ARCHER, CATHRO & ASSOCIATES (1981) LIMITED
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Vancouver, B.C. V6B 1L8
Telephone: 604-688-2568 Fax: 604-688-2578

ASSESSMENT REPORT

describing

AERIAL PHOTOGRAPHY, LIDAR TOPOGRAPHIC SURVEYS, HERITAGE STUDY, BARITE MARKETING STUDY, RESOURCE ESTIMATION AND SCOPING STUDY

at the

MEL PROPERTY

Andy 1-8	YA72509-YA72516	Keli 5-8	YA66927-YA66930
Boz 1-4	YA66985-YA66988	Mel 1-188	YE60001-YE60188
Chungo 1-8	YA66946-YA66953	Mel 11-16	Y22230-Y22235
Dave 1-8	YA72501-YA72508	Mel 189-318	YE60459-YE60588
Edy 1-7	YA66962-YA66968	Mumbo 1-8	YA66977-YA66984
Hose 1-8	YA66919-YA66926	Ott 1-8	YA66954-YA66961
Jean 1-4	Y72731-Y72734	Ralfo 1-7	YA66939-YA66945
Jean 5-10	Y72961-Y72966	Sam 1-86	YB46141-YB46226
Jean 11-21	Y74418-Y74428	Sin 1-8	YA66989-YA66996
Jeri 1-8	YA66931-YA66938	Sov 1-6	YA28600-YA28605
Joe 1-2	YA45269-YA45270	Tomi 1-8	YA66969-YA66976
Joni 1-8	YA66846-YA66853	Wet 1-32	Y83309-Y83332
Keli 1-4	YA66842-YA66845	Yang 1-6	YA66997-YA67002

NTS 095D/06
Latitude 60°23´N; Longitude 127°20´W

located in the

Watson Lake Mining District
Yukon Territory

prepared by

Archer, Cathro & Associates (1981) Limited

for

SILVER RANGE RESOURCES LTD.

by

J. Stevens, B.A.Sc., EIT

April 2015

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APPENDICES

TABLES

FIGURES

INTRODUCTION

The Mel property (the "Property") covers a zinc-lead-barite deposit and other zinc showings. The Property is located in southeastern Yukon and is owned wholly by Silver Range Resources Ltd. ("Silver Range").

This report describes aerial photography, LIDAR topographic surveys, heritage, barite marketing and scoping studies and resource estimation conducted between July and December 2014 on behalf of Silver Range. Archer, Cathro & Associates (1981) Limited ("Archer Cathro") supervised the various activities. The author participated in, and interpreted the results of the program, and his Statement of Qualifications is presented in Appendix I. A Statement of Expenditures is provided in Appendix II.

PROPERTY LOCATION, CLAIM DATA AND ACCESS

The Property is located in southeastern Yukon at latitude 60°23´ north and longitude 127°20´ west on NTS map sheet 095D/06 (Figure 1). It comprises 575 contiguous mineral claims that cover an area of about 11,430 hectares (114 km^2). All of the claims are registered with the Watson Lake Mining Recorder in the name of Archer Cathro, which holds them in trust for Silver Range. Specifics concerning claim registration are tabulated below, while the locations of individual claims are shown on Figure 2.

Claim Name	Grant Number	Expiry Date*
Andy 1-8	YA72509-YA72516	April 3, 2020
Boz 1-4	YA66985-YA66988	April 3, 2020
Chungo 1-8	YA66946-YA66953	April 3, 2020
Dave 1-8	YA72501-YA72508	April 3, 2020
Edy 1-7	YA66962-YA66968	April 3, 2020
Hose 1-8	YA66919-YA66926	April 3, 2020
Jean 1-4	Y72731-Y72734	April 3, 2020
5-10	Y72961-Y72966	April 5, 2020
11-21	Y74418-Y74428	April 3, 2020
Jeri 1-8	YA66931-YA66938	April 3, 2020
Joe 1-2	YA45269-YA45270	April 3, 2020
Joni 1-8	YA66846-YA66853	April 3, 2020
Keli 1-4	YA66842-YA66845	April 3, 2020
5-8	YA66927-YA66930	April 3, 2020
Mel 1-188(3)	YE60001-YE60188	April 3, 2020
189-318(3)	YE60459-YE60588	April 3, 2020
Mel 11-16	Y22230-Y22235	April 3, 2020
Mumbo 1-8	YA66977-YA66984	April 3, 2020
Ott 1-8	YA66954-YA66961	April 3, 2020
Ralfo 1-7	YA66939-YA66945	April 3, 2020
Sam 1-86	YB46141-YB46210	April 3, 2020
Sin 1-8	YA66989-YA66996	April 3, 2020
Sov 1-6	YA28600-YA28605	April 3, 2020

ARCHER, CATHRO & ASSOCIATES (1981) LTD.

MEL PROJECT

Figure 1 – Property Location

April 2015

Tomi 1-8	YA66969-YA66976	April 3, 2020
Wet 1-16	Y83309-Y83324	April 3, 2020
25-32	Y83225-Y83332	April 3, 2020
Yang 1-6	YA66997-YA67002	April 3, 2020

* Expiry dates include 2014 work, which has been filed for assessment credit but not yet accepted.

The Property lies approximately 47 km north of the Alaska Highway and is accessed by a system of bush road/bush trail/winter road, which leaves the Alaska Highway at km 901. A bush road that extends 33.5 km from the Alaska Highway to the Coal River is used year-round by local residents and other mineral exploration companies to access nearby properties. Access to the Property requires crossing the Coal River by fording or ice bridge to reach an 11.4 km section of bush trail/winter road which accesses the airstrip at the Property (Figure 2). Watson Lake lies 125 km west-southwest of the Property and is the nearest supply centre. The community of Lower Post is located approximately 55 km west of the bush road turn-off.

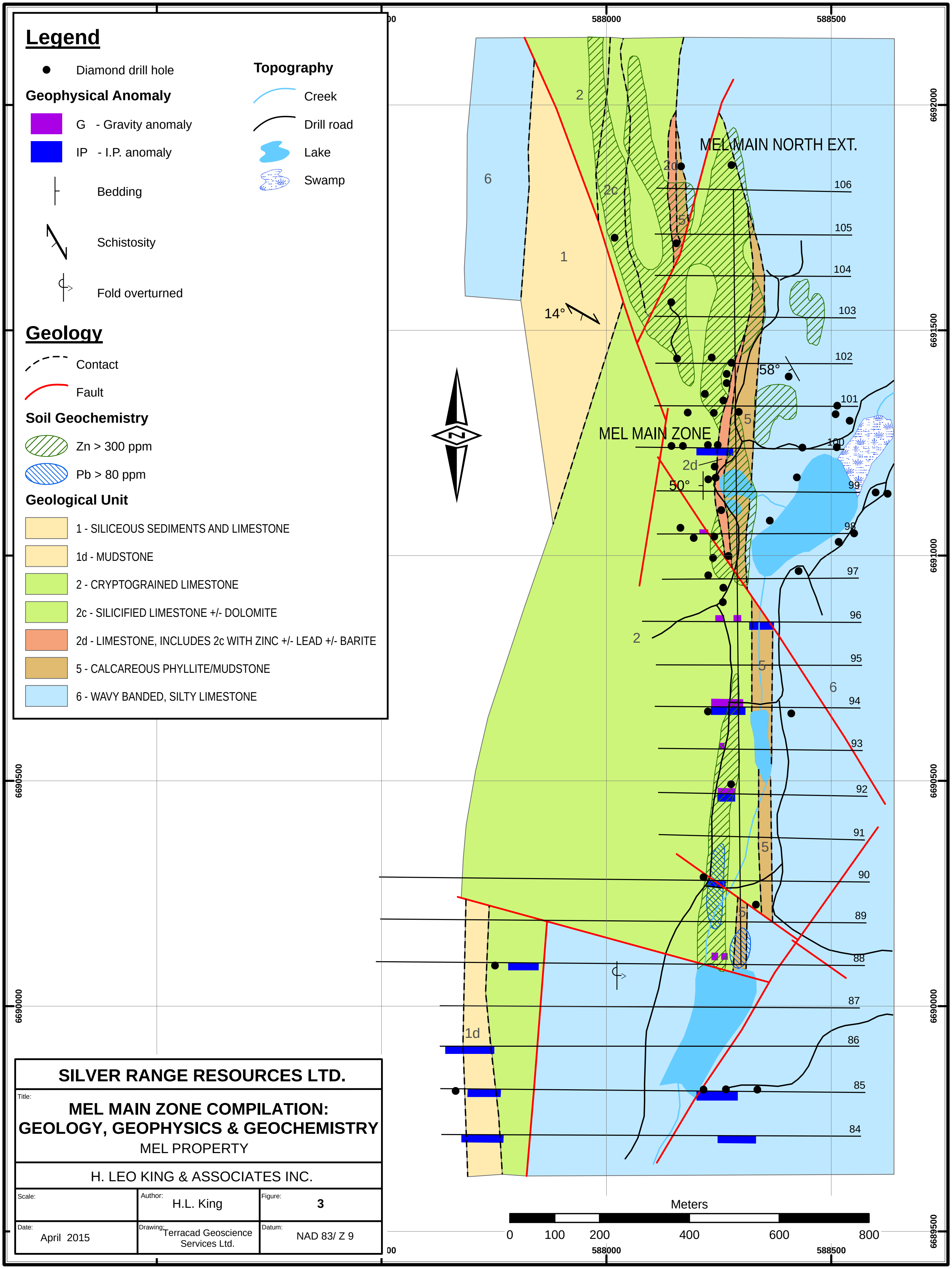
The Property is situated within the Kaska First Nations ("Kaska") traditional territory.

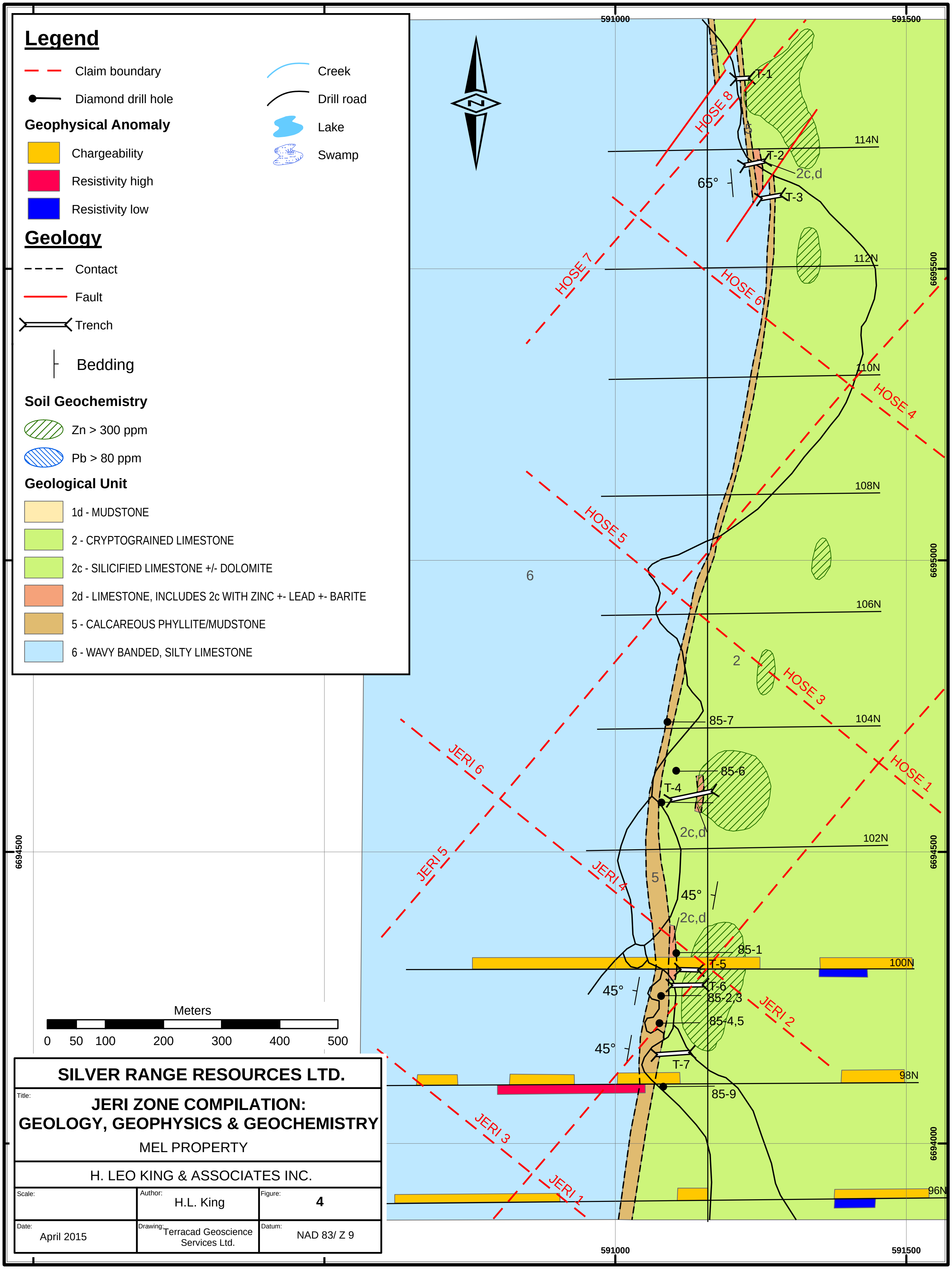
HISTORY AND PREVIOUS WORK

Extensive exploration work was carried out on the Property by several operators at various times between 1967 and 1997. The Property was dormant from 1997 to 2012. The locations of historical workings including mineral showings, geochemical and geophysical anomalies, trenches and drill holes, are illustrated for the Mel Main, Jeri, Jeri North and Mel East Zones on Figures 3, 4, 5 and 6 respectively. Table I summarizes work performed and results obtained by exploration programs conducted since 1967.

Table I: Exploration History of the Mel Property

Year of Work Reported	Owner/ Operator	Claim Group	Work Performed	Results
1967	J. Melynchuk and T. Flint	Mel & Jean	Staked claims	N/A
1967 - 1968	Newmont Mining Corporation	Mel	Trenching, geochemical surveys	Trenching exposed Mel Main Zone zinc-lead-barite mineralization over strike length of 488 m. The trenches averaged 5.35% combined lead-zinc over widths of 2.3 to 9 m.
1973 - 1975	Granby Mining Corp.	Mel, Jean & Wet	Mapping, geochemical survey and diamond drilling – 18 holes (1,952 m)	Drilling intersected 2 mineralized zones of zinc+/-lead+/-barite. Mel Main Zone averaged 6.1 m (true


Legend
Diamond drill hole
Geophysical Anomaly
G - Gravity anomaly
IP - I.P. anomaly
Bedding
Schistosity
Fold overturned
Topography
Creek
Drill road
Lake
Swamp
Geology
Contact
Fault
Soil Geochemistry
Zn > 300 ppm
Pb > 80 ppm
Geological Unit
1 - SILICEOUS SEDIMENTS AND LIMESTONE
1d - MUDSTONE
2 - CRYPTOGRAINED LIMESTONE
2c - SILICIFIED LIMESTONE +/- DOLOMITE
2d - LIMESTONE, INCLUDES 2c WITH ZINC +/- LEAD +/- BARITE
5 - CALCAREOUS PHYLLITE/MUDSTONE
6 - WAVY BANDED, SILTY LIMESTONE
MEL MAIN NORTH EXT.
MEL MAIN ZONE
588000
588500
6692000
6691500
6691000
6690500
6690000
6689500
14°
58°
50°
106
105
104
103
102
101
100
99
98
97
96
95
94
93
92
91
90
89
88
87
86
85
84
Meters
0 100 200 400 600 800
SILVER RANGE RESOURCES LTD.
Title:
MEL MAIN ZONE COMPILATION:
GEOLOGY, GEOPHYSICS & GEOCHEMISTRY
MEL PROPERTY
H. LEO KING & ASSOCIATES INC.
Scale:
Author: H.L. King
Figure: 3
Date: April 2015
Drawing: Terracad Geoscience Services Ltd.
Datum: NAD 83/ Z 9


Legend
Claim boundary
Diamond drill hole
Geophysical Anomaly
Chargeability
Resistivity high
Resistivity low
Creek
Drill road
Lake
Swamp
Geology
Contact
Fault
Trench
Bedding
Soil Geochemistry
Zn > 300 ppm
Pb > 80 ppm
Geological Unit
1d - MUDSTONE
2 - CRYPTOGRAINED LIMESTONE
2c - SILICIFIED LIMESTONE +/- DOLOMITE
2d - LIMESTONE, INCLUDES 2c WITH ZINC +- LEAD +- BARITE
5 - CALCAREOUS PHYLLITE/MUDSTONE
6 - WAVY BANDED, SILTY LIMESTONE
N
591000
591500
6695500
6695000
6694500
6694000
HOSE 8
HOSE 7
HOSE 6
HOSE 5
HOSE 4
HOSE 3
HOSE 1
JERI 6
JERI 5
JERI 4
JERI 3
JERI 2
JERI 1
T-1
T-2
T-3
T-4
T-5
T-6
T-7
2c,d
65°
45°
114N
112N
110N
108N
106N
104N
102N
100N
98N
96N
85-7
85-6
85-1
85-2,3
85-4,5
85-9
6
5
2
Meters
0 50 100 200 300 400 500
SILVER RANGE RESOURCES LTD.
Title:
JERI ZONE COMPILATION:
GEOLOGY, GEOPHYSICS & GEOCHEMISTRY
MEL PROPERTY
H. LEO KING & ASSOCIATES INC.
Scale:
Author: H.L. King
Figure: 4
Date: April 2015
Drawing: Terracad Geoscience Services Ltd.
Datum: NAD 83/ Z 9

Legend

- Pond
- Swamp
- Claim Boundary
- Diamond drill hole

Geophysical Anomaly

- Chargeability
- Resistivity high
- Resistivity low

Soil Geochemistry

- >Zn 300ppm

Geology

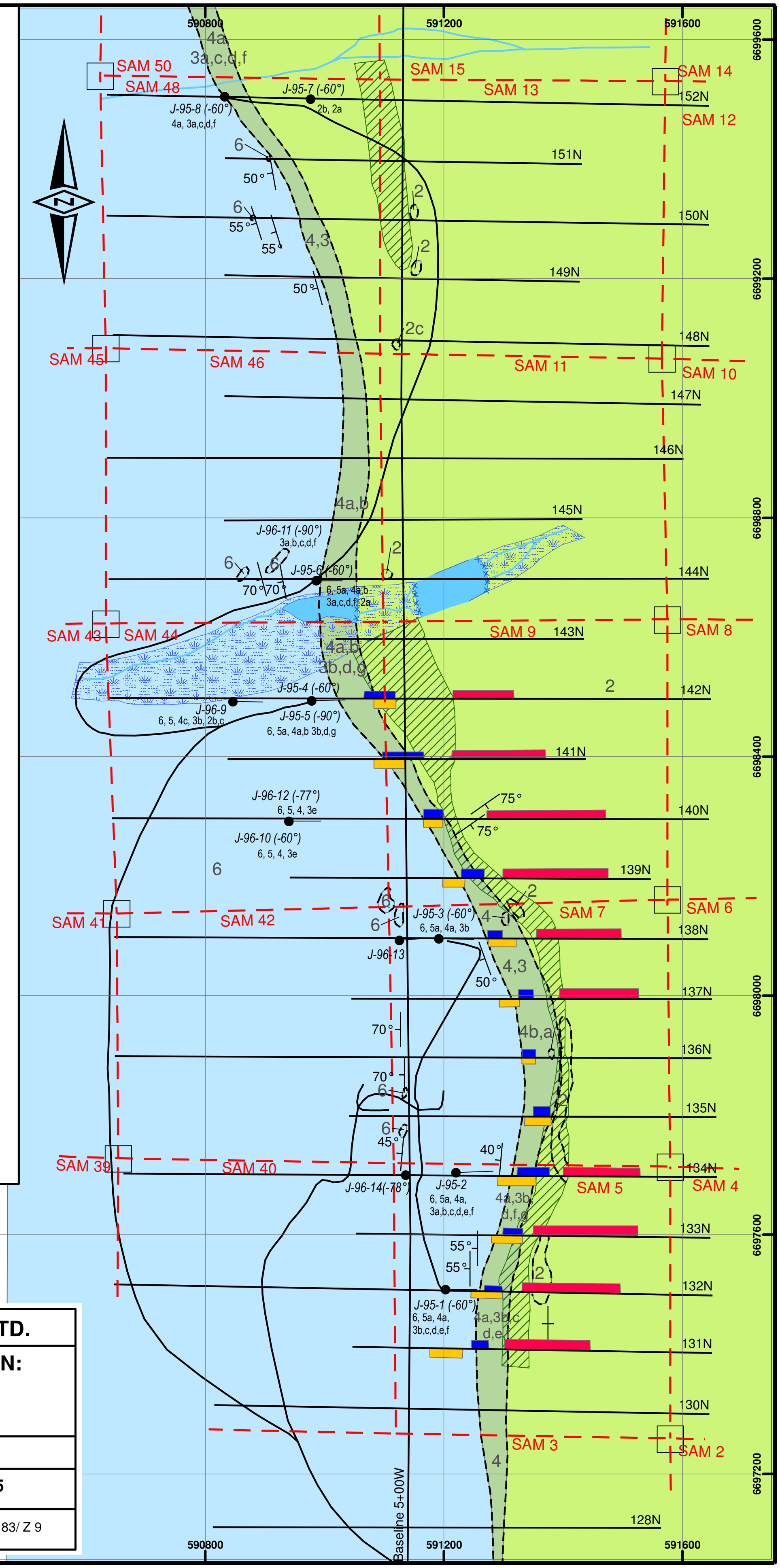
- Contact
- Fault
- Bedding
- Bedding, vertical
- Claim post

Geological Unit

- 6 - WAVY BANDED, SILTY LIMESTONE
- 5 - CALCAREOUS PHYLLITE/MUDSTONE
  - 5a - Shale, weakly altered
- 4 - VOLCANIC ROCKS
  - 4a - Chaotic volcanic breccia partly supported by coarse dolospar, locally to moderately silicified
  - 4b - Lapilli tuff and tuff breccia - fragments of cryptograined lst, siliceous dolomite, dolomite with hydrozincite and smithsonite
  - 4c - Andesitic flows and or flow breccia, local chlorite patches
- 3 - SEDIMENTARY ROCKS
  - 3a - Siltstone
  - 3b - Calcarcous siltstone
  - 3c - Limestone
  - 3d - Dolomite, locally sparry calcite
  - 3e - Mineralized dolomite with sphalerite
  - 3f - Chert
  - 3g - Mineralized chert with sphalerite
- 2 - CRYPTOGRAINED LIMESTONE
  - 2a - Limestone, weakly altered
  - 2b - Limestone, dolomitized
  - 2c - Limestone, silicified +/- dolomite
  - 2d - Limestone, includes 2c with zinc +/- lead +/- barite

Meters

0 50 100 200 300 400 500



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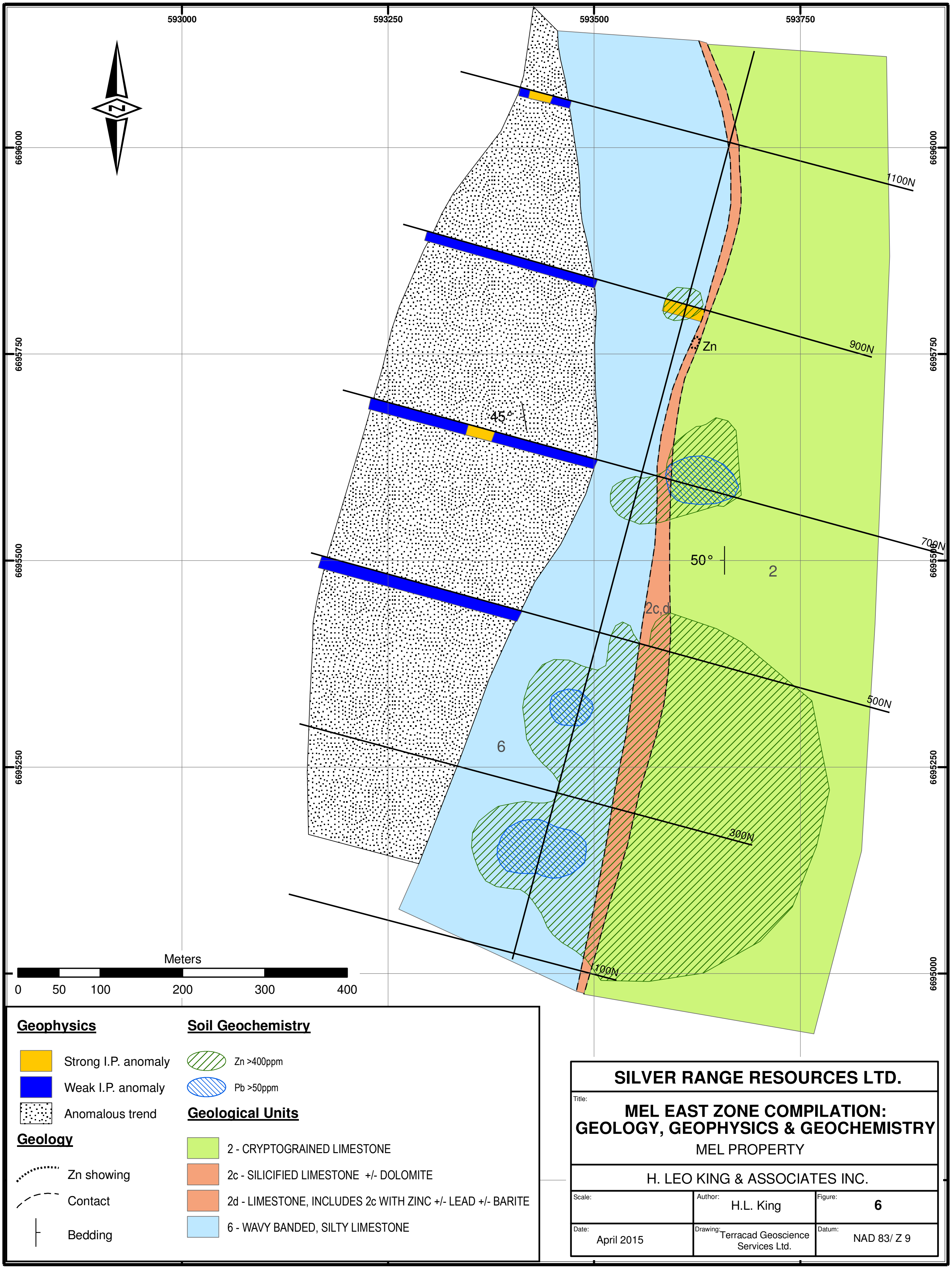
6697600

SILVER RANGE RESOURCES LTD.

Title: **JERI NORTH ZONE COMPILATION: GEOLOGY, GEOPHYSICS, GEOCHEMISTRY & DRILLING**
MEL PROPERTY

H. LEO KING & ASSOCIATES INC.

Scale:	Author: H.L. King	Figure: 5
Date: April 2015	Drawing: Terracad Geoscience Services Ltd.	Datum: NAD 83/ Z 9



593000
593250
593500
593750
6696000
6695750
6695500
6695250
6695000
N
1100N
900N
700N
500N
300N
100N
Zn
45°
50°
2
2c,d
6
Meters
0
50
100
200
300
400
Geophysics
Strong I.P. anomaly
Weak I.P. anomaly
Anomalous trend
Geology
Zn showing
Contact
Bedding
Soil Geochemistry
Zn >400ppm
Pb >50ppm
Geological Units
2 - CRYPTOGRAINED LIMESTONE
2c - SILICIFIED LIMESTONE +/- DOLOMITE
2d - LIMESTONE, INCLUDES 2c WITH ZINC +/- LEAD +/- BARITE
6 - WAVY BANDED, SILTY LIMESTONE
SILVER RANGE RESOURCES LTD.
Title:
MEL EAST ZONE COMPILATION:
GEOLOGY, GEOPHYSICS & GEOCHEMISTRY
MEL PROPERTY
H. LEO KING & ASSOCIATES INC.
Scale:
Author:
H.L. King
Figure:
6
Date:
April 2015
Drawing:
Terracad Geoscience Services Ltd.
Datum:
NAD 83/ Z 9

				width).
1976 - 1977	St. Joseph Explorations Ltd.	Mel, Jean & Wet	Staked more claims, geological mapping, geochemical and geophysical surveys	Soil and geophysical anomalies were identified over a 600 m length to the south of the Mel Main Zone.
1978 - 1979	St. Joseph Explorations Ltd.	Mel, Jean, Wet & Sov	Diamond drilling – 19 holes (4,054 m), metallurgical testwork	Mineral resource* estimated at 4,782,380 tonnes of 5.61% Zn, 2.05% Pb, 52.1% barite. Metallurgical testing yielded concentrates ranges from 60.9% to 64.7% Zn, 78.0% to 79.6% Pb, and 90.3% to 94.4% barite.
1981 - 1983	Sulpetro Minerals Ltd.	Joni, Keli, Edy, Hose, Jeri, Sin, Ott, Tomi, Yang, Ralfo, Mumbo, Chungo & Boz	Regional exploration, geochemical surveys, IP & gravity surveys	Mel East Zone zinc mineralization discovered. Large zinc soil anomaly defined in area of Mel East Zone.
1984	Sulpetro Minerals Ltd.	Joni, Keli, Edy, Hose, Jeri, Sin, Ott, Tomi, Yang, Ralfo, Mumbo, Chungo & Boz	Soil and silt sampling	Smithsonite discovered at Jeri Zone.
1985	Sulpetro Minerals Ltd.	Jeri & Sin	Diamond drilling (drilling on Jeri & Sin claims) – 10 holes (1,009.8 m)	Surface mapping and diamond drilling at the Jeri Zone showed significant zinc mineralization & alteration over a strike length of 550 m and through a vertical range of at least 100 m. Mineralization included 13.11% Zn over 3.37 m within silicified and dolomitized limestone.

1985	Sulpetro Inc.	Wet, Jean, Yang, Tomi, Ott, Sin & Jeri	Airstrip constructed, upgraded access road, and constructed tote road to Jeri Zone	Airstrip built and 5.5 km tote road completed to Jeri Zone.
1987	Novamin Resources Inc.	Jean	Diamond drilling – 7 holes (2,012 m)	Drilling extended the Mel Main Zone zinc-lead-barite mineralization to depth of 490 m. Mineral resource* estimated at 5,581,030 tonnes grading 6.63% Zn, 1.92% Pb, 49.64% barite.
1989	Barytex Resources Corp./ Breakwater Resources Ltd.	Jean	Diamond drilling – 4 holes (663 m). Carried out pre-feasibility study and barite marketing study.	Mineral resource* estimated at 5,687,993 tonnes grading 6.77% Zn, 1.92% Pb, and 51.1% barite. Marketing study results encouraging.
1990	Barytex Resources Corp./ Breakwater Resources Ltd.	Jean	Diamond drilling – 11 holes (1,552 m), bulldozer stripping of Mel Main Zone. Resource estimate completed based on 48 intersections from 42 diamond drill holes by Nevin Sadlier-Brown Goodbrand Ltd. Additional metallurgical testwork by Westcoast Mineral Testing Inc.	Stripping exposed north end of Mel Main Zone. Drill indicated mineral resource* at 5,238,000 tonnes grading 7.86% Zn, 2.09% Pb, 48.98% barite was estimated for the Mel Main Zone.
1993	International Barytex Resources Ltd.	Jeri, Sin, Hose, Andy & Sam	11 trenches excavated on Jeri Zone, geological mapping, staked 86 Sam claims, soil sampling on Jeri North Zone	Geological mapping traced favorable contact hosting Jeri Zone zinc mineralization over 9 km. Zinc mineralization was exposed over a 2.5 km section of the Jeri Zone. Assay results for Trench 4 averaged 10.7% Zn over a 5 m wide zone, and in Trench 5 averaged 16.5% Zn over a 5 m wide zone.

1994	International Barytex Resources Ltd.	Jean	Diamond drilling – 6 holes (3,122 m) completed on Mel Main Zone. Soil sampling north of Mel Main Zone and Jeri North Zone. Geophysical survey to south of Mel Main Zone.	Mineral resource* estimated by the company at 6,778,000 tonnes grading 7.1% Zn, 2.03% Pb, 54.69% barite.
1995	International Barytex Resources Ltd.	Jean & Sam	Diamond drilling – 8 holes (847.6 m) completed on Jeri North Zone. 2 holes (317.5 m) drilled on Jean claims south of Mel Main Zone. Geophysical and geochemical surveys.	Jeri North Zone drilling intersected zinc mineralization. Hole J-95-5 intersected 15.6% Zn over 5.1 m (core length) and Hole J-95-4 intersected 9.9% Zn over 5 m (core length). IP conductors and soil geochemical anomalies (Zn + Pb) were outlined along Jeri Zone horizon.
1996	Cominco Ltd.	Jean & Sam	Diamond drilling – 6 holes (1,189 m) on Jeri North Zone tested mineralized horizon over 1,000 m strike length. 1 hole drilled to south of Mel Main Zone. Soil sampling completed over 5.6 km of favorable zinc mineralized horizon on Jeri North Zone. Soil sampling on Mel East Zone.	Hole J-96-10 drilled on the Jeri North Zone, 200 m to the south of J-95-4 & J-95-5, intersected 12.38% Zn over a 3 m core length. To south of Mel Main Zone a diamond drill hole tested an IP anomaly but did not intersect the favorable contact zone. Soil sampling on Mel East Zone returned anomalous zinc results in an area 1,400 m long by 150 m wide.
1997	Cominco Ltd.	Jean, Sam & Joni	IP resistivity and soil geochemical surveys in 3 areas: south of Mel Main Zone, Mel East Zone, and southern part of Jeri Zone. Magnetic & gravity surveys conducted south of Mel Main Zone. Diamond drilling – 2	A number of geophysical and geochemical anomalies were identified in all zones surveyed. Carbonaceous mudstones were interpreted to be the source for the geophysical anomalies.

			holes (360.9 m) tested geophysical conductors located 1.5 km south of Mel Main Zone.	
2012	Kobex Minerals Inc.	Sam	Geochemical soil survey on Jeri North Zone.	Anomalous zinc in soil values were confirmed at several locations within the north trending Jeri North Zone. The soil survey results increased the resolution of the soil geochemical coverage.

* Mineral resources reported in this table are historical in nature and described below

The exploration programs and highlight results are summarized in the following paragraphs, while more detailed descriptions of results are provided in the appropriate sections below.

The Property was first staked by prospectors in 1967 and was subsequently acquired by Empire Metals Corporation Ltd. ("Empire"). Newmont Mining Corporation ("Newmont") optioned the Property and conducted a program of trenching and soil geochemical surveys in 1968. Five trenches dug by Newmont exposed the Mel Main Zone zinc-lead-barite mineralization over a strike length of 488 m. Samples taken from the trenches averaged 5.3% combined lead-zinc over widths from 2.3 to 9 m.

In September 1973, Newmont dropped its option and the Property reverted to Empire. Granby Mining Corp. ("Granby") then optioned the Property, and between 1974 and 1975, it conducted a diamond drill program of 18 holes (1,952 m). Granby's drilling intersected two parallel, north-striking, barite-sphalerite-galena zones, the Mel Main Zone and Mel Main North Extension (Figure 4). Mineralized intervals in the Mel Main Zone reportedly averaged 6.1 m true width, but only weak mineralization was intersected in the Mel Main Extension (Chisholm, 1973 and Wilkinson, 1975).

In January 1976, Empire changed its name to Sovereign Metals Corporation Ltd. ("Sovereign"). Later that year, St. Joseph Explorations Ltd. ("St. Joseph") optioned the Property from Sovereign and conducted geological mapping, geochemical and geophysical surveys. During 1978 and 1979, St. Joseph completed a 19 hole diamond drill program totaling 4,054 m (Miller, 1977 and 1979). Preliminary metallurgical testing conducted on drill core from the Mel Main Zone by Lakefield Research in 1978 yielded concentrates ranging from 60.9% to 64.7% Zn, 78.0% to 79.6% Pb and 90.3% to 94.4% barite.

In 1981, St. Joseph sold its 51% interest in the Property to Sulpetro Ltd. Following the sale, Sulpetro Minerals Ltd. ("Sulpetro") was established to hold the Property. Regional exploration conducted by Sulpetro in 1981 led to the discovery of the Mel East Zone, a zinc showing located 7.3 km northeast of the Mel Main Zone (Miller and Blanchflower, 1982). Limited geochemical surveys conducted by Sulpetro over the next two years defined a large zinc soil anomaly in the area of the Mel East Zone.

Geological mapping and geochemical soil sampling conducted in 1984 between the Mel Main Zone and the Mel East Zone recognized a zinc showing at the Jeri Zone, located 4 km north-northeast of the Mel Main Zone. During 1985, Sulpetro drilled 10 holes totaling 1,009 m to test the Jeri Zone (Miller, 1985). Nine of the 10 holes drilled over a strike length of 550 m intersected zinc mineralization. Significant zinc values were intersected in 4 of the holes: 3.37 m of 13.11% Zn in Hole J-85-1, 4.5 m of 7.96% Zn in Hole J-85-2, 2 m of 14.6% Zn in Hole J-85-4 and 4.24 m of 3.78% Zn in Hole J-85-5. Later that year, Sulpetro sold its interest to Novamin Resources Ltd. ("Novamin"), which in 1987 drill tested the Mel Main Zone at depth with 7 holes totaling 2,012 m. Drill results indicated that the zinc-lead-barite mineralization continued to a depth of 490 m below surface (Miller, 1987). Breakwater Resources Ltd. purchased Novamin in 1988, thus obtaining joint ownership of the Property with Barytex Resources Corp. ("Barytex"), formerly Sovereign.

In 1989, Barytex conducted a soil geochemical survey near the Jeri Zone and completed 4 diamond drill holes (663 m) on the Mel Main Zone. The drill program consisted of in-fill drilling at the north end of the Mel Main Zone and confirmed the continuity of the mineralization (Miller, 1989).

A 1989 pre-feasibility study by Sandwell Swan Wooster Inc. concluded that the Property was potentially viable and provided recommendations for further exploration and development (Morris, 1989). A barite marketing study (Slim, 1989) concluded that barite as a by-product could offer the opportunity for a viable commercial operation.

In 1990, Barytex conducted an in-fill drill program consisting of 11 diamond drill holes totaling 1,552 m plus surface stripping. Drilling between previous, widely spaced holes aided in the design of an open-pit (Miller, 1990).

A resource estimate, based on 48 intersections from 42 diamond drill holes, was prepared by consultants Nevin Sadlier-Brown Goodbrand Ltd. in a report dated October 9, 1990 (Croft, 1990). Additional metallurgical testwork by Westcoast Mineral Testing Inc. generally confirmed earlier metallurgical results (Hawthorn, 1990).

In November 1992, Barytex was reorganized and the company's name changed to International Barytex Resources Ltd. ("IBX").

During 1993, IBX staked another 86 claims to cover the northerly strike extension of the Jeri Zone and established 66 line-kilometres of grid. Geological mapping traced the favourable contact hosting the Jeri Zone zinc mineralization for a strike length of 9 km and discovered the Jeri North Zone. Eleven trenches excavated in 1993, exposed mineralization along a 2.5 km section of the Jeri Zone. The most significant assay results from trench sampling were obtained from trench 5, where a 5 m wide interval averaged 16.5% Zn and in trench 4, where a 5 m wide interval averaged 10.7% Zn (King, 1994a). At the Jeri North Zone, on the northern extension of the Jeri Zone, reconnaissance soil sampling was carried out on lines spaced 1,000 m apart from section 166N to 206N. Soil samples were taken at 25 m intervals along section lines that crossed the favorable contact zone.

In 1994, IBX established grid lines spaced 100 m apart from line 130N to 152N at the Jeri North Zone. Soil samples were collected at 25 m intervals along lines that crossed the favorable contact zone. A total of 59 soil samples were taken. The soil sampling revealed anomalous zinc and lead values along the favorable contact (King, 1994b).

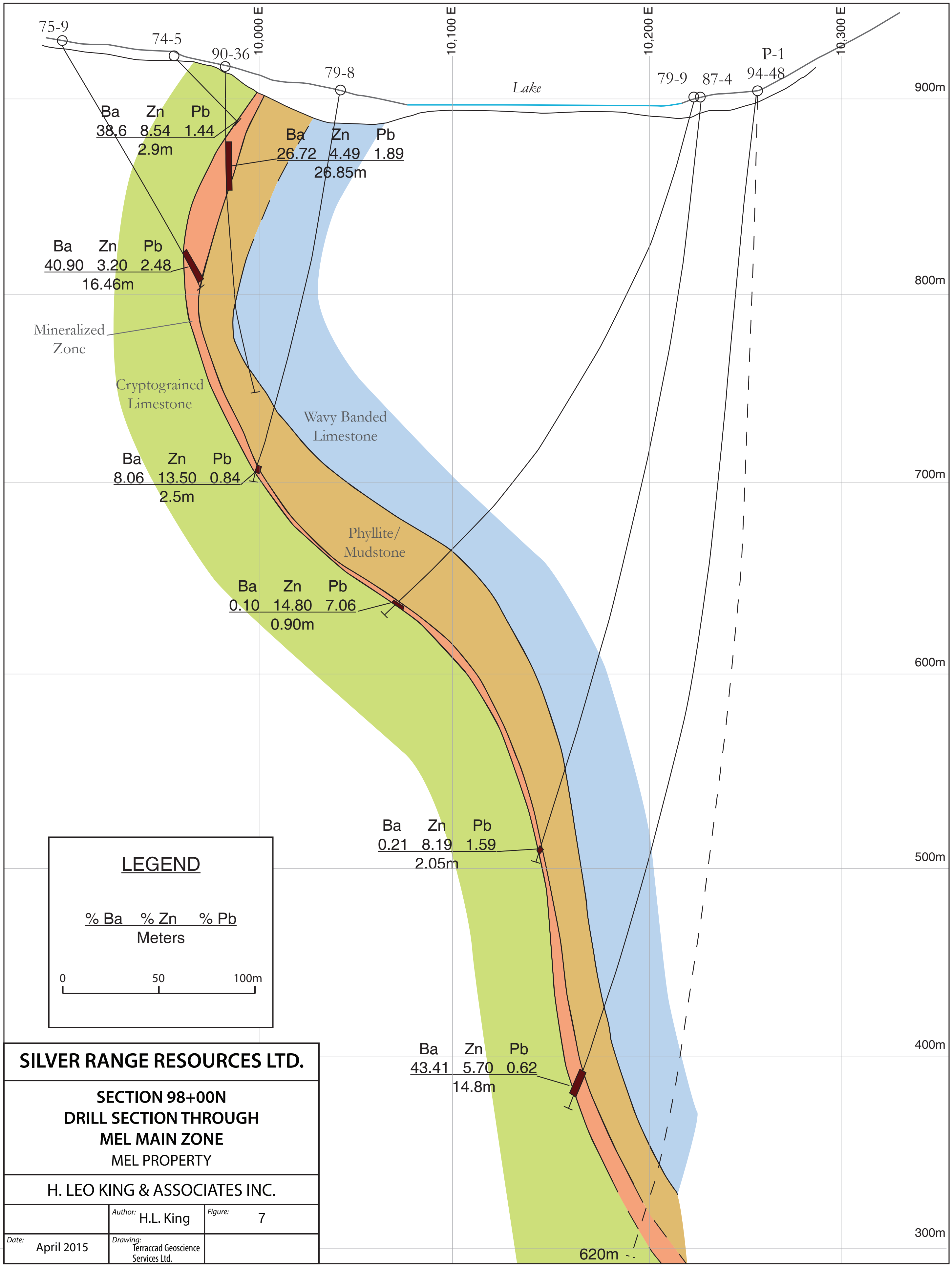
In 1994, six additional drill holes totaling 3,122 m were drilled by IBX at the Mel Main Zone. Higher grade intersections were obtained from those holes, with some intersections grading in excess of 12% combined lead-zinc. The highest grade intersection assayed 19.72% zinc over an estimated true thickness of 5.16 m (King, 1994b). This was the last drilling completed on the Mel Main Zone, and it remains open to extension down dip. A representative drill section through the Mel Main Zone is shown in Figure 7.

Geophysical surveys including magnetic, very-low-frequency (“VLF”) and IP surveys were carried out by IBX in 1994 over the southerly projection of the Mel Main Zone. VLF and magnetic coverage extended from lines 82N to 96N and IP surveys were conducted on lines 82N to 84N, 88+50N and 89N to 91N. The IP survey outlined a chargeability and resistivity anomaly on line 84N that is on-strike with the Mel Main Zone. The geophysical work was carried out by S.J.V. Consultants Ltd., a geophysical contractor.

Reconnaissance soil sampling was also carried out by IBX in 1994 on-strike and to the north of the Mel Main Zone from 114N to 134N. Samples were taken along grid lines spaced 200 m apart. Sample density varied from 10 m to 20 m spacings along the lines. A total of 54 soil samples were collected. No anomalous zinc or lead values were returned from this soil sampling (King, 1994b).

At the Jeri North Zone, soil sampling was done across a 2 km long segment of the favorable contact between cryptograined limestone and wavy-banded limestone in 1994 by IBX. Samples were taken at 25 m intervals along lines spaced 200 m apart. Anomalous soil geochemical zinc and lead values were returned on most lines sampled. Two zinc soil geochemical anomalies were outlined, one extending from line 131N to 143N, and the other from line 150N to 152N (Figure 5). IP geophysical surveys were carried out along lines 135N and 136N within one of these zinc soil anomalies. Strong chargeability highs were outlined on both lines, coincident with the zinc anomaly that marks the favorable contact between wavy-banded limestone and the underlying cryptograined limestone (King, 1994b)

In 1995, an IP survey was conducted by IBX on lines 85N and 86N, approximately one kilometre south of the Mel Main Zone. This survey defined coincident chargeability and resistivity anomalies that extend north from an anomaly identified on line 84N during the 1994 survey (Figure 3). Two diamond drill holes (317.5 m) were completed on Section 85N in an



SILVER RANGE RESOURCES LTD.

