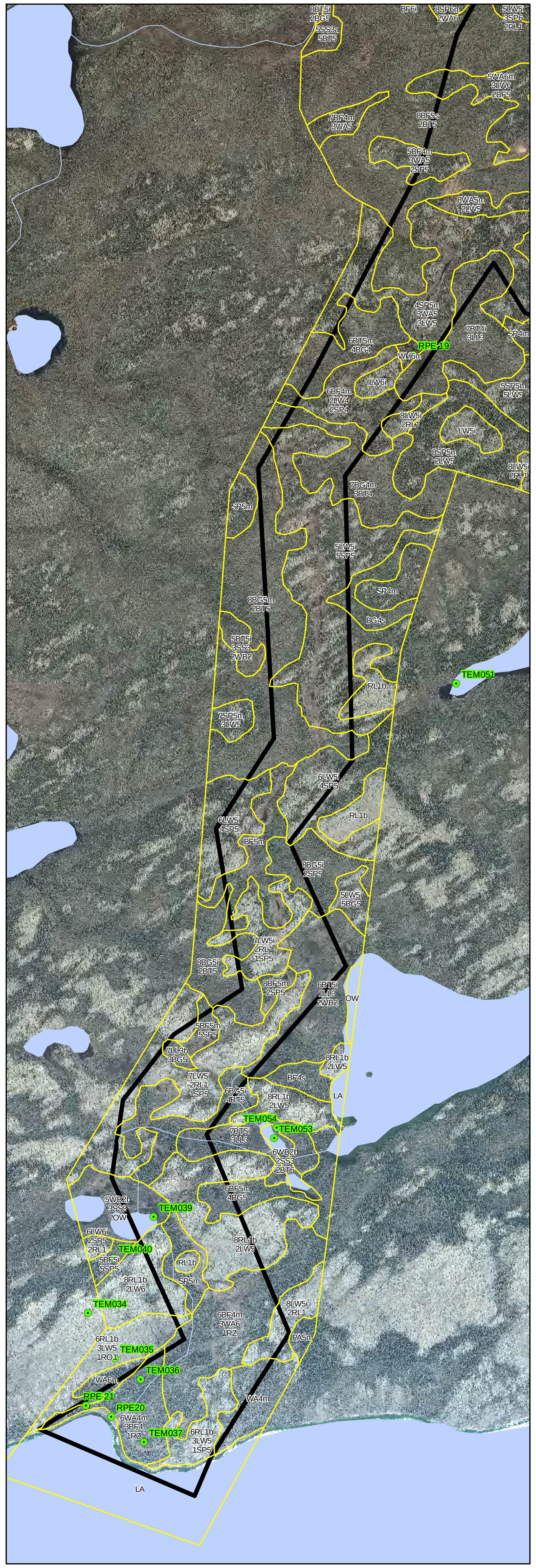
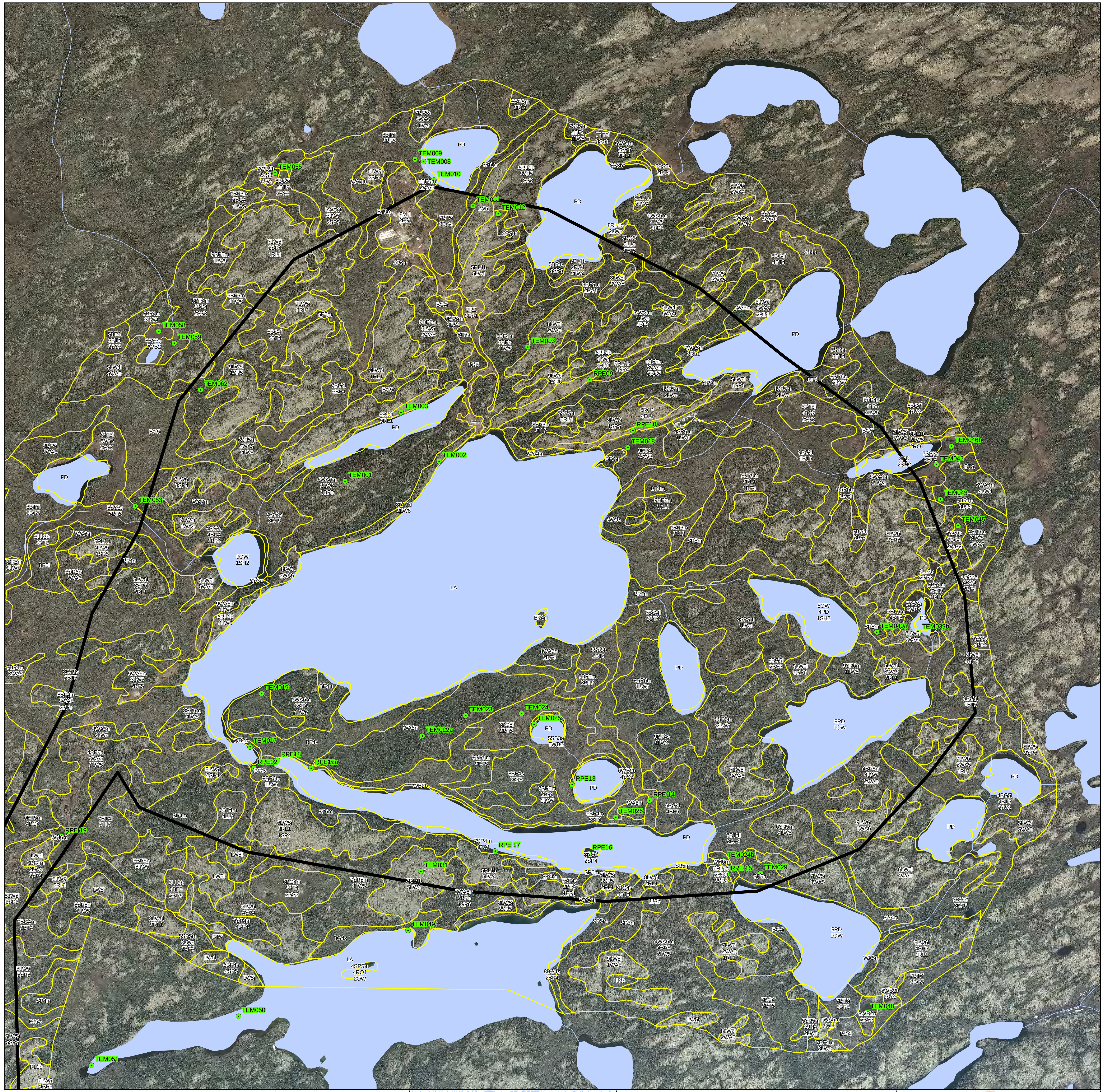
APPENDIX C