SECTION 98+00N
DRILL SECTION THROUGH
MEL MAIN ZONE
MEL PROPERTY

H. LEO KING & ASSOCIATES INC.

	Author: H.L. King	Figure: 7
Date: April 2015	Drawing: Terraccad Geoscience Services Ltd.	

attempt to explain the IP anomaly outlined on lines 84N to 86N. Minor graphite was noted in the core along several shear zones, which may explain the IP anomaly. However, the targeted contact zone between the wavy-banded limestone and the cryptograined limestone was not intersected (King, 1995).

Geochemical and geophysical surveys were conducted in 1995 by IBX at the Jeri North Zone. IP surveys were carried out on grid lines spaced 100 m apart, from lines 131N to 142N. Strong chargeability highs and corresponding resistivity lows, partially coincident with anomalous zinc soil geochemical values, were outlined over a strike length of 1,100 m (Figure 5).
A program of diamond drilling was carried out in 1995 by IBX to test the coincident IP and geochemical anomalies at the Jeri North Zone. Eight widely-spaced drill holes, totaling 847.6 m, tested the anomalous zone over a strike length of 2 km. This drilling intersected a sequence of intermediate volcanic flows and volcaniclastic sediments that are overlain by the relatively thin unit of calcareous phyllite/mudstone that forms the base of the wavy-banded limestone throughout much of the Property. A massive chert unit up to 5 m thick was intersected below of the volcanic-volcaniclastic sequence. In places, the chert rests directly on the basal cryptograined limestone unit but on other sections it is separated from the cryptograined limestone by a dolomitic horizon. Sphalerite was encountered mainly within the chert unit, with lesser amounts occurring in an overlying ash layer and in the underlying dolomitic horizon. Five of the 8 holes drilled intersected zinc mineralization, with two of these holes yielding high zinc assays: 15.6% Zn over a core length of 5.1 m in hole J-95-5 and 9.9% Zn over a core length of 5 m in hole J-95-4 (King, 1995).

In 1996, Cominco Ltd. (“Cominco”), under an option agreement with IBX, began exploration work on the Property. Work was carried out on the Jeri North and Mel East Zones and in an area immediately south of the Mel Main Zone.

One diamond drill hole was drilled 1.5 km south of the Mel Main Zone to test an IP anomaly believed to represent the southern extension of the favorable mineralized horizon hosting the Mel Main Zone. This drill hole did not reach the favorable contact zone.

At the Jeri North Zone, exploration work included 6 diamond drill holes totaling 1,189 m. These holes further tested zinc mineralization discovered in 1995. Drill hole J-96-10, located 200 m south along strike of holes J-95-4 and J-95-5 encountered 12.38% Zn over a 3 m core length. The other 5 holes drilled within this area intersected lower grade mineralization (Senft, 1996).

Cominco conducted additional soil sampling in 1996 to the north of the Jeri North Zone along grid lines from 149N to 224N. Several anomalous samples lie along the projected trace of the mineralized horizon.

At the Mel East Zone, Cominco conducted a soil sampling program to confirm the presence of the large zinc anomaly identified by Sulpetro during its 1983 exploration program. Strong zinc values were outlined over an area 1,400 m long by 150 m wide and open to the north, south and east. This anomaly is coincident with the favorable contact hosting the zinc showing referred to as the Mel East Zone and represents an attractive drill target.

In 1997, Cominco completed soil sampling in three areas on the Property. Four lines of soil sampling were completed south of the Mel Main Zone on lines 87N to 90N. Three lines of soil sampling were also completed at the Jeri Zone at 50 m intervals along lines spaced 200 m apart. A total of 39 samples were collected. In the area of the Mel East Zone, a single contour line of soil sampling totaling 39 samples was completed to cover the southern extension of the mineralized horizon (Senft and Hall, 1998).

During 1997, Cominco conducted IP and resistivity surveys in three areas: south of the Mel Main Zone, the Mel East Zone area, and an area in the southern part of the Jeri Zone. In addition, a magnetic survey and a limited gravity survey were conducted south of the Mel Main Zone. The geophysical program identified anomalies in all three areas surveyed. A compilation of the geophysical surveys carried on the Mel Main, Jeri, Jeri North and Mel East Zones are shown on Figures 3, 4, 5, and 6 respectively. Two drill holes totaling 360.9 m tested geophysical conductors located 1.5 km south of the Mel Main Zone. These holes intersected carbonaceous mudstones, which are interpreted to be a source for the geophysical anomalies, but neither of these drill holes cut the favorable contact that hosts the Mel Main Zone.

In 2012, Kobex Minerals Inc. ("Kobex") carried out a soil sampling program on a portion of the Jeri North Zone (Livingstone, 2012 and King, 2013). A total of 229 soil samples were collected and analyzed to fill in gaps in the 1996 soil sampling carried out at the Jeri North Zone by Cominco. Samples were collected from four separate grids along east-west lines spaced 100 m apart, with soil sampling stations spaced at 50 m intervals. Of the 229 samples collected, 12 returned anomalous zinc values, 12 returned anomalous lead values and 12 returned anomalous barium values. Results of the 2012 soil sampling program confirm the presence of elevated zinc in soils within all 4 of the previously established grids at the Jeri North Zone and extended 2 of the areas of anomalous zinc values (Figure 8). Lead values are typically low.

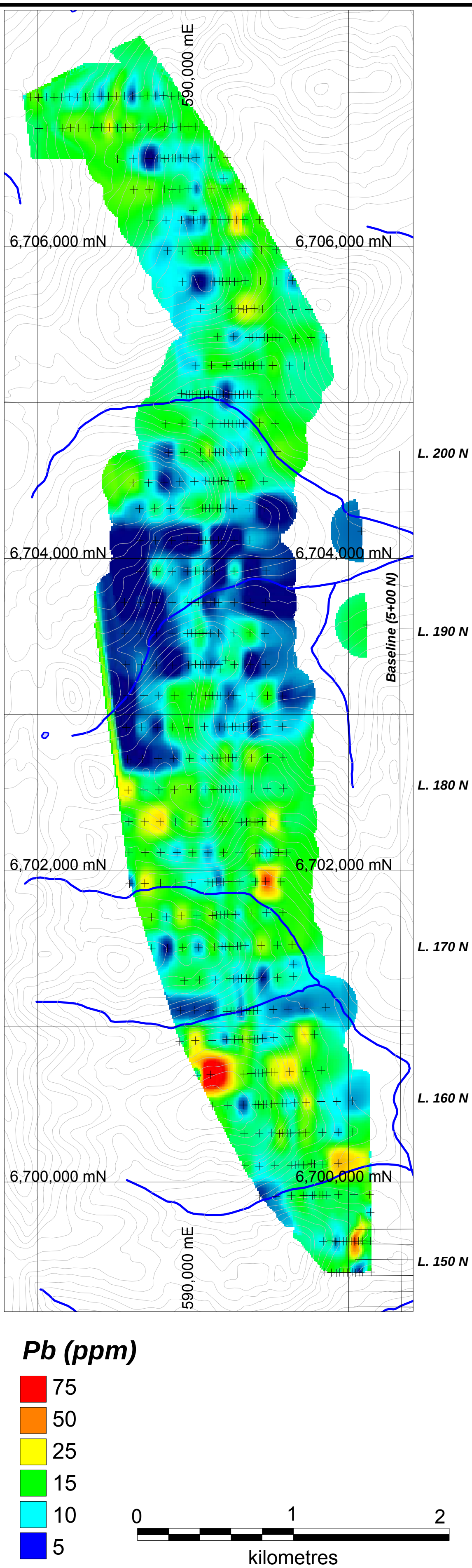
To date a total of 90 diamond drill holes (16,759 m) have been drilled on the Property. Appendix III contains data concerning locations, orientations and lengths of the drill holes. Appendix IV lists the significant mineralized intervals in the holes.

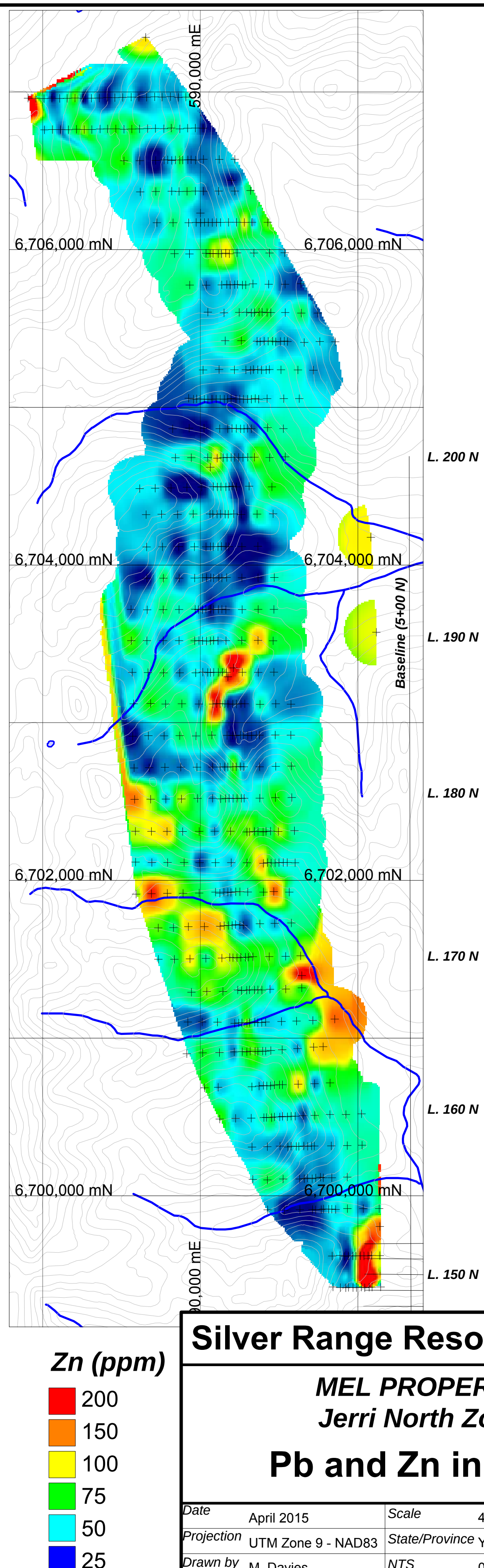
In June 2014, Sliver Range purchased the Property from Kobex, and in September 2014, Breakwater sold its NSR royalty to Whirlwind Capital Ltd.

GEOMORPHOLOGY

The Property is situated within the Liard Plateau on the southern fringe of the Logan Mountains. The terrain is characterized by subdued topography with local elevations ranging from 900 m at valley bottoms to 1,200 m at hill tops. The area was covered by the eastern limit of the Cordilleran Ice Sheet and is immediately west of the Laurentide Ice Sheet limit (Smith, 2000). In the Mel property area, a meltwater channel flows easterly across north-trending ridges. Ice-flow directions immediately north and south of the Mel property have been interpreted as northeasterly.

No stratigraphic sections of surficial material have been done on the Property; however, observations made during mapping suggest that moraine deposits are thin on high and mid-elevation slopes. This, coupled with unidirectional ice flow/dispersion trains, means that





Silver Range Resources Ltd.

MEL PROPERTY
Jerri North Zone

Pb and Zn in Soils

Date	April 2015	*Scale*	40,000	*Figure*
Projection	UTM Zone 9 - NAD83	*State/Province*	YT	8
Drawn by	M. Davies	*NTS*	095D/06	
H. Leo King & Associates Inc.		*File*	MelGeochem	

prospecting and soil geochemical sampling can be effective exploration techniques. Glaciofluvial deposits emanating from north-facing cirques are not considered good areas to prospect or sample, because the glaciofluvial material may be far-travelled and likely does not reflect underlying bedrock sources. At low elevations, up-valley advancing glaciation and thick fine-grained deposits have the potential to make drift prospecting and interpretation of geochemical results considerably more complicated (Kennedy, 2009).

The Property is entirely below tree line, and vegetation consists of spruce, pine and balsam with willow and alder comprising much of the understory. Most of the area is in varying stages of regeneration following forest fires.

Creeks draining the Property flow into the Coal and Rock rivers, which belong to the Liard River watershed. Water from small lakes and streams on the Property provide sufficient water for camp and diamond drilling requirements. There are ample areas suitable for potential plant sites, tailings storage and waste disposal on the Property.

The climate at the Property is characterized by long, cold winters and short, moderate summers. Precipitation is moderate and winter snow accumulation is in the order of 80 centimeters.

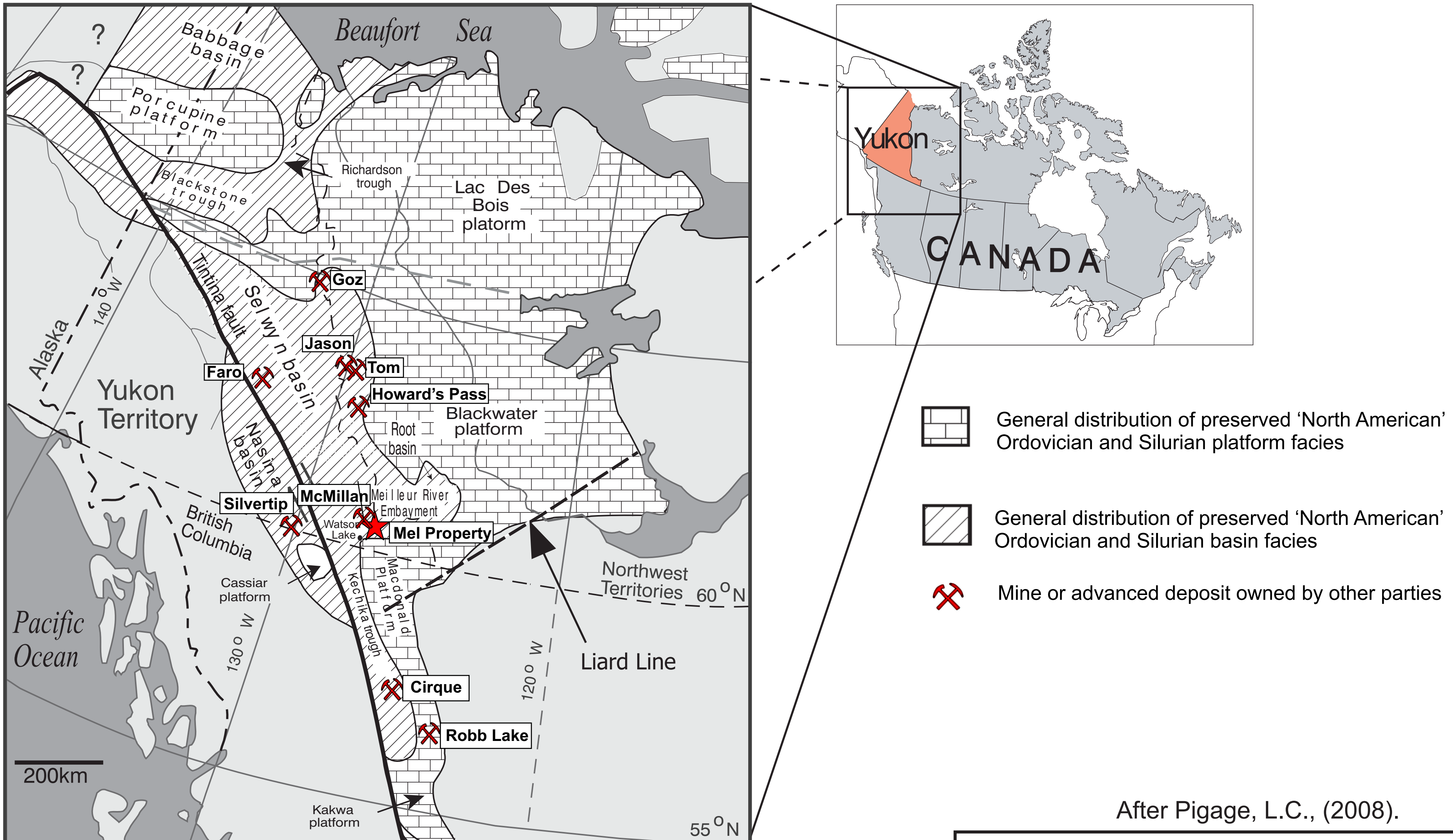
REGIONAL GEOLOGY

The Property is located within Selwyn Basin, a tectonic element comprising deep water clastic rocks and chert with minor carbonate and volcanic strata, which accumulated along the North American continental margin during Neoproterozoic and Paleozoic time. Selwyn Basin extends from Alaska through Yukon and western Northwest Territories into British Columbia (Figure 9). The basin is bounded to the northeast by a carbonate platform (MacDonald Platform), which comprises the near-shore facies of ancient North America (Abbott et al, 1986).

In the area of the Property, Selwyn Basin lies east of units belonging to the Cassiar, Slide Mountain and Yukon-Tanana terranes, which are pericratonic and oceanic terranes that were formed along the western margin of ancient North America in Paleozoic time. Deformation and metamorphism associated with accretion of these and other allochthonous terranes was initiated in Middle Jurassic and culminated in Tertiary time. The resulting transpressional/ transextensional orogenic belt is referred to as the Cordilleran orogen (Nelson and Colpron, 2007).

Post-accretion strike-slip movement along the Tintina Fault resulted in about 450 km of dextral offset, dismembering various terranes within the orogenic belt (Murphy and Mortensen, 2003). The Property is located about 40 km northeast of the Tintina Fault.

The Property is situated on the Coal River map sheet (NTS 95D), which was mapped by the Geological Survey of Canada in 1967 (Gabrielse and Blusson, 1969). More detailed mapping was conducted in the immediate vicinity of the Property by the Department of Indian and Northern Affairs in the early 1970s (Carne, 1976) and the Yukon Geological Survey in 2006 and 2007 (Pigage, 2008). Pigage’s maps and report incorporate many observations made by economic and academic geologists, who worked on the Property or studied rocks and minerals



After Pigage, L.C., (2008).

Location of Mel Project in southeast Yukon. General distribution of Ordovician-Silurian platform carbonate and basinal shale facies for Canadian Cordillera and Alaska are indicated. Modified from Cecile et al. (1997).

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FIGURE 9

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TECTONIC SETTING

MEL PROPERTY

DATE: APRIL 2015

taken from it. The following description of the regional geological setting is primarily based upon Pigage's report.

The Property lies immediately north of the boundary between Selwyn Basin and MacDonald Platform, near the junction between the main body of Selwyn Basin and the easterly trending Meilleur River Embayment (Figure 9). Eight predominantly sedimentary units, ranging from Neoproterozoic to Lower Carboniferous, have been mapped in the area. All of these units have been deformed with east-verging, asymmetric, north-trending folds related to easterly-directed thrust faults. Interpretation of the fold pattern indicates amplitudes of 500 to 2000 m. Northeasterly trending normal faults are younger than the folds and thrust faults. The period of compressional deformation started later than Early Triassic and ended before Late Eocene, based on evidence from adjacent map sheets (Pigage, 2008).

Table II shows the names, ages and general lithologies for the units that occur near the Property. All of the known mineral occurrences on the Property lie within the Rabbitkettle Formation. Where present, argillaceous rocks typically exhibit pervasive axial-planar slaty cleavage.

Table II: Regional Lithological Units

Age	Unit Name	Lithological Description
Devonian-Carboniferous	Besa River Formation (DCBR)	Tan-orange to tan-weathering, striped, greenish-grey generally noncalcarous argillaceous siltstone with some beds of dark grey siltstone and localized argillaceous sandstone and limestone conglomerate.
Silurian-Devonian	MacDonald Platform carbonates (SDc)	Thick assemblage of carbonate rocks including several locally undifferentiated formations.
Silurian-Devonian	Road River Group (SDRR)	Thick bedded, noncalcarous, graptolitic, dull black, silty shale and underlying thinly interbedded black chert and grey-weathering black silty dolostone.
Ordovician	Sunblood Formation (OSu)	Predominantly thick-bedded, pale grey, laminated to bioturbated dolostone interbedded with thick-bedded dark grey, bioturbated dolostone.
Cambian-Ordovician	Rabbitkettle Formation (ЄOR & ЄOR 1)	ЄOR – light grey to brownish-grey weathering, silty to argillaceous, locally nodular limestone, informally called "wavy-banded limestone", with interbeds of pale grey, fine grained massive limestone.

		ЄOR1 – local subunit of up to 150 m thick, massive light grey to off-white, very fine grained limestone.
Neoproterozoic	Vampire Formation (pЄV)	Dark grey-green, fissile, pinstriped, noncalcarous, silty phyllite and massive, cream-grey weathering, quartz sandstone with minor conglomerate.
Neoproterozoic	Narchilla Formation Hyland Group (pЄN)	Medium green to silvery-tan weathering, thin-bedded, noncalcarous phyllite sometimes with interbeds of white, fine-grained, laminated quartz sandstone; occasionally green phyllite with local maroon phyllite interbeds.

PROPERTY GEOLOGY

Figure 10 illustrates geology in and around the main areas of interest on the Property, along with the locations of the known mineral zones, all of which are located within or atop Unit ЄOR1, a sub-unit of the Rabbitkettle Formation. Three of the 4 main areas of interest occur within a north trending syncline that is cored by Sunblood Formation. The Mel Main Zone lies on the western, overturned limb of the syncline, while the Jeri and Jeri North Zones are on the eastern limb. The exposure of the Unit ЄOR1 at the Mel East Zone could represent a second limestone horizon or a folded repeat or faulted-offset of the horizon observed at the Jeri and Jeri North Zones. The faulted-offset option is favored by economic geologists who have worked on the Property.

On the Property, Unit ЄOR1 is up to 150 m thick and consists of massive light grey to off-white, cryptograined limestone that typically contains faint, white calcite and tan siderite veinlets. It is sandwiched within a thicker section of Unit ЄOR wavy-banded, argillaceous limestone. At the Mel Main Zone, Unit ЄOR1 is overlain by an up to 20 m thick lens of mineralized rock, which is capped by a 10 to 45 m thick layer of pale green to cream noncalcarous phyllite to mudstone. The lensy phyllite/mudstone subunit is also present in the southern part of the Jeri Zone and at the Mel East Zone. At the Jeri North Zone, Unit ЄOR1 is locally overlain by a mineralized chert horizon that lies at the base of a 30 m thick section of Unit ЄOv basaltic flows and tuffs.

MINERALIZATION

Three of the 4 zones of mineralization that have been identified on the Property occur within strata deposited directly atop Unit ЄOR1, while the fourth zone (Jeri Zone) is hosted mainly within hydrothermally altered rocks that are thought to be equivalent to the Unit ЄOR1 cryptograined limestone. The Mel Main Zone is exposed within the western limb of the main syncline on the Property, while the Jeri and Jeri North are located 3 km apart on the eastern limb of the syncline. The Mel East Zone lies within a separate horizon of Unit ЄOR1 or a fold repeated or faulted-offset of the horizon that hosts the Jeri and Jeri North Zones. Three of the zinc-rich zones, the Mel Main, Jeri and Jeri North Zones, have been tested by drilling.

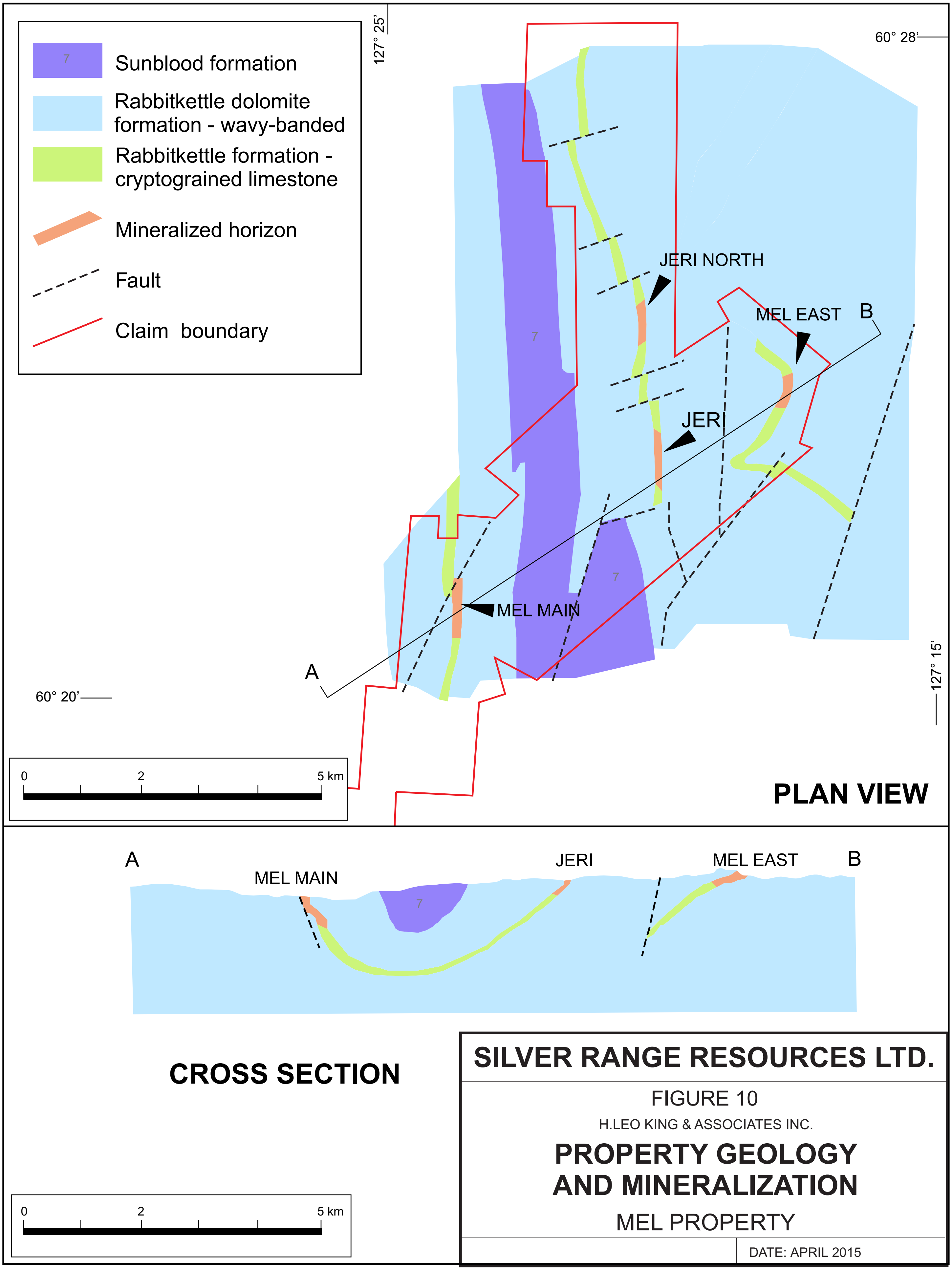

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FIGURE 10

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PROPERTY GEOLOGY AND MINERALIZATION

MEL PROPERTY

DATE: APRIL 2015

The zinc-lead-barite mineralization at the Mel Main Zone and zinc showings at the south-end of the Jeri Zone and in the Mel East Zone, all occur within a stratigraphic sequence consisting of underlying Unit ЄOR1 cryptograined limestone and overlying phyllite/mudstone subunit, which grades upward into Unit ЄOR wavy-banded argillaceous limestone. The stratigraphic sequence hosting the Jeri North Zone is similar except that the mineralization occurs in a chert horizon, between the basal cryptograined limestone unit and an overlying volcanic flow and volcaniclastic sequence that is capped by the wavy-banded argillaceous limestone. The stratigraphic sections at the various zones are compared on Figure 11, and the zones are individually described in the following sub-sections.

MEL MAIN ZONE

At the Mel Main Zone, mineralization consists of coarse-grained sphalerite, galena and barite disseminated throughout a mixture of mudstone, silica and carbonate. Minor amounts of fine-grained, sparsely disseminated pyrite occur locally, but overall, pyrite accounts for less than 2% of the sulphides.

The Mel Main Zone is a disc-shaped and stratigraphically controlled body, which rests disconformably on unaltered cryptograined limestone. The mineralization is located on the steeply dipping, western limb of a major syncline and is slightly deformed by a secondary fold (Figure 7).

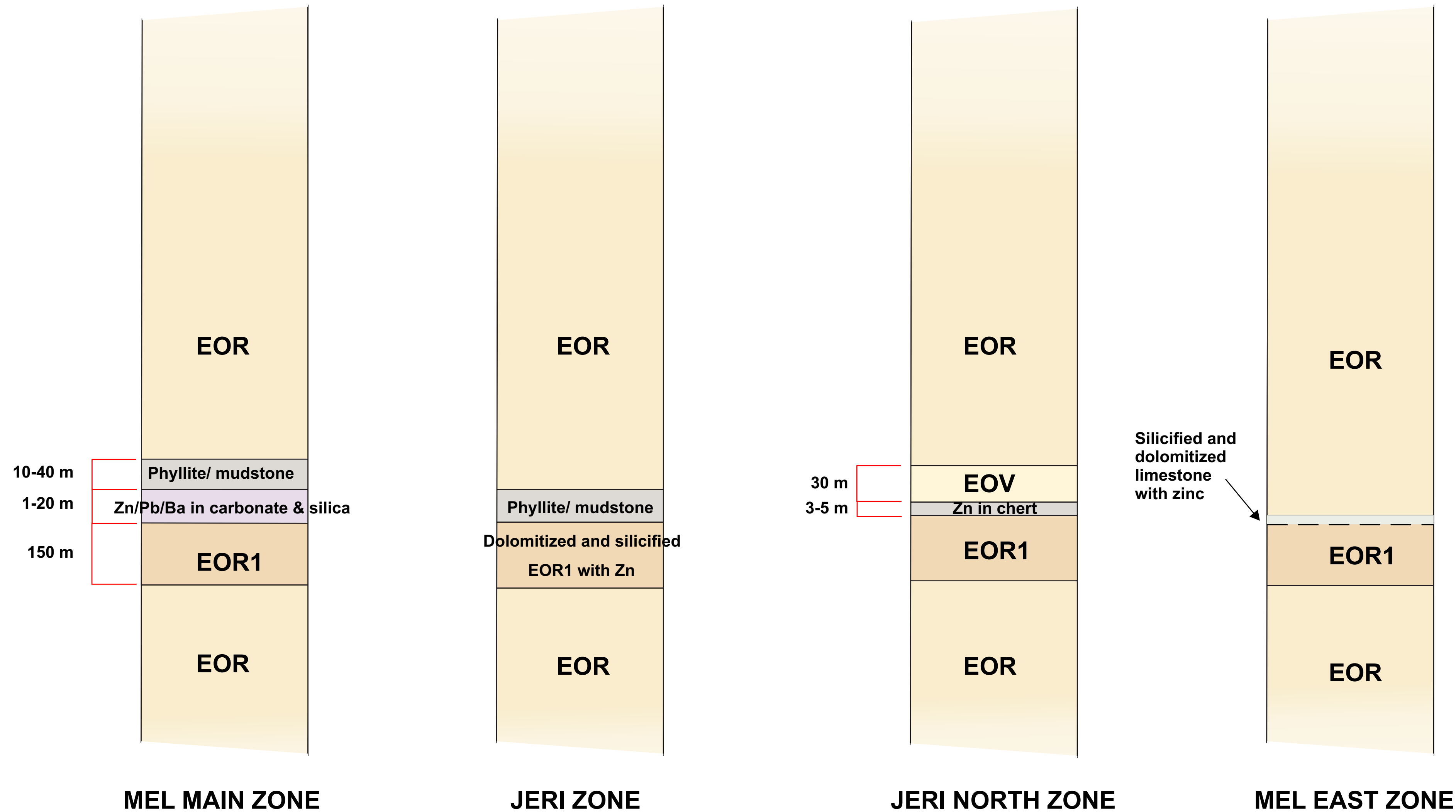
Trenching and diamond drilling have delineated the mineralized zone over a strike length of about 700 m and from surface to a depth of 500 m down dip. The true thickness of the zone varies from less than 1 m at each end to a maximum of 17.9 m in the central portion.

In the upper part of the zone, the central portion of the mineralized body consists of massive barite with moderate zinc and lead contents. The highest grade zinc and lead values occur at the margins of the zone where it thins and barite content decreases. The zone narrows at a depth of about 400 m below surface and then widens again to form an hour-glass pattern. Below 500 m, the mineralized body appears to thicken again and there is corresponding increase in barite content. The mineralized zone remains open to extension at depth (Figure 12).

An Inferred Mineral Resource for the Mel Main Zone is estimated at 5,380,000 tonnes grading 6.45% Zn, 1.85% Pb and 44.79% barite, at a 5% zinc-equivalent cut-off (see Technical Report Section).

JERI ZONE

Mineralization at the Jeri Zone is atypical on the Property because it is hosted in altered, limestone considered to be the equivalent of the cryptograined limestone, which underlines the Mel Main Zone. The zinc mineralization in the Jeri Zone is, in part, discordant to bedding and is hosted in hydrothermal dolomite and silicified dolomite. This type of strong footwall alteration is exposed along the eastern fold limb of the main syncline for a strike length of about 8 km.



	Noncalcaerous phyllite/mudstone
EOV	Basaltic volcanic flows and volcaniclastics
EOR1	Cryptograined limestone
EOR	Wavy-banded argillaceous limestone

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FIGURE 11

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COMPARATIVE STRATIGRAPHIC SECTIONS OF MINERALIZED ZONES

MEL PROPERTY

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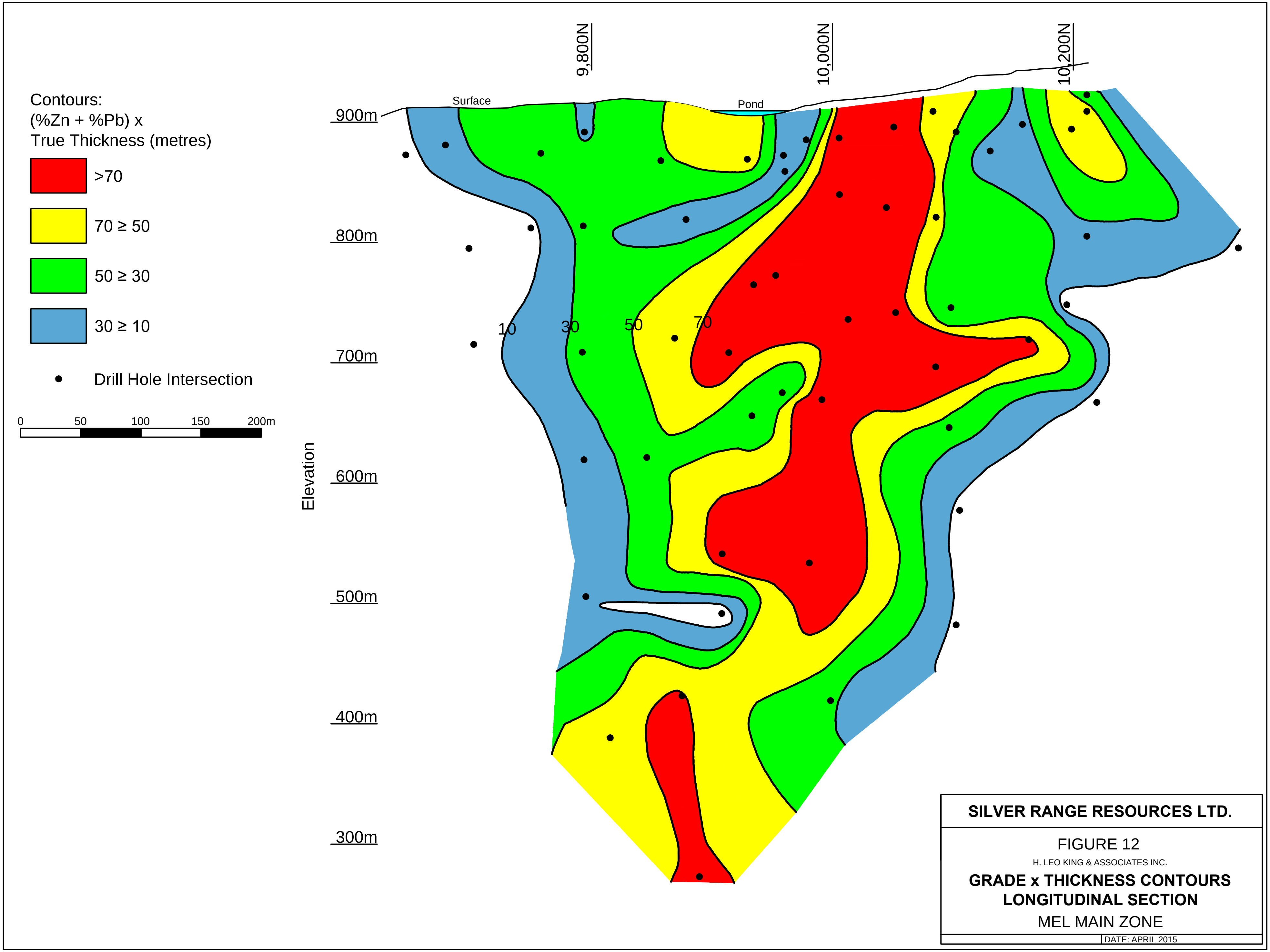

Contours:
(%Zn + %Pb) x
True Thickness (metres)
>70
70 ≥ 50
50 ≥ 30
30 ≥ 10
Drill Hole Intersection
0
50
100
150
200m
9,800N
10,000N
10,200N
Surface
Pond
900m
800m
700m
600m
500m
400m
300m
Elevation
10
30
50
70
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FIGURE 12
H. LEO KING & ASSOCIATES INC.
GRADE x THICKNESS CONTOURS
LONGITUDINAL SECTION
MEL MAIN ZONE
DATE: APRIL 2015

At the Jeri Zone, the footwall limestone is locally silicified, dolomitized and brecciated at, and immediately beneath, the contact with the overlying phyllite/mudstone. The altered and brecciated limestone commonly contains zinc minerals, smithsonite and sphalerite. Geochemically elevated lead values have been reported, but no economically significant lead mineralization has been identified. Barite is present as a gangue mineral in quartz veins but does not appear to be sufficiently abundant to be economically important. The presence of the zinc carbonate mineral, smithsonite, suggests that some zinc mineralization may be secondary.

Ten holes totalling 1,009 m have tested the Jeri Zone (Figure 13). Nine of the holes, drilled over a strike length of 550 m, intersected zinc mineralization. Significant intersections of smithsonite and sphalerite from the drilling include 3.37 m of 13.11% Zn in Hole J-85-1, 4.5 m of 7.96% Zn in Hole J-85-2 and 2 m of 14.6% Zn in Hole J-85-4.

Eleven trenches were excavated across the Jeri Zone along a 2.5 km segment of the favourable horizon. Significant zinc values were obtained from: Trench No. 3, which assayed 5.3% Zn over a sample width of 7 m; Trench No. 4, which returned 10.5% Zn over a sample width of 5 m; and, Trench No. 5, which returned 16.5% Zn over a sample width of 5 m. The mineralization in trenches consisted of disseminated smithsonite and minor sphalerite hosted in silicified and dolomitized limestone. The work conducted to date on the Jeri Zone is not sufficient to allow a resource estimate.

About 3 km of favourable stratigraphy between the Jeri and Jeri North Zones remains to be tested by trenching or drilling.

JERI NORTH ZONE

Geological mapping has traced the altered limestone horizon hosting the Jeri Zone for 8 km northward through the Jeri North Zone, where diamond drilling discovered zinc mineralization within an extensive chert horizon, which overlies cryptograined limestone and underlies volcanic flows and tuffs. The best drill results were obtained in 1995 from: Hole J-95-4, which intersected 9.9% Zn over 5 m (4.7 m estimated true width); and, Hole J-95-5, which was drilled on the same section line and intersected 15.6% Zn over 5.1 m (3.1 m estimated true width) 70 m down dip from the J-95-4 intersection.

Sphalerite occurs mostly within the chert horizon but also occurs in lesser amounts within an overlying ash layer and underlying dolomitized limestone. The sphalerite within the chert is very coarse grained where observed in drill core.

In 1996, additional drilling was completed in an attempt to expand the zone of zinc mineralization intersected in Holes J-95-4 and J-95-5 (Figure 14). One of these holes, J-96-10, was drilled on-strike 200 m to the south of J-95-4 and intersected two intervals containing significant sphalerite. One interval assayed 3.39% Zn over 2.1 m of core length, and the other interval returned 12.38% Zn over 3.0 m of core length. However, holes that tested further down dip and on-strike of the above-mentioned intersections failed to encounter significant zinc mineralization, thus limiting the potential size of the known zone to about 400 m in strike length and 100 m down dip.

The discovery of zinc mineralization at the Jeri North Zone indicates there is potential for discovery of additional deposits of stratigraphically controlled zinc mineralization elsewhere along the east limb of the syncline on the Property.

MEL EAST ZONE

At the Mel East Zone, zinc mineralization occurs as smithsonite at the contact between cryptograined limestone and wavy-banded limestone on a faulted-offset(?) segment of the eastern fold limb. Three grab samples taken in 1981 from 3 separate small outcrops averaged 9.6% Zn. Subsequent soil sampling revealed a 1,400 m long, zinc-in-soil geochemical anomaly that coincides with the projected surface trace of the mineralized contact. No trenching or diamond drilling has been done at the Mel East Zone.

HISTORICAL DIAMOND DRILLING

MEL MAIN ZONE

Between 1974 and 1994, a total of 13,107.6 m of diamond drilling was completed in 64 holes within Mel Main Zone. The holes were designed to test the extent and grade of the zinc-lead-barite zone at depth. Only visibly mineralized drill intervals were sampled. Approximate drill hole locations are shown on Figure 3 (re-surveying of some holes may not be possible due to forest fire activity on the Property over the past 20 years). Drill hole data and types of mineralization found within the holes are listed in Table III below.

Table III: Mel Main Zone – Historical Diamond Drill Hole Data and Visual Results

Hole	Year	Azimuth (º)	Dip Angle (º)	Length (m)	Comments and/or Mineralization Type
74-1	1974	093	-45	62.7	Zinc + lead + barite
74-2	1974	093	-45	52.1	Zinc + lead + barite
74-3	1974	000	-90	92.1	Incomplete. Hole bottomed in massive grey limestone
74-4	1974	093	-60	48.2	Zinc + lead + barite
74-5	1974	093	-45	51.5	Zinc + lead + barite
74-6	1974	093	-45	64.3	Zinc ± lead + silica
74-7	1974	093	-45	118.3	No mineralization. Drilled under West zone.
74-8	1974	093	-45	74.2	Zinc + lead + barite
75-9	1975	093	-60	146.6	Zinc + lead + barite
75-10	1975	093	-65	283.8	No mineralization. Hole deflected. Failed to reach footwall.
75-11	1975	093	-55	126.5	Zinc + lead + barite
75-12	1975	093	-50	157.0	Zinc + lead + barite
75-13	1975	093	-45	202.1	Zinc ± lead
75-14	1975	093	-60	130.2	No mineralization. Drilled north of Mel Main zone.
75-15	1975	093	-60	151.5	No mineralization. Drilled north of Mel Main zone.

75-16	1975	093	-60	50.3	No mineralization. Drilled under West zone.
75-17	1975	093	-60	53.7	No mineralization. Drilled under West zone.
75-18	1975	093	-45	102.4	West zone. Lead-zinc. Drilled under West zone.
78-1	1978	092	-60	215.5	Drilled outside the zone.
78-2	1978	092	-45	46.3	Drilled outside the zone.
78-3	1978	092	-55	29.6	Drilled outside the zone.
78-4	1978	092	-65	299.0	Drilled outside the zone.
78-5	1978	103	-50	102.4	Drilled outside the zone.
78-6	1978	000	-90	200.0	Zinc + lead + barite
78-7	1978	000	-90	157.6	Zinc + lead + barite
79-1	1979	090	-50	114.9	Zinc - lead + barite
79-2	1979	000	-90	231.3	Zinc + lead + barite
79-3	1979	000	-90	306.6	Zinc + lead + barite
79-4	1979	270	-57	262.1	Zinc + lead + barite
79-5	1979	270	-77	275.2	Zinc + barite
79-6	1979	270	-58	336.2	Zinc + lead - barite
79-7	1979	270	-70	260.0	Zinc + lead + barite
79-8	1979	270	-80	206.3	Zinc - lead ± barite
79-9	1979	274	-74	321.8	Zinc + lead - barite
79-10	1979	270	-59	213.3	Very minor zinc-lead mineralization.
79-11	1979	000	-84	289.3	Zinc + lead + barite
79-12	1979	065	-50	169.2	Zinc + lead + barite ± quartz
87-1	1987	273	-50	133.2	Drilled outside the zone.
87-2	1987	273	-60	38.7	Drilled outside the zone.
87-3	1987	273	-85	66.8	Drilled outside the zone.
87-4	1987	273	-76	515.7	Zinc + barite
87-5	1987	273	-77	399.6	Zinc + lead
87-6	1987	273	-79	448.1	Zinc - lead
87-7	1987	273	-81.5	410.0	Zinc + lead
89-30	1989	272	-85	184.1	Zinc + lead + barite
89-31	1989	272	-88	220.1	Zinc + lead + barite
89-32	1989	272	-87	204.2	Zinc + lead + barite
89-33	1989	272	-89.5	54.6	Zinc + lead + barite
90-34	1990	092	-60	143.6	Zinc - lead + barite
90-35	1990	000	-90	203.0	Zinc + lead + barite
90-36	1990	000	-90	167.0	Zinc + lead + barite
90-37	1990	090	-69	142.1	Minor zinc-lead-barite mineralization.
90-38	1990	090	-75	133.2	Zinc ± lead + barite
90-39	1990	090	-46	64.6	Zinc ± lead
90-40	1990	090	-70	134.1	Zinc + barite
90-41	1990	000	-90	152.7	Zinc + lead + barite
90-42	1990	092	-71	249.0	Zinc + lead + barite
90-43	1990	042	-45	43.3	Zinc + lead + barite
94-44	1994	278	-60	428.9	Zinc + lead + barite

94-45	1994	278	-68	462.1	Zinc ± lead
94-46	1994	266	-68	660.3	Zinc + lead + barite
94-47	1994	276	-68	542.5	Zinc + lead + barite
94-48	1994	266	-83	542.9	Zinc ± lead + barite
94-49	1994	282	-73	359.0	Zinc + lead

Most of the holes intersected the Mel Main Zone as planned. The primary gangue minerals include quartz, calcite, sericite and minor pyrite, while ore minerals comprise sphalerite, galena and barite, with trace amounts of chalcopyrite, covellite and tetrahedrite.

The best intervals from the Mel Main Zone holes are listed in Table IV below.

Table IV: Mel Main Zone – Historical Diamond Drilling Assay Highlights

Hole	From (m)	To (m)	Interval (m)	Zinc (%)	Lead (%)	Barite (%)
74-1	35.20	44.20	8.86	5.86	2.38	65.00
74-2	33.83	47.09	12.81	4.82	2.20	63.10
74-4	37.03	46.63	9.13	6.16	1.13	48.30
74-5	46.02	48.92	2.87	8.62	1.55	65.60
74-8	66.29	70.87	4.41	9.07	2.88	54.50
75-9	131.67	139.60	3.97	7.09	1.93	63.18
75-11	110.64	118.11	4.80	4.79	1.76	69.55
78-6	179.22	187.15	6.56	5.55	5.03	69.56
78-7	128.32	146.61	10.49	5.02	2.39	71.61
79-1	89.00	104.00	12.29	7.84	0.22	68.10
79-2	222.00	230.40	7.27	13.63	1.74	26.15
79-3	22.05	28.90	4.84	4.41	4.80	53.50
79-4	246.68	255.80	8.98	6.74	2.97	63.72
79-6	328.80	331.50	2.61	8.78	8.45	3.08
79-7	245.40	255.10	9.55	5.00	5.55	43.23
79-8	198.80	201.30	2.46	13.50	0.84	13.70
79-9	312.90	313.80	0.78	14.80	7.06	0.20
79-11	277.20	285.70	6.51	4.64	1.56	36.99
87-4	499.60	509.93	6.67	12.08	0.02	60.22
87-5	388.96	394.10	5.16	23.17	2.31	0.07
89-30	32.40	46.00	6.80	6.61	1.08	64.06
89-31	205.70	215.70	7.07	8.43	2.41	42.17
89-32	44.30	60.00	8.85	5.14	3.18	51.60
89-33	25.15	40.17	8.62	10.07	0.39	65.30
89-33	158.10	171.30	7.76	7.72	2.19	68.30
90-34	79.90	111.10	17.90	9.37	0.50	59.27
90-35	46.70	59.70	7.46	5.43	2.11	63.22
90-35	187.50	198.10	7.50	4.61	3.72	74.77
90-36	33.30	45.30	6.88	7.09	1.48	60.17

90-39	45.58	48.93	2.90	9.76	0.73	0.70
90-41	102.95	105.68	1.37	2.55	9.91	50.93
90-41	124.90	143.36	10.53	6.57	2.66	63.03
90-42	36.00	38.90	2.22	9.24	1.88	40.99
90-43	30.80	34.10	2.70	6.35	3.16	56.67
94-44	395.80	397.50	1.30	17.78	5.76	0.19
94-44	409.05	419.00	7.62	6.48	4.06	0.10
94-46	640.90	650.90	9.40	5.89	2.66	70.63
94-46	642.70	648.70	5.64	6.97	2.62	69.25
94-47	530.20	536.80	5.70	4.00	1.33	54.05
94-47	533.68	536.80	2.70	6.50	1.13	67.42
94-48	521.90	535.40	9.60	5.98	0.67	77.47

JERI ZONE

In 1985 a total of 1009.8 m of diamond drilling was completed in 10 holes within the Jeri zone. The holes were designed to test the extent and grade of the zinc mineralization at depth. Only visibly mineralized drill intervals were sampled. Approximate drill hole locations are shown on Figure 4 (re-surveying of some holes may not be possible due to forest fire activity on the Property over the past 20 years). Drill hole data and types of mineralization found within the holes are listed in Table V below.

Table V: Jeri Zone – Historical Diamond Drill Hole Data and Visual Results

Hole	Year	Azimuth (º)	Dip Angle (º)	Length (m)	Comments and/or Mineralization Type
J-85-1	1985	90.00	-50.00	98.1	Sphalerite in dolomitized-silicified Limestone.
J-85-2	1985	90.00	-48.00	105.8	Sphalerite ± pyrite
J-85-3	1985	90.00	-70.00	148.4	Sphalerite ± pyrite
J-85-4	1985	90.00	-49.00	99.7	Sphalerite ± pyrite
J-85-5	1985	90.00	-70.00	90.5	Minor fine-grained pyrite.
J-85-6	1985	90.00	-49.00	118.9	Sphalerite ± pyrite
J-85-7	1985	90.00	-47.00	89.0	Sphalerite
J-85-8	1985	90.00	-47.00	86.0	No mineralization.
J-85-9	1985	90.00	-46.00	105.8	Sphalerite with minor smithsonite.
J-85-10	1985	90.00	-50.00	67.7	Minor sphalerite

All but one of the Jeri diamond drill holes intersected the mineralized zone. The primary gangue minerals include brecciated and silicified limestone, while ore minerals were primarily sphalerite and smithsonite.

The best intercepts from the Jeri Zone holes are listed in Table VI below.

Table VI: Jeri Zone – Historical Diamond Drilling Assay Highlights

Hole	From (m)	To (m)	Interval (m)	Zinc (%)
J-85-1	2.43	5.80	3.32	13.11
J-85-2	50.00	51.40	1.40	5.65
J-85-2	59.05	61.50	2.30	3.17
J-85-2	72.60	77.18	4.15	7.96
J-85-3	15.30	16.33	0.73	3.84
J-85-4	59.65	61.80	1.65	14.60
J-85-5	50.00	54.25	3.00	3.78
J-85-6	21.00	21.50	0.47	2.02
J-85-7	37.54	40.23	2.10	1.50
J-85-9	67.80	70.30	2.50	1.95

JERI NORTH ZONE

Between 1995 and 1996, a total of 2036.6 m of diamond drilling in 14 holes was completed in the Jeri North Zone. As in the Mel Main and Jeri zones, the mineralization in the Jeri North Zone occurs at the contact with the footwall cryptograined limestone and the hanging wall wavy banded limestone. The holes were designed to test the extent and grade of the zinc mineralization at depth. Only visibly mineralized drill intervals were sampled. Approximate drill hole locations are shown on Figure 5 (re-surveying of some holes may not be possible due to forest fire activity on the Property over the past 20 years). Drill hole data and types of mineralization found within the holes are listed in Table VII.

Table VII: Jeri North Zone – Historical Diamond Drill Hole Data and Visual Results

Hole	Year	Azimuth (º)	Dip Angle (º)	Length (m)	Comments and/or Mineralization Type
J-95-1	1995	90.00	-60.00	146.90	Sphalerite in dolomitic limestone with minor barite.
J-95-2	1995	90.00	-60.00	126.80	Few sphalerite grains in cryptocrystalline limestone.
J-95-3	1995	90.00	-60.00	117.00	Minor smithsonite.
J-95-4	1995	90.00	-60.00	104.80	Coarse-grained sphalerite in chert matrix.
J-95-5	1995	90.00	-60.00	139.00	Coarse-grained sphalerite in chert matrix.
J-95-6	1995	90.00	-60.00	87.20	No mineralization.
J-95-7	1995	90.00	-60.00	50.60	No mineralization.
J-95-8	1995	90.00	-60.00	75.30	No mineralization.
J-96-9	1996	90.00	-60.00	218.20	Sphalerite in dolomitized, silicified limestone, minor pyrite.
J-96-10	1996	90.00	-60.00	218.20	Sphalerite in dolomitized, silicified limestone.
J-96-11	1996	90.00	-86.00	105.50	Sphalerite in dolomitized, silicified limestone, quartz veinlets, trace pyrite.

J-96-12	1996	90.00	-77.00	244.10	No mineralization.
J-96-13	1996	90.00	-75.00	181.70	No mineralization.
J-96-14	1996	90.00	-77.00	221.30	Disseminated sphalerite in quartz breccia zone.

Several of the Jeri North diamond drill holes failed to intersect the mineralized zone. The primary gangue minerals include brecciated and silicified limestone, while ore minerals were primarily sphalerite and smithsonite.

The best intercepts from the Jeri North Zone holes are listed in Table VIII below.

Table VIII: Jeri North Zone – Historical Diamond Drilling Assay Highlights

Hole	From (m)	To (m)	Interval (m)	Zinc (%)
J-95-2	109.30	109.65	0.35	8.16
J-95-4	76.60	81.60	5.00	9.9
J-95-5	120.50	128.10	7.60	10.92
J-96-10	183.50	184.50	1.00	27.035

AERIAL PHOTOGRAPHY AND LIDAR TOPOGRAPHIC SURVEYS

In summer 2014, Eagle Mapping Ltd. of Port Coquitlam, BC was contracted to conduct aerial photography and a LIDAR survey of the Property and access corridor. Aerial photographs were captured between August 18th and 22nd, 2014. Once the photographs were finalized, survey points were established on the Property and differential GPS was used to orthoreference the photographs.

The LIDAR survey of the Property and access corridor was conducted on September 22nd, 2014. The LIDAR data was processed to provide a bare-earth DEM file, intensity imagery and a detailed (one metre contour) topography map. Appendix V contains digital air photographs, intensity imagery and topography files.

HERITAGE STUDY

In November 2014, Silver Range contracted Stantec Inc. of Whitehorse, YT to conduct a Historic Resources Overview Assessment ("HROA") on the Property. The HROA is a detailed desktop review of the exploration area to classify the land base into zones of heritage potential. The aim of the HROA is to assess the potential for heritage resources within the Property, and to make recommendations concerning the need and scope for further heritage studies.

The HROA examined all available maps, digital elevation models, satellite imagery, aerial photographs, ethnographies, histories and archaeological reports for the Property. The criteria used to determine potential for heritage resources included: proximity to streams and water bodies, known heritage sites, known Aboriginal or historic trails, topography, vegetation cover and presence of fish and wildlife habitat as outlined in the Wildlife Key Area maps produced by the Yukon Government Department of Environment.

The HROA produced a set of maps that identify areas of elevated heritage resource potential. It recommended performing a Heritage Resources Impact Assessment prior to conducting any potentially land-altering development activities within 30 m of the areas of elevated heritage resource potential. The remainder of the Property is considered to have low potential for heritage resources and no further heritage assessment is recommended in those areas. Appendix VI contains a copy of the HROA.

BARITE MARKETING STUDY

In August 2014, Silver Range contracted World Industrial Minerals of Arvada, Colorado to complete a barite marketing study (Guilinger, 2014) to determine the potential demand for a drilling-grade barite concentrate. This study examined historical data from metallurgical test work on the Property and investigated current market trends, pricing and sales opportunities throughout North America. Based on data from flotation tests conducted in the 1980s, the study found that the Property should be able to produce a barite product with sufficient grade to meet the specifications for drilling mud, chemical and construction applications (>94% $BaSO_4$). While the historical test work showed that the necessary $BaSO_4$ grade could be achieved, the mercury, cadmium and base metal content of the barite concentrate were not specified in the historical test work results. The study recommended follow-up analysis and test work to determine probable lead, zinc, cadmium and mercury contents of the barite concentration with respect to specifications and requirements for use in drilling fluids.

Based on the location of the Property, the marketing study concluded that barite sales would likely be restricted to western Canadian and Alaskan markets. Current production facilities are very limited in this region, and demand is high due to on-going oil and gas operations. The study recommends that an initial sales rate of 50,000 metric tonnes per year would be reasonable, and not too disruptive to existing import markets. This figure does not currently assume any sales to Alaska, which it notes are feasible and should be evaluated more through further study. Based on analysis of 2013 pricing, a sales price of $100 USD per metric tonne (FOB mine site) is recommended. The study also suggests that potential synergies may exist with the under-utilized Fireside Minerals barite grinding plant in Watson Lake. Appendix VII contains a copy of the study.

TECHNICAL REPORT

After acquiring the property in summer 2014, Silver Range contracted H. Leo King to author a technical report on the Property. Giroux Consultants Ltd. was contracted to calculate a NI 43-101 compliant mineral resource for the Mel Main Zone using the historical drill hole results. The resource calculation was based on 64 historical diamond drill holes and yielded an Inferred Mineral Resource of 5,380,000 tonnes grading 6.45% Zn, 1.85% Pb and 44.79% $BaSO_4$ at a 5% Zn equivalent cut-off. The technical report can be viewed on SEDAR (http://www.sedar.com). Appendix VIII contains a copy of the Inferred Mineral Resource estimate.

SCOPING STUDY

In October 2014, Silver Range contracted several outside consultants to conduct a scoping level study on the Mel Main Zone mineral resource estimate, to determine potential mining, processing, infrastructure and economic parameters. Snowden Mining Consultants Inc. ("Snowden") of Vancouver, BC was contracted to perform project management and the mining and infrastructure portions of the study. Knight Piésold Ltd. ("Knight Piésold") of Vancouver, BC was contracted to perform the tailings and mine waste portions of the study. Blue Coast Group Ltd. ("Blue Coast") of Parksville, BC was contracted to perform the metallurgical and processing portions of the study. Morrison Hershfield Ltd. ("Morrison Hershfield") of Burnaby, BC and Whitehorse, YT was contracted to perform the environmental portion of the study. Hugh M. Hamilton & Associates ("Hugh Hamilton") of Rosland, BC was contracted to perform the concentrate marketing and transportation portions of the study.

A site visit was conducted to review the current state of the property, including the state of drill core storage, assessment of the access routes and potential outstanding reclamation liabilities from previous exploration. The site visit was performed on October 23, 2014 and was conducted by the author, representing Silver Range, and by David Warren of Snowden Mining Consultants Ltd. The representatives flew from Whitehorse to Watson Lake via charter aircraft, and then flew from Watson Lake to the Property via charter helicopter. On arriving at the property several boxes of diamond drill core were pulled from the storage racks to examine and photograph the core representing the material which would make up the hanging wall of the Mel Main Zone, as well as other notable intercepts. On departure from the Property, the helicopter flew out along the bush road/bush trail access route to the Property so the condition of the route could be assessed and photographed. Fresh tire tracks were seen in the southern section of the bush road, indicating recent use.

Snowden completed Whittle optimisation, preliminary open pit and underground mine designs, preliminary scheduling and costing of the mine aspects. Blue Coast provided a review of the metallurgical test work, conceptual flowsheet, mass balance and plant costing. Knight Piésold provided tailings storage alternatives, of which one was selected and costed. Morrison Hershfield provided a review of the environmental data and an estimate of time and resources to complete studies and obtain permits. Hugh Hamilton developed estimated Net Smelter Return values and marketing strategies for the anticipated concentrates. Snowden compiled an economic spreadsheet model of the team's findings.

The Property has many virtues and advantages. It is relatively accessible and has no known environmental obstacles. The deposit has excellent metallurgical properties and the site is amenable for construction of the required facilities. Unfortunately, the initial economic estimates suggest that mining of the Mel Main Zone is not viable at current metal prices. Several opportunities exist to improve the potential project economics, including: improving the size and grade of the deposit through further exploration, increasing the volume of material mineable by open pit and increasing the saleable volume of barite concentrate to match the volume produced. Appendix IX contains a summary of the economic model of the Property.

DEPOSIT MODEL

The zinc-lead-barite mineralization at the Property differs somewhat from zone to zone and is difficult to definitively categorize as a specific deposit type. The zones show certain characteristics that are consistent with carbonate replacement deposit ("CRD") model but also exhibits features common to sedimentary exhalite ("SEDEX") and karst/unconformity in-filling, Mississippi Valley-type ("MVT") deposits. None of the deposit models is a perfect fit for any of the mineral zones on the Property. The main characteristics of the CRD, SEDEX, and MVT models are briefly summarized in the following paragraphs.

CRD mineralization results from high-temperature alteration of limestone strata. Most of these deposits contain pyritic ores with zinc-lead-silver as ubiquitous metals. They are epigenetic and although stratabound, commonly exhibit discordant features (Titley, 1993). Silicification is the primary alteration of the carbonate minerals in the host limestone, and barite is often present in the ore assemblage. Mines with CRD mineralization are common in the Cordillera of Mexico and southwestern USA. The Silvertip deposit in northern British Columbia and the McMillian deposit in southeastern Yukon (Figure 9) are local examples of CRD mineralization.

SEDEX mineralization forms stratabound, tabular to lensoid beds of predominantly sulphide minerals that are deposited on the seafloor in basins near exhalative centers occurring along deep-seated faults or fracture zones acting as conduits for mineral-rich brines (Carne and Cathro, 1982). Those deposits are mainly enriched in zinc, lead and silver and feature iron sulphides, sphalerite, galena and often barite interbedded with basinal sedimentary rocks. Most SEDEX deposits are syngenetic and are hosted in reduced facies, fine-grained sedimentary rocks that consist predominantly of carbonaceous chert and shale (Goodfellow and Lydon, 2007). There are numerous large SEDEX deposits in Selwyn Basin of Yukon and northern British Columbia including the mines of the Faro district and the Howard's Pass, Tom, Jason and Cirque deposits (Figure 9).

MVT deposits contain low temperature, epigenetic, lead-zinc±silver minerals that occur with dolomite, calcite and quartz gangue as open space filling within platform carbonate sequences. The mineralization is stratabound and mostly consists of galena, sphalerite, pyrite and marcasite. Barite and fluorite are often present (Alldrick et al, 2005). The Goz deposit on east-central Yukon and Robb Lake deposit in northern British Columbia are local examples of MVT mineralization (Figure 9).

The mineral zones at the Property are all stratabound and are hosted in a predominantly carbonate formation within a generally basinal sequence of rocks. Galena-lead ratios from mineralization collected in the Mel Main and Jeri Zones are more radiogenic than those from material that define the Canadian Cordilleran shale curve (Godwin and Sinclair, 1982 and Godwin et al, 1988). The galena-lead data for mineralization from the Property is consistent with Devonian-Mississippian deposition, which would make it an epigenetic event, because the host strata are Cambrian-Ordovician Rabbitkettle Formation. This factor favors a CRD or MVT model for mineralization at the Property (Pigage, 2008). Nelson and Colpron (2007) argue that there is a possible genetic link between SEDEX deposits formed in Selwyn Basin and MVT deposits found in adjacent carbonate platform sequences. They suggest that both types of mineralization could be deposited from metal-enriched hydrothermal brines emanating from deep-seated extensional structures located along active boundaries between basinal and platform settings.

DISCUSSION AND CONCLUSIONS

The Mel Main Zone is a zinc-lead-barite deposit hosted within Cambrian to Ordovician marine sediments. Mappable units of carbonate and clastic sediments are broadly folded into a north-south trending, overturned syncline. The Mel Main Zone occurs on the western limb of the syncline within a lensy stratigraphic horizon, which is underlain by cryptograined limestone and overlain by a distinctive phyllite/mudstone unit that grades upward into wavy-banded, argillaceous limestone.

Diamond drilling at the Mel Main Zone has outlined an Inferred Mineral Resource estimated at 5,380,000 tonnes of 6.45% Zn, 1.85% Pb and 44.79% barite using a 5% Zn-Equivalent cut-off. In-fill drilling to up-grade the resource to an Indicated Mineral Resource is warranted.

The overturned and steeply dipping deposit is open to extension down dip, with potential for a significant increase in tonnage. Three other zones of zinc-rich mineralization are also present on the Property, but no mineral resource estimates have been made for them.

The Jeri Zone is located about 4 km northeast of the Mel Main Zone on the eastern limb of the same syncline that hosts the zinc-lead-barite mineralization at the Mel Main Zone. At the Jeri Zone, unusually strong alteration of the footwall carbonate rocks to zinc-bearing, hydrothermal dolomite and silicified dolomite has been exposed for several kilometers along the fold limb.

The Jeri Zone has been tested by trenching and diamond drilling over a strike length of 550 m. The drilling has intersected encouraging zinc values, including 13.11% Zn over 3.37 m, within the larger zone of silicified and dolomitized limestone.

Trenching at the Jeri Zone has exposed smithsonite and minor sphalerite mineralization over widths of 5 m to 7 m. Sampling has yielded high zinc values in 3 of 10 trenches, with mineralized exposures grading from 5.3% Zn over a sample width of 7 m to 16.5% Zn over a sample width of 5 m.

There is potential for the discovery of additional zinc mineralization within the thick dolomitized section of limestone that hosts the Jeri Zone. An untested geophysical anomaly at the south end of the Jeri Zone, interpreted to be located at the base of the dolomitized limestone, represents a particularly attractive drill target.

The Jeri North Zone lies 3 km north of the Jeri Zone on the eastern limb of the same syncline that hosts the Mel Main Zone. At the Jeri North Zone, coarse-grained sphalerite occurs within a chert unit below a volcanic flow and volcaniclastic sequence that grades upwards into wavy-banded limestone. This mineralized chert unit rests on the same cryptograined limestone that forms the base of the Mel Main Zone. The chert and volcanic sequence seen at the Jeri North Zone is not present at the Mel Main and Jeri Zones.

Diamond drilling at the Jeri North Zone resulted in the discovery of promising zinc mineralization. One hole intersected 9.9% Zn over a core length of 5 m and another hole, drilled deeper on the same section, intersected 15.6% Zn over a core length of 5.1 m. Although additional drilling on the Jeri North Zone did not extend the zone of zinc mineralization beyond an estimated 400 m of strike extent, there is significant potential within untested portions of the favorable horizon.

Geological mapping, trenching, geophysical and geochemical surveys and diamond drilling at the Jeri and Jeri North Zones have traced the favorable zinc-bearing horizon along the east limb of the syncline for a length of 8 km. Additional drilling is warranted to evaluate several untested targets.

The Mel East Zone is another showing of zinc mineralization, located 3 km northeast of the Jeri Zone. It is believed to be hosted in a faulted-offset of the same stratigraphic sequence that hosts the Mel Main, Jeri and Jeri North Zones. The Mel East Zone has not been trenched or drilled. Anomalous zinc-lead soil geochemistry and a coincident IP anomaly have defined a drill target.

The mineralized zones on the Property have been variously categorized as carbonate-replacement, sedimentary exhalative and unconformity or karst-related. Although the zones exhibit certain characteristics that are consistent with each of these deposit types, they also show features that are inconsistent with each deposit type. Regardless, the mineralization occurs in a predictable stratigraphic setting, which has made historical exploration successful and will help guide future work.

Exploration conducted to date at the Mel Main Zone has defined a mineral resource of potential economic interest, and historical metallurgical testwork has produced encouraging results. Further work on the Mel Main, Jeri, Jeri North and Mel East Zones is warranted.

Respectfully submitted,

ARCHER, CATHRO & ASSOCIATES (1981) LIMITED

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1993 Characteristics of high-temperature, carbonate-hosted massive sulphide ores in the United States, Mexico and Peru; in: Mineral Deposit Modelling, R.V Kirkham, W.D. Sinclair, R.I. Thorpe, and J.M. Duke (eds), Geological Association of Canada, Special Paper 40, p. 585-614.

Wilkinson, W.J.
1975 Report on Empire Metals option (Otter Lake), diamond drill program; report prepared for Granby Mining Corp.

APPENDIX I

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

I, Justin Stevens, engineer in training, with business addresses in Whitehorse, Yukon Territory and Vancouver, British Columbia and residential address in Vancouver, British Columbia, hereby certify that:

1. I graduated from the University of British Columbia in 2011 with a B.A.Sc. in Mining Engineering.

2. From 2013 to present, I have been actively engaged in mineral exploration in Yukon Territory.

3. I am an Engineer in Training (EIT) with the Association of Professional Engineers and Geoscientists of British Columbia.

4. I have interpreted all data resulting from this work.

J. Stevens B.A.Sc., EIT

APPENDIX II

STATEMENT OF EXPENDITURES

Amended Statement of Expenditures
575 Mel Project Mineral Claims
March 13, 2015

Labour

D. Eaton (geologist) 160 hours June to January 2015 at $120/hr	$ 20,160.00
H. Burrell (geologist) 31 hours June to January 2015 at $96/hr	3,124.80
M. Dumala (geologist) 216 1/2 hours June to January 2015 at $96/hr	21,823.20
A. Carne (engineer) 342 1/2 hours June to January 2015 at $85/hr	30,568.13
J. Stevens (engineer) 842 1/2 hours June to January 2015 at $85/hr	75,193.13
J. Mariacher (office) 107 1/2 hours June to January 2015 at $90/hr	10,158.75
R. Drechsler (office) 32 hours June to January 2015 at $80/hr	2,688.00
D. Arnold-Wallinger (office) 95 1/2 hours June to January 2015 at $74/hr	7,420.35
S. Newman (office) 130 1/2 hours June to January 2015 at $62/hr	8,495.55
L. Smith (office) 116 hours June to January 2015 at $62/hr	7,551.60
	187,183.51

Expenses (including management)

Eagle Mapping Ltd. LIDAR survey	99,027.68
Trans North Helicopters – 4.4 hours Bell 206B at $990/hr plus fuel	5,792.94
Alkan Air	3,704.78
	108,525.40
Total	295,708.91

Note – at least $60,000 of these expenditures were incurred November 14 and later to cover Mel 189-318 assessment of $58,500.

APPENDIX III

LIST OF ALL DRILL HOLES

ZONE	HOLE	NORTHING	EASTING	HOLE LENGTH (m)	ELEVATION (m)
Mel Main	74_1	10087.1	9955.1	62.65	928.7
Mel Main	74_2	10005.9	9938.7	52.13	911.0
Mel Main	74_3	10005.9	9937.2	92.07	910.9
Mel Main	74_4	9928.3	9938.2	48.17	906.5
Mel Main	74_5	9789.3	9954.0	51.52	921.8
Mel Main	74_6	9637.0	9970.4	64.33	914.7
Mel Main	74_7	10339.7	9770.2	118.29	912.3
Mel Main	74_8	10214.5	9944.2	74.24	950.7
Mel Main	75_9	9790.0	9895.8	146.65	930.6
Mel Main	75_10	9926.5	9862.0	283.84	926.7
Mel Main	75_11	10083.5	9880.5	126.52	911.6
Mel Main	75_12	10216.1	9866.8	157.01	913.4
Mel Main	75_13	10341.2	9958.4	202.13	935.1
Mel Main	75_14	10524.0	9986.2	130.18	1077.8
Mel Main	75_15	10647.5	9985.4	151.52	1101.0
Mel Main	75_16	10655.4	9869.7	50.30	1093.8
Mel Main	75_17	10479.0	9863.8	53.66	1011.4
Mel Main	75_18	10492.2	9732.5	102.44	913.8
Mel Main	78_1	9400.0	9935.0	215.50	915.0
Mel Main	78_2	9000.0	9925.0	46.30	900.0
Mel Main	78_3	10006.0	9847.6	29.60	926.0
Mel Main	78_4	10005.0	9878.1	299.00	914.0
Mel Main	78_5	9200.0	9985.2	102.43	902.0
Mel Main	78_6	10005.9	9962.5	200.00	887.2
Mel Main	78_7	9928.3	9958.9	157.62	880.5
Mel Main	79_1	10003.5	9879.6	114.90	912.9
Mel Main	79_2	10087.6	9998.9	231.30	918.0
Mel Main	79_3	10213.4	10002.3	306.60	942.1
Mel Main	79_4	9931.8	10145.0	262.12	903.2
Mel Main	79_5	9931.8	10145.0	275.23	903.2
Mel Main	79_6	10072.6	10252.8	336.20	904.2
Mel Main	79_7	10003.3	10141.6	260.00	903.3
Mel Main	79_8	9789.8	10040.8	206.30	902.1
Mel Main	79_9	9784.0	10224.8	321.80	902.3
Mel Main	79_10	9710.8	10121.1	213.30	904.2
Mel Main	79_11	9823.1	10075.3	289.30	901.8
Mel Main	79_12	9814.9	9871.4	169.20	936.2
Mel Main	87_1	9399.1	10107.1	133.20	905.4
Mel Main	87_2	8943.0	10045.4	38.71	900.2
Mel Main	87_3	8943.0	10045.4	66.75	900.2
Mel Main	87_4	9861.1	10287.2	515.72	902.2

Mel Main	87_5	10006.1	10227.9	399.59	902.5
Mel Main	87_6	10089.6	10216.3	448.06	912.7
Mel Main	87_7	9787.1	10229.9	409.96	902.3
Mel Main	89_30	10097.3	9974.5	184.10	927.4
Mel Main	89_31	10157.3	9985.4	220.06	935.0
Mel Main	89_32	10198.6	9988.0	204.22	942.1
Mel Main	89_33	10049.3	9973.4	54.56	919.0
Mel Main	90_34	10039.1	9895.6	143.56	909.8
Mel Main	90_35	9850.2	9973.7	203.00	918.4
Mel Main	90_36	9751.0	9981.1	167.03	910.9
Mel Main	90_37	9698.6	9929.9	142.07	922.2
Mel Main	90_38	9742.0	9944.3	133.23	921.2
Mel Main	90_39	9674.9	9970.6	64.63	912.2
Mel Main	90_40	10129.5	9943.1	134.10	935.2
Mel Main	90_41	9959.2	9955.6	152.70	904.2
Mel Main	90_42	9959.2	9955.8	249.02	904.2
Mel Main	90_43	9959.5	9955.9	43.28	904.2
Mel Main	94_44	9900.0	10304.0	428.90	902.2
Mel Main	94_45	9900.0	10304.0	462.10	902.2
Mel Main	94_46	9900.0	10333.0	660.30	908.5
Mel Main	94_47	10000.0	10376.0	542.50	903.3
Mel Main	94_48	9805.5	10259.0	542.90	905.4
Mel Main	94_49	10100.0	10222.0	359.00	912.8
Mel South	SM 95-1	8500.0	10035.0	212.10	Unknown
Mel South	SM 95-2	8500.0	9970.0	105.40	Unknown
Mel South	SM 96-3	8500.0	-85.0	336.50	910.0
Jeri North	J-95-1	13206.0	-456.0	146.90	1120.0
Jeri North	J-95-2	13410.0	-414.0	126.80	1160.0
Jeri North	J-95-3	13800.0	-450.0	117.00	1160.0
Jeri North	J-95-4	14200.0	-650.0	104.80	975.0
Jeri North	J-95-5	14200.0	-650.0	139.00	975.0
Jeri North	J-95-6	14400.0	-650.0	87.20	1030.0
Jeri North	J-95-7	15200.0	-650.0	50.60	1020.0
Jeri North	J-95-8	15200.0	-800.0	75.30	1060.0
Jeri North	J-96-9	14200.0	-790.0	218.20	950.0
Jeri North	J-96-10	14000.0	-700.0	218.20	1030.0
Jeri North	J-96-11	14408.0	-655.0	105.50	955.0
Jeri North	J-96-12	14000.0	-700.0	244.10	1030.0
Jeri North	J-96-13	13800.0	-521.0	181.70	1140.0
Jeri North	J-96-14	13400.0	-510.0	221.30	1200.0
Jeri	J-85-1	10015.5	9953.9	98.14	1107.0
Jeri	J-85-2	9947.2	9925.9	105.77	1103.1
Jeri	J-85-3	9947.2	9925.9	148.44	1103.1
Jeri	J-85-4	9897.5	9925.3	99.69	1090.4

Jeri	J-85-5	9897.5	9925.3	90.53	1090.4
Jeri	J-85-6	10282.9	9931.2	118.87	1098.9
Jeri	J-85-7	10331.8	9954.4	89.00	1093.1
Jeri	J-85-8	10413.1	9942.6	85.95	1083.7
Jeri	J-85-9	9795.9	9924.1	105.77	1065.1
Jeri	J-85-10	9305.0	9396.0	67.66	960.0

APPENDIX IV

LIST OF SIGNIFICANT INTERCEPTS

Hole ID	From	To	Length (m)	Pb (%)	Zn (%)	Ba (%)	$BaSO_4$ (%)
74_1	37.03	41.61	4.58	4.01	7.52	38.25	64.99
incl.	39.47	41.61	2.14	7.35	8.11	38.25	64.99
And	42.37	44.20	1.83	0.70	5.16	38.25	64.99
74_2	33.83	47.40	13.57	2.16	4.83	37.13	63.08
incl.	33.83	35.66	1.83	0.17	9.31	37.13	63.08
and	39.93	41.76	1.83	5.70	4.14	37.13	63.08
74_4	37.03	47.24	10.21	1.05	5.86	26.72	45.40
incl.	38.40	40.39	1.99	0.19	8.10	28.42	48.29
and	44.81	46.63	1.82	5.33	7.92	28.42	48.29
74_5	46.02	48.92	2.90	1.44	8.53	38.60	65.58
incl.	46.02	47.55	1.53	0.10	12.25	38.60	65.58
and	47.55	48.01	0.46	8.10	9.10	38.60	65.58
74_6	57.15	58.67	1.52	1.90	3.11	0.00	0.00
74_8	66.29	70.87	4.58	2.87	8.99	32.07	54.49
incl.	66.75	68.28	1.53	3.53	9.87	32.07	54.49
and	68.28	69.04	0.76	0.45	19.73	32.07	54.49
and	69.04	70.33	1.29	3.15	6.60	32.07	54.49
75_9	131.67	134.42	2.75	0.60	4.70	37.96	64.49
And	134.72	139.60	4.88	2.65	8.35	36.78	62.49
incl.	137.16	139.60	2.44	4.85	10.40	36.78	62.49
And	142.19	144.02	1.83	2.15	3.95	12.00	20.39
75_11	107.59	124.05	16.46	2.21	3.17	31.35	53.26
incl.	110.64	113.69	3.05	0.18	6.67	29.58	50.25
and	116.28	118.11	1.83	6.10	6.70	46.37	78.78
and	122.22	124.05	1.83	8.20	0.80	43.43	73.79
75_12	145.39	151.49	6.10	1.15	5.66	21.07	35.80
incl.	146.61	148.74	2.13	1.95	12.40	29.95	50.89
75_13	198.12	198.88	0.76	1.15	13.50	NS	NS
78_6	166.21	191.26	25.05	1.96	4.14	46.28	78.63
incl.	166.21	167.03	0.82	7.01	0.06	50.56	85.90
and	171.60	172.52	0.92	0.17	5.31	43.81	74.43
and	179.22	180.14	0.92	0.11	5.14	51.00	86.65
and	181.97	187.15	5.18	7.67	6.17	42.89	72.88
and	188.06	191.26	3.20	0.04	12.11	36.70	62.35
78_7	128.32	148.44	20.12	2.05	4.92	37.60	63.87
incl.	128.32	131.92	3.60	8.66	6.64	36.54	62.08
and	135.27	140.21	4.94	1.40	5.68	45.05	76.54
and	141.12	142.04	0.92	0.03	11.80	36.94	62.76
and	142.95	144.78	1.83	1.10	7.98	36.30	61.68
79_1	86.20	104.00	17.80	0.24	7.29	33.08	56.20
incl.	89.00	92.00	3.00	0.01	13.00	27.93	47.45
and	95.00	98.00	3.00	0.01	7.16	45.69	77.63
and	101.00	104.00	3.00	1.14	13.90	22.09	37.53

79_2	222.00	230.40	8.40	1.69	13.46	14.99	25.47
incl.	222.00	223.00	1.00	5.73	4.78	17.40	29.56
and	223.00	229.00	6.00	1.36	16.20	17.45	29.65
and	229.00	230.40	1.40	0.26	7.94	2.72	4.62
79_3	22.05	28.90	6.85	4.44	4.44	28.58	48.55
And	283.00	292.91	9.91	0.86	1.74	0.10	0.17
incl.	283.00	285.00	2.00	0.41	4.78	0.07	0.12
79_4	246.68	255.80	9.12	2.97	6.63	36.90	62.69
incl.	250.00	255.80	5.80	3.47	8.67	38.70	65.75
79_5	260.25	269.30	9.05	0.00	3.23	28.15	47.82
incl.	266.35	269.30	2.95	0.00	5.92	29.80	50.63
79_6	328.84	331.52	2.68	7.86	7.76	1.85	3.14
incl.	328.84	329.63	0.79	10.40	1.70	1.13	1.92
and	329.63	330.57	0.94	12.50	20.20	1.79	3.04
79_7	245.40	255.80	10.40	4.60	4.34	21.85	37.12
incl.	245.40	246.30	0.90	19.50	7.16	22.30	37.89
and	246.30	251.00	4.70	5.11	3.96	29.71	50.48
and	253.20	255.10	1.90	3.19	10.10	33.60	57.09
79_8	198.80	201.30	2.50	0.84	13.50	8.06	13.69
79_9	312.90	313.80	0.90	7.06	14.80	0.10	0.17
79_11	277.20	285.70	8.50	1.41	4.46	18.73	31.83
incl.	277.20	280.00	2.80	1.24	5.06	0.32	0.54
and	282.50	285.70	3.20	2.60	6.04	40.50	68.81
79_12	157.75	161.30	3.55	1.67	3.82	14.29	24.29
87_4	489.60	509.93	20.33	0.17	6.74	26.45	44.94
incl.	499.60	501.60	2.00	0.03	29.20	14.83	25.20
and	501.60	507.20	5.60	0.02	7.16	35.79	60.81
and	508.00	509.93	1.93	0.02	13.60	29.59	50.27
87_5	388.96	394.10	5.14	2.31	23.17	0.04	0.06
87_6	439.30	440.40	1.10	0.38	8.72	0.08	0.14
87_7	401.05	403.10	2.05	1.59	8.19	0.22	0.37
89_30	31.50	47.90	16.40	0.93	5.74	34.94	59.36
incl.	32.40	36.30	3.90	0.39	5.96	33.40	56.75
and	37.90	40.00	2.10	0.70	14.40	34.00	57.77
and	40.00	46.00	6.00	1.94	5.48	38.13	64.79
And	165.40	180.00	14.60	0.88	3.85	26.65	45.29
incl.	165.40	166.50	1.10	3.46	4.56	12.59	21.39
and	170.00	179.10	9.10	0.79	4.80	23.68	40.23
89_31	33.10	47.24	14.14	1.23	1.63	22.24	37.79
incl.	46.00	47.24	1.24	5.52	0.04	4.77	8.10
And	205.70	216.40	10.70	2.29	7.95	23.25	39.50
incl.	205.70	207.70	2.00	6.36	6.30	23.00	39.08
and	207.70	212.00	4.30	2.15	6.35	30.74	52.23
and	212.00	215.70	3.70	0.58	11.99	18.92	32.14

89_32	44.30	65.68	21.38	2.51	4.09	26.15	44.43
incl.	44.30	50.20	5.90	1.68	6.46	34.09	57.92
and	50.20	55.70	5.50	4.01	5.97	40.75	69.23
and	58.50	60.00	1.50	10.90	4.60	31.60	53.69
And	189.30	195.25	5.95	1.58	2.68	31.03	52.72
incl.	193.35	195.25	1.90	1.83	5.64	35.73	60.71
89_33	25.15	43.60	18.45	0.34	8.58	35.41	60.17
incl.	25.15	32.25	7.10	0.55	6.54	42.86	72.82
and	32.25	35.40	3.15	0.04	26.80	14.11	23.97
And	158.10	171.30	13.20	2.17	7.79	40.03	68.00
incl.	158.10	161.10	3.00	6.09	5.41	31.32	53.21
and	167.10	171.30	4.20	2.09	12.87	37.18	63.16
90_34	79.90	114.10	34.20	0.58	8.76	31.25	53.10
incl.	79.90	84.50	4.60	0.12	7.29	35.46	60.25
and	84.50	87.50	3.00	0.53	17.24	35.71	60.67
and	87.50	90.50	3.00	0.04	24.76	21.61	36.72
and	90.50	93.50	3.00	0.02	14.87	30.49	51.80
and	102.50	108.50	6.00	2.15	5.91	28.36	48.18
and	108.50	111.10	2.60	0.04	13.34	13.76	23.38
90_35	46.70	59.70	13.00	2.11	5.34	36.23	61.55
incl.	49.85	52.90	3.05	1.16	6.16	36.82	62.56
and	52.90	56.69	3.79	3.70	7.80	42.55	72.29
And	187.50	199.00	11.50	3.51	4.30	40.58	68.94
incl.	188.70	198.10	9.40	3.64	5.04	46.63	79.22
90_36	30.90	57.75	26.85	1.82	4.27	26.45	44.95
incl.	33.30	39.30	6.00	0.40	8.46	38.54	65.48
and	42.30	45.30	3.00	4.36	7.89	34.98	59.43
and	56.14	57.75	1.61	5.23	4.98	23.42	39.79
90_38	110.70	112.65	1.95	0.56	2.22	29.31	49.80
90_39	45.58	48.93	3.35	0.73	9.76	0.44	0.75
90_40	60.55	71.60	11.05	0.43	3.33	31.76	53.95
incl.	63.60	66.40	2.80	0.08	8.47	21.10	35.85
90_41	47.62	53.40	5.78	0.19	2.53	35.47	60.26
And	102.95	105.68	2.73	9.91	2.55	29.97	50.92
And	124.90	146.69	21.79	2.37	6.04	35.41	60.16
incl.	124.90	126.87	1.97	10.72	3.93	11.37	19.32
and	126.87	128.94	2.07	3.71	4.97	27.85	47.32
and	130.17	137.50	7.33	3.03	8.51	35.67	60.61
and	140.00	143.26	3.26	0.03	12.81	34.98	59.43
90_42	36.00	39.30	3.30	1.74	8.24	21.57	36.66
And	235.70	242.70	7.00	0.45	3.33	23.79	40.43
90_43	29.27	37.65	8.38	1.78	2.80	21.85	37.13
incl.	30.80	34.10	3.30	3.16	6.35	33.35	56.66

94_44	395.80	397.50	1.70	5.77	17.78	0.11	0.19
incl.	396.50	397.50	1.00	7.15	26.11	0.10	0.17
And	409.05	411.05	2.00	7.77	11.92	0.07	0.11
incl.	409.05	410.15	1.10	13.57	16.53	0.08	0.14
And	415.90	419.00	3.10	8.11	13.15	0.08	0.14
incl.	416.15	417.15	1.00	15.75	16.93	0.07	0.12
and	417.15	418.15	1.00	9.09	15.31	0.08	0.14
94_45	447.45	447.95	0.50	1.13	1.39	0.08	0.14
94_46	640.90	650.90	10.00	2.39	5.30	37.44	63.56
incl.	640.90	641.90	1.00	6.54	1.19	41.93	71.24
and	645.00	647.20	2.20	2.54	5.68	51.37	87.28
and	647.20	648.70	1.50	2.86	17.74	33.11	56.25
94_47	530.20	536.80	6.60	1.33	4.00	31.81	54.05
incl.	530.20	530.50	0.30	4.61	3.76	10.58	17.98
and	533.68	534.00	0.32	8.78	1.01	39.75	67.54
and	534.92	536.80	1.88	0.19	8.92	32.60	55.38
94_48	520.60	536.30	15.70	0.59	5.44	41.16	69.93
incl.	521.90	522.90	1.00	0.03	9.02	16.39	27.85
and	527.20	528.15	0.95	0.11	10.64	29.19	49.59
and	528.65	531.65	3.00	2.29	7.88	45.39	77.12
and	532.95	533.95	1.00	0.03	14.98	39.54	67.18
and	534.55	535.40	0.85	0.02	8.71	38.24	64.97
94_49	351.20	352.80	1.60	2.16	2.35	2.37	4.02
J-95-2	109.30	109.65	0.35	<0.01	8.16	n/a	n/a
J-95-4	76.60	81.60	5	n/a	9.90	n/a	n/a
J-95-5	120.50	128.10	7.6	n/a	10.92	n/a	n/a
J-96-10	183.50	184.00	0.5	<0.01	22.44	n/a	n/a
And	184.00	184.50	0.5	<0.01	31.63	n/a	n/a
J-85-1	2.43	5.80	3.37	n/a	13.11	n/a	n/a
J-85-2	72.60	77.18	4.58	n/a	7.96	n/a	n/a
J-85-4	59.65	61.80	2.15	n/a	14.60	n/a	n/a

APPENDIX V

DIGITAL AERIAL PHOTOGRAPHS AND TOPOGRAPHIC FILES

This appendix is contained in a digital format on the disc attached to this report.

APPENDIX VI

HERITAGE STUDY

Heritage Resources Overview Assessment for the Mel Claim Area, Southeastern Yukon

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Acknowledgements

Stantec Consulting Ltd. would like to thank all of the people from the various organizations who contributed to the project. The project proponent was Archer Cathro & Associates (1981) Limited.

Christian Thomas at the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, discussed the assessment with us and provided information on past heritage resources work in the study area. We thank him for his input and comments.

The opinions, recommendations, omissions, and / or errors in this report are those of Stantec Consulting Ltd. alone and do not necessarily reflect the positions held by Archer Cathro & Associates (1981) Limited, Silver Range Resources Ltd., the Kaska Dena Council or its member Nations, or the Government of Yukon.

Management Summary

This report details the results of a Heritage Resources Overview Assessment (HROA) for the Silver Range Resources Ltd. Mel claim area, on behalf of Archer Cathro & Associates (1981) Limited.