Interim LSA Ecosystem Map (on Orthophoto)





Legend

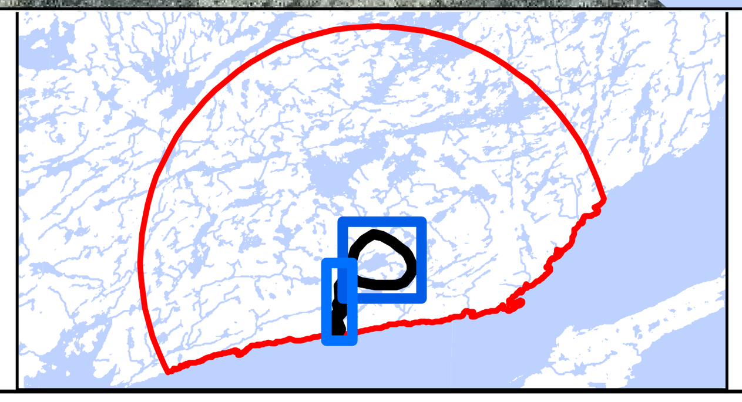
- Survey Locations
- Ecosystem Polygons
- LSA
- RSA (15km buffer)

Structural Modifier

e.g. 6WA4m

a = low shrub
b = tall shrub
i = irregular canopy
m = multistoried canopy
s = single storied canopy
t = two storied canopy

THOR LAKE
Terrestrial Ecosystem Map on Orthophoto



N

0 100 200 300
Meters

AVALON RARE METALS INC.

PREPARED BY	Stantec		
DRAFT DATE 17/12/2009		SCALE 1:10,000	
REVISION DATE		PROJECT 1036222	FIGURE NO. C
DRAWN JB	CHECKED SP	APPROVED TC	VOL

10366222_Thor_Field_Overview_20K_NE.mxd

APPENDIX D

Interim Regional Mapping Unit Descriptions

Bedrock-Lichen: Crest or upper slope position with rapid to very rapid drainage and tree cover from 0-30%. Shallow soils (5-30cm) with >30% exposed rock or sparsely vegetated rock (crust lichens).

Upland Pine: Upper slope position with rapid to well drained shallow soils (<50cm to bedrock) supporting pine forests.

Spruce Upland: Upper slope to crest position with well to moderately well drained soils. Shallow soils (<50cm to bedrock) with poor to medium nutrient regimes that support both white and black spruce.

Spruce Wet: Imperfect to poorly drained sites that support spruce stands. Isolated pockets of permanent seepage may be present.

Mixed Upland: Mid to lower slope position with moderately well drained shallow soils supporting a mixture of coniferous and deciduous species.

Broadleaf Upland: Mid to upper slope position with well drained shallow soils that support deciduous forests.

Shrub Upland: Imperfect to well drained sites, sparsely vegetated (fire regeneration) with open low shrubs.

Shrub Riparian: Imperfect to poorly drained sites along streams, lakes and wetlands that support shrubs and sparse tree cover.

Treed fen: Poorly drained moderately rich sites that support black spruce and tamarack. Open shrubby forests, often found adjacent to riparian areas.

Shrub Wet: Poorly drained open shrub communities with sparse and stunted black spruce; sometimes associated with thick organics over rock on lower slopes or very wet depressions.

Shrub Fen: Very poorly drained shrub communities found on thick organics with sparse, stunted black spruce and tamarack.

Sedge Fen: Very poorly drained sedge communities found on thick organics with a high water table.

Marsh/Shallow Water: Level and depressional areas around the shorelines of water bodies and riparian zones dominated by emergent sedges and rushes.

Exposed Soil/Barren Land: land devoid of vegetation due to extreme climatic or edaphic conditions. It includes areas of recent disturbance, such as mud slides, debris torrents, avalanches, and human disturbances.

Gravel Bar: An elongated landform generated by waves and currents, usually running parallel to the shore. It is composed of unconsolidated small rounded cobbles, pebbles, stones and sand.

Lake: A naturally occurring static body of water, greater than 2m deep in some portion. The boundary of the lake is the natural high water mark.

Pond: A small body of water greater than 2m deep but not large enough to be classified as a lake.

River: A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial.

Bedrock: A gentle to steep, bedrock escarpment or outcropping, with little soil development and sparse vegetative cover.

Settlement: An area in which residences and other human developments form an almost continuous covering of the landscape. These areas include cities and towns, subdivisions, commercial and industrial parks, and similar developments both inside and outside city limits.

APPENDIX E

Interim LSA Ecosystem Descriptions

REGIONAL MAPPING CATEGORIES AND ECOSITE DESCRIPTIONS

The following are descriptions of the regional mapping categories and ecosites which outline the main vegetation and site characteristics found in the Great Slave Upland High Boreal Ecoregion that includes the Thor Lake Project area. These descriptions are based on field data collected during the summer of 2009. However, in general, the main characteristics of this ecoregion are a nearly level bedrock plain with thin discontinuous till veneers, scattered outwash and lacustrine deposits, and a mosaic of black spruce woodlands with jack pine and paper birch regeneration on burnt areas (Ecosystem Classification Group 2008).

Regional Mapping Category: Bedrock – Lichen

This vegetation community is typically found on a crest or upper slope position with rapid to very rapid drainage and tree cover from 0-30%. Shallow soils (5-30cm) with >30% exposed rock or sparsely vegetated rock (crust lichens).

Ecosite RL: Bedrock – Lichen – Juniper – Saxifrage

The moisture regime for this ecosite is xeric to very xeric with a poor to very poor nutrient regime. This ecosite typically has very rapid drainage and water storage capacity is essentially nil due to fragmental or shallow soils. These ecosites are often associated with a crest position and more than 30% exposed rock or sparsely vegetated rock (crust lichens).

Tree cover is usually less than 10% and may include jack pine, white spruce or deciduous species. Trees are usually stunted and of poor form due to the extremely dry conditions and poor to very poor nutrient regime. Characteristic shrub species are common juniper (*Juniperus communis*), creeping juniper (*Juniperus horizontalis*) and common bearberry (*Arctostaphylos uva-ursi*). The forb layer includes species such as three-toothed saxifrage (*Saxifraga tricuspidata*), rusty woodsia (*Woodsia* ilvensis) and parsley fern (*Crytogramma crispa*). A nearly continuous cover of crust lichens and reindeer lichens can be found on these sites.

Photo 1: Representative RL Ecosite: Bedrock – Lichen – Juniper – Saxifrage (Example TEM Field Site Number 34)

Ecosite LW: Lichen – Bearberry – Woodland

Ecosite LW is found in subxeric and xeric conditions with a poor to very poor nutrient regime. This ecosite is well or rapidly drained with shallow soils ranging from 5 – 30 cm. Slope positions range from upper to crest with variable aspects.

Tree cover is sparse (10 – 30%) with jack pine and/or white spruce being the dominant species. Shrubs species include common bearberry (*Arctostaphylos uva-ursi*), common juniper (*Juniperus communis*), creeping juniper (*Juniperus horizontalis*), Canada buffaloberry (*Sheperdia canadensis*) and crowberry (*Empetrum nigrum*). The forb layer includes species such as three-toothed saxifrage (*Saxifraga tricuspidata*), rusty woodsia (*Woodsia* ilvensis), plains wormwood (*Artemisia* campestris) and parsley fern (*Crytogramma crispa*). A discontinuous cover of crust and reindeer lichens can be found on these sites.

Photo 2: Representative LW Ecosite: Lichen – Bearberry – Woodland (Example TEM field site number 13)

REGIONAL MAPPING CATEGORY: PINE UPLAND

This vegetation community is typically found on upper slope positions with rapid to well-drained shallow soils (<50 cm to bedrock) that support pine forests.

Ecosite JH: Jack Pine – Heath – Lichen – Upland Forest

Ecosite JH is found in upper slope positions (> 10% slope) with a submesic to subxeric moisture regime. The soil nutrient regime is typically poor with shallow soils over bedrock (< 50 cm).

Jack pine is the dominant tree species, regenerating after forest fires and representing an intermediate seral stage. Crown closure ranges between 10 and 40% in old stands but can be as high as 70% in younger stands. The shrub layer is represented by lingonberry (Vaccinium vitis-idaea). The forb layer will typically have American milk vetch (Astragalus americanus). Ground cover includes various lichens/mosses and rock (EBA Engineering Consultants Ltd. 2005).