The HROA was anticipated to be required either as part of the Yukon Environmental and Socio-economic Assessment Board (YESAB) proposed development review process and/or as a requirement to obtain a Mining Land Use Permit. The objective of this heritage study was to determine heritage potential within the claim area. Based on the HROA findings, a number of areas have been classified as having elevated heritage resource potential. It is recommended that a field-based Heritage Resource Impact Assessment (HRIA) be conducted prior to any potentially land-altering development activities located within 30 meters of areas identified as having elevated heritage potential.

Heritage resources are protected from non-permitted alterations or disturbance by the Historic Resources Act (Government of Yukon 2002) and the Archaeological Sites Regulations (Government of Yukon 2003). To ensure that the discovery of any unanticipated heritage resources is addressed, it is recommended that Archer Cathro & Associates (1981) Limited inform their personnel and contractors that, in the event that heritage resources are encountered, all development activities in the vicinity of the heritage resources must be suspended immediately. In such cases the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, and the Kaska Dena Council must be contacted immediately with information on the heritage remains and the nature of the disturbance. Information on the identification of heritage resources can be found in a publication entitled Handbook for the Identification of Heritage Sites and Features (Gotthardt and Thomas 2005).

This study was designed as a heritage resources overview assessment and was not intended to evaluate or comment on traditional Aboriginal use of the areas in which development is proposed. The results of this study, therefore, should not be considered valid for that purpose.

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Table of Figures

Table of Appendices

1.0 INTRODUCTION

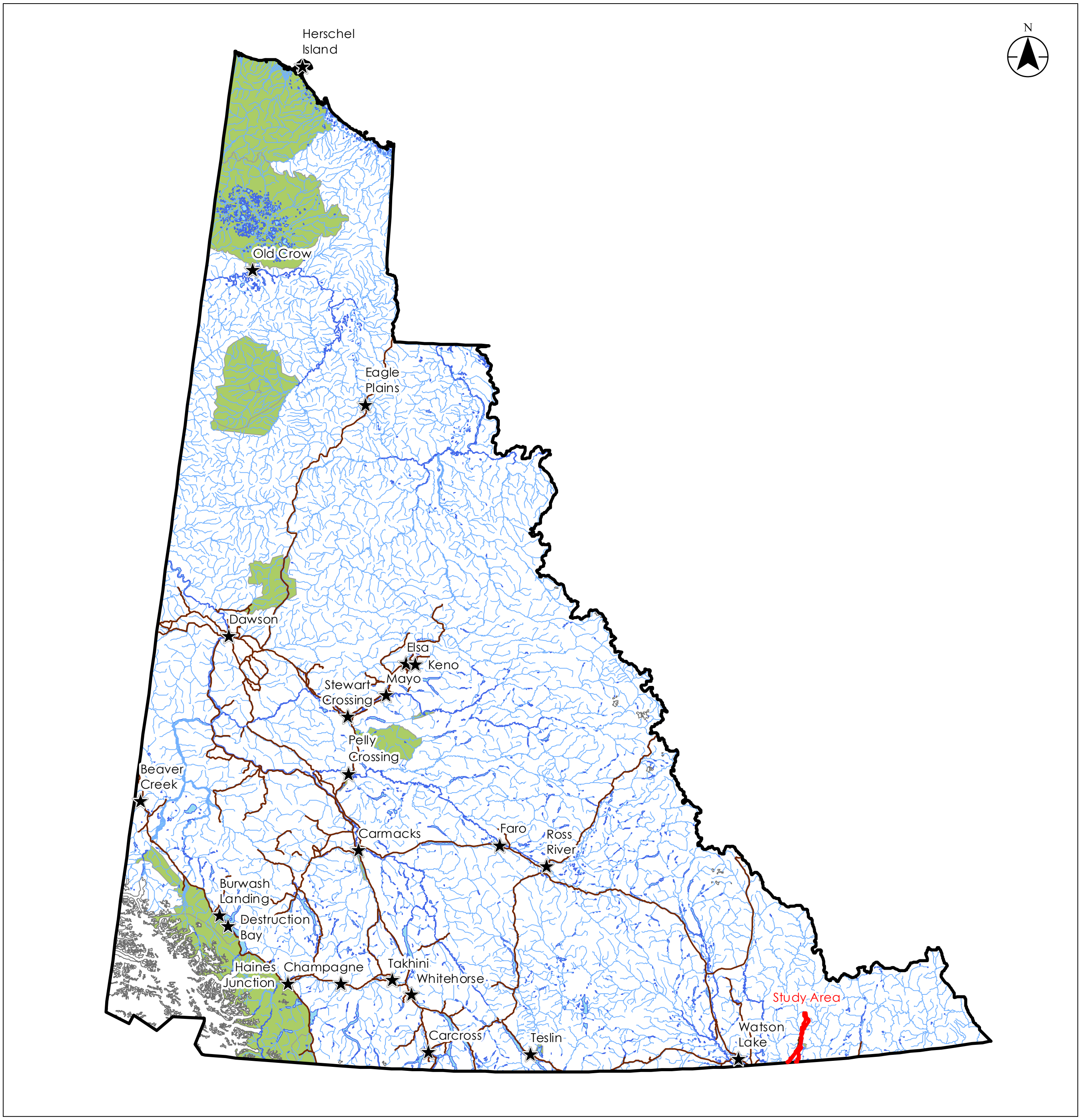
This report details the results of a Heritage Resources Overview Assessment (HROA) for proposed mineral exploration activities within the Silver Range Resources Ltd. Mel claim area, on behalf of Archer Cathro & Associates (1981) Limited.

The study area is located approximately 60 km east of the town of Watson Lake (Maps 1-2). It is located in the Liard Basin ecoregion of the Yukon. The south end of the Mel claim area is situated at the Alaska Highway near the confluence of Liard River and Contact Creek and extends north across the Coal River nearly to Camp Creek.

Silver Range Resources Ltd. plans to conduct additional mineral exploration within the historically explored Mel claim area.

The HROA was anticipated to be required as part of the Yukon Environmental and Socio-economic Assessment Board (YESAB) proposed development review process. The objective of this heritage study was to determine the heritage potential of the Silver Range Resources Ltd. Mel claim area.

F:\2015\123220209\gis\figures\working\map_1_study_area_location.mxd Revised: 2015-02-27 By: jmacmillan



Legend

- Study Area
- Town/City
- Road
- Watercourse
- Waterbody
- Glacier
- Park

Notes
1. Coordinate System: Yukon Albers

0 60 120 Kilometers
1:6,500,000 (at original document size of 8.5x11)

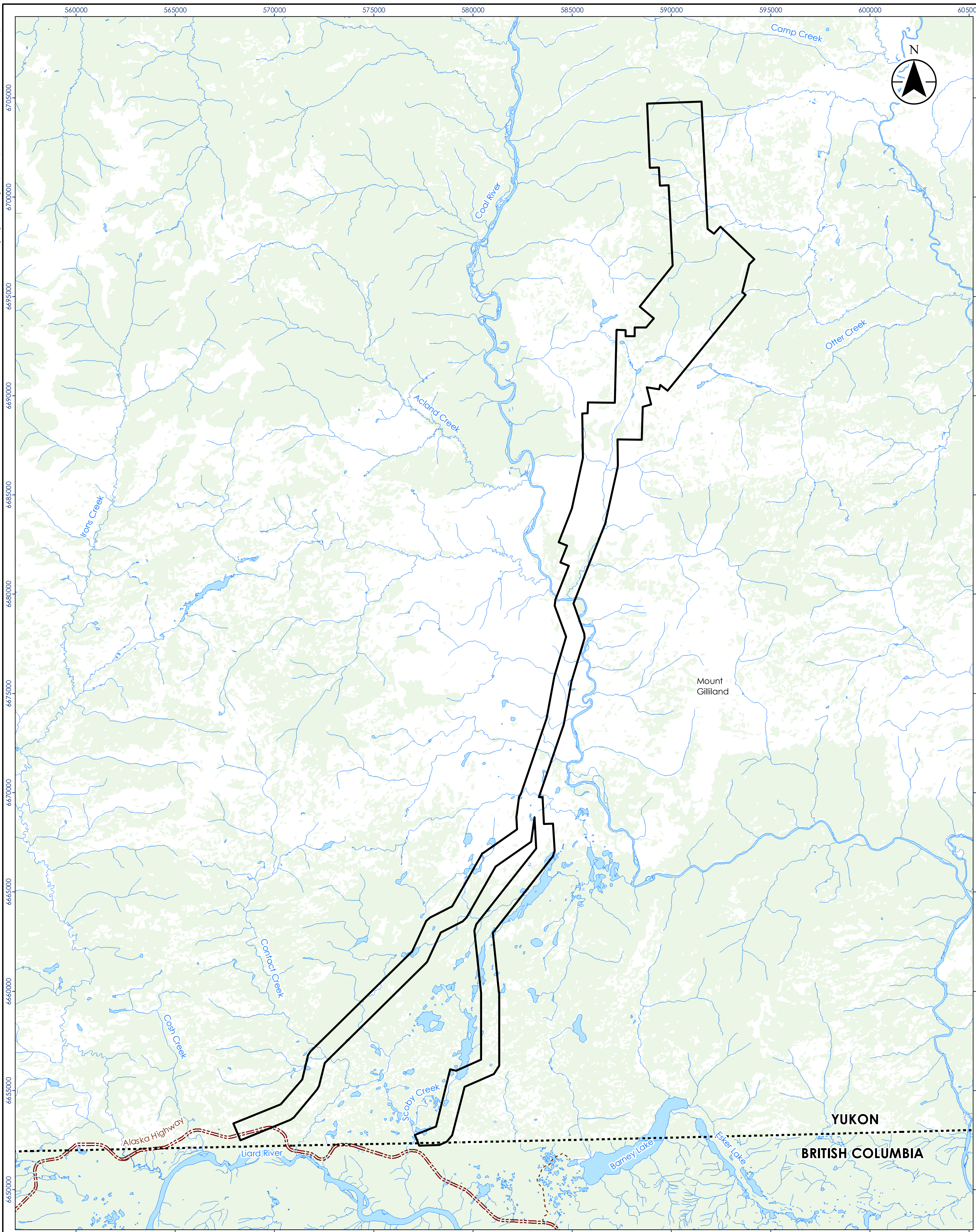
Stantec

Project Location: 123220209
NTS Map Sheets: 095 D/03, 095 D/04, 095 D/06
Prepared by J. MacMillan on 2015-01-26
Technical Review by T. Heffner on 2015-02-27

Client/Project
Archer, Cathro & Associates (1981) Limited
Heritage Resource Overview Assessment
Mel Property

Figure No.
1

Title
MAP 1: Study Area Location



Legend

- HROA Study Area
- Administrative Boundary
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area

0 4,000 8,000 metres

1:200,000 (At Original document size of 11x17)

Stantec

Project Location

123220209

NTS Map Sheets: 095 D/03, 095 D/04, 095 D/06

Prepared by J. MacMillan on 2015-01-26

Technical Review by T. Heffner on 2015-02-27

Client/Project

Archer, Cathro & Associates (1981) Limited
Heritage Resource Overview Assessment
Mel Property

Figure No.

2

Title

MAP 2: Study Area Location

Notes

1. Coordinate System: NAD 1983 UTM Zone 9N

1.1 REPORT FORMAT

This report is divided into seven sections and one Appendix.

Section 1: Introduction
This section introduces the HROA, the relevant legislative references and definitions, and provides a summary of contacts made with First Nations.

Section 2: Heritage Assessment Description
This section discusses the intent of the heritage assessment in relation to the proposed development.

Section 3: Study Area
This section describes the location of the HROA study area and discusses post-contact human landscape use in the region. A brief overview of previous archaeology within the area is also presented.

Section 4: Methodology
This section discusses the methods used while conducting the heritage assessment.

Section 5: Results
This section summarizes the results of the HROA and provides a map of heritage potential zones in the development area.

Section 6: Recommendations
This section provides recommendations for the management of heritage resources potential identified during the HROA.

Section 7: References Cited
This section lists bibliographic information for all references cited in this report.

Appendix
Included with this report is one appendix containing a glossary of archaeological terms.

1.2 LEGISLATIVE REFERENCES

The Historic Resources Act (Government of Yukon 2002) and Archaeological Sites Regulations (Government of Yukon 2003a) contain legislation that ensures the management and protection of Yukon archaeological and historical resources. This legislation applies to archaeological and historic sites on both private and public land that are older than 45 years. Archaeological and historical sites are protected from unpermitted surveys, disturbances, alterations or excavations.

The Yukon Territorial Lands Act Land Use Regulations (Government of Yukon 2003b) contains regulations regarding operations around, and the discovery of archaeological sites. Section 9(a) of the Regulations stipulates that "no permittee shall, unless expressly authorized in their permit or expressly authorized in writing by an inspector, conduct a land use operation within 30 m of a known monument or a known or suspected archaeological site or burial ground." Furthermore, Section 15 states that "Where, in the course of a land use operation, a suspected archaeological site or burial ground is unearthed or otherwise discovered, the permittee shall immediately (a) suspend the land use operation on the site; and (b) notify the engineer or an inspector of the location of the site and the nature of any unearthed materials, structures, or artifacts."

Chapter 13 of the Umbrella Final Agreement (Government of Canada *et al*. 1993) provides regulations for the ownership and management of heritage resources found within First Nation Settlement Lands and Traditional Territories. Section 3.1 states that each Yukon First Nation shall own and manage heritage resources found on its Settlement Land. Under section 3.2, ethnographic moveable heritage resources recovered from its Traditional Territory that are not public records or private property, are owned and managed by the First Nation.

Schedule 1 of the Yukon Quartz Mining Land Use Regulations (Government of Yukon 2003c) applies to all quartz mineral claims or locations in the Yukon, and provides regulations related to the discovery of and operations around heritage sites. Section E(8) states that "Exploration activities must not be carried out within 30 m of a known archaeological or palaeontological site unless the Chief indicates, in writing, that such activities may be carried out." Additionally, Section E(9) states that "Any sites containing archaeological objects, paleontological objects or human remains or burial sites discovered in the course of carrying out an exploration program must be immediately marked and protected from further disturbance and, as soon as practicable, the discovery reported to the Chief." No other operations are to be conducted within 30m of the site until permission is granted.

Schedule 1 of the Yukon Placer Mining Land Use Regulations (Government of Yukon 2003d) prohibits disturbances to discovered and undiscovered archaeological sites. Section D(6) states that "All archaeological sites and burial grounds must be avoided. If such a site is encountered in the course of an operation, it is to be marked, reported to the Chief and protected from further disturbance until authorization is given by the Chief." These regulations apply to lands on which a placer mining lease has been granted.

1.3 FIRST NATIONS REFERRAL AND CORRESPONDENCE

The area assessed during this study is located within the traditional territory of the Liard First Nation. Stantec Consulting Ltd. contacted the Liard First Nation to initiate discussion concerning the heritage resources overview assessment and to obtain any existing traditional land use information or oral history pertinent to the study area.

2.0 HERITAGE ASSESSMENT DESCRIPTION

A Heritage Resources Overview Assessment (HROA) is a detailed desktop review of an exploration area to classify the land base into zones of heritage potential. The aim of a HROA is to assess the potential for heritage resources (such as archaeological or historic sites) within a defined study area and to make recommendations concerning the need and scope for further heritage studies.

Background research was conducted into the natural and cultural setting of the exploration area. The physical characteristics of the land base were reviewed in detail to determine the level of potential for heritage sites. The research component of this HROA included a review of relevant literature, such as historical and archival documents and maps, published ethnographic and historic volumes, and unpublished archaeological reports. Local knowledge is an important component of heritage studies; Liard First Nation was contacted and a request for relevant traditional land use information was made. Spatial data for the study area was also researched and compiled, including digital and hardcopy topographic and resource maps, digital elevation models, fish and wildlife habitat mapping, surficial and bedrock geological mapping, historical and contemporary air photos, and digital imagery. This information was used to create a conceptual model of past human activities within the study area. The characteristics of the landscape were analyzed to determine where those activities may have occurred.

These results are presented on Maps 3.1-3.10, while polygon shapefiles of heritage potential zones are also provided to facilitate project planning and heritage resource management. No further heritage studies are recommended in zones identified as having low potential. In the event that zones of elevated heritage resources potential are identified within the development area, recommendations are provided for further heritage studies (e.g., Preliminary Field Reconnaissance or Heritage Resources Impact Assessment). Please note that additional data resulting from any future Traditional Knowledge (TK) and Traditional Land Use (TLU) research may indicate additional areas of elevated heritage potential.

3.0 PROJECT AREA

3.1 STUDY AREA LOCATION

The Mel Claim study area is located in the southeastern portion of the Yukon within the traditional territory of the Liard First Nation. The study area is located approximately 60 km east of the town of Watson Lake (Map 1) in the Liard Basin ecoregion of the Yukon. The south end of the Mel claim area is situated at the Alaska Highway near the confluence of Liard River and Contact Creek and extends north across the Coal River nearly to Camp Creek.

Palaeoenvironmental Background

The Liard Basin ecoregion was glaciated several times over the past several hundred thousand years and evidence of the most recent McConnell (ca. 23 ka) glaciation can be found within the area (Smith *et al.*, 2004:243). Glacial ice derived from Pelly, Selwyn and Cassiar Mountains converged to create a trunk glacier that flowed down Liard valley that coalesced with glaciers from the northern Rocky Mountains (Smith *et al.*, 2004:244-245). Deglaciation was complete before 9,000 years ago. Glacial meltwater sculpted glaciofluvial channels in many places and, where blocked by ice, impounded proglacial lakes. As a result, the surficial geology of the ecoregion consists of thick deposits of glacial till with localized areas of glaciofluvial sand and gravel and glaciolacustrine silt and clay.

Modern Environmental Background

The Liard Basin ecoregion is a part of the Boreal Cordillera ecozone. The Liard Basin ecoregion is characterized as an area of low hills and broad plains surrounded by higher mountains and plateaus. The relief in the area is between 580 and 1890 m asl (Smith *et al.*, 2004:241).

Major watercourses include the Liard, Meister, Frances, Hyland and Coal rivers. Notable lakes include Frances, Simpson, Watson, Blind, Stewart, Tillei and McPherson. Wetlands are numerous and widespread, and occasionally large within the floodplains of the larger rivers. Mean annual precipitation ranges from 400-600 mm and February to May are the driest months of the year (Smith *et al.*, 2004: 245). Annual stream flow peaks in May in lower elevations streams and in June in higher elevation streams due to snowmelt. Minimum stream flow occurs in early spring.

Permafrost is uncommon in Liard basin ecoregion and generally confined to peat plateaus with high moisture content and thick organic soils (Smith *et al.*, 2004). Soils on glacial till vary from brunisolic luvisols on fine-grained sediments, to eutric brunisols on coarser sediments. Some areas of periodic alluvial deposition are characterized by productive cumulic regosols that support dense vegetation and large timber. Soils in bog areas consist of mesic organic cryosols.

The majority of this ecoregion lies below treeline and vegetation consists mainly of productive boreal forest due to moderate elevation, precipitation and climate and nutrient-rich soils. Forest cover and understory vary with topography, soils and hydrology. Typical tree species found in the ecoregion include black and white spruce, lodgepole pine, trembling aspen, balsam poplar, paper birch and willow, while Subalpine fir occurs at elevations above 900 m asl. Typical shrubs include willow, alder, rose, high-bush cranberry, lichen, kinnikinnick and moss. There is a wide range of vegetation found throughout this ecoregion (Smith et al. 2004).

Common wildlife found in this ecoregion include mammals such as woodland caribou, moose, wolves, black bear, wolverine, marten, lynx and beaver. Less common mammals include grizzly bear, mule deer, white-tailed deer, and cougars. Numerous bird species are found throughout the region. Migratory species making use of the Tintina Trench flyway include swans, geese, ducks and cranes. Other migratory species include a variety of raptors and passerines. The many hydrological features present in the region provide valuable breeding, moulting and staging habitat for seasonally resident populations (Smith et al. 2004).

3.2 ETHNOGRAPHY

The study area is located within the traditional territory of the Liard First Nation, who are Kaska people. The Kaska today comprise the Dease River First Nation at Good Hope Lake, the Daylu Dena Council at Lower Post and the Kwadacha Nation at Fort Ware, in British Columbia. In the Yukon, Kaska groups include the Liard First Nation and the Ross River Dena Council (Kaska Dena website http://www.kaskadenacouncil.com).

Early Kaska ethnography was first compiled by George Dawson in the late 1880s during the course of a geological survey for the Government of Canada during a visit to McDames Creek. He identified six Kaska groups that were sustained by a seasonal round in northern British Columbia and the southern Yukon. Most relevant to the current study area are the *Ti-tsho-ti-na* who harvested resources in the vicinity of Lower Post and the lands to the east. The *Sa-ze-oo-ti-na* occupied the lands between the Liard and Dease Rivers. To the south, the A-tsha-to-ti-na used the lands below Fort Halkett on the Liard. The *Thlo-co-chassies* and the *Nahannies* were residents of the Upper Liard River, and the *Ai-yá-na* hunted and trapped north of the Pelly River (Dawson 1897: 9-11).

Catholic Oblate missionary Father Elphège Allard established missions at McDame Creek, Telegraph Creek and Lower Post and recorded early contacts with the Kaska in the early 20th Century. James Teit recorded some aspects of Kaska society while visiting Dease Lake during his 1912-1915 field studies for his published ethnology of the Tahltan and Kaska. John Honigmann is the most accomplished ethnographer of Kaska culture; in 1944 he spent the summer completing ethnographic reconstructions with Dease River and Upper Liard consultants. Further research was conducted in 1945 at Lower Post and in a Liard winter settlement. Honigmann published various research projects on the Kaska over five decades, culminating in his 1981 essay (Honigmann 1981) based upon his previous research in *the Handbook of North American Indians Volume 6*.

Ethnographic research that pertains directly to the study area was compiled by Sheila Greer (1985) as a research component of the archaeological survey of the proposed Coal River Springs Territorial Park. Greer's ethnological research (1985: 7-8) indicated that in the 1800s, the area east of Lower Post on the Liard and Kechika Rivers, including the Coal River Springs locality and the Mel claim area footprint, were the traditional lands of the *Tselona*, or Nelson Indians of the Kaska Nation. They were known ethnographically to cross the Rocky Mountains to trade at Fort Nelson, where their habits of long distance travel for trade earned them the name of "Grand Lakers" (Honigmann 1981: 442).

The following is a brief review of Kaska ethnography and ethnohistory with an emphasis on material culture, seasonal rounds and subsistence strategies as they relate to activities that are most likely to have left physical evidence of past human use of the landscape.

Kaska Dena Ethnography

The Kaska are members of the Athapaskan language family and their traditional territory encompasses southeast Yukon, southwest Northwest Territories, and northeast British Columbia. Kaska territory in the Yukon extends from Stewart River in the north to Drury and Little Salmon Lakes in the northwest, down to the community of Rancheria near the British Columbia border and east beyond the Northwest Territories border. This region includes the Pelly, Logan, and Cassiar Mountains which feed the Stewart, Pelly, Ross, Macmillan, Teslin, Liard, and Frances Rivers.

The Kaska seasonal subsistence round involved summer aggregations at fishing camps around major lakes and rivers (Honigmann 1954). Salmon fishing took place on tributaries of the Yukon River (such as Pelly River) but most summer fishing was for jackfish, walleye, lake trout, grayling, and whitefish. Settlement near these locations involved several families who returned to the same fishing grounds each year. Berry gathering, medicinal plant harvesting, and meat preservation were also carried out at this time of year. Berries and roots constituted an important food source and included cranberries, blueberries, soapberry, salmonberry, raspberry, strawberry, fern roots, lily bulbs, mushrooms, rhubarb, rose petals, and wild onions. Snares, traps, and deadfalls were set for rabbits, beaver, ground hog, bear, moose, caribou, sheep, and marten in summer while eggs were collected and birds were hunted along wetlands.

The Kaska dispersed in late summer to the mountains and upland regions to capture mountain goats (in the southern part of Kaska territory), caribou, sheep, gophers, and ground hogs. Autumn was an important time for preparing skins and drying meat on wooden scaffolds that could be cached for winter consumption. Caribou and sheep surrounds were built and large numbers of animals could be killed during communal drives. Constructed fences associated with game drive lanes are still visible today as are the stone cairns that were used for navigation in alpine areas (Honigmann 1954).

With the onset of winter, people aggregated at fishing lakes and relied on cached meat supplies as well as fresh meat from ice fishing (whitefish and grayling), netting beavers under the ice, porcupine hunting, and snaring rabbits and ground birds. Snowshoes were used to overtake caribou and moose in deep snow. Food was cached in snow pits, rock piles, or ground pits still visible today as small circular depressions. Trapping also took in place in winter and increased in importance as Hudson Bay Company posts were established along Liard, Pelly, and Stewart Rivers. Winter travel was primarily by toboggan and snowshoe as opposed to the canoes and skin boats of summer. People dispersed again in spring to capture muskrat, beaver, waterfowl, moose, and fish.

The Kaska built conical lodges and inverted v-shaped lean-tos with a tied pole framework and brush walls with a roof of moss, bark, sod, or skin. Large lodges could be 6 to 8 m in diameter and were occasionally built on stone foundations but were not excavated. The most visible archaeological record of winter and summer dwellings are the central hearths, post holes, and associated cache pits. Near the main dwellings a number of smaller structures would be erected: meat and fish drying racks, racks for boat frames and toboggans, frames for skin tanning and smoking, as well as small huts for spiritual activities such as a sweat lodge. Sweat lodges were sometimes excavated up to 30 cm deep to preserve heat and these depressions may still be visible today. Smaller summer lean-tos were made by erecting a central ridge pole suspended by two forked poles at either end of the dwelling. Poles were then laid against the ridge pole and covered in spruce boughs, sod, and / or skins. Sweat lodges were made of a domed willow pole framework over which skins were draped. Stones heated in fires were used to boil water for cooking meat (and steaming sweat lodges) and are visible in archaeological sites as clusters of heat cracked cobbles. Cave sites in upland regions with bedrock exposures were also reportedly occupied by hunting parties or small families.

A wide variety of implements were used for hunting, fishing, and plant food gathering. Stone tools included projectile points (for arrows and spears), knives, scrapers (for preparing hides), and axes for woodworking and breaking bone. Flaking debris associated with stone tool manufacture and repair are the most commonly recovered artifacts in archaeological contexts. Several hunting / fishing implements were made from antler, bone and wood which are sometimes recovered at archaeological sites with good preservation. Examples of organic Kaska tools include antler adzes, fish spears, horn/antler utensils, fish bone awls, and beaver tooth drills. Many kinds of traps, snares, corrals and hunting blinds were used and are still preserved in modern landscapes. Box and funnel traps were used, in conjunction with weirs, to catch grayling, trout, and whitefish. Gill nets, fish spears, bone fish hooks, gaffs, and willow bark or sinew lines were also used to catch fish (Honigmann 1954). Additional activities that have left a material record in the area include stone hunting blinds, piles of discarded animal bone, and roasting pits.

3.3 TRADITIONAL AND CONTEMPORARY USE

Greer (1985) concluded that the areas east of Lower Post, including the Coal River Springs area, was used by the *Tselona* or Nelson Indians. Greer conducted interviews with three Kaska residents of Lower Post who had knowledge of traditional land use on the lands within the proposed Coal River Springs Park. It was recorded that two well-used trails passed through the area. "In recent years Lower Post residents have used this area for hunting, trapping, fishing and berry collecting" (Greer 1985: 8). A wide variety of wildlife was harvested within the immediate vicinity of Coal River Springs including large ungulates and smaller fur bearing animals. These lands were known to the Kaska elders in the early 20th Century as good places to hunt moose and beaver. There were no long term villages here, but rather short stay, temporary "bush camps." Also remembered were the remains of a fish trap made of spruce bark, designed to catch whitefish at the mouth of a small creek in the study area, and a historic trapper's cabin (Greer 1985: 9).

3.4 POST-CONTACT HISTORY

The first non-native presence in the region began in the 1820s when Hudson's Bay Company explorers and factors developed trade routes from upper Fort Liard, Northwest Territories westward along the Liard River to Frances Lake and the Pelly River to the Yukon River. Continuous contact between outsiders and the Kaska began with the construction of Fort Halkett on the Liard River in 1829. Other trading posts, although short-lived, were established at Dease Lake in 1838 and at Frances Lake in 1843. Lower Post in northern British Columbia was established in 1872 at the confluence of the Liard and Dease Rivers, 20 km south of Watson Lake and served as a trading post and meeting place for the local Kaska.

Two events in the late 19th Century had a profound effect on the traditional lifestyles of the Kaska and their neighbours. These events were the Cassiar Gold Rush, which began near McDame Creek, a feeder to the Dease River in1870, followed by the Klondike Gold Rush in1898, when Kaska territory became an inland travel route to the Yukon goldfields. As a result, thousands of fortune seekers flooded into Kaska territory. Oblate missionary Allard wrote that the Kaska Indians were very numerous until the Cassiar Gold Rush in1878 brought an influx of outsiders who carried both whisky and infectious diseases. When Allard arrived in the mid-1920s, he witnessed a local Indian population under extreme demographic pressure and commented that "The actual population of the Upper Liard Indians is about eighty. I am informed that a few years ago it was two or three times as great" (Allard 1929: 25).

Oblate Father Allard spent a decade (1925-1935) in charge of church missions and Indian day schools for Kaska children at Telegraph Creek, McDame Creek and at Lower Post, which eventually opened a large residential school in 1940 and closed in 1975. Over the course of the 20th Century, the small school house at Lower Post transformed into a large dormitory with compulsory attendance of First Nations children from the Yukon and northern British Columbia, including the Kaska. As a result Kaska language, clothing, customs and traditional land use were significantly transformed.

The provincial government of British Columbia also began to influence Kaska lifeways. In addition to the provincial/territorial boundary that drew a line through Kaska territory, the McKenna-McBride Commission in 1916 reduced Indian lands around the confluence of the Dease River and Liard River to a 640 acre land parcel (McKenna McBride Final Report 1916; Stikine Agency: 761). These restrictions disrupted the annual movement of Kaska groups to their customary hunting areas and fishing spots. Under the provisions of the BC Game Act, to hunt game in British Columbia, the hunter, native or non-native, required provincial residency. Since many Kaska wintered in the Yukon and visited their relatives and families and hunted moose in the vicinity of Lower Post each summer and fall, they found themselves in direct conflict with the Indian Agents and no longer allowed to hunt freely in their traditional territories because they were considered Yukon residents.

Another event on a scale of magnitude not seen since the Klondike Gold Rush, and one that would have profound effects on the Kaska Nation, was the construction of the Alaska Highway in 1942-43. The highway ran from Dawson Creek and passed through the south end of the Mel claim area, before reaching its terminus at Fairbanks, Alaska. This project had serious social, economic and demographic consequences for the Kaska. During the course of construction, 20,000 American soldiers and workers flooded into the southern Yukon. They brought with them a host of infectious diseases. Between 1940 and 1950, the infant mortality rate rose from 27% to 58%. In 1942, 47% of the Indian children in the southern Yukon died before their first birthdays (Coates 1985: 158). The first enumeration of the Stikine Indian Agency in1914 recorded 238 Kaska, the population rose to 323 in1934 but by 1944, during the construction of the Alaska Highway, their numbers dropped to 175 (Honigmann 1981: 442).

3.5 PRECONTACT CULTURE HISTORY

The most comprehensive culture history for the Yukon was compiled by Workman (1978) and the following description will follow his work, except where otherwise cited. Major differences between Workman's chronology and that in use today include the conception of a Northern Cordilleran tradition (Clark 1991, 1983; Clark and Clark 1993; Clark and Morlan 1982; Gotthardt 1990; Hare 1995), the recognition of the mid-Holocene Annie Lake Complex (Greer 1993; Hare 1995), and the combination of Workman's Aishihik and Bennett Lake Phases into the Late Prehistoric Period (Hare 1995).

Northern Cordilleran Tradition (>7000 BP)

Increasing evidence for a pre-microblade technological tradition in the Yukon has led many researchers to adopt the Northern Cordilleran tradition as a viable construct in Yukon archaeology. Clark and Clark (1993) would classify any interior site older than 7,000 - 8,000 BP and lacking microblades as Northern Cordilleran. In many places this technological tradition existed contemporaneously with users of the microblade technology of the Little Arm Phase and this appears to have been the case in the southern Yukon (Hare 1995). Characteristic artifact forms included large bifaces, blades from informal cores, tools on blades (transverse notched burins, and burin/scraper/notch combinations), and large, convex based and side notched or lobate stemmed Kamut points (Gotthardt 1990). To this list can be added elongate stone knives (Clark 1991) and bipoints (Hare 1995). The basal occupation of the Canyon site (JfVg-1), which is dated to 7,195 ± 130 BP, as well as Moose Lake (KaVn-2), which is dated to between 10,670 ± 80 BP and 10,130 ± 50 BP, have both been identified as Northern Cordilleran occupations (Hare 1995).

Little Arm Phase (8000-5000 BP)

After about 8,000 BP a distinctive microblade technology spread to many areas of the Yukon and, while it was thought that this technology became obsolete after around 5,000 BP, reevaluations suggest that it was present much later (Hare 1995; Hare and Hammer 1997). Clark (1991) accounted for these later microblade assemblages by suggesting that they resulted from hybridization with subsequent cultures. This phase was characterized by microblades, tabular and wedge-shaped microcores, burins, geometric round-based points, and the absence of Taye Lake diagnostics (see below). There were no notched points, and large bifaces and other heavy implements were very rare or absent. Endscrapers were large and narrow, but not abundant and gravers also occurred. Sites probably represented short stays by small groups and evidence suggested that subsistence resources were much like the early Taye Lake Phase, and included bison, caribou, moose, and birds.

Annie Lake Complex (5100-4600 BP)

Greer (1993) reviewed evidence of a distinctive technological complex in southwestern Yukon that consisted of concave based lanceolate projectile points. She noted that these points have morphological similarities to McKean points on the Plains and Shuswap points from the Plateau and suggested that this may represent a broad cultural interaction sphere. During initial excavations at the Annie Lake site (JcUr-3) Greer (1993) was able to provide bracketing dates of 4,900-2,000 BP for this complex. With additional work at the site, Hare (1995) determined that the complex dated between 6,200-2,900 BP and is likely restricted to 5,100-4,600 BP (Hare 1995: 130), although he feels that this is tentative. Hare (1995) also added the use of high quality lithic materials and highly curated multipurpose tools as traits of the complex.

Taye Lake Phase (5000-1250 BP)

Part of the widespread Northern Archaic Tradition, which Clark (1991) believes developed out of the Northern Cordilleran tradition, the Taye Lake Phase consists of all archaeological materials that are younger than 5,000 BP but predate the White River Ash. This phase was characterized by notched or lanceolate points with straight or slightly concave bases, an abundance of large bifaces, thick unifaces, a variety of endscrapers, and a developed bone industry. Ground stone was present but native copper was not in use. Burins were rare and gravers were only found sporadically. End scrapers were profuse, of either rounded or angular form, possibly with multiple working edges. This was the only phase where endscrapers had been prepared for hafting. Workman suggested a division of this phase at 3,000 - 3,500 BP with late traits being tabular schist bifaces and stone wedges, and early traits being notched cobbles and shaped, beveled blades. He saw this division as coincidental with the onset of Neoglaciation, the resulting formation of proglacial lakes, and the probable disappearance of grasslands and bison. Large, rich sites were suggestive of seasonal return to favourable locations over a long period of time. Big game hunting was likely supplemented by trapping, fishing, and bird hunting. On technological grounds, Workman proposed a population replacement or absorption at the beginning of this phase to explain the many differences and very few similarities between it and the Little Arm Phase but, as Hare (1995: 104-105) noted, technological traditions are not the equivalent of cultural traditions so population movements are not necessary to account for the differences.

The Taye Lake Phase is somewhat arbitrarily separated from the Late Prehistoric Period by the White River Ash, a useful stratigraphic marker, and while Workman (1978) saw a great deal of cultural continuity across this horizon, he also felt that the ashfall had catastrophic effects on the people living in the southwest Yukon at the time of the eruption. Coincidental with the eruption, people were coping with other significant changes to the landscape; neoglacial ice had restricted access to the mountains and had caused flooding of the valleys, while at the same time salmon were prevented from reaching the interior, and bison, an important resource, may have disappeared (Workman 1973). As a result, he believed that the area was probably abandoned for a number of years and people dispersed either north or south, out of the path of the ash. This proposed exodus may have caused hostility with neighbouring groups, whose territory was restricted by the newcomers. Workman (1973, 1978, 1979) also believed that the migrations, which resulted in the arrival of Athapaskan speakers to the American Pacific Coast and Southwest, were triggered by this eruption. Moodie et al. (1992) offered corroborating evidence by recording oral traditions among Mackenzie Dene that tell of a large volcanic eruption, widespread ashfall, and of their coming to the Mackenzie Valley from over the western mountains. Otherwise, Workman's arguments for cultural upheaval as a result of the volcanic explosion remain circumstantial.

Late Prehistoric Period (1250-50 BP)

This period postdates the fall of the White River Ash and includes the introduction of European trade goods near its terminus. It was characterized by native copper implements and flaked stone to a lesser degree. Characteristic artifact types included endscrapers with rounded outlines and thin working edges, and bifaces and unifaces with thin working edges. Burins were absent or very rare and tabular bifaces and stone wedges (pièces esquillées) reached maximum popularity. Unique traits were native copper, abraded cobbles, multi-barbed bone points, small stemmed Kavik-like points, small side-notched points, and slate pieces with thick, flat ground edges. Those types shared with the Taye Lake Phase were geometric and notched points, multi-barbed bone points, stone wedges, boulder spalls, two endscraper types, flake blade cores, blunted discoids, tabular bifaces, stemless points, broad, thin endscrapers, discoidal flake cores, and other general traits. Small sites probably reflected the ethnographic settlement pattern. Workman (1978) agreed with MacNeish (1964) that forest expansion was probably responsible for the decrease in site size and number but, unlike that author, saw no evidence for increased fishing and trapping at the expense of large game hunting.

Near the end of the Late Prehistoric Period an elaborate bone industry and a growing significance of European trade goods were in evidence. Not present, but expected characteristics of this phase included the increased use of metal tools at the expense of stone and native copper, the use of metal pots instead of skin or bark bags and boiling stones, an increase in axe-chopped bones with fewer calcined fragments, an increased emphasis on fur-bearing animals because of the fur trade, and increased sedentism with log cabin villages being occupied at least seasonally.

3.6 PREVIOUS HERITAGE WORK

Only two previous heritage assessments have been conducted within the vicinity of the Mel claim area that resulted in the discovery of heritage resources.

The first assessment was done in 1985 by Sheila Greer (Greer1985) for the Government of Yukon in consideration of the development of a territorial park at Coal River Springs. Greer's ethnological and traditional land use findings have been described above. This section briefly reviews her archaeological findings, which included four archaeological sites, three of which are located adjacent to the Mel claim area.

Just to the south of the Mel claim area, within British Columbia, Heritage North Consulting Ltd. conducted an archaeological impact assessment in 1997 for a proposed realignment of the Alaska Highway. Their study resulted in the discovery of one archaeological site.

Previously Recorded Archaeological Sites

JaSu-1 is a campsite situated at the western edge of an esker ridge located several hundred meters west of a lake outlet. The site comprises both surface and subsurface materials including historic material, such as metal buttons. Precontact remains included lithic debitage, calcined bone and an end scraper. Debitage and bone were located above and below a grey ash layer that is believed to originate from the White River volcanic eruption. Because this site is multi-component, Greer (1985: 11) believes that JaSu-1, named the *Tsa* Site, is the only one of the four sites recorded in the Coal River Springs survey to have archaeological research potential.

JaSu-2 is located on a small esker ridge within a few hundred meters of the Tsa site, beside the outlet of a long narrow, unnamed lake west of Coal River. Calcined bone fragments of unknown age were located on the west end of the esker ridge.

JaSu-3 is also located within 100 meters of the Tse site. The site consists of a single subsurface chert flake buried in the *A soil horizon* on a knob overlooking the same unnamed lake.

JaSu-4 is located several km east of JaSu 1-3. The site consists of a single non-calcined bone fragment and a lone chert flake excavated on a high bench on the north side of the outlet of the eastern-most of a series of small lakes located west of the Coal River.

IlSw-1 consists of both a surface and subsurface precontact lithic scatter and a historic cemetery. The precontact portion of the site is situated on the edge of a high terrace overlooking Contact Creek. Archaeological materials identified included lithic debitage of obsidian and siltstone raw materials.

4.0 METHODOLOGY

The following section describes the methods used for the Heritage Resources Overview Assessment (HROA). Background information was combined with aerial and previous ground observations of similar areas to produce a preliminary assessment of heritage resources potential in the study area. The results of the HROA are presented in Section 5.0.

4.1 HERITAGE RESOURCES OVERVIEW ASSESSMENT

All available maps, digital elevation models, satellite imagery, air photographs, ethnographies, histories, and archaeological reports for the study area were examined. Criteria used to determine potential for heritage resources included: proximity to streams and water bodies, known heritage sites, known Aboriginal or historic trails, topography, vegetation cover, and presence of fish and wildlife habitat as outlined in the Wildlife Key Area maps produced by the Yukon Government Department of Environment.

4.2 LIMITATION OF THE HROA

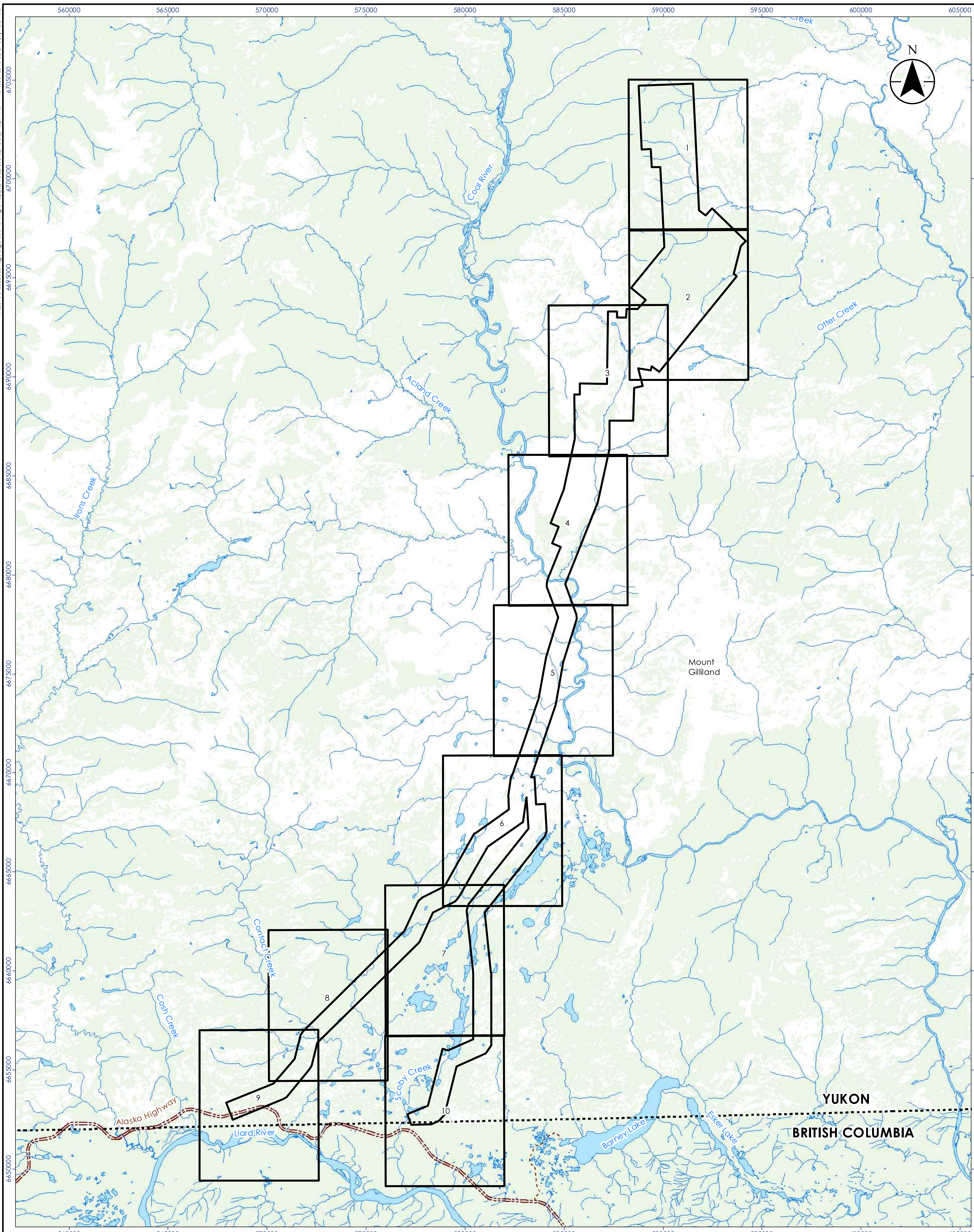
The criteria used to determine heritage resources potential during this assessment was derived from previously recorded sites and historic features near the study area and from previous experience in comparable terrain. Our current understanding of past settlement patterns and land use of the study area is limited by the lack of detailed ethnographic data, the scarcity of pre-contact heritage studies and recorded sites in the area, and the lack of detailed information on environmental and geomorphological changes throughout the glacial and post-glacial periods.

When viewing the HROA results it is important to note that low potential does not mean *no* potential. It is possible for heritage sites to be located outside of areas identified as having elevated heritage resources potential. To ensure that the discovery of any unanticipated heritage resources is addressed, it is recommended that Silver Range Resources Ltd. and Archer Cathro & Associates (1981) Limited inform their personnel and contractors that, in the event heritage resources are encountered, all development activities in the vicinity of the heritage resources must be suspended immediately. In such cases, the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon and the Liard First Nation must be contacted immediately with information on the heritage remains and nature of the disturbance.

5.0 RESULTS

The land base in the study area has been classified into zones of elevated heritage potential. It is important to note that the classification scheme is a predictive tool and that low potential does not mean no potential as it is possible for heritage resources to be encountered anywhere in the study area. Zones of heritage potential are portrayed as polygons on Maps 3.1-3.10. GIS shapefiles are provided so that these HROA polygons can be overlaid onto development planning maps.

The proposed development area encompasses a portion of the Coal River valley as well as Contact Creek, Scoby Creek, Otter Creek and multiple unnamed lakes, streams and seasonal drainages that are tributary to the Coal River, Rock River or Liard River. It also includes areas of low-lying and rolling kettle/kame topography, and low, rounded hills. The HROA results are tailored to this varied topography and the range of potential pre- and post-contact human activities possible within it. Section 6.0 discusses general patterns regarding the assignment of heritage resources potential and provides recommendations.



Legend

- HROA Study Area
- Administrative Boundary
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area

0 4,000 8,000 metres

1:200,000 (At Original document size of 11x17)

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Project Location

NTS Map Sheets:
095 D/03, 095 D/04,
095 D/06

123220209
Prepared by J. MacMillan on 2015-01-26
Technical Review by T. Heffner on 2015-02-27

Client/Project

Archer, Cathro & Associates (1981) Limited
Heritage Resource Overview Assessment
Mel Property

Figure No.

3

Title

MAP 3: HROA Results Index Map

Notes

1. Coordinate System: NAD 1983 UTM Zone 9N

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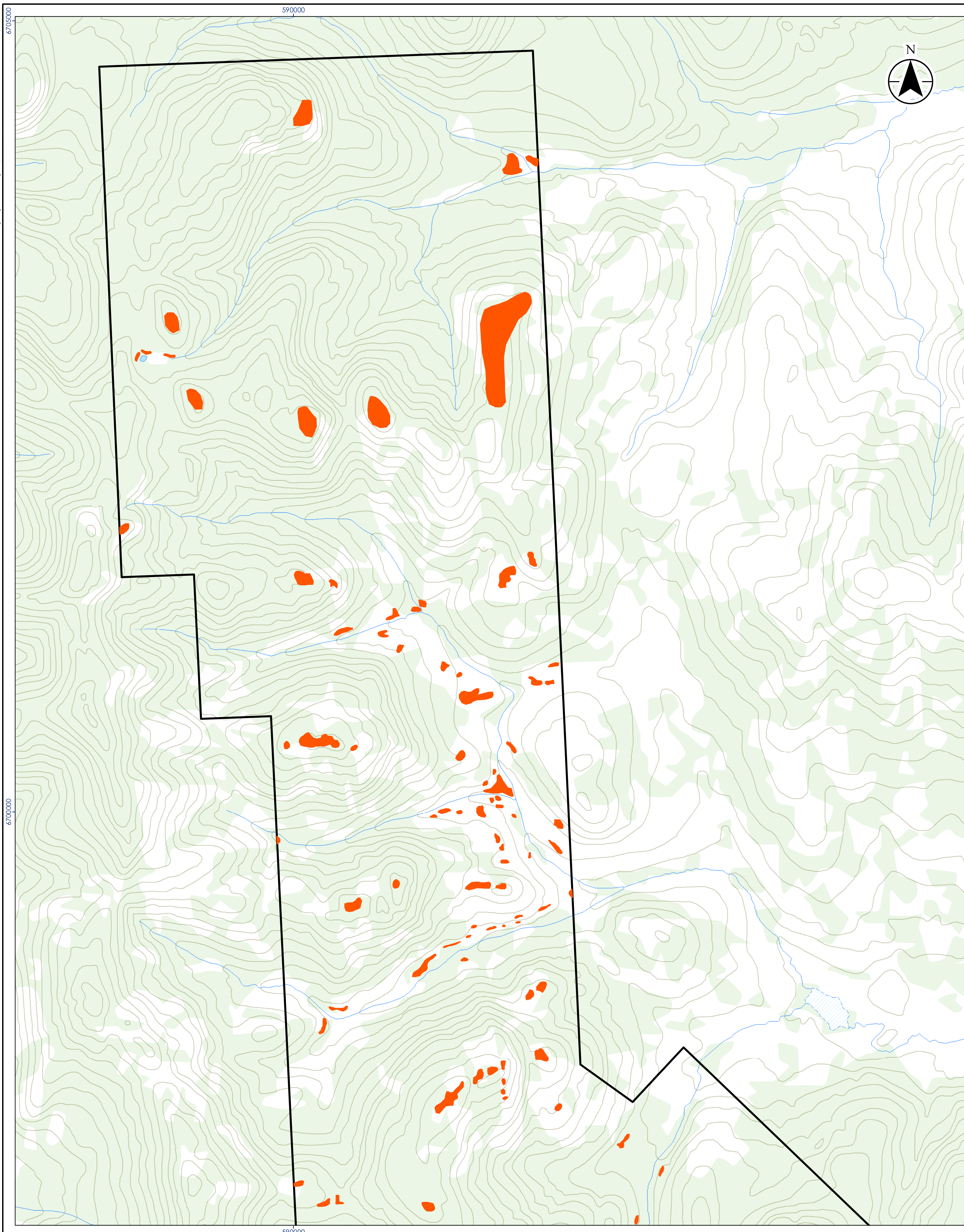

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

0 500 1,000
metres
1:25,000 (At Original document size of 11x17)

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Figure No.
3.1

Title
MAP 3.1: HROA Results Map

Notes
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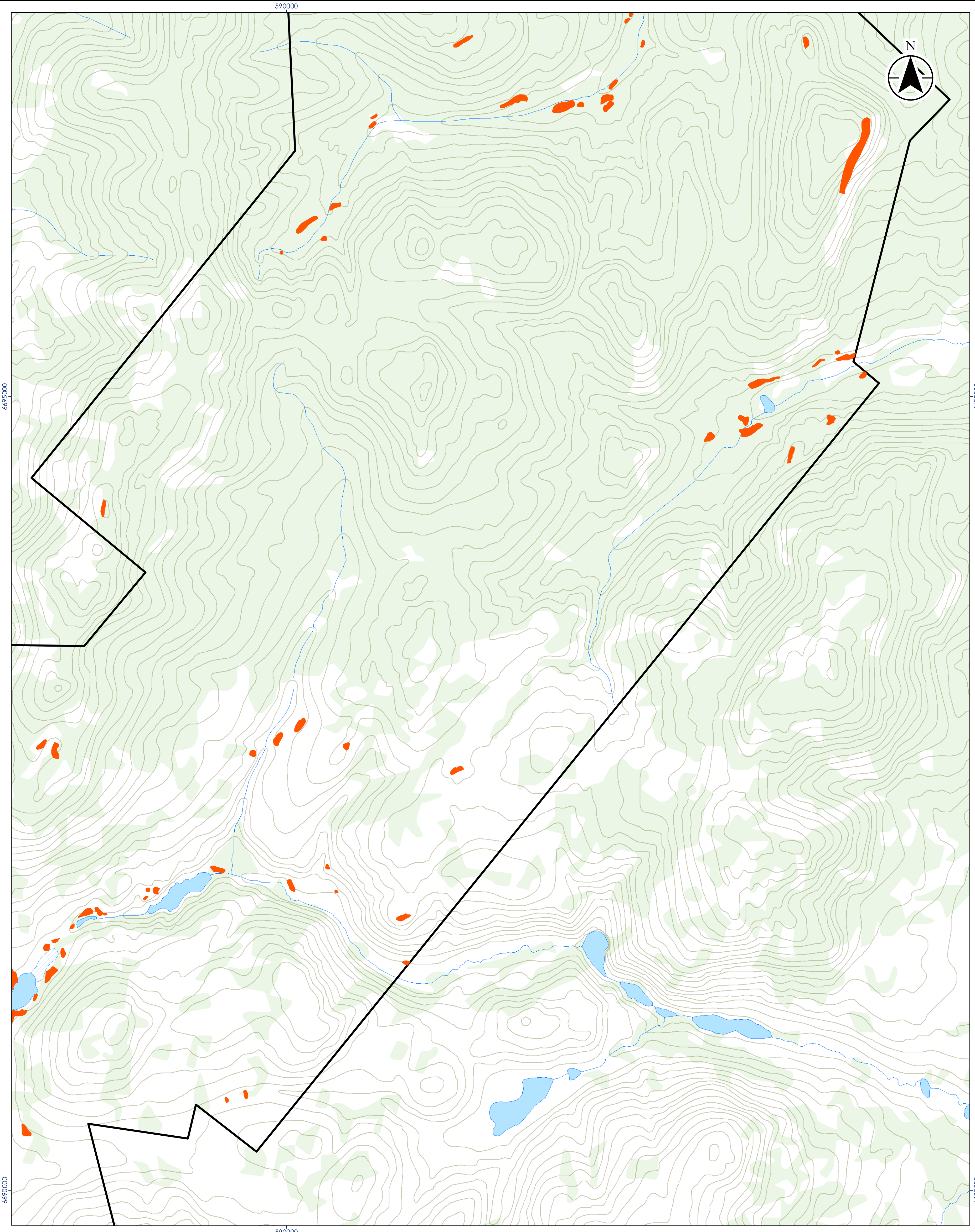

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

0 500 1,000 metres

1:25,000 (At Original document size of 11x17)

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095 D/06

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Figure No.

3.2

Title

MAP 3.2: HROA Results Map

Notes

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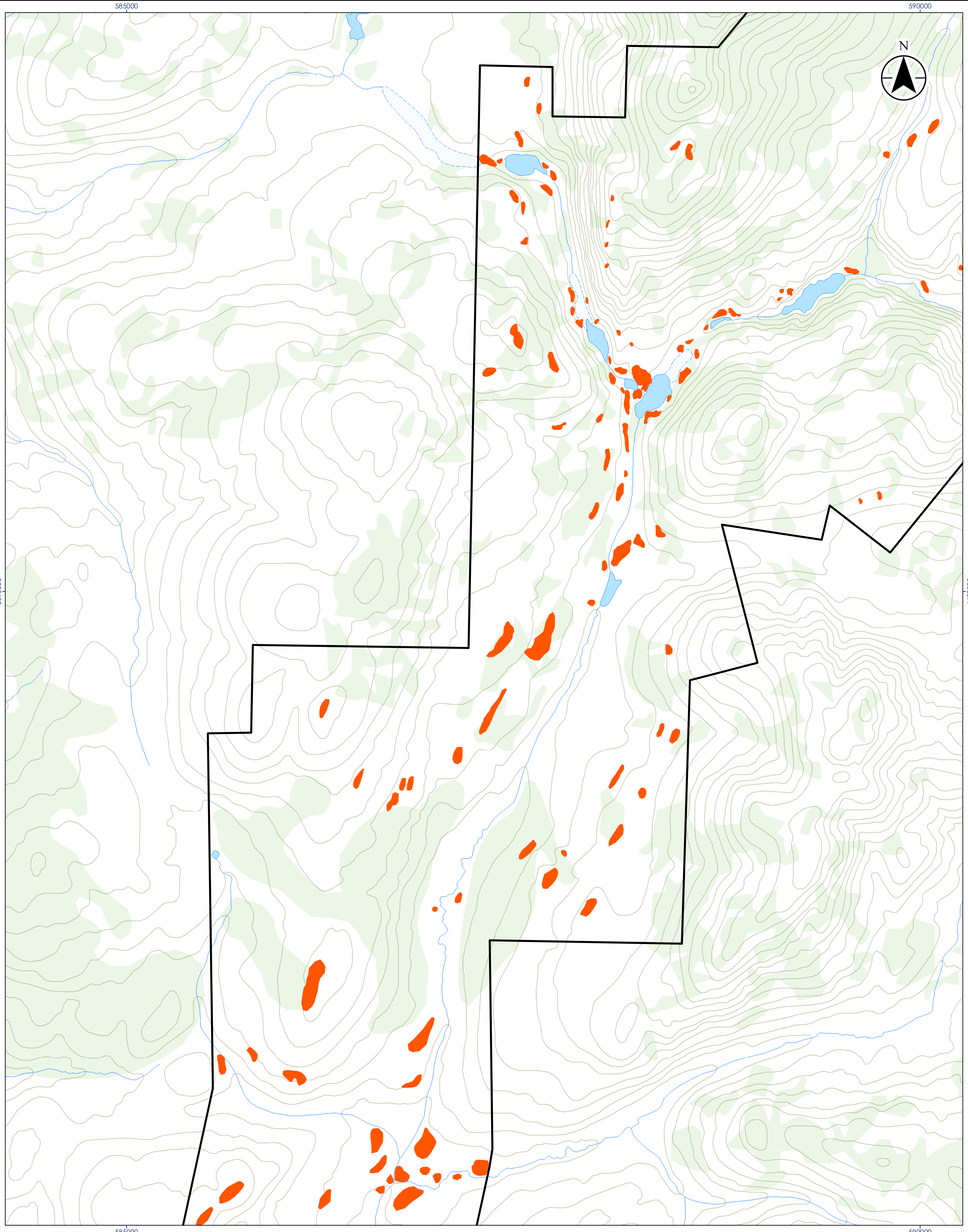

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

0 500 1,000 metres
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Figure No.
3.3

Title
MAP 3.3: HROA Results Map

Notes
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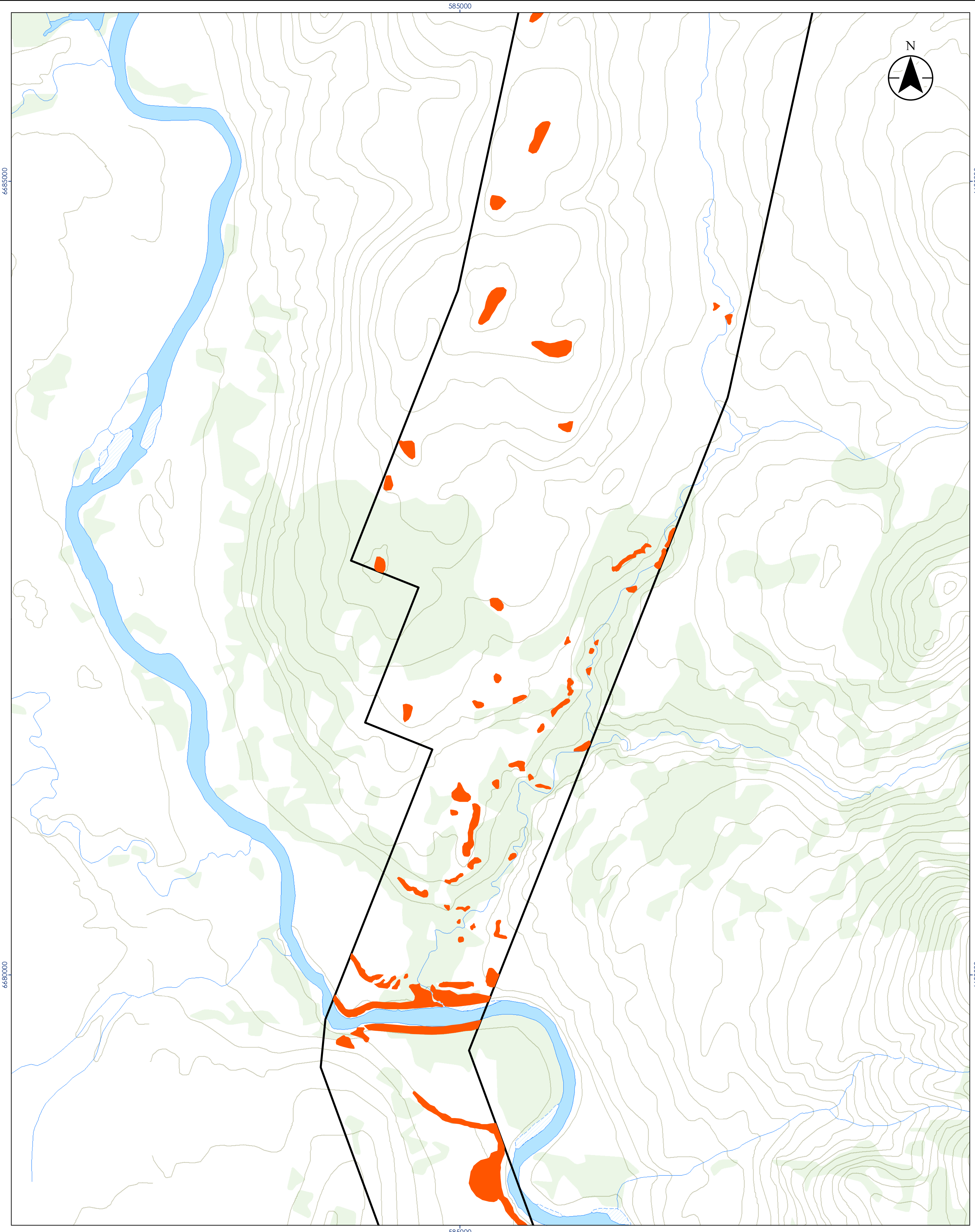

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

0 500 1,000 metres

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NTS Map Sheets:
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Figure No.
3.4

Title
MAP 3.4: HROA Results Map

Notes
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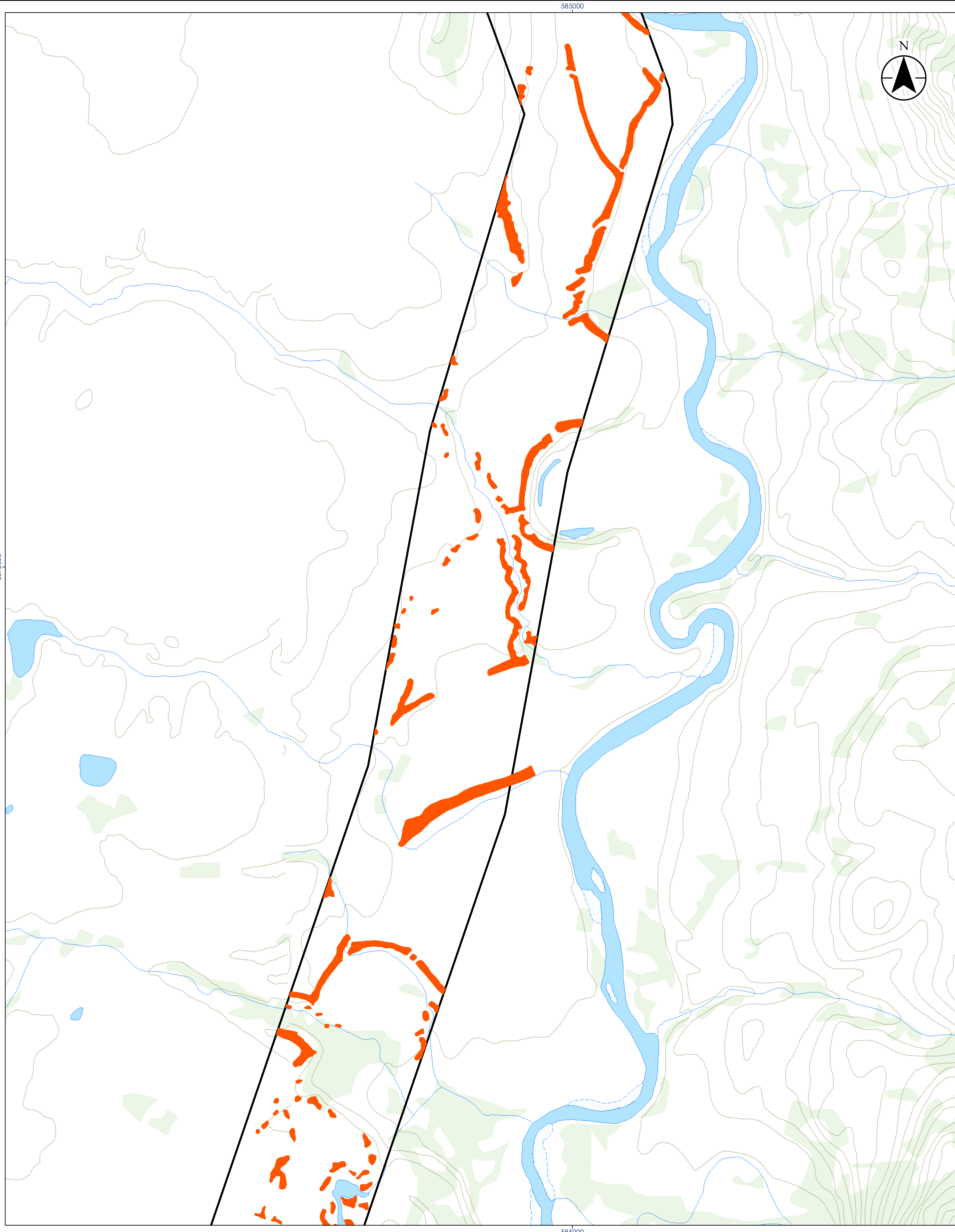

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

0 500 1,000 metres
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Figure No.
3.5

Title
MAP 3.5: HROA Results Map

Notes
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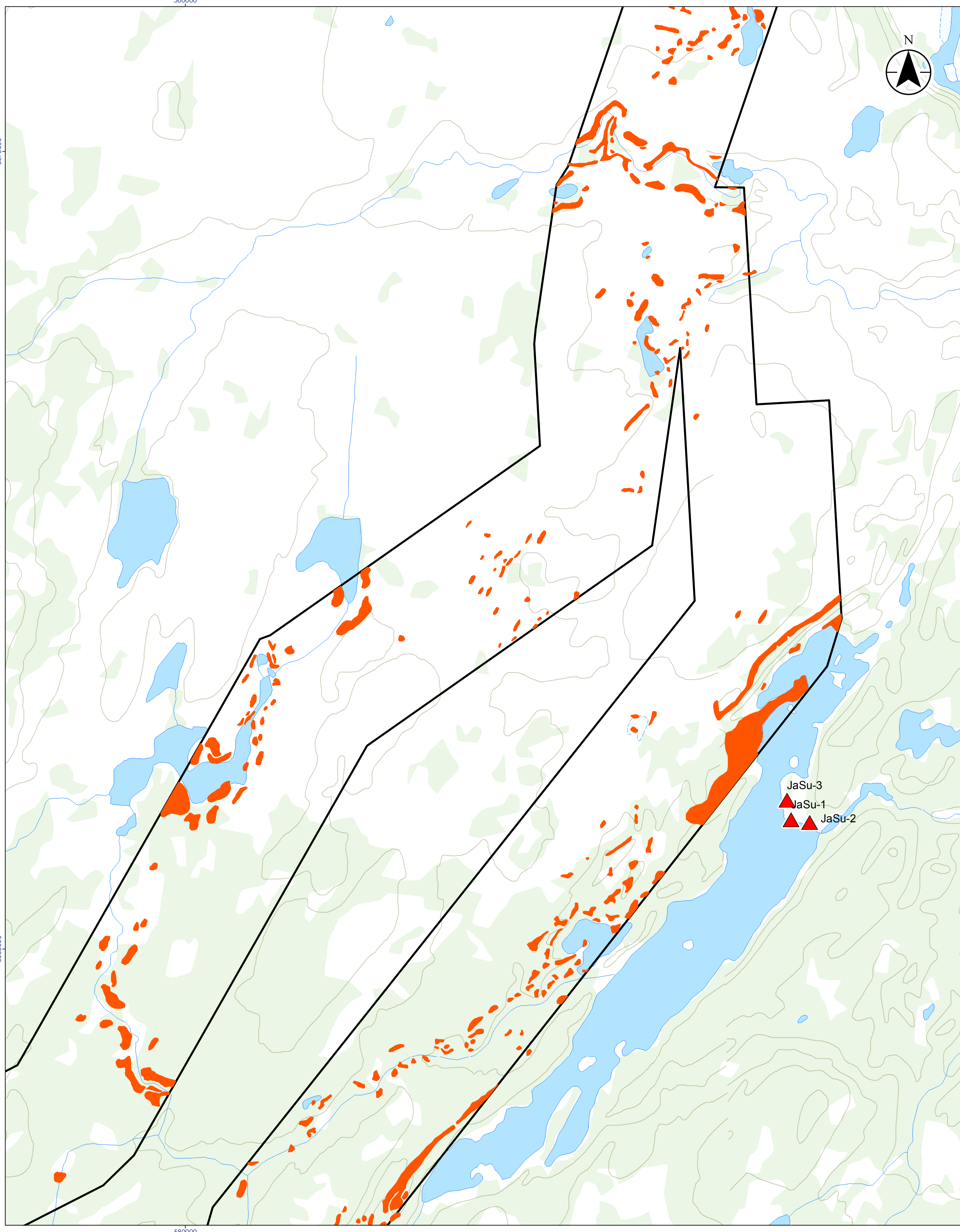

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour
- Archaeological Site

0 500 1,000 metres

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Mel Property

Figure No.

3.6

Title

MAP 3.6: HROA Results Map

Notes

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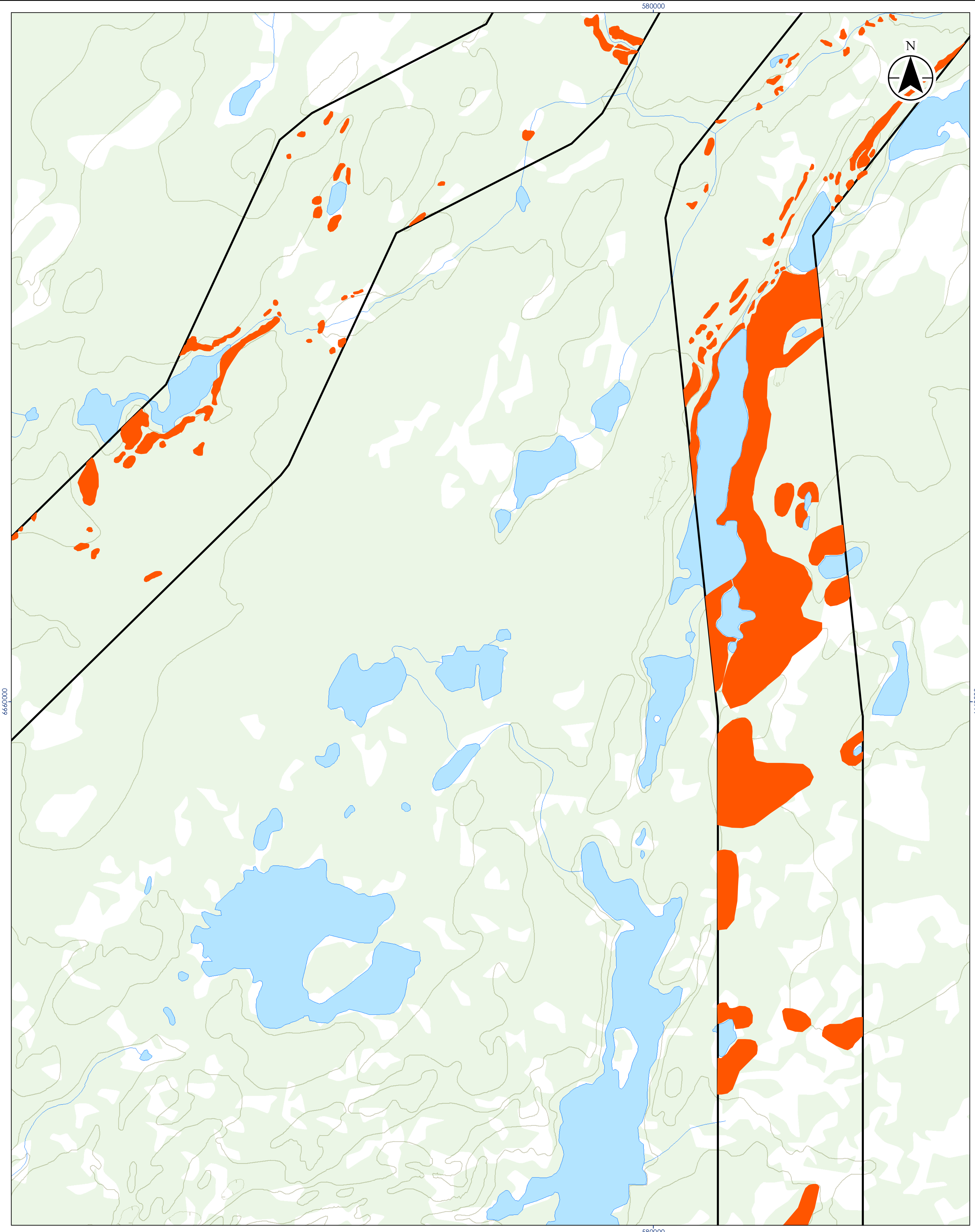

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

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metres
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Project Location
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095 D/06

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Figure No.
3.7

Title
MAP 3.7: HROA Results Map

Notes
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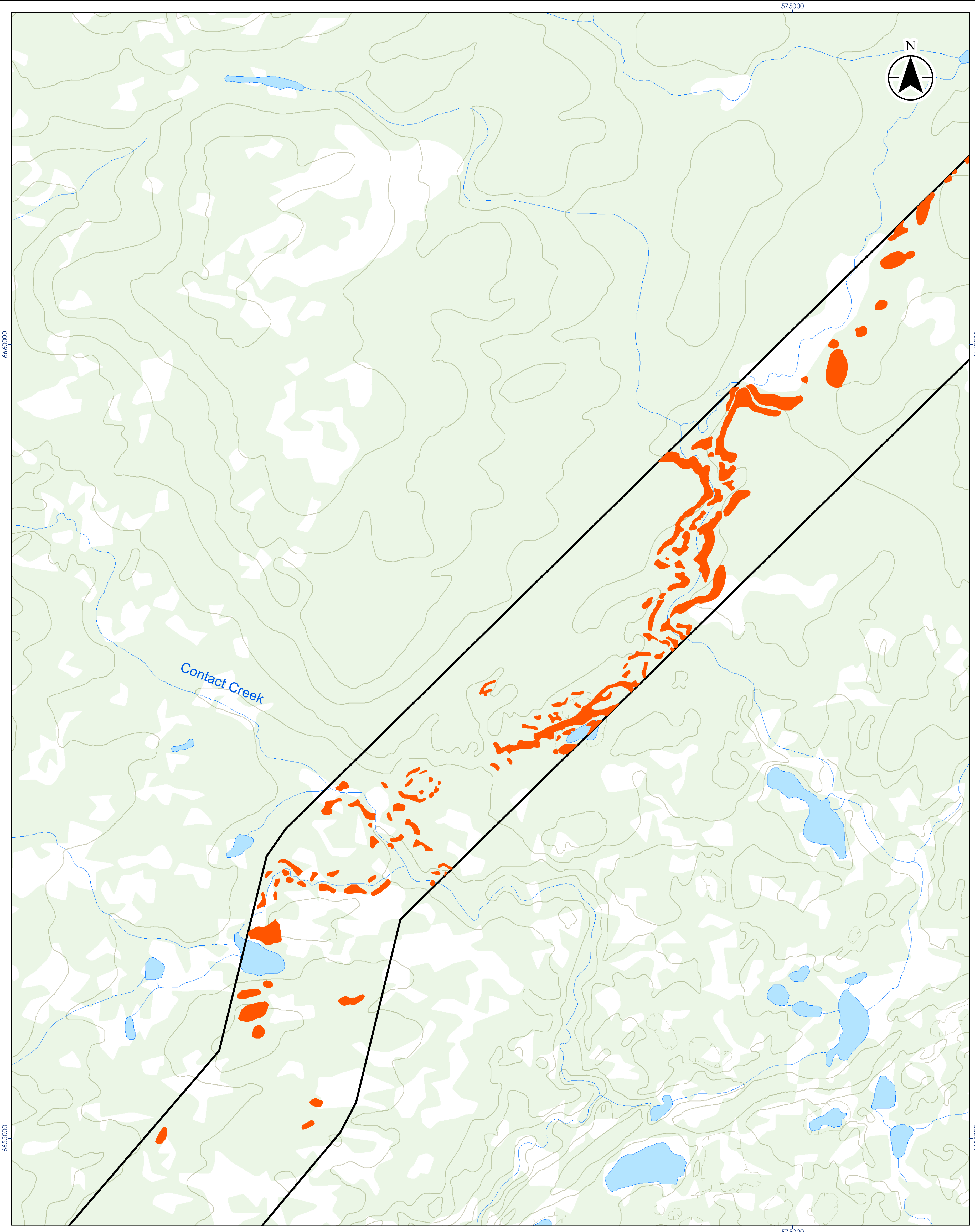

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

0 500 1,000 metres

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Project Location

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Heritage Resource Overview Assessment
Mel Property

Figure No.

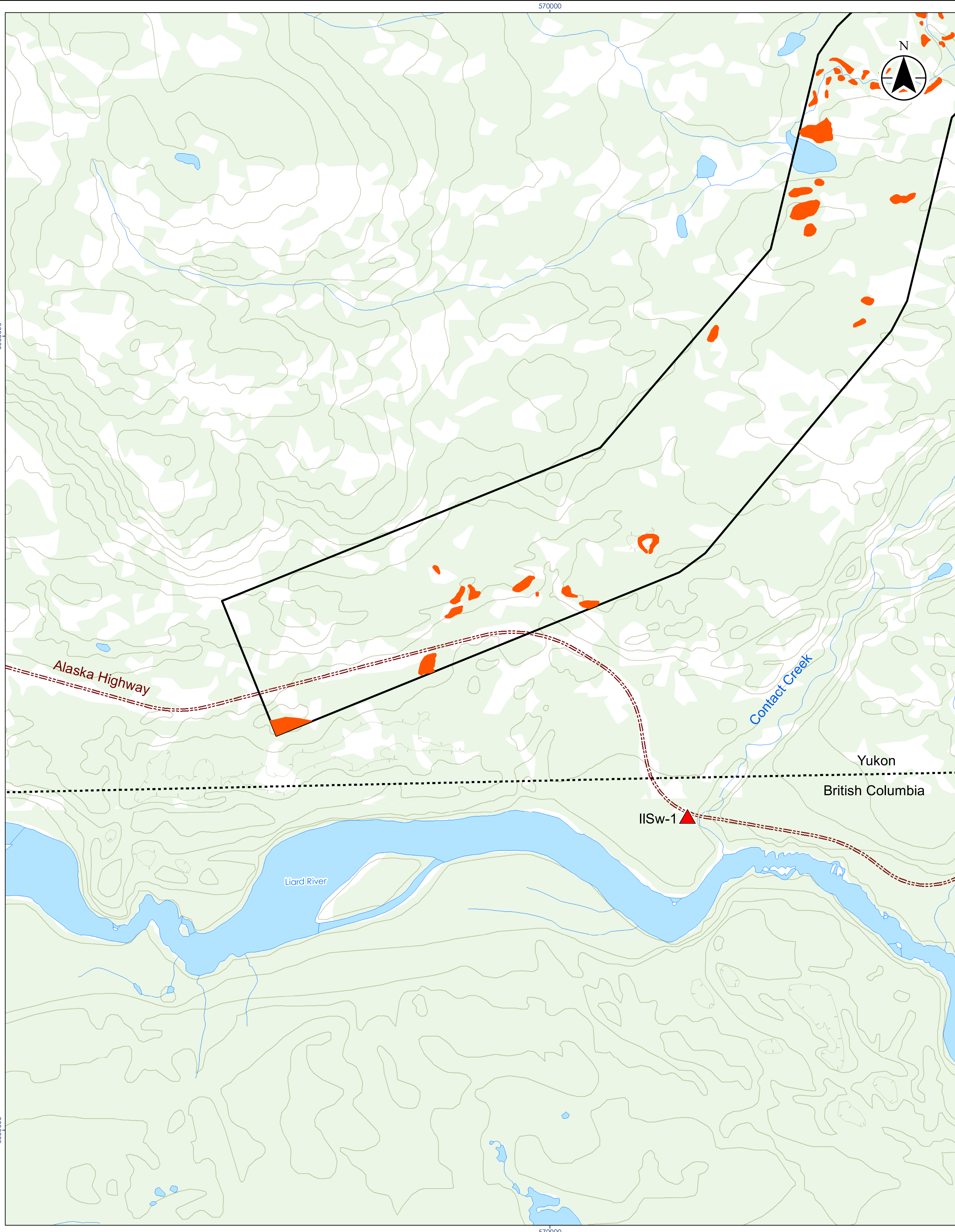
3.8

Title

MAP 3.8: HROA Results Map

Notes

1. Coordinate System: NAD 1983 UTM Zone 9N



Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour
- Archaeological Site

0 500 1,000 metres

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Project Location
NTS Map Sheets:
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Heritage Resource Overview Assessment
Mel Property

Figure No.
3.9

Title
MAP 3.9: HROA Results Map

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N

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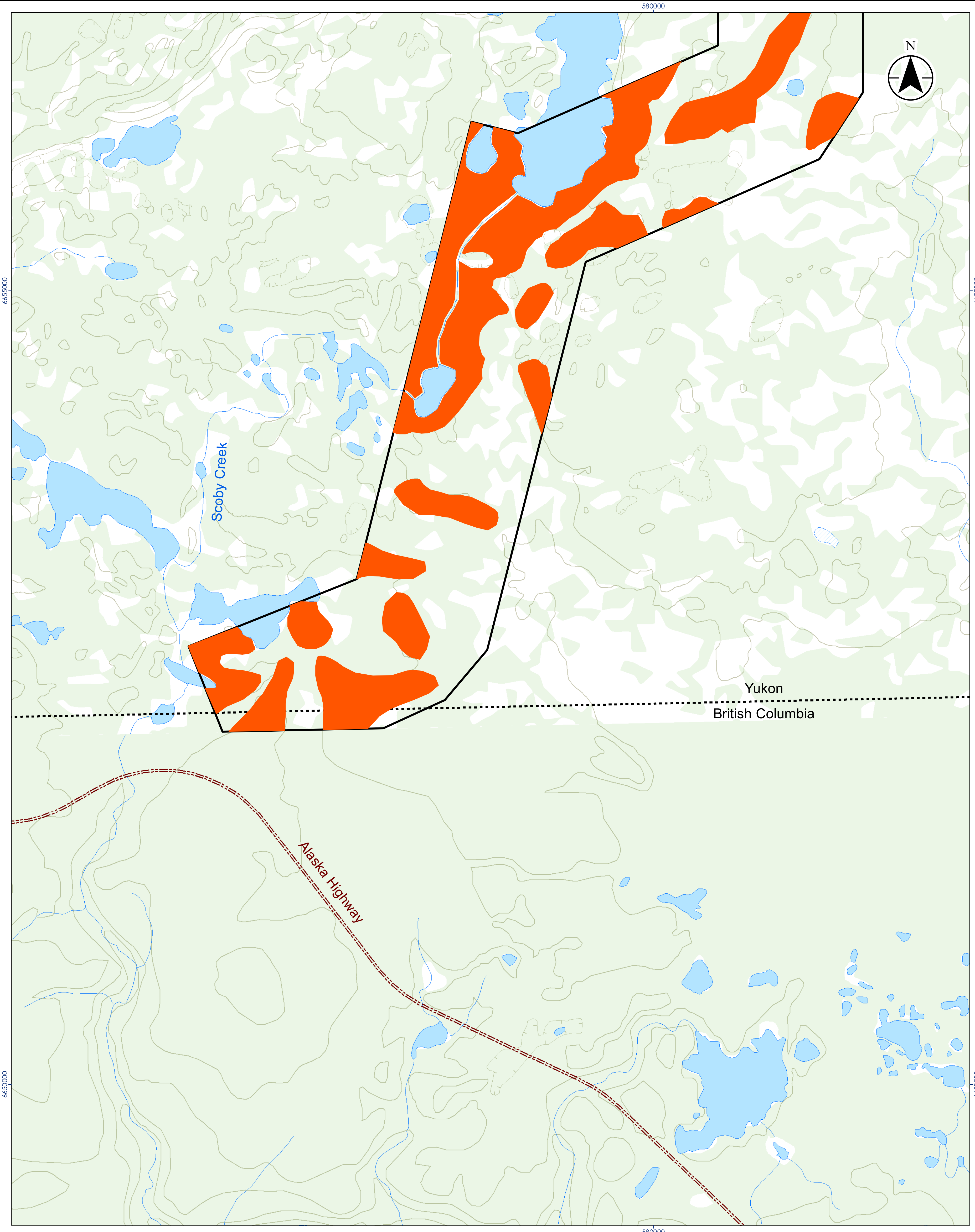

Legend

- Administrative Boundary
- HROA Study Area
- Primary road
- Secondary road
- Local road
- Access road
- Trail
- Watercourse
- Waterbody
- Waterbody, intermittent
- Forested area
- Heritage Potential
- Depression contour
- Topographic contour

0 500 1,000 metres
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Project Location
NTS Map Sheets:
095 D/03, 095 D/04,
095 D/06

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Heritage Resource Overview Assessment
Mel Property

Figure No.
3.10

Title
MAP 3.10: HROA Results Map

Notes
1. Coordinate System: NAD 1983 UTM Zone 9N

6.0 HERITAGE RESOURCE MANAGEMENT RECOMMENDATIONS

This section provides recommendations, including a discussion of gaps in heritage data, a prediction of the type and number of sites expected, and a discussion of the options for managing heritage sites during exploration and development planning.

6.1 GAPS IN THE HERITAGE RESOURCES RECORD OF THE STUDY AREA

No archaeological survey has taken place specifically within the exploration area and there has been limited archaeological work within the general vicinity. Due to these gaps in the archaeological survey of the area and surroundings, a more detailed framework for traditional and pre-contact land use within the area has yet to be established. Consequently, regional site density and distribution is relatively unknown.

6.2 HERITAGE RESOURCE POTENTIAL AND RESOURCE VALUES

A large portion of the study area is considered to have low pre-contact heritage resources potential, due to the rolling nature of the terrain and the absence of level, well drained features located near water sources. Areas considered to have elevated pre-contact heritage resources potential are typically located near hydrological resources on distinct, well-drained topographic features or are in upland areas on prominent landforms or level terrain that provide strategic hunting positions. These topographic features include knolls, eskers, ridges, and saddles that represent favorable locations for camping while moving through the area and / or ideal hunting grounds for large mammals moving along the uplands. Other elevated potential landforms include terrace features along fish-bearing streams and rivers, with most being old terraces of Coal River. Generally, areas with heritage potential are more frequent along the larger streams and their associated lakes and wetlands, but less frequent along the smaller, unnamed drainages located within the study area. Upland areas north and east of Coal River are predominantly rounded and gently sloped with few prominent overlooks and no obvious routes for pedestrian travel. Middle elevations within the northern portion of the study area are steeper and more rugged than lower or upper elevations and it is expected that archaeological site density will be lower in the middle elevation areas.

From the archaeological record, it is inferred that larger, more permanent pre-contact sites will be positioned adjacent to the major hydrological features, whereas upland sites and sites along smaller hydrological features are expected to represent short-term hunting sites with low artifact density. The remains of structures are not expected to be readily visible in this area given the regularity of forest fires and the relatively short-term pre-contact settlement pattern. Cultural depressions associated with pre-contact semi-subterranean dwellings are rare in this region but may be present along the major hydrological features. Hunting blinds may also be present in upland areas.

Historic use of the area may also result in heritage resource sites, as the region is still used today for hunting and trapping. Cabins, brush structures, historic drying racks, tent remains, and trapping equipment may be present in the area. Remains of small-scale historic mining and prospecting activities may also be present.

6.3 HERITAGE RESOURCE MANAGEMENT OPTIONS

Limited portions of the Mel claim are assessed as having elevated heritage potential. A Heritage Resources Impact Assessment (HRIA) is recommended prior to any potentially land-altering development activities being conducted within 30 meters of these areas. A HRIA offers the opportunity to ground-truth the heritage resources potential and can negate or confirm the presence of heritage resources. In the event that heritage resources are discovered in the development area, management options can be provided.

A Preliminary Field Reconnaissance (PFR) survey, including an aerial and pedestrian survey would allow refinement of the heritage potential mapping and facilitate gathering of baseline heritage data that can be incorporated into project planning and the design of subsequent heritage assessments.

6.4 RECOMMENDATIONS

Areas identified as having elevated heritage resources potential are shown on Maps 3.1-3.10. A Heritage Resources Impact Assessment (HRIA) is recommended prior to any potentially land-altering development activities being conducted within 30 meters of these areas.

The remainder of the Mel claim area is considered to have low potential for heritage resources and no further heritage assessment is recommended in those areas.

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Appendix A GLOSSARY OF ARCHAEOLOGICAL TERMS

ABORIGINAL; INDIGENOUS: Pertaining to the original occupants of a given region.

A-HORIZON: the uppermost, often dark coloured natural level in a soil profile characterized by roots, humus, and a lack of clay, iron, carbonates and soluble salts which have leached to lower levels.

ARCHAEOLOGY: The science concerned with the recovery, analysis, description and explanation of the remains of past human cultures.

ARCHAEOLOGICAL IMPACT ASSESSMENT (AIA): A study undertaken for a proposed development project to determine whether it will adversely affect archaeological remains.

ARCHAEOLOGICAL SURVEY OR SITE INVENTORY: Examination of a locality for evidence of past human activity and the recording of that evidence to produce an inventory of sites in that locality.

ARTIFACT: Any manually portable product of human workmanship. In its broadest sense includes tools, weapons, ceremonial items, art objects, all industrial waste, and all floral and faunal remains modified by human activity.

BARK-STRIPPED TREE: A tree which has had bark removed by First Nations people for a number of possible purposes (i.e., fibre, food, medicine).

BASALT: A fine-grained volcanic rock used for the manufacture of chipped stone artifacts. Colour ranges from black to grey; texture granular to glass like.

B-HORIZON: That natural level within a soil profile which directly underlies the surficial A-horizon and which contains the clay, iron oxides and carbonates which have leached down from it.

BIFACE: A stone artifact flaked on both sides.

BORDEN NUMBER: A standardized number consisting of four letters and one number assigned to each archaeological site which identifies it and denotes its general location in Canada.