No field plots were established in the LSA (very little of this ecosystem occurs in the LSA), however the ecosite was seen in the RSA, and the photo below was taken in the RSA from a helicopter

Photo 3: Representative JH Ecosite: Jack Pine – Heath – Lichen – Upland Forest (Example RSA air call number 117)

REGIONAL MAPPING CATEGORY: SPRUCE UPLAND

This vegetation community is typically found on lower slope to crest positions with well to moderately well drained and somewhat coarse textured soils. Shallow soils (<50cm to bedrock) with poor to medium soil nutrient regimes that support both white and black spruce.

Ecosite BF: Black Spruce – Feathermoss – Crowberry – Upland Forest

Ecosite BF is found in subhygric to submesic moisture regimes with typically poor soil nutrient regime. Topographically, this ecosite is usually found on the lower or mid-slope position with variable aspects.

Black spruce is the dominant tree species but white spruce may also occur. Tree height is usually less than 10m with crown closure ranging from 10-40%. Characteristic shrub species include green alder (*Alnus crispa*), Labrador tea (*Ledum groenlandicum*), crowberry (*Empetrum nigrum*), and alpine bearberry (*Arctostaphylos rubra*). The forb layer includes species such as dwarf scouring rush (*Equisetum scripoides*) and three-toothed cinquefoil (*Potentilla tridentata*). The ground cover includes a variety of lichens and feathermosses.

Photo 4: Representative BF Ecosite: Black Spruce – Feathermoss – Crowberry – Upland Forest (Example TEM field site number 40)

Ecosite WA: White Spruce – Green Alder – Prickly Rose – Upland Forest

Ecosite WA is found on mesic to submesic moisture regimes with poor to medium nutrient regimes. This ecosite is typically found in the upper slope to crest position (5 – 15% slope) with well drained sandy loam soils but may also occur on the mid or lower slope positions. The depth to bedrock is shallow (<50 cm) and there is often <70% coarse fragments.

Forests on these sites are moderately productive and dominated by white spruce. Tree heights of mature (older) stands are in the 20 m range with diameters up to 30 cm. Green alder (*Alnus crispa*), low bush-cranberry (*Viburnum edule*) and prickly rose (*Rosa acicularis*) are characteristic species in the shrub layer. Northern bastard toadflax (*Geocaulon lividum*) and fairyslipper (*Calypso bulbosa*) are often found in the forb layer. Red stemmed feathermoss (*Pleurozium schreberi*) and stair-step moss (*Hylocomium splendens*) are common ground cover species.

Photo 5: Representative WA Ecosite: White Spruce – Green Alder – Prickly Rose – Upland Forest (Example TEM field site number 22a)

REGIONAL MAPPING CATEGORY: MIXED UPLAND

This vegetation community is typically found on mid to lower slope positions with moderately well-drained shallow soils supporting a mixture of coniferous and deciduous species.

Ecosite SP: Spruce – Paper Birch – Toadflax – Forest

Ecosite SP is found in subhygric to submesic moisture regimes with a poor to medium nutrient regime and silty soils. This ecosite occupies both the mid to lower slope position (5-10% slope) and also occurs in moderately shallow soils over bedrock where pockets of soil has developed in association with the RL and LW ecosites.

The forest canopy is predominately a mixture of white spruce and paper birch but black spruce may also be present. These moderately productive sites have a well developed shrub layer with green alder (*Alnus crispa*), Labrador tea (*Ledum groenlandicum*) and lingonberry (*Vaccinium vitis-idaea)* being common. The forb layer often contains Northern bastard toadflax (*Geocaulon lividum*), fairyslipper (*Calypso bulbosa*) and alpine bearberry (*Arctostaphylos rubra*). Red stemmed feathermoss (*Pleurozium schreberi*), stair-step moss (*Hylocomium splendens*) and reindeer lichens are common ground cover species.

Photo 6: Representative SP Ecosite: Spruce – Paper Birch – Toadflax – Forest (Example TEM field site number 40a)

REGIONAL MAPPING CATEGORY: BROADLEAF UPLAND

This vegetation community is typically found on mid to upper slope positions with well-drained shallow soils that support a continuous canopy of deciduous forests.

Ecosite PA: Paper Birch – Aspen – Willow – Forest

Ecosite PA has a submesic moisture regime with a medium nutrient regime. The slope position ranges from mid to upper with well drained moderately deep loamy soils.

Paper birch or aspen dominates the tree canopy layer and white spruce may be a minor component. Crown closure can range from 50-80% with tree heights generally less than 15m. Willow (*Salix* spp.), common juniper (*Juniperus communis*) and northern black currant (*Ribes hudsonianum*) are typically found in the shrub layer. The forb and ground cover species have not been documented for this ecosite.

Photo 7: Representative PA Ecosite: Paper Birch – Aspen – Willow – Forest (Example TEM field site number 141)

REGIONAL MAPPING CATEGORY: SHRUB UPLAND

This vegetation community is typically found on imperfect to well drained sites, sparsely vegetated (fire regeneration) with open low shrubs.