BORDEN SYSTEM: A code of 4 letters and a number used to designate archaeological sites in Canada (e.g. GtRx 7; FlJr 10 etc.). Proposed by Charles E. Borden, University of British Columbia, in 1954. The alphabetic prefix refers a block of l0 minutes by l0 minutes within a grid system which covers all of Canada south of 62 N latitude. The numerical suffix indicates the site within this block in numerical order of registration.

CACHE: A deliberate store of equipment, food, furs or other resources placed in, or on the ground (perhaps protected by a rock CAIRN), or raised above the ground on a platform.

CACHEPIT: Small circular depressions (usually less than 3 m) that were used to store food.

CHALCEDONY: A semi-translucent silicate (quartz) rock with a wax-like lustre and a great range of colours, used as raw material for the manufacture of chipped stone artifacts. Commonly called agate.

CHERT: A mainly opaque, fairly granular, silicate rock with a dull shiny lustre and a great range of colours, used as raw material for the manufacture of chipped stone artifacts. Varieties include jasper and flint.

CONCHOIDAL FLAKE: A type of spall resulting from the fracture of fine grained, or glassy rocks. Characterized by a bulb of percussion, striking platform remnant, and extremely sharp edges. A predictable fracture pattern that allows the manufacture of predetermined tools from these materials.

CONTACT: The time of first prolonged direct contact between First Nations peoples and Europeans, which in the Yukon occurred during the mid 1800s with the establishment of fur trade forts. The term is synonymous with the HISTORIC PERIOD which is characterized by contemporary written works.

CONTEXT: The spatial relationships of archaeological items and samples within a site. "Primary Context" refers to materials found in their original position; "Secondary Context" refers to materials which have been displaced and re-deposited by disturbance factors; "Geological Context" is the relationship of the archaeological finds to geological strata.

CONCENTRATION: A notable accumulation of archaeological materials in a small area, such as a "concentration of flakes" etc.

CORE: (1) A blocky nucleus of stone from which flakes or blades have been removed (see MICROBLADE CORE). (2) A column or lineal sample of materials obtained by "coring" the ground, trees, etc.

CORTEX: The naturally weathered outer surface of a pebble.

CULTURE: The distinctive lifeway – including language, technology, subsistence, social organization, customs, beliefs and rituals – practiced by a people. This term can also be used to refer to the culture of particular groups of people at a particular point in time. In an archaeological context, the term culture refers to materials or objects of human origin, in contrast to natural.

CULTURAL DEPOSIT: Sediments and materials laid down by, or heavily modified by, human activity.

CULTURAL DEPRESSION: A pit excavated by people into natural sediments. Pits have been excavated for a variety of reasons including: houses (pithouses, house pit), food storage (cache, cache pit), food cooking (roasting pit, berry trenches, hearth) and burials.

CULTURALLY MODIFIED TREE (CMT): A tree that had been intentionally altered in some way. In the interior, CMTs are usually characterized by bark-stripped trees, that is, trees that have had the bark removed to access the cambium for eating, for extracting tree sap, for manufacture, or for medicinal purposes, by First Nations people. Blazed trees may also be referred to as CMTs.

CULTURE SEQUENCE: The chronological succession of cultural traits, phases or traditions in a local area.

CULTURE TYPE: A chronologically limited cultural unit within a local culture sequence, characterized by sufficient descriptive traits to set it apart from all other units. A phase is generally represented by two or more components in several sites and is the basic classification of archaeological "cultures".

DACITE: Volcanic rock (or lava) that contains 62% to 69% silica and moderate a mounts of sodium and potassium. Dacite is a variety of basalt.

DATUM: A fixed reference point on an archaeological site from which measurements are taken.

DEBITAGE: Waste byproducts from tool manufacture.

DETRITUS: Waste byproducts from tool manufacture. Most frequently applied to chips and fragments resulting from stone flaking.

DISTURBANCE: A cultural deposit is said to be disturbed when the original sequence of deposition has been altered or upset by post-depositional factors. Agents of disturbance include natural forces such as stream or wind erosion, plant or animal activity, landslides etc.; and cultural forces such as later excavations.

ETHNOGRAPHIC ANALOGY: Interpretation of archaeological remains by comparison to historical cultures.

ETHNOGRAPHY: That aspect of cultural anthropology concerned with the descriptive documentation of living cultures. In the Cariboo this is based on First Nations testimony and participant observation.

ETHNO-HISTORY: The study of ethnographic cultures through historical records.

ETHNOLOGY: The aspect of cultural anthropology concerned with the comparative and processional analysis of ethnographic cultures.

FAUNAL REMAINS: Bones and other animal parts found in archaeological sites. Important in the reconstruction of past ecosystems and cultural subsistence patterns (see: MICROFAUNAL REMAINS).

FEATURE: A nonportable product of human workmanship. Usually clusters of associated objects; pit houses, hearths, cache pits, cooking ovens etc.

FLAKE: A fragment removed from a core or nucleus of cryptocrystalline or fine grained rock by percussion or pressure. May be used as a tool with no further deliberate modification, may be RETOUCHED, or may serve as a PREFORM for further reduction.

FLINT: A microcrystalline silicate rock similar to CHERT, used for the manufacture of flaked stone tools. Colour most commonly grey, honey-brown, or black.

GROUND STONE: Stone artifacts shaped by sawing, grinding, and/or polishing with abrasive materials (e.g., "ground slate knives", "polished soapstone pendants" etc.).

HEARTH: A fireplace, often circular and may be unlined, rock or clay-lined, or rock-filled. Minimally consists of fire-altered rock and charcoal.

HISTORIC ARCHAEOLOGY: The archaeological investigation of POSTCONTACT sites.

HISTORIC PERIOD: The time after European contact or the beginning of written recording.

HORIZON: Layers typical of the soil profile in a particular region.

HOUSEPIT: An aboriginally excavated house floor. See PITHOUSE.

IN SITU: Archaeological items are said to be "in situ" when they are found in the location where they were last deposited.

LITHIC: Of/or pertaining to stone. A lithic artifact is one manufactured from stone.

LITHIC INDUSTRY: That part of an archaeological artifact assemblage manufactured of stone.

LITHIC SCATTER: An archaeological site consisting of two or more stone artifacts.

LITHIC TECHNOLOGY: The process of manufacturing tools, etc. from stone. Most frequently refers to stone flaking.

LOCALITY: A very large site or site area composed of two or more concentrations or clusterings of cultural remains.

MATRIX: An inclusive term for the natural and cultural sediments of an archaeological site.

MICROFAUNAL REMAINS: Very small animal remains, such as rodent bones, tiny bone fragments, insects, small molluscs, etc., discovered in an archaeological site.

MIDDEN: A deposit of camp refuse associated with human occupational sites. Most frequently refers to coastal SHELL MIDDENS.

MUNSELL COLOUR CODE: A system of describing colours by a code of letters and numbers defining "hue", "value" and "chroma". Important in accurately describing the colours of archaeological soils and sediments.

OBSIDIAN: Natural volcanic glass. Colour ranges from nearly translucent through black, red and green. A favourable raw material for the manufacture of flaked stone tools.

PALEOSOL: "Old Soil." Buried soil horizons indicative of past soil conditions different from that presently prevailing.

PETROGLYPH: Pictures, symbols, or other artwork pecked, carved or incised on natural rock surfaces.

PICTOGRAPH: Aboriginally painted designs on natural rock surfaces. Red ochre is the most frequently used pigment and natural or abstract designs may be represented.

PITHOUSE: A semi subterranean "earth lodge" winter dwelling. Usually consisted of an earth covered log framework roof over a circular to rectangular excavation. The archaeological feature is called a housepit.

POSTCONTACT PERIOD: Refers to the period following the first arrival of Europeans (see: HISTORIC PERIOD).

PRECONTACT: Refers to the period before the first arrival of Europeans in a given area.

PREHISTORIC: The period prior to written records for any given area. In North America synonymous with PRECONTACT.

PRELIMINARY FIELD RECONNAISSANCE (PFR): A study undertaken for a proposed development project to determine whether it will adversely affect archaeological remains.

PROJECTILE POINT: An inclusive term for arrow, spear or dart-points. Characterized by a symmetrical point, a relatively thin cross section and some element to allow attachment to the projectile shaft. Flaked stone projectile points are usually classified by their outline form: triangular, leaf-shaped, lanceolate, stemmed, corner-notched, and side-notched.

PROVENIENCE: The horizontal and/or vertical position of an object in relation to a set of spatial co-ordinates.

QUARTZ CRYSTAL: Pure silicate rock crystal. Usually perfectly clear with six crystal surfaces. May be used as a raw material for lithic tool manufacture.

RETOUCH: The removal of small secondary flakes along the edge of a lithic artifact to improve or alter the cutting properties of that edge. Retouch flaking may be BIFACIAL or UNIFACIAL.

RETOUCHED FLAKE: A stone flake which has had one or more edges modified by the deliberate removal of secondary chips.

ROCK-SHELTER: A shallow cave or rock overhang large enough to have allowed human occupancy at some time.

SCRAPER: A tool presumably used in scraping, scouring, or planing functions. Most frequently refers to flaked stone artifacts with one or more steep UNIFACIALLY RETOUCHED edge(s).

SETTLEMENT PATTERN: The spatial distribution of cultural activities across a landscape at a given moment in time.

SHOVEL-SCREENING: A rapid excavation procedure in which the site matrix is shoveled directly through a screen (usually 1/4" mesh).

SHOVEL TEST: a small scale, generally informal test excavation to ascertain the nature of the deposits, to determine the presence or absence of an archaeological site, or to delimit the boundaries of a known site.

SITE: Any location with detectable evidence of past human activity. Includes HABITATION SITES, KILL SITES, QUARRY SITES, ROCK ART sites, BURIAL sites, etc.

SITE SURVEY: The process of searching for and describing archaeological sites in a given area.

SOIL SAMPLE: A quantity of soil, site matrix, or sediments collected for physical or chemical analysis.

STORAGE PIT (Also called CACHE PITS): Typically circular excavations usually less than 3 m in diameter assumed to have aboriginally functioned as storage "cellars".

STRATA: Depositional units or layers of sediment distinguished by composition or appearance. (Singular: "stratum").

STRATIGRAPHY: The study of various deposits, built up over time, which form delineated layers (such as ash, charcoal or crushed shell) in the earth walls of a pit.

SURVEY(ING): (1) In Archaeology, the process of locating archaeological sites. (2) More generally, the process of mapping and measuring points on the ground surface.

SURVEY AREA: The region within which archaeological sites are to be located.

TOOL: An artifact that has been intentionally modified or formed for a specific purpose (i.e., projectile point, knife, scraper).

TYPE: A distinctive formal artifact class restricted in space and time, e.g., the "Folsom Point" is a projectile point "type".

TYPOLOGY: The classification of artifacts according to analytical criteria, to determine and define significant trends or variations in time and space.

UNIFACE: A stone artifact flaked only on one surface.

USE WEAR: Polish, striations, breakage, or minor flaking which develop on a tool's edge during use. Microscopic examination and study of the wear may indicate the past function of tools.

WETLAND: Areas of land that are inundated by surface water or ground water sufficient to support the growth and reproduction of vegetative and aquatic life.

WORKED: Having chips, flakes, scratches or other evidence of deliberate modification on stone, bone, antler, shell, etc.

ZOOARCHAEOLOGY: The study of faunal remains found in archaeological sites and their cultural significance.

APPENDIX VII

BARITE MARKETING STUDY

WORLD INDUSTRIAL MINERALS
11950 W. 67th Ave • PO Box 130
Arvada, CO 80001
720-898-4808 Fax 720-898-4810

MARKET EVALUATION
MEL BARITE DEPOSIT
YUKON TERRITORY
CANADA

SEPTEMBER 2014

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Introduction

Silver Range Resources Limited requested a proposal from World Industrial Minerals concerning the investigation of selected markets that utilize barite in their processes and product lines. Currently high quality barite is in great demand for all use sectors. This study includes comparing chemical assay data from the Mel deposit located northeast of Watson Lake, Yukon to specifications of the various end use markets listed below. For those markets in which the barite meets spec, consumers/distributors have been identified. It is understood that several potential applications are more transportation sensitive than others and that reasonable, economic distribution limits will be estimated. The focus of the identification program for each use category is as follows:

- Oil and Gas
- Chemical
- Fillers/Extenders
- Plastics
- Construction

Additionally the following was addressed:

- Determine to what extent a market exists nearby or within a reasonable transportation distance.
- Estimate the approximate yearly production that could be absorbed by any existing market.
- Provide a reasonable price estimate for the sale of barite products and the appropriate specifications for each application/product.

Physical Characteristics/Properties

Barite is the mineralogical name for barium sulfate ($BaSO_4$). Barite is a soft (hardness 3 on the moh's scale) virtually inert mineral with a specific gravity (SG) of 4.5 (ideal). Barite occurs in igneous, sedimentary as well as metamorphic rocks. These barite deposits occur in the following forms

- Bedded
- Residual/Eluvial
- Vein and Cavity Fillings

Barite's high specific gravity makes it ideal for use as a weighting agent in drilling muds for oil and gas drilling. Lighter color high brightness (90+% on the GE brightness scale) combined with low oil absorption, and wettability by oils allow barite not only to be used in drilling muds but as a filler/additive in a variety of industrial applications.

Mining and Processing

Bedded deposits are commonly found in sedimentary host environments and are generally amenable to large scale open pit mining methods. Residual or eluvial deposits usually require highly selective open pit mining methods. Typical mining equipment used for these types of deposits is power shovels, draglines and front end loaders.

For the Mel deposit with its associated complex geometry the vein/stratform barite would be extracted as a byproduct of the proposed lead zinc mining. Base metal mines of this type (with associated commercial grade barite) are found in Sardinia and the United Kingdom.

Most bedded barite deposits require only crushing and sizing while others with more complex geometry require crushing, jigging, wet grinding and or flotation. The Mel deposit as indicated by the historic processing literature requires the flotation processing step to separate the barite from the lead-zinc and other associated deleterious minerals. Additional processing steps such as heavy media separation and or magnetic separation may be necessary to achieve the required purity of the barite product.

Production and Consumption

In 2013 world barite production totaled 8.5 million metric tonnes. This represents a drop in production from 2012 of 700,000 tonnes. Table 1 shows annual world production since 2009.

Table 1
Annual World Barite Production
(Metric Tonnes)

Country	2009	2010	2011	2012	2013
China	3,000,000	4,000,000	4,100,000	4,200,000	3,800,000
Germany	45,606	55,887	55,342	55,000	55,000
India	1,200,000	1,300,000	1,350,000	1,700,000	1,500,000
Iran	361,217	326,275	330,000	330,000	330,000
Kazakhstan	170,000	170,000	200,000	250,000	250,000
Mexico	152,790	143,225	134,727	139,997	125,000
Morocco	586,937	572,429	769,504	1,000,000	850,000
Pakistan	56,333	49,038	50,000	52,000	50,000
Peru	27,881	52,275	86,700	76,007	75,000
Russia	63,000	60,000	63,000	63,000	65,000
Thailand	51,895	33,465	67,703	70,000	70,000
Turkey	213,187	172,618	250,786	260,000	260,000
United States	396,000	662,000	710,000	666,000	660,000
Vietnam	75,000	85,000	85,000	85,000	90,000
All Other Countries	270,154	267,778	257,738	250,000	300,000
Total	**6,670,000**	**7,950,000**	**8,510,000**	**9,200,000**	**8,500,000**

In North America (Canada, United States, Mexico) the annual barite production is tabulated in Table 2 as follows:

Table 2
Annual North America Barite Production
(Metric Tonnes)

Country	2009	2010	2011	2012	2013
Canada	15,000	22,000	25,000	25,000	25,000(e)*
Mexico	152,790	143,225	134,727	139,997	125,000
United States	396,000	662,000	710,000	666,000	660,000
Total	**563,790**	**827,225**	**869,727**	**830,997**	**810,000**

e*=estimated

Barite production in North America represents 9.5% of the world's total output in 2013.

Consumption (metric tonnes) of barite in Canada, the United States and Mexico for 2012 is given as follows:

Canada: 115,294
United States: 3,430,000
Mexico: 178,597

In 2012(last year for published actual figures) Canada imported approximately 78% or 90,600 metric tonnes of its barite for its needs from the United States. The United States imported approximately 85% or 2,920,000 metric tonnes of its barite for internal consumption primarily from China. Mexico imported 21% or 38,600 metric tonnes of barite from the United States.

Overall in 2012 the United States re-exported approximately 129,200 Mt of barite to Canada and Mexico and an additional 21,800 Mt to other offshore locations. Mexico also exported modest amounts of chemical grade barite to the United States.

In Canada in 2012 essentially 100% of the domestic and imported barite is used in drilling mud for the oil and gas business.

In the United States in 2012 1,110,000 Mt is imported as crude unground barite and 1,790,000 Mt is imported as ground barite. Of the total amount of barite consumed in 2012 97% or 3,210,000 Mt was used in drilling mud and 3% 107,000 Mt was consumed in all other non-drilling mud applications.

As of 2012 Canada had one operating barite mine with a grinding plant and one independently operating grinding plant. All the output from these facilities is sold drilling mud for the oil and gas industry. The United States has 5 operating barite mines, 2 jig plants and 30 grinding mills. Of the 30 grinding plants 4 are associated with mines and 26 are free standing. Two additional barite mines and associated plants are currently shut in.

In 2012 Mexico had 5 operating mines and at least 3 operating grinding mills. Mexican facilities are not shown in the Table or on the map because they are not within the scope of this report.

Table 3 shows the location of these mines and grinding facilities in Canada and the US.

Table 3
North America Mines and Grinding Plants

Company	Site Name	County	State/Province	Operation Type
		Canada		
Fireside Minerals	Fireside Mine		British Columbia	Mine
Fireside Minerals	Watson Lake		Yukon Territory	Grinding Plant
Alliance Energy Grp.	Lethbridge		Alberta	Grinding Plant
		United States		
Ambar Inc	Ambar Lonestar	Terrebonne	Louisiana	Grinding Plant
Baker Hughes	Morgan City	Orleans	Louisiana	Grinding Plant
Baker Hughes	Argenta	Lander	Nevada	Jig Plant
Baker Hughes	Argenta	Lander	Nevada	Mine/Grinding Plant
Baker Hughes	Barite	Lander	Nevada	Grinding Plant
Baker Hughes	Corpus Christi	Nueces	Texas	Grinding Plant
Baroid (Hallibuurtion)	Houston	Harris	Texas	Grinding Plant
Baroid (Halliburton)	Dunphy	Eureka	Nevada	Grinding Plant
Baroid (Halliburton)	Rossi	Elko	Nevada	Mine/Grinding Plant
Baroid (Halliburton)	Corpus Christi	Nueces	Texas	Grinding Plant
Baroid (Halliburton)	New Orleans	Orleans	Louisiana	Grinding Plant
Baroid (Halliburton)	Lake Charles	Calcasieu	Louisiana	Grinding Plant
Canadian Energy Serv.	Corpus Christi	Nueces	Texas	Grinding Plant
Chemical Products Corp	Cartersville	Bartow	Georgia	Mine/Grinding Plant
Cimbar	Houston	Harris	Texas	Grinding Plant
Cimbar	Mount Vernon	Posey	Indiana	Grinding Plant
Cimbar	Chatsworth	Murray	Georgia	Grinding Plant
Cimbar	Wellsville	Columbiana	Ohio	Grinding Plant
Elementis Pigments	E. St. Louis	Saint Clair	Illinois	Grinding Plant
Excalibar (Newpark)	Corpus Christi	Nueces	Texas	Grinding Plant
Excalibar (Newpark)	Houston	Harris	Texas	Grinding Plant
Excalibar (Newpark)	New Iberia	Iberia	Louisiana	Grinding Plant
Excalibar (Newpark)	Dyersburg	Dyer	Tennessee	Grinding Plant
JM Huber	Quincy	Adams	Illinois	Grinding Plant
M-1 (Schlumberger)	Galveston	Galveston	Texas	Grinding Plant
M-1 (Schlumberger)	Greystone	Lander	Nevada	Mine/Grinding Plant
M-1 (Schlumberger)	Battle Mountain	Lander	Nevada	Grinding Plant
M-1 (Schlumberger)	Amelia	Assumption	Louisiana	Grinding Plant
M-1(Schlumberger)	West Lake	Calcasieu	Louisiana	Grinding Plant
Milwhite	Brownsville	Cameron	Texas	Grinding Plant
NOV Minerals	Big Ledge	Elko	Nevada	Mine/Jig Plant
NOV Minerals	Evanston	Uinta	Wyoming	Grinding Plant

Applications and Chemical and Physical Specifications

As previously stated approximately 97% of all barite consumed annually is used as a weighting agent in drilling mud. Approximately 3% is used annually in all other non-drilling applications.

Oil and Gas

This application for barite is as a weighting agent in natural gas and oil field drilling muds to suppress high formation pressures and prevent blowouts. As a well is drilled the bit passes through various formations, each with different characteristics. The deeper the hole, the more barite is needed as a percentage of the total mud mix. An additional benefit of barite is that it does not interfere with magnetic measurements taken in the borehole, either in logging-while-drilling or in separate drill hole logging. Barite used for drilling oil and gas wells can be black, blue, brown, buff or gray depending on the ore body. Most barite needs to be ground to a small uniform size before it is used as a weighting agent in petroleum well drilling mud based on specifications set by the American Petroleum Institute (API).

Specification

Up until 2010 the specification for barite used worldwide was the following:

Specific Gravity (S.G.): 4.2

Sizing	: 97% of material by weight must pass through a 75 micrometer screen and no more than 30% by weight can be less than 6 micrometers.
Contaminates	: The barite can have no more than 250 milligrams per kilogram of water soluble alkaline earth metals such as calcium.
Other Impurities	: Common impurities in drilling grade barite include quartz, chert, dolomite, siderite, and metallic oxide and sulfide compounds. These are normally insoluble, and as a result standards limiting their concentrations have not been developed.

Base Metal Impurities: The API standard does not address heavy metal impurities, but barite derived from base metal deposits such as the Mel deposit can and normally do contain heavy metals such as cadmium and mercury and discharges of these may be regulated under environmental law. For example US environmental regulations pertaining to offshore drilling allow drilling waste discharges containing barite only if barite contains less than 3 parts per million (ppm) cadmium and 1 ppm mercury. Shown in APPENDIX A is an example Material Data Safety Sheet (MSDS) published by IMCO Barite that describes the test used to determine the level of mercury and cadmium leaching (if any) from barite. The test listed on page 5 of the MSDS under item 12 “Ecological Information” is mysid shrimp toxicity test. This test is required by the US environmental Protection Agency (USEPA) by all operations using barite in Region V

(Gulf of Mexico). Additional MSDS sheets are included in APPENDIX A that characterize the variety of barite drilling muds available in the market.

S.G. Specification Modification: Effective August 1, 2010 the API specification for specific gravity (S.G. Specification 13A) was modified to include a lower S.G. specification of 4.1 S.G. From this point on either 4.1 or 4.2 S.G. barite was allowed in drilling mud. The proposed modification was put forth in late 2006 because of a perceived shortage both current and ongoing of 4.2 S.G. material. The operators in the western United States involved primarily in drilling the shallower, less pressurized horizontal drill holes widely adopted the lower 4.1 S.G. barite. The lower S.G. material was more widely available and was less costly than the 4.2 S.G. barite. Offshore drillers continue to use 4.2 S.G. barite as do onshore customers in other parts of the United States that rely on imported barite.

Shown in APPENDIX B are specification sheets published by suppliers for drill mud grade barite.

Chemical

To make many barium chemicals barite ($BaSO_4$) is converted to barium Carbonate ($BaCO_3$). The specification of the barite suitable for conversion to barium carbonate is as follows:

$BaSO_4$	92-98%
SiO_2	None
Fe_2O_3	maximum 1%
Al_2O_3	None
$SrSO_4$	maximum 1%
CaF_2	maximum 0.5%

Sizing: minus 850 micrometers 100%
minus 150 micrometers maximum 5%

Another product BaS (Barium Sulfide) can also be made and serves as a precursor for a range of barium chemicals. Specifications are similar to those listed above.

Fillers/Extenders/Glass/Plastics/Construction

Properties noted for drilling mud plus its light color and high brightness, low oil absorption and wettability by oils allow barite to be used as a filler and weighting agent in acoustical compounds, adhesives, athletic goods (bowling balls, golf tennis balls), carpet backing, friction materials, linoleum, mold release agents, paints (primer- automotive and appliance, topcoats, automotive, gloss enamels, powder coatings, semi-gloss and gloss latex and industrial and architectural coatings), paper (bristolboard, heavy printing paper, playing cards), radiation shielding, rope finishes, rubber (floor mats, white walled tires, tires for heavy construction vehicles) and urethane foams. Barite is also used in the construction industry to weigh down underwater pipelines. Barite absorbs gamma radiation and can replace lead in nuclear shields.

Specifications for fillers, plastics, paints, construction and general applications are shown in the table below:

Table 4
Specifications (%)

	Industrial (Includes Construction) Grade BARA 200C	Plastics Cimbar 1025P	Powder Coatings Cimbar CF	Paints/Plastics Cimbar UF
$BaSO_4$ (Min)	94	97-98	98	98
S.G. (Min)	4.2	4.2	4.2	4.2
SiO_2 (Max)	2.5			
Total Silicates (Max)	no spec	0.2	0.82	0.82
$SrSO_4$ (Max)	1.5	1-2	1-2	1-2
Fe_2O_3 (Max)	0.5	0.015	0.04	0.04
MgO (Max)	0.03	no spec	no spec	no spec
CaO (Max)	0.03	no spec	no spec	no spec
Al_2O_3 (Max)	0.05	0.01	0.01	0.01
Total Heavy Metals (Max)	**Non-Leaching**		0.05	0.05
Moisture (Max)	<0.1	no spec	0.15	0.15
LOI (Max)	no spec	0.25	0.75	0.75
Oil Absorption (Min)	8-9	11-12	10	11
Dry Brightness (Min)	no spec	89-92	90+	90+
Surface Area m^2/g (Min)	no spec	2	no spec	no spec
Mean particle size (Micrometers)	no spec	2-3	4.8	2.5
% passing 75 micrometers	97	no spec	no spec	no spec
% passing 44 micrometers	85	no spec	no spec	no spec

Shown in APPENDIX B are specifications from additional suppliers of barite products.

Environmental Health and Safety

Barite is virtually inert and by itself poses almost no health or safety hazard. Water soluble barium compounds are toxic if ingested. The primary health and safety concerns with the use of barite in drilling mud relate to heavy metal and silica content. Alaska, California and the US Gulf States require that barite used in drilling mud contain less than 3 ppm cadmium and less than 1 ppm mercury. This may be a barrier to entry for barite associated with base metal sulfides in these locations. There are currently no maximum cadmium and mercury specification for use of barite in the remainder of the United States. According to the Alberta Energy Regulator (AER) Directive 050 Table 3.4 (Contained in Appendix E) the maximum allowable mercury content for oil and gas drilling mud is 6.6ppm. Allowable limits for other metals are also contained in Table 3.4.

In the United States as well in Canada crystalline silica (a common constituent in barite) in levels of 0.1% or greater is classified as a Class 1 Known Carcinogen. As indicated in the specification sheets and MSDS sheets contained in APPENDICES A and B almost all commercial barite products have silica contents exceeding 0.1% and therefore come under safety regulations similar to US OSHA and Health Canada Hazard Communication Standards i.e. worker right to know rules, product labeling, and worker training.

Markets and Drivers

The barite market is driven by one application-that as a weighting additive in drilling mud for the oil and gas industry worldwide. On an annual basis around 97% of all barite produced is used for drilling mud and about 3% is used for all other applications such as chemical, construction, fillers, extenders and plastics. The number of active oil and gas drilling rigs worldwide has a direct impact on barite consumption. The annual world barite production figures shown in Table 1 can be specifically related to the oil and gas active drill rig count. Simply stated years of high oil and gas prices result in greater drilling activity which results in greater barite production and consumption. For periods of lower oil and or gas prices the opposite is true.

China, Morocco and India are the main producers of barite in the world with production totaling 6,150,000 MT or 75% of the world's output in 2013. China exports almost two thirds of its annual production while Morocco and India export almost all of their production. Table 5 shows China, Morocco and India annual 2013 production along with consumption plus US imports from these countries. All reported values expressed in metric tonnes.

Table 5
China, Morocco and India Barite Markets

Country	Production	Consumption	Exports	% Exported	Imports To US/%
China	3,800,000	1,400,000(e)	2,400,000	63	2,400,000/100
Morocco	850,000	0	850,000	100	25,500/3
India	1,500,000	400,000 (e)	1,100,000	73	88,000/8

The US is the largest consumer of barite in the world followed by China.

All barite exported by these countries meet the 4.2 S.G. specification for barite use in drilling mud. Most of the barite produced in the United States comes from Nevada (approximately 600,000 Mt). The vast majority of this US barite sold has a 4.1 S.G. specification. For many years in order to preserve resources, US producers have since 2006 successfully penetrated the US market with lower S.G. material. To be clear the grade of the barite mined is relatively unchanged but the material has been down blended to achieve the lower 4.1 S.G. This lower S.G. barite serves the shale gas and shallow oil and gas drilling programs primarily because the lower formation pressures do not necessitate the need for higher 4.2 S.G. barite.

Canada is a small scale barite producer (about 25,000 Mt annually) and as such has to rely on imports to meet its needs (around 90,000 Mt annually)-all from the US. Almost 100% of the barite produced and consumed in Canada is for drilling mud.

Both the supply and demand are in harmony. Ongoing stockpiling programs lessen the impact of increasing rig counts and subsequent demand increases.
The demand for barite is expected to remain strong particularly in the international arena. Drilling activity has been increasing in the Middle East and Africa. Overall increased shale drilling worldwide has also resulted in increased barite consumption. Marketing analysts involved with barite predict that consumption is expected to increase to 9,300,000 Mt by 2016. One of the results of a stable and increasing barite market is the increased interest shown by the oil and gas service companies in finding new sources of supply.

Pricing

The following series of Tables tracks the various prices for barite throughout the world for both drilling grade and non-drilling grade barite. Note that transportation from the F.O.B. locale to final destination is an additional cost to the posted price.

Table 6
4.1 S.G. Average F.O.B. Nevada Mine Prices
(Converted to US Dollars Per Mt)

2009	2010	2011	2012	2013
$72.50	$69.85	$78.00	$101.60	$104.33

Table 7
4.2 S.G. Bulk Lump Barite F.O.B. Port or Country
August 2014 Prices
(US Dollars Per Mt)

India (Port of Chennai)	: $136-148
Morocco	: $115-127
China	: $120-133

Table 8
4.1 S.G. Bulk Lump Barite F.O.B. Port or Country
August 2014 Prices
(US Dollars Per Mt)

India (Port of Chennai)	: $112-125

Morocco	: No Sales of 4.1 S.G. Barite
China	: $109-113

Table 9
4.22 S.G. Ground Bagged Barite F.O.B. Port or Country
August 2014 Prices
(US Dollars Per Mt)

Turkey (Southern)	: $150-155
Morocco	: $110-170

Table 10
4.2 S.G. Chemical/Paint Grade Barite
August 2014 Prices
(US Dollars Per Mt)

Paint Grade

Chinese Lump Delivered Gulf Coast USA	: $235- 275
Ground White 96-98% $BaSO_4$ 40-44 microns F.O.B. USA Grinding Plant	: $285- 336

Chemical Grade

Chinese Delivered Gulf Coast USA : $161-180

Table 11
Drilling Grade Barite F.O.B. USA Grinding Plants
Average 2012 Prices
(US Dollars Per Mt)

Texas Grinding Plants (8 Facilities)	: $192.80
Louisiana Grinding Plants (6 Facilities)	: $183.90
All Other Locations (10 Facilities)	: $182.44

Logistics and Transportation

Barite is a relatively simple mineral to process and as such does not require specialized handling or unique carriers to be transported. Specific to the oil industry barite is mined with the final product being in the form of lumps to be further ground to meet the API specification for drilling mud. In Nevada and Canada all of the mines have associated grinding plants whose output is spec barite for drilling mud. Output from these grinding plants is bagged ground barite. Transportation from the grinding plants at or near the mines is by truck or train. All of the mines in the United States are owned by oilfield suppliers (Baker Hughes, M-1, Schlumberger etc.) who service their customers in the various oilfields in the United States and Canada. Generally the bagged material is stored in company owned or independent third party warehouses strategically scattered throughout the oil and gas regions of Canada and the United States. These suppliers usually offer turnkey services to their customers which include delivery of the barite from their own facility. Barite mining, processing and transportation costs are integrated into this turnkey drill site service program.

Shipments of barite from overseas (China, India, Morocco primarily) for the oil and gas industry is in lump form and then further processed by the numerous grinding plants located all along the Gulf of Mexico near Ports of entry. Barite from ships is offloaded and trucked to the processing facilities. Output from the facility is ground bagged barite. As indicated in Table 3 all of the oil field service providers who own mines in Nevada also own several grinding plants that are located along the Gulf. The other operators of grinding plants along the Gulf are also oil field supply companies that offer similar turnkey services to the oil and gas companies. Barite processing and transportation costs are integrated into the turnkey drill site service program.

Mel Deposit

Discussion

Qualified Markets

The Mel Deposit is a base metal occurrence with significant recoverable barite that is likely saleable as a drilling mud additive to the oil and gas industry. A review has been made of processing data provided by Silver Range Resources Limited (SRR) dating from the 1980's which indicates that a concentrate in the 94.6% $BaSO_4$ range can be achieved. Grades at and above 94% meet the specifications for drilling mud, chemical and construction applications. The Mel barite does not meet specifications for plastics, fillers and extenders which require $BaSO_4$ grades of 97% or higher. Since approximately 97% of the barite market is for drilling muds the Mel barite is suitable for highest sales volume market.

The biggest challenge facing commercialization of the Mel barite is assessing the mercury/cadmium content and the potential impact, if any on the various qualified markets. The moderately remote location of the deposit is also a transportation cost consideration.

Mercury/Cadmium/Base Metals

Processing literature provided by SRR indicates that the Mel lead-zinc deposit contains high levels of mercury in the 500 ppm level and that the mercury is specifically found in the zinc flotation concentrate and that the mercury is locked in or chemically bound with the zinc sulfide sphalerite. Analysis of the zinc concentrate also indicates that the cadmium content of the zinc is 2,500 ppm. Test work that resulted in making a high grade $BaSO_4$ flotation concentrate gave the following assay results:

- **$BaSO_4$: 94.6%**
- **Pb : 130 ppm**
- **Zn : 160 ppm**

No analyses were reported for mercury or cadmium. APPENDIX C contains excerpts from the metallurgical test wok reporting these results. Within residual lead and zinc values reported above, the mercury and cadmium values may be potentially higher than 1ppm and 3ppm respectively and may be problematic if present. Additional analyses and possible follow up test work would be necessary to confirm metal content and guide further metal reduction processing. These 1ppm mercury and 3ppm cadmium values are the maximum allowable values in barite for all offshore drilling applications plus use many US States. Review of the metals content table in APPENDIX E also indicates the barite concentrate is out of spec for lead and zinc. Updated analyses and test work is recommended to asses metal content issues in the barite.

Location

The location of the Mel deposit in the southeast portion of the Yukon likely precludes penetration of the **continental** US drilling mud markets. The northern continental US is well served by the barite mines in Nevada and the US Gulf Coast. Additionally lump barite imports to the US Gulf Coast are further processed by the grinding plants located at all major Gulf coastal ports (see Table 3). This finished barite product is distributed to oil and gas drilling regions throughout the continental US via a mature interconnected transportation infrastructure consisting of rail, highway and barging (Mississippi, Ohio, Missouri Rivers among others). Alaska is served by both road from the Fireside operation in northern BC and ocean going barges or ships originating from coastal California or Washington Ports. Most oil and gas drilling in Alaska is on the North Slope or in the southern portions of the state both on and offshore.

Marketing Potential

The western Canadian and Alaska drilling mud business appears to be the only viable markets for the Mel barite. This market includes the eastern half of British Columbia and the prolific oil and gas fields of Alberta. As previous mentioned the size of the Canadian barite market for drilling mud is around 115,000 Mt annually. Production in Canada totals 25,000 Mt annually, leaving around 90,000 Mt of barite being imported from the US. It is highly likely that the Mel operation could capture a portion of these imports. The closest US barite mine sites to Canada are in Nevada. The closest grinding plant to Canada is located in Evanston Wyoming. The owner, NOV also has a mine in Nevada. Output from the Wyoming grinding plant services mainly northern US location (Wyoming, Montana, and North Dakota).

The Alaska market is small, varying from 15,000 to 18,000 Mt annually depending on the amount of drilling ongoing at any one time. Halliburton, Baker Hughes and Schlumberger are the dominant suppliers of barite in Alaska. Because of the location of the Mel Deposit is likely that some portion of the annual output could be sold in Alaska.

The only Canadian based potential competitor to the Mel barite is the Fireside deposit currently being seasonally mined at a location southeast of the Mel Deposit (See attached map). The mine is owned by Fireside Minerals Limited who also operates a grinding plant in Watson Lake, Yukon. APPENDIX D contains background information of Fireside Minerals plus historic and current operational data on the mine. As previously mentioned the mine only operates seasonally during the summer months and apparently sells 4.1 S.G. drilling mud grade barite to locations in Canada and Alaska. The last published information on production was in 2010 in which 22,000 Mt was milled. Production has been in the 25,000 Mt range annually since 2010. The Fireside mine is the only barite operation active in Canada currently. Assuming a 120 day mining and processing season it appears that the mining is in excess 200 Mt per day. The material is trucked to Watson Lake for processing.

As shown on the attached map there are warehouse facilities located all across Alberta and portions of British Columbia that store and supply barite to oil and gas operations in the area. These facilities are operated by Baker Hughes, Dicorp- a Canada based oil field supply Service Company, Halliburton (Baroid) and Schlumberger (M-1 Drilling Fluids). The attached map shows the locations of the current oil and gas plays in this part of Canada. As indicated the various companies supplying barite to local drilling operations are well positioned. If oil and gas prices hold steady it is likely that drilling activity along with barite consumption will increase in these emerging fields.

Mining/Processing

According to SRR there are no plans to have stand-alone barite operation. The barite is intimately associated with the lead-zinc deposit and the barite can only be economically recovered if the lead-zinc mine goes into production. When the lead-zinc mine goes into production it will be a year-around operation. The by-product barite output, depending on the capacity of the processing circuit, can be sized to current market potential and be expanded to meet future demand. Pending completion of a follow-up detailed marketing study of actual barite consumption in specific locations in Alberta and British Columbia an initial 200 metric tonne per day production rate would seem reasonable. Assuming a 250 day per year operation an initial 50,000 Mt per year output would be envisioned. This production rate should not be considered too disruptive to the status quo of 90,000 Mt of imports per year. Additional sales in Alaska are also likely. Since the barite is a byproduct of the relatively large lead-zinc mine the estimated barite production rate would not significantly impact the operation if production had to be varied up or down to meet market demand. The infrastructure at the mine site could also support a grinding plant which would be more economical that placing a facility at Watson Lake. There are unique synergies (shared mining, processing and admin costs) being associated with a major lead-zinc mine for establishing a successful byproduct barite operation. Additionally a steady operation such as a zinc-lead mine in the region with consistent byproduct barite output would go a long way to towards capturing market share with the major oil field service companies operating in the area.

Transportation/Logistics

The Mel location is remote as indicated by the location shown on the attached map. The barite operation is dependent on the construction and operation of the Mel lead-zinc mine of which the barite would be by-product output. As indicated on the map the Alaska Highway passes through Watson Lake from Fort Nelson. The segment of road connecting the Mel Deposit with the Alaska Highway is currently a seasonal winter road. Prior to startup of any operation an all season road would have to be constructed. The nearest location to the Mel-deposit that has storage facilities for barite is Fort Nelson which is 510km by road (Alaska Highway). Halliburton and Di-Corp both operate here. Fort Nelson is also the railhead for the CN Line. This north-south rail line continues to the west rail at Fort St. John. As indicated on the map all of the oil and gas operations are east in Alberta. To service these locations barite would have to be trucked from Fort St John east to the more northern warehouse locations in Alberta. For the southern locations in Alberta, barite could continue by train from Fort St John to Prince George and on in to Edmonton and Calgary. As indicated on the map most locations are accessible by rail.

To be competitive a ground finished product should be made at the Mel mine site. Barite from other sources stored at the various facilities indicated on the map is bagged finished product.

To offset a portion of the barite transportation costs from the Mel Deposit to Fort Nelson a backhaul arrangement should be investigated with suppliers delivering goods to the Mel lead-zinc operation.

Prices

As previously mentioned barite sales prices are quoted FOB mine or plant site. The railhead at Fort Nelson would be the most logical location to sell from. Since consumers commonly pay transportation, receiving barite shipments by relatively inexpensive rail should make the Mel barite a competitive product in the region. Many variables must be considered when pricing a product such as spot sales, contract sales, volume discounts etc. An F.O.B. in the range of $100 USD per metric tonne would seem reasonable. In 2013 the average sale price for 4.1 S.G. barite from the Nevada barite mines was $104 USD per metric tonne. Since all of these mines are owned by oilfield service providers it is not known what sort of contract or service bundling arrangement they may have with consumers.

SWOT Analysis

The Mel Barite deposit has a number of positive and negative attributes that should be considered when making the decision to get into the barite business. The various strengths, weaknesses, opportunities and threats (SWOT) are highlighted.

Strengths

1. Test work to date has determined that a viable drilling mud spec grade material can be made.
2. Test work has also shown that a construction/chemical spec grade material can be made.
3. The barite is a byproduct of a Lead-Zinc mining operation which because of synergies should result in a lower production costs.
4. Barite resources appear adequate for a long term operation.
5. The mine will operate year round which should result in a steady cash flow for the barite portion of the mine.
6. Oil and Gas drilling in northeast BC and northern Alberta appears to be increasing thus opening up markets for more barite consumption in the region of the Mel deposit.
7. Relatively inexpensive rail service is available at Fort Nelson which will allow rail access to almost all oil and gas drilling areas in the region.
8. It is likely that backhaul arrangements can be made with the lead-zinc mine suppliers to haul bagged barite to the rail head in Fort Nelson thus saving on transportation cost to market.
9. The local competitor barite mining operation is seasonal and too small to represent any serious competition to the Mel barite operation.
10. Initial barite sales in the 50,000 Mt/year range seem doable.
11. Pricing in the $100 USD per Mt seem reasonable.

Weaknesses

1. The mercury, cadmium and base metal levels of the barite are potentially too high for several drilling mud applications and thus sales may be limited.
2. Additional processing of the barite is likely required to reduce metal levels which will raise production costs and reduce profitability.
3. There is essentially no market in Canada for the potentially higher priced spec grade chemical and construction grade barite.
4. Transportation costs to market can be high especially if no viable back haul arrangements can be made.

Opportunities

1. A deal could be made with Fireside Minerals to jointly operate their underutilized grinding plant at Watson Lake thus saving the capital expenditure of constructing a grinding plant.

2. Barite output could be sold to Fireside Minerals for them to incorporate into their already established marketing system and thus avoid issues related to stand alone sales and marketing efforts.
3. If the Mel barite mercury, cadmium and base metal levels are found to exceed requirements and cannot be sufficiently reduced by processing it may be possible to blend with the Fireside material in order to meet specification.
4. If market conditions improve for barite sales it sould be relatively easy to scale up processing at the mine.

Threats

1. Due to pricing and or technical issues the Mel lead-zinc mine could shut down thus terminating the byproduct barite operation.
2. Lower oil and gas prices in the future and associated drop in rig activity may limit barite sales.

Conclusions

Review of the Mel Barite Project results in the following conclusions:

- Mercury and cadmium levels in the barite concentrate need to be assessed.
- If mercury and cadmium contents are problematic, additional multistage processing can likely reduce the levels to the acceptable range in the barite.
- Due to increased oil and gas drilling activity in the eastern British Columbia and north-central Alberta regions, the Mel Barite Deposit may be uniquely positioned to tap into this growing market.
- Barite production costs should be lower because the barite is a byproduct of lead-zinc mining.
- The availability of rail service at Fort Nelson significantly reduces transportation costs to key markets in Alberta and eastern British Columbia.

Recommendations

The following recommendations are made:

- Additional analyses and test work should be conducted for barite ores, with a focus on ensuring appropriate cadmium, mercury and base metal levels can be achieved.
- Once the decision is made to put the lead-zinc mine into production and a timetable is finalized a follow-up detailed marketing and transportation study should be completed.
- Discussions should be held at the appropriate time with Fireside Minerals regarding the joint operation of the underutilized grinding plant at Watson Lake.
- The feasibility of combining marketing and sales efforts with Fireside Minerals should be investigated.

APPENDIX A

MATERIAL SAFETY DATA SHEET
BARITE

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

TRADE NAME: BARITE

OTHER NAME: Barium Sulfate

APPLICATIONS: Drilling fluid densifier

EMERGENCY TELEPHONE: 800-438-7436 (800 GETS GEO)

SUPPLIER: Supplied by Industrial Minerals Company
A Business Unit of GEO Drilling Fluids, Inc.
1431 Union Ave. Bakersfield, California, 93305

TELEPHONE: 661-325-5919
FAX: 661-325-5648

2. COMPOSITION, INFORMATION ON INGREDIENTS

INGREDIENT NAME:	CAS No.:	CONTENTS :	EPA RQ:	TPQ:
Silica, crystalline, quartz	14808-60-7	4-6 %		
Barite	7727-43-7	91-93 %		
Mica	12001-26-2	1-5 %		

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW:

CAUTION! MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION. Avoid contact with eyes, skin and clothing. Avoid breathing airborne product. Keep container closed. Use with adequate ventilation. Wash thoroughly after handling. This product is a/an transparent tan to powder. Slippery when wet. A nuisance dust.

ACUTE EFFECTS:

HEALTH HAZARDS, GENERAL:

Particulates may cause mechanical irritation to the eyes, nose, throat and lungs. Particulate inhalation may lead to pulmonary fibrosis, chronic bronchitis, emphysema and bronchial asthma. Dermatitis and asthma may result from short contact periods.

INHALATION: May be irritating to the respiratory tract if inhaled.
INGESTION: May cause gastric distress, nausea and vomiting if ingested.
SKIN: May be irritating to the skin.
EYES: May be irritating to the eyes.

CHRONIC EFFECTS:

CARCINOGENICITY:

IARC: Not listed. OSHA: Not regulated. NTP: Not listed.

ATTENTION! CANCER HAZARD. CONTAINS CRYSTALLINE SILICA WHICH CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

IARC Monographs, Vol. 68, 1997, concludes that there is sufficient evidence that inhaled crystalline silica in the form of quartz or cristobalite from occupational sources causes cancer in humans. IARC classification Group 1.

ROUTE OF ENTRY:

Inhalation. Skin and/or eye contact.

TARGET ORGANS:

Respiratory system, lungs. Skin. Eyes.

4. FIRST AID MEASURES

GENERAL: Persons seeking medical attention should carry a copy of this MSDS with them.

INHALATION: Move the exposed person to fresh air at once. Perform artificial respiration if breathing has stopped. Get medical attention.

INGESTION: Drink a couple of glasses water or milk. Do not give victim anything to drink of he is unconscious. Get medical attention.

SKIN: Wash skin thoroughly with soap and water. Remove contaminated clothing. Get medical attention if any discomfort continues.

EYES: Promptly wash eyes with lots of water while lifting the eye lids. Get medical attention if any discomfort continues.

5. FIRE FIGHTING MEASURES

AUTO IGNITION TEMP. (?F): N/D
FLAMMABILITY LIMIT - LOWER(%): N/D
FLAMMABILITY LIMIT - UPPER(%): N/D

EXTINGUISHING MEDIA:

This material is not combustible. Use extinguishing media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES:

No specific fire fighting procedure given.

UNUSUAL FIRE & EXPLOSION HAZARDS:

No unusual fire or explosion hazards noted.

HAZARDOUS COMBUSTION PRODUCTS: This material is not combustible.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:

Wear proper personal protective equipment (see MSDS Section 8).

SPILL CLEAN-UP PROCEDURES:

Avoid generating and spreading of dust. Shovel into dry containers. Cover and move the containers. Flush the area with water. Do not contaminate drainage or waterways. Repackage or recycle if possible.

7. HANDLING AND STORAGE

HANDLING PRECAUTIONS:

Avoid inhalation of dust and contact with skin and eyes.

STORAGE PRECAUTIONS:

Store in tightly closed original container in a dry, cool and well-ventilated place.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

INGREDIENT NAME:	CAS No.:	OSHA PEL: TWA: STEL:	ACGIH TLV: TWA: STEL:	OTHER: TWA: STEL:	UNITS:
Silica, crystalline, quartz	14808-60-7	*	0.1		mg/m^3 resp.dust
Barite	7727-43-7	15	10		mg/m^3 total dust
Mica	12001-26-2	20 mppcf *	3		mg/m^3 total dust

INGREDIENT COMMENTS:

* OSHA PELs for Mineral Dusts containing crystalline silica are 10 mg/m3 / (%SiO2+2) for quartz and 1/2 the calculated quartz value for cristobalite and tridymite. * mppcf = millions of particles per cubic foot of air.

PROTECTIVE EQUIPMENT:

ENGINEERING CONTROLS:

Use appropriate engineering controls such as, exhaust ventilation and process enclosure, to reduce air contamination and keep worker exposure below the applicable limits.

VENTILATION:

Supply natural or mechanical ventilation adequate to exhaust airborne product and keep exposures below the applicable limits.

RESPIRATORY PROTECTION:

Respiratory protection must be used if air contamination exceeds acceptable level.

HAND PROTECTION:

Use suitable protective gloves if risk of skin contact.

EYE PROTECTION:

Wear dust resistant safety goggles where there is danger of eye contact.

PROTECTIVE CLOTHING:

Wear appropriate clothing to prevent repeated or prolonged skin contact.

HYGIENIC WORK PRACTICES:

Wash promptly with soap and water if skin becomes contaminated. Change work clothing daily if there is any possibility of contamination.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE/PHYSICAL STATE:	Powder, dust.
COLOR:	Tan to Grey.
ODOR:	Odorless or no characteristic odor.
SOLUBILITY DESCRIPTION:	Insoluble in water.
MELT./FREEZ. POINT (?F, interval):	2876
DENSITY/SPECIFIC GRAVITY (g/ml):	4.10 - 4.15 TEMPERATURE (?F): 68
BULK DENSITY:	107 - 135 lb/cu ft; 1714 - 2163 kg/m3
VAPOR DENSITY (air=1):	N/A
VAPOR PRESSURE:	N/A TEMPERATURE (?F):

10. STABILITY AND REACTIVITY

STABILITY:

Normally stable.

CONDITIONS TO AVOID:

N/A.

HAZARDOUS POLYMERIZATION:

Will not polymerize.

POLYMERIZATION DESCRIPTION:

Not relevant.

MATERIALS TO AVOID:

N/A

HAZARDOUS DECOMPOSITION PRODUCTS:

No specific hazardous decomposition products noted.

11. TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION:

No toxicological data is available for this product.

12. ECOLOGICAL INFORMATION

ACUTE AQUATIC TOXICITY:

This product passes the mysid shrimp toxicity test required by the U.S. Environmental Protection Agency (EPA) Region VI (Gulf of Mexico) NPDES Permit, which regulates offshore discharge of drilling fluids, when tested in a standard drilling fluid.

13. DISPOSAL CONSIDERATIONS

WASTE MANAGEMENT:

This product does not meet the criteria of a hazardous waste if discarded in its purchased form. Under RCRA, it is the responsibility of the user of the product to determine at the time of disposal, whether the product meets RCRA criteria for hazardous waste. This is because product uses, transformations, mixtures, processes, etc, may render the resulting materials hazardous.

DISPOSAL METHODS:

Recover and reclaim or recycle, if practical. Should this product become a waste, dispose of in a permitted industrial landfill. Ensure that containers are empty by RCRA criteria prior to disposal in a permitted industrial landfill.

14. TRANSPORT INFORMATION

PRODUCT RQ: N/A
U.S. DOT:
U.S. DOT CLASS: Not regulated.

15. REGULATORY INFORMATION

REGULATORY STATUS OF INGREDIENTS:

NAME:	CAS No:	TSCA:	CERCLA:	SARA 302:	SARA 313:	DSL(CAN):
Silica, crystalline, quartz	14808-60-7	Yes	No	No	No	Yes
Barite	7727-43-7	Yes	No	No	No	Yes
Mica	12001-26-2	Yes	No	No	No	Yes

REPARED BY: Andy Philips
REVISION No.: April 4, 2013

MSDS STATUS: Approved.
DATE: August 5, 2013
DISCLAIMER:

MSDS furnished independent of product sale. While every effort has been made to accurately describe this product, some of the data are obtained from sources beyond our direct supervision. We cannot make any assertions as to its reliability or completeness; therefore, user may rely on it only at user's risk. We have made no effort to censor or conceal deleterious aspects of this product. Since we cannot anticipate or control the conditions under which this information and product may be used, we make no guarantee that the precautions we have suggested will be adequate for all individuals and/or situations. It is the obligation of each user of this product to comply with the requirements of all applicable laws regarding use and disposal of this product. Additional information will be furnished upon request to assist the user; however, no warranty, either expressed or implied, nor liability of any nature with respect to this product or to the data herein is made or incurred hereunder.

MATERIAL SAFETY DATA SHEET

DEEP SWEEP™

Drilling Fluids

1. Product and Company Identification

Material name	**DEEP SWEEP™**
Chemical description	Coarse Ground Barite
Applications	Weighting Agent
Supplier	Baker Hughes Drilling Fluids 2001 Rankin Rd. Houston, TX 77073 Emergency telephone number 713-439-8900

2. Composition / Information on Ingredients

Components	CAS #	Percent
BARIUM SULFATE	7727-43-7	91 - 93
CRYSTALLINE SILICA, QUARTZ	14808-60-7	4 - 6
MICA	12001-26-2	1 - 5

3. Hazards Identification

Emergency overview
Harmful in contact with eyes. Prolonged exposure may cause chronic effects. No hazards resulting from the material as supplied. Contact with this material can cause irritation to the skin, eyes and mucous membranes.

Potential health effects

Eyes
Dust or powder may irritate eye tissue. Eye contact may result in corneal injury.

Skin
Health injuries are not known or expected under normal use. Prolonged or repeated contact can result in defatting and drying of the skin which may result in skin irritation and dermatitis (rash).

Inhalation
Inhalation of dusts may cause respiratory irritation.

Ingestion
Health injuries are not known or expected under normal use. Ingestion of large amounts may produce gastrointestinal disturbances including irritation, nausea, and diarrhea.

Target organs
Eyes. Lungs. Respiratory system.

Chronic effects
Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material. Shortness of breath. May cause delayed lung damage.

Signs and symptoms
Cough. Discomfort in the chest. Shortness of breath. Conjunctivitis. Corneal damage. Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material.

4. First Aid Measures

First aid procedures

Eye contact
Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.

Skin contact
Wash off skin with soap and water. Get medical attention if irritation develops or persists.

Inhalation
Move to fresh air. If breathing is difficult, give oxygen. Call a physician if symptoms develop or persist.

Ingestion
If swallowed, rinse mouth with water (only if the person is conscious). If ingestion of a large amount does occur, seek medical attention.

Notes to physician
Symptoms may be delayed.

General advice
Call a physician if symptoms develop or persist. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. If you feel unwell, seek medical advice (show the label where possible).

5. Fire Fighting Measures

Hazardous combustion products
Combustion products include fumes, smoke, carbon monoxide, carbon dioxide and sulfur dioxide.

Extinguishing media

Suitable extinguishing media	Use any media suitable for the surrounding fires.

Protection of firefighters

Protective equipment for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Stay upwind. Surfaces may become slippery after spillage. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
Environmental precautions	Do not flush into surface water or sanitary sewer system.
Methods for containment	Stop the flow of material, if this is without risk.
Methods for cleaning up	Vacuum or sweep up material and place in a disposal container. Avoid the generation of dusts during clean-up. Do not flush with water. Forms smooth, slippery surfaces on floors, posing an accident risk.

7. Handling and Storage

Handling	Wear personal protective equipment. Minimize dust generation and accumulation. In case of insufficient ventilation, wear suitable respiratory equipment.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from Aluminium.

8. Exposure Controls / Personal Protection

Exposure guidelines

ACGIH - Threshold Limits Values - Time Weighted Averages (TLV-TWA)

BARIUM SULFATE	7727-43-7	10 Mg/m3 TWA
CRYSTALLINE SILICA, QUARTZ	14808-60-7	0.05 Mg/m3 TWA (respirable fraction)

ACGIH - Threshold Limits Values - TLV Basis - Critical Effects

BARIUM SULFATE	7727-43-7	pneumoconiosis (baritosis)
CRYSTALLINE SILICA, QUARTZ	14808-60-7	silicosis; lung function; lung fibrosis; cancer

OSHA - Final PELs - Time Weighted Averages (TWAs)

BARIUM SULFATE	7727-43-7	15 Mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)

Engineering controls	Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

Personal protective equipment

Eye / face protection	Wear dust goggles.
Skin protection	Use of protective coveralls and long sleeves is recommended. Use of impervious boots is recommended.
Hand protection	Rubber or plastic gloves.
Respiratory protection	When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Suitable mask with particle filter P3 (European Norm 143)
General hygeine considerations	Do not breathe dust. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. Physical and Chemical Properties

Appearance / Color / Form	Powder. Tan. Solid.
Odor	None.
Clarity	Not available
Odor threshold	Not available
Physical state	Solid
pH	7 (2% aq. solution)
Melting point	2930 °F (1610 °C) estimated
Freezing point	2876 °F (1580 °C)
Boiling point	4046 °F (2230 °C) estimated
Flash point	Non-flammable
Evaporation rate	Not available
Flammability limits in air, lower, % by volume	Not available

Flammability limits in air, upper, % by volume	Not available
Vapor pressure	Not available
Vapor density	Not available
Specific gravity	4.2 - 4.25 g/ml @ 20 Deg C
Relative density	4200 - 4250 kg/m3
Solubility	Insoluble in water.
Octanol/H2O coeff	Not available
Auto-ignition temperature	Not available
Decomposition temperature	Not available
Bulk density	1714 - 2163 kg/m3 @ 20 Deg C

10. Chemical Stability and Reactivity Information

Chemical stability	Stable at normal conditions.
Conditions to avoid	Exposure to water vapor.
Possibility of hazardous reactions	Will not occur.

11. Toxicological Information

Component analysis - LD50

Toxicology Data - Selected LD50s and LC50s

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Oral LD50 Rat: 500 mg/kg

Chronic effects Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material.

Carcinogenicity

ACGIH - Threshold Limits Values - Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	A2 - Suspected Human Carcinogen

NTP (National Toxicology Program) - Report on Carcinogens - Known Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Known Carcinogen

12. Ecological Information

Ecotoxicity	This material is not expected to be harmful to aquatic life.
Persistence / degradability	The methods for determining the biological degradability are not applicable to inorganic substances.
Bioaccumulation / accumulation	Not expected to bioaccumulate.
Mobility in environmental media	This material is insoluble in water and will sink in the marine environment.

13. Disposal Considerations

Disposal instructions Can be landfilled, when in compliance with local regulations. This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste.

14. Transport Information

Department of Transportation (DOT) Requirements

Not regulated as dangerous goods.

IATA

Not regulated as dangerous goods.

IMDG

Not regulated as dangerous goods.

15. Regulatory information

US federal regulations

This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

NTP (National Toxicology Program) - Report on Carcinogens - Known Carcinogens

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Known Carcinogen

Occupational Safety and Health Administration (OSHA)

29 CFR 1910.1200 hazardous chemical: Yes

CERCLA (Superfund) reportable quantity: None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories

Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

Section 302 extremely hazardous substance: No

Section 311 hazardous chemical: Yes

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (CCS)	Yes
Europe	European Inventory of New and Existing Chemicals (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Japanese Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Korean Inventory of Chemicals (KICS)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

International regulations

The product does not need to be labelled in accordance with EC directives or respective national laws.

IARC - Group 1 (Carcinogenic to Humans)

CRYSTALLINE SILICA, QUARTZ	14808-60-7	Monograph 68, 1997 (Listed under Crystalline silica, inhaled in the form of quartz or cristobalite from occupational sources)

State regulations

WARNING: This product contains a chemical known to the State of California to cause cancer.

California - Proposition 65 - Carcinogens List

CRYSTALLINE SILICA, QUARTZ	14808-60-7	carcinogen, initial date 10/1/88 (airborne particles of respirable size)

Massachusetts - Right To Know List

BARIUM SULFATE	7727-43-7	Present
CRYSTALLINE SILICA, QUARTZ	14808-60-7	Carcinogen; Extraordinarily hazardous

New Jersey - Right to Know Hazardous Substance List

CRYSTALLINE SILICA, QUARTZ	14808-60-7	sn 1660

Pennsylvania - RTK (Right to Know) List

BARIUM SULFATE	7727-43-7	Present
CRYSTALLINE SILICA, QUARTZ	14808-60-7	Present (includes dust)

16. Other information

HMIS ratings	Health: 1* Flammability: 0 Physical hazard: 0 Personal protection: E
NFPA ratings	Health: 1 Flammability: 0 Instability: 0
Disclaimer	The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
US preparer	Cheryl Hood - (713)625-4888
Issue date	05-12-2006

Baser *Mining Industry and Commerce, Inc.*

MATERIAL SAFETY DATA SHEET

1. IDENTIFICATION OF THE SUBSTANCE PREPARATION AND COMPANY

TRADE NAME : BASER BARYTE
* GROUND BARYTE FOR PAINT IND.

BASER MINING IND. & CO., INC.

Address : Eski Büyükdere Cad. Ayazağa Yolu
İz Plaza Giz No:4 Kat :17 Maslak-**TURKEY**
Tel : (90) 212 – 2907140
Fax : (90) 212 - 2907149
E-Mail : serkan.rodoplu@ado-baser.com

Barite is exempted from REACH registration (EC) 1907/2006 Article 2 § 7(b) and Annex V point 7

2. COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients	Composition (w/w)	CAS Number	Risk Phrases
No hazardous components		7727-43-7	

3. IDENTIFICATION OF HAZARDS

Inhalation : Irritant **Eyes :** Irritant **Skin :** Irritant **Ingestion :** N/D

4. FIRST AID MEASURES

Inhalation : Remove to fresh air

Ingestion : Drink water to dilute. Induce vomiting Seek medical attention.

Skin : Wash with soap & water. Launder clothes Prior to re-use

Eyes : Flush with clean water for at least 15 minutes.

Other : Ordinary measures of personal hygiene should be observed. Sensitive individuals should avoid further contact.

Information : If irritation persists seek medical attention.

5. FIRE FIGHTING MEASURES

Extinguishing Media : Carbon dioxide, dry or foam chemicals, water safe to use.
Special Exposure Hazards : None
Protective Equipment : Noncombustible.

6. ACCIDENTAL RELEASE MEASURES

Spillage handling : Contain spill, sweep, shovel or vacuum material into waste container. Rebag and recycle if possible.

7. HANDLING AND STORAGE

Handling : Keep dust to a minimum.

Storage : Store in dry area.

Barser Mining Industry and Commerce, Inc.

MATERIAL SAFETY DATA SHEET

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ventilation : Supply adequate natural or mechanical ventilation
Respiratory : Use an approved HSE/OOSHH respirator
Clothing : Protective clothing for cleanliness
Hands : Cotton or rubber gloves
Face/Eyes : Safety glasses
Feet : Rubber or leather safety boots

Ingredient	Occupational Exposure Limits	% Wt
Barium sulphate	OES TWA 2 mg/m^3 Respirable dust	100
Silica (quartz)	MEL TWA 0.4 mg/m^3 Respirable dust	< 1

9. PHYSICAL AND CHEMICAL PROPERTIES

Composition	: Single compound	**Net weight (Kgs)**	: 25- 40- 50
Phase	: Powder	**Viscosity, Kinematic (cstk)**	: N/A
Colour	: White, Grey	**Viscosity, dynamic (cps)**	: N/A
Odour	: Odourless	**Upper Flammable Limit (%)**	: N/A
Particle size (microns)	: <1-100	**Lower Flammable Limit (%)**	: N/A
Density (20) C gr/ml	: 4.2 to 4.4	**Upper Explosion Limit (%)**	: N/A
Boiling point (C)	: N/A	**Lower Explosion Limit (%)**	: N/A
Melting point	: 1593	**Flash point (C) /Method**	: N/A
Water solubility	: Insoluble	**Autoignition temperature (C)**	: N/A
pH	: 6 – 9	**Pour point (C)**	: N/A
Vapour pressure	: N/A	**Cloud poind (C)**	: N/A
Vapour density (air=1)	: N/A	**Partition coefficient**	: N/D

10. STABILITY AND REACTIVITY

NFPA Rating : 0
Stability : Stable even under fire exposure conditions
Incompatible with : Aluminium
Hazardous decomposition : Does not decompose
Hazardous polymerisation : No
Oxidising Properties : None

Mining Industry and Commerce, Inc.

MATERIAL SAFETY DATA SHEET

11. TOXICOLOGICAL INFORMATION

Animal Data

Inhalation LC50, Rat	: N/D	**Mutagenicity**	: N/D
Percutaneous LD50, Rat	: N/D		
Oral LD50, Rat	: N/D	**Carcinogenicity**	: N/D
Sub-acute toxicity	: N/D		
		Teratogenicity	: N/D
Other toxicity studies	: Intrapleural Rat TDLo 200 mg/Kg: Ref 2		
Skin irritation, method	: N/D	**Skin sensitisation, method**	: N/D
Skin irritation, result	: N/D		
Eye irritation, method	: N/D	**Skin sensitisation, result**	: N/D
Eye irritation, result	: N/D		

Human Data

Skin irritation	: Irritant	**Skin sensitisation**	: N/D
Eye irritation	: Irritant		
Irritation of mucous	:		
Membrane-inhalation	: Irritant	**Pulmonary sensitisation**	: N/D
-ingestion	: N/D		
Toxicity through skin	: N/D	**Carcinogenicity**	: N/D
Toxicity by inhalation	: N/D	**Teratogenicity**	: N/D
Toxicity by ingestion	: N/D	**Other medical data**	: Exposure over extented time may result in baritosis

12. ECOLOGICAL INFORMATION

PARCOM Ecotoxicity Testing		**Persistence and degradability**	
Algae (Skeletonema)	: N/D	**Biodegradability**	: N/D
Herbivore (Acartia tonsa)	: N/D	**Bioaccumulation potential**	: N/D
Sedimentary reworker	:		
- Corophium sp	: N/D		
		Biotreatment interference	: N/D
- Other species	: Mysidopsis bahia ; N/D	**Tainting potential**	: N/D
CNS Category	: 0		

Presence and level of regulated compounds

Heavy metals	: Trace	**Radioactives**	: None
Organohal logens	: No	**Organophosphorus**	: No
Organotins	: No		

Baser Mining Industry and Commerce, Inc.

MATERIAL SAFETY DATA SHEET

13. DISPOSAL CONSIDERATIONS

Classification of waste : Non-hazardous waste
Disposal techniques : Transport to a site licenced to handle non-hazardous chemical waste.

Preferred means of disposal : Licenced landfill
Additional information : -.-

14. TRANSPORT INFORMATION

UN Hazard Number	: n/a	**Hazard symbol**	: Not regulated
UN Hazard Class	: n/a	**IMO/IMDG Page**	: N/C
Marine pollutant	: No	**Proper shipping name**	: Micronised baryte for paint ind. Drilling fluid additive N.O.S. (Barium Sulphate)

15. REGULATORY INFORMATION

Hazardous Ingredients : No hazardous components

EEC Classification : 231-784-4
Risk phrases : N/A
Safety phrases : N/A

16. OTHER INFORMATION

Reference : 1: HSE EH40/94 Occupational exposure limits 1994
2 : RTECS U.S. Department of Health and Human Services 1983.

Abbreviations : The following abbreviations have been used in preparing this Safety Data Sheet-
N/D – Not Determined
N/A – Not Applicable
N/C – Not Classified

17. STATEMENT

The information in this document is given in good faith, and to the knowledge of Baser Mining Ind. & Co., Inc.is accurate at the date of issue (01.01.99). It should be used for guidance only. The data do not constitute a specification in whole or in part.

O BRI-CHEM
SUPPLY CORP.

Material Safety Data Sheet

Barite

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	Barite
Product Identifier	Barite
MSDS No.	0070
Supplier	Bri-Chem Supply Corp, 5151 Bannock Street Unit 5, Denver, CO, 80216, 303-722-1681, www.brichemsupplycorp.com
Emergency Contact Information	Chem Trek, (800) 424-9300, 24/7

2. HAZARDS IDENTIFICATION

Potential Health Effects

Inhalation	Can irritate the nose and throat.
Skin Contact	Health injuries are not known or expected under normal use. Repeated or prolonged exposure can irritate the skin.
Eye Contact	May cause slight irritation as a "foreign object". Tearing, blinking and mild temporary pain may occur as particles are rinsed from the eye by tears. May cause corneal injury.
Ingestion	Health injuries are not known or expected under normal use. Ingestion of large amounts may produce gastointestinal disturbances including irritation, nausea, and diarrhea.
Effects of Long-Term (Chronic) Exposure	Long-term exposure to products containing crystalline silica may cause silicosis. Avoid inhalation.

Potential Environmental Effects

Not hazardous to the environment.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS Registry No.	Concentration %	Other Identifiers
	Non-hazardous and other components below reportable levels	80-90	
Silica, quartz	14808-60-7	4-6	
Mica	12001-26-2	1-5	

4. FIRST AID MEASURES

First Aid Procedures

Inhalation	Move victim to fresh air. If breathing is difficult, trained personnel should administer emergency oxygen. Call a Poison Centre or doctor if the victim feels unwell.
Skin Contact	Wash gently and thoroughly with lukewarm, gently flowing water and non-abrasive soap for 5 minutes. Call a Poison Centre or doctor if the victim feels unwell.
Eye Contact	Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 15-20 minutes, while holding the eyelid(s) open. If a contact lens is present, DO NOT delay flushing or attempt to remove the lens. If irritation or pain persists, see a doctor.

Ingestion	Have victim rinse mouth with water. NEVER give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. DO NOT INDUCE VOMITING. Call a Poison Centre or doctor if the victim feels unwell.

5. FIRE FIGHTING MEASURES

Flammable Properties	Does not burn.
Suitable Extinguishing Media	Not combustible. Use extinguishing agents compatible with product and suitable for surrounding fire.
Specific Hazards Arising from the Chemical	Toxic fumes may be formed.
Protective Equipment and Precautions for Firefighters	Use water spray to cool unopened containers. A full-body encapsulating chemical protective suit with positive pressure SCBA may be necessary.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Use the Personal Protective Equipment recommended in Section 8 of this MSDS. Surfaces may become slippery after spillage. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
Environmental Precautions	It is good practice to prevent releases into the environment. Do not allow into any sewer, on the ground or into any waterway.
Methods for Containment and Clean-up	Stop or reduce leak if safe to do so. Collect using shovel/scoop or approved HEPA vacuum and place in a suitable container for disposal.

7. HANDLING AND STORAGE

Handling	Wear personal protective equipment to avoid direct contact with this chemical. Avoid generating dusts.
Storage	Store in an area that is: cool, dry, well-ventilated. Keep away from aluminum.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guideline Comments	(Silica, quartz) ACGIH® = American Conference of Governmental Industrial Hygienists. TWA = Time-Weighted Average. 0.025 mg/m3 Respirable fraction OSHA = US Occupational Safety and Health Administration. TWA = Time-Weighted Average. 0.01 mg/m3 Respirable 2.4 mppcf 0.3 mg/m3 Total dust.
Engineering Controls	Use a local exhaust ventilation and enclosure, if necessary, to control amount in the air.

Personal Protective Equipment (PPE)

Eye/Face Protection	Wear chemical safety goggles.
Skin Protection	Wear chemical protective clothing e.g. gloves, aprons, boots.
Respiratory Protection	Wear a NIOSH approved air-purifying respirator with an appropriate cartridge.
General Hygiene Considerations	It is good practice to: avoid breathing product; avoid skin and eye contact and wash hands after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Solid
Appearance	Tan powder.
Particle Size	Not available
Odour	Odourless
Odour Threshold	Not applicable
Molecular Formula	Not applicable
Molecular Weight	Not applicable
Boiling Point	2876 °F (1580 °C)
Decomposition Temperature	Not available
Melting Point	Not available
Freezing Point	Not available
Relative Density (water = 1)	4100
Bulk Density	107 - 135 lb/ft3 (1714 - 2163 kg/m3)
Solubility in Water	Insoluble.
Solubility in Other Liquids	Not applicable
pH	7
Partition Coefficient, n-Octanol/Water	Not available
Viscosity-Kinematic	Not available
Surface Tension	Not available
Vapour Pressure	Not available
Vapour Pressure at 50 deg C	Not available
Saturated Vapour Concentration	Not available
Critical Temperature	Not available
Vapour Density (air = 1)	Not available
Evaporation Rate	Not available
Flash Point	Not applicable
Lower Flammable/Explosive Limit	Not available
Upper Flammable/Explosive Limit	Not available
Auto-ignition Temperature	Not available

10. STABILITY AND REACTIVITY

Chemical Stability	Normally stable.
Conditions to Avoid	Water, moisture or humidity.
Incompatible Materials	Strong oxidizers. Fluoride.
Hazardous Decomposition Products	May include oxides of nitrogen. May include oxides of phosphorus.
Possibility of Hazardous Reactions	Hazardous polymerization will not occur.

11. TOXICOLOGICAL INFORMATION

Effects of Long-Term (Chronic) Exposure

Chronic lung disease (silicosis) and/or lung cancer may result from prolonged/repeated breathing of the dust of this material.

Carcinogenicity

(Silica, quartz)
IARC: Group 1 – Carcinogenic to humans.
ACGIH®: A2 – Suspected human carcinogen.
NTP: Known human carcinogen.

No information was located for: Skin Irritation / Corrosion, Eye Irritation / Corrosion, Effects of Short-Term (Acute) Exposure, Respiratory and/or Skin Sensitization, Teratogenicity / Embryotoxicity, Reproductive Toxicity, Mutagenicity, Toxicologically Synergistic Materials

12. ECOLOGICAL INFORMATION

Ecotoxicity	Not harmful to aquatic life.
Persistence and Degradability	The methods for determining the biological degradability are not applicable to inorganic substances.
Bioaccumulation / Accumulation	This product and its byproducts are not expected to bioaccumulate.
Mobility	This material is insoluble in water and will sink in the marine environment.

13. DISPOSAL CONSIDERATIONS

Contact local environmental authorities for approved disposal or recycling methods in your jurisdiction.

14. TRANSPORT INFORMATION

Shipping Information

Not regulated under Canadian TDG Regulations. Not regulated under US DOT Regulations.

Other Transport Information

Special Shipping Information	Not applicable

15. REGULATORY INFORMATION

USA

Toxic Substances Control Act (TSCA) Section 8(b)

All ingredients are listed on the TSCA Inventory.

Additional USA Regulatory Lists

CERCLA: Not applicable.
SARA Title III - Section 302: No
SARA Title III - Section 311/312: Yes. (Silica, quartz)
California Proposition 65: Listed
Pennsylvania Right To Know: Listed.

16. OTHER INFORMATION

Date of Preparation	February 21, 2013
Disclaimer	This Health and Safety information is correct to the best of our knowledge and belief at the date of its publication, but we cannot accept liability for any loss, injury or damage which may result from its use. We shall ensure, so far as is reasonably practicable, that any revision of this Data Sheet is sent to all customers to whom we have directly supplied this substance, but must point out that it is the responsibility of any intermediate supplier to ensure that such revision is

passed to the ultimate user. The information given in the Data Sheet is designed only as guidance for safe handling, storage, and the use of the substance. It is not a specification nor does it guarantee any specific properties. All chemicals should be handled only by competent personnel, within a controlled environment. Should further information be required, this can be obtained through the sales office whose address is at the top of this data sheet.

APPENDIX B

HALLIBURTON | Baroid

BAROID®

Weighting Material | **Product Data Sheet**

Product Description

BAROID® weighting material is ground Barite and meets API Specification 13A Section 7 for drilling fluid Barite. It is used to increase the density of drilling fluids to control formation pressures. BAROID weighting material has a specific gravity of 4.2 and can be used to increase the density in oil- and water-based drilling fluids up to 21 lb/gal (2.52 SG). It is chemically inert and does not affect drilling fluid chemical properties.

Applications / Functions

- Helps increase mud density up to 21 lb/gal (2516 kg/m³)
- Helps control formation pressures
- Helps stabilize the borehole
- Helps prepare solids-laden plugs for well control applications

Advantages

- Is the industry standard weighting agent for drilling fluids
- Is chemically inert
- Cost-effective weighting agent

Typical Properties

• Appearance	Powder
• Specific gravity, minimum	4.2

Recommended Treatment

Use the following weight-up formulas to determine the appropriate concentrations to be added to the system.

- For 1 bbl starting volume
  X = 1470 (Wf - Wi)/(35 - Wf)
- For 1 bbl final volume
  X = 1470 (Wf - Wi)/(35 - Wi)
- Where:
  X = BAROID weight material required, lb/bbl
  Wi = Initial mud weight, lb/gal
  Wf = Final desired mud weight, lb/gal

Packaging

BAROID weighting material is packaged in 50-lb (22.7-kg), 100-lb (45.4-kg), 55.1-lb (25-kg) and 110.2-lb (50-kg) sacks and in bulk.

www.halliburton.com/baroid

3/25/2010

Scomi
Scomi Oiltools

DRILL-BAR Product Data Sheet

Product Description

DRILL-BAR is a finely ground, low abrasion and high purity API barite with the chemical formula, $BaSO_4$, used to increase the density of all types of drilling fluids.

Typical Properties

COMMON NAME	Barite	**CHEMICAL FORMULA**	$BaSO_4$
APPEARANCE	Solid/Powder	**SOLUBILITY IN WATER @ 20 °C**	Insoluble
SPECIFIC GRAVITY	≥ 4.2	**pH**	Neutral
BULK DENSITY	145 lb/ft^3 (2323 g/m^3)	**SOLUBLE HARDNESS (as calcium)**	< 250mg/kg
PARTICLE > 75 MICRON	3 % maximum mass fraction	**PARTICLE > 6 MICRON**	30 % maximum mass fraction

Applications/ Functions

DRILL-BAR is used as the primary weight material in both water based and non-aqueous fluids.

Advantages

- **DRILL-BAR** is compatible with in all drilling fluids for the purpose of increasing density, except systems formulated with K^+ and Cs^+ formate salts which can dissolve the barium.
- Common oil field chemical.
- **DRILL-BAR** has a specific gravity of 4.2 or higher and chemically inert to drilling fluids additives.
- Does not react with other drilling fluid additives or interfere with their function.
- Minimally abrasive.

Recommended Treatment

The quantity of **DRILL-BAR** to increase the fluid density may be calculated as follows:-

$$\text{100 lb sacks of DRILL-BAR / 100 bbl of fluid} = \frac{1470\,(W_1 - W_2)}{(35 - W_2)}$$

$$\text{Volume increase (bbl)} = \frac{\text{Sacks of DRILL-BAR}}{14.7}$$

$$\text{kg of DRILL-BAR per m}^3\text{ of fluid} = \frac{4200\,(SG_1 - SG_2)}{(4.2 - SG_2)}$$

$$\text{Volume increase (m}^3) = \frac{\text{kg of DRILL-BAR}}{4200}$$

W_1 = Initial Density lb/gal SG_1 = Initial Density g/cm^3
W_2 = Final Density lb/gal SG_2 = Final Density g/cm^3

Limitations	➢ Must not be used in potassium and caesium formate fluid systems. ➢ In wells where the fracture gradient is close to the over burden, the effective ECD from a barite formulated fluid may exceed the fracture gradient and alternative weighting agents should be considered.
Recommended Handling	Consult MSDS before use and use personal protective equipment as advised.
Packaging	**DRILL-BAR** is available in 25 kg, 50 lb, 50 kg, 100 lb, 1.0/1.5 MT Big Bags and in bulk.

November 2010

Level 17, 1 First Avenue, Bandar Utama
47800 Petaling Jaya, Selangor Malaysia
PH: +603.7717.3000, FAX: +603.7717.5258
www.scomioiltools.com
info@scomigroup.com

Milwhite, Inc.

BARITE 3

(BLANCA 2)

DESCRIPTION	**BARITE 3** is a select, natural, white high-quality barytes ($BaSO_4$).
TYPICAL PHYSICAL PROPERTIES	Specific Gravity .... 4.30 min. Weight per solid gallon .... 35.82 One pound bulks gallons .... 0.02792 % Moisture as Produced (220°F) .... <0.3 pH (20% sol'n) .... 7-7.5 Color (Visual) .... White % Reflectance (Photovolt) .... 90 min. Mean Particle Size, microns .... 1-3 Hegman Fineness Grind .... 7+ Bulk Density, lbs/ft^3 Loose .... 65-70 Packed 110-115
TYPICAL CHEMICAL ANALYSIS	% $BaSO_4$ .... 97-99 % Fe_2O_3 .... 0.3-0.5 % SiO_2 .... 0.1-0.2 % Loss on Ignition (1832°F) 0.2-0.8
APPLICATION	**BARITE 3** is designed for use in plastics, paints and coatings or any application requiring a "white," high-density filler.
PACKAGING	**BARITE 3** is available in 50-lb. bags and 2000-lb. bulk bags.

Revised 01/02/02

5487 South Padre Island Hwy. • Brownsville, TX 78521 • 956-547-1970 phone • 956-547-1999 fax

Milwhite, Inc.

BASCO™ WATE

DESCRIPTION

BASCO™ WATE is an exactly ground barite used to increase the density of both oil and water-based drilling fluids. **BASCO™ WATE** is a chemically inert powder, light tan to gray in color, which meets or exceeds the American Petroleum Institute's drilling fluid specification 13A for barite.

SPECIFICATIONS

Density, g/cm^3 .... 4.20 min.
Water Soluble Alkaline Earth Metals as
  Calcium, mg/kg .... 250 max.
Residue Greater Than 75 Micrometers, wt. % .... 3.0 max.
Particles Less Than 6 Micrometers in Equivalent
  Spherical diameter, wt. % .... 30.0 max.

PRIMARY FUNCTION

Weighting material.

APPLICATION

BASCO™ WATE, used to increase the density of drilling fluids up to approximately 22 pounds per gallon, provides the necessary hydrostatic pressure to balance formation pressures.

BASCO™ WATE is also used in formulating barite plugs to control underground blowouts and in formulating high filtration squeezes to control loss of circulation.

LIMITATIONS

BASCO™ WATE is limited to the preparation of weighted fluids to approximately 22 pounds per gallon.

MIXING RECOMMENDATIONS

BASCO™ WATE may be mixed either through the mud hopper or bulk tanks.

HANDLING and STORAGE

BASCO™ WATE is non-toxic and requires no special safety requirements for handling or storage.

To prevent caking and ensure easy pouring, **BASCO™ WATE** should be kept dry.

SPECIAL PRECAUTIONS

As with all powdered products, it is recommended that inhalation of dust particles be avoided.

PACKAGING

BASCO™ WATE is available in 50-lb. bags, 100 lbs bags, bulk trucks and railcars.

Revised 01/02/98

5487 South Padre Island Hwy. • Brownsville, TX 78521 • 956-547-1970 phone • 956-547-1999 fax

Milwhite, Inc.

MARFIL 40

(GB-80)

DESCRIPTION	**MARFIL 40** is a natural, inert, quality barytes ($BaSO_4$).
TYPICAL PHYSICAL PROPERTIES	Specific Gravity ... 4.20 min. Weight per solid gallon ... 35.07 One pound bulks gallons ... 0.02851 % Moisture as Produced (220°F) ... <0.3 pH (20% sol'n) ... 7–8 Wet Screen Analysis % retained, 200 mesh ... 1-3 % retained, 325 mesh ... 15–20 Mean Particle Size, microns ... 23–28 Bulk Density, lbs/ft^3 Loose ... 78–82 Packed ... 146–150 Oil Absorption, ml/100g ... 9.5-10.5
TYPICAL CHEMICAL ANALYSIS	% $BaSO_4$ ... 92-93 % $SrSO_4$ ... 1-2 % CaO ... 0.5-0.7 % Fe_2O_3 ... 0.1-1.4 % SiO_2 ... 0.9-1.1 % Loss on Ignition (1832°F) ... 1.4-2.6
APPLICATION	**MARFIL 40** has low oil absorption and is relatively insoluble in water making it an excellent weighting material for sound dampening.
PACKAGING	**MARFIL 40** is available in 50 lb. bags, 2000 lb. bulk bags, bulk trucks and railcars.

Revised 02/01/02

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Milwhite, Inc.

MARFIL 20

(GB-99)

DESCRIPTION	**MARFIL 20** is a natural, inert, quality barytes ($BaSO_4$).

TYPICAL PHYSICAL PROPERTIES

Specific Gravity	4.20 min.
Weight per solid gallon	35.07
One Pound bulks gallons	0.02851
% Moisture as Produced (220°F)	<0.3
pH (20% sol'n)	7–8
Wet Screen Analysis	
% retained, 325 mesh	0.5-1
% retained, 400 mesh	2-3
Mean Particle Size, microns	12-16
Hegman Fineness Grind	3+
Bulk Density, lbs/ft^3	
Loose	74–78
Packed	140–144
Oil Absorption, ml/100g	11-11.5

TYPICAL CHEMICAL ANALYSIS

% $BaSO_4$	92-93
% $SrSO_4$	1-2
% CaO	0.5-0.7
% Fe_2O_3	0.1-1.4
% SiO_2	0.9-1.1
% Loss on Ignition (1832°F)	1.4-2.6

APPLICATION

MARFIL 20 is designed for use in plastics, rubber, sound dampening and athletic goods such as bowling balls.

PACKAGING

MARFIL 20 is available in 50 lb. bags, 2000 lb. bulk bags, bulk trucks and railcars.

Revised 02/01/02

5487 South Padre Island Hwy. • Brownsville, TX 78521 • 956-547-1970 phone • 956-547-1999 fax

Milwhite, Inc.

MARFIL 10

DESCRIPTION

MARFIL 10 is a natural, inert, quality barytes ($BaSO_4$).

TYPICAL PHYSICAL PROPERTIES

Specific Gravity	4.20 min.
Weight per solid gallon	35.07
One pound bulks gallons	0.02851
% Moisture as Produced (220°F)	<0.3
pH (20% sol'n)	7-8
Wet Screen Analysis	
% retained, 325 mesh	0.1-0.5
% retained, 400 mesh	1-2
Mean Particle Size, microns	11-14
Hegman Fineness Grind	3.5+
Bulk Density, lbs/ft^3	
Loose	69-73
Packed	133-138
Oil Absorption, ml/100g	11-11.5

TYPICAL CHEMICAL ANALYSIS

% $BaSO_4$	92-93
% $SrSO_4$	1-2
% CaO	0.5-0.7
% Fe_2O_3	0.1-1.4
% SiO_2	0.9-1.1
% Loss on Ignition (1832°F)	1.4-2.6

APPLICATION

MARFIL 10 is designed for use in plastics, paints, coatings and brake linings. **MARFIL 10** can be "plugged in" your existing formula using comparable competitive products.

PACKAGING

MARFIL 10 is available in 50 lb. bags or 2000 lb. bulk bags.

Revised 02/15/2002

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APPENDIX C

(3) Only minor lead and zinc reported to the various cleaner tailing products, indicating that future testing probably does not need to include either locked cycle or pilot testing.

(4) The barite recovery to the second cleaner concentrate was somewhat low, at 91.9 %

The Lakefield testing included "complete" analyses of the zinc concentrate, which identified a high 700 ppm, mercury content as well the following:

Element	%
Fe	1.8
Cu	0.20
Ni	0.0042
Bi	0.0006
Cd	0.25
Co	0.0025
Ge	0.017
In	0.0007
As	< 0.01
Sb	0.0067
Se	0.0002
Fl	0.005
Cl	0.0016
SiO2	1.31
Al2O3	0.18
CaO	0.28
MgO	0.056
Ba	0.32

Lakefield evaluated the pyrometallurgical removal of Hg, resulting in depletion to 50 ppm. At this grade, the zinc concentrate would have general acceptability to smelters.

Investigations at WMT mainly duplicated the results which were achieved by Lakefield, except that a small portion, < 3 %, of the zinc reported to the lead concentrate resulting in a 10 % zinc content in an otherwise clean lead concentrate.

The optical microscopy indicated that between regrinding and reagent manipulation, the zinc grade of the lead concentrate can be reduced to an estimated < 3 %.

The testing by WMT, confirmed the high mercury grade of the zinc flotation concentrate. A mass balance on the mercury indicated that it is locked in, or chemically bound with the sphalerite.

An Investigation of

THE RECOVERY OF LEAD, ZINC AND BARITE

on Mel Project Core Samples

submitted by

ST. JOSEPH EXPLORATIONS LIMITED

Progress Report No. 1

Project No. L.R. 2078

NOTE:

This report refers to the samples as received.

The practice of this Company in issuing reports of this nature is to require the recipient not to publish the report or any part thereof without the written consent of Lakefield Research of Canada Limited.