Ecosite SL: Scrub Birch – Willow – Alder – Open Shrub

Ecosite SL is found on subhygric to submesic sites with a medium nutrient regime. This sparsely vegetated ecosite occurs as a result of fire and is dominated by open low shrubs. The forb and ground cover species have not been documented for this ecosite. This ecosystem type was mapped in the RSA but not currently mapped in the LSA.

No photos taken.

REGIONAL MAPPING CATEGORY: SHRUB RIPARIAN

Ecosite SW: Scrub Birch – Willow – Water Sedge – Riparian Shrub

Ecosite SW is found on subhygric to hygric soil moisture regimes with a medium to rich nutrient regime. This ecosite is found in riparian areas adjacent to small streams where there is sparse tree cover but dense shrub cover usually less than 5m tall.

Typical shrub species include scrub birch (*Betula glandulosa*) and willow (*Salix* spp). The forb and ground cover species include water sedge (*Carex aquatilis*) and buckbean (*Menyanthes trifolium*).

Photo 8: Representative SW Ecosite: Scrub Birch – Willow – Water Sedge – Riparian Shrub

REGIONAL MAPPING CATEGORY: SPRUCE WET

This vegetation community is typically found on imperfect to poorly drained sites that support both white spruce and black spruce stands. Isolated pockets of permanent seepage may be present.

Ecosite WH: White Spruce – Horsetail – Glow Moss – Forest

Ecosite WH is typically a small, localized site found on subhygric to hygric moisture regimes with a medium to rich nutrient regime. Small isolated pockets of permanent seepage maybe present. The slope position is typically depressional or level.

White spruce is the dominant tree species but very minor amounts of black spruce and paper birch may also be present.. The shrub layer is not well developed with Labrador tea (*Ledum groenlandicum*) and lingonberry (*Vaccinium vitis-idaea*) usually present. Forb species include a high cover of common horsetail (*Equisetum arvense*) and a variety of sedge species. Ground cover species include stair-step moss (*Hylocomium splendens*) and glow moss (*Aulacomnium palustre*).

Photo 9: Representative WH Ecosite: White Spruce – Horsetail – Glow Moss – Forest (Example TEM field site number 155)

Ecosite BG: Black Spruce – Cloudberry – Sphagnum Moss – Bog – Forest

Ecosite BG occurs on subhygric to hygric moisture regimes that also have a poor soil nutrient regime. It is found on lower or depressional slope positions as well as toe and level positions.

These low productivity sites support sparse and stunted stands of black spruce typically ranging from 5 – 8 m in height. These sites usually occur on thin organic soils over bedrock, but may also form on lacustrine deposits. The well-developed shrub layer has a high cover of lingonberry (*Vaccinium vitis-idaea*), Labrador tea (*Ledum groenlandicum*) and or northern Labrador tea (*Ledum decumbens*). Typical species in the forb layer include cloudberry (*Rubus chamaemorus*) and red baneberry (*Actaea rubra*). Sphagnum moss, reindeer lichens, and glow moss (*Aulacomnium palustre*) are common ground cover species.

Photo 10: Representative BG Ecosite: Black Spruce – Cloudberry – Sphagnum Moss – Bog – Forest (Example TEM field site number 24)

REGIONAL MAPPING CATEGORY: TREED FEN

This vegetation community is typically found on poorly drained sites that support black spruce and tamarack. Open shrubby forests, often found adjacent to riparian areas.

Ecosite BT: Black Spruce – Tamarack – Water Sedge – Fen

Ecosite BT is found on hygric to subhydric moisture regimes with a poor to medium nutrient regime. Slope position can vary from level, depressional, lower or toe. These sites are often present around water bodies or are transitional to riparian areas.

Black spruce and tamarack are the dominant tree species but tree cover is sparse. These ecosites are located on organic soils that form open shrubby forests ranging from 5 to 10 m in height. The typical shrub species include willow (*Salix* spp.), Labrador tea (*Ledum groenlandicum*) and scrub birch (*Betula glandulosa*). The forb layer consists of various sedge species, common horsetail (*Equisetum arvense*) and cloudberry (*Rubus chamaemorus*). Glow moss (*Aulacomnium palustre*) is the dominant ground cover.

Photo 11: Representative BT Ecosite: Black Spruce – Tamarack – Water Sedge – Fen (Example TEM field site number 46b)

REGIONAL MAPPING CATEGORY: SHRUB WET

This vegetation community is typically found on poorly drained open shrub communities with sparse and stunted black spruce; sometimes associated with thick organics over rock on lower slopes or very wet depressions.

Ecosite LL: Labrador Tea – Reindeer Lichen – Black Spruce – Bog

Ecosite LL is found on hygric and subhydric moisture regimes with a poor nutrient regime. This ecosite may have a thick organic layer over sloping rock on lower slopes, and also occur at times in very wet depressions.

Generally, the vegetation consists of very open shrub communities with sparse & stunted black spruce (<5m tall), tamarack is usually absent. Shrub species include scrub birch (*Betula glandulosa*) and dwarf bog-rosemary (*Andromeda polifolia*). The characteristic species in the forb layer is water sedge (*Carex aquatilis*). Reindeer lichen species are the dominant ground cover.