LAKEFIELD RESEARCH OF CANADA LIMITED
Lakefield, Ontario
May 3, 1978

Test No. 2 - Continued

Metallurgical Results

Product	Weight %	Assays, % Pb	Assays, % Zn	Assays, % $BaSO_4$	% Distribution Pb	% Distribution Zn	% Distribution $BaSO_4$
1. Pb Cleaner Conc.	2.79	79.6	3.12	1.15	97.66	2.10	0.1
2. Pb 2nd Cl. Tail.	0.11	5.04	4.90	35.3	0.24	0.13	0.1
3. Pb 1st Cl. Tail.	1.08	0.36	3.06	45.3	0.17	0.80	0.9
4. Zn Cleaner Conc.	6.01	0.23	62.3	0.54	0.61	90.33	0.1
5. Zn 3rd Cl. Tail.	1.41	0.59	16.4	11.5	0.37	5.58	0.3
6. Zn 2nd Cl. Tail.	0.27	0.39	1.71	33.8	0.04	0.11	0.2
7. Zn 1st Cl. Tail.	2.62	0.12	0.42	43.4	0.14	0.21	2.2
8. Barite Cl. Conc. No. 1	43.83	0.013	0.016	94.6	0.25	0.17	81.3
9. Barite Cl. Conc. No. 2	5.07	0.016	0.020	92.7	0.04	0.02	9.2
10. Barite 2nd Cl. Tail.	3.78	0.065	0.027	26.2	0.11	0.02	1.9
11. Barite 1st Cl. Tail.	10.21	0.031	0.073	9.44	0.14	0.18	1.9
12. Barite Ro. Tailing	22.82	0.023	0.052	4.00	0.23	0.29	1.8
Head (Calculated)	100.00	2.27	4.14	51.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	2.90	76.8	3.19	2.44	97.90	2.23	0.2
Products 1 to 3	3.98	56.0	3.16	14.1	98.07	3.03	1.1
Products 4 and 5	7.42	0.30	53.6	2.62	0.98	95.91	0.4
Products 4 to 6	7.69	0.80	51.8	3.72	1.02	96.02	0.6
Products 4 to 7	10.31	0.25	38.7	13.8	1.16	96.29	2.8
Products 8 and 9	48.90	0.013	0.016	94.4	0.29	0.19	90.5
Products 8 to 10	52.68	0.017	0.017	89.5	0.40	0.21	92.4
Products 8 to 11	62.89	0.019	0.026	76.5	0.54	0.39	94.3

APPENDIX D

18,000 MT Processed & Shipped @ 4.1 API

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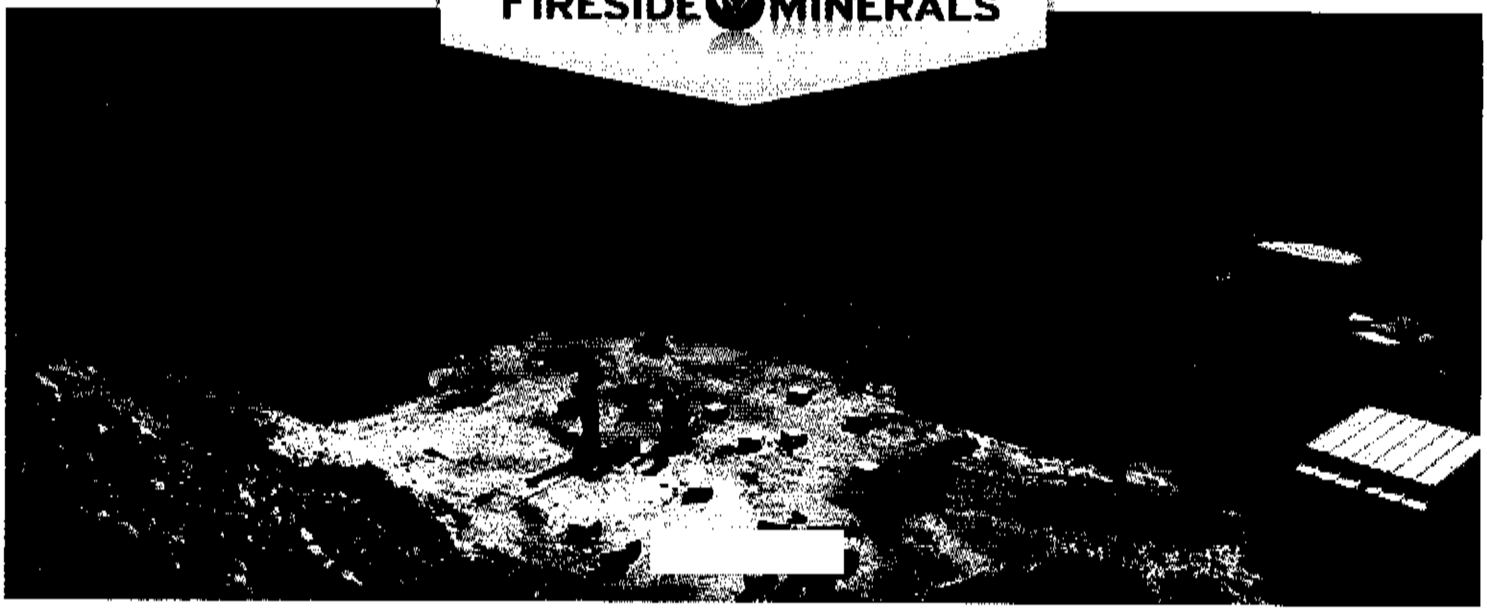
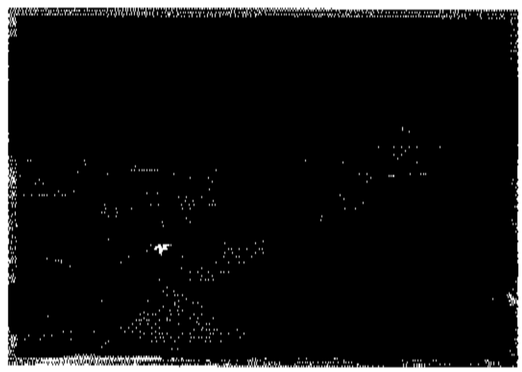


Welcome to Fireside Minerals Ltd.

Fireside Minerals Ltd. is a dynamic business that serves the oil and gas industry in Western Canada and Alaska, we have over 50 years of experience in the mining and heavy equipment industry.

Fireside's primary focus is production at its barite mine located in Northern British Columbia. In addition, Fireside also owns a grinding/mill facility in Watson Lake, Yukon. This mill takes the ore from the mine and produces it into a fine powder that is then ready for sale into the oil and gas markets in Canada and Alaska. Fireside Minerals LTD pride themselves on doing the job right, being consistent and having excellent quality control.

Fireside has been built upon the premise of utilizing its large barite reserves as a lower cost provider of barite to the oil and gas industry. Minerals is a member of The Mining Association of British Columbia and has been for the last decade.



Contact Us

Fireside Minerals Ltd.
Box 32069
Westbank, BC, Canada
V4T-3G2
Ph: (778).755.1389 Fax: (250).769.8596

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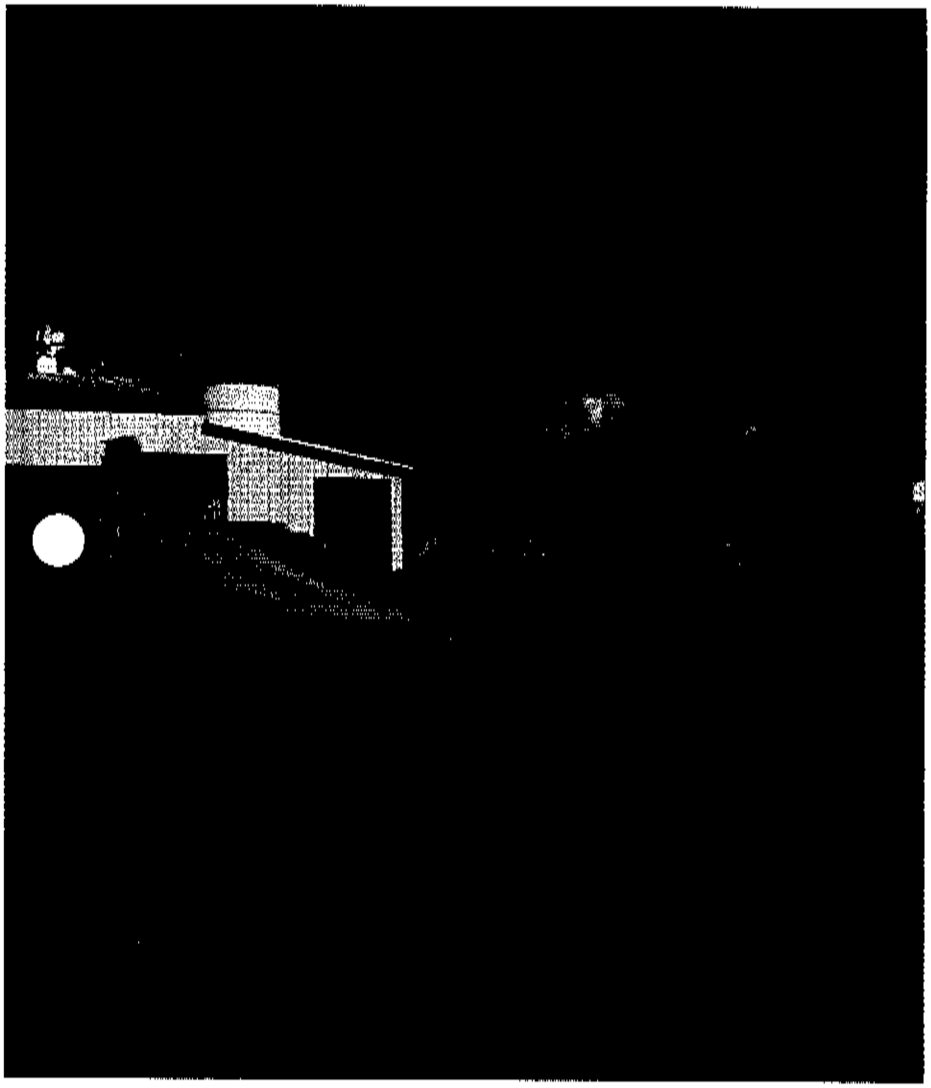

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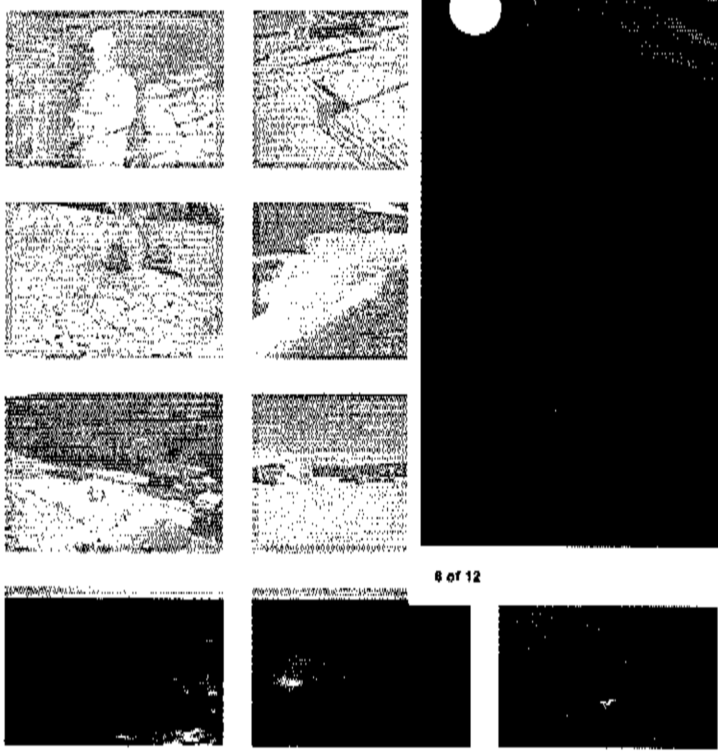

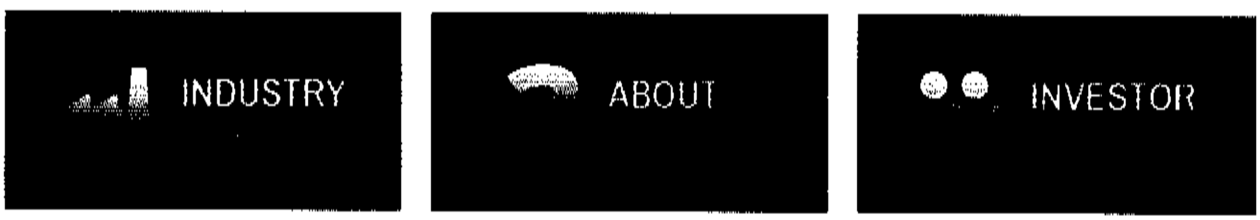

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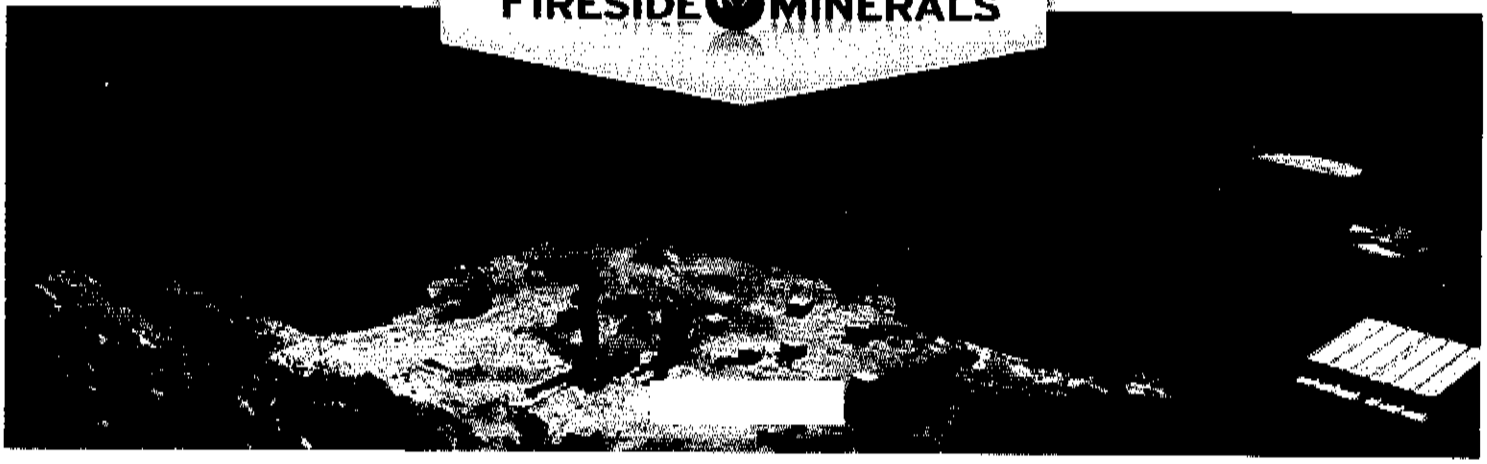


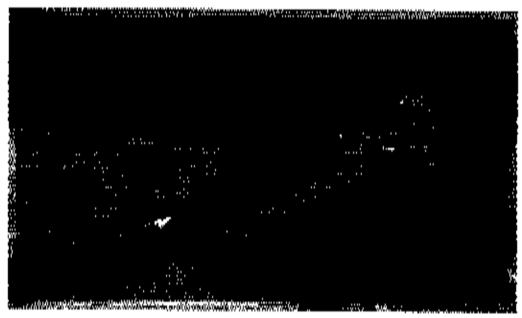
Fireside Minerals Products

• 4.1 API Spec Barite – Barite packaged in 40kg bags and stacked onto pallets.

Please contact us directly for more information and pricing.

The mill is setup for a wide array of bagging and packaging requirements such as 40 kg bags, bulk bags and sea-cans.

Fireside offers a wide range of protective coverings, coatings and fastener options to ensure the highest possible product quality for both domestic and international shipments.



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FIRESIDE MINERALS

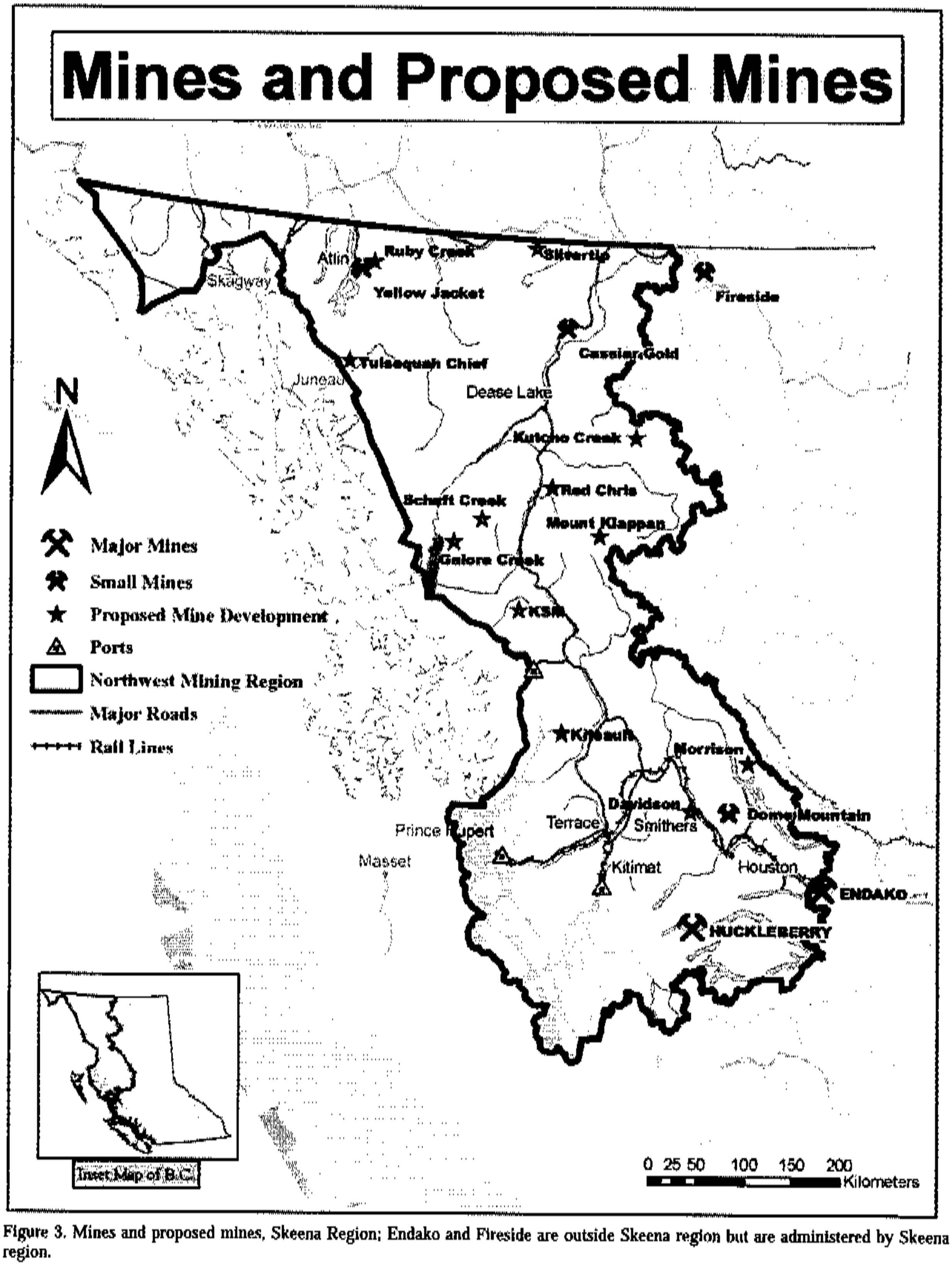


Figure 3. Mines and proposed mines, Skeena Region; Endako and Fireside are outside Skeena region but are administered by Skeena region.

TABLE 1. MINE PRODUCTION AND RESERVES, SKEENA REGION

Mine	Operator	Production (2009)	Reserves (Dec.31, 2009)	Tonnes milled (2009)	Grade
Endako	Thompson Creek Metals Company (75%) & Sojitz Corporation	4504 tonnes molybdenum	280 100 000 tonnes at 0.047% Mo (includes low-grade stockpile)	9 759 000	0.059% Mo
Huckleberry	Huckleberry Mines Ltd. (50% Imperial Metals Corp.)	20 834 tonnes copper, 6.56 tonnes molybdenum, 10.8 kg gold	14 010 000 tonnes at 0.362% Cu, 0.005% Mo (on May 11, 2010)	6 133 700	0.377% Cu, 0.006% Mo
Fireside	Fireside Minerals Inc.	16 000 tonnes (in 2010)	165 400 (not NI 43-101 compliant)	22 000 (in 2010)	

add to gold-copper resources

8) GJ – copper-gold project optioned by Teck Resources
9) Silverhope – porphyry copper-molybdenum discovery
10) Bell Copper – Xstrata reconsiders deep copper resource
11) Lone Pine – new molybdenum zone
12) Silvertip – acquired by Silvercorp; major exploration program
13) BA – exploration of new silver volcanogenic prospect
14) Chist Creek – new volcanogenic massive sulphide zone
15) Coles Creek – significant gold intercept

MINES AND QUARRIES

MAJOR METAL MINES

The **Endako** open-pit molybdenum mine (MINFILE 093K 006) is 75% owned and operated by Thompson Creek Metals Company. Sojitz Corporation, a major Japan-based molybdenum-trading company, holds 25% interest. In 2009, the mine produced 4504 tonnes of molybdenum from 9 759 000 tonnes of ore with an average grade of 0.059% Mo. Decreased metal output compared with 2008 resulted from lower grade ore and lower throughput. Molybdenum recovery was 78.4%. The mine employs 265 people. In-situ and stockpile ore reserves on the property at the beginning of 2010 were 280.1 Mt grading 0.047% Mo at a cut-off grade of 0.02% Mo. Thompson Creek forecasts Endako production in 2010 will be 4230 tonnes of molybdenum. Cost of molybdenum production was $6.13 per pound in 2009 and is estimated at $9 in 2010. Ore is mined from the West Denak pit located 3.5 km from the mill along the arcuate trend of the ore zone (Figure 4). The ore passes through an in-pit crusher and is delivered to the mill via a 3 km conveyor. Recurring problems with the conveyor resulted in periodic trucking of ore.

Figure 4. Endako molybdenum mine, mining in the West Denak pit, June 2010.

Construction is underway to modernize and expand capacity of the Endako mill from 28 000 to 52 000 tonnes of ore per day (Figure 5). The company estimates capital expenditure in 2010 to be $240 million. A total of $85.2 million was spent in the two preceding years. The Endako mine and mill began operation (at 16 000 tonnes per day) in 1965 at a cost of just $22 million; completion of the $498 million expansion and modernization project will

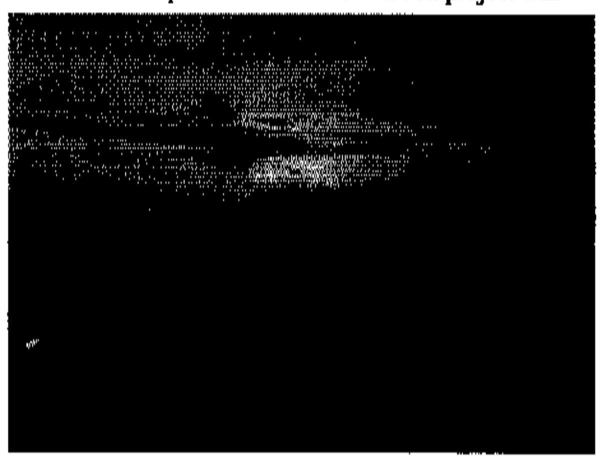


Figure 5. Endako molybdenum mine; mill, commissioned in 1965 continued in operation in June, 2010 while a new mill was under construction.

enable treatment of lower grade ore and to lower the operating cost on a per tonne basis. New semi-autogenous (SAG) and ball mills, a modern flotation circuit and an upgrade of the roaster circuit are included. A workforce of 500 is building the project; completion is scheduled for late 2011. Output in 2011 is estimated at about 5000 tonnes Mo, increasing to 6800 tonnes in 2012 when benefits of the expansion and modernization project are realized.

Endako is a porphyry molybdenum deposit within the early Cretaceous Francois Lake granite batholith. The ore body is a 3.5 km long vein system that changes in strike along its length from west-northwest in the Endako pit to northerly in the Denak pit, resulting in an arcuate shape. The zone is 400 m wide and extends more than 400 m below surface at a moderate southerly dip. Mineralization is related to intrusion of the Casey aplite which domed and fractured the older and coarse grained Endako phase of the batholith. Post-mineral cross faults segment the ore zone into the Endako, East Denak and West Denak pits. In the long-term mine plan these will merge into a large 'Super-Pit'. Exploration took place 2 to 3 km northwest of West Denak pit, comprising 12 000 m of drilling. The Endako ore vein system was found to continue and an increase in the molybdenum resource is expected. Further drilling is anticipated in 2011.

The **Huckleberry** copper mine (MINFILE 093E 037) is operated by Huckleberry Mines Ltd. It is owned 50% by Imperial Metals Corp. and 32% by Mitsubishi Material Corporation with the remaining 18% shared equally among Dowa Mining Ltd, Furakawa Company Ltd and Marubeni Corporation. The mine is located 123 km by road south of Houston at the foot of Huckleberry Mountain and employs 275 people including camp and trucking contractors. Copper concentrate is trucked to the port of Stewart for shipment to Japan and molybdenum concentrate is trucked to Vancouver. In 2009 Huckleberry milled 6 133 700 tonnes of ore from the Main Zone Extension (MZX) pit grading 0.377% Cu and 0.006% Mo (Figure 6). Metal production amounted to 20 834 tonnes of copper, 6.56 tonnes of molybdenum and 10.8 kg of gold. Copper recovery was 90.2% but molybdenum recovery was 1.87%. Proven and probable reserves on May 11, 2010 were 14 010 000 tonnes at a grade of 0.362% Cu and 0.005% Mo and a strip ratio of 0.56:1. Forecast 2010 production is 29 000 tonnes of copper.

Huckleberry is a porphyry copper deposit related to the late Cretaceous Bulkley intrusions. In the Main zone, copper mineralization occurs in hornfelsed and fractured Hazelton Group volcanic rocks adjacent to a 500 m diameter granodiorite stock. The arcuate ore zone is 150 to 200 m wide by 600 m long and rims the contact of the stock. The mined-out East zone was larger, measuring 150 m wide by one km long, and centred on a fault-controlled 40 m wide granodiorite dike that trends at 105°. Ore in both zones is a stockwork of quartz, pyrite and chalcopyrite, crosscut by gypsum-filled fractures (Figure 7). The Main and East zones are disrupted by the

Figure 6. Huckleberry copper mine; mining in the MZX pit in September 2010, low grade stockpile and mill in the background.

Figure 7. Huckleberry copper mine; ore from the MZX pit, biotite hornfels with chalcopyrite and gypsum filling fractures.

reactivated 105 fault which resulted in 100 m of right lateral offset of ore. MZX is the faulted portion of the Main zone north of the 105 fault. Instability in the MZX pit results from splays of the 150 fault, which is located behind and oblique to the high wall.

The future of Huckleberry lies in development of the Saddle zone and Main zone 'Super pit' which could provide ore to 2013 and 2025 respectively. The Saddle zone is a ridge of bedrock left between the MZX and Main pits. The Super pit resource comprises material below and peripheral to the Main zone. The measured and indicated resource in the two zones is 182.9 Mt at a grade of 0.321% Cu. The inferred resource is 45.4 Mt at a grade of 0.288% Cu. To mine this material will require the removal of 40 Mt of waste rock and tailings from the Main zone pit and construction of a new tailings impoundment. Both of these, in turn, require geotechnical assessment, engineering design and permit amendments, resulting in a near-term ore shortfall. A 4400 m drilling program was undertaken to locate ore that is readily accessible. Targets included the areas immediately east and west of the MZX pit, and a low hill that lies on trend with the 60° to 70° south plunge of the Main ore zone. There is also 6 Mt of stockpile material grading 0.20% to 0.26% Cu.

INDUSTRIAL MINERAL QUARRIES

Fireside Minerals Ltd made steady improvements to its summer-seasonal **Fireside** barite operation (MINFILE 094M 003) located 125 km east of Watson Lake. Fireside Minerals, a private company, relocated its office from Red Deer, Alberta to Kelowna, British Columbia. The company reduced its reliance on contractors by purchasing most mining equipment it requires, including a new dozer, excavator, blast-hole drill and several ore trucks. Mining of 22 000 tonnes of rock from the Bear Pit yielded 16 000 tonnes of barite recovered from jigs at the minesite (Figures 8, 9). There was also a pre-season stockpile of 6000 to 8000 tonnes of barite. All the barite was trucked to the company's grinding and bagging plant in Watson Lake. To the end of November, over 18 000 tonnes of pre-sold barite was shipped and the plant continued to operate with orders to fill in early 2011 (A. Allan, personal communication, 2010). At the south end of the Bear pit, the barite vein was found to be discontinuous and diamond drilling is proposed to evaluate this area prior to mining in 2011.

Vertically dipping barite veins at Fireside are associated with a gabbro dike of inferred Paleozoic age that was emplaced into strata of the Kechika Group (Figure 10), and may be related to rifting of the early Paleozoic North American continental shelf (see Wojdak, 2008). The Bear pit resource, as of November 2010, is 165 400 tonnes of barite-rock which requires removal of 419 300 tonnes of waste rock down to 710 m elevation, a 2.54:1 waste-to-ore strip ratio. The resource, though not NI 43-101 compliant, is considered adequate to plan a 5-year mine life producing 30 000 tonnes of barite per year. Disseminated barite occurs locally along the margin of the Bear vein but is not included in the resource estimate. The specific gravity for sales specification was lowered to 4.1 from 4.2, enabling the processing of lower grade ore.

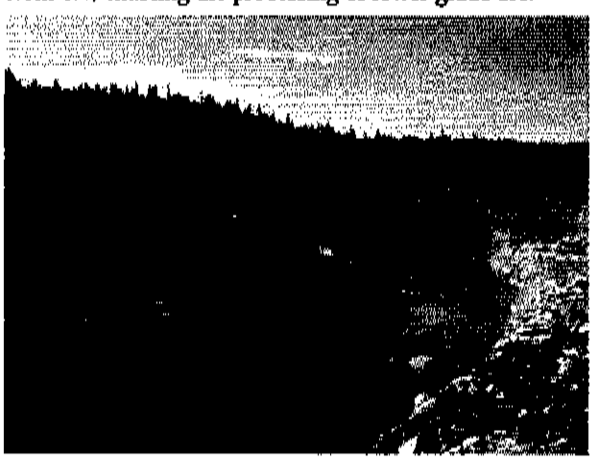


Figure 8. Fireside barite mine; benching south wall of the Bear pit, July 2010.

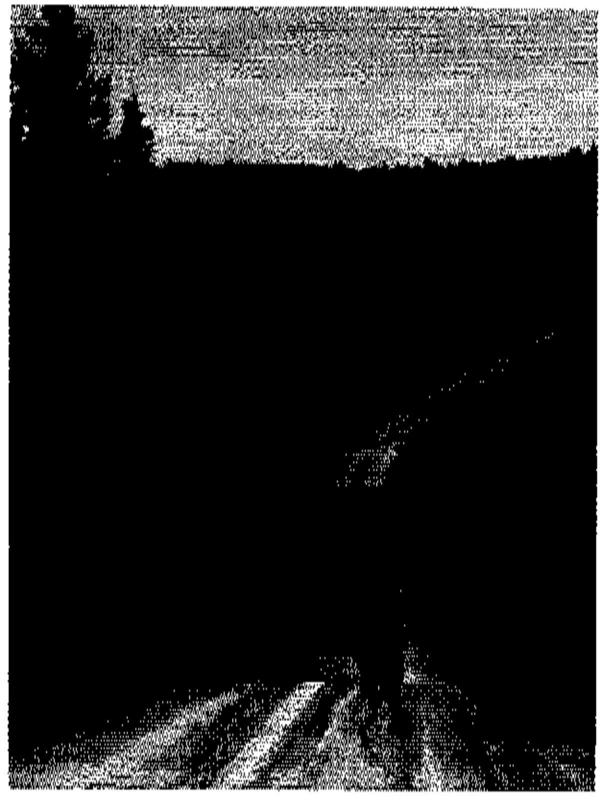


Figure 9. Fireside barite mine; ore truck on the 4.2 km haul from the Bear pit to the processing plant.

Figure 10. Fireside barite mine; Keith McLeod (General Manager) against a bench of Kechika siltstone, host to the West Bear vein.

Jade in northwest British Columbia is mined chiefly by Cassiar Jade Contracting. Total production in 2010 is estimated at 150 tonnes of high-value gemstone from three localities: **Provencher Lake** produced about 85 tonnes (MINFILE 104I 073, 092), Kutcho about 60 tonnes (MINFILE 104I 078) and **Cassiar** about 5 tonnes (MINFILE 104P 005). At both Provencher and Kutcho, located 80 and 90 km respectively east of Dease Lake, the jade that is recovered occurs equally as "placer" boulders in glacial till and as lenses in bedrock. Angular boulder

APPENDIX E

Directive 050: Drilling Waste Management

May 2, 2012

Effective June 17, 2013, the Energy Resources Conservation Board (ERCB) has been succeeded by the Alberta Energy Regulator (AER).

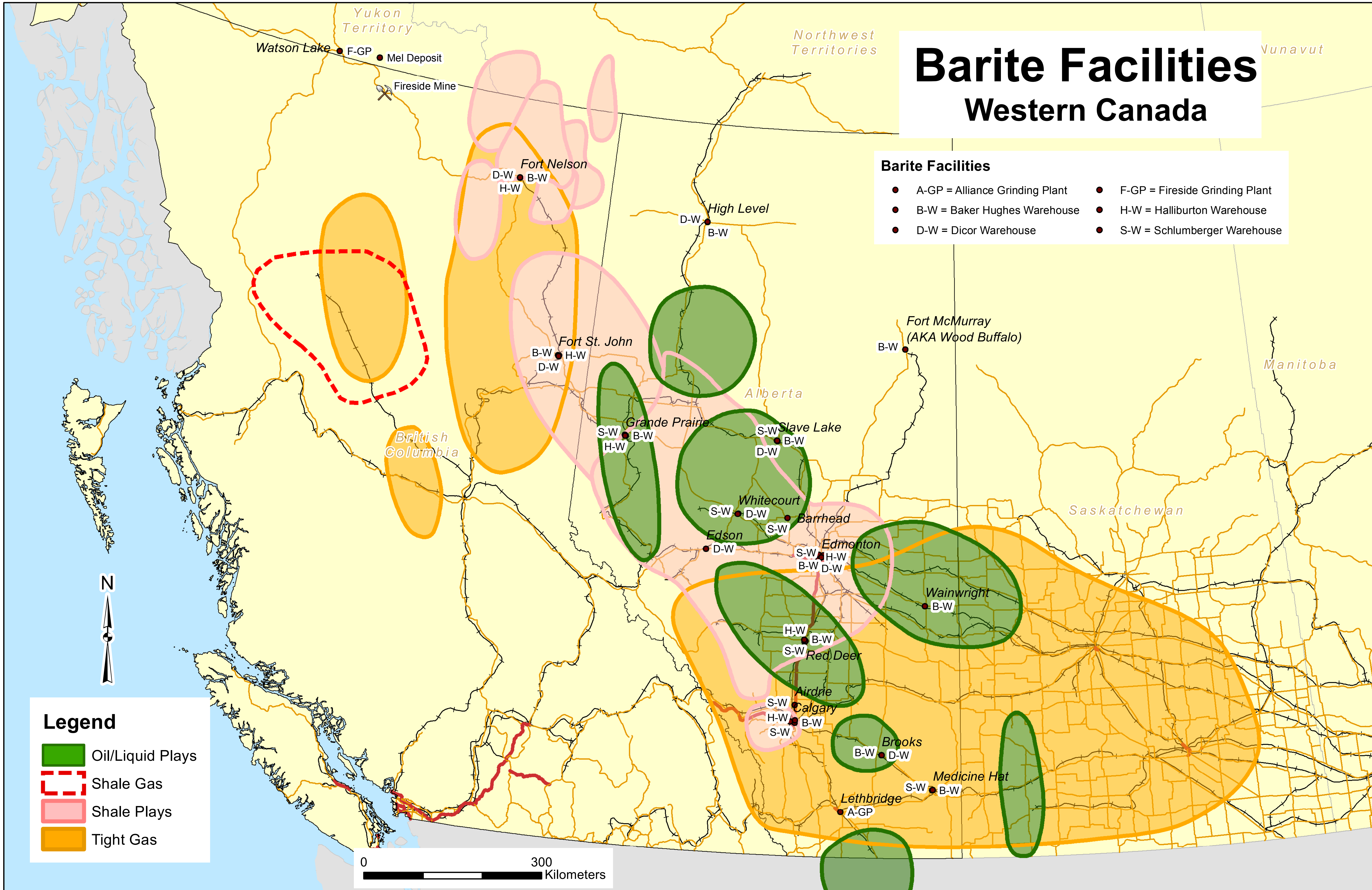
As part of this succession, the title pages of all existing ERCB directives now carry the new AER logo. However, no other changes have been made to the directives, and they continue to have references to the ERCB. As new editions of the directives are issued, these references will be changed.

Some phone numbers in the directives may no longer be valid. Contact AER Inquiries at 1-855-297-8311 or inquiries@aer.ca.

Table 3.4 Soil metal endpoints—guideline values

Metal	Guideline value (mg/kg)		
	Agricultural land use	Natural area land use	Residential/parkland land use
Antimony	20	20	20
Arsenic (inorganic)	17	17	17
Barium	750	750	500
Barite-barium[1]	10 000	10 000	10 000
Beryllium	5	5	5
Boron (hot water soluble)	2	2	2
Cadmium	1.4	3.8	10
Chromium (total)	64	64	64
Chromium (hexavalent)	0.4	0.4	0.4
Cobalt	20	20	20
Copper	63	63	63
Lead	70	70	140
Mercury (inorganic)	6.6	12	6.6
Molybdenum	4	4	4
Nickel	50	50	50
Selenium	1	1	1
Silver	20	20	20
Thallium	1	1	1
Tin	5	5	5
Uranium	23	33	23
Vanadium	130	130	130
Zinc	200	200	200

[1] AEW's *Soil Remediation Guidelines for Barite* (2009) must be followed to determine if the site qualifies as a barite site. If it does not, then the 750 mg/kg total barium value applies.



Barite Facilities
Western Canada
Barite Facilities
A-GP = Alliance Grinding Plant
B-W = Baker Hughes Warehouse
D-W = Dicor Warehouse
F-GP = Fireside Grinding Plant
H-W = Halliburton Warehouse
S-W = Schlumberger Warehouse
Legend
Oil/Liquid Plays
Shale Gas
Shale Plays
Tight Gas
Yukon Territory
Northwest Territories
Nunavut
British Columbia
Alberta
Saskatchewan
Manitoba
Watson Lake
F-GP
Mel Deposit
Fireside Mine
Fort Nelson
High Level
Fort McMurray (AKA Wood Buffalo)
Fort St. John
Grande Prairie
Slave Lake
Whitecourt
Barrhead
Edson
Edmonton
Wainwright
Red Deer
Airdrie
Calgary
Brooks
Medicine Hat
Lethbridge
A-GP
N
0
300
Kilometers

APPENDIX VIII

MINERAL RESOURCE ESTIMATE

The Inferred Mineral Resource for the Mel Main Zone comprises 5,380,000 tonnes grading 6.45% zinc (Zn), 1.85% lead (Pb) and 44.79% barite ($BaSO_4$). This resource is stated above a 5.0% zinc-equivalent (ZnEQ%) cut-off grade. A summary of Inferred Mineral Resources at various zinc-equivalent cut-off grades is provided in Table 1.1.

The Mel Main Zone mineral resource estimate was completed by Gary Giroux, P. Eng., MASc. of Giroux Consulting Ltd. Mr. Giroux is a qualified person and independent of Silver Range, based on the guidelines provided by NI 43-101.

Mel Main Zone – Inferred Resource within Mineralization Solid using a Zn Equivalent cut-off					
Cut-Off	Tonnes > Cut-off	Grade > Cut-off			
(ZnEQ%)	(Tonnes)	Zn(%)	Pb(%)	ZnEQ(%)	BaSO4(%)
3.5	5,620,000	6.31	1.82	8.43	44.21
4.0	5,570,000	6.34	1.83	8.48	44.29
4.5	5,500,000	6.38	1.84	8.53	44.43
5.0	**5,380,000**	**6.45**	**1.85**	**8.61**	**44.79**
5.5	5,180,000	6.56	1.87	8.74	45.10
6.0	4,960,000	6.66	1.90	8.87	44.95
6.5	4,630,000	6.79	1.95	9.06	44.77
7.0	4,220,000	6.95	2.00	9.28	44.65

Data generated during the various drill programs conducted at Mel Main Zone were independently reviewed by Giroux Consultants Ltd. In 2012, 107 pieces of drill core were selected and re-sampled by taking ¼ of the core. In general, the duplicate assays match the original assays very well and show no analytical bias.

The resource estimate for the Mel Main Zone was initiated using a wire-frame 3D solid model in "GEMS." Three-dimensional solids were manually digitized from the available drill data and were used to constrain the interpolation of mineralization. The model was constructed based upon mineralogical boundaries and structural controls. Two solids were created, each representing a separate mineralogical domain ("Mineralized Solid" and "Barite Shell").

Drill holes were "passed through" these geological solids with the entry and exit points recorded. Using this information the assays were "back-tagged" with different codes if inside or outside the solids. Of the 64 supplied drill holes, 48 intersected the Mineralized Solid.

A block model with dimensions 10 metres north-south, 5 metres east-west and 5 meters vertical was superimposed over the domain solids. For each block, the percentage below surface topography and within each mineralized solid was recorded.

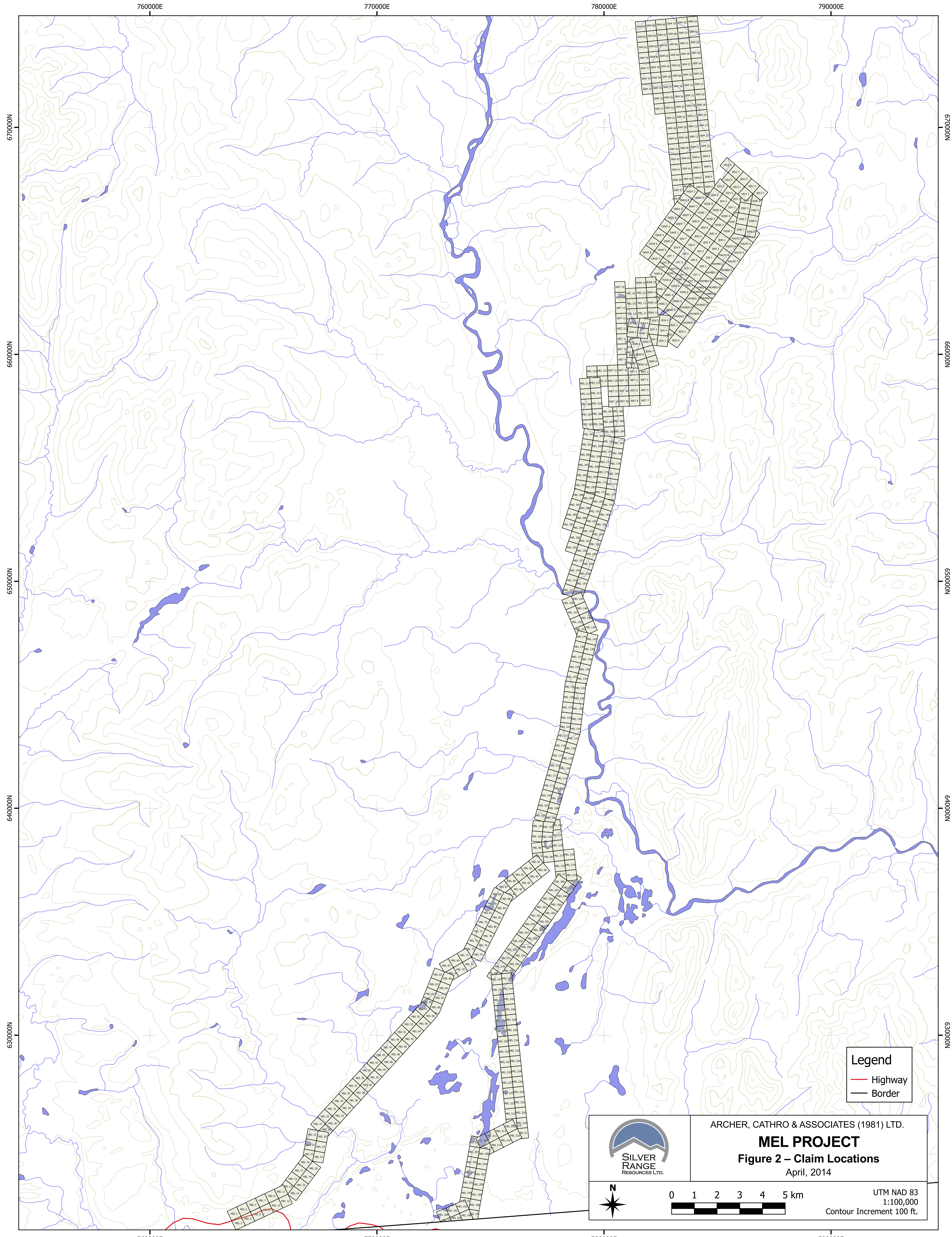
The bulk density for rock within the Mel Main Zone was established from 47 specific gravity determinations. A specific gravity for each domain was calculated by using a regression equation and the estimated values for lead, zinc and barite in the two mineralized domains and the waste domain. A nominal specific gravity of 1.8 was applied to overburden.

Uniform, two metre long, down-hole composites were produced to honour the Mineralized Solids and Barite Shell. Grades for the elements of interest were interpolated into blocks within the Mineralized Solid and Barite Shell using Ordinary Kriging. The kriging exercise was completed in a series of four passes. Appropriate block model validation techniques for resource estimation at this stage of project development were applied.

APPENDIX IX

SCOPING STUDY ECONOMIC MODEL SUMMARY

Scoping Study Parameters		
Parameter	Units	Value
Pb Price	$/lb	0.95
Zn Price	$/lb	0.90
Barite Price	$/t	100
CAD/USD		0.90
Pb Recovery	%	92.6
Zn Recovery	%	91.9
Barite Saleable Tonnes	t/year	50000
Open Pit Mining Cost	$/t	2.50
Underground Mining Cost	$/t	55.00
Milling Cost	$/t	22.66



760000E
770000E
780000E
790000E
670000N
660000N
650000N
640000N
630000N
Legend
Highway
Border
SILVER RANGE RESOURCES LTD.
ARCHER, CATHRO & ASSOCIATES (1981) LTD.
MEL PROJECT
Figure 2 – Claim Locations
April, 2014
N
0 1 2 3 4 5 km
UTM NAD 83
1:100,000
Contour Increment 100 ft.

Silver Range Resources Ltd.

JERI ZONE

Longitudinal Section & Plan

Drawn By: J. Stevens	Date: April 2015
NAD 83 UTM Zone 9	Figure: 13

Legend

%Zn x metres

- No mineralization
- 0 < %Zn x m ≤ 5
- 5 < %Zn x m ≤ 10
- 10 < %Zn x m ≤ 20
- 20 < %Zn x m ≤ 50
- 50 < %Zn x m ≤ 100

- 2 - Cryptograined limestone
- 3 - Sedimentary rocks
- 6 - Wavy banded silty limestone
- Swamp
- Trace of mineralized zone
- Trail
- Diamond drill hole

Silver Range Resources Ltd.	
JERI NORTH ZONE Longitudinal Section & Plan	
Drawn By: J. Stevens	Date: April 2015
NAD 83 UTM Zone 9	Figure: 14