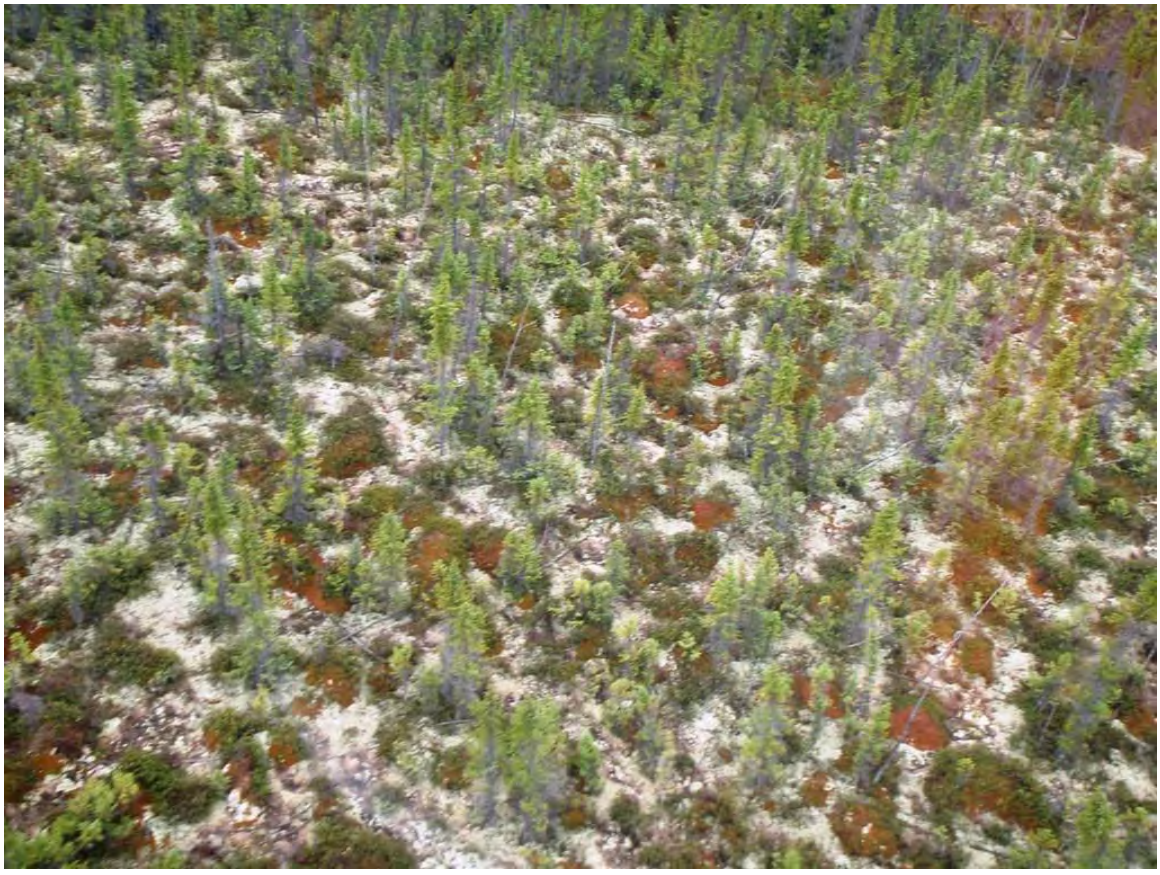


Photo 12 Representative LL Ecosite: Labrador Tea – Reindeer Lichen – Black Spruce – Bog (Example TEM field site number 121)

REGIONAL MAPPING CATEGORY: SHRUB FEN

This vegetation community is typically found on very poorly drained shrub communities found on thick organics with sparse, stunted black spruce and tamarack.

Ecosite WS: Willow – Scrub Birch – Alder – Tall Shrub – Fen

Ecosite WS is found on hygric and subhydric moisture regimes with a medium nutrient regime on organic soils. The slope position is depressional or level.

The tree canopy is a sparse cover of stagnated black spruce and tamarack. Willow (*Salix* spp.), scrub birch (*Betula glandulosa*) and alder (*Alnus* spp.) are the characteristic shrub species. The forb and ground cover species have not been documented for this ecosite.

No photos taken.

Ecosite SS: Scrub Birch – Sweet Gale – Bog Rosemary – Fen

Ecosite SS is found on subhydric to hygric moisture regimes with a medium to rich nutrient regime on organic soils. The slope position is depressional or level and the ecosite is usually forming a transitional band between the sedge fen (and ponds and lakes) and the treed fen or wet spruce forests.

Stunted black spruce and tamarack can be found scattered throughout this dominantly shrub community. The dominant shrub species are scrub birch (*Betula glandulosa*), willow (*Salix* spp.) sweet gale (*Myrica gale*), and dwarf bog rosemary (*Andromeda polifolia*), and generally form a discontinuous cover less than two meters in height. Water sedge (*Carex aquatilis*), dwarf raspberry (*Rubus arcticus*) and tufted bulrush (*Scirpus caespitosus*) are commonly found in the forb/graminoid layer.

Photo 13: Representative SS Ecosite: Scrub Birch – Sweet Gale – Bog Rosemary – Fen (Example TEM field site number 42)

REGIONAL MAPPING CATEGORY: SEDGE FEN

This vegetation community is typically found on very poorly drained sedge communities found on thick organics with a high water table.

Ecosite WB: Water Sedge – Buckbean – Arrow Grass – Fen

Ecosite WB is found on subhydric to hydric moisture regimes with a rich to very rich nutrient regime. Standing water is often present as these sites are either found immediately adjacent to lakes and ponds or within localized depressions across the landscape.

The tree canopy is absent and the shrub layer usually contains minor amounts of scrub birch (*Betula glandulosa*), sweet gale (*Myrica gale*), dwarf bog rosemary (*Andromeda polifolia*) and willow (*Salix* spp.). The herbaceous layer forms the dominant cover and includes buck bean (*Menyanthes trifoliata*), arrow-grass (*Triglochin maritima*) and water sedge (*Carex aquatilis*).

Photo 14: Representative WB Ecosite: Water sedge - Buckbean - Arrow Grass Fen (Example TEM field site number 25)

REGIONAL MAPPING CATEGORY: MARSH/SHALLOW WATER

This vegetation community is typically found on level and depressional areas around the shorelines of water bodies and riparian zones dominated by emergent sedges and rushes.

Ecosite SH: Swamp Horsetail – Marsh

Ecosite SH is found on hydric sites with a rich to very rich nutrient regime. Tree and shrub canopies are absent and swamp horsetail (*Equisetum fluviatile*) is the dominant forb species.

Photo 15: Representative SH Ecosite: Swamp Horsetail – Marsh (Example TEM field site number 110)

Ecosite GB: Great Bulrush – Marsh

Ecosite GB is found on hydric sites with a very rich nutrient regime. Tree and shrub canopies are absent and great bulrush (*Scirpus lacustris*) is the dominant forb species.

No photos taken.

APPENDIX F

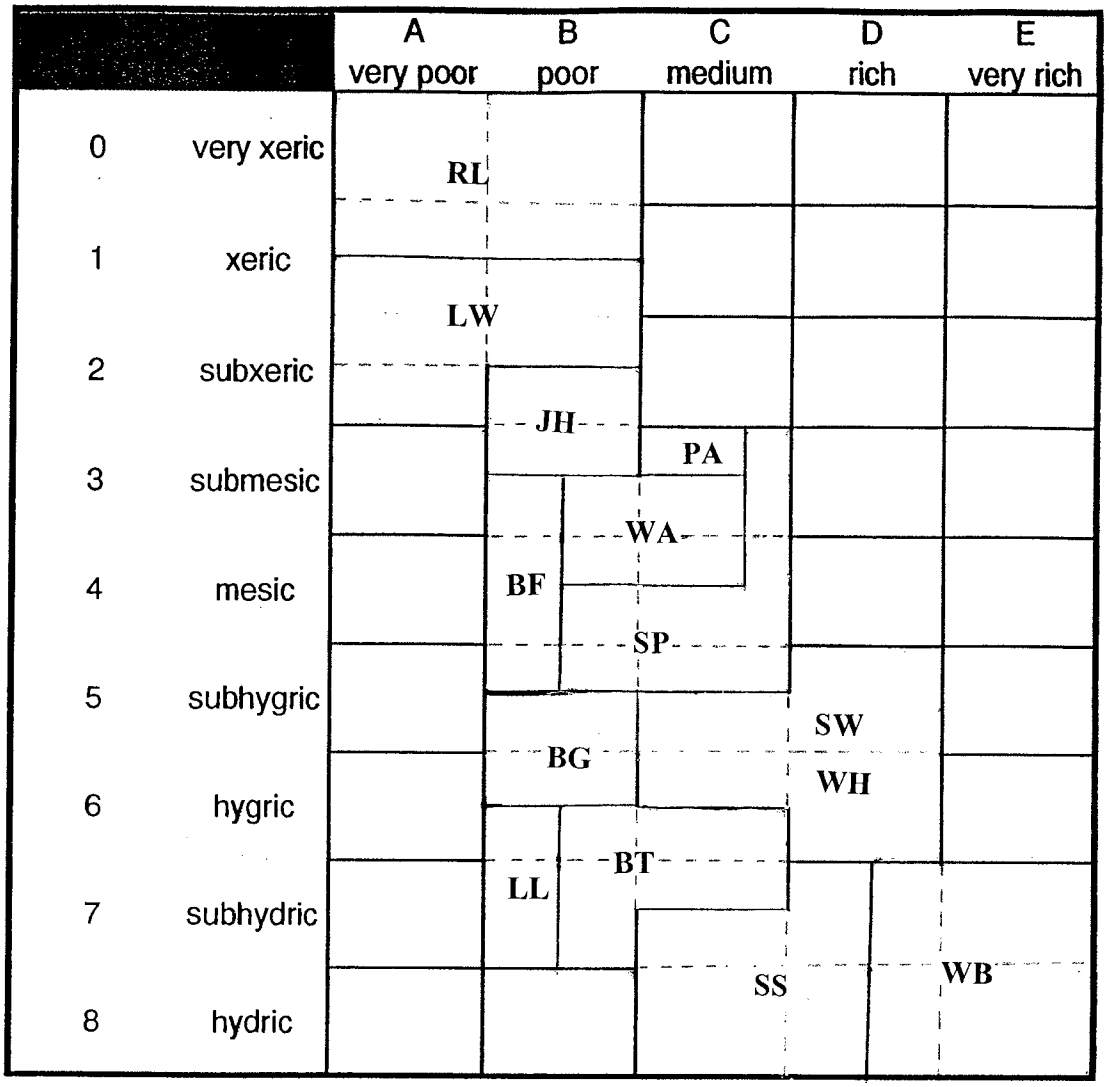
Interim Ecosystem Mapping Legend and Mapped Hectares

Map Code	Final Name	Mapped Area (ha)	Description	Soil Drainage
BF	black spruce – feathermoss – crowberry upland forest	187	moist to moderately dry upland poor forest	moderate (well)
BG	black spruce – cloudberry – sphagnum moss bog forest	243	very moist to wet black spruce forest, poor low productive sparse forest, usually thin soils over bedrock	imperfect-poor
BT	black spruce – tamarack – water sedge fen	128	wet to very wet black spruce tamarack moderately rich open shrubby forest, often along riparian areas and wetlands	poor
JH	jack pine – heath – lichen forest	not mapped	upper slope, >10% slope, shallow to bedrock (<50 cm), >70% crown closure	rapid - well
LA	lake	197	naturally occurring static body of water, greater than 2 m deep in some portion. The boundary for the lake is the natural high water mark.	n/a
LL	labrador tea – reindeer lichen – black spruce bog	6	very open non-treed shrubby community with sparse and short black spruce, sometimes thick organics over sloping rock on lower slopes, and sometimes very wet depressions	poor
LW	lichen – bearberry woodland	291	jack pine and/or white spruce open woodland, crest and upper slope position, sparsely 10 – 30% treed, very dry and rapidly drained, generally 5 – 30 cm soil development	rapid – well
MI	mine	6	unvegetated area used for the extraction of mineral ore and other materials.	n/a
OW	shallow open water	14	wetland composed of permanent shallow open water and lacking extensive emergent plant cover. The water is less than 2 m deep. (If vegetated, these units should developed into site series groups for interpretation.)	n/a
PA	paper birch – aspen – willow forest	1	mid to upper slope on significant aspect, well drained deciduous forest on shallow soils	well
PD	pond	142	small body of water greater than 2 m deep, but not large enough to be classified as a lake (e.g., less than 50 ha).	n/a
RL	bedrock – lichen – juniper – saxifrage	81	crest position, >30% exposed rock or sparsely vegetated rock (crust lichens), <10% trees, very dry and very rapidly drained	very rapid
RO	bedrock	5	A gentle to steep, bedrock escarpment or outcropping, with little soil development and sparse vegetative cover.	n/a

Map Code	Final Name	Mapped Area (ha)	Description	Soil Drainage
RW	rural/camp	1	residences such as farms and other human developments such as work or recreational camps spread out over the landscape.	n/a
RZ	road surface	4	area cleared and compacted for the purpose of transporting goods and services by vehicles.	n/a
SL	scrub birch – willow – alder open shrub	not mapped	sparsely vegetated (fire regeneration) open low shrub	imperfect-well
SP	spruce – paper birch – toadflax forest	255	mid to lower slope, 5 – 10% slope, moderately shallow silty loam soils over rock, mod productive spruce or jack pine and paper birch community	moderate (well)
SS	scrub birch – sweet gale – bog rosemary fen	38	shrub dominated fen dominated by scrub birch, sweet gale, and bog rosemary	very poor
SW	scrub birch – willow – water sedge riparian shrub	184	riparian shrub community along streams, mineral soil, sparse tree species less than 5 m tall	imperfect - poor
WA	white spruce – green alder – prickly rose forest	184	upper slope to crest position, well drained sandy loam soils, shallow to bedrock (<50 cm), 5 – 15% slope, <70% coarse fragments, productive forest	well
WB	water sedge – buckbean – arrow grass fen	12	wetland fen dominated by sedges, buckbean and arrow-grass	very poor
WH	white spruce – horsetail – glow moss forest	1	wet to very wet white spruce forest, isolated pockets of permanent seepage	imperfect-poor

APPENDIX G

Edatopic Grid of Mapped Ecosystems within the LSA


A
very poor
B
poor
C
medium
D
rich
E
very rich
0
very xeric
1
xeric
2
subxeric
3
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4
mesic
5
subhygric
6
hygric
7
subhydric
8
hydric
RL
LW
JH
PA
WA
BF
SP
SW
BG
WH
BT
LL
SS
